Cessna®

200-SERIES

SERVICE MANUAL

MARCH 1965

THIS MANUAL SUPERSEDES AND REPLACES ALL
PREVIOUS 200-SERIES SERVICE MANUALS.

D 310-13 McCormick-Armstrong Co.—1500—4/1/65

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1960		210	57001 thru 57575
1961		210A	21057576 thru 21057840
1962		210B	21057841 thru 21058085
1963		210C	21058086 thru 21058220
1964	210 CENTURION	210D	21058221 thru 21058510
1965	210 CENTURION	210E	21058511 thru
1963		205	205-0001 thru 205-0480
1964		205A	205-0481 thru 205-0577
1964	SUPER SKYWAGON	206	206-0001 thru 206-0275
1965	SUPER SKYWAGON (UTILITY CARGO DOOR)	U206	U206-0276 thru
1965	SUPER SKYWAGON (PASSENGER DOOR)	P206	P206-0001 thru
1965	SUPER SKYLANE	P206	P206-0001 thru

FOREWORD

This manual contains factory recommended procedures and instructions for ground handling, servicing and maintaining Cessna 200-Series aircraft. These include the Models 205, 206, and 210. Besides serving as a reference for the experienced mechanic, this book also covers step-by-step procedures for the less experienced man. This manual should be kept in a handy place for ready reference. If properly used, it will better enable the mechanic to maintain Cessna 200-Series aircraft and thereby establish a reputation for reliable service.

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

MAINTENANCE AND SAFETY SUGGESTIONS

ON ALL 210-SERIES AIRCRAFT

1. When parting any lines, always cap or plug all lines and fittings to avoid entrance of dirt and air into the system. This applies to all test and fill equipment as well.

2. When installing any new lines or equipment, always be certain lines and equipment are clean, have been flushed with clean hydraulic fluid and are as near full of clean fluid as possible to minimize bleeding.

3. Avoid using the airplane hand pump to retract the landing gear.

4. Avoid subjecting the hydraulic system or any component to more than 2200 PSI. It is possible to exceed the pressure limit when external hand pumps are connected to bypass the power pack.

5. Avoid rigging adjustments or maintenance on the landing gear when the airplane is not securely on jacks.

6. Avoid pressure of more than 10 PSI to the power pack reservoir during filling operations; otherwise, damage to the reservoir seals may result.

7. Avoid using or installing gust locks on the flaps; otherwise, damage may result if flaps are accidentally operated.

8. Before performing any maintenance in any of the wheel or strut wells, always disconnect the doors to avoid injury from unintentional actuation of the doors.

ON MODEL 210 AND 210A AIRCRAFT

1. Before performing any checking, inspecting, parting of lines and/or maintenance procedures, discharge all pressure from the accumulator by operating the wing flaps until pressure has been expended.

2. When removing accumulator from the airplane, always release all nitrogen or air pressure from the accumulator and avoid recharging accumulator until it has been reinstalled in the airplane.

SECTION 1

GENERAL DESCRIPTION

1-1. GENERAL DESCRIPTION - 210 SERIES. The Cessna 210 Series airplanes are four-place, high-wing monoplanes, of all-metal, semi-monocoque airframe construction. The 210 Series employ a fully retractable tricycle landing gear with the familiar spring-steel main gear struts. The steerable nose gear is an air-oil filled oleo strut. The landing gear is hydraulically actuated. Prior to the Model 210D, the wing flaps are also hydraulically actuated. Beginning with the Model 210D, the wing flaps are electrically actuated. An individual child's seat is located immediately aft of each rear passenger's seat on the Model 210D and on. The airplanes are powered by a single six-cylinder, horizontally-opposed, air-cooled, fuel-injection Continental engine driving an all-metal constant-speed propeller. Distinctive features of the airplane are the swept fin and rudder and the conical camber design of the wing tips.

1-2. GENERAL DESCRIPTION - 205 SERIES. The Cessna 205 Series airplanes are six-place, high-wing monoplanes, of all-metal, semi-monocoque airframe construction. The 205 Series employ a non-retractable tricycle landing gear with the familiar spring-steel main gear struts. The steerable nose gear is an air-oil filled oleo strut. The flaps are electrically actuated. The airplanes are powered by a single six-cylinder, horizontally-opposed, air-cooled, fuel-injection Continental engine driving an all-metal constant-speed propeller. Distinctive features of the airplane are the swept fin and rudder and the conical camber design of the wing tips.

1-3. GENERAL DESCRIPTION - 206 SERIES. The Cessna 206 Series airplanes are high-wing monoplanes, of all-metal, semi-monocoque airframe construction. The 206 Series employ a non-retractable tricycle landing gear with the familiar spring-steel main gear struts. The steerable nose gear is an air-oil filled oleo strut. The flaps are electrically actuated. The airplanes are powered by a single six-cylinder, horizontally-opposed, air-cooled, fuel-injection Continental engine driving an all-metal constant-speed propeller. All 206 Series are equipped with an entrance door on each side of the cabin and a baggage door on the left side of the fuselage, except the Model 206 and U206 Series. The Model 206 and U206 Series are equipped with large double cargo doors on the right side of the fuselage and an entrance door on the left side of the cabin. Except for the P206 Super Skylane, all 206 Series seating arrangements are standard one-place, but provisions are made for the addition of optional seats to make six-place airplanes. The P206 Super Skylane is a standard six-place airplane. Distinctive features of the airplane are the swept fin and rudder and the conical camber design of the wing tips.

1-4. Leading particulars of each model, with dimensions based on gross weight, are given in the following charts. If these dimensions are used for constructing a hangar or computing clearances, remember that such factors as nose strut inflation, tire pressures, tire sizes, and load distribution may result in some dimensions that are considerably different from those listed.

DESIGN GROSS WEIGHT	2900 lb
FUEL CAPACITY (Total)	65 gal.
Optional (210A only)	84 gal.
OIL CAPACITY	12 qt
ENGINE MODEL (Refer to Section 12 for Engine Data)	CONTINENTAL IO-470-E
PROPELLER (Constant Speed)	82" HARTZELL or McCAULEY
LANDING GEAR (Retractable Hydraulic Actuated)	Tricycle
MAIN WHEEL TIRES	15 x 6.00 x 6, 6-ply rating
Pressure	53 psi
NOSE WHEEL TIRE	5.00 x 5, 6-ply rating
Pressure (210)	35 psi
Pressure (210A)	45 psi
NOSE GEAR STRUT PRESSURE (Strut Extended)	95 psi
WHEEL ALIGNMENT	
Camber	+4°±1.5°
Toe-in	0 to .06"
AILERON TRAVEL	
Up	20°±2°
Down	14°±2°
WING FLAP TRAVEL (Hydraulic-Actuated)	0° to 38°, +2°-1°
RUDDER TRAVEL (Measured perpendicular to hinge line)	
Right	27°13'±1°
Left	27°13'±1°
ELEVATOR TRAVEL	
Up	26°30'±1°
Down	22° ±1°
ELEVATOR TRIM TAB TRAVEL	
Up (210)	25°, +1°-0°
Down (210)	15°, +1°-0°
Up (210A)	10°, +2°-0°
Down (210A)	25°, +2°-0°
PRINCIPAL DIMENSIONS	
Wing Span	36' 7"
Tail Span	10' 10"
Length	27' 9"
Fin Height (Maximum with Nose Gear Depressed and Rotating Beacon Installed on Fin)	9' 9"
Track Width	8' 2-1/2"
BATTERY LOCATION	
210	Under Baggage Compartment Floor
210A	Under Pilot's Seat

DESIGN GROSS WEIGHT	3000 lb
FUEL CAPACITY (Total)	
Standard	65 gal.
Optional	84 gal.
OIL CAPACITY	12 qt
ENGINE MODEL (Refer to Section 12 for Engine Data)	CONTINENTAL IO-470-S
PROPELLER (Constant Speed)	82" McCAULEY
LANDING GEAR (Retractable Hydraulic Actuated)	Tricycle
MAIN WHEEL TIRES	6.00 x 6, 6-ply rating
Pressure	42 psi
NOSE WHEEL TIRES	5.00 x 5, 6-ply rating
Pressure	45 psi
NOSE GEAR STRUT PRESSURE (Strut Extended)	95 psi
WHEEL ALIGNMENT	
Camber	+4°±1.5°
Toe-in	0° to .06"
AILERON TRAVEL	
Up	20°±2°
Down	14°±2°
WING FLAP TRAVEL (Hydraulic Actuated)	0° to 40°, +1°-2°
RUDDER TRAVEL (Measured perpendicular to hinge line)	
Right	27°13'±1°
Left	27°13'±1°
ELEVATOR TRAVEL	
Up	26°30'±1°
Down	18° ±1°
ELEVATOR TRIM TAB TRAVEL	
Up	20°, +1°-0°
Down	20°, +1°-0°
PRINCIPAL DIMENSIONS	
Wing Span	36' 7"
Tail Span	10' 10"
Length	27' 9"
Fin Height (Maximum with Nose Gear Depressed and Rotating Beacon Installed on Fin)	9' 9"
Track Width	8' 2-1/4"
BATTERY LOCATION	Right Side of Firewall

DESIGN GROSS WEIGHT	3100 lb
FUEL CAPACITY (Total)	
Standard	65 gal.
Optional	84 gal.
OIL CAPACITY (Detergent Only)	12 qt
ENGINE MODEL (Refer to Section 12 for Engine Data)	CONTINENTAL IO-520-A
PROPELLER (Constant Speed)	82" McCAULEY
LANDING GEAR (Retractable Hydraulic Actuated)	Tricycle
MAIN WHEEL TIRES	6.00 x 6, 6-ply rating
Pressure	42 psi
NOSE WHEEL TIRE	5.00 x 5, 6-ply rating
Pressure	45 psi
NOSE GEAR STRUT PRESSURE (Strut Extended)	95 psi
WHEEL ALIGNMENT	
Camber	+4°±1.5°
Toe-in	0" to .06"
AILERON TRAVEL	
Up	21°±2°
Down	14°30'±2°
WING FLAP TRAVEL (Electrically Actuated)	0°to 40°, +1°-2°
RUDDER TRAVEL (Measured perpendicular to hinge line)	
Right	27°13'±1°
Left	27°13'±1°
ELEVATOR TRAVEL	
Up	26°30'±1°
Down	18° ±1°
ELEVATOR TRIM TAB TRAVEL	
Up	20°, +1°-0
Down	10°, +1°-0°
PRINCIPAL DIMENSIONS	
Wing Span	36' 7"
Tail Span	11' 8"
Length	27' 9"
Fin Height (Maximum with Nose Gear Depressed and Rotating Beacon Installed on Fin)	9' 9"
Track Width	8' 2-1/4"
BATTERY LOCATION	Right Side of Firewall

DESIGN GROSS WEIGHT	3300 lb
FUEL CAPACITY (Total)	
Standard	65 gal.
Optional	84 gal.
OIL CAPACITY	12 qt
ENGINE MODEL (Refer to Section 12 for Engine Data)	CONTINENTAL IO-470-S
PROPELLER (Constant Speed)	82" McCAULEY
LANDING GEAR (Non-retractable)	Tricycle
MAIN WHEEL TIRES	
Standard	6.00 x 6, 6-ply rating
Pressure	42 psi
Optional	8.00 x 6, 6-ply rating
Pressure	35 psi
NOSE WHEEL TIRE	
Standard	5.00 x 5, 6-ply rating
Pressure	45 psi
Optional	6.00 x 6, 4-ply rating
Pressure	35 psi
NOSE GEAR STRUT PRESSURE (Strut Extended)	95 psi
WHEEL ALIGNMENT	
Camber	+4°±1.5°
Toe-in	0" to .06"
AILERON TRAVEL	
Up	20°±2°
Down	14°±2°
WING FLAP TRAVEL (Electrically-Actuated)	0° to 40°, +1°-2°
RUDDER TRAVEL(Measured perpendicular to hinge line)	
Right	27°13'±1°
Left	27°13'±1°
ELEVATOR TRAVEL	
Up	26°30'±1°
Down	18° ±1°
ELEVATOR TRIM TAB TRAVEL	
Up	20°, +1°-0°
Down	20°, +1°-0°
PRINCIPAL DIMENSION	
Wing Span	36' 7"
Tail Span	10' 10"
Length	27' 9"
Fin Height (Maximum with Nose Gear Depressed and Rotating Beacon Installed on Fin)	9' 9"
Track Width	8' 1-3/4"
BATTERY LOCATION	Right Side of Firewall

DESIGN GROSS WEIGHT	3300 lb
FUEL CAPACITY (Total)	
Standard	65 gal.
Optional	84 gal.
OIL CAPACITY (Detergent Only)	12 qt
ENGINE MODEL (Refer to Section 12 for Engine Data)	CONTINENTAL IO-520-A
PROPELLER (Constant Speed)	82" McCAULEY
LANDING GEAR (Non-retractable)	Tricycle
MAIN WHEEL TIRES	
Standard	6.00 x 6, 6-ply rating
Pressure	42 psi
Optional	8.00 x 6, 6-ply rating
Pressure	35 psi
NOSE WHEEL TIRE	
Standard	5.00 x 5, 6-ply rating
Pressure	45 psi
Optional	6.00 x 6, 4-ply rating
Pressure	35 psi
NOSE GEAR STRUT PRESSURE (Strut Extended)	95 psi
WHEEL ALIGNMENT	
Camber	+4°±1.5°
Toe-in	0" to .06"
AILERON TRAVEL	
Up	21°±2°
Down	14°30'±2°
WING FLAP TRAVEL (Electrically Actuated)	0° to 40°, +1°-2°
RUDDER TRAVEL (Measured perpendicular to hinge line)	
Right	27°13'±1°
Left	27°13'±1°
ELEVATOR TRAVEL	
Up	26°30'±1°
Down	18° ±1°
ELEVATOR TRIM TAB TRAVEL	
Up	15°, +1°-0°
Down	25°, +1°-0°
PRINCIPAL DIMENSIONS	
Wing Span	36' 7"
Tail Span	11' 8"
Length (Except Super Skylane)	27' 9"
Length (Super Skylane)	28' 2"
Fin Height (Maximum with Nose Gear Depressed and Rotating Beacon Installed on Fin)	9' 9"
Track Width	8' 1-3/4"
BATTERY LOCATION	Right Side of Firewall

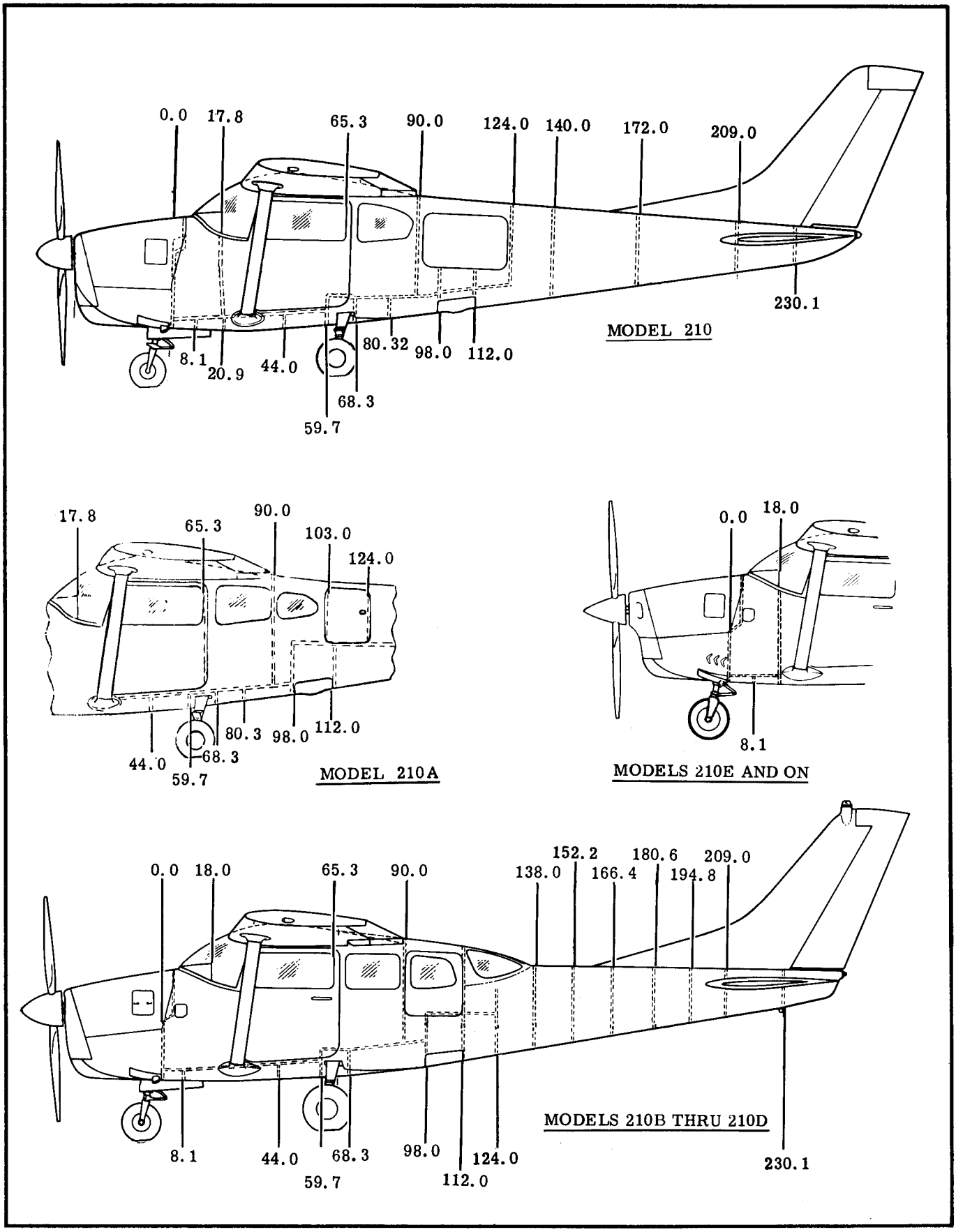
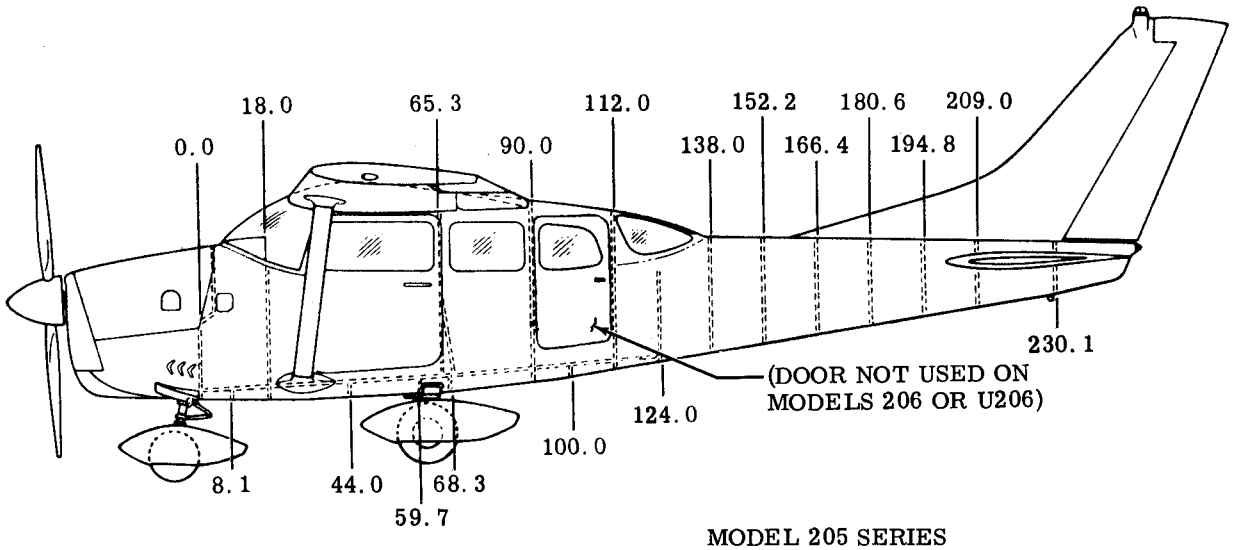
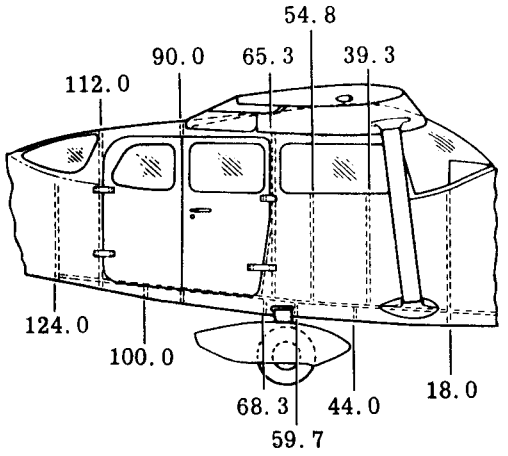


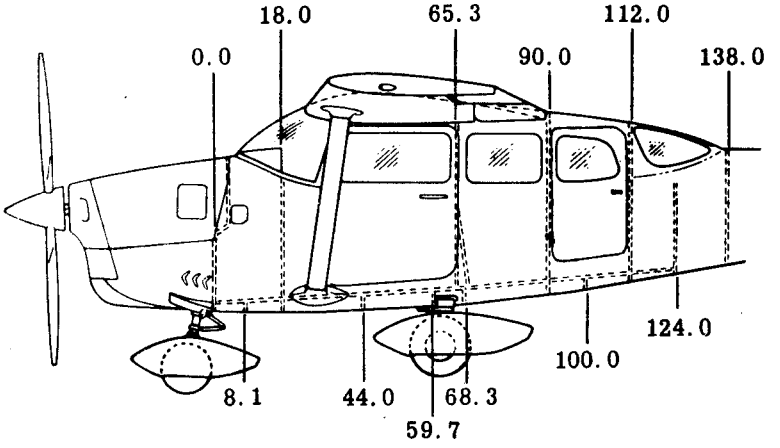
Figure 1-1. Fuselage Reference Stations (210 Series)



MODEL 205 SERIES
MODEL 206 & U206
MODEL P206 SUPER SKYWAGON



RIGHT SIDE VIEW OF
MODELS 206 & U206



MODEL P206
SUPER SKYLANE

Figure 1-2. Fuselage Reference Stations (205 and 206 Series)

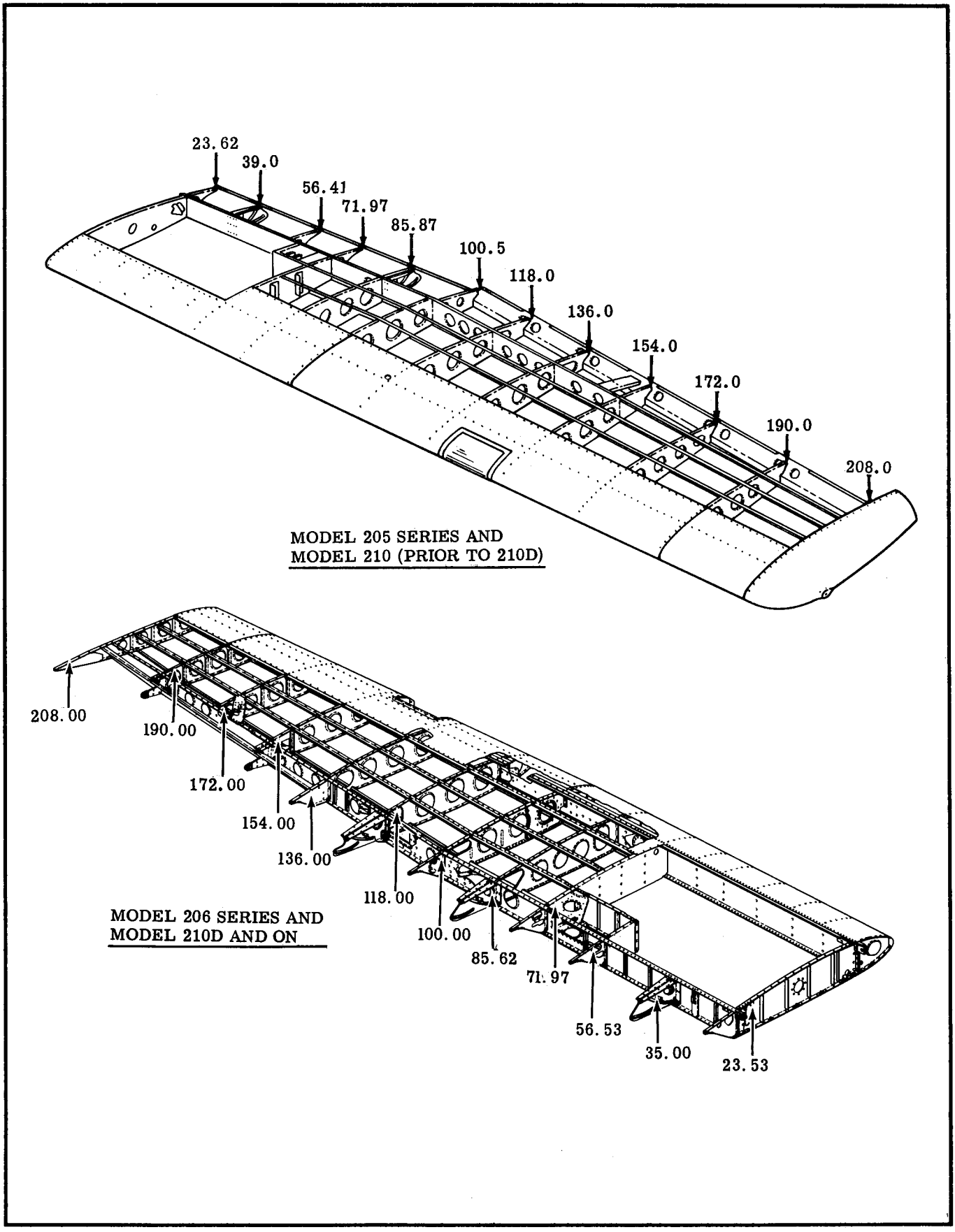


Figure 1-3. Wing Reference Stations

TORQUE VALUES IN POUND-INCHES

FINE THREAD SERIES

BOLT SIZE (See Note 1)	STANDARD TYPE NUTS (See Note 2)	STANDARD TYPE NUTS Alternate Values AN310 (See Note 4)	SHEAR TYPE NUTS MS20364, AN320 AN316, AN7502	SHEAR TYPE NUTS Alternate Values AN320 (See Note 4)
10-32	20-25	20-28	12-15	12-19
1/4-28	50-70	50-75	30-40	30-48
5/16-24	100-140	100-150	60-85	60-106
3/8-24	160-190	160-260	95-110	95-170
7/16-20	450-500	450-560	270-300	270-390
1/2-20	480-690	480-730	290-410	290-500
9/16-18	800-1000	800-1070	480-600	480-750
5/8-18	1100-1300	1100-1600	660-780	660-1060
3/4-16	2300-2500	2300-3350	1300-1500	1300-2200
7/8-14	2500-3000	2500-4650	1500-1800	1500-2900
1-14	3700-5500	3700-6650	2200-3300	2200-4400
1-1/8-12	5000-7000	5000-10000	3000-4200	3000-6300
1-1/4-12	9000-11000	9000-16700	5400-6600	5400-10000

COARSE THREAD SERIES

BOLT SIZE (See Note 1)	STANDARD TYPE NUTS (See Note 3)	SHEAR TYPE NUTS MS20364, AN320, AN316
8-32	12-15	7-9
10-24	20-25	12-15
1/4-20	40-50	25-30
5/16-18	80-90	48-55
3/8-16	160-185	95-100
7/16-14	235-255	140-155
1/2-13	400-480	240-290
9/16-12	500-700	300-420
5/8-11	700-900	420-540
3/4-10	1150-1600	700-950
7/8-9	2200-3000	1300-1800
1-8	3700-5000	2200-3000
1-1/8-8	5500-6500	3300-4000
1-1/4-8	6500-8000	4000-5000

NOTES:

(1) AN3, AN23, AN42, AN173, MS20004, NAS334, NAS464 Series bolts; AN502, AN503, NAS220 and NAS517 Series Screws.

(2) AN310, AN315, AN345, AN362, AN363, MS20365, AN366, "EB","1452", "Z1200," "UWN" and other self-locking nuts.

(3) AN310, AN340, MS20365, AN366 and other self-locking anchor nuts.

(4) When using AN310 and AN320 castellated nuts where alignment between bolt and cotter pin holes is not reached using normal torque values, use alternate torque values or replace nut.

These torque values are derived from oil-free cadmium-plated threads, and are recommended for all installation procedures contained in this book except where other values are stipulated. They are not to be used for checking tightness of installed parts during service.

SECTION 2

GROUND HANDLING, SERVICING, LUBRICATION, AND INSPECTION

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2-1. GROUND HANDLING.

2-2. TOWING. Moving the airplane by hand is accomplished by using the wing struts and landing gear struts as push points. A tow bar attached to the nose gear should be used for steering and maneuvering the airplane. When no tow bar is available, press down at the horizontal stabilizer front spar, adjacent to the fuselage, to raise the nose wheel off the ground. With the nose wheel clear of the ground, the airplane can be turned by pivoting it about the main wheels.

CAUTION

When towing the airplane, never turn the nose wheel of the Model 210 and 210A more than 30 degrees either side of center or the nose gear will be damaged. Nose wheel turning radius of all other 200 Series airplanes is 35 degrees either side of center. Do not push on control surfaces or outboard empennage surfaces. When pushing on the tailcone, always apply pressure at a bulkhead to avoid buckling the skin.

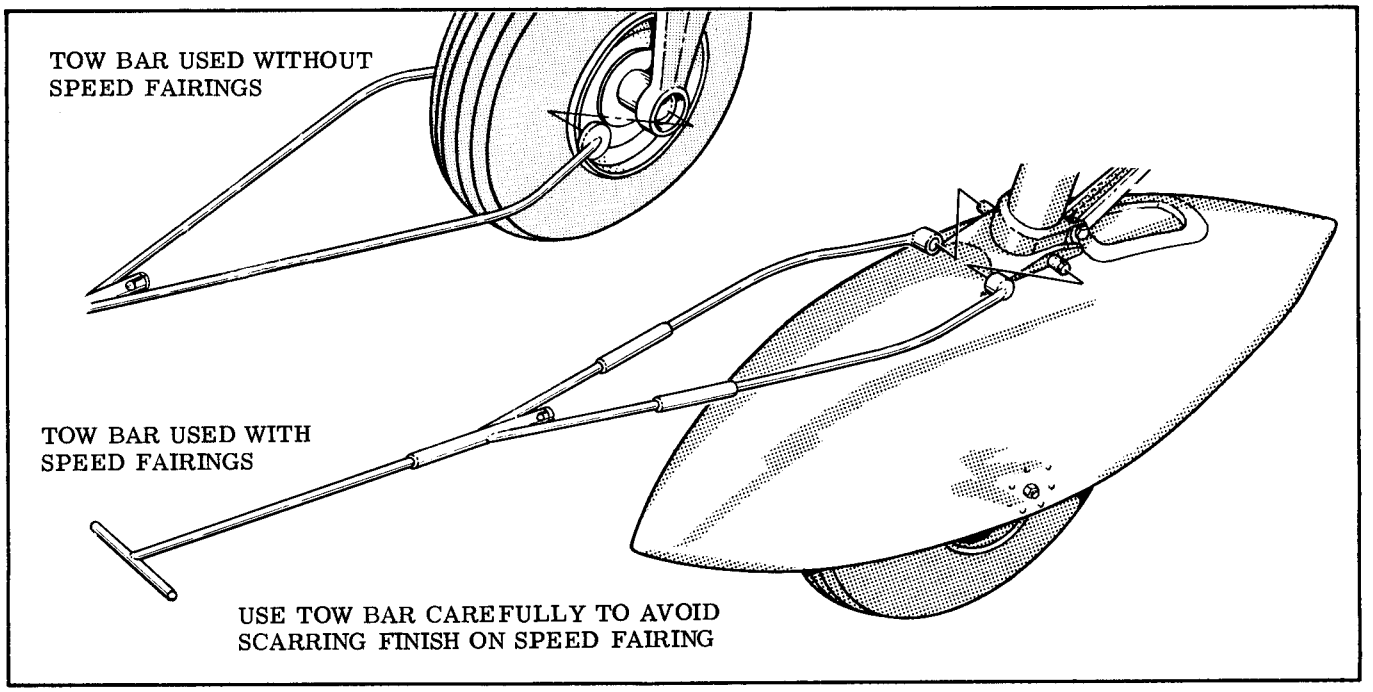


Figure 2-1. Typical Tow Bars

2-3. HOISTING. The airplane may be hoisted with hoists of two-ton capacity, either by using hoisting rings (optional-equipment) or by using suitable slings. The front sling should be hooked to the engine lifting eye, and the aft sling should be positioned around the fuselage at the first bulkhead forward of the leading edge of the stabilizer. If the optional hoisting rings are used, a minimum cable length of 60 inches for each cable is required to prevent bending of the eye-bolt type hoisting rings. If desired, a spreader jig may be fabricated to apply vertical force to the eye-bolt.

2-4. JACKING. Refer to figure 2-2 for jacking procedures.

CAUTION

When using the universal jack point, flexibility of the gear strut will cause the main wheel to slide inboard as the wheel is raised, tilting the jack. The jack must then be lowered for a second jacking operation. Jacking both wheels simultaneously with universal jack points is not recommended.

2-5. PARKING. Parking precautions depend principally on local conditions. As a general precaution, it is wise to set the parking brake or chock the wheels, and install the control lock. In severe weather, and high wind conditions, tie down the airplane as outlined in paragraph 2-6 if a hangar is not available.

2-6. TIE-DOWN should be accomplished in anticipation of high winds. Tie down airplanes as follows:

a. Tie ropes or chains to the wing tie-down fittings located at the upper end of each wing strut. Secure the opposite ends of the ropes or chains to ground anchors.

b. Secure a rope (no chains or cables) to the upper trunnion of the nose gear and secure opposite end of rope to a ground anchor.

c. Secure the middle of a rope to tail tie-down ring. Pull each end of rope away at 45° angle and secure to ground anchors at each side of tail.

d. Install surface control locks between wing tip and aileron and over fin and rudder.

e. Install control lock on pilot's control column if available; if control lock is not available, tie pilot's control wheel back with front seat belt.

2-7. HANGAR STORAGE. An airplane stored in a hangar requires little attention. The following operations will maintain the airplane in a serviceable condition.

NOTE

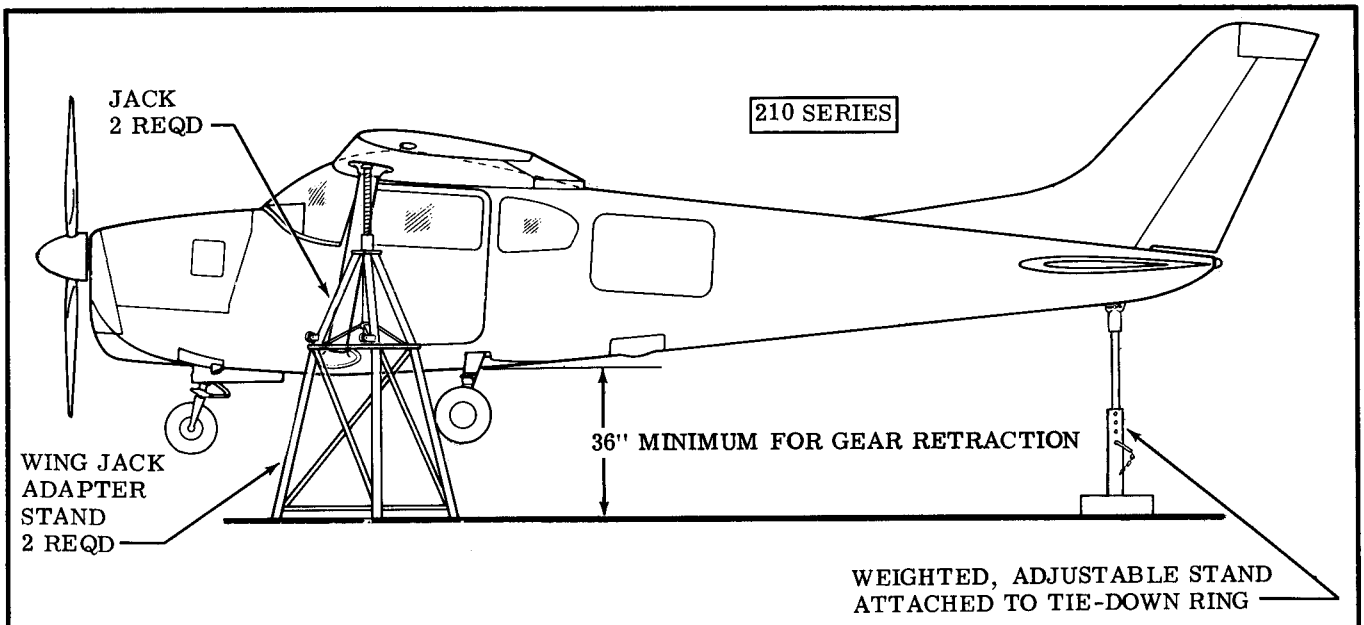
If the airplane is to be stored for a long period, see paragraph 2-9.

a. Rotate propeller by hand every few days to maintain an oil film on the internal parts of the engine.

b. Keep fuel tanks full to retard moisture condensation in the tanks.

c. Keep battery fully charged to prevent the electrolyte from freezing in an unheated hangar.

2-8. OUTSIDE STORAGE. Short-term outside storage of an airplane requires secure tie-down procedures in accordance with paragraph 2-6, as well as the precautions listed in paragraph 2-7. In addition, the pitot tube, air vents, openings in the engine cowling, and other similar openings should have protective covers installed if rain, sleet, snow, or blowing dust are anticipated.



NOTE

Wing jacks available from the Cessna Spare Parts Department are REGENT Model 4939-30 for use with the SE-576 wing stands. Combination jacks are the REGENT Model 4939-70 for use without wing stands. The 4939-70 jack (70-inch) may be converted to the 4939-30 jack (30-inch) by removing the leg extensions and replacing lower braces with shorter ones. The base of the adjustable tail stand (SE-767) is to be filled with concrete for additional weight as a safety factor. The SE-576 wing stand will also accommodate the SANCOR Model 00226-150 jack. Other equivalent jacks, tail stands, and adapter stands may be used.

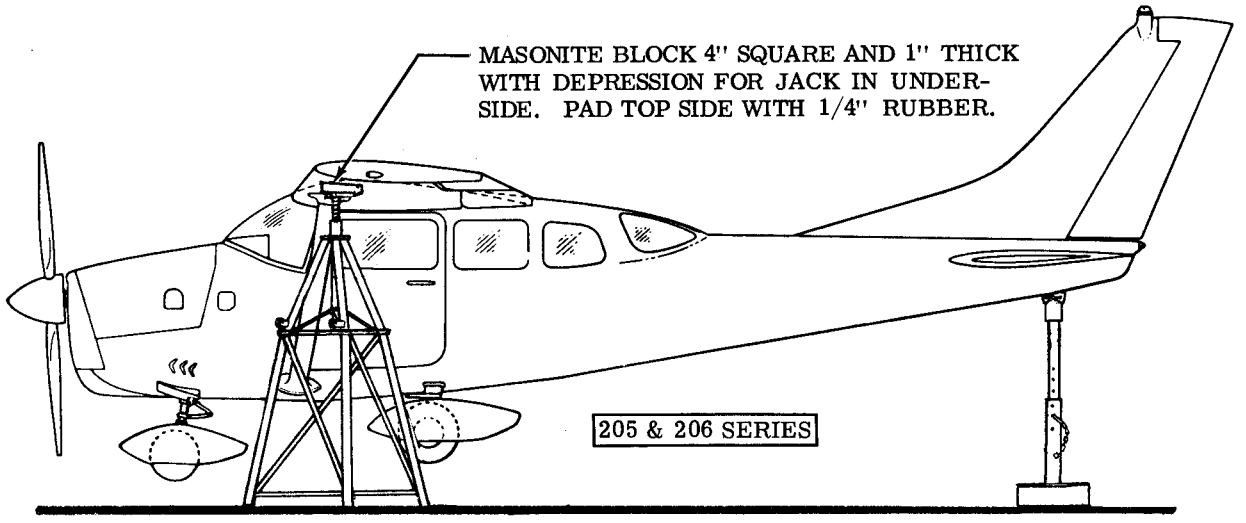
JACKING THE MODEL 210 SERIES AIRPLANE

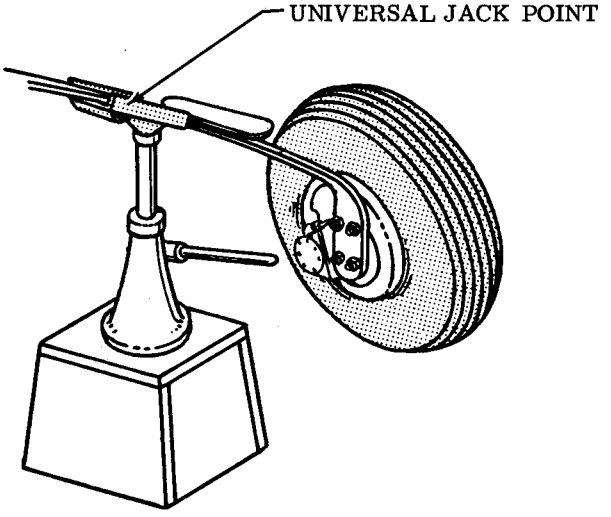
1. Lower the airplane tail so that wing jack and stands can be placed at wing jack points.
2. Raise airplane tail and attach tail stand to tail tie-down ring. Be sure the tail stand weighs enough to keep the tail down under all conditions and that it is strong enough to support any weight that may be placed upon it.
3. Raise jacks evenly until desired height is reached. When jacking the airplane, the main landing gear wheels must be a minimum of 16" above shop floor for landing gear retraction.
4. The universal jack point may be used to raise only one main wheel. Do not use brake casting as a jack point. Flex brake line away from gear strut when using universal jack point.
5. The nose may be raised by weighting down the tail. Place weight on each side of stabilizer, next to fuselage.
6. Whenever the landing gear is to be operated in the shop, use the wing jack and tail jack points to raise the airplane.
7. The airplane may be hoisted as outlined in paragraph 2-3.

REMOVING THE MODEL 210 SERIES AIRPLANE FROM JACKS

1. Place landing gear control handle in gear down position.
2. Operate ground hydraulic power source or airplane emergency hydraulic hand pump until landing gear is down and locked, the green (Down) light is illuminated and landing gear control handle has tripped to down neutral.
3. Disconnect ground hydraulic power source and/or stow emergency hydraulic hand pump handle.
4. On the Models 210 and 210A airplanes, expend hydraulic pressure in the accumulator by operating the wing flaps. To do this, operate wing flaps until they cease to move, then manually move wing flaps in the direction the wing flap control handle indicates until they hang limp.
5. Ascertain that green (DOWN) light is illuminated; then place master switch in OFF position.
6. Lower jacks evenly until airplane rests on the landing gear and remove wing jacks and tail stand.
7. Compress nose landing gear shock strut to static position.

Figure 2-2. Jacking Details (Sheet 1 of 2)





NOTE

The same general procedure may be used for jacking the Model 205 and 206 Series airplanes, except for deleting all references to retractable landing gear and hydraulic wing flaps. Since wing jack points are not provided, use the padded blocks shown to protect wings while using wing jacks. Place pads at front spars, just outboard of wing struts.

Figure 2-2. Jacking Details (Sheet 2 of 2)

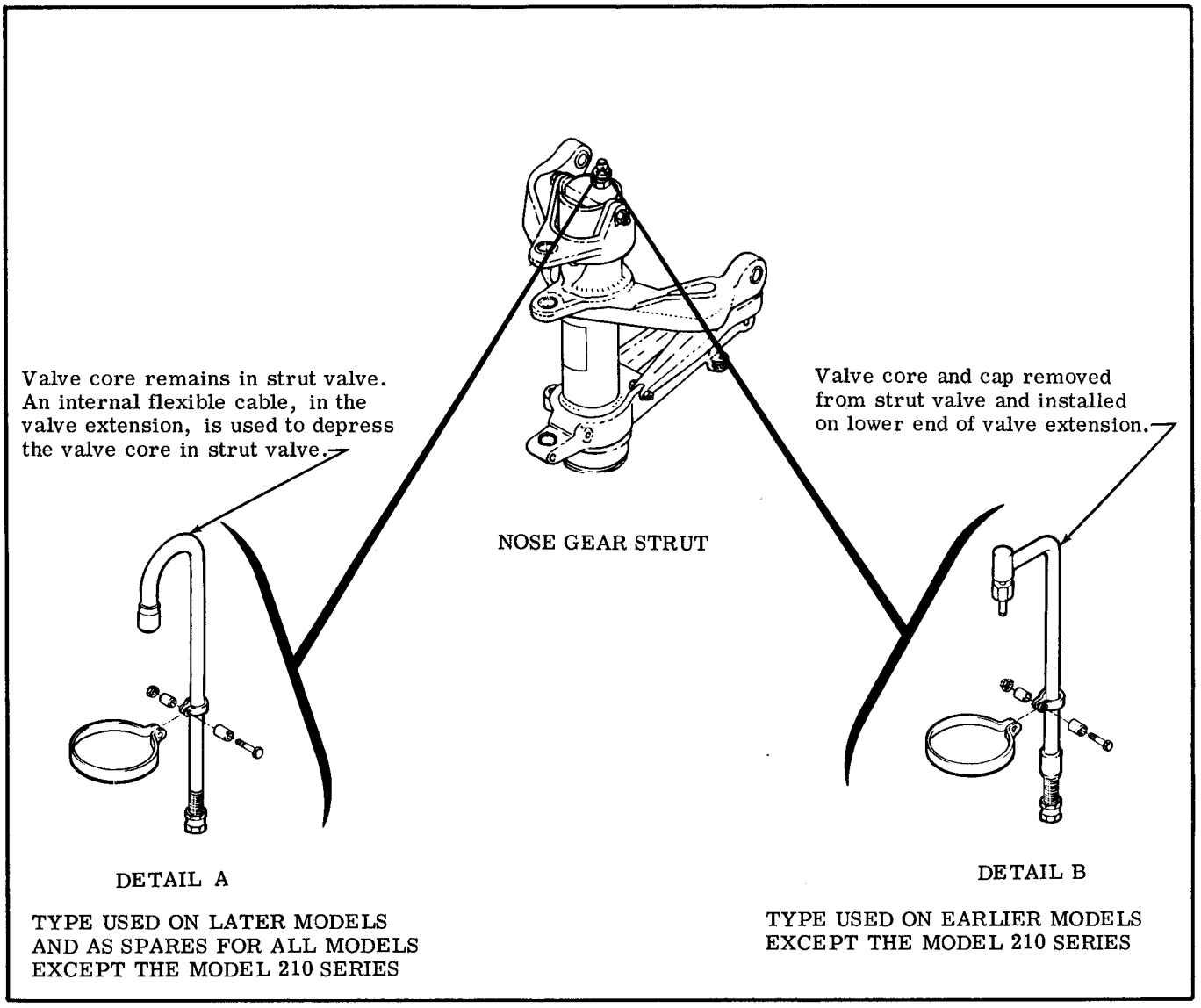


Figure 2-3. Strut Filler Valve Extension

SHOP NOTES:

2-9. EXTENDED STORAGE requires the following precautions in addition to secure tie-down or storing the airplane in a hangar.

a. Operate engine until oil temperature reaches normal range. Drain engine oil sump completely and reinstall drain plug.

b. Fill oil sump with 12 quarts of corrosion preventive oil, which has been pre-heated to 225°. Continental Motors Corporation recommends Cosmoline No. 1223 supplied by E. F. Houghton & Co., 305 W. Lehigh Avenue, Philadelphia, Pa.

c. Start and operate engine at 1200 - 1500 rpm for five minutes.

CAUTION

Monitor cylinder head temperature closely. Temperature shall not exceed maximum allowable.

d. With engine operating and induction air filter removed, spray corrosion-preventive oil into the induction airbox, at the rate of one-half gallon per minute, until smoke comes from the exhaust stack, then increase the spray until the engine is stopped.

CAUTION

Injecting oil too fast can cause a hydrostatic lock.

e. Do not rotate propeller after completing step d.

f. Remove all spark plugs, and spray corrosion-preventive oil, which has been pre-heated to 150° - 180°F., into all spark plug holes.

g. Replace lower spark plugs or install solid plugs, and install dehydrator plugs in the upper spark plug holes.

h. Cover spark plug terminals with shipping plugs or other suitable covers, and cover all other engine and accessory vents, and other openings with a vapor-proof covering material.

i. Drain corrosion-preventive oil from the sump and reinstall drain plug.

NOTE

The corrosion-preventive oil is harmful to paint and should be wiped from painted surfaces immediately.

j. Attach a warning placard on the throttle control knob, to the effect that the engine contains no lubricating oil. Placard the propeller to the effect that it should not be rotated while the engine is in storage.

k. Lubricate all airframe items, and seal or cover all openings.

l. Model 210 and 210A, expend hydraulic pressure in the accumulator. To do this, operate wing flaps until they cease to move, then move flaps manually in the direction the flap lever indicates until they hang limp.

m. Model 210 and 210A, release accumulator precharge air pressure.

n. Remove battery from airplane and store in a cool place; service battery periodically.

o. Block up fuselage to remove weight from tires to prevent tires from flat-spotting.

NOTE

Tires will take a set, causing them to be out-of-round, if an airplane is left parked for more than a few days. For this reason, a stored airplane should be blocked up to prevent the tires from flat-spotting.

2-10. RETURNING AIRPLANE TO SERVICE. After short-term storage, returning the airplane to service is accomplished by completing a thorough pre-flight inspection. After extended storage, use the following procedure to return the airplane to service.

a. Remove airplane from blocks and check tires for proper inflation. Check for proper nose gear strut inflation.

b. Check battery and install.

c. Remove all materials used to seal and cover openings.

d. Remove warning placards posted at throttle and propeller.

e. Remove and clean engine oil filter, then reinstall and safety. If an external oil filter is installed, replace filter element and safety.

f. Check that oil sump drain plug is installed and safetied, then service the engine with proper grade and quantity of oil.

NOTE

The corrosion-preventive oil will mix with engine lubricating oil, so flushing the oil system is not necessary. Draining the oil sump will remove enough of the corrosion-preventive oil.

g. Service the induction air filter(s) and install.

h. Remove dehydrator plugs installed in spark plug. holes and rotate propeller by hand several revolutions to clear corrosion-preventive oil from cylinders.

i. Install all spark plugs and connect spark plug leads.

j. Check fuel strainer. Remove and clean filter screen if necessary. Check fuel tanks and fuel lines for moisture condensation and sediment, and drain enough fuel to eliminate.

k. Check hydraulic system for correct amount of fluid.

l. Model 210 and 210A, precharge accumulator in accordance with paragraph 2-25.

m. Perform a thorough pre-flight inspection, then start and warm up engine.

2-11. LEVELING. On all models except the Model 206, remove the scuff plate at the baggage compartment door opening and use the lower sill to level the airplane longitudinally. Corresponding points on either the upper or lower main door sills may be used to level the airplane laterally. On the Model 206, corresponding points on the front seat rails may be used to level the airplane laterally. The lower surface of the pilot's upper door sill may be used for longitudinal leveling.

2-12. SERVICING.

2-13. Servicing requirements are shown in the Servicing Chart (figure 2-4). The following paragraphs

supplement this figure by adding details not included in the chart.

2-14. FUEL TANKS should be filled to capacity immediately after flight to reduce moisture condensation. Standard tank capacity is 65 gallons. All Models except the 1961 Model 210 may have as optional equipment long range wing which provides a fuel capacity of 84 gallons. The recommended fuel grade to be used in the airplanes is 100/130 minimum, aviation grade gasoline.

2-15. FUEL DRAINS are located at various points in the fuel systems to provide for drainage of water and sediment. See Section 13 for location of drain plugs and valves for the different models.

2-16. ENGINE OIL. Check engine lubricating oil with the oil dipstick 5 to 10 minutes after the engine has been stopped. Oil capacity for each model is 12 quarts total with a normal operating capacity of 10 quarts. Do not operate with less than the minimum-for-flight quantity of 9 quarts. If the airplane is equipped with an external oil filter, one addition quart is required when the filter element is changed. To minimize loss of oil through the crankcase breather line, fill to the specified oil level shown on the dipstick for normal flight of less than three hours. For extended flights, fill to the full mark on the dipstick. Change engine oil and filter element every 50 hours of operation or every four months, whichever should occur first. When changing external oil filter element refer to paragraph 12-84.

NOTE

Engine oil should be drained while the oil is still hot. The nose of the airplane should be raised for more positive draining of any sludge which may have collected in the oil sump.

On airplanes not equipped with an external oil filter, change engine oil every 25 hours or every four months, whichever should occur first. At each oil change, remove and clean the oil screen with solvent (Federal Specification P-S-661 or equivalent). Reduce oil change periods for prolonged operations in dusty areas, in cold climates where sludging conditions exist, or where short flights and long idle periods are encountered which cause sludging conditions.

In the IO-470 series engines, it is recommended that detergent oil not be used during the first 25 hours of engine operation, in order to permit piston rings to seat properly. This applies to a newly overhauled engine as well as a new engine. After the first 25 hours, either straight mineral oil or detergent oil may be used. If a detergent oil is used, it must conform to Continental Motors Corporation Specification MHS-24.

NOTE

In the IO-520-A engine, use ONLY detergent oil conforming to Continental Motors Corporation Specification MHS-24.

When adding or changing engine oil, use the following recommended grades: above 40°F. use SAE 50; below 40°F. use SAE 30 oil.

2-17. ENGINE INDUCTION AIR FILTERS keep dust and dirt from entering the induction system. The value of maintaining the induction air filter in good clean condition can never be overstressed. More engine wear is caused through the use of a dirty air filter than is generally believed. The frequency with which the filter should be removed and cleaned will be determined primarily by aircraft operating conditions. A good general rule, however, is to remove and clean the filter at least every 50 hours, of engine operating time and more frequently if warranted by operating conditions. Some operators prefer to hold a spare filter at their home base of operation so that a clean filter is always readily available for use. Under extremely dusty conditions, daily maintenance of the filter is recommended The Model 210 Series, beginning with the Model 210D, use two induction air filters. To service the induction air filter, proceed as follows:

a. Remove filter from air box and wash filter in solvent (Federal Specification P-S-661 or equivalent).

b. Drain and dry, then dip flock-coated screen filter in same grade of oil used in engine and allow excess oil to drain off.

c. Be sure air box is clean, inspect filter and replace if necessary.

2-17A. VACUUM SYSTEM AIR FILTERS. On airplanes equipped with vacuum systems containing a central air filter, change the central filter every 500 hours of operation. If equipped with a suction gage, also change central air filter whenever suction gage reading drops below 4.6 inches of mercury. If not equipped with a suction gage, also change central air filter whenever erratic or sluggish responses are noted with normal indicator light indications. With central air filter installed, change gyro instrument air filters whenever the gyro instruments are overhauled. On airplanes equipped with vacuum systems that do not contain a central air filter, replace the gyro instrument air filters every 100 hours and whenever erratic or sluggish responses are noted with normal suction gage readings or indicator light indications.

2-18. BATTERY. Battery servicing involves adding distilled water to maintain the electrolyte even with the horizontal baffle plate or split ring at the bottom of the filler holes, checking cable connections, and neutralizing and cleaning off any spilled electrolyte or corrosion. Use bicarbonate of soda (baking soda) and clean water to neutralize electrolyte or corrosion. Follow with a thorough flushing with clean water. Do not allow bicarbonate of soda to enter battery. Brighten cable and terminal connection with a wire brush, then coat with petroleum jelly before connecting. Check the battery every 50 hours (or at least every 30 days), oftener in hot weather. Add only distilled water, not acid or "rejuvenators," to maintain electrolyte level in the battery. Inspect the battery box and clean, remove any evidence of corrosion.

2-19. TIRES should be maintained at the air pressure specified in the charts of Section 1. When checking tire pressure, examine tire for wear, cuts, bruises, and slippage.

NOTE

Recommended tire pressure should be maintained. Especially in cold weather, remember that any drop in temperature of the air inside a tire causes a corresponding drop in pressure.

2-20. NOSE GEAR STRUT. The nose gear strut requires periodic checking to ascertain that the strut is filled with hydraulic fluid and is inflated to the correct air pressure. All models except the Model 210 Series may be equipped with one of the air filler extension valves shown in figure 2-3. This valve extension assembly is added to the filler valve, at the top of the nose gear strut, to provide easier servicing while the strut is installed. To fill the nose gear strut (all models) with hydraulic fluid and air, proceed as follows:

a. Tie down tail to raise nose wheel off ground.

b. Remove filler valve cap from filler valve or from lower end of valve extension, and depress valve core to completely deflate nose strut.

c. Remove valve core from filler valve. To remove valve core from the type shown in Detail A of figure 2-3, it will be necessary to disconnect filler valve extension from valve at top of strut.

d. Attach a rubber hose to the valve extension or to the filler valve.

e. With other end of rubber hose in a container of hydraulic fluid (MIL-H-5606), compress and extend strut several times. This will draw fluid into the strut as it is extended.

f. After the strut has been cycled several times, allow strut to extend. Holding end of hose above fluid level in container, slowly compress strut, allowing excess fluid to be drained into container.

g. While strut is compressed, remove hose and install valve core in valve extension, or install filler valve and extension.

h. Inflate strut to 95 psi with nose wheel off ground (strut extended).

NOTE

Keep the nose gear shock strut, especially the exposed portion of the strut piston, wiped off with a clean dry cloth to remove dust and grit which may cut the seals in the strut barrel. Do not wipe the strut with hydraulic fluid, since this tends to collect even more dust and grit.

2-21. NOSE GEAR SHIMMY DAMPENER. The shimmy dampener should be serviced at least every 100 hours. The dampener must be filled completely with fluid, free of entrapped air, to serve its purpose. When refilling the shimmy dampener, proceed as follows:

a. To fill the shimmy dampener on the Model 210 and 210A, turn the nose wheel to the right to its limit of travel so that air cannot be entrapped behind the dampener piston. Remove filler plug on top of dampener barrel and fill with MIL-H-5606 hydraulic fluid. Reinstall filler plug.

b. To fill the shimmy dampener on other 200 series airplanes, remove dampener and submerge in MIL-H-5606 hydraulic fluid with plug removed. Work dampener piston shaft in and out to remove any entrapped air and ascertain complete filling of cylinder. Reinstall plug before removing dampener from hydraulic fluid.

NOTE

Keep the shimmy dampener, especially the exposed portions of the dampener shaft wiped off with a clean dry cloth to remove dust and grit which may cut the seals in the dampener barrel. Do not wipe the shaft with hydraulic fluid, since this tends to collect even more dust and grit.

2-22. HYDRAULIC BRAKE SYSTEMS should be checked for the correct amount of fluid at least every 100 hours. Add MIL-H-5606 hydraulic fluid at the brake master cylinders. Bleed the brake system of entrapped air whenever there is a spongy response to the brake pedals.

2-23. HYDRAULIC RESERVOIR (210 SERIES ONLY). In the 210 and 210A airplanes the hydraulic reservoir should be checked and replenished as necessary every 25 hours. In the 210B and on the reservoir should be filled as necessary whenever the fluid level in the reservoir sight window shows low. Filling is accomplished by using a pressure brake bleeder or Hydro-Fill unit attached to the filler fitting on the firewall. MIL-H-5606 hydraulic fluid should be pumped into the filler until fluid flows from the reservoir overboard vent line. A slower method of filling the reservoir is to remove the filler valve and use gravity-feed from a container at least as high as the top of the firewall.

NOTE

Before checking fluid level or refilling the reservoir in the Model 210 and 210A airplanes, expend all fluid from accumulator by actuating the flaps. To do this, operate flaps until they cease to move, then move flaps manually in the direction the flap lever indicates until the flaps hang limp, thus indicating a lack of hydraulic pressure in the system. The airplane should be approximately level when checking fluid level. Do not overtighten the screw in the filler block or the seal will be damaged.

2-24. HYDRAULIC FILTER (210 SERIES ONLY). The Model 210 and 210A airplanes use a hydraulic filter with a replaceable element. Model 210B and on use a hydraulic filter with a fine-mesh screen. The filter element or filter screen should be removed and cleaned at the first 100 hours and thereafter, at 500 hour intervals or whenever improper fluid circulation is suspected. There are two types

of filter units installed on the 210 and 210A airplanes, figure 5-5 depicts these filters; figure 2-6 depicts the type of filter screens used on the 210B and on.

2-25. ACCUMULATOR (MODEL 210 AND 210A ONLY). Accumulator precharge on the 210 and 210A airplanes should be checked every 100 hours and serviced as required. Charge accumulator to 600 psi plus zero minus 100 psi with nitrogen or dry air. Hydraulic system pressure should be zero when charging the accumulator with nitrogen or dry air.

NOTE

Nitrogen is preferable to compressed air for charging the accumulator, since nitrogen is an inert, moisture-free gas which prevents water condensation and oxidation contamination in the accumulator. A regulator, gage, and filler hose are available from the Cessna Spare Parts Department.

2-26. HYDRAULIC FLUID SAMPLING. (210 Series). This operation is performed only when reason exists to suspect contamination of the airplane hydraulic fluid.

a. Place airplane master switch in OFF position.

b. Place landing gear control handle in down position, and actuate hydraulic hand pump to open landing gear doors.

c. Remove door open line from nose gear door actuator cylinder. Using the hydraulic hand pump, drain off a small sample of hydraulic fluid into a non-metallic container.

d. Reconnect nose gear actuating cylinder line and analyize fluid sample in accordance with paragraph 5-39.

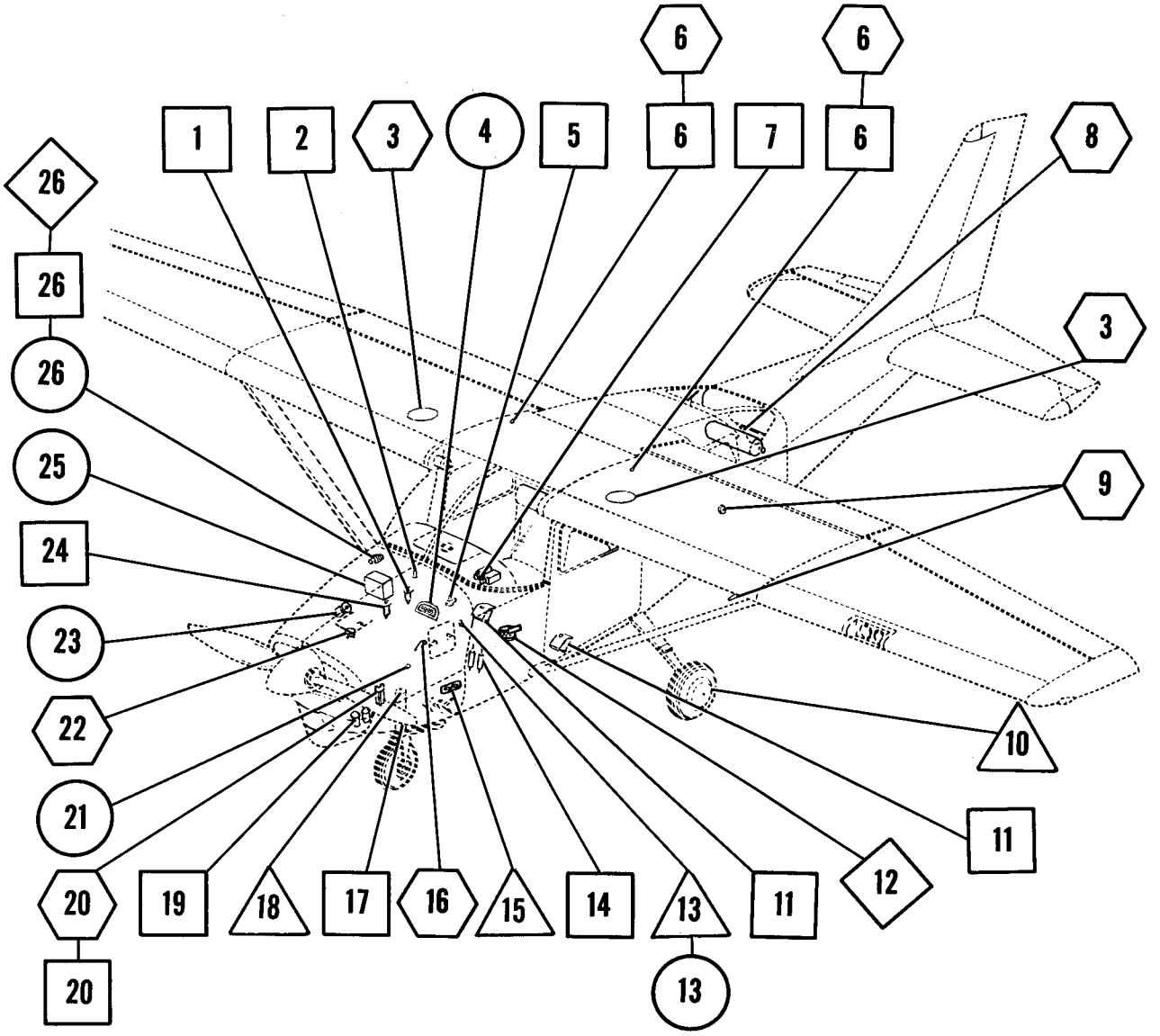
2-27. OXYGEN CYLINDER. Some airplanes are equipped with an optional oxygen system. The oxygen cylinder should be refilled when the oxygen system pressure is below 300 psi. Refer to Section 15 for details on filling the oxygen cylinder. All oxygen systems are equipped with a filler valve so that the system may be filled without removing the oxygen cylinder.

WARNING

Do not permit smoking or open flame in or near airplane while work is performed on oxygen system, or when the system is in operation. Guard against inadvertently turning the master switch on. Oil, grease, or other lubricants in contact with oxygen create a serious fire hazard, and such contact must be avoided. Only a thread compound approved under MIL-T-5542 can be used safely on oxygen systems. Apply only to the first three threads of male fittings to prevent thread seizure.

2-28. OXYGEN FACE MASKS. Oxygen face masks are normally stowed in a plastic bag on the baggage shelf. Oxygen system servicing should include checking the condition of the face masks, hoses, and fittings, and a replenishment of the supply of masks as required.

SHOP NOTES:



RECOMMENDED FUEL:
AVIATION GRADE -- 100/130 MINIMUM GRADE

IO-520 SERIES RECOMMENDED ENGINE OIL: (Detergent Only)
AVIATION GRADE --SAE 30 BELOW 40°F. (4.4°C)
SAE 50 ABOVE 40°F. (4.4°C)

IO-470 SERIES RECOMMENDED ENGINE OIL:
AVIATION GRADE --SAE 30 BELOW 40°F. (4.4°C)
SAE 50 ABOVE 40°F. (4.4°C)

HYDRAULIC FLUID:
SPEC. NO. MIL-H-5606

OXYGEN:
SPEC. NO. MIL-O-27210

Figure 2-4. Servicing (Sheet 1 of 4)

DAILY

3 FUEL TANKS:
Fill after each flight. Keep full to retard condensation. Refer to paragraph 2-14 for details.

6 FUEL TANK SUMP DRAINS:
If optional quick-drain valves are installed, drain off water and sediment before the first flight of the day.

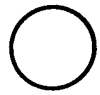
8 OXYGEN CYLINDER:
Check for anticipated requirement before each flight. Refer to paragraphs 2-27 and 2-28 for details.

9 PITOT AND STATIC PORTS:
Check for obstructions before first flight of the day.

16 OIL DIPSTICK:
Check on preflight. Add oil as necessary. Refer to paragraph 2-16 for details.

22 OIL FILLER CAP:
Whenever oil is added, check that oil filler cap is tight and oil filler door is secure.

20 FUEL STRAINER:
Drain off any water and sediment before the first flight of the day.



50 HOURS

4 INDUCTION AIR FILTER:
Service every 50 hours, oftener under dusty conditions. Refer to paragraph 2-17 for details.

21 23 ENGINE OIL SYSTEM:
Change engine oil and external filter element every 50 hours. Without external filter, change oil and clean oil screen every 25 hours. Reduce these intervals under severe operating conditions. Refer to paragraphs 2-16 and 12-84 for details.

25 BATTERY:
Check level of electrolyte every 50 hours (or at least every 30 days), oftener in hot weather. Refer to paragraph 2-18 for details. Battery location: Model 210 under baggage compartment floor; Model 210A under pilot's seat; all other models - right side of engine firewall.

26 HYDRAULIC FILTER:
See under 100 hours.

13 HYDRAULIC FLUID RESERVOIR:
At first 50 and first 100 hours, thereafter at each 500 hours or one year, whichever comes first, a sample of fluid should be examined for sediment and discoloration as outlined in paragraph 2-26 and 5-39.

Figure 2-4. Servicing (Sheet 2 of 4)

100 HOURS

1 VACUUM SYSTEM OIL SEPARATOR:
Remove, flush with solvent, and dry with compressed air.

2 FUEL/AIR CONTROL UNIT SCREEN:
Remove and clean the screen in the bottom of the fuel/air control unit.

5 VACUUM RELIEF VALVE FILTER SCREEN:
Check air inlet screen or filter for cleanliness. Remove, flush with solvent, and dry with compressed air. On Garwin valves, remove retaining ring to remove screen. On filter-equipped valves, replace garter filter at engine overhaul periods.

7 GYRO INSTRUMENT AIR FILTERS:
On airplanes not equipped with a central air filter, replace instrument air filters every 100 hours and when erratic or sluggish responses are noted with normal suction gage readings. Refer to paragraph 2-17A for details.

6 FUEL TANK SUMP DRAINS:
If quick-drain valves are not installed, remove plugs and drain off any water or sediment. Re-install and resafety plugs.

11 FUEL COLLECTOR TANK AND/OR SELECTOR VALVE DRAINS:
Remove plugs and drain off any water and sediment. Reinstall and resafety plugs. Some airplanes use drain valves instead of drain plugs.

19 AUXILIARY FUEL PUMP SCREENS:
Model 210 airplanes with serial numbers 21057761 through 21058220 are equipped with Bendix auxiliary fuel pumps having a filter screen in each pump. Model 210 airplanes prior to 21057761, did not have a filter screen in the pumps; however, some airplanes may have been retrofitted with a filter screen in the primary auxiliary pump. Clean the screen in the primary pump at every 100 hours. All other models employ a pump that does not require a filter screen.

14 BRAKE MASTER CYLINDERS:
Check fluid level and refill as required with MIL-H-5606 hydraulic fluid.

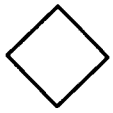
17 SHIMMY DAMPENER:
Check fluid level and refill as required with MIL-H-5606 hydraulic fluid. Refer to paragraph 2-21 for details.

26 HYDRAULIC FILTER:
Check and clean screen type filter at first 25 and first 50 hours, thereafter at each 100 hours. Replaceable filter element (210, 210A), replace at first 100 hours; thereafter, replace at each 500 hours.

24 HYDRAULIC ACCUMULATOR (MODELS 210 AND 210A ONLY):
Check every 100 hours. Refer to paragraph 2-25 for details.

20 FUEL STRAINER:
Disassemble and clean strainer bowl and screen.

Figure 2-4. Servicing (Sheet 3 of 4)



500 HOURS

26 HYDRAULIC FILTER:
Replaceable filter element (210, 210A), replace at first 100 hours; thereafter, replace at each 500 hours.

12 VACUUM SYSTEM AIR FILTERS:
Replace central air filter every 500 hours. Replace gyro instrument air filters at instrument overhaul. Refer to paragraph 2-17A for details.

AS REQUIRED

10 TIRES:
Maintain proper tire inflation as listed in the Charts in Section 1. Also refer to paragraph 2-19.

18 NOSE GEAR SHOCK STRUT:
Keep strut filled and inflated to correct pressure. Refer to paragraph 2-20 for details.

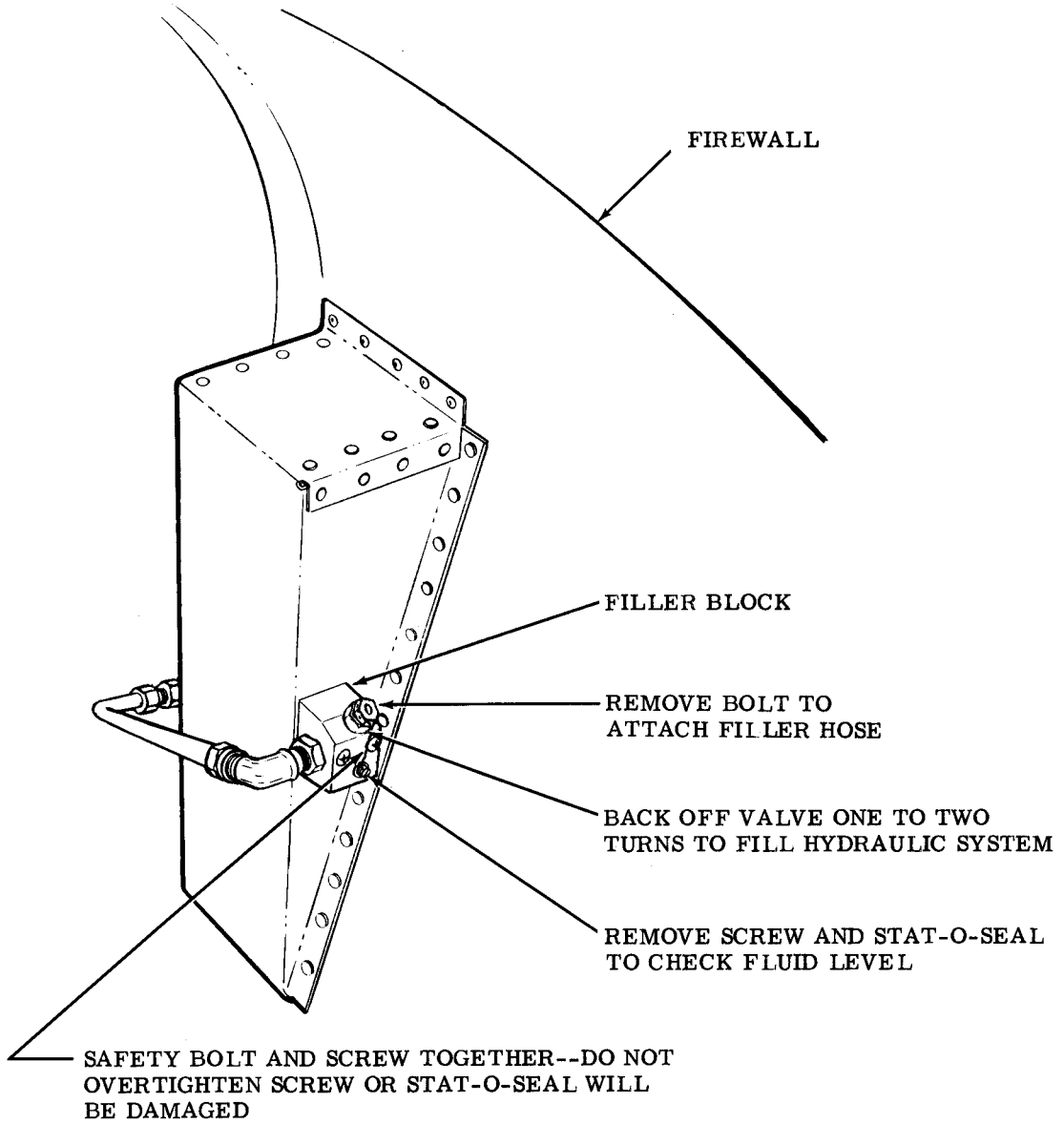
13 HYDRAULIC FLUID RESERVOIR AND FILLER:
Check fluid level at least every 25 hours and fill as required. Refer to paragraph 2-23.

15 GROUND SERVICE RECEPTACLE (OPT):
Connect to 12-volt, DC, negative-ground power unit for cold weather starting and lengthy ground maintenance of the electrical system. Master switch should be turned on before connecting a generator type external power source; it should be turned off before connecting a battery type external power source. Refer to paragraph 12-91.

CAUTION

Be certain that the polarity of any external power source or batteries is correct (positive to positive and negative to negative). A polarity reversal will result in immediate damage to semiconductors in the airplane's electronic equipment.

Figure 2-4. Servicing (Sheet 4 of 4)



NOTE

WITH AIRCRAFT APPROXIMATELY LEVEL, FLUID LEVEL IS SATISFACTORY IF FLUID DRAINS FROM LOWER HOLE.

Figure 2-5. Hydraulic System Filler Block- 210, 210A

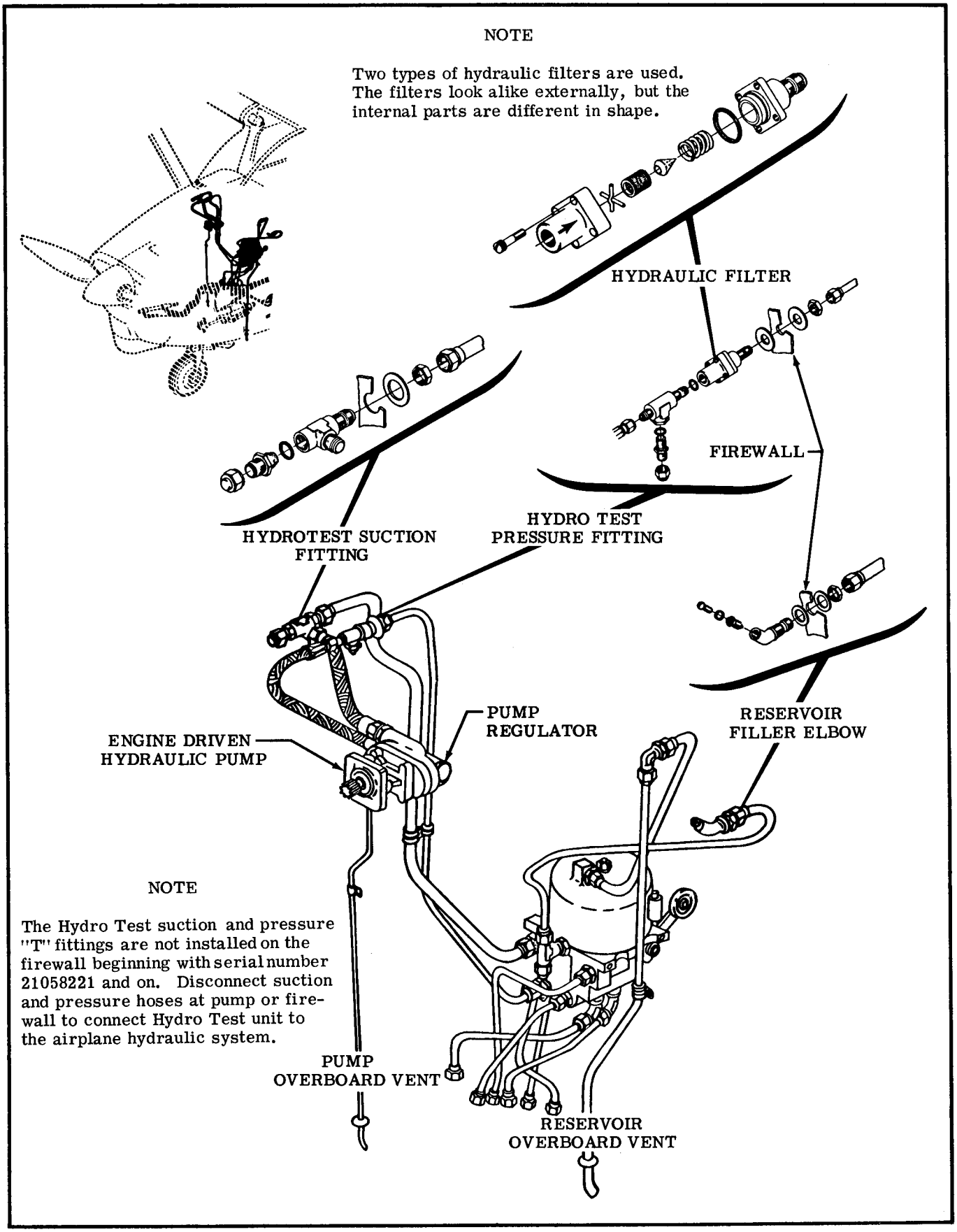


Figure 2-6. Hydraulic System Servicing Details - 210B and on

2-29. CLEANING.

2-30. Keeping the airplane clean is important. Besides maintaining the trim appearance of the airplane, cleaning reduces the possibility of corrosion and makes inspection and maintenance easier.

2-31. WINDSHIELDS AND WINDOWS should be cleaned carefully with plenty of fresh water and soap, using the palm of the hand to feel and dislodge any caked dirt or mud. A sponge, soft cloth or chamois may be used, but only as a means of carrying water to the plastic. Dry with a clean, damp chamois. Rubbing with a dry cloth will build up an electrostatic charge which will attract dust particles. Oil and grease may be removed by rubbing lightly with a kerosene-moistened cloth.

CAUTION

Do not use gasoline, alcohol, benzene, acetone, carbon tetrachloride, fire extinguisher fluid, de-icer fluid, lacquer thinner or glass window cleaning spray. These solvents will soften and craze the plastic.

2-32. PLASTIC TRIM. Plastic trim should be cleaned with soap and water. Observe caution in preceding paragraph when cleaning the plastic trim throughout the airplane.

2-33. ALUMINUM SURFACES require a minimum of care, but should never be neglected. The airplane may be washed with clean water to remove dirt, and with carbon tetrachloride or other non-alkaline grease solvents to remove oil and/or grease. Household type detergent soap powders are effective cleaners, but should be used cautiously since some of them are strongly alkaline. Many good aluminum cleaners, polishes, and waxes are available from commercial suppliers of aircraft products.

2-34. PAINTED SURFACES are best cared for by washing with clean water and a mild soap, then waxing with any good automotive wax. Use only clean, cold water and a mild soap during the initial curing period of the paint, which may be as long as 90 days.

2-35. ENGINE COMPARTMENT cleaning is essential to minimize any danger of fire, and for proper inspection of components. The engine and engine compartment may be washed down with a suitable solvent, then dried throughly.

2-36. UPHOLSTERY AND INTERIOR cleaning prolongs the life of upholstery fabrics and interior trim. To clean the interior:

a. Empty the ash trays.

b. Brush out or vacuum clean the carpeting and upholstery to remove dirt.

c. Wipe off leather, Royalite, and plastic surfaces with a damp cloth.

d. Soiled upholstery fabrics and carpeting may be cleaned with a foam-type detergent, used according to the manufacturer's instructions.

e. Oily spots and stains may be cleaned with household spot removers, used sparingly. Before using any solvent, read the instructions on the container and test it on an obscure place in the fabric to be cleaned. Never saturate the fabric with a volatile solvent; it may damage the padding and backing materials.

f. Scrape off sticky materials with a dull knife, then spot clean the area.

2-37. PROPELLERS should be wiped off occasionally with an oily cloth to clean off grass and bug stains. In salt water areas this will assist in corrosion-proofing the propeller.

2-38. WHEELS should be washed off periodically and examined for corrosion, chipped paint, and cracks or dents in the wheel castings. Sand smooth, prime, and repaint minor defects.

2-39. LUBRICATION.

2-40. Lubrication requirements are shown on the Lubrication Chart (figure 2-7). Before adding grease to grease fittings, wipe off all dirt. Lubricate until new grease appears around parts being lubricated, and wipe off excess grease. The following paragraphs supplement this figure by adding details.

2-40A. NOSE GEAR TORQUE LINKS. Lubricate nose gear torque links every 50 hours. When operating in dusty conditions, more frequent lubrication is recommended.

SHOP NOTES:

FREQUENCY (HOURS)

50 | 100 | 500

METHOD OF APPLICATION

HAND | GREASE GUN | OIL CAN | SYRINGE (FOR POWDERED GRAPHITE)

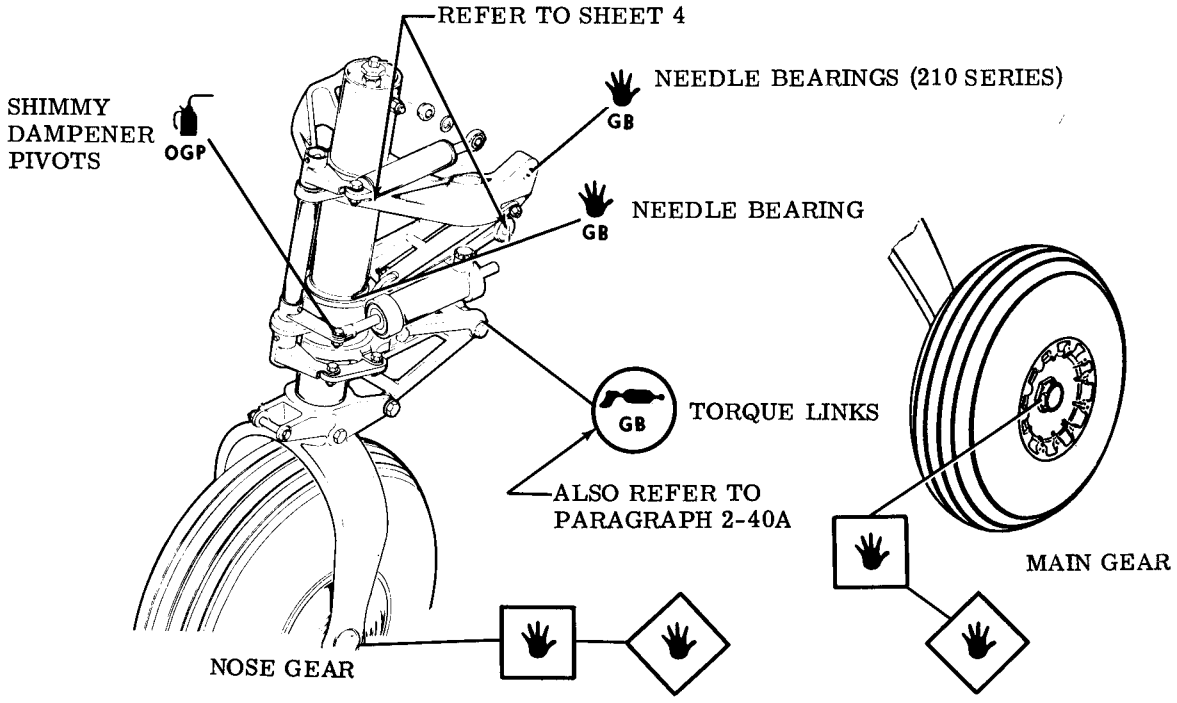
WHERE NO INTERVAL IS SPECIFIED, LUBRICATE AS REQUIRED AND WHEN ASSEMBLED OR INSTALLED.

NOTE

The military specifications listed below are not mandatory, but are intended as guides in choosing satisfactory materials. Products of most reputable manufacturers meet or exceed these specifications.

LUBRICANTS

GG —— MIL-G-6711 POWDERED GRAPHITE
GB —— MIL-G-7711 GENERAL PURPOSE GREASE
OGP —— MIL-L-7870 GENERAL PURPOSE OIL
VV —— VV-P-236 PETROLATUM



NOSE AND MAIN WHEEL BEARINGS

Clean and repack at first 100 hour inspection; thereafter, every 500 hours. Use MIL-G-7711 or aircraft wheel bearing grease.

Figure 2-7. Lubrication (Sheet 1 of 4)

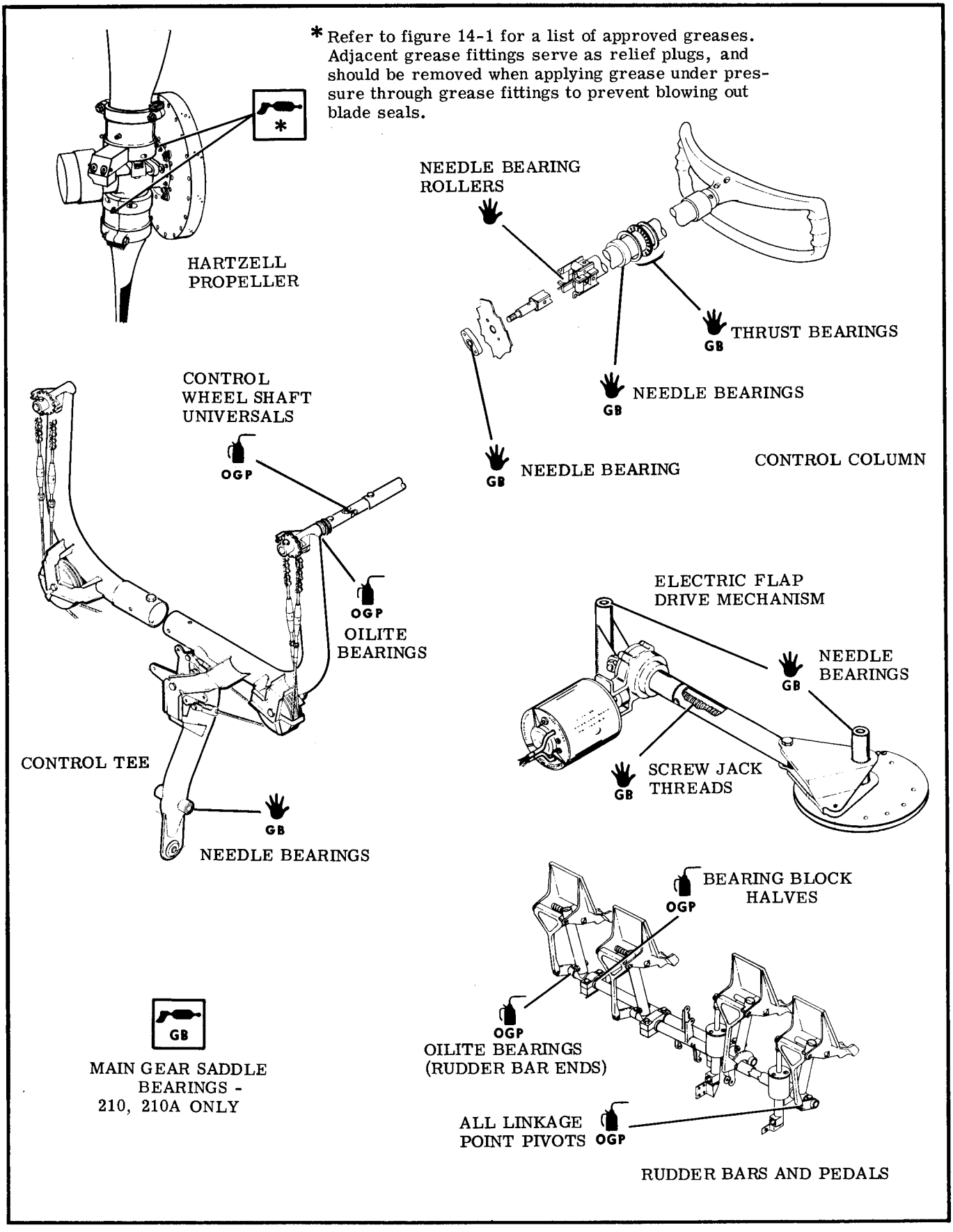


Figure 2-7. Lubrication (Sheet 2 of 4)

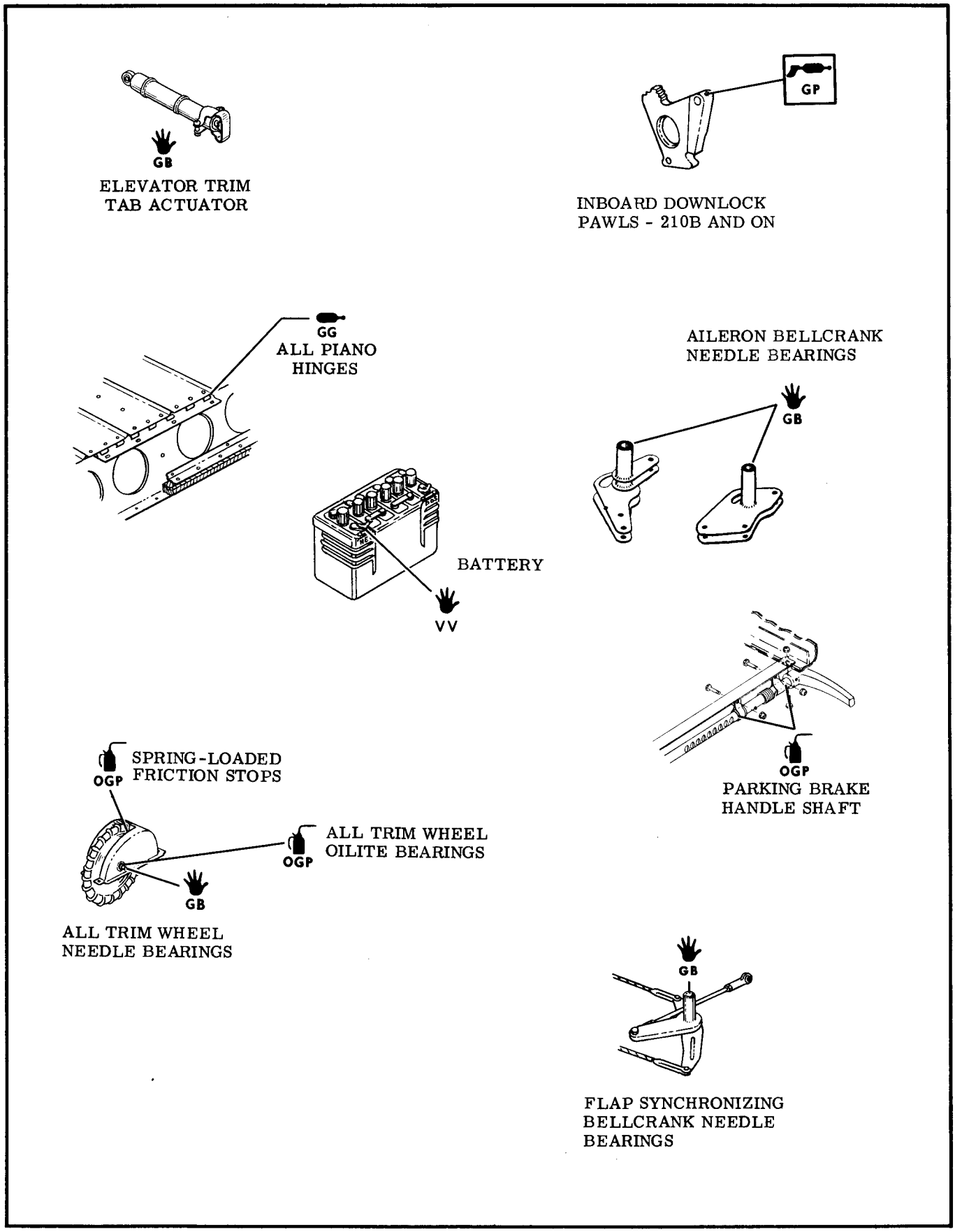
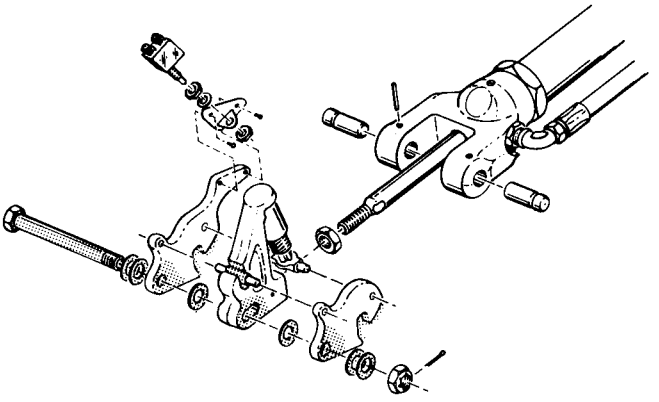
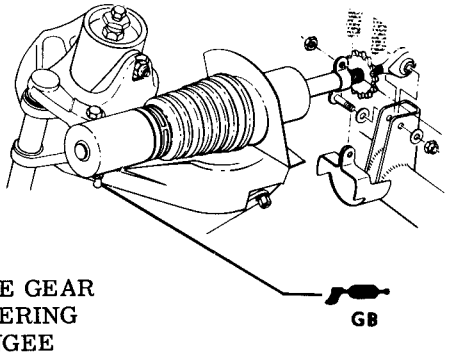


Figure 2-7. Lubrication (Sheet 3 of 4)

SPRAY BOTH SIDES OF SHADED AREAS WITH ELECTROFILM LUBRI-BOND "A" WHICH IS AVAILABLE IN AEROSOL SPRAY CANS, OR AN EQUIVALENT LUBRICANT. TORQUE ATTACHING BOLT TO 10-20 LB-IN.

NOSE GEAR DOWNLOCK MECHANISM





NOSE GEAR STEERING BUNGEE

GREASE SPARINGLY

NOTES

On the Model 206 rear cargo doors, do not lubricate the surfaces of the hooks which engage the latch plates on the upper and lower door sills.

Sealed bearings require no lubrication.

McCauley propellers are lubricated at overhaul and require no other lubrication.

Do not lubricate roller chains or cables except under seacoast conditions. Wipe with a clean, dry cloth.

Lubricate unsealed pulley bearings, rod ends, Oilite bearings, pivot and hinge points, and any other friction point obviously needing lubrication, with general purpose oil every 1000 hours or oftener if required.

Paraffin wax rubbed on seat rails will ease sliding the seats fore and aft.

Lubricate door latching mechanism with MIL-G-7711 general purpose grease, applied sparingly to friction points, every 1000 hours or oftener if binding occurs. Lubricate door latch striker with an automotive type door lubricant as necessary.

Figure 2-7. Lubrication (Sheet 4 of 4)

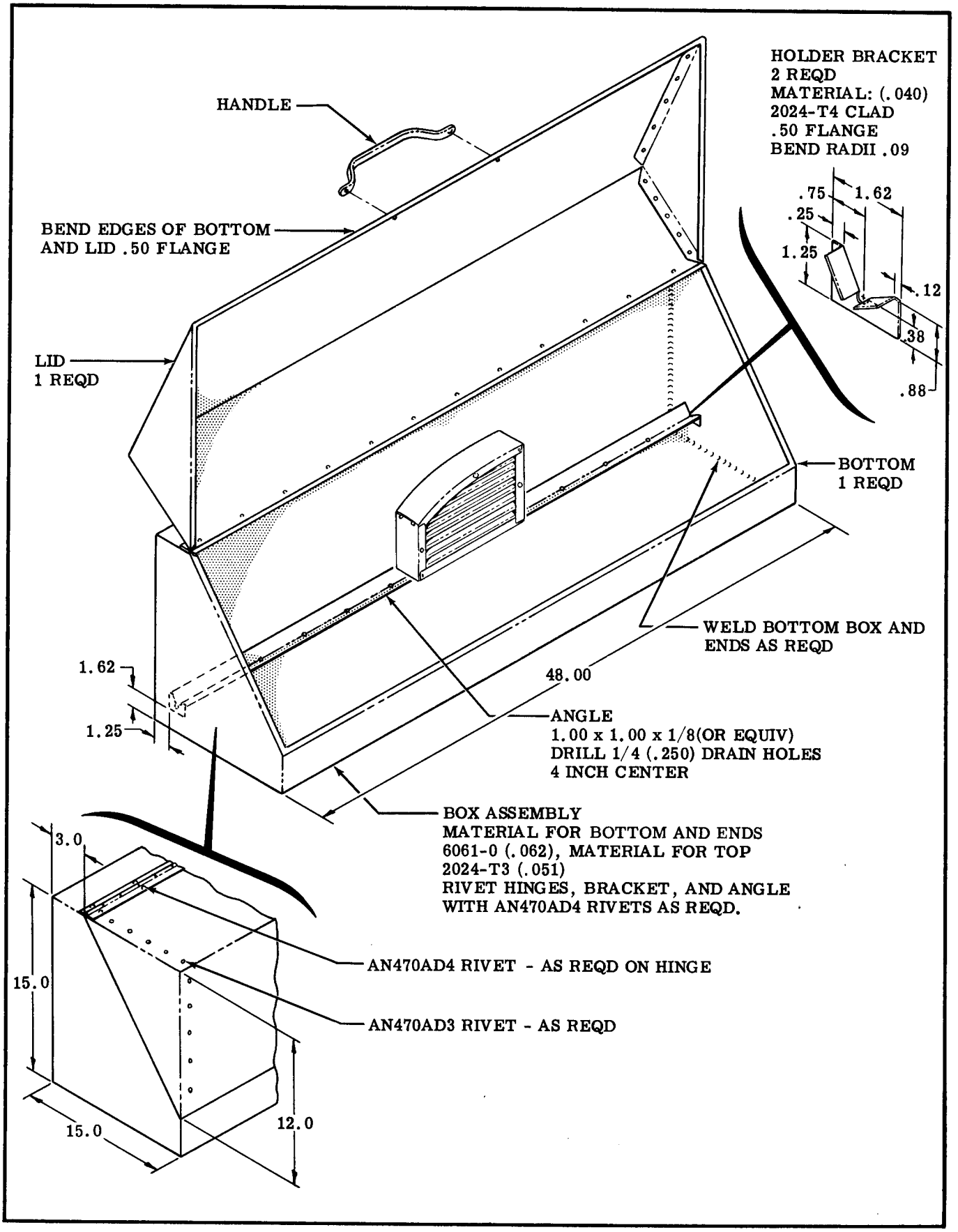


Figure 2-8. Construction of Induction Air Filter Servicing Box

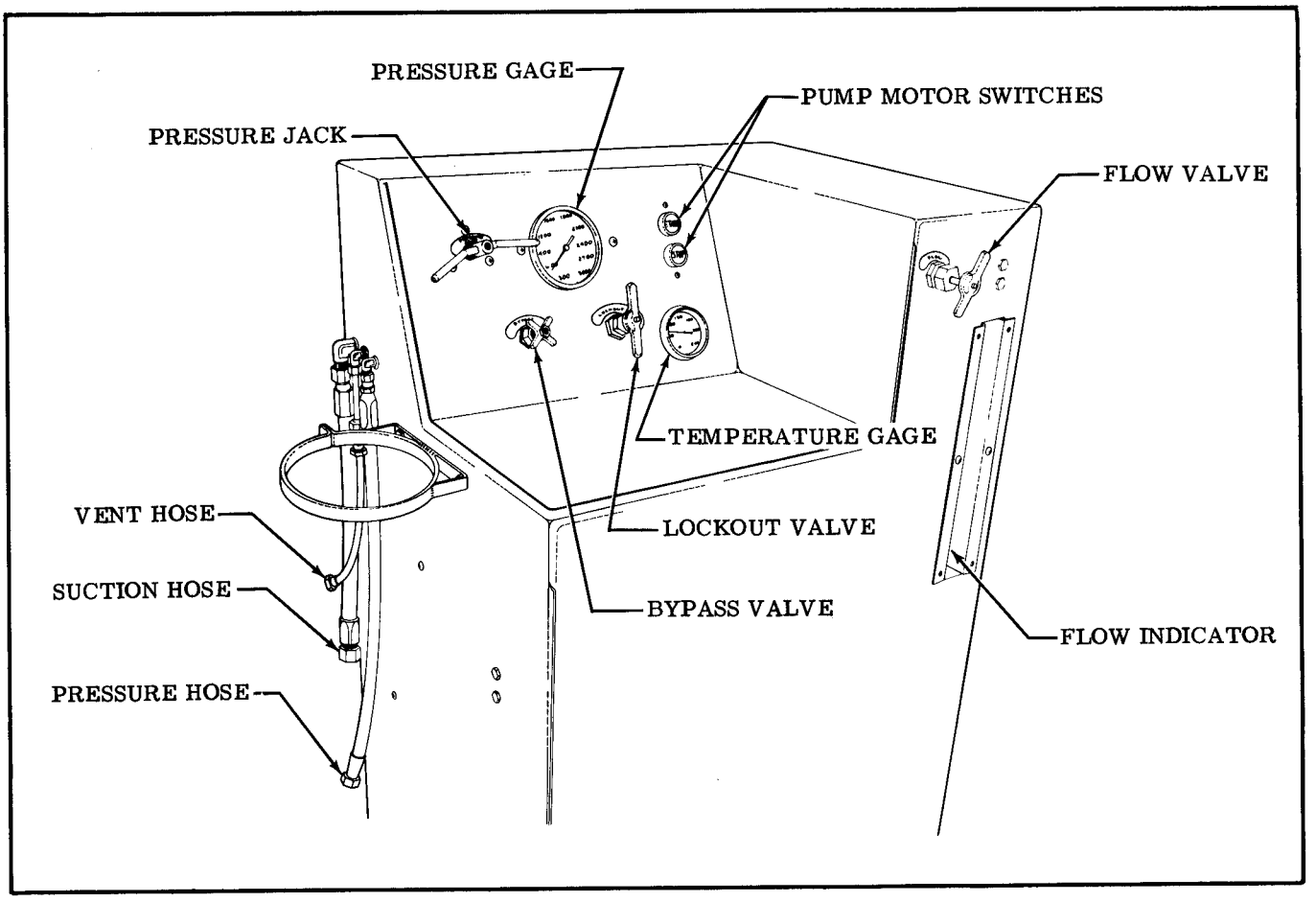


Figure 2-9. Hydro Test Unit

2-41. SERVICING OPERATIONS USING THE HYDRO TEST.

2-42. FLOW REGULATION. The following procedure is used to adjust the Hydro Test flow to any value desired for a specified operation, with the Hydro Test connected to the airplane hydraulic system and the airplane on jacks.

a. Open bypass valve and lockout valve.
b. Start Hydro Test 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.

2-43. HYDRO TEST OPERATING SUGGESTIONS.

a. Always open bypass valve before starting Hydro Test motor. This procedure permits the motor to start under a no-load condition and, if practiced, will contribute to the service life of the Hydro Test unit.
b. Operation of the Hydro Test with bypass and lockout valves closed simultaneously should not be continued for more than one minute.
c. Avoid unnecessary, continuous operation of the Hydro Test under high pressure - low flow conditions. Such operation causes rapid heating of the fluid supply and will be indicated by the Hydro Test temperature gauge. When pressure is no longer needed, open the bypass valve. This will relieve pressure and allow the fluid to recirculate freely.
d. Normal position of the pressure jack will expose approximately 1-1/2 inches of the threaded area of the pressure jack. Rotating the pressure jack out any further is unnecessary and serves no useful purpose.
e. Do not operate the Hydro Test unit with the pressure jack removed.
f. All hoses should be capped or plugged and stowed on rack provided when they are not in use.
g. Avoid contamination of the Hydro Test unit by checking condition of the fluid in the airplane before making connections. See paragraph 2-26 for further details.
h. Before disconnecting the Hydro Test from the airplane make certain that the airplane's reservoir is full of fluid. If the Hydro Test remains idle for any length of time while connected to the airplane, fluid may siphon from the airplane reservoir to the Hydro Test reservoir.

NOTE

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

2-44. USING THE HYDRO TEST ON MODEL 210 AND 210A AIRCRAFT.

2-45. GEAR CYCLING.

a. Remove cowling as necessary for access.

b. Disconnect hydraulic pump suction (larger) hose from fitting and connect Hydro Test suction (larger) hose to firewall fitting. Cap or plug disconnected pump hose.

c. Disconnect hydraulic pump pressure (smaller) hose from fitting in filter at firewall and connect Hydro Test pressure (smaller) hose to the fitting. Cap or plug disconnected pump hose.

NOTE

Be certain pressure hose is filled with fluid before connecting it to the airplane. Failure to do so could result in contamination of the airplane's hydraulic system with air.

d. Connect Hydro Test vent hose to airplane reservoir vent line protruding below lower edge of firewall at cowl flap opening.

NOTE

Before connecting this line to the overboard vent be certain the line is wiped clean and free of any dirt or foreign material which might have worked into the line. If reason exists to suspect that line is dirty internally, remove line from firewall fitting at top forward side of firewall and blow out line with compressed air and clean hydraulic fluid.

e. Connect Hydro Test electric cable to appropriate electrical power supply.

f. Place airplane on jacks in accordance with figure 2-2.

g. Be sure airplane hydraulic fluid is clean and free of contamination in accordance with paragraph 2-26.

h. Set Hydro Test valves as follows:

1. Flow valve - CLOSED.
2. Lockout valve - OPEN.
3. Bypass valve - OPEN.

i. Start Hydro Test pump motor.

j. Slowly close Hydro Test bypass valve until completely closed.

k. Operate gear and flaps until all air is dissipated in Hydro Test flow gauge sight glass. (Air from reservoir and suction line.)

l. Gear cycle time can be lengthened by slowly opening the bypass valve. This will bleed off part of Hydro Test pump flow.

m. At conclusion of cycle test, fully open bypass valve and stop Hydro Test motor.

n. With gear down and doors closed, operate flaps until all oil is discharged from accumulator.

o. Disconnect all Hydro Test hydraulic lines from aircraft. Aircraft reservoir will be full upon conclusion of gear and/or flap cycling.

NOTE

When conducting the accumulator air charge, pressure regulator, landing gear handle release, and priority valve tests the slower the gauge moves the more accurate will be the reading.

2-46. CHECKING ACCUMULATOR AIR CHARGE. For this test the aircraft does not have to be placed on jacks but gear handle must be in down position.

a. Connect Hydro Test to airplane in accordance

b. Set Hydro Test valves as follows:

1. Flow valve - CLOSED.
2. Lockout valve - SLIGHTLY open.
3. Start Hydro Test pump motor and gradually close bypass valve.

NOTE

On this check, cause pressure to rise slowly but steadily by gradually closing the bypass valve. The pressure gauge needle will momentarily stop or hesitate when hydraulic pressure equals accumulator air charge. Be certain to discharge all hydraulic pressure in accumulator before beginning this test; otherwise, an accurate reading cannot be obtained. Reading should be 500 to 600 PSI.

2-47. CHECKING SYSTEM PRESSURE REGULATOR. For this test the aircraft does not have to be placed on jacks but gear handle must be in down position.

a. Connect Hydro Test to airplane in accordance with paragraph 2-45.

b. Set valves as follows:

1. Flow valve - CLOSED.
2. Lockout valve - SLIGHTLY open.
3. Bypass valve - OPEN.
4. Start Hydro Test motor pump.
5. Operate wing flaps until all fluid is discharged from accumulator.
6. Slowly close Hydro Test bypass valve until gauge reaches 1500 PSI, then very slowly close bypass valve until pressure gauge suddenly drops back to zero. The highest reading indicated on the pressure gauge will be the setting at which the transfer valve provided unloading. This reading should be 1500 to 1600 PSI.

NOTE

By gradually closing the bypass valve, the flow of hydraulic fluid can be controlled to such an extent that the transfer valve in the regulator will off-seat sufficiently to slowly dissipate the small amount of fluid being emitted to it and thereby hold the Hydro Test pressure gauge needle on the exact pressure at which the transfer valve is operating.

2-48. CHECKING LANDING GEAR HANDLE RELEASE - GEAR DOWN.

a. Connect Hydro Test to airplane in accordance with paragraph 2-45.

b. Run two complete gear cycles, then place gear down and doors closed.
c. Set Hydro Test bypass valve full open.
d. Operate wing flaps until all hydraulic fluid is discharged from accumulator.
e. Place landing gear handle in full down position.
f. Slowly close bypass valve until pressure gage reads 1300 psi.
g. Very slowly close bypass valve until landing gear handle trips back to down-indicated position. Read gage at point of handle release, (1350 ± 50 psi). Adjust handle release in accordance with instructions contained in figure 5-3A.

2-49. CHECKING LANDING GEAR HANDLE RELEASE - GEAR UP.
a. Connect Hydro Test to airplane in accordance with paragraph 2-45.
b. Run two complete gear cycles, then place gear full up and doors closed.
c. Open bypass valve fully.
d. Operate wing flaps until all hydraulic fluid is discharged from accumulator.
e. Place landing gear handle in full up position.
f. Slowly close bypass valve until gauge reads 1300 PSI.
g. Very slowly close bypass valve until landing gear handle trips back to up-indicated position. Read gage at point of handle release (1350 ± 50 psi). Adjust handle release in accordance with instructions contained in figure 5-3A.

2-50. CHECKING PRIORITY VALVE.
a. Connect Hydro Test to airplane in accordance with paragraph 2-45.

NOTE

When performing this test, the airplane master switch may be turned off. This precludes door operation prior to priority valve operation; thereby making it easier and faster to perform this check.

b. Run two complete gear cycles, then place gear down and doors open. Open bypass valve fully.
c. Operate wing flaps until all hydraulic fluid is discharged from accumulator.
d. Place landing gear handle in full up position.
e. Very slowly close bypass valve until downlocks on main gear or nose gear unlock. Rear gauge at point of unlock, (750 - 800 PSI).

NOTE

The Hydro Test flow gauge can also be used in conjunction with this test. During pressure build-up towards opening of the priority valve, there is practically no flow of fluid; therefore, the flow gauge indicator will be resting on the bottom of the sight glass. However, with opening of the priority valve, the sudden increase in flow will cause the indicator to rise in the sight glass, positively establishing the opening point of this valve. This also holds true in nearly all of the other checks to be performed with the Hydro Test.

2-51. CHECKING PRESSURE REGULATOR CYCLING. Normal cycling of the pressure regulator will occur approximately once every 5 to 20 minutes. Whenever cycling time drops to less than 5 minutes, leakage is occuring somewhere in the airplane hydraulic system.

NOTE

Check accumulator precharge first, since incorrect precharge will produce rapid or frequent cycling as well as system internal leakage.

Airplane does not have to be on jacks but gear handle must be in down indicate position.
a. Dissipate all hydraulic pressure from accumulator by operating wing flaps.
b. Disconnect 1/4 inch pressure line at accumulator regulator outlet marked "System Port." Cap system port tightly. Plug disconnected line to retain fluid.
c. Connect Hydro Test to airplane in accordance with paragraph 2-45.
d. Start Hydro Test and close bypass valve. If regulator continues to recycle abnormally a malfunction is occuring in the regulator section of the accumulator.

NOTE

A stuck accumulator piston will cause abnormal recycling much in the same manner as incorrect precharge. This condition can be misleading since it produces the same symptoms as several other malfunctions.

e. If recycling becomes normal after performing the above steps proceed as follows:
f. Open bypass valve and stop Hydro Test.
g. Disconnect Hydro Test pressure hose from firewall fitting and, using a suitable adapter, connect pressure hose to pressure line leading from accumulator to power pack.
h. Start Hydro Test and close bypass valve. When pressure gage on Hydro Test indicates maximum pressure Hydro Test will deliver, close lockout valve and stop Hydro Test motor. If pressure falls off rapidly leakage is occuring in the pressure poppets of the power pack.
i. If pressure holds fairly well after performing steps "f" through "h," and steps "a" through "d" have been performed, the malfunction will be a sticking accumulator piston or incorrect accumulator precharge.

2-52. TESTING FOR AIR LEAKAGE IN SUCTION LINE TO ENGINE PUMP.
a. Connect Hydro Test to airplane in accordance with paragraph 2-45.
b. Operate gear through five complete cycles or until all air is dissipated from Hydro Test sight glass.
c. With gear in down position operate Hydro Test for five minutes. No air should be visible in Hydro Test sight glass.

d. Air visible in sight glass indicates leakage in suction lines, 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.

2-53. GEAR CYCLE TIMING.

When hydraulic system or aircraft pump is suspected because gear cycle time is slow, the malfunction could be caused by low fluid in aircraft reservoir causing system to be full of air. The following procedure will purge air from system and fill reservoir.

NOTE

The Hydro Test bypass valve should be closed tight during following test.

a. Connect Hydro Test to airplane in accordance with paragraph 2-45.

NOTE

Before beginning this check Hydro Test flow should be adjusted for a flow of 1 gallon per minute.

b. Retract landing gear.
c. Record time from hand full-up to handle trip-back to neutral. Time should be 12+12-0 seconds.
d. Extend landing gear.
e. Record time from handle full-down to handle trip-back to neutral. Time should be 9+9-0 seconds.

NOTE

If time is within limit when operated by Hydro Test, but exceeds limit when operated by engine-driven pump, there is internal leakage in pump. Repair or replace pump. If time exceeds limit when operated either by Hydro Test or engine-driven pump, internal leakage is in hydraulic system. This can be isolated by use of the Hydro Test in the following manner.

1. Bleed off all system pressure by operating flaps.
2. Turn aircraft master switch off and place gear selector handle in down position.
3. Close bypass valve and observe pressure rise upon complete actuation of doors.
4. Repeat the above procedure on the door closed cycle.
5. Proper sealing of the landing gear door system will be evidenced by a sharp rise in pressure immediately upon completion of door actuation.
6. Failure of pressure to rise sharply after doors have completely actuated indicates an internal leak some where in the door system.

2-54. CHECKING SYSTEM RELIEF VALVE.

NOTE

Airplane does not have to be on jacks, but gear handle must be in down-indicated position.

a. Operate wing flaps until all hydraulic fluid is discharged from accumulator.
b. Connect Hydro Test suction and vent lines in accordance with paragraph 2-45.
c. Disconnect 1/4 inch hydraulic line at accumulator.
d. Connect Hydro Test 1/4 inch pressure hose to pressure line leading to power pack.
e. Start Hydro Test and slowly close bypass valve. Pressure should rise to relief valve setting (1750 to 1800 psi). Airplane system relief valve should open at this setting and prevent any additional rise in pressure.
f. If pressure does not rise to the specified setting, relief valve is stuck open.
g. If pressure rises above specified setting, relief valve is not opening.

2-55. CHECKING FLAP THERMAL - RELIEF VALVE

NOTE

Airplane does not have to be on jacks, but gear handle must be in down-indicated position.

a. Operate wing flaps until all hydraulic fluid is discharged from accumulator.
b. Disconnect wing flap lines at either flap actuating cylinder and plug the actuator ports and flap line that is to remain idle.
c. Connect Hydro Test suction and vent lines in accordance with paragraph 2-45.
d. Connect Hydro Test 1/4 inch pressure hose to wing flap up line.
e. Wing flap handle in neutral position.
f. Operate Hydro Test in accordance with instructions outlined in paragraph 2-45, and build up pressure to 1800 to 1900 psi. Flap thermal-relief valve should open preventing any additioal pressure build up. Read gage at maximum pressure, (1800 to 1900 psi).

2-56. AIRPLANE SYSTEM BLEEDING AND PROOF PRESSURE TESTING.

The Hydro Test may be used for airplane hydraulic system bleeding and proof pressure testing. When bleeding or proof pressure testing of the airplane hydraulic system as outlined in paragraphs 5-37 and 5-38, refer to paragraphs 2-42 and 2-43 for correct operation of the Hydro Test.
a. The Hydro Test pressure jack has a pressure capability to the limits of the Hydro Test pressure gage.
b. The Hydro Test motor - driven pump has a pressure capability to the limits of the Hydro Test relief valve (1950 psi).

2-57. BLEEDING PROCEDURE.

For all bleeding operations, proceed as follows:

a. Flow valve set for full flow (1.25 gpm).
b. Lock out valve - CLOSED
c. Bypass valve - OPEN
d. Start Hydro Test pump and slowly open lockout valve until all air bubbles disappear and clean hydraulic fluid is forced from the loosened fittings.
e. Tighten fittings and close lockout valve.

NOTE

In bleeding some parts of the airplane hydraulic system, it may be necessary to partially close the bypass valve in order to obtain sufficient flow due to system resistance.

2-58. PROOF PRESSURE TESTING.

For all proof (static) or dead ended pressure testing proceed as follows:

a. Flow valve set for minimum flow (slightly above 0.5 gallons per minute).
b. Lockout valve - CRACKED OPEN.
c. Bypass valve - OPEN.
d. Pressure jack out approximately 1-1/2 inches.
e. Start Hydro Test pump motor.
f. Slowly close bypass valve until pressure is near desired limits. (Maximum obtainable with Hydro Test motor driven pump is 1950 PSI).
g. Close lockout valve.
h. Stop Hydro Test pump motor immediately.
i. Screw pressure jack in to increase pressure to desired limits.
j. To relieve pressure after completion of desired test, open lockout valve.

SHOP NOTES:

2-59. USING HYDRO TEST ON MODEL 210B AND ON AIRPLANES.

NOTE

The Power Pack in the Model 210C and on is equipped with a time-delay valve. Also, Model 210B airplanes retrofitted with Model 210C hydraulic Power Packs incorporate this time-delay valve. Beginning with the Model 210D and on, the hydraulic Power Pack was redesigned to eliminate the wing flap portion of the Power Pack. The Model 210D and on utilizes an electric-driven wing flap system. Therefore, when using the Hydro Test, delete paragraphs pertaining to the wing flaps. On the Model 210D, an alternate Power Pack may be used. This alternate Power Pack uses one landing gear priority valve for both gear-up and gear-down operations. The Model 210E uses this alternate Power Pack as the standard hydraulic Power unit.

2-60. CONNECTING HYDRO TEST.

a. Remove cowling as necessary for access.

b. Disconnect hydraulic pump suction (larger) hose from fitting and connect Hydro Test suction (larger) hose to firewall fitting. Cap or plug disconnected pump hose.

c. Disconnect hydraulic pump pressure (smaller) hose from fitting in filter at firewall and connect Hydro Test pressure (smaller) hose to the fitting. Cap or plug disconnected pump hose.

d. Connect Hydro Test vent hose to airplane reservoir vent line protruding below lower edge of firewall at left cowl flap opening.

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 electric cable to appropriate electrical power source.

2-61. DISCONNECTING HYDRO TEST.

a. Be sure landing gear is down and locked, and doors are closed.

b. With bypass valve closed and lockout valve open, operate Hydro Test until airplane reservoir is full, then open bypass valve and stop Hydro Test pump motor.

c. Disconnect all Hydro Test hoses from airplane immediately, beginning with suction hose. If suction hose remains connected for any length of time after Hydro Test is shut down, fluid will transfer from airplane reservoir into Hydro Test reservoir. Connect all airplane hoses and reinstall cowling.

2-62. FILLING AIRPLANE RESERVOIR. Normally, the reservoir is filled by using a manually operated pressure brake bleeder or Hydro Fill unit (available from Cessna Spare Parts Department). The Hydro Test is used to fill the reservoir before disconnecting it from the airplane hydraulic system, as outlined in the preceding paragraph.

2-63. BLEEDING TIME-DELAY VALVE. The time-delay valve in the Power Pack may be purged of air by operating the engine-driven pump, or the Hydro Test may be used.

a. Make sure reservoir is full.

b. Start engine and let run at 1000 rpm, or connect Hydro Test in accordance with paragraph 2-60.

c. Place landing gear handle in the 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.

e. Check that time-delay operates properly by moving 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 Hydro Test in accordance with paragraph 2-61.

2-64. BLEEDING AIRPLANE HYDRAULIC SYSTEM. Bleeding may be accomplished by jacking the airplane and using the Hydro Test to cycle the landing gear and door systems through several cycles. Refer to paragraph 2-63 for bleeding of the time-delay valve inside the Power Pack. Use only clean, filtered hydraulic fluid (MIL-H-5606) in the hydraulic system.

NOTE

There is only one reason to have to bleed the hydraulic system, the entrance of considerable air into the hydraulic system. The most probable cause for air getting into the system are: permitting reservoir fluid level to become low, air leaks in the engine-driven pump or pump suction line, and poor maintenance procedures when connecting lines and installing actuators, etc.

2-65. BLEEDING OF THE EMERGENCY HAND PUMP may be accomplished by disconnecting the door open line and operating the emergency hand pump until fluid flows from disconnected line with no evidence of air in line, reconnect door open line and replenish reservoir with clean hydraulic fluid as necessary to maintain fluid level.

2-66. LEAK-TESTING. When testing a system for leakage, the Power Pack must be bypassed. When checking an actuating cylinder for internal leakage, connect the Hydro Test to one port of the unit and leave other port open. Perform test as follows:

CAUTION

When leak-testing any actuator, with pressure applied to one port of the cylinder, always have the opposite port open to atmospheric pressure. Otherwise, excessive pressure may build up due to the differential area across the piston. (The rod side of the piston has less area than the head side. Thus, pressure applied to the head side of the piston may apply a far greater pressure to fluid on the rod side of the piston.) The total of line assemblies, fittings, actuators, and any other part subject to hydrostatic (dead end) pressure shall be deemed faulty due to overstressing if hydraulic pressure in that immediate subsystem is allowed to exceed 2275 psi for any period of time.

a. Jack the airplane (see paragraph 2-4).
b. Connect Hydro Test pressure hose to system or unit to be leak-tested, using suitable fittings.
c. Set flow valve for minimum flow.
d. Set lockout valve cracked open.
e. Set bypass valve open.
f. Set pressure jack out approximately 1-1/2 inches.
g. Start Hydro Test pump motor.
h. Slowly close bypass valve until pressure reaches 1950 psi (maximum obtainable with Hydro Test pump motor).
i. Close lockout valve to trap fluid, then stop Hydro Test Pump motor immediately.
j. Screw pressure jack in, increasing pressure to 2200 psi, and hold 5 minutes. Check for leaks while system or unit is under pressure. The pressure jack has a pressure capability to the limit of the Hydro Test pressure gage. (See Caution above.)
k. After completion of test, open Hydro Test lockout valve to release pressure, then disconnect Hydro Test and reconnect hydraulic system lines.
l. Remove airplane from jacks.

2-67. CYCLING LANDING GEAR.
a. Connect Hydro Test in accordance with paragraph 2-60, and jack the airplane as outlined in paragraph 2-4.
b. Observe color of hydraulic fluid through sight gage in airplane reservoir. If fluid appears discolored, or any other reason exists to suspect fluid contamination, draw off a fluid sample as outlined in Section 5.

NOTE

Fluid sampling is necessary only when good reason exists to suspect contamination. If examination of fluid reveals contamination, flush complete hydraulic system with clean hydraulic fluid (MIL-H-5606) and examine several seals and cylinder bores for damage.

c. Set Hydro Test flow valve closed, lockout valve open, and bypass valve open.
d. Start Hydro Test pump motor.
e. Slowly close bypass valve completely.
f. Observe fluid flowing through Hydro Test sight gage. When all air bubbles have dissipated operations may be continued.
g. Using landing gear control handle in airplane, operate gear as desired.

NOTE

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

h. After completion of cycling, open Hydro Test bypass valve and stop pump motor.
i. Disconnect Hydro Test in accordance with paragraph 2-61.
j. Make sure landing gear is down and locked, and remove airplane from jacks.

2-68. CHECKING TIME-DELAY VALVE - MODEL 210C AND ON. The following procedure will also apply to Model 210B airplanes that have been retrofitted with a Model 210C Power Pack, which contains a 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 Hydro Test in accordance with paragraph 2-60.
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 Section B-2 and Section D-2 of Appendix B and D, for disassembly and repair of the Power Pack of the appropriate model.
e. Disconnect Hydro Test in accordance with paragraph 2-61.

2-69. CHECKING HANDLE-RELEASE TO NEUTRAL.
a. Cycle the landing gear through two complete cycles in accordance with paragraph 2-67.
b. Set Hydro Test bypass valve full open.
c. Place landing gear handle full down.
d. Very slowly, close bypass valve until handle trips back to neutral. Read Hydro Test pressure gage at point of handle trip. In the Model 210B this pressure should be 1300±50 psi. In the Model 210C and on the pressure should be 750-1250 psi. Record this pressure.

NOTE

The Model 210C and on hydraulic Power Pack is equipped with a time-delay valve. Therefore, on Model 210B airplanes retrofitted with the Model 210C hydraulic Power Pack, the landing gear handle trip-back to neutral is delayed 3 to 9 seconds between the time the landing gear position (up or down) light is illuminated and the landing gear handle returns to neutral. One release valve serves to release the handle from both the gear down and gear up positions. If the handle centering bungee and/or 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 procedure checks the release pressure from the gear up position. This is performed only to assure the satisfactory operation of other equipment relative to handle release operations.

e. Set Hydro Test bypass valve full open.
f. Place landing gear handle full up.
g. Very slowly, close bypass valve until handle trips back to neutral. Read Hydro Test pressure gage at point of handle trip. In the Model 210B this pressure should be 1300±50 psi. In the Model 210C and on the pressure should be 750-1250 psi. Compare the pressure with that recorded in step d. Be sure to allow time for time-delay valve to open in the 210C and on.
h. Refer to paragraph 5A-21 for Model 210B thru Model 210D, and paragraph 5C-18 for Model 210E and on, for handle release adjustment.
i. Make sure landing gear is down and locked, and disconnect Hydro Test in accordance with paragraph 2-61.
j. Remove airplane from jacks.

2-70. CHECKING GEAR UP PRIORITY VALVE - MODEL 210B THRU 210D. (Except Model 210D equipped with alternate Power Pack.)
a. Cycle landing gear through two complete cycles in accordance with paragraph 2-67.

NOTE

When performing this test, the airplane's electrical system may be de-energized. This will permit the doors to remain open, thereby making it easier and faster to complete this check.

b. Open Hydro Test bypass valve.
c. 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 gage. This also holds true in nearly all of the other checks to be performed with the Hydro Test.

d. Refer to paragraph 5A-23 for adjustment of the gear up priority valve.

2-71. CHECKING GEAR DOWN PRIORITY VALVE - MODEL 210B THRU 210D. (Except Model 210D equipped with alternate Power Pack.)
a. Cycle landing gear through two complete cylces in accordance with paragraph 2-67.

NOTE

When performing this test, the airplane's electrical system may be de-energized. This will permit the doors to remain open, thereby making it easier and faster to complete this check.

b. With landing gear fully retracted, open Hydro Test bypass valve.
c. Place landing gear handle full down. 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 550±50 psi.

NOTE

As the priority valve opens, the nose gear or main gear uplocks 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 gage. This also holds true in nearly all of the other checks to performed with the Hydro Test.

d. Refer to paragraph 5A-24 for adjustment of the gear down priority valve.

2-72. CHECKING PRIORITY VALVE - MODEL 210E (and those Model 210D airplanes equipped with alternate Power Pack).

NOTE

The Model 210E Power Pack, which is also used as an alternate Power Pack on the Model 210D, contains only one priority valve used for gear up and gear down operation.

a. Cycle landing gear through two complete cycles in accordance with paragraph 2-67.
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 paragraph 5C-17 for priority valve adjustment.
f. Make sure landing gear is down and locked, and disconnect Hydro Test in accordance with paragraph 2-61. Remove airplane from jacks.

2-73. CHECKING PRIMARY (SYSTEM) RELIEF VALVE.
a. Connect Hydro Test in accordance with paragraph 2-60.
b. Open Hydro Test bypass valve.
c. Make sure master switch is OFF.
d. Place landing gear handle full down.
e. Slowly close bypass valve, observing pressure build-up and point at which pressure stabilizes on Hydro Test gage. Stabilization indicates relief valve setting. The relief valve pressure should be 1750 to 1800 psi, at a flow rate on one gallon-per-minute on the Hydro Test.
f. The Power Pack must be removed and partially disassembled to adjust primary relief valve setting. Refer to paragraph B2-55 of Appendix B to adjust primary relief valve on the Model 210B thru 210D, except those Model 210D equipped with alternate Power Pack. Refer to paragraph D2-25 for the Model 210E and those Model 210D equipped with the alternate Power Pack.

2-74. CHECKING SECONDARY (HAND PUMP) RELIEF VALVE.
a. Place landing gear handle full down. With master switch OFF, operate emergency hand pump to open landing gear doors.
b. Disconnect door open line from nose gear door cylinder and connect Hydro Test pressure hose to door open line.
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 1900 to 1950 psi.
e. The Power Pack must be removed and partially disassembled to adjust the secondary relief valve setting. Refer to paragraph B2-77 of Appendix B to adjust the secondary relief valve on the Model 210B thru 210D, except those Model 210D equipped with alternate Power Pack. Refer to paragraph D2-24 for the Model 210E and those Model 210D equipped with the alternate Power Pack.
f. Open lockout valve on Hydro Test to release the pressure, disconnect Hydro Test pressure hose from door open line and reconnect door open line to nose gear door cylinder.

2-75. TESTING FOR AIR LEAKAGE IN SUCTION LINE TO ENGINE PUMP.
a. Connect Hydro Test to airplane in accordance with paragraph 2-60.
b. Operate gear through five complete cycles or until all air is dissipated from Hydro Test sight glass.
c. With gear in down position, operate Hydro Test for five minutes. No air should be visible in Hydro Test sight glass.
d. Air visible in sight glass indicates leakage in suction lines, 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.

2-76. CHECKING LANDING GEAR CYCLE TIME. When the hydraulic system or aircraft pump is suspected of malfunction because gear cycle time is slow, it could be caused by low fluid in aircraft reservoir, causing system to be full of air. The following procedure will purge air from system and fill the reservoir.
a. Cycle the landing gear through two complete cycles in accordance with paragraph 2-67.
b. With landing gear extended, place handle in full up position and record time required for gear to retract and handle return to neutral. Time should not exceed 12 seconds (+12 seconds, -0 seconds) on the Model 210B. On the 210C and on, time should not exceed 10. 5 seconds (+5 seconds, -0 seconds), plus the time required for the time-delay valve to operate (see paragraph 2-66).

NOTE

Model 210B airplanes that have been retrofitted with a Model 210C Power Pack use the gear cycle time of the Model 210C and on.

c. With landing gear retracted, place handle in full down position and record time required for gear to extend and handle return to neutral. Time should not exceed 9 seconds (+9 seconds, -0 seconds) on the Model 210B. On the 210C and on, time should not exceed 7.5 seconds (+8 seconds, -2 seconds), plus the time required for the time-delay valve to operate (see paragraph 2-68).

NOTE

If time is within limit when operated by Hydro Test, but exceeds limits when operated by engine-driven pump, there is internal leakage in pump. If time exceeds limit when operated either by Hydro Test or engine-driven pump, internal leakage is in hydraulic system. Check actuators for internal leakage. Refer to paragraph 2-66 when checking actuators. Repair or replace actuators as required. If actuators are not defective, Power Pack internal leakage is indicated. Repair or replace Power Pack. Refer to the correct Appendix Section for repair of hydraulic components on the appropriate airplane.

2-77. CHECKING FLAP THERMAL-RELIEF VALVE.

NOTE

Aircraft does not have to be on jacks but gear handle must be in down-indicate position.

a. Disconnect flap up line at either flap actuator. Cap actuator port and connect Hydro Test pressure line to flap up line.
b. Position flap handle to flaps up and maintain this position throughout entire test.
c. Slowly close Hydro Test bypass valve and observe pressure gauge. Gauge will stabilize at pressure where thermo relief valve opens. Correct thermal relief valve setting will be (1850 - 1900) PSI.
d. Disconnect Hydro Test and reconnect flap up line to actuator.

2-78. CHECKING FLAP WEEP VALVE.

NOTE

Airplane does not have to be on jacks but gear handle must be in down-indicate position.

a. Disconnect flap down line at either flap actuator. Cap actuator port and connect Hydro Test pressure line to flap down line.
b. Position flap handle to flaps down and maintain this position throughout entire test.
c. Very slowly close Hydro Test bypass valve and observe pressure gauge. With pressure decreasing, weep valve shall open before pressure has dropped to at least 40 PSI. Pressure will drop rapidly upon opening of weep valve.
d. Disconnect Hydro Test and reconnect flap down line.

2-79. BENCH TESTING HYDRAULIC POWER PACK.

2-80. A new or newly overhauled hydraulic Power Pack may be tested, using the Hydro Test, prior to installing the unit in the airplane. When bench testing the hydraulic Power Pack it will be necessary to use a serviceable hydraulic actuator cylinder. A main landing gear rotary actuator cylinder may be used in place of a nose landing gear actuator. For control of the door valve solenoid it will be necessary to fabricate an electrical harness as shown in figure 2-10. This harness, when connected to a 12-volt battery, will allow control of the electrical current to the door valve solenoid, permitting complete operation of the door hydraulic circuits.

2-81. CONNECTING POWER PACK TO HYDRO TEST.
a. Attach hydraulic Power Pack to a holding fixture. (See figure B2-3.)
b. Connect Hydro Test to Power Pack as follows:
1. Connect Hydro Test suction hose to suction port on Power Pack.
2. Connect Hydro Test pressure hose to pressure port on Power Pack.
3. Connect Hydro Test vent hose to vent port at top of Power Pack reservoir.
c. Using hydraulic hose of adequate length, connect serviceable nose landing gear actuator cylinder or main landing gear rotary actuator cylinder to Power Pack.

NOTE

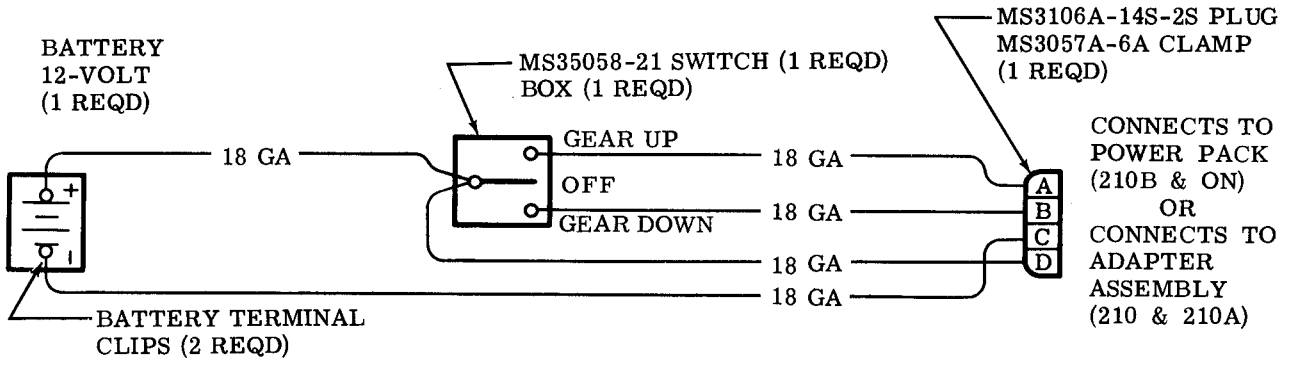
Check to be sure that door open and door close ports on the Power Pack are connected to the correct port of the actuator cylinder. Also that gear up and gear down ports of the Power Pack are connected to the correct ports of the actuator cylinder.

d. Install caps on all other open ports on Power Pack.
e. Connect electrical test harness to Power Pack electrical connector and to a 12-volt battery as shown in figure 2-10.

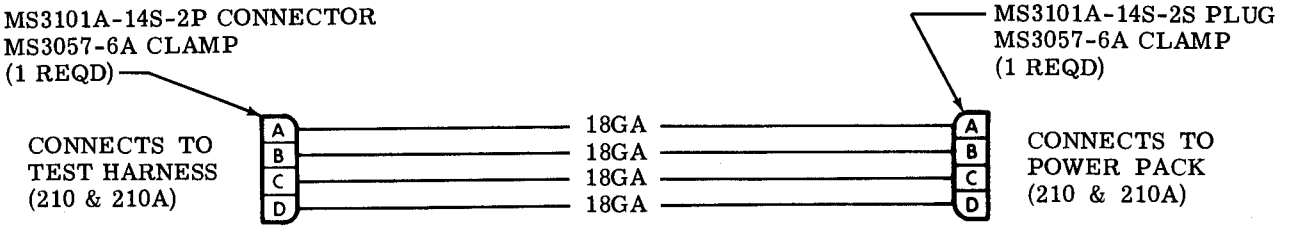
2-82. OPERATIONAL CHECK OF POWER PACK VALVES. Bench checking the gear up and gear down priority valves, time delay valve, and system relief valve using the Hydro Test may be performed in accordance with the foregoing paragraphs except that Power Pack is on the bench instead of in the airplane. When checking gear up or gear down priority valve, read pressure just as the actuator starts to move.

NOTE

At completion of gear up or gear down cycle, return manual switch in test harness to neutral or power off position before placing the landing gear control handle in the opposite position.



HYDRAULIC POWER PACK TEST HARNESS SCHEMATIC



ADAPTER ASSEMBLY (FOR USE WITH TEST HARNESS - 210 & 210A ONLY)

NOTE

SK210-42, Hydraulic Test Harness and Adapter, is available from the Cessna Spare Parts Department.

Figure 2-10. Test Harness Schematic

To avoid repetition throughout the inspection, general points to be checked are given below. In the inspection, only the items to be checked are listed; details as to how to check, or what to check for, are excluded. The inspection covers several different models. Some items apply only to specific models, and some items are optional equipment that may not be found on a particular airplane.

CHECK AS APPLICABLE:

MOVABLE PARTS for: lubrication, servicing, security of attachment, binding, excessive wear, safetying, proper operation, proper adjustment, correct travel, cracked fittings, security of hinges, defective bearings, cleanliness, corrosion, deformation, sealing, and tensions.

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

METAL PARTS for: security of attachment, cracks, metal distortion, broken spotwelds, corrosion, condition of paint, and any other apparent damage.

WIRING for: security, chafing, burning, defective insulation, loose or broken terminals, heat deterioration, and corroded terminals.

BOLTS IN CRITICAL AREAS for: correct torque in accordance with the torque values given in the chart in Section 1, when installed or when visual inspection indicates the need for a torque check.

FILTERS, SCREENS, AND FLUIDS for: cleanliness, contamination and/or replacement at specified intervals.

AIRPLANE FILE.

Miscellaneous data, information, and licenses are a part of the airplane file. Check that the following documents are up-to-date and in accordance with current Federal Aviation Regualtions.

To be displayed in the airplane at all times:

1. Aircraft Airworthiness Certificate (Form FAA 1362).
2. Aircraft Registration Certificate (Form FAA 500A).

To be carried in the airplane at all times:

1. Airplane Radio Station License, if transmitter installed (Form FCC 404-2).
2. Weight and balance Report or latest copy of Repair and Alteration Form (Form FAA-337).
3. Airplane Equipment List.
4. Airplane Log Book.
5. Engine Log Book.

Check FAA Airworthiness Directives and Cessna Service Letters for compliance at the time specified by them.

ENGINE RUN-UP.

Before beginning the step-by-step inspection, start, run up, and shut down the engine in accordance with instructions in the Owner's Manual. During the run-up, observe the following, making note of any discrepancies or abnormalities:

1. Engine temperatures and pressures.
2. Static rpm.
3. Magneto drop (See Owner's Manual).
4. Engine response to changes in power.
5. Any unusual engine noises.
6. Propeller response (See Owner's Manual).
7. Fuel tank selector and/or shut-off valve; operate engine on each tank position and off position long enough to make sure the valve functions properly.
8. Idling speed and mixture; proper idle cut-off.
9. Generator warning light or ammeter.
10. Suction gage.
11. Fuel flow indicator.

After the inspection has been completed, an engine run-up should again be performed to ascertain that any discrepancies or abnormalities have been corrected.

SCOPE AND PREPARATION

The 50-hour inspection includes a visual check of the engine, propeller, and aircraft exterior for any apparent damage or defects; an oil change and filter element change on aircraft equipped with an external oil filter; and accomplishment of lubrication and servicing requirements. Remove propeller spinner and engine cowling, and replace after the inspection has been completed.

If the airplane is not equipped with an external oil filter, the engine oil should be changed and the oil screen cleaned every 25 hours. Refer to paragraphs 2-16, 2-17, 2-17A, and 2-40A for detailed instructions regarding servicing and lubrication requirements in an unusual environment.

The 100-hour (or periodic) inspection includes everything in the 50-hour inspection. Also loosen or remove all fuselage, wing, empennage, and upholstery inspection doors, plates, and fairings as necessary to perform a thorough, searching inspection of the airplane. Replace after the inspection has been completed.

NOTE

Numbers appearing in the "AS SPECIFIED" column refer to the data listed at the end of the inspection chart.

	AS SPECIFIED	EACH 100 HOURS	EACH 50 HOURS
PROPELLER.			
1. Spinner and spinner bulkhead			●
2. Blades			●
3. Hub			●
4. Lubrication (Hartzell)		●	
5. Bolts and nuts			●
6. Governor and control			●
ENGINE COMPARTMENT.			
Check for evidence of oil, hydraulic fluid and fuel leaks, then clean entire engine and compartment, if needed, prior to inspection.			
1. Engine oil, screen, filler cap, dipstick, drain plug and external filter element	1		●
2. Oil cooler			●
3. Induction air filter (Also see paragraph 2-17.)			●
4. Induction airbox, air valves, doors, and controls			●
5. Cold and hot air hoses			●

		AS SPECIFIED	EACH 100 HOURS	EACH 50 HOURS	
6.	Engine baffles			●	
7.	Cylinders, rocker box covers, and push rod housings			●	
8.	Crankcase, oil sump, accessory section, and front crankshaft seal			●	
9.	All lines and hoses			●	
10.	Intake and exhaust systems (Also see paragraph 12-24.)			●	
11.	Ignition harness			●	
12.	Spark plugs and compression check		●		
13.	Crankcase, hydraulic, and vacuum system breather lines			●	
14.	Electrical wiring			●	
15.	Vacuum pump, oil separator, and relief valve			●	
16.	Vacuum relief valve screen or filter		●		2
17.	Engine controls and linkage			●	
18.	Engine shock mounts, engine mount structure, and ground straps			●	
19.	Cabin heater valves, doors, and controls			●	
20.	Starter, solenoid, electrical connections			●	
21.	Starter brushes, brush leads, and commutator				3
22.	Generator or Alternator, drive belt, pulley, and electrical connections			●	
23.	Generator or Alternator brushes, brush leads, and commutator or slip ring				3
24.	Voltage regulator mounting and electrical leads			●	
25.	Magnetos (externally) and electrical connections			●	
26.	Bendix magneto breaker compartment and timing (Also see paragraph 12-72)		●		4
27.	Slick magneto timing				5
28.	Slick magneto breaker compartment (Also see paragraph 12-78)				5
29.	Fuel injection fuel-air control unit, fuel pump, fuel manifold valve, fuel lines, and nozzles			●	

	AS SPECIFIED	EACH 100 HOURS	EACH 50 HOURS	
30. Fuel-air control unit screen		●		
31. Hydraulic pump		●		
32. Firewall		●		
33. Engine cowling			●	
34. Cowl flaps and control			●	
AIRFRAME.				
1. Aircraft exterior			●	
2. Aircraft structure		●		
3. Windows, windshield, and doors			●	
4. Seats, stops, seat rails, upholstery, structure, and seat mounting			●	
5. Safety belts and attaching brackets			●	
6. Control column bearings, sprockets, pulleys, cables, chains, and turnbuckles		●		
7. Control lock, control wheel, and control column mechanism		●		
8. Instruments and markings		●		
9. Gyro filter and central air filter (Also see paragraph 2-17A.)		●		6
10. Magnetic compass compensation				7
11. Instrument wiring and plumbing		●		
12. Instrument panel, shockmounts, ground straps, cover, and decals and labeling		●		
13. Defrosting, heating, and ventilating systems, and controls		●		
14. Cabin upholstery, trim, sunvisors, and ash-trays		●		
15. Area beneath floor, lines, hoses, wires, and control cables		●		
16. Electrical horns, lights, switches, circuit breakers, fuses, and spare fuses			●	
17. Exterior lights			●	

	AS SPECIFIED	EACH 100 HOURS	EACH 50 HOURS	
18. Pitot and static systems		●		
19. Stall warning sensing unit, and pitot and stall warning heaters		●		
20. Radios and radio controls		●		
21. Radio antennas		●		
22. Battery, battery box, and battery cables		●		
23. Battery electrolyte level (Also see paragraph 2-18.)			●	
24. Oxygen system		●		8
25. Oxygen supply, masks, and hoses				9

CONTROL SYSTEMS.

In addition to the items listed below, always check for correct direction of movement, correct travel, and correct cable tension.

1. Cables, terminals, pulleys, pulley brackets, cable guards, turnbuckles, and fairleads		●		
2. Chains, terminals, sprockets, and chain guards		●		
3. Trim control wheels, indicators, actuator, and bungee		●		
4. Travel stops		●		
5. All decals and labeling		●		
6. Flap control lever or switch, flap rollers and tracks, flap position transmitter and linkage, flap position indicator, and flap electric motor and transmission, actuating cylinders, synchronizing system		●		
7. Elevator downspring system		●		
8. Rudder pedal assemblies and linkage		●		
9. Skin and structure of control surfaces and trim tabs		●		
10. Balance weight attachment		●		

	AS SPECIFIED	EACH 100 HOURS	EACH 50 HOURS	
FUEL SYSTEM.				
1. Fuel strainer, drain valve, and control			●	
2. Fuel strainer screen and bowl				●
3. Electric fuel pump, throttle switch, and electric connections			●	
4. Fuel tanks, fuel accumulator tank, fuel lines, drains, filler caps, and placards				●
5. Drain fuel and check tank interior, attachment, and outlet screens				7
6. Fuel vents and vent valves				●
7. Fuel selector and/or shut-off valve and placards				●
8. Fuel quantity gages and transmitter units				●
9. Engine primer				●
10. Vapor return line and check valve				●
LANDING GEAR.				
1. Brake fluid, lines and hoses, linings, disc and clips, brake assemblies, and master cylinders				●
2. Main gear wheels, wheel bearings, step and spring strut, tires, and fairings				●
3. Nose gear strut servicing, and shimmy dampener servicing				●
4. Nose gear wheel, wheel bearings, strut, steering system, shimmy dampener, tire, fairing, and torque links				●
5. Parking brake system				●
LANDING GEAR RETRACTION SYSTEM.				
NOTE: When performing inspection of the landing gear retraction system, a hydraulic power source is required. Refer to paragraphs 2-41 through 2-82 for Hydro Test operation.				
1. Operate the landing gear through five fault-free cycles, noting cycling time. Refer to paragraphs 2-53 and 2-76				● 4

	AS SPECIFIED	EACH 100 HOURS	EACH 50 HOURS
2. Check landing gear doors for at least 1/2 inch clearance with any part of landing gear during operation, and for proper fit when closed			●
3. Check down position of main gear struts. Refer to figures 5-10 and 5A-8			●
4. Check main gear downlock engagement. Refer to figures 5-21, 5A-8, and 5A-13			●
5. Check overcenter adjustments of retracted main gear downlock. Refer to figures 5-21 and 5A-13			●
6. Check main gear uplock hook operation. Refer to paragraphs 5-110, 5A-52, and 5C-47			●
7. Check that main gear snubbing action occurs. Refer to paragraph 5C-46			●
8. Check adjustment and operation of main gear up and down indicator switches, nose gear up and down indicator switches, and nose gear safety switch. Refer to paragraphs 5-109, 5-111, 5-114, 5-116, and 5-118 for Model 210 and 210A. Refer to paragraphs 5A-103, 5A-104, 5A-108, 5A-109, and 5A-110 for the Model 210B and on. Also check indicator lights for proper operation			●
9. Check nose gear downlock adjustments. Refer to paragraphs 5-113 and 5A-106			●
10. Check nose gear uplock operation. Refer to paragraphs 5-115 and 5A-106			●
11. Check adjustment of landing gear handle up-down switch. Refer to paragraphs 5-31, 5A-28, and 5C-22			●
12. Check all hydraulic system components for security, hydraulic leaks, and any apparent damage to components or mounting structure			●

NOTE

Hydraulic fluid for the brakes passes through the actuator-to-saddle plate attachment and is sealed by an O-ring. After the bolts are checked for tightness, check that no leakage of brake fluid occurs with pressure applied to the brake pedals.

13. Check gear and door linkage for security, wear of pivot points and bearings, and for distortion or other damage			●
14. Check main gear strut-to-saddle attachment			●
15. Check condition of all springs			●
16. Clean hydraulic filter. Refer to paragraphs 5-13, 5A-14, and 5C-10			● 10
17. Hydraulic fluid contamination check. Refer to paragraph 2-26			11

	AS SPECIFIED	EACH 100 HOURS	EACH 50 HOURS
18. Check operation of emergency hand pump ----------			●
19. Check accumlator precharge (Models 210 and 210A). Refer to paragraph 2-25 ----------			●

NOTE

A high-time inspection is merely a 100-hour inspection with the addition of an engine overhaul. Continental recommends overhaul at 1200 hours for the IO-470 series engines and at 800 hours for the IO-520 series engines. At the time of overhaul, constant-speed propellers, governors and engine accessories should be overhauled.

1 Each 25 hours, if not equipped with an external filter.

2 Each 1000 hours, or to coincide with engine overhauls, replace garter-type filters.

3 Starters and generators each 200 hours; alternators, each 500 hours.

4 First 25 hours; each 100-hour inspection thereafter.

5 Check timing each 200 hours; check breaker compartment each 500 hours, unless timing is off.

6 Central filter each 500 hours and gyro filters at instrument overhaul; gyro filters each 100 hours without central filter.

7 Each 1000 hours, or to coincide with engine overhauls.

8 Refer to Section 15 for details.

9 Refer to paragraphs 2-27 and 2-28 for details.

10 At first 25 hours and first 50 hours of operation; at each 100-hour inspection thereafter.

11 At first 50 and first 100 hours, thereafter at each 500 hours or one year, whichever comes first.

SECTION 3

FUSELAGE

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3-1. WINDOWS AND WINDSHIELDS.

3-2. CLEANING. (See paragraph 2-31.)

3-3. WAXING will fill in minor scratches in clear plastic and help protect the surface from further abrasion. Use a good grade of commercial wax applied in a thin, even coat. Bring the wax to a high polish by rubbing lightly with a clean, dry flannel cloth.

3-4. REPAIRS. Damaged window panels and windshield may be removed and replaced if the damage is extensive. However, certain repairs as prescribed in the following paragraphs can be made successfully without removing the damaged part from the airplane. Three types of temporary repairs for cracked plastic are possible. No repairs of any kind are recommended on highly-stressed or compound curves where the repair would be likely to affect the pilot's field of vision. Curved areas are more difficult to repair than flat areas and any repaired area is both structurally and optically inferior to the original surface.

3-5. SCRATCHES on clear plastic surfaces can be removed by hand-sanding operations followed by buffing and polishing, if following steps are accomplished carefully.

a. Wrap a piece of No. 320 (or finer) sandpaper or abrasive cloth around a rubber pad or wood block. Rub the surface around the scratch with a circular motion, keeping the abrasive constantly wet with clean water to prevent scratching the surface further. Use minimum pressure and cover an area large enough to prevent the formation of "bull's-eyes" or other optical distortions.

b. Continue the sanding operation, using progressively finer grade of abrasives until the scratches disappear.

c. When the scratches have been removed, wash the area thoroughly with clean water to remove all gritty particles. The entire sanded area will be clouded with minute scratches which must be removed to restore transparency.

d. Apply fresh tallow or buffing compound to a motor-driven buffing wheel. Hold the wheel against the plastic surface, moving it constantly over the damaged area until the cloudy appearance disappears. A 2000-foot-per-minute surface speed is recommended to prevent overheating and distortion.

NOTE

Polishing can be accomplished by hand but it will require a considerably longer period of time to attain the same result as a buffing wheel.

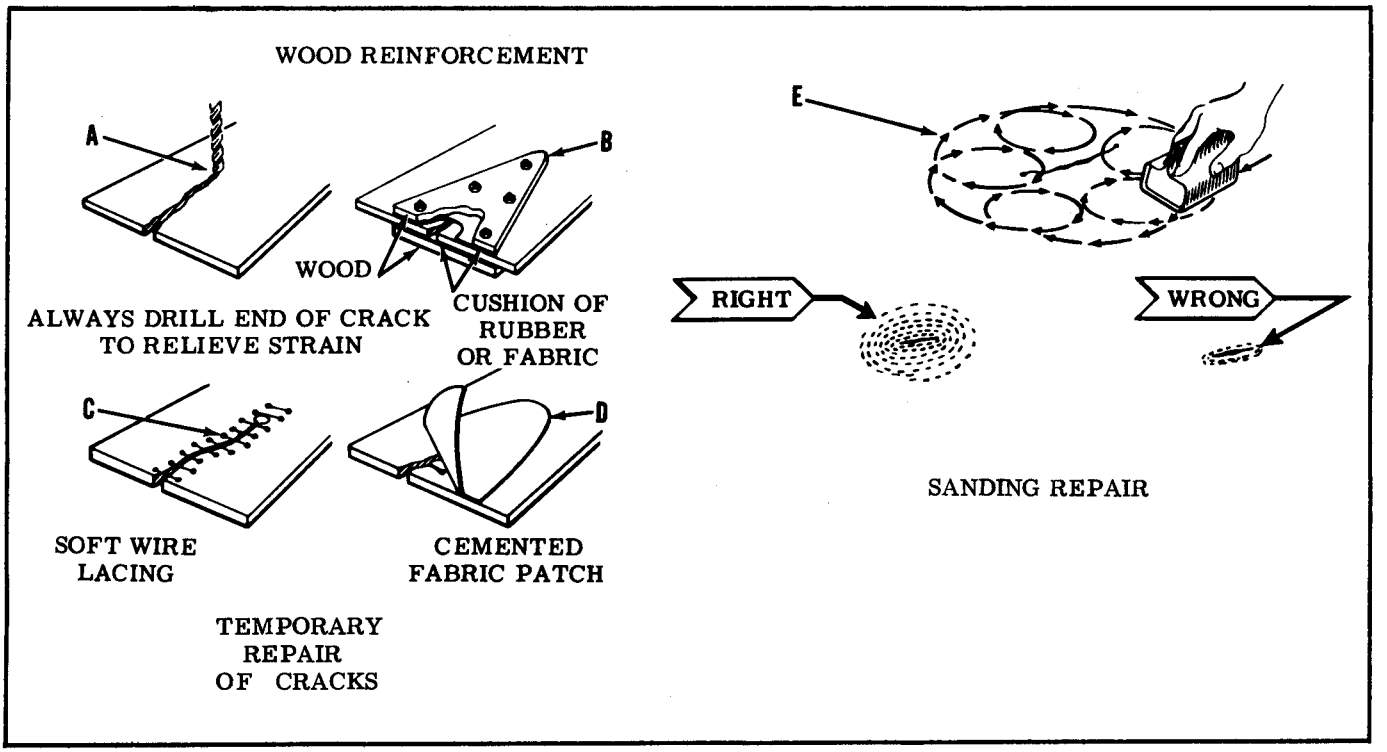


Figure 3-1. Repair of Plexiglas

e. When buffing is finished, wash the area thoroughly and dry it with a soft flannel cloth. Allow the surface to cool and inspect the area to determine if full transparency has been restored. Then apply a thin coat of hard wax and polish the surface lightly with a clean flannel cloth.

NOTE

Rubbing the plastic surface with a dry cloth will build up an electrostatic charge which attracts dirt particles and may eventually cause scratching of the surface. After the wax has hardened, dissipate this charge by rubbing the surface with a slightly damp chamois. This will also remove the dust particles which have collected while the wax is hardening.

f. Minute hairline scratches can often be removed by rubbing with commercial automobile body cleaner or fine-grade rubbing compound. Apply with a soft, clean, dry cloth or imitation chamois.

3-6. CRACKS. (See figure 3-1.)

a. When a crack appears in a panel, drill a hole at the end of the crack to prevent further spreading. The hole should be approximately 1/8 inch in diameter, depending on the length of the crack and thickness of the material.

b. Temporary repairs to flat surfaces can be effected by placing a thin strip of wood over each side of the surface and then inserting small bolts through the wood and plastic. A cushion of sheet rubber or airplane fabric should be placed between the wood and plastic on both sides.

c. A temporary repair can be made on a curved surface by placing fabric patches over the affected areas. Secure the patches with airplane dope, Specification No. MIL-D-5549; or Lacquer, Specification No. MIL-L-7178. Lacquer thinner, Specification No. MIL-T-6094 can also be used to secure the patch.

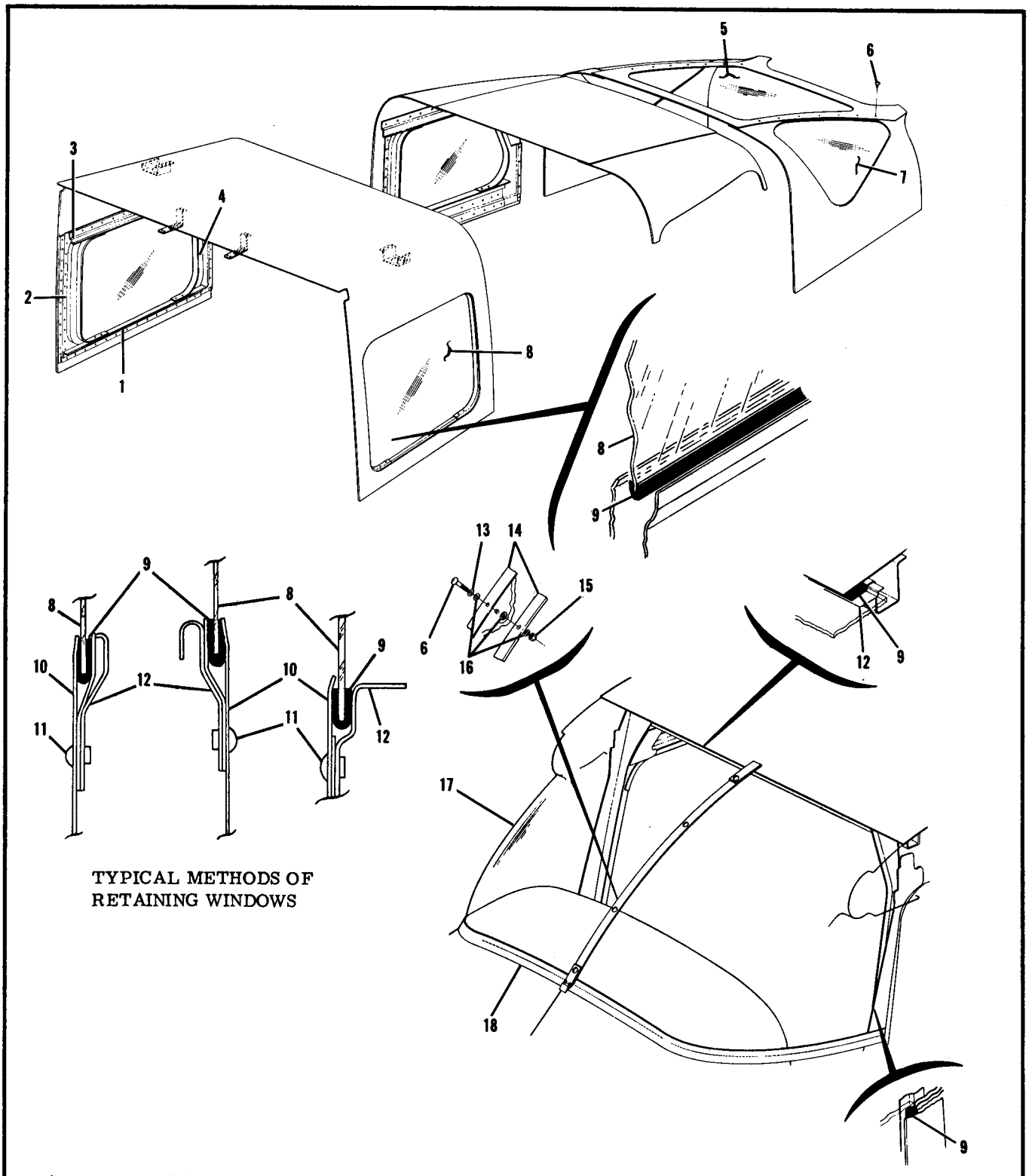
d. A temporary repair can be made by drilling small holes along both sides of the crack 1/4 to 1/8 inch apart and lacing the edges together with a soft wire. Small-stranded antenna wire makes a good temporary lacing material. This type of repair is used as a temporary measure only, and as soon as facilities are available the panel should be replaced.

3-7. WINDSHIELDS. (See figure 3-2.) Windshields are single-piece, "free-blown" acrylic plastic panels set in sealing strips and held by formed retainer strips riveted to the fuselage. A windshield centerstrip supports the center of the windshield. Various sealants have been used to prevent leakage around the windshield. However, Presstite No. 579.6 sealing compound used in conjunction with a felt strip at the top and sides, and EC-1202 tape (manufactured by the Minnesota Mining and Mfg. Co., St. Paul, Minnesota) used at the bottom of the windshield will give satisfactory results. If desired, the EC-1202 tape, which is available in different widths and thicknesses, can be used as a sealant at all edges of the windshield.

3-8. REMOVAL.

a. Remove the screws and attaching parts at the windshield centerstrip.

b. Drill out all rivets securing the retainer strip at the front of the windshield.



1. Lower Retainer
2. Forward Retainer
3. Upper Retainer
4. Aft Retainer
5. Rear Center Window
6. Screw
7. Rear Side Window
8. Window
9. Seal
10. Fuselage Skin
11. Rivet
12. Retainer
13. Washer
14. Windshield Centerstrip
15. Nut
16. Washer
17. Windshield
18. Windshield Retainer Strip

Figure 3-2. Cabin Plexglas

c. Remove wing fairings over windshield edges.
d. Pull windshield straight forward, out of side and top retainers.

3-9. REPLACEMENT.
a. Apply felt strip and sealing compound or sealing tape to all edges of windshield to prevent leaks.
b. Reverse steps listed in preceding paragraph to install a windshield.
c. When installing a new windshield, check the fit and carefully file or grind away any excess plexiglas.
d. Use care not to crack windshield when installing. If not previously removed, top retainer may be removed if necessary. Starting at an upper corner and gradually working windshield into position is recommended.

NOTE

Screws and self-locking nuts, or screws and Rivnuts may be used instead of the factory-installed rivets which fasten the front retaining strip to the cowl deck. If the Rivnuts are properly installed and at least No. 6 screws are used, no loss of strength will result.

3-10. MOVABLE WINDOWS. (See figures 3-3.) The movable windows, hinged at the top, are installed in the doors. Window assemblies, that is, the clear plastic and frame units may be replaced by removing the hinge pins and disconnecting the window stop. To remove the frame from the plastic panel, drill out the blind rivets at the frame splice. When replacing the plastic panel in a frame, make sure that the sealing strip and an adequate coating of Presstite No. 579. 6 sealing compound is used around all edges of the plastic panel.

3-11. FIXED WINDOWS. Fixed windows are mounted in sealing strips and sealing compound, and are held in place by various retainer strips. To replace the side windows, remove upholstery and trim panels, then drill out rivets as necessary to remove the retainer strips.

3-12. WRAP-AROUND REAR WINDOWS. The fixed windows extend around the rear of the cabin on the Model 205 series, 206 series, and 210B and on. These windows provide for better pilot visibility. The curved triangular rear side windows are set in retaining and sealing strips and are removed from inside the cabin after rivets securing the retaining strips are drilled out. Removal of the rectangular rear window require that the three rows of rivets immediately forward and above the window be drilled out. Remove screws securing the retainer strips at each side of the window and deflect retainer strips up and aft from skin splice above the window. Remove window from outside of the airplane.

3-13. INSTALLATION OF REAR WINDOWS. Installation of the "wrap-around" rear windows may be accomplished by reversing the procedures listed in paragraph 3-12, observing the following precautions:
a. Check the fit of a new window and carefully file or grind away any excess plexiglas.
b. Use care not to crack plexiglas when installing.
c. Be sure to use sealing strips and sealing compound to prevent leaks.

3-14. CABIN DOORS. (See figure 3-3.)

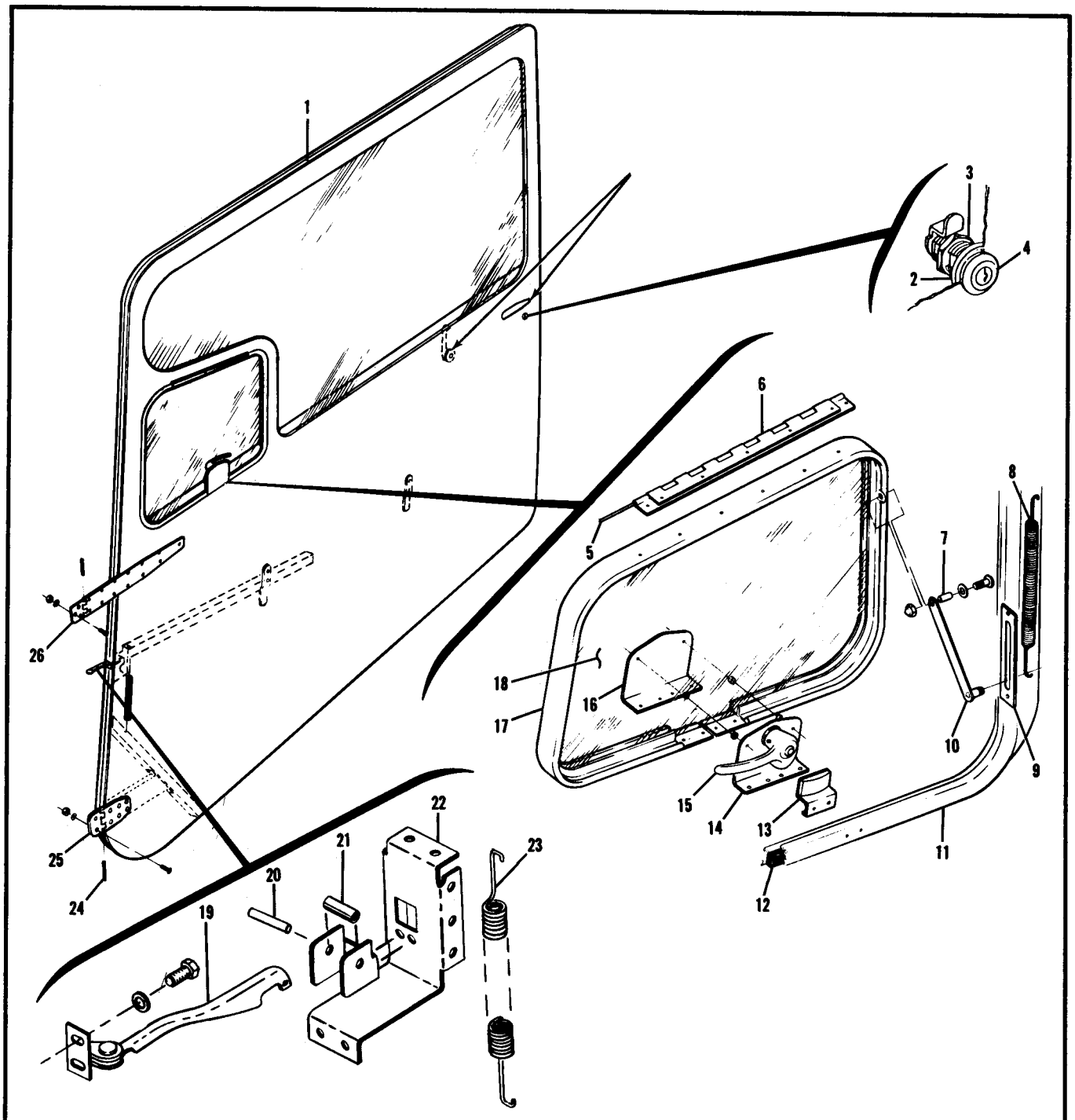
3-15. REMOVAL AND INSTALLATION. Removal of cabin doors is accomplished either by removing the screws which attach the hinges or by removing the hinge pins. If the type of door stop which is connected to the fuselage and the door is used, it must also be disconnected. Some airplanes are equipped with removable hinge pins to facilitate door removal. If the permanent hinge pins were removed, they may be replaced by clevis pins secured with cotter pins, or new hinge pins may be installed and "spin-bradded." When fitting a new door, some trimming of the door skin at the edges and some reforming with a soft mallet may be necessary to achieve a good fit.

3-16. CABIN DOOR WEATHERSTRIP is cemented around all edges of the door. New weatherstrip may be applied after mating surfaces of weatherstrip and door are clean, dry and free from oil or grease. Apply a thin, even coat of adhesive to each surface and allow to dry until tacky before pressing strip in place. Minnesota Mining and Manufacturing Co. No. EC-880 cement is recommended.

3-17. ADJUSTMENT OF CABIN DOOR. The cabin door should be adjusted so the cabin door skin fairs with the fuselage skin. Slots at the latch strike plate permit repositioning of the strike plate. Depth of latch engagement may be changed by adding or removing washers or shims between the strike plate and the doorpost. Some airplanes contain wedges at the upper forward edge of the door which aid in preventing air leaks at this point. They engage as the door is closed. Several attaching holes are located in the wedges, and the set of holes which gives best results should be selected.

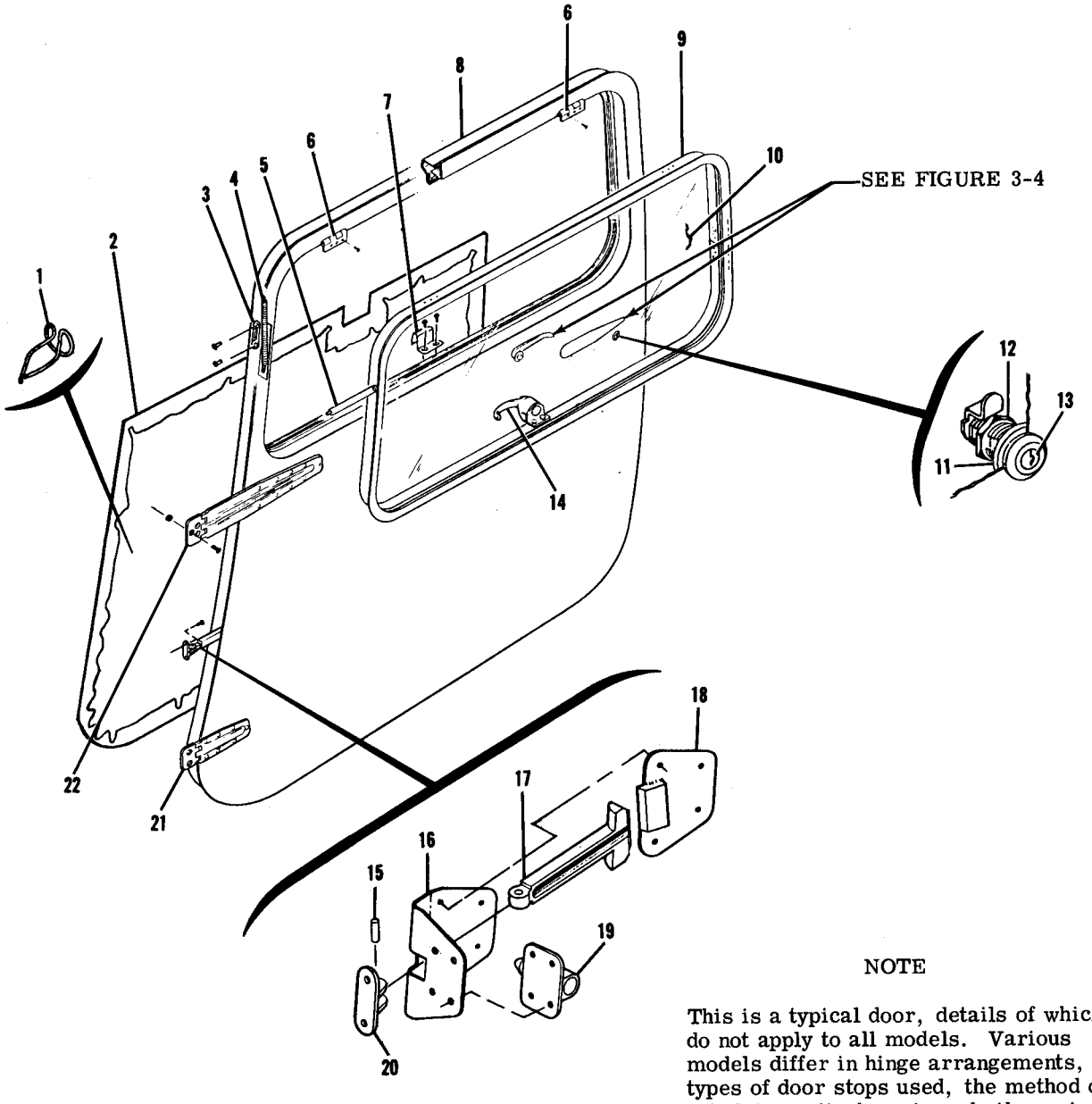
3-18. DOOR LATCHES. Flush-mounted outside door handles and conventional inside door handles are used to actuate door latches. Cabin and front cargo door latches are shown in figure 3-4, which may be used as a guide during removal, disassembly, and installation. When installing an inside door handle, position it in the same relative position as the opposite door handle. The front cargo door latch is similar to the cabin door latch. The rear cargo door latch is shown in figure 3-5. Rig the rear cargo door latch as outlined in paragraph 3-25.

3-18A. DOOR LOCK. Standard equipment on 200-series aircraft includes a door lock on the left cabin door. If the lock cylinder is replaced, the new cylinder may be modified to accept the original key. This is desirable, as the same key is used for the ignition switch and the cabin door lock. After removing the lock mechanism from the door, proceed as follows:
1. Remove lock cylinder from housing.
2. Insert original key into cylinder and file off any protruding tumblers flush with cylinder. Without removing key, check that cylinder rotates freely in housing.



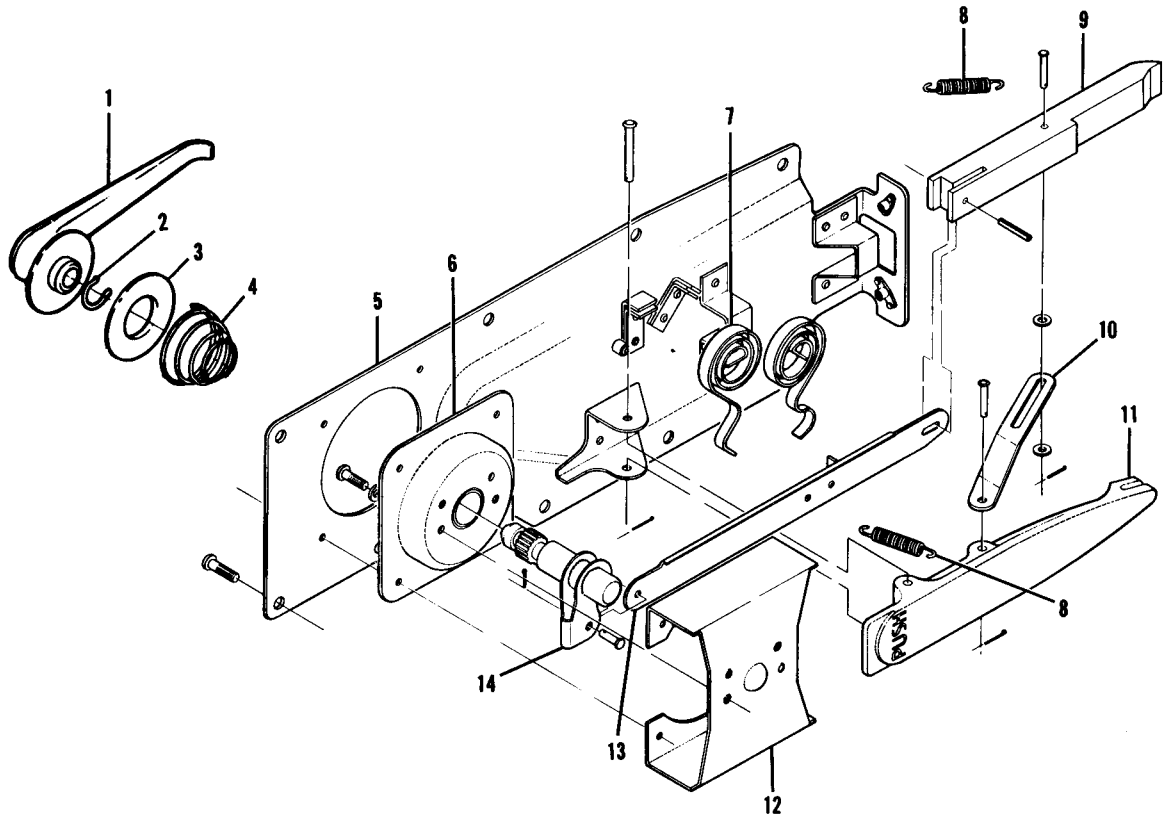
1. Weatherstrip
2. Washer
3. Nut
4. Lock Assembly
5. Hinge Pin
6. Hinge
7. Spacer
8. Spring
9. Guide Plate
10. Arm
11. Frame Assembly
12. Seal
13. Catch
14. Base Plate
15. Handle
16. Plate
17. Storm Window Frame
18. Window
19. Door Stop
20. Roll Pin
21. Spacer
22. Bracket
23. Spring
24. Hinge Pin
25. Lower Hinge
26. Upper Hinge

Figure 3-3. Cabin Doors (Sheet 1 of 2)



1. Upholstery Clip
2. Upholstery Panel
3. Wedge
4. Spring
5. Window Stop
6. Window Hinge
7. Latch Plate
8. Cabin Door
9. Window Frame
10. Window
11. Washer
12. Nut
13. Lock Assembly
14. Latch Handle
15. Pin or Rivet
16. Reinforcement
17. Door Stop Arm
18. Stop Assembly
19. Spring - Loaded Plunger
20. Hinge
21. Lower Hinge
22. Upper Hinge

Figure 3-3. Cabin Doors (sheet 2 of 2)



NOTE

On the early Model 210 airplanes, the cabin door latch mechanism is installed in the door structure instead of on the removable base plate. See figure 3-5 for rear cargo door latch mechanism on the Models 206 & U206.

1. Inside Handle
2. Retaining Clip
3. Escutcheon
4. Spring
5. Base Plate
6. Bearing Plate
7. Spring
8. Spring
9. Latch Bolt
10. Pull Bar
11. Outside Handle
12. Bracket
13. Latch Strap
14. Shaft Assembly

Figure 3-4. Door Latches

3. Replace locking mechanism in door, and check lock operation with door open.

4. Destroy new key and disregard code number on cylinder.

3-19. BAGGAGE DOORS.

3-20. REMOVAL AND INSTALLATION. Baggage door removal is accomplished by disconnecting the door stop, then removing hinge pins or bolts securing door to hinges. When fitting a new door some trimming of the door at the edges and some reforming with a soft mallet may be necessary to achieve a good fit.

3-21. CARGO DOORS - MODELS 206 & U206. (See figure 3-5.)

3-22. The baggage door on the left side of the fuselage has been replaced by a fixed window, the right cabin door has been replaced by a fixed window, and large cargo doors have been added to the right side of the fuselage. The front cargo door is hinged at the rear spar bulkhead and the rear cargo door is hinged at fuselage station 112. They close together at fuselage station 90. The rear cargo door is a structural, load-carrying member. The rear cargo door handle is located in the forward edge of the door and is inaccessible while the front cargo door is closed. This is a safety feature designed to prevent inadvertent opening of the rear cargo door in flight. Operating the rear cargo door handle actuates push-pull rods which cause hooks to engage or disengage with latch plates on the upper and lower door sills. When fully closed, the over-center action of the handle holds the door tightly closed to permit load to be transmitted into the door structure through load-carrying pins on the door and their corresponding sockets on the door sills. The front cargo door is not a load-carrying member. It contains a conventional latching mechanism similar to the cabin door latching mechanism. Telescoping door stops, with detent positions, are used to hold the cargo doors open. An entrance step is located on the fuselage, below the front cargo door. An optional spoiler kit, AK206-1, must be installed before flight with the cargo doors removed is permissible. This spoiler kit consists of a spoiler assembly which attaches to the front cargo door hinge points and deflects air away from the cargo door opening. Addition of screws to the rear wall will be required with the installation of the spoiler kit.

CAUTION

Prior to the Serial No. 206-0196, the front cargo door must be either in full open or full closed position before operating wing flaps, or damage will result. All other airplanes with cargo doors contain a flap interrupt switch, mounted on the front cargo door frame, which prevents flap operation while the front cargo door is open. As noted in Service Letter 65-1, the switch and electrical wiring may be installed on earlier serials. If the airplane is operated with cargo doors removed, a spoiler kit (AK206-1) must be installed. The kit contains a switch depressor to retain use of the flaps.

3-23. REMOVAL AND INSTALLATION. Either cargo door may be removed after removing the pins and cotter pins from the hinges. Disconnect the door stops from the cargo doors before removal. When installing the doors, be sure to install the cotter pins in all hinge pins and connect door stops.

3-24. REMOVAL AND INSTALLATION OF LATCHES. Figure 3-4 and 3-5 show details of the cargo door latches and may be used as guides during removal, disassembly, assembly, and installation.

3-25. RIGGING OF REAR CARGO DOOR LATCH. (See figure 3-5.)

a. Three results must be obtained by rigging:
   1. Hooks must fully engage latch plates, but must clear them .05" minimum as door is opened.
   2. Load-carrying pins must fully engage their sockets when door is locked.
   3. Door must be flush with fuselage skins when door is locked.

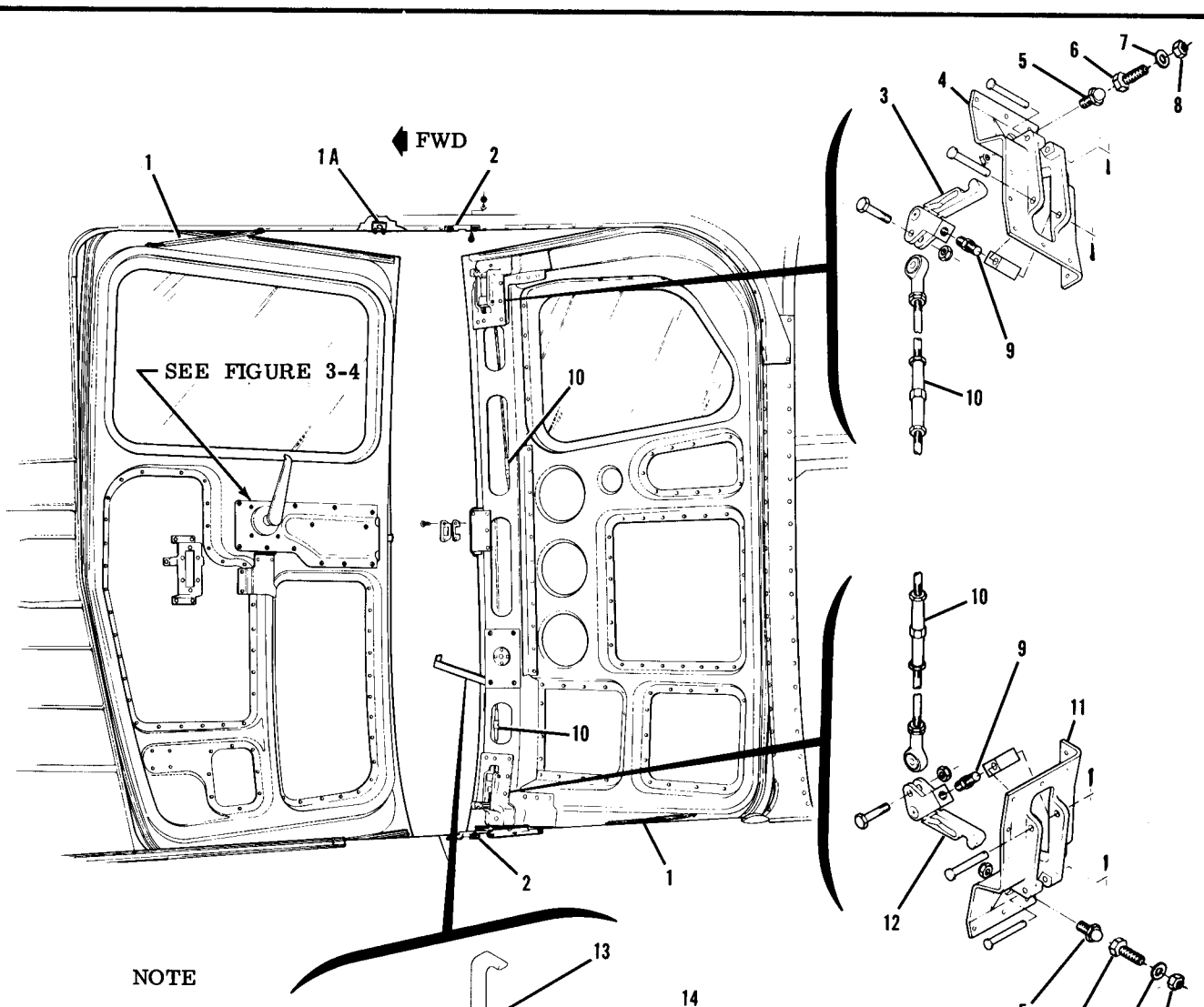
NOTE

Adjusting door slightly less than flush is permissible if air leaks around door seal are encountered.

b. There are four sets of adjustments for rigging:
   1. Adjusting bolts (9). These determine depth of hook engagement and clearance of hooks as door is opened.
   2. Slots in latch plates (2). Plates may be moved inboard or outboard as necessary for full load-carrying pin engagement.
   3. Washers under sockets (6). These may be added as required to make door flush with fuselage skins.
   4. Turnbuckles (10). These must be adjusted to cause both hooks to pull door closed tightly. Handle should snap over-center snugly, but excessive force should not be required for handle operation.
   5. If aircraft has a flap interrupt switch, check that flaps operate with the cargo doors closed, but will not operate with doors open. Switch adjustment is provided by means of slotted holes on the front cargo door frame.

3-26. SEATS. (See figures 3-6 thru 3-13.)

3-27. INDIVIDUAL SEATS. Standard individual seats are equipped with manually operated reclining seat backs. Rollers permit the seats to slide fore-and-aft on seat rails, and pins which engage various holes in seat rails lock seats in the selected positions. Seat stops limit travel. Removal is accomplished by removing the seat stops, and sliding the seats forward and aft to disengage them from the seat rails. Be sure to replace seat stops after installing a seat. Vertically adjustable individual seats, operated manually or by electrical power, may be installed.



NOTE

To aid in cargo loading, the center seat bolt attach points on the floor of the Model U206 are designed to fold flat.

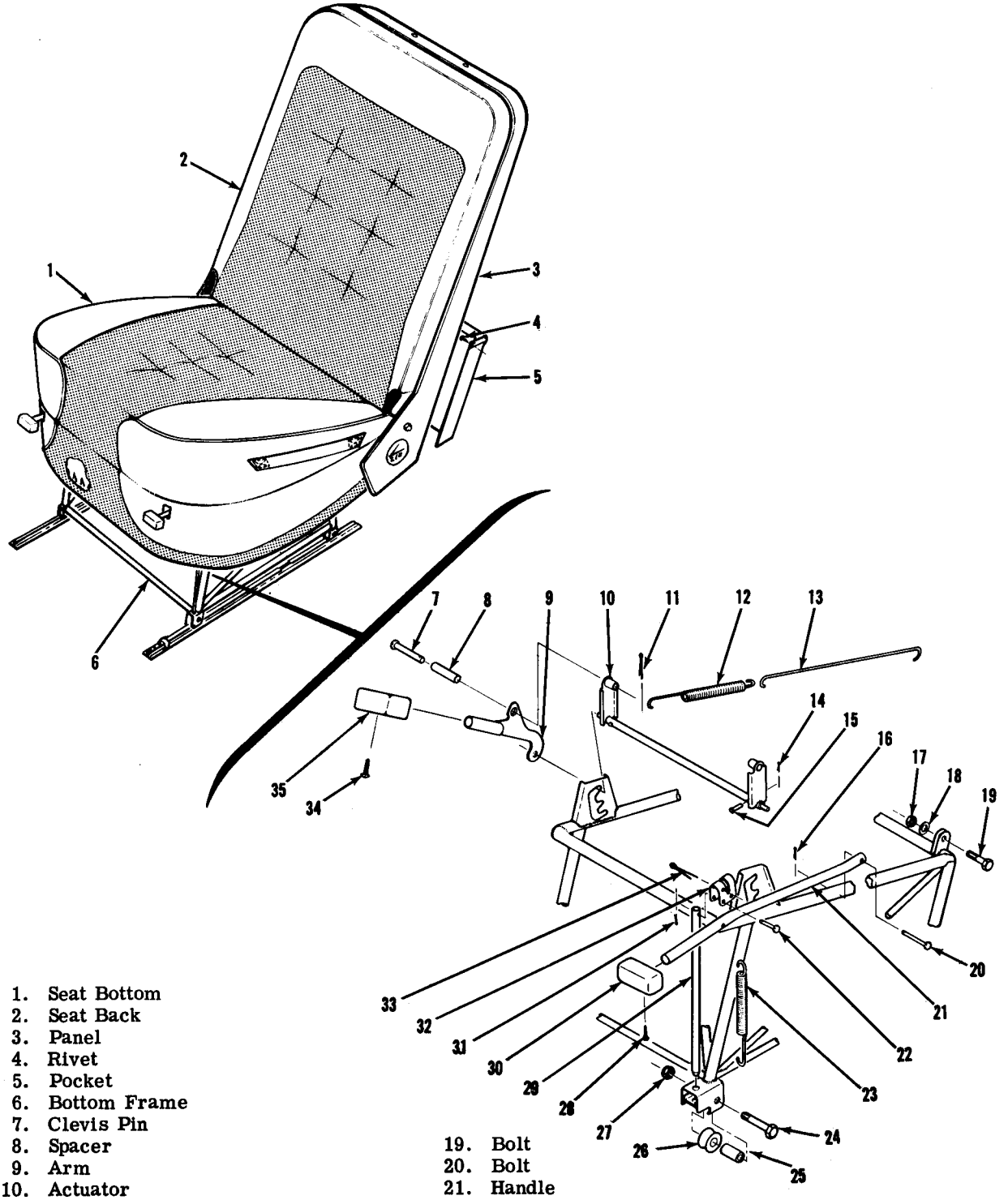
Beginning with Serial No. 206-0154, and on all U206 airplanes, a tee handle is stowed in the glove compartment. The front cargo door may be locked and unlocked externally by inserting the tee handle through a hole opposite the inside handle.

NOTE

Sockets (6) are mounted in the upper and lower door sills. Install an abrasive shim beneath latch plate (2) to prevent latch plate from slipping.

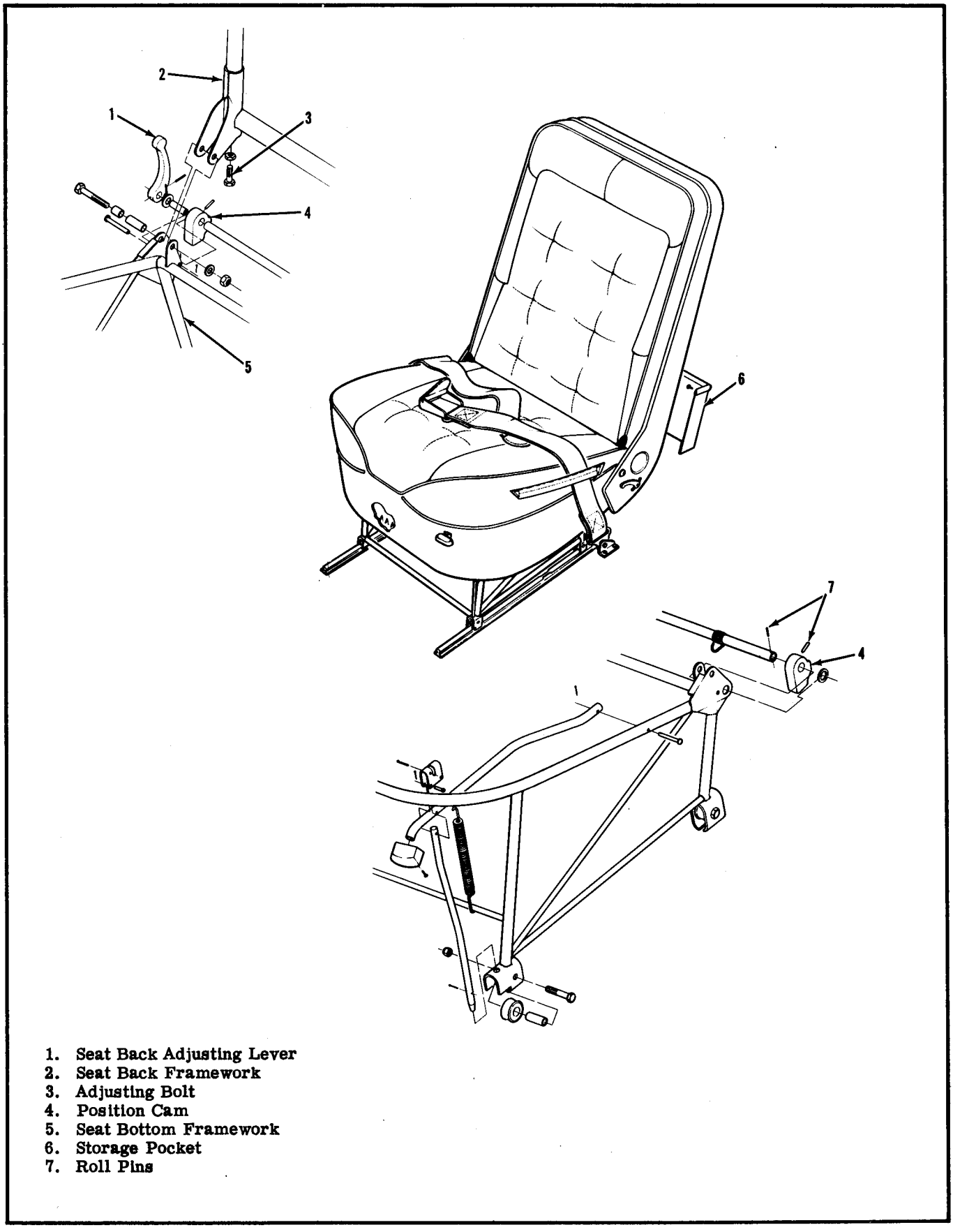
1. Door Stop
1A. Flap Interrupt Switch
2. Latch Plate
3. Upper Hook
4. Upper Latch Carrier
5. Load-Carrying Pin
6. Socket
7. Washer
8. Nut
9. Adjusting Bolt
10. Turnbuckle
11. Lower Latch Carrier
12. Lower Hook
13. Handle
14. Bushing

Figure 3-5. Cargo Doors (206 & U206)



1. Seat Bottom
2. Seat Back
3. Panel
4. Rivet
5. Pocket
6. Bottom Frame
7. Clevis Pin
8. Spacer
9. Arm
10. Actuator
11. Cotter Pin
12. Spring
13. Spring Link
14. Cotter Pin
15. Clevis Pin
16. Cotter Pin
17. Nut
18. Washer
19. Bolt
20. Bolt
21. Handle
22. Clevis Pin
23. Spring
24. Bolt
25. Bushing
26. Roller
27. Nut
28. Screw
29. Latch Pin
30. Knob
31. Cotter Pin
32. Clevis
33. Cotter Pin
34. Screw
35. Knob

Figure 3-6. Single Seat (Model 210)

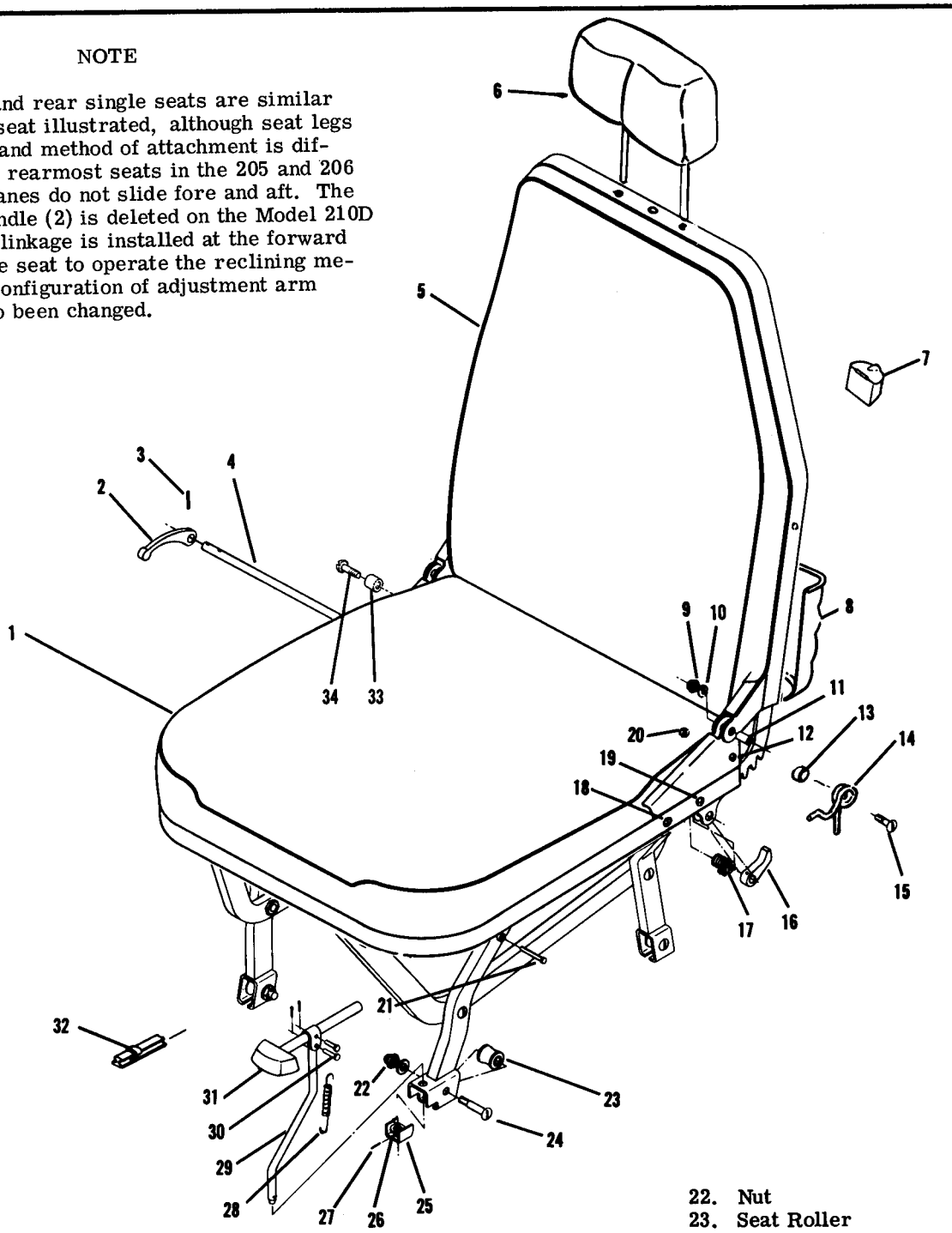


1. Seat Back Adjusting Lever
2. Seat Back Framework
3. Adjusting Bolt
4. Position Cam
5. Seat Bottom Framework
6. Storage Pocket
7. Roll Pins

Figure 3-7. Single Seat (Model 210A and 210B)

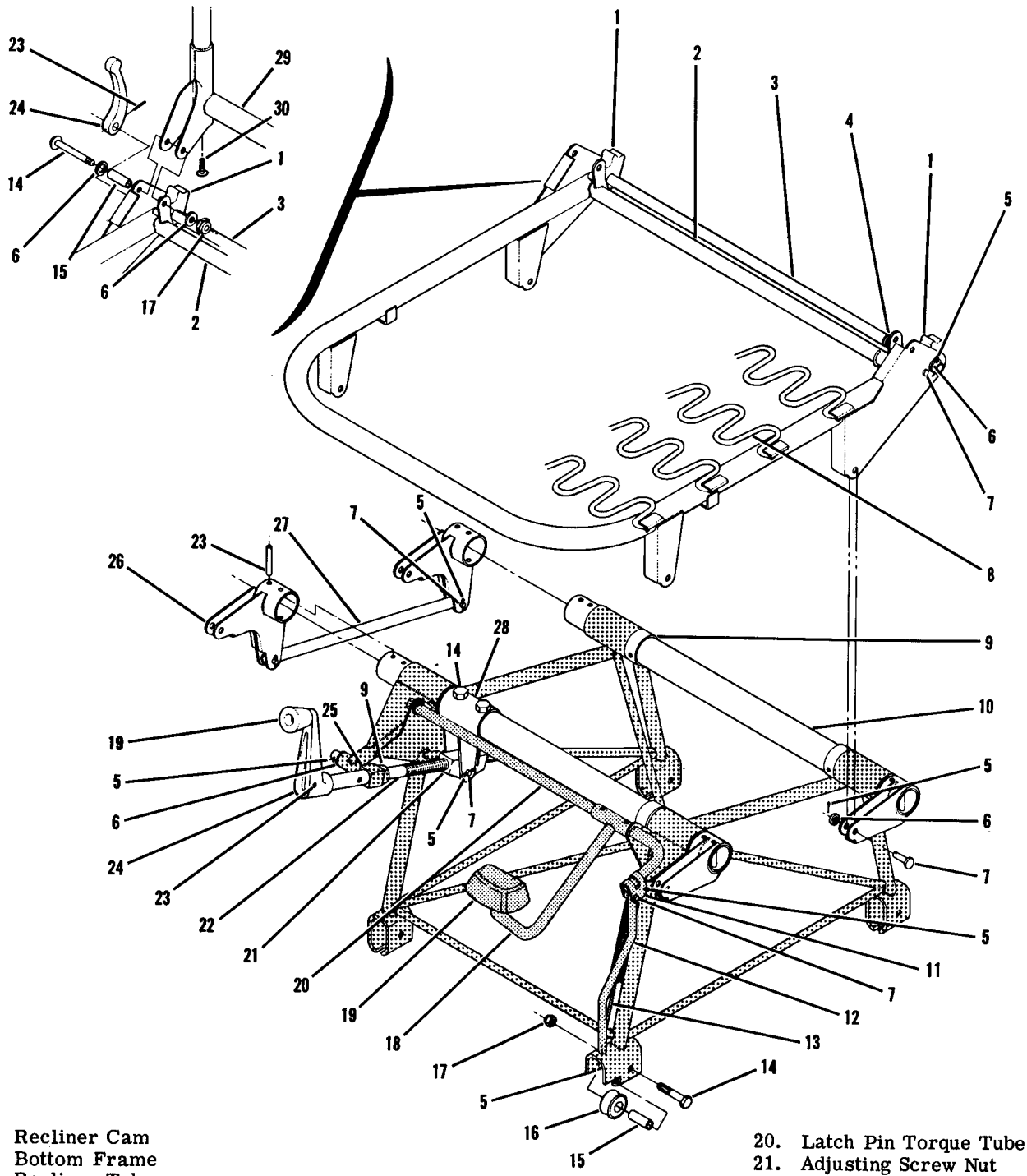
NOTE

The center and rear single seats are similar to the front seat illustrated, although seat legs are shorter and method of attachment is different. The rearmost seats in the 205 and 206 series airplanes do not slide fore and aft. The reclining handle (2) is deleted on the Model 210D and on, and linkage is installed at the forward corner of the seat to operate the reclining mechanism. Configuration of adjustment arm (31) has also been changed.



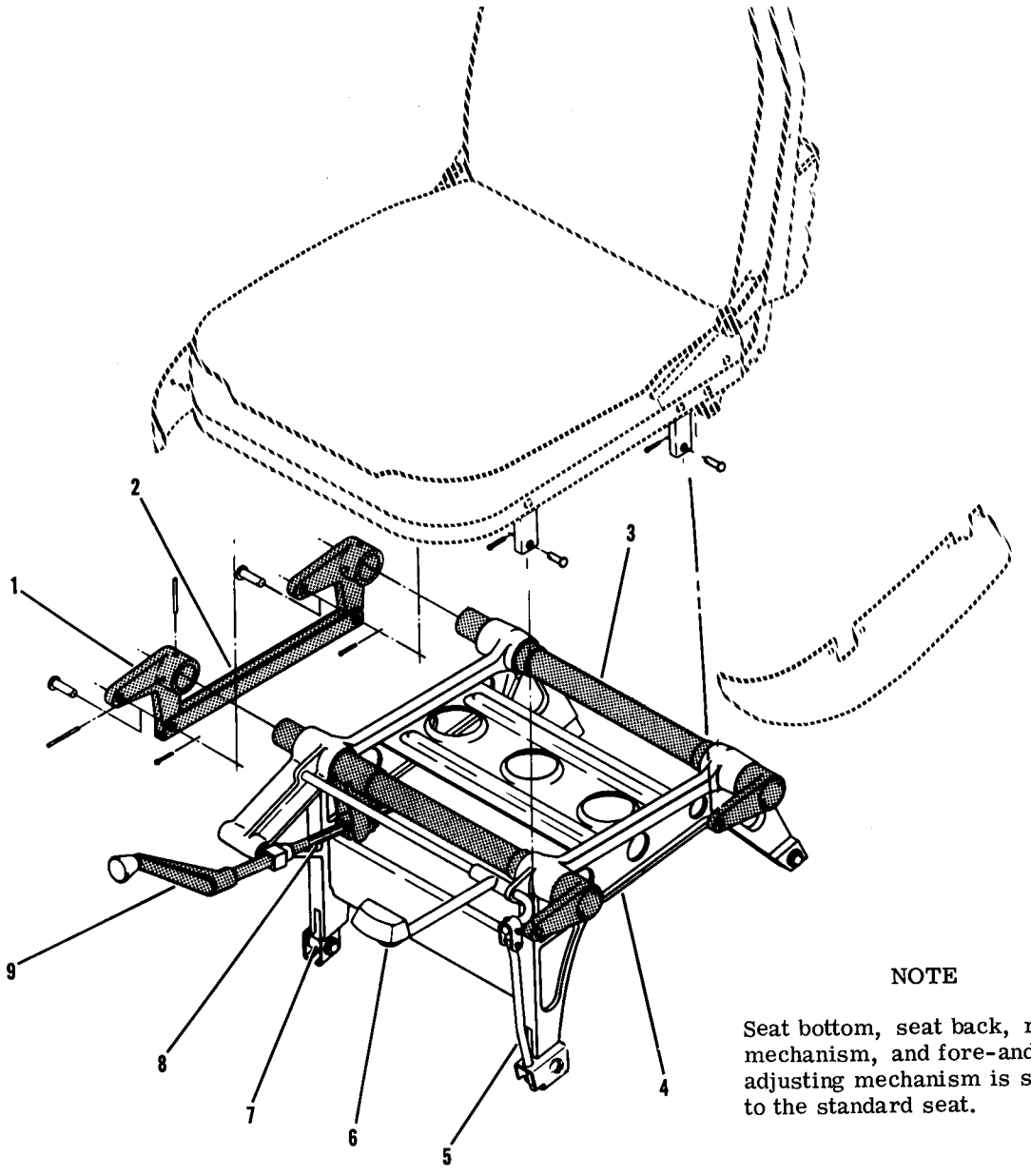
1. Seat Bottom
2. Recline Handle
3. Pin
4. Shaft
5. Seat Back
6. Headrest
7. Ash Tray
8. Magazine Pocket
9. Nut
10. Washer
11. Bushing
12. Screw
13. Bushing
14. Spring
15. Screw
16. Seat Adjustment Pawl
17. Spring
18. Bolt
19. Bolt
20. Nut
21. Pin
22. Nut
23. Seat Roller
24. Bolt
25. Bracket
26. Washer
27. Pin
28. Adjustment Spring
29. Adjustment Pin
30. Pin
31. Fore/Aft Adjustment Arm
32. Seat Stop
33. Handle Stop
34. Clevis Bolt

Figure 3-8. Single Seat (Except prior to 210C)



1. Recliner Cam
2. Bottom Frame
3. Recliner Tube
4. Cam Return Spring
5. Cotter Pin
6. Washer
7. Clevis Pin
8. Seat Springs
9. Collar
10. Torque Tube
11. Clevis
12. Latch Pin
13. Spring
14. Bolt
15. Bushing
16. Roller
17. Nut
18. Seat Latch Arm
19. Knob
20. Latch Pin Torque Tube
21. Adjusting Screw Nut
22. Adjusting Screw
23. Roll Pin
24. Handle
25. Bearing Block
26. Torque Tube Arm
27. Actuator Rod
28. Bellcrank
29. Back Frame
30. Stop Screw

Figure 3-9. Vertically Adjustable Seat Mechanism (210B)

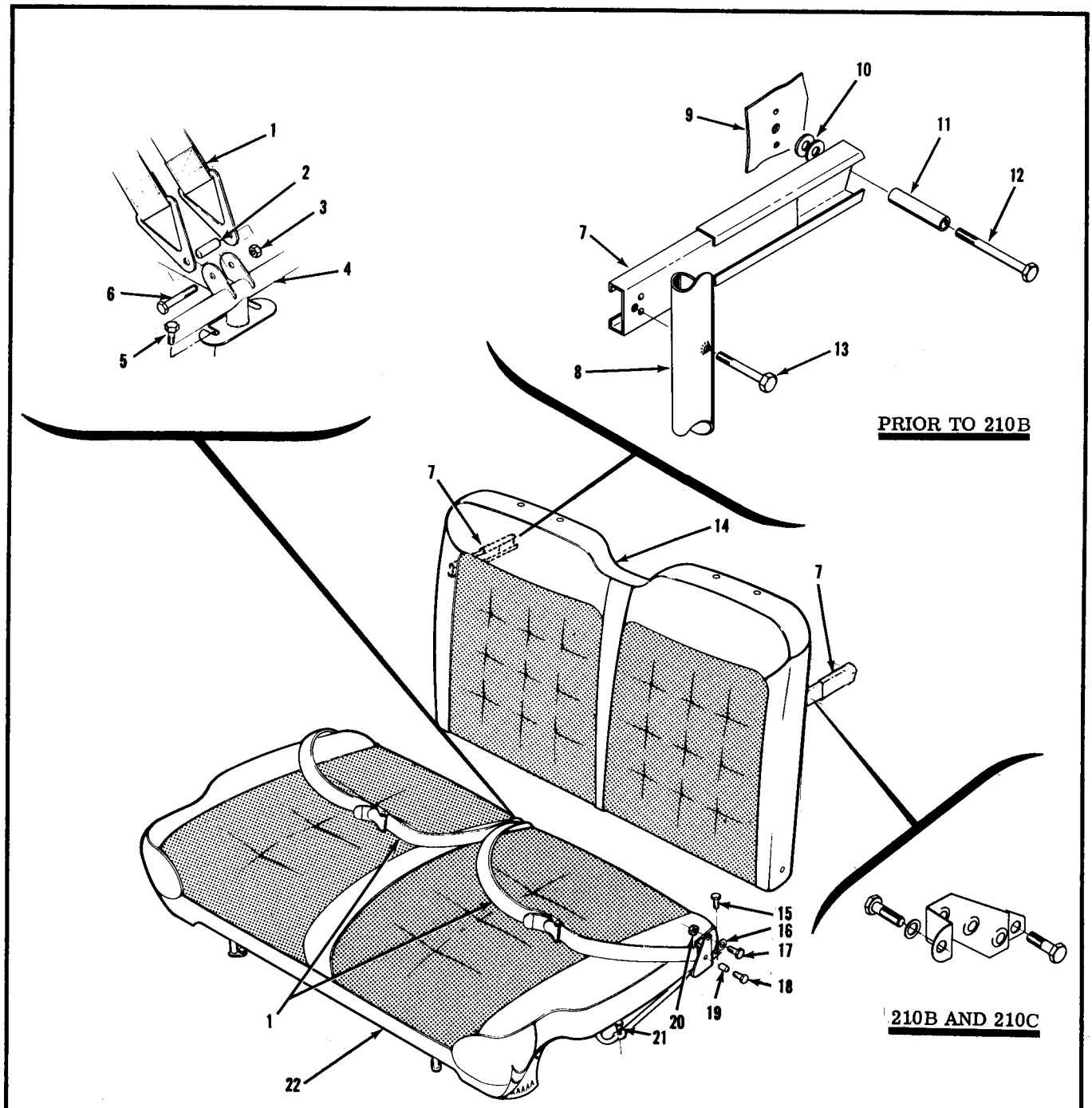


NOTE

Seat bottom, seat back, reclining mechanism, and fore-and-aft adjusting mechanism is similar to the standard seat.

1. Bellcrank
2. Channel
3. Torque Tube
4. Seat Structure
5. Pin
6. Fore-and-Aft Adjustment Handle
7. Seat Roller
8. Adjustment Screw
9. Vertical Adjustment Handle

Figure 3-10. Vertically Adjustable Seat Mechanism (Except Prior to 210C)



1. Safety Belt
2. Spacer
3. Nut
4. Seat Bottom Frame
5. Bolt
6. Bolt
7. Latch
8. Seat Back Frame
9. Support Bracket
10. Washers
11. Spacer
12. Bolt
13. Bolt
14. Seat Back
15. Bolt
16. Washer
17. Bolt
18. Bolt
19. Spacer
20. Nut
21. Bolt
22. Seat Bottom

Figure 3-11. Two-Place Seat (Prior to 210D)

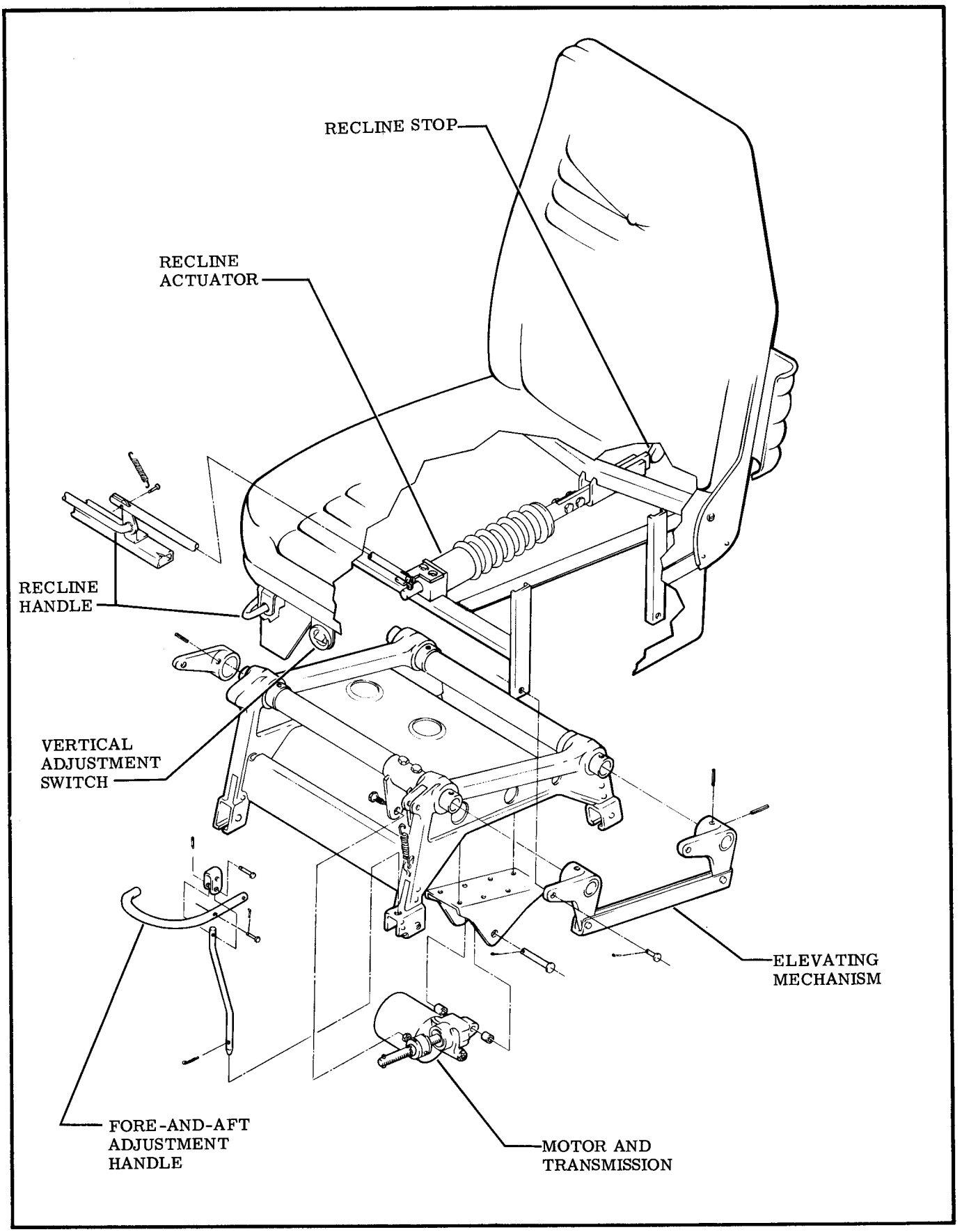


Figure 3-12. Power Seat

WARNING

It is extremely important that the pilot's seat stops are installed, since acceleration and deceleration could possibly permit the seat to become disengaged from the seat rails and create a hazardous situation, especially during take-off and landing.

3-28. TWO-PLACE SEATS. Standard two-place seats consist of a double-width seat bottom and a double-width seat back. Removal is accomplished by removing the bolts which secure the seat bottom to the fuselage. Use care not to damage upholstery when removing seats. If desired, seat backs may first be removed from seat bottoms. Additional clearance may be obtained by removing one or more arm rests.

NOTE

To help prevent upholstery damage, several thicknesses of waxed heavy paper (waxed is preferred) should be inserted between the seat and the side panel and arm rest during removal and installation of the seat.

3-29. POWER SEATS. Optional power seats for the pilot and copilot may be installed. An electric motor, geared to a screwjack actuator, operates the mechanism which raises and lowers the seat vertically. Fore-and-aft adjustment and seat back reclining adjustment are still accomplished manually, although the reclining mechanism is locked automatically in any desired position, throughout the travel range of the seat back, by releasing the reclining adjustment handle. The seat is removed in the usual manner after disconnecting electrical wires at the quick-disconnects in the floorboard,

3-29A. CHILD SEAT. (See figure 3-13.) An individual child's seat is located immediately aft of each rear passenger's seat on the Model 210D and on. The seat back folds into the cushion well when not in use to increase the baggage area.

3-30. REPAIR OF SEAT STRUCTURE. Replacement of defective parts is recommended in repair of seats. However, a cracked seat framework may be welded, provided the crack is not in an area of stress concentration (close to a hinge or hearing point). The tubular steel type construction may be spliced or replaced using a torch weld, as no heat treat is required on the tubular steel. The square-tube aluminum framework used on later seats is 6061 aluminum, heat-treated to a T-6 condition. Use a heliarc weld on these seats as torch welds will destroy the heat-treatment of the frame structure. Figure 3-14 gives instructions for replacing defective cams on reclining seat backs of the type illustrated.

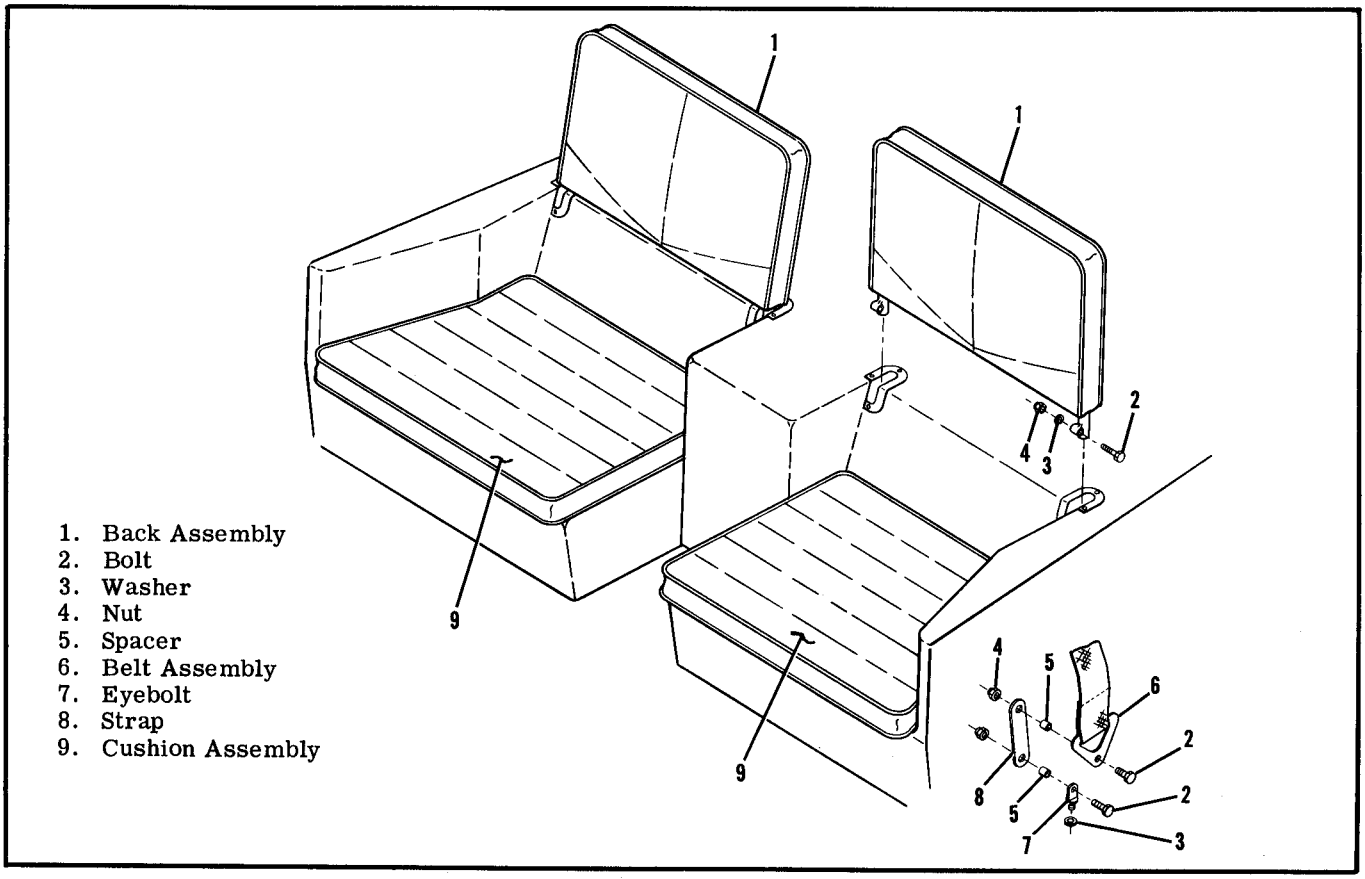
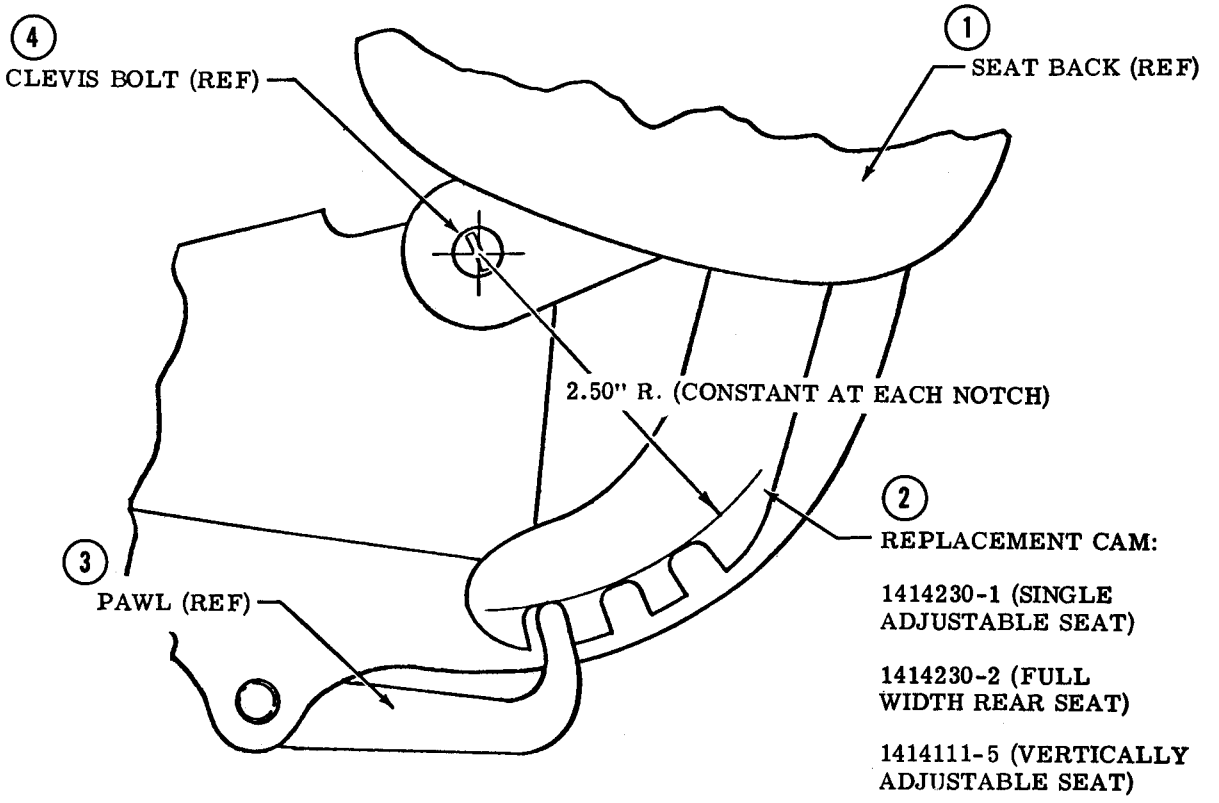


Figure 3-13. Child Seat



REPLACEMENT PROCEDURE:

a. Remove seat from aircraft.

b. Remove "Royalite" upholstery panels from aft side of seat back, loosen upholstery retaining rings and upholstery material as required to expose the rivets retaining the old cam assembly.

c. Drill out existing rivets and insert new cam assembly (2). Position seat back so that pawl (3) engages first cam slot as shown.

d. Position the cam so each slot bottom aligns with the 2.50" radius as shown.

e. Clamp securely in this position and check travel of cam. Pawl must contact bottom of each cam slot. Using existing holes in seat frame, drill through new cam and secure with MS20470AD6 rivets.

f. Reinstall upholstery, upholstery panels and seat.

Figure 3-14. Seat Back Cam Replacement

3-31. CABIN UPHOLSTERY.

3-32. Due to the wide selection of fabrics, styles and colors, it is impossible to depict each particular type of upholstery. The following paragraphs describe general procedures which will serve as a guide in removal and replacement of upholstery. Major work, if possible, should be done by an experienced trim mechanic. If the work must be done by a mechanic unfamiliar with upholstery practices, the mechanic should take careful notes during the removal of each item to facilitate its replacement later.

3-33. UPHOLSTERY MATERIALS AND TOOLS will vary with the job. Scissors for trimming upholstery to size and a dull-bladed putty knife for wedging the material beneath the retainer strips are the only tools required for most trim work. Use industrial rubber cement to hold soundproofing mats and fabric edges in place. Refer to Section 19 for Royalite repairs.

3-34. SOUNDPROOFING. The airplane is insulated with spun glass mat-type insulation and a sound deadener compound applied to the inner surfaces of the skin in most areas of the cabin and baggage compartment. Some airplanes utilize aluminum foil backed tape to help reduce noise level in the cabin. All soundproofing material should be replaced in its original position any time it is removed. A soundproofing panel is placed in the gap between the wing and fuselage and held in place by the wing root fairing. Cabin and baggage compartment upholstery and carpeting also assist in reducing noise level.

3-35. CABIN HEADLINER REMOVAL.

a. Remove sun visors, all inside finish strips and plates, door post upper shields, front spar trim shield, dome light panel, rear baggage shelf and any other visible retainers securing the headliner.

b. Work edges of headliner free from metal tabs which hold the fabric.

c. Starting at the front of the headliner, work the headliner down, removing screws through metal tabs which hold the wire bows to the cabin top. Pry loose the outer ends of the bows from the retainers above the doors. Detach each wire bow in succession.

NOTE

Always work from front to rear when removing the headliner; it is impossible to detach the wire bows when working from rear to front.

d. Remove the headliner assembly and bows from the airplane.

NOTE

Due to the difference in length and contour of the wire bows, each bow should be tagged to assure proper location in the headliner.

e. Remove the spun glass soundproofing panels.

NOTE

The lightweight sound-proofing panels are held in place with industrial rubber cement.

3-36. CABIN HEADLINER INSTALLATION.

a. Before installing headliner, check all items concealed by the headliner to see that they are mounted securely. Use wide cloth tape to secure loose wires to the fuselage, and to seal any openings in the wing roots. Straighten any tabs bent during removal of the headliner.

b. Apply cement to inside of skin in areas where soundproofing panels are not supported by wire bows, and press soundproofing in place.

c. Insert wire bows into headliner seams, and secure rearmost edges of headliner after positioning the two bows at the rear of the headliner. Stretch the material along the edges to make sure it is properly centered, but do not stretch it tight enough to destroy the ceiling contours or distort the wire bows. Secure the edges of the headliner with sharp tabs or, where, necessary, rubber cement.

d. Work the headliner forward, installing each wire bow in place with the tabs. Wedge the ends of wire bows into the retainer strips. Stretch the headliner just taut enough to avoid wrinkles and maintain a smooth contour.

e. When all bows are in place and fabric edges are secured, trim off any excess fabric and reinstall all items removed.

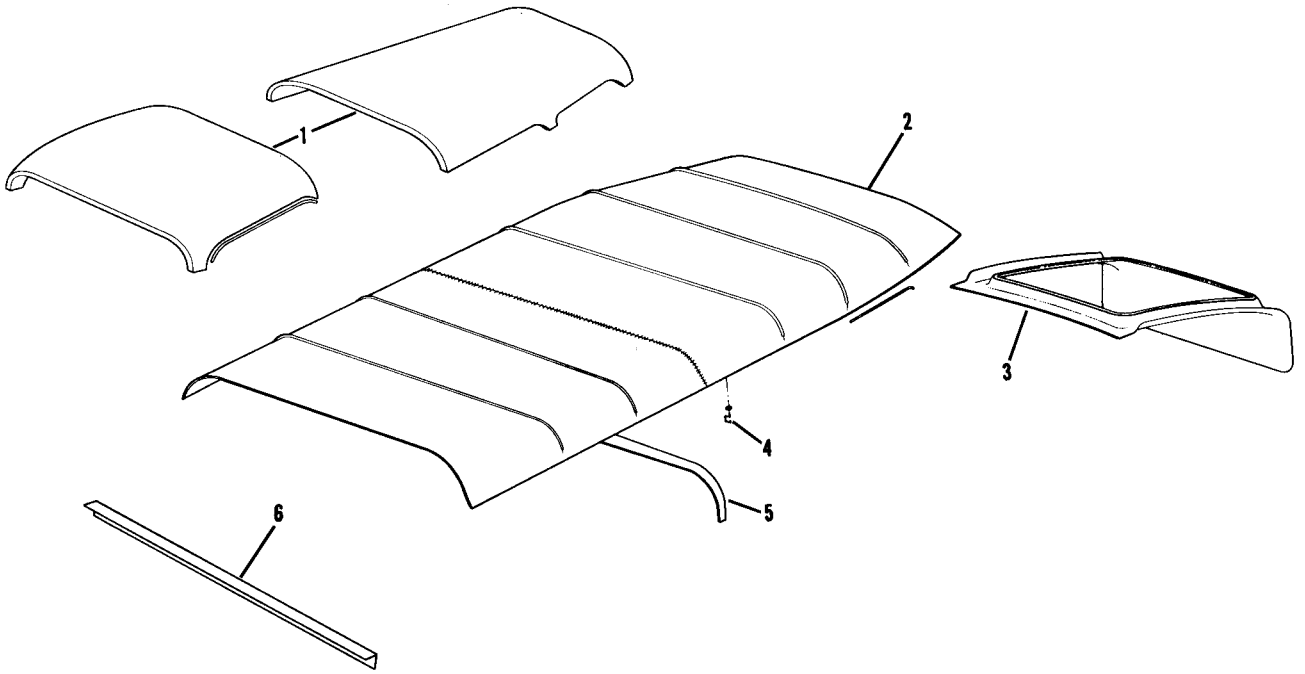
3-37. UPHOLSTERY SIDE PANELS. Removal of upholstery side panels is accomplished by removing seats for access, then removing parts attaching the panels. Remove screws, retaining strips, arm rests, and ash trays as required to free the various panels. Automotive type spring clips attach most door panels. A dull putty knife makes an excellent tool for prying loose the clips. When installing upholstery side panels, do not over-tighten sheet metal screws. Larger screws may be used in enlarged holes as long as the area behind the hole is checked for electrical wiring, fuel lines, and other components which might be damaged by using a longer screw.

3-38. WINDLACE (DOOR SEAL) is installed to provide additional sealing and provide an ornamental edging for the door opening. The windlace is held in position by sheet metal screws and is mounted between the upholstery panels or trim and the doorpost structure.

3-39. CARPETING. Cabin area and baggage compartment carpeting is held in place by rubber cement, small sheet metal screws, and retaining strips. When fitting a new carpet, use the old one as a pattern for trimming and marking the screw holes.

The Model 206 and U206 utilize a tough lightweight heavy-duty floor covering of vinyl. Royalite is used on the door and side panels of the airplane.

3-40. BAGGAGE COMPARTMENT UPHOLSTERY is washable plastic or Royalite held in place by screws and retainers. The floor covering is cemented to the



NOTE

Headliner shown is for airplanes with the rear window installed. On airplanes prior to the Model 210B, the headliner extends into the baggage compartment.

1. Headliner Soundproofing
2. Headliner
3. Rear Window Trim
4. Coat Hanger Hook
5. Tiara Strip
6. Trim Shield

Figure 3-15. Cabin Headliner

floor in some models. Cargo tie-downs and/or safety belt brackets may be removed as necessary where they are installed through the floor covering.

3-41. CARGO TIE-DOWN PROVISIONS. Three types of cargo tie-downs may be installed as shown in figure 3-16. Different combinations of all three may also be used. Small eyebolts are provided to attach a baggage net on all aircraft except prior to the Model 210D. This baggage net is mandatory on all aircraft whose baggage and seating area are combined. The rearmost seats on some aircraft have plates bolted to the cabin floor that secure the rear legs. If the seats are removed, an anchor ring may be attached to the plate for cargo tie-down.

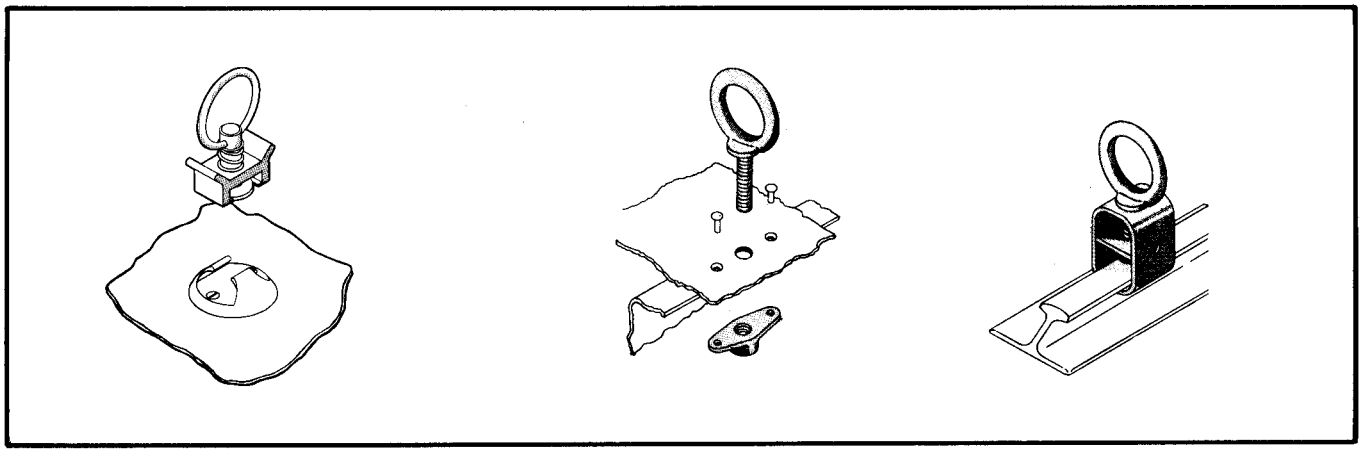


Figure 3-16. Cargo Tie-Down Rings

3-42. CARGO PACK - MODELS 205 AND 206 SERIES.

3-43. REMOVAL OF CARGO PACK. Removal is accomplished by removing the screws, fairing, and seal from around each landing gear spring, then positioning a support under the pack and removing all screws attaching it to the airplane. The four small panels which enclose the area around the nose gear shock strut and drag brace may be left installed instead of the two larger panels installed as standard. However, the control extensions and cowl flap baffles, used on Model 206 Series only, must be removed as outlined in paragraph 3-45.

3-44. INSTALLATION OF CARGO PACK. Prior to positioning the pack under the airplane, inspect all Rivnuts in the bottom of the fuselage for obstructions. Also check the small panels which enclose the area around the nose gear shock strut and drag brace. Two panels are provided in this area on standard airplanes; these are to be replaced by four smaller panels when a cargo pack is installed. If not previously removed, remove the two standard panels by unsnapping the quick-release fasteners. Install the four smaller panels furnished with the cargo pack.

NOTE

Install the two rearmost panels first, the right hand panel lapping over the left hand panel along the airplane centerline. Install the two forward panels in a similar manner.

a. Move the pack into position under the airplane. Raise the aft end of the pack and insert a support under it.

b. Raise the forward end of the pack and align the two forward holes in the pack rim with the two front Rivnuts. Install two screws to support the forward end of the pack.

NOTE

Install lock washers and flat washers under the heads of all pack attaching screws.

c. Raise the aft end of the pack and install two attaching screws.

d. Check pack for proper alignment, then install and tighten all remaining screws, except for one screw just forward and one screw just aft of each landing gear spring. These two screws will be utilized later to help secure the fairing which covers each landing gear opening.

e. Position the rubber seal and fairing around each main landing gear spring by spreading these components, at their split side, enough to slip them over the gear spring. When installed, the split should be at the back of the gear spring. Check alignment and proper fit of fairing, then install fairing retaining screws.

NOTE

Seven screws are used to secure the fairing at each landing gear. Two screws, previously mentioned in step "d," secure the top of the fairing and the rim of the cargo pack, in this area, to the fuselage. Five additional screws secure and seal the sides and bottom of each fairing to the pack.

f. Install cowl flap baffles and control extensions, used on the Model 206 Series only, in accordance with paragraph 3-46.

3-45. REMOVAL OF COWL FLAP BAFFLES AND CONTROL EXTENSIONS. (See figure 3-17.)

a. Disconnect cowl flap control clevises from cowl flaps, and take off all four baffles (1) by removing screws (3) and nuts (2).

b. Remove clevis (7) and link (5) from each control end and reinstall the clevises.

c. Place cowl flap control lever in "OPEN" position and connect control ends to cowl flaps, but do not secure at this time.

d. Move control to "CLOSED" position and check that trailing edge corners of cowl flaps bear snugly against rubber bumpers. Open cowl flaps, readjust clevis ends as required to obtain the snug fit when closed, then secure the controls to the cowl flaps and tighten the jamb nuts.

e. Operate cowl flap control several times to check cowl flap operation.

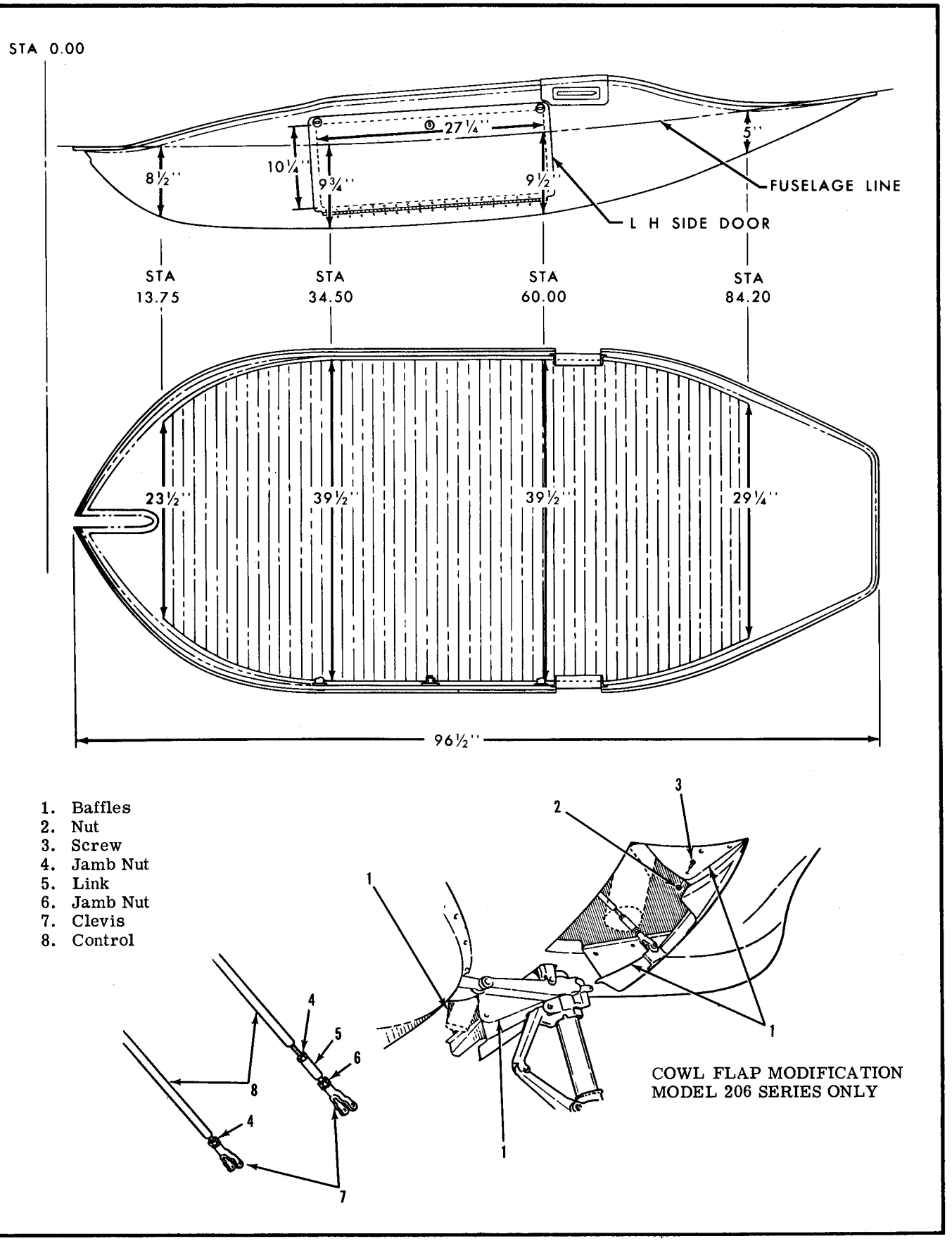


Figure 3-17. Cargo Pack

3-46. INSTALLATION OF COWL FLAP BAFFLES AND CONTROL EXTENSIONS. (See figure 3-17.)

a. Disconnect cowl flap control clevises from cowl flaps, and remove clevises. Leave jamb nuts (4) on the control ends.

b. Install links (5) on control ends, install jamb nuts (6) on links, and attach clevises (7) to the links. Do not tighten jamb nuts.

c. Position baffles (1) along the sides of the cowl flaps so attaching holes are aligned, and install attaching screws and nuts.

NOTE

Each baffle is designed for installation on a specific cowl flap. Determine the correct baffle for each cowl flap. Note that the flanges on the baffles are turned toward the inside of each cowl flap opening.

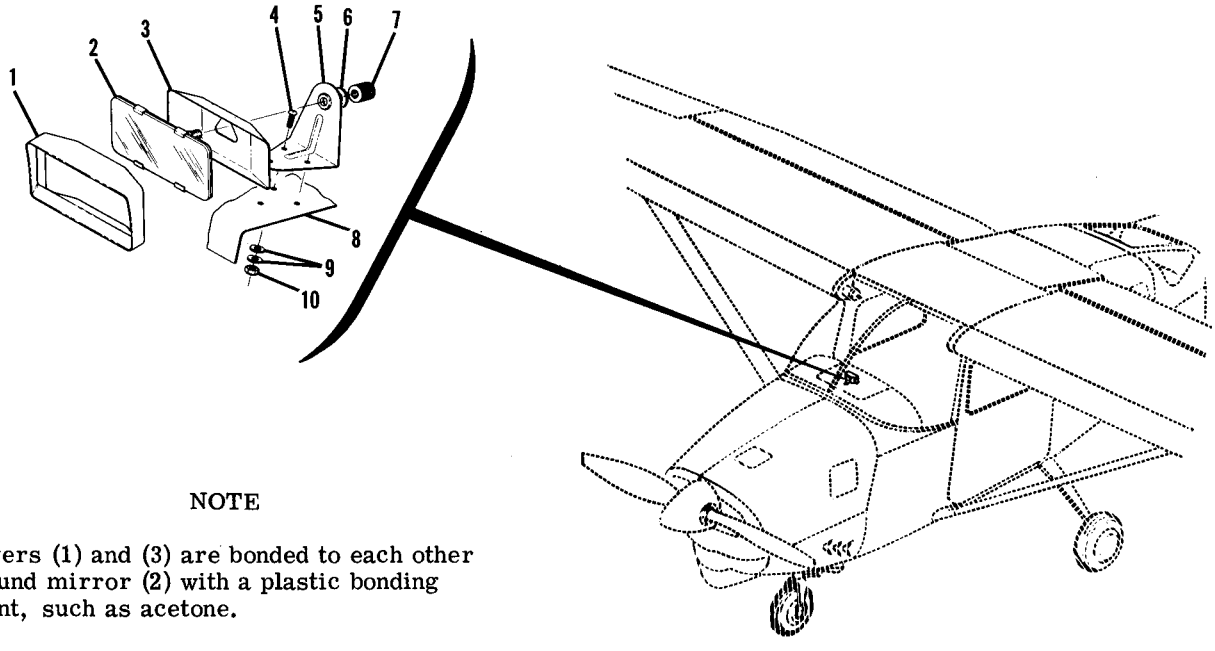
d. Place cowl flap control lever in "OPEN" position and connect control ends to cowl flaps, but do not secure at this time.

e. Measure the distance from trailing edge of cowl flaps to cowl skin. Disconnect clevises and adjust links (5) and clevises (7) so that each cowl flap is open 4.25". When in the "CLOSED" position, the cowl flaps are still open 1.05", measured at the same place. Be sure that the controls, links, and clevises have sufficient thread engagement, then secure clevises to cowl flaps and tighten all jamb nuts.

f. Operate cowl flaps several times to check cowl flap operation.

3-47. GLIDER TOW-HOOK. A glider tow-hook, which is mounted in place of the tail tie-down ring, is available for all models.

3-48. REAR VIEW MIRROR. An optional rear view mirror may be installed on the cowl deck above the instrument panel on all 200-Series aircraft (1965 and on). Figure 3-18 shows details of the rear view mirror installation.

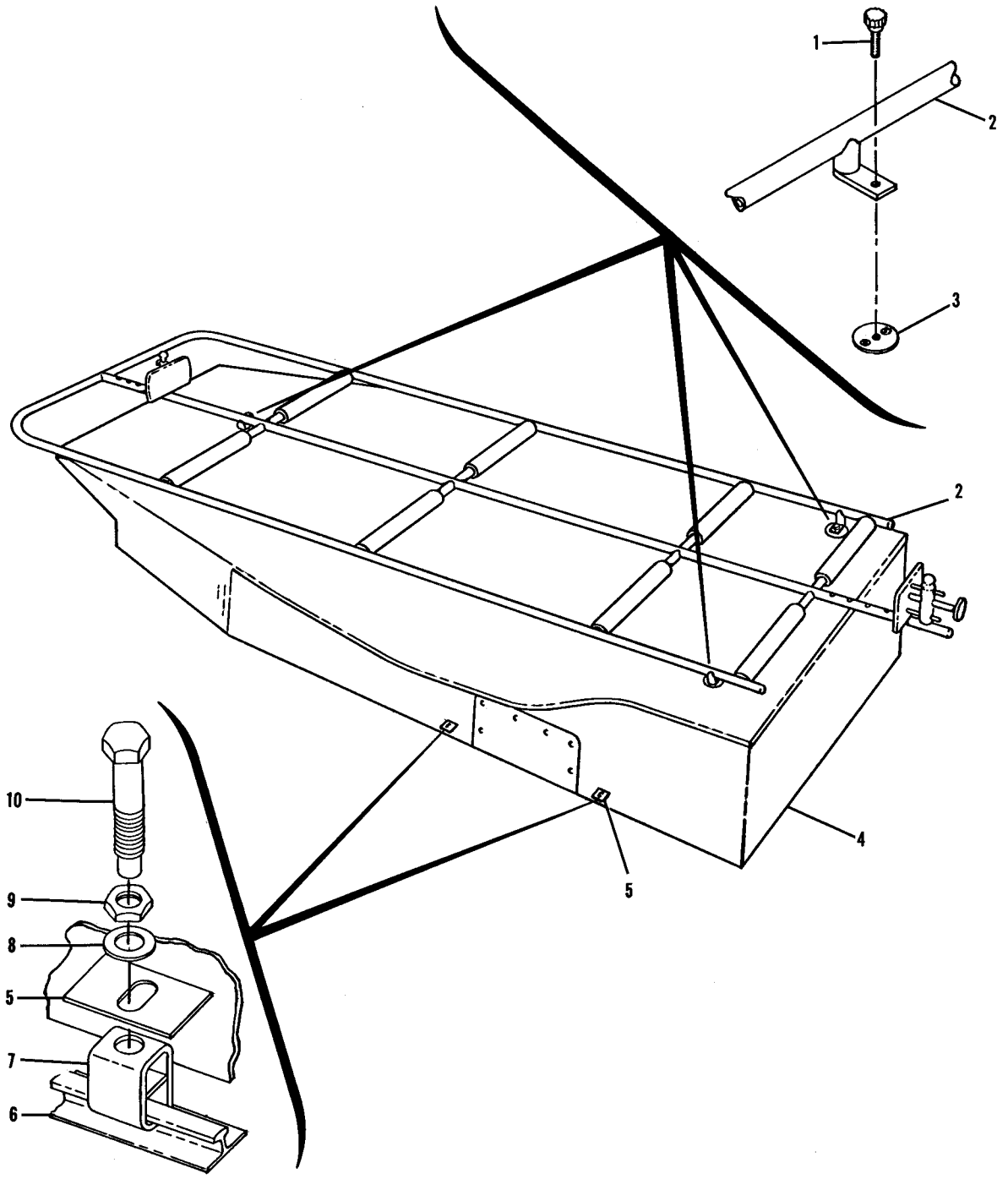


NOTE

Covers (1) and (3) are bonded to each other around mirror (2) with a plastic bonding agent, such as acetone.

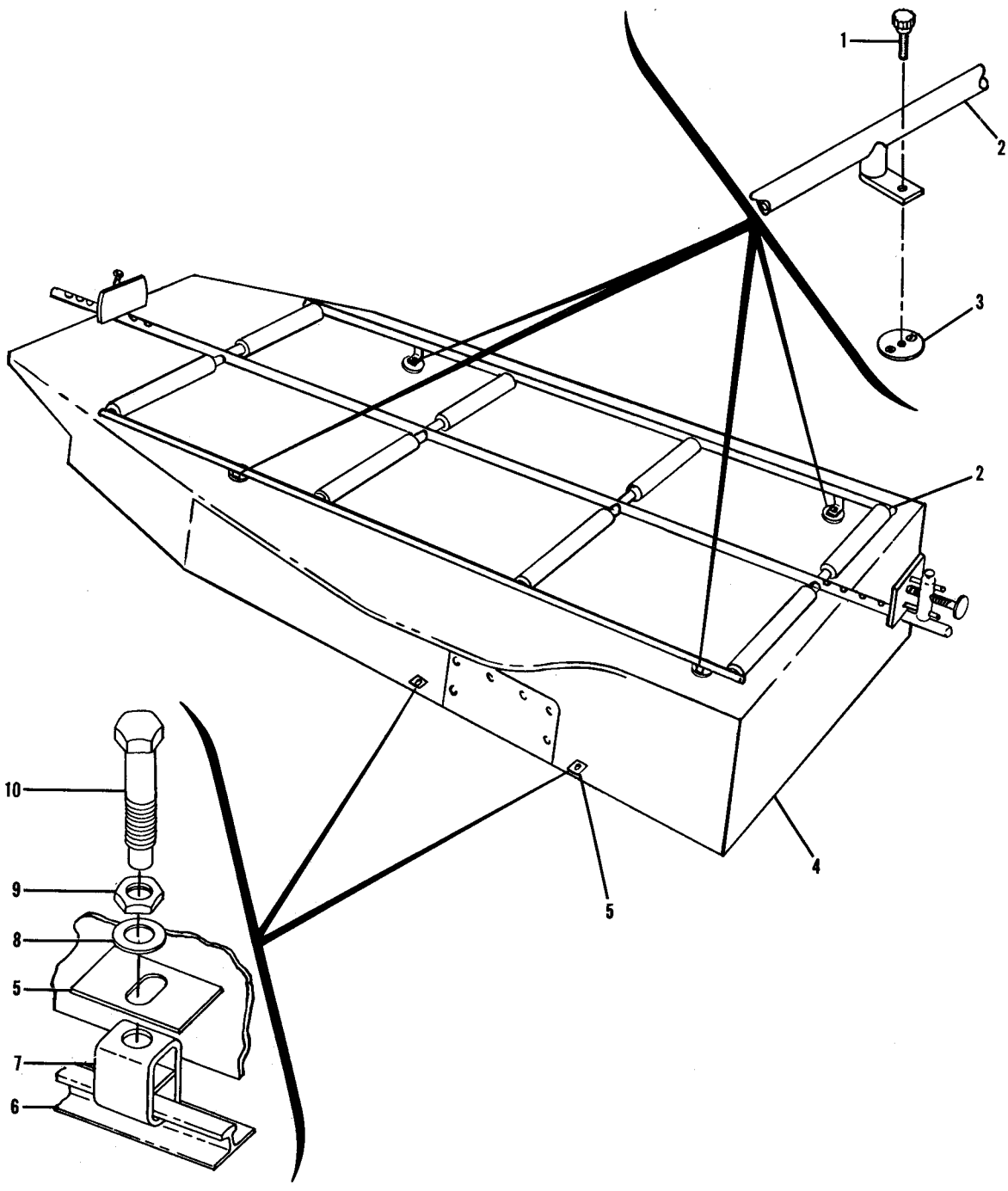
1. Cover
2. Mirror
3. Cover
4. Screw
5. Bracket
6. Washer
7. Knurled Nut
8. Cowl Deck
9. Washer
10. Nut

Figure 3-18. Rear View Mirror Installation



1. Thumb Screw
2. Rack Assembly
3. Pad
4. Platform
5. Bracket
6. Seat Rail
7. Weld Assembly
8. Washer
9. Nut
10. Bolt

Figure 3-19. Casket Carrier Installation (Sheet 1 of 3)



1. Thumb Screw
2. Rack Assembly
3. Pad
4. Platform
5. Bracket
6. Seat Rail
7. Weld Assembly
8. Washer
9. Nut
10. Bolt

Figure 3-19. Casket Carrier Installation (Sheet 2 of 3)

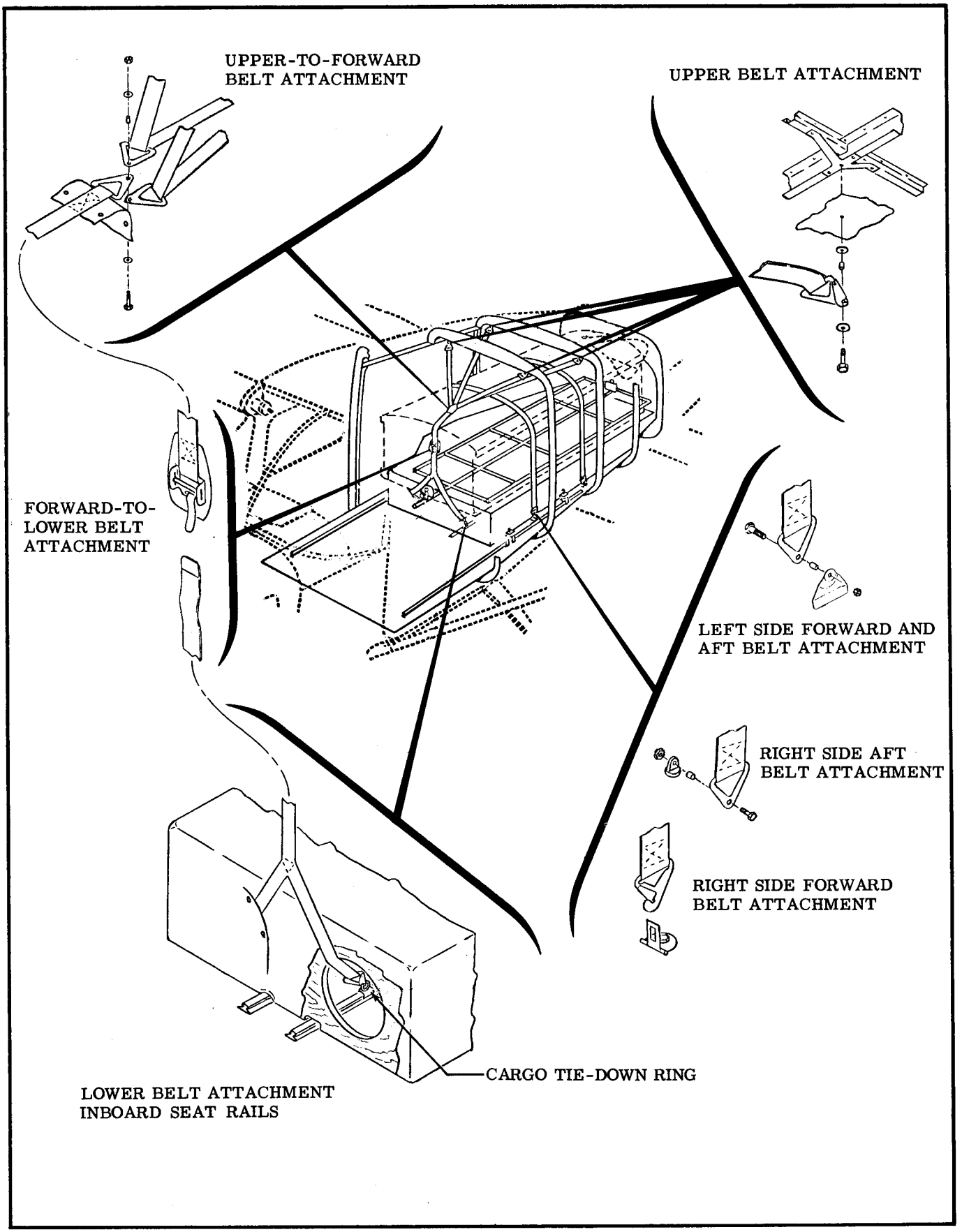


Figure 3-19. Casket Carrier Installation (Sheet 3 of 3)

3-49. CASKET CARRIER. An optional mortuary kit has been designed for installation in the Model 206 and Model U206 (aircraft with large cargo doors). This kit consists of a casket carrier platform, rack assembly, and tie-down belt assemblies. Accessory Kit No. AK206-18 provides airplane modification instructions and parts required to make the installation of the casket carrier platform, rack assembly, and tie-down belt assemblies. Modification to the airplane consists of modifying the pilot's seat back, removing baggage shelf structure, adding reinforcement angles at station 124.00 bulkhead, adding a floor pan between stations 124.00 and 138.00, installing floor mat, rear and side upholstery panels, casket platform, rack assembly, and tie-down belt assemblies. The casket carrier platform rack and tie-down belts are shown in figure 3-19.

3-50. CASKET CARRIER INSTALLATION. Accessory Kit No. AK206-18 provides airplane modification instructions. The following instructions may be used to install the casket carrier platform, rack, and tie-down belt assemblies.

a. Remove all seats and safety belts except pilot's and copilot's.

b. Move pilot and copilot's seats forward to the limit of travel.

c. Install bolt assemblies to existing left forward and left aft seat belt attach brackets as shown in figure 3-19.

d. Place platform in cabin and butt aft end of platform against step at station 124.00.

e. Secure platform to the outboard seat rails with weld assemblies and attaching hardware as shown in figure 3-19.

f. Attach rack assembly to top of platform with thumb screws as shown in figure 3-19.

NOTE

A few early model platform racks were attached to the platform as shown on sheet 1 of figure 3-19, while later model racks have four attach points as shown on sheet 2 of figure 3-19. If an early model rack assembly is being replaced, a slight modification to the platform will be necessary to install the later type rack assembly.

g. Install cargo tie-down rings on inboard seat rails as shown in figure 3-19.

NOTE

The cargo tie-down ring on the left inboard seat rail is tightened down against the seat rail, since no seat adjusting hole exists in the rail at this point. The cargo tie-down ring on the right inboard seat rail will engage an existing seat adjustment hole.

h. Attach lower belt assembly to tie-down rings installed on inboard seat rails at forward end of platform.

i. Attach upper belt assemblies to the four points at the cabin headliner as shown in figure 3-19.

j. Using bolt, spacer, washer, and nut, attach upper belt assemblies to the forward belt assembly as shown in figure 3-19.

k. Attach right forward and right aft belt assemblies to existing seat belt attach points as shown in figure 3-19.

l. When loading casket, move pilot's and copilot's seats forward to limit of travel and remove pilot's seat back by removing the quick-release pins.

m. After casket is loaded, tighten all belts securely and check all tie-down points for security.

n. Install pilot's seat back.

3-51. CASKET CARRIER REMOVAL. After the casket is removed, the platform, rack, and belt assemblies may be removed by reversing the installation procedure.

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SECTION 4

AIRFRAME

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4-1. WINGS. (See figure 4-1.)

4-2. Each all-metal wing panel is a semicantilever, semi-monocoque type, with two main spars and suitable ribs for the attachment of the skin. Skin panels are riveted to ribs, spars, and stringers to complete the structure. An all-metal, balanced aileron, a high-lift flap, and a detachable wing tip are mounted on each wing assembly. A single fuel tank is mounted between the wing spars at the inboard end of each wing and the leading edge of the left wing has landing and taxi lights installed. Colored wing tip lights are mounted at each contoured wing tip.

4-3. REMOVAL. Removal of a wing panel is accomplished most easily if three men are available to handle the wing. Otherwise the wing should be supported with a sling or maintenance stand when the fastenings are loosened. To remove a wing:

a. Remove wing gap fairings and screws securing cabin top skin to the wing top skin.

b. Remove all wing inspection plates.

c. Drain fuel from tank of wing being removed.

d. Disconnect:

1. Wing flap hydraulic lines (prior to Model 210D) at wing root unions.

2. Electrical wires at wing root disconnects.

3. Fuel lines at wing root.

4. Pitot line (left wing only) at wing root.

5. Cabin ventilator hoses at wing root.

e. Slack off tension on flap and aileron cables by loosening carry-thru cable turnbuckles; then disconnect cables at flap and aileron bellcranks.

NOTE

To ease rerouting the cables, a guide wire may be attached to each cable before it is pulled free of the wing. Then disconnect cable from wire and leave the guide wire routed through the wing; it may be attached again to the cable during reinstallation and used to pull the cable into place.

f. Support wing at outboard end and disconnect strut at wing fitting. Tie the strut up with wire to prevent it from swinging down and straining strut-fuselage fittings. If the fuselage fitting projects from the fuselage and is covered by the strut fairing, loosen the fairing and slide it up the strut; the strut may then be lowered without damage.

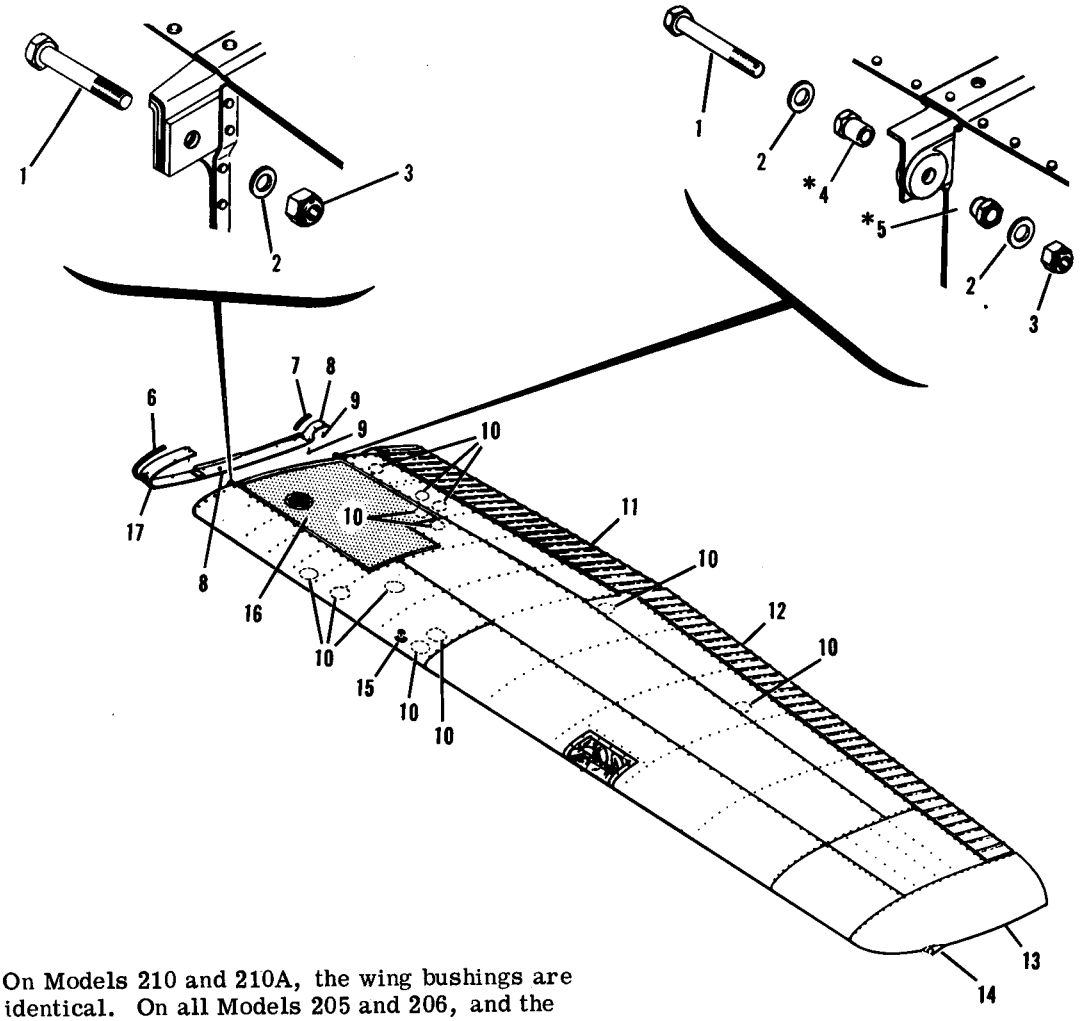
g. Mark position of wing attachment eccentric bushings; these bushings are used to rig out "wing-heaviness."

h. Remove nuts, washers, bushings and bolts attaching wing spars to fuselage.

NOTE

It may be necessary to use a long drift punch to drive out wing attaching bolts, or to rock the wing slightly while pulling bolts.

i. Remove wing and lay on padded stand.



*On Models 210 and 210A, the wing bushings are identical. On all Models 205 and 206, and the Model 210B and on, the forward bushing is approximately half the length of the aft bushing. Care should be taken to install the short bushing in the forward side and the long bushing in the aft side. At least one washer should always be installed under the bolt head and under the nut. Torque the bolts to the value listed in the Torque Table in Section 1.

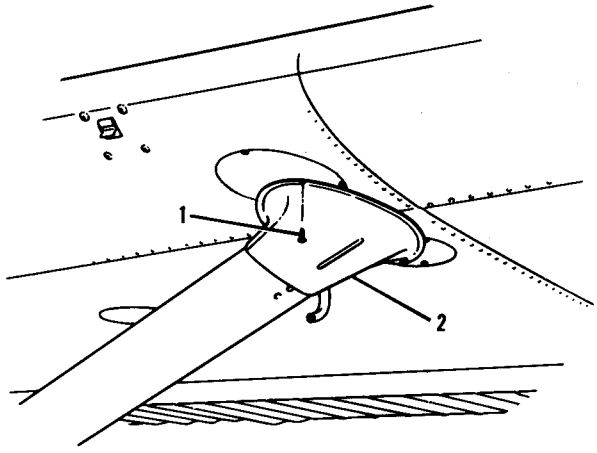
NOTE

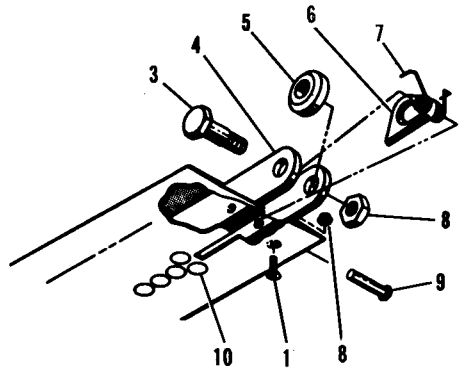
Aileron and flap configurations differ on the various models, but removal and installation provisions are the same.

1. Bolt
2. Washer
3. Nut
4. Long Aft Bushing
5. Short Forward Bushing
6. Rub Strip
7. Moulding
8. Fairing
9. Screw
10. Inspection Plate
11. Flap
12. Aileron
13. Tip Assembly
14. Navigation Light
15. Stall Warning Unit
16. Fuel Tank
17. Fillet

Figure 4-1. Wing Installation

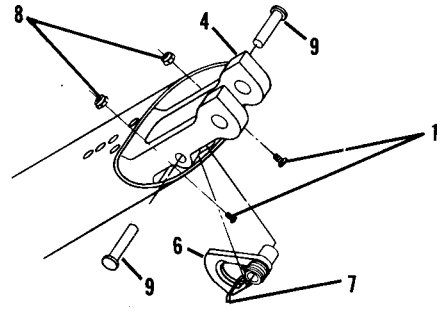
MODEL 210 PRIOR TO SERIAL 21058123



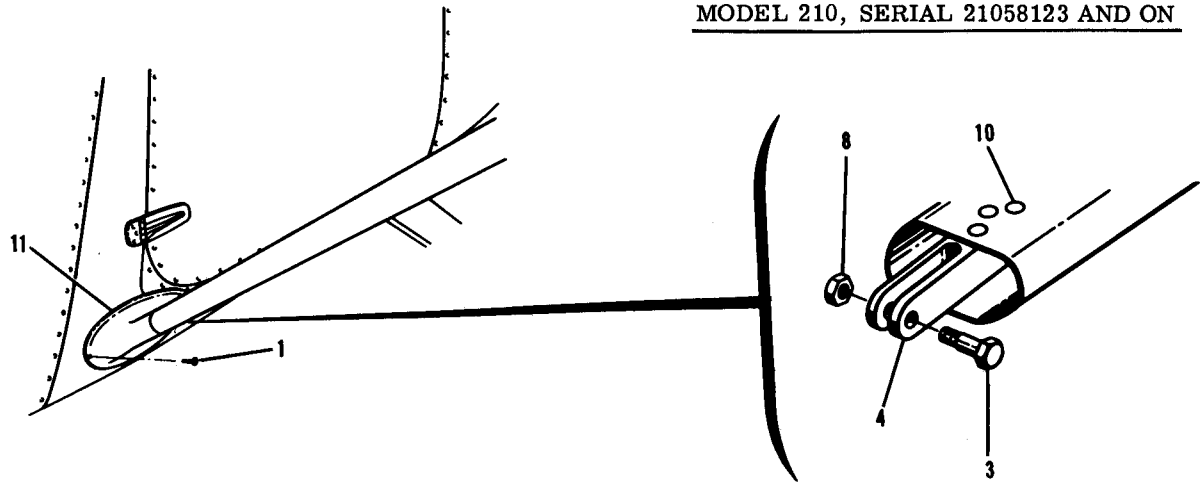


NOTE

On some airplanes, upper fairings are sealed around the upper strut with foam rubber tape to maintain proper characteristics of fuel vents. All Models 205 and 206, and Model 210 series prior to Serial No. 21058123 use only one pin (9) and one retaining screw (1). Model 210 series, 21058123 and on, use two shorter pins (9) and two retaining screws (1).



ALL MODELS 205, 206 AND MODEL 210, SERIAL 21058123 AND ON



1. Screw
2. Upper Fairing
3. Bolt
4. Strut Fitting
5. Spacer
6. Mooring Ring
7. Spring
8. Nut
9. Pin
10. Rivet
11. Lower Fairing

Figure 4-2. Wing Struts

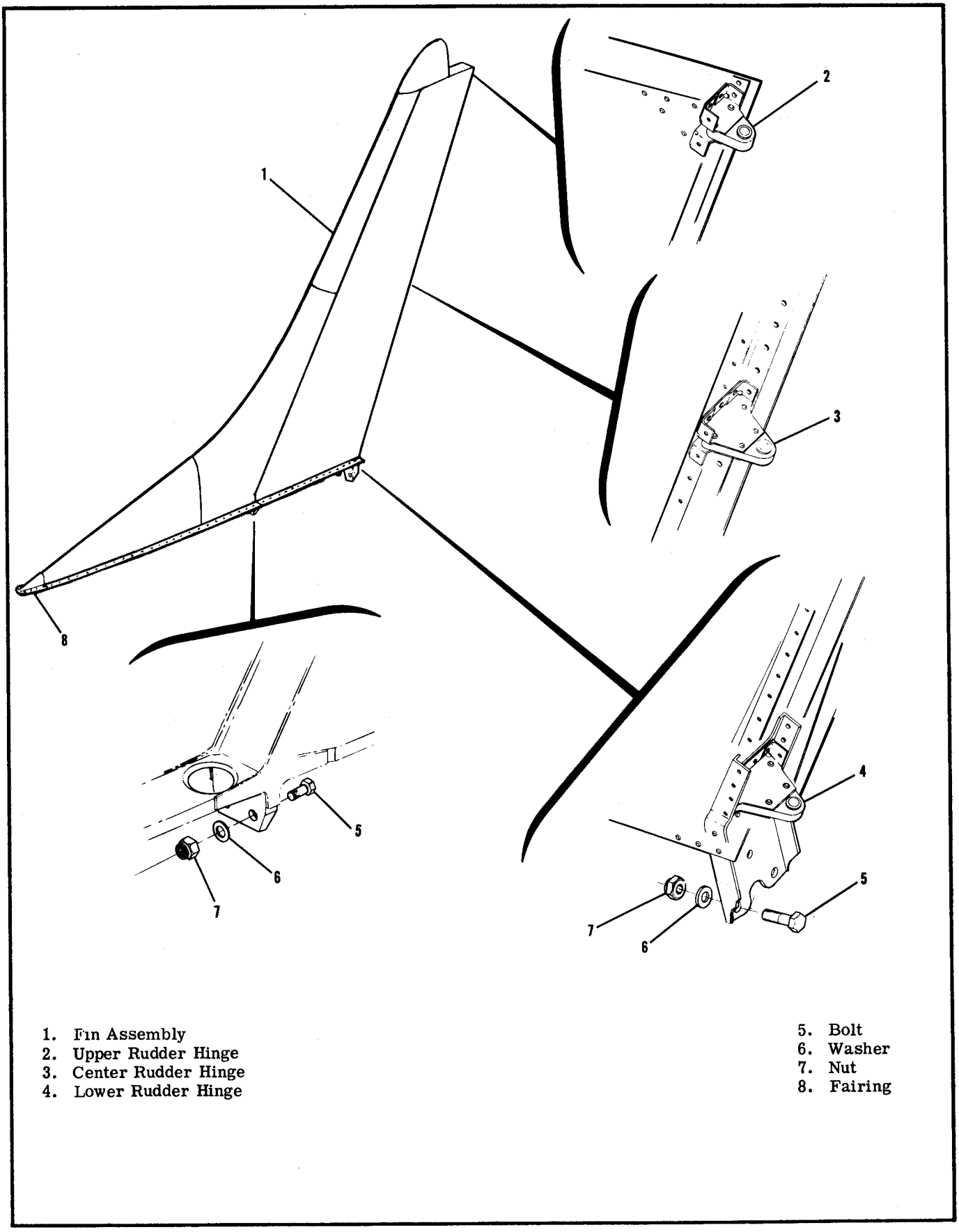
4-4. REPAIR of a damaged wing panel may be accomplished in accordance with instructions given in Section 19. Extensive repairs of wing skin or structure are best accomplished by using the wing repair jig, which may be obtained from Cessna. The jig serves not only as a holding fixture, making work on the wing easier, but also assures absolute alignment of the repaired wing.

4-5. REPLACEMENT.

a. Hold wing in position and install bolts, bushings, washers and nuts attaching wing spars to fuselage fittings.

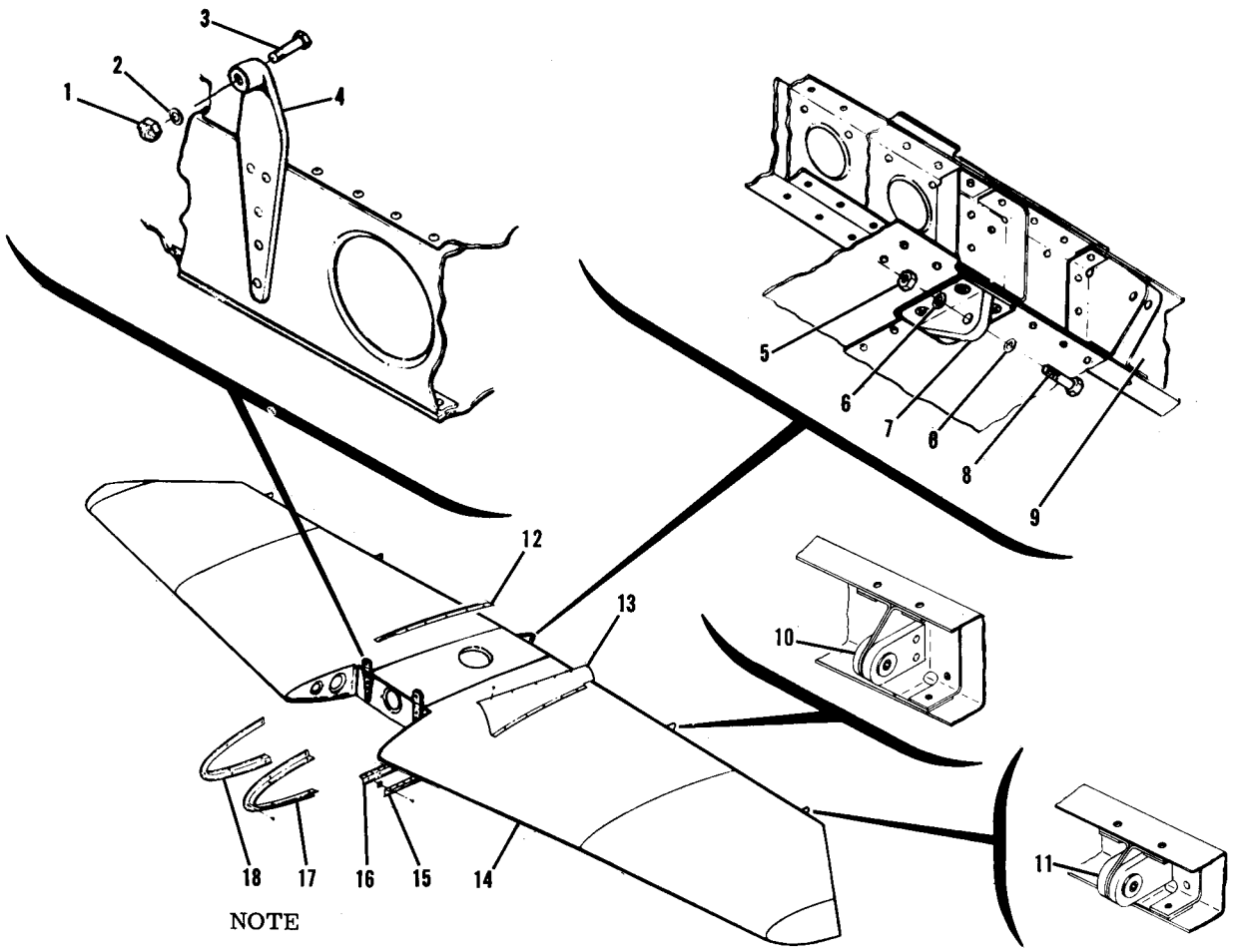
b. Install bolt, spacer and nut to attach upper end of wing strut to wing fittings.

c. Route flap and aileron cables.



1. Fin Assembly
2. Upper Rudder Hinge
3. Center Rudder Hinge
4. Lower Rudder Hinge
5. Bolt
6. Washer
7. Nut
8. Fairing

Figure 4-3. Fin Installation



NOTE

Stabilizer configurations differ on the various models, but removal and installation provisions are the same.

1. Nut
2. Washer
3. Bolt
4. Bracket
5. Nut
6. Washer
7. Bracket
8. Bolt
9. Elevator Pylon Bracket
10. Elevator Inboard Hinge
11. Elevator Outboard Hinge
12. Upper Right Fairing
13. Upper Left Fairing
14. Stabilizer Assembly
15. Lower Left Fairing
16. Lower Right Fairing
17. Forward Left Fairing
18. Forward Right Fairing

Figure 4-4. Horizontal Stabilizer Installation

d. Connect:
1. Flap hydraulic lines at wing root unions (prior to Model 210D). Bleed per Section 5.
2. Electrical wires at wing root disconnects.
3. Fuel lines at wing root.
4. Pitot line (if left wing is being installed).
5. Ventilator hoses.

e. Rig aileron system (Section 6).

f. Rig flap system (Section 7 or 7A).

g. Refuel wing tank and check for leaks.

h. Check operation of wing tip, courtesy and landing lights.

i. Check operation of fuel gage.

j. Install wing root fairings and screws securing cabin top skin to the wing top skin.

NOTE

Be sure to insert soundproofing panel in wing gap before replacing fairings.

k. Install all inspection plates, interior panels and upholstery. Test operate flap and aileron systems.

4-6. ADJUSTMENT (CORRECTING "WING-HEAVY" CONDITION). If considerable control wheel pressure is required to keep the wings level in normal flight, a wing-heavy condition exists. To correct wing heaviness:

a. Remove wing fairing strip on the wing-heavy side of the airplane.

b. (See figure 4-1.) Loosen nut (3) and rotate bushings (4 and 5) simultaneously until the bushings are positioned with the thick side of the eccentrics up. This will lower the trailing edge of the wing, and decrease wing heaviness by increasing the angle-of-attack of the wing.

CAUTION

Be sure to rotate the eccentric bushings simultaneously. Rotating them separately will destroy the alignment between the off-center bolt holes in the bushings, thus exerting a shearing force on the bolt, with possible damage to the hole in the wing spar.

c. Tighten nut and reinstall fairing strip.
d. Test-fly the airplane. If the wing-heavy condition still exists, remove fairing strip on the "lighter" wing, loosen nut and rotate bushings simultaneously until the bushings are positioned with the thick side of the eccentric down. This will raise the trailing edge of the wing, thus increasing wing heaviness to balance heaviness in the opposite wing.
e. Tighten nut, install fairing strip, and repeat test flight.

4-7. WING STRUTS. (See figure 4-2.)

4-8. Each wing has a single lift strut which transmits a part of the wing load to the lower portion of the fuselage. The strut consists of a streamlined tube riveted to two end fittings for attachment at the fuselage and wing.

4-9. REMOVAL AND REPLACEMENT of wing struts can be accomplished in accordance with the following steps:
a. Remove screws attaching strut fairings to wing and fuselage. Slide fairings away from the ends of the strut.
b. Remove fuselage and wing inspection plates or fairings at strut junction points.
c. Support wing securely, then remove nut and bolt securing strut to fuselage.
d. Remove nut, bolt, and spacer used to attach strut to wing, then remove strut from airplane.
e. Install strut by reversing steps listed above.

4-10. REPAIR of wing struts is limited to replacement of strut seals, tie-downs and attaching parts. A badly dented, cracked, or deformed wing strut should be replaced.

4-11. FIN. (See figure 4-3.)

4-12. The fin is primarily of metal construction consisting of ribs and spars covered with skin. Fin tips and some dorsal sections are of Fiberglas. Hinge brackets at the rear spar attach the rudder.

4-13. REMOVAL.
a. Remove stinger and fairings on each side of the fin.
b. Disconnect tail light electrical wire, rotating beacon wire and antenna leads. Unfasten any antennas that would interfere with fin removal.
c. Disconnect rudder cables at rudder bellcrank.
d. Remove rudder hinge bolts and rudder if desired, or rudder and fin may be removed together.
e. Remove screws attaching dorsal to fuselage.
f. Remove bolts attaching fin rear spar to fuselage.
g. Remove bolts attaching fin front spar to fuselage.
h. Remove the fin.

4-14. REPAIR of the fin should be accomplished in accordance with applicable instructions in Section 19.

4-15. REPLACEMENT of the fin may be accomplished by reversing the procedure in paragraph 4-13. Be sure to check and reset rudder and elevator travel if any stop bolts were removed or settings disturbed.

4-16. HORIZONTAL STABILIZER. (See figure 4-4.)

4-17. The horizontal stabilizer is primarily an all-metal assembly constructed with a rear spar which extends throughout the full span of the horizontal stabilizer and a front spar which extends approximately one-half the span of the stabilizer. The skin is riveted to both spars and ribs. Stabilizer tips are molded Fiberglas. The elevator tab actuator screw is contained within the horizontal stabilizer assembly, and is supported by a bracket riveted to the main spar. The underside of the stabilizer contains an opening which provides access to the elevator tab actuator screw. Hinges are located on the rear spar to support the elevators.

4-18. REMOVAL.

NOTE

Removal of the stabilizer requires removal of the rudder, fin and elevators.

a. Remove the fairings above the horizontal stabilizer and elevator tab actuator access cover.
b. Disconnect rudder cables at rudder bellcrank, then remove rudder by removing rudder hinge bolts.
c. Disconnect the elevator tab push-pull tube at tab horn and actuator and remove push-pull tube.
d. Disconnect elevator cables from elevator bellcrank.
e. Remove the elevator by removing elevator hinge bolts.
f. Remove the fin.
g. Remove the bolts securing the horizontal stabilizer to the fuselage.
h. Disconnect elevator tab actuator cables.
i. Remove the horizontal stabilizer.

4-19. REPLACEMENT.
a. Install the horizontal stabilizer by reversing the procedures listed in the preceding paragraph.
b. Check operation of:
1. Rudder control system.
2. Elevator control system.
3. Elevator trim tab control system.
4. Tail navigation light, antennas and rotating beacon.

SECTION 5

HYDRAULICS AND LANDING GEAR

THIS SECTION IS APPLICABLE TO MODELS 210 AND 210A

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5-1. LANDING GEAR RETRACTION SYSTEM.

5-2. Retraction and extension of the landing gear is accomplished by a hydraulically-powered system integrated with electrical circuits which help control and indicate the position of the gear. Retraction and extension of the gear utilizes three actuators and the landing gear door and locking systems employ five actuators.

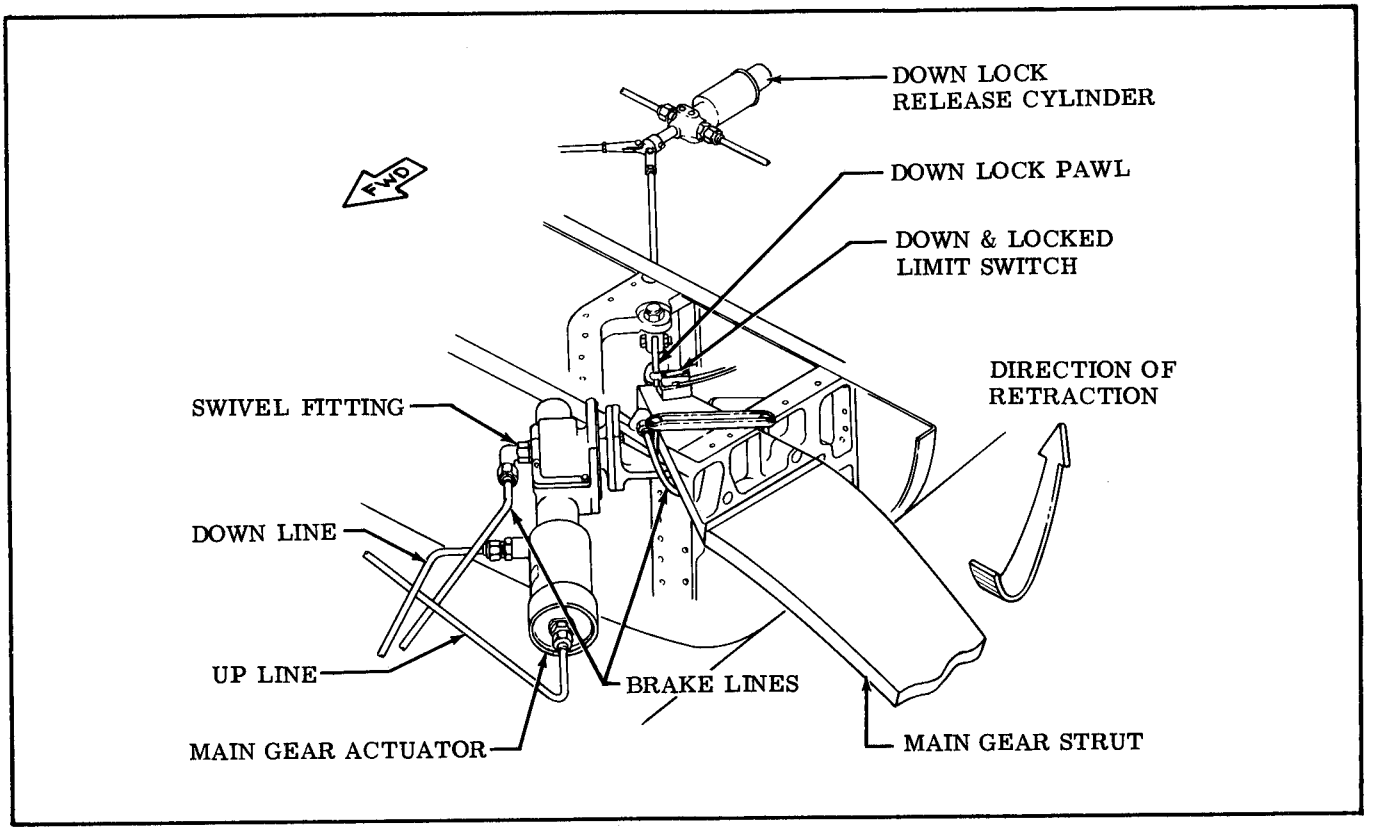


Figure 5-1. Main Gear Details

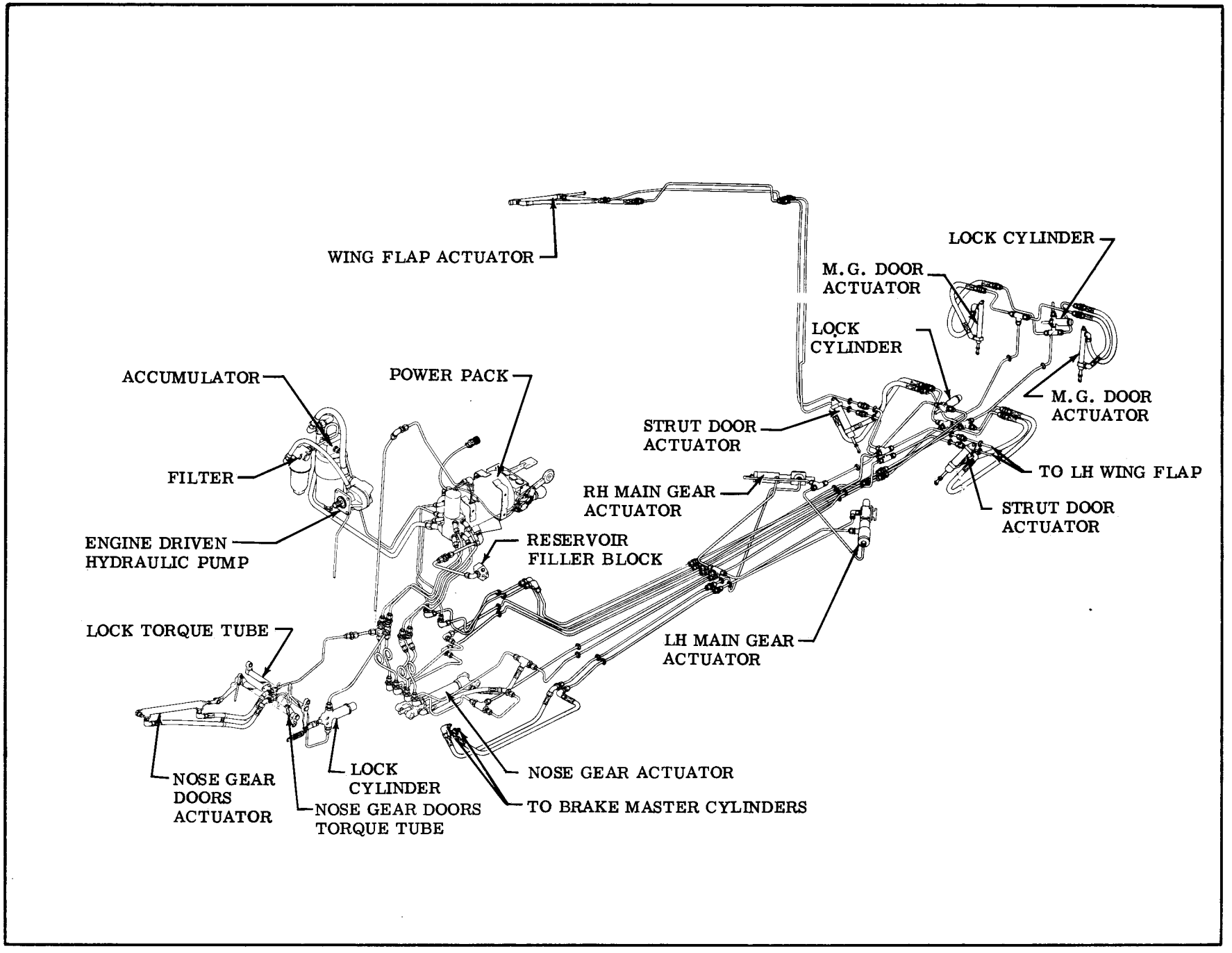


Figure 5-2. Hydraulic System

5-3. TROUBLE SHOOTING.

NOTE

Use of the Hydro Test is strongly recommended for trouble shooting of landing gear malfunction. When the Hydro Test is employed to power the hydraulic system, landing gear operation may be slowed down to a "slow motion," during which hydraulic pressures can be noted precisely and mechanical action can be observed.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
GEAR EXTENDS AND LOCKS BUT GREEN LIGHT FAILS TO LIGHT UP.		
Defective bulb, circuit, or down limit switch.	"Press-to-test" the bulb, see figure 5-6 to trouble-shoot the circuit.	Replace bulb, repair circuit or adjust limit switches.
GEAR WILL NOT EXTEND OR WILL ONLY PARTIALLY EXTEND.		
Engine pump failure.	Test-operate doors and flaps using Hydro Test. If system functions from a ground source, pump is faulty.	Repair or replace pump.
Unloader valve in accumulator failed in unloaded position.	Use Hydro Test or: Install gage in pressure line from pump. Disconnect pressure line from accumulator and plug accumulator port with gage. Operate engine-driven pump. Pressure indicated by gage on pump line should rise to 1500(+50, -00) psi, then drop to less than 300 psi. Pressure indicated by gage on accumulator should rise to 1500 (+50, -00) psi and remain steady.	Replace accumulator regulator section or repair accumulator per Section A3 of Appendix A.
Defective relief valve or gear up return poppet (see also figure 5-3) or Power Pack internal leakage.	With Hydro Test, pressure will not increase as indicated by gage attached to door open line.	Repair poppet by O-ring replacement or relief valve per paragraph A2-9.
Leak or rupture of pump or gear down system lines, fittings or components.	Observe for fluid leakage.	Repair or replace defective parts.
DOORS WILL NOT OPEN AND GEAR WILL NOT BEGIN TO EXTEND.		
Handle up-down switch not switching over to down-limit circuit.	With system pressurized, hold handle out as well as down, switch OFF the master switch, and move gear handle full down. Place master switch ON after gear has started to extend. NOTE Down light lit, but doors will not close after gear is extended.	Adjust or replace handle up-down switch.
Solenoid and/or spool valve jammed in door close position.	With system pressurized, open and close aircraft master switch repeatedly or pull and push gear handle in and out to loosen valve by action of solenoid.	Repair solenoid valve per Appendix, paragraph A2-11.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
GEAR WILL NOT RETRACT OR WILL ONLY PARTIALLY RETRACT.		
Engine pump failure.	Test-operate system with Hydro Test. If system functions with ground-source, pump is defective.	Repair/replace pump.
Unloader valve failed in unloaded position.	Use Hydro Test or: Install gage in pressure line from pump. Disconnect pressure line from accumulator and plug accumulator port with gage. Operate engine-driven pump. Pressure indicated by gage on pump line should rise to 1500(+50, -00) psi, then drop to less than 300 psi. Pressure indicated by gage on accumulator should rise to 1500 (+50, -00) psi and remain steady.	Replace accumulator regulator section.
Leak or rupture of pump system pressure line, fittings or components.	Observe for fluid leakage.	Repair or replace defective parts.
Leak or rupture of gear up or door system lines, fittings or components.	Observe for fluid leakage.	Repair or replace defective parts.
Poppet failure (probably the gear down return poppet) See figure 5-3.	Flaps operate properly and gear, if manually moved to a semi-retracted position, extends and locks properly.	Repair poppet by installing new O-rings. See paragraph 5-22 for poppet adjustment.
Excessive internal leakage in gear or gear door actuators.	Flaps operate properly.	Check for further cause below.
Excessive internal leakage in door actuators.	Use Hydro Test or: Detach gear lines at top of control tunnel and plug to block gear actuators from system. Place gear control valve handle in up position with master switch energized and repeat with master switch de-energized in effort to operate doors only on hand pump pressure.	If doors are sluggish or weak in operation or do not operate at all, further block off one door actuator at a time from system until defective door actuator is isolated. Repair or replace actuator. See Appendix for actuator repair.
Excessive internal leakage in Power Pack.	Pump cycles rapidly. Flaps may operate but are sluggish and weak. Reservoir temperature may approach 160°F.	Repair Power Pack per Appendix paragraph A2-1 through A2-14.
DOORS OPEN BUT GEAR WILL NOT RETRACT.		
Pump unloader valve in accumulator fails to load pump. Pressure is adequate to open doors, but insufficient for gear retraction.	Use Hydro Test or: Install gage in pressure line from pump. Disconnect pressure line from accumulator and plug accumulator port with gage. Operate engine-driven pump. Pressure indicated by gage on pump line should rise to 1500(+50, -00) psi, then drop to less than 300 psi. Pressure indicated by gage on accumulator should rise to 1500 (+50, -00) psi and remain steady.	Repair accumulator per Appendix paragraph A3-1 through A3-6.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
DOORS OPEN BUT GEAR WILL NOT RETRACT. (Cont)		
Power Pack internal leakage. (prevents pressure building up to 750+ required for gear actuation)	Use Hydro Test or external hand pump and gage at gear-down line.	Repair poppets by O-ring replacement, or cam per paragraph A2-14.
Gear actuator internal leakage (full actuating pressure is applied to actuators, but leaks past pistons, so pressure is not sufficient to retract gear)	Use Hydro Test. Doors open firmly and pressure increases MOMENTARILY to 750 psi, Downlock pawls release correctly, but pressure will not rebuild. Block off flow to one actuator at a time to isolate faulty one.	Repair or replace faulty actuator.
Door actuator internal leakage (prevents pressure building up to 750+ required for gear actuation)	Use Hydro Test or external hand pump. Door operation sluggish and weak. Open doors, detach and plug door lines at top of control tunnel to block door actuators from system. If retraction is satisfactory, reconnect door actuator lines, isolating one actuator at a time to find defective one.	Repair or replace faulty door actuator.
Engine driven pump failure or internal leakage.	If system functions well on Hydro Test, install gage in pump pressure line and run up engine to check pump output. Look for flow from pump overboard vent line, which indicates internal seal failure.	Repair or replace pump.
Broken line, fitting or other component beyond Power Pack in gear up system.	After doors open, reservoir level falls to reserve level immediately and fluid leaks into lower fuselage or gear tunnels.	Replace or repair broken component.
Reservoir level of fluid is low.	Check fluid level in reservoir.	Replenish fluid in reservoir.
GEAR WILL NOT UPLOCK AND DOORS WILL NOT CLOSE COMPLETELY.		
Interrupted electrical circuit.	Check circuit for loose connections and faulty switches.	Repair circuit or replace switches.
	Landing gear circuit breaker trips due to ground shorting.	Remove ground shorting fault and repair circuit.
Interrupted electrical circuit due to sagging of gears while doors are closing.	Detach nose gear doors and main wheel doors from their actuators at rod end at door. Use Hydro Test flow of not less than . 50 gallon per minute. Manually hold one gear at a time against up stop until a proper function is achieved.	Adjust up limit switch actuator towards gear on that gear which when held up manually allowed function to be completed. Repeat check and adjustment until cycle is completed automatically.
Uplock hooks not rigged correctly.	Check rigging in accordance with procedures listed in this section.	Rig correctly.
No precharge in accumulator.	Check precharge.	Precharge correctly to 600+0-100 psi, preferable with nitrogen.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
GEAR FALLS DOWN AFTER RETRACTION AND CLOSING OF DOORS.		
Uplock not engaging gear and doors.	Air entrapped in door down system.	Bleed off air from door down system.
Uplocks misrigged.	Inspect uplock rigging adjustments.	Adjust uplocks.
Springs on uplocks failed.	Inspect for deformed or broken uplock springs.	Replace faulty uplock springs.
Gear up return poppet of gear control valve is seating with handle in gear up range of travel and trapping pressure upon handle release to up neutral position.	Use Hydro test: Attach gage to door open line. Gage should not indicate more 50 psi as gear handle releases toward gear up neutral position and 10 psi within 5 seconds after release to up neutral position.	Adjust gear up return poppet by shimming.
Gear down pressure poppet is leaking into gear down line with control valve handle in the gear up neutral position and is leaking faster than slightly open return poppet can tolerate without pressure exceeding 30 psi in gear down and door open line.	Same as above except that unloader valve recycles more frequently.	Replace gear down pressure poppet O-rings or entire poppet assembly.
GEAR RELEASES AND BEGINS TO RETRACT BEFORE DOORS ARE OPEN.		
Switch on handle pull out is not opening circuit.	Observe plunger pin motion for sticking.	Bend switch leaf to adjust switch or replace switch.
	Continuity check for broken or frozen contact points.	Replace switch.
Switch on handle up-down travel not opening circuit to solenoid valve when handle is moved into upper half of total travel.	Check switch operation vs mid-neutral barrier position break and make.	Adjust switch.
	Continuity check for broken or frozen contact points.	Replace switch.
Solenoid valve remains energized despite above checks.	Check for short circuit within Power Pack wire harness or plug.	Repair or replace pack wire harness and/or plug.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
GEAR RELEASES AND BEGINS TO RETRACT BEFORE DOORS ARE OPEN. (Cont.)		
Priority valve faulty. a. Pressure setting too low, or: b. Priority valve not closing tight, allowing pressure flow to gear actuators before doors are open.	Place airplane on jacks. Install pressure gauge in door open line. Place L.G. control handle in full up position, doors closed, master switch off. Apply hydraulic power with emergency hand pump or Hydro Test. Observe gauge reading at time gear down locks start to move. The pressure should be 750 +50-0 psi. If reading is wrong, priority valve should be adjusted per figure 5-3B.	Adjust priority valve. If adjustment will not correct trouble, priority valve is leaking and priority valve should be repaired in accordance with paragraph A2-5 of Appendix.
DOORS DO NOT REMAIN CLOSED AFTER AIRCRAFT IS SHUT DOWN.		
Master switch circuit was opened within one minute after valve operation.	Delay opening master switch circuit.	Avoid opening master switch circuit as much as three minutes.
Door latches and springs not properly rigged.	Check door rigging.	Readjust rigging.
Gear pressure poppet leaking.	Install gauge on door open line.	Replace O-rings on gear poppet or replace poppets.
DOORS WILL NOT CLOSE.		
Voltage is extremely low.	Check other electrical systems and charging light.	Repair electrical system.
Interrupted electrical circuit.	Master switch is off and no indicator light shows.	Energize master switch.
	Landing gear circuit breaker is tripped and no indicator light shows.	Repair shorting fault and reset circuit breaker.
	Limit switch does not provide continuity when actuated and no indicator light shows.	Replace limit switch.
	Handle pull out switch does not provide continuity when pin is depressed but indicator light is lit.	Replace handle pull out switch.
	Limit switch does not actuate and no indicator light shows.	Adjust toward gear.
	Handle pull out switch does not actuate due to binding of handle slide action.	Replace handle assembly.
	Handle cam does not actuate up-down switch in upper half of handle travel.	Adjust switch toward cam until action matches mid-barrier position of handle.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
DOORS WILL NOT CLOSE.		
Interrupted electrical circuit (Cont).	Open circuit in wire or terminals with no indicator light.	Locate and repair or replace wire or components.
	Loose or defective plug joining Power Pack conduit to aircraft conduit.	Repair or replace plug.
	Loose or broken ground connection to door valve solenoid.	Repair ground connection.
Defective solenoid or jammed door control valve in Power Pack.	Place aircraft on jacks. Supply pressure with emergency hand pump. L.G. control handle must be full up or down and full in. The door solenoid should be energized in this position. Check magnetic attraction of solenoid by holding steel or iron close to it. If magnetic field is not present, but up or down light is lit, switches or wiring on Power Pack are defective or solenoid is burned out. If magnetic field is present, but doors will not close, the solenoid valve is mechanically jammed, which will necessitate Power Pack repair.	Replace solenoid or, if valve is mechanically jammed, repair solenoid valve per paragraph A2-11.
GEAR VALVE HANDLE DOES NOT RETURN TO NEUTRAL AND CYCLE IS INCOMPLETE.		
More than 2.7 "G" loading on aircraft during cycle.	Repeat operation under normal conditions.	Avoid operation during excessive "G" loading.
Excessive airspeed or yaw during cycle.	Repeat operation under normal conditions.	Avoid operation during abnormal conditions.
Handle was not placed firmly onto detent.	Repeat handle movement.	Move handle full travel onto detent.
Handle release pressure setting too low.	Install gauge on corresponding gear up or down line.	Adjust handle release pressure.
OPERATION IS GENERALLY SPONGY OR ERRATIC.		
Air is entrapped in system.	Inspect fluid level in reservoir.	Fill reservoir and bleed systems.
	Break lines at actuators and check for air or follow test stand procedure for bleeding.	Bleed entrapped air.
	Check for leakage along suction line, reservoir to engine pump.	Tighten or replace fittings and bleed systems.
	Internal seal leakage in engine pump.	Replace or repair pump and bleed system.
Air entrapped in accumulator or line between accumulator and Power Pack.	Use Hydro Test if available. Observe sharp fluctuation in line pressures.	Bleed system.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
OPERATION IS GENERALLY SPONGY OR ERRATIC.		
Accumulator is not charged or precharge is excessive.	Check precharge pressure.	Precharge correctly.
VIBRATION AND NOISE WITH GEAR DOWN AND LOCKED		
Excessive clearance at fuselage strut support forging.	Check clearances shown in figure 5-10.	Shim as necessary.
VIBRATION AND NOISE WITH GEAR RETRACTED		
Stop and guide bumpers allowing gear to move when retracted.	Check adjustment of stop bumper and guide bumper.	Adjust bumpers for correct gear clearance with uplocks engaged.
LEAKAGE OF FLUID FROM POWER PACK.		
	NOTE Ordinarily, fluid leaking from the Power Pack runs down the pack and drips from the emergency hand pump chute. This is deceptive, for it does not indicate the hand pump is leaking. Most leaks are repairable, but in some locations a leak will necessitate the replacement of the entire Power Pack.	
(REPAIRABLE) LEAKAGE FROM:		
Poppet caps.	A discoloration from slight leakage is normal.	Negligible.
L.G. control lever up and down detent plungers. (Handle release.)	Presence of leaked fluid at either side of pack.	Renew O-ring seals on plungers. Reset handle release pressure.
Filler port fitting Vent port fitting. Door open port fitting Door close port fitting Gear up fitting Gear down fitting Flap up fitting Flap down fitting Pressure port fitting. Suction port ("banjo") fittings	Check visually.	Replace O-rings and tighten fittings.
Solenoid boss O-ring	Leakage around solenoid threads.	Replace solenoid O-ring.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
LEAKAGE OF FLUID FROM POWER PACK. (Cont)		
NON-REPAIRABLE LEAKAGE FROM:		
Reservoir seals at forward and aft body of reservoir.	Visual evidence of leakage.	Replace reservoir seals.
Flap control shaft seals.	Visual evidence of leakage.	Replace O-rings on flap control shaft per paragraph A2-12.
L.G. control shaft seals.	Visual evidence of leakage.	Replace O-rings on gear control shaft per paragraph A2-12.
Emergency hand pump piston.	Visual evidence of leakage.	Repair hand pump per paragraph A2-10.
Reservoir cracks at mounting straps, spot welds, etc.	Visual evidence of leakage.	Replace reservoir.

NOTE

If the emergency hand pump is used to retract the gear, with the airplane on jacks, "help" the gear manually into its retracted position. Otherwise excessive strain is exerted on the hand pump mechanism, which is designed primarily for emergency extension, not retraction, of the landing gear.

SHOP NOTES:

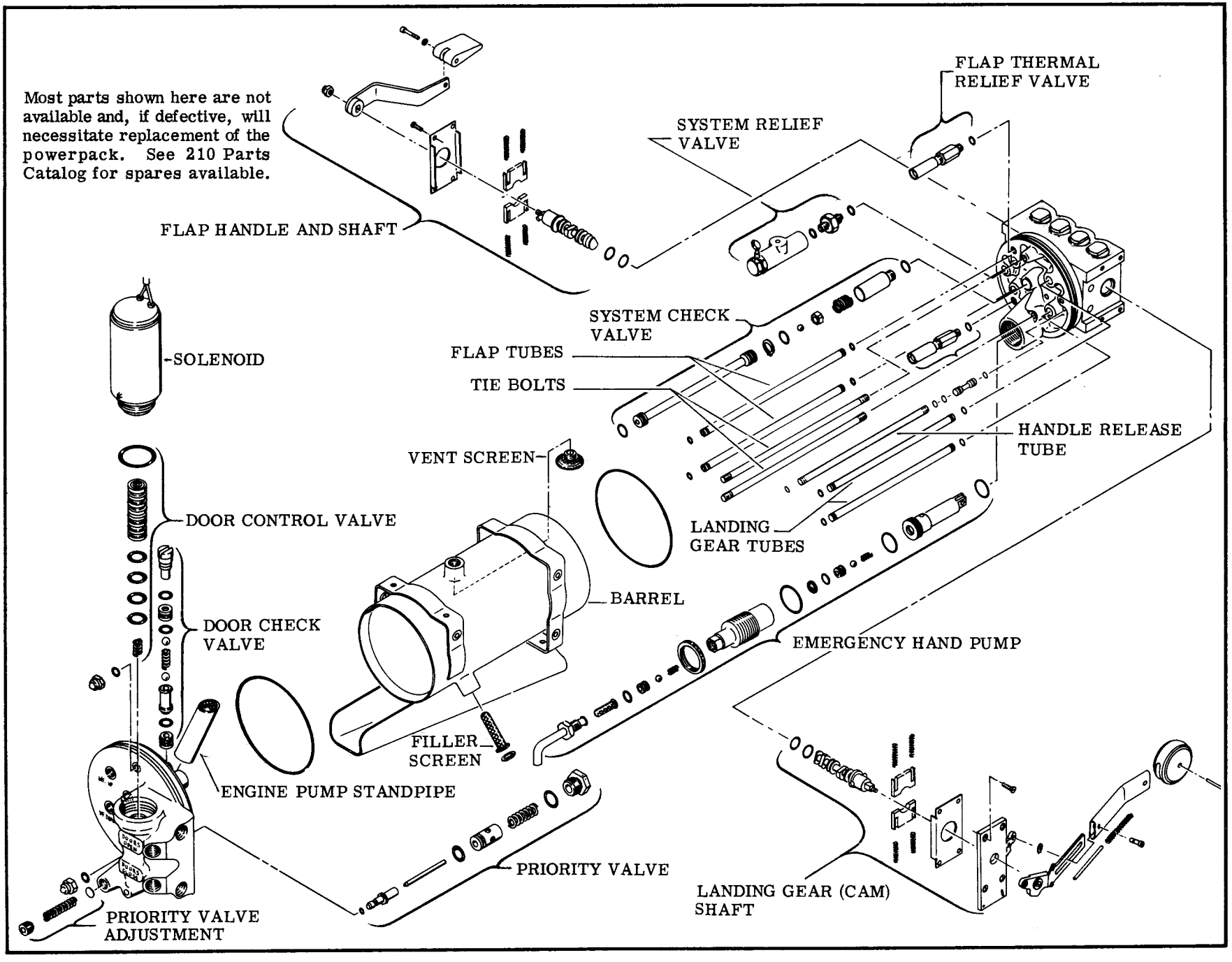


Figure 5-2A. Power Pack Assembly

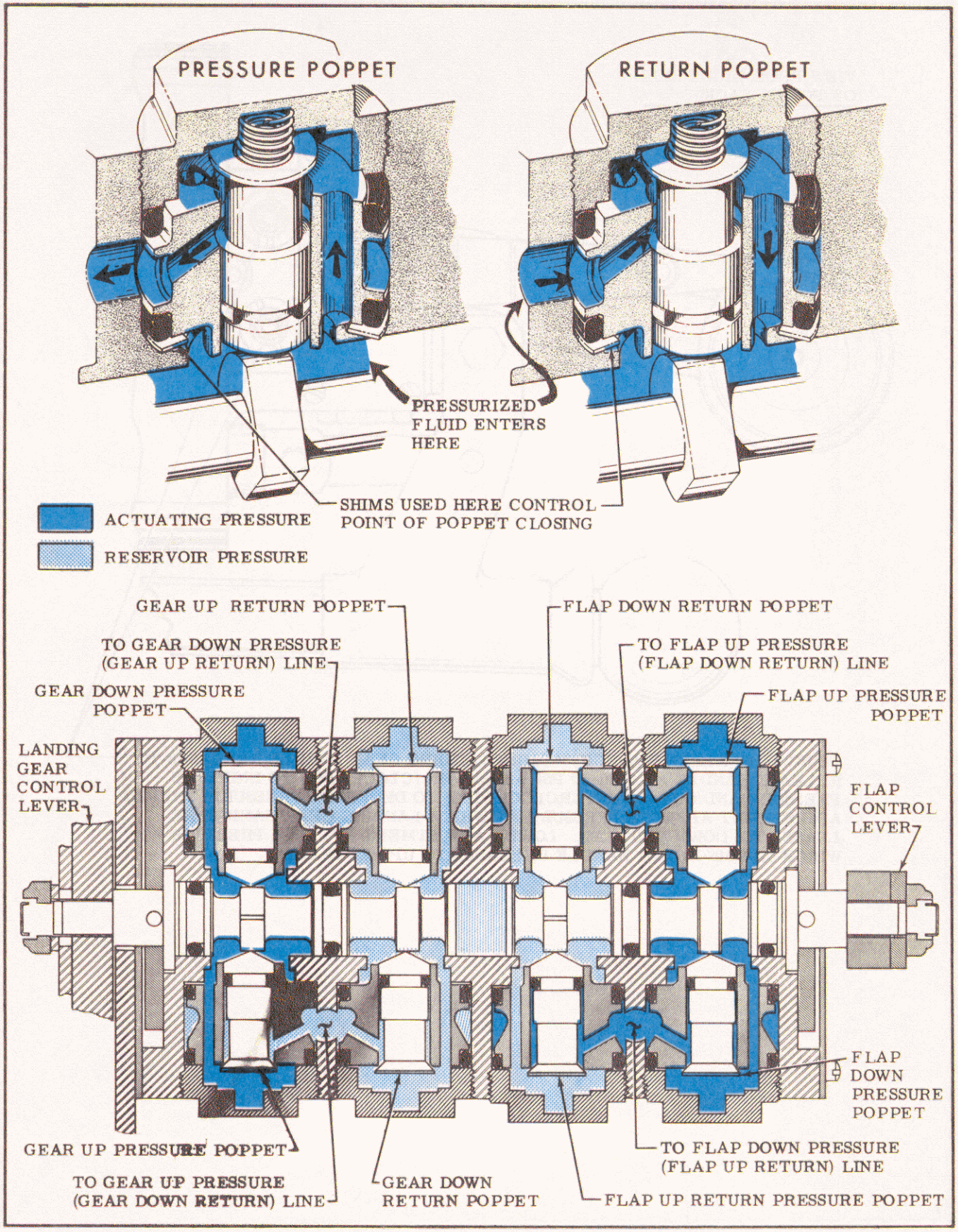


Figure 5-3. Power Pack Poppet Operation

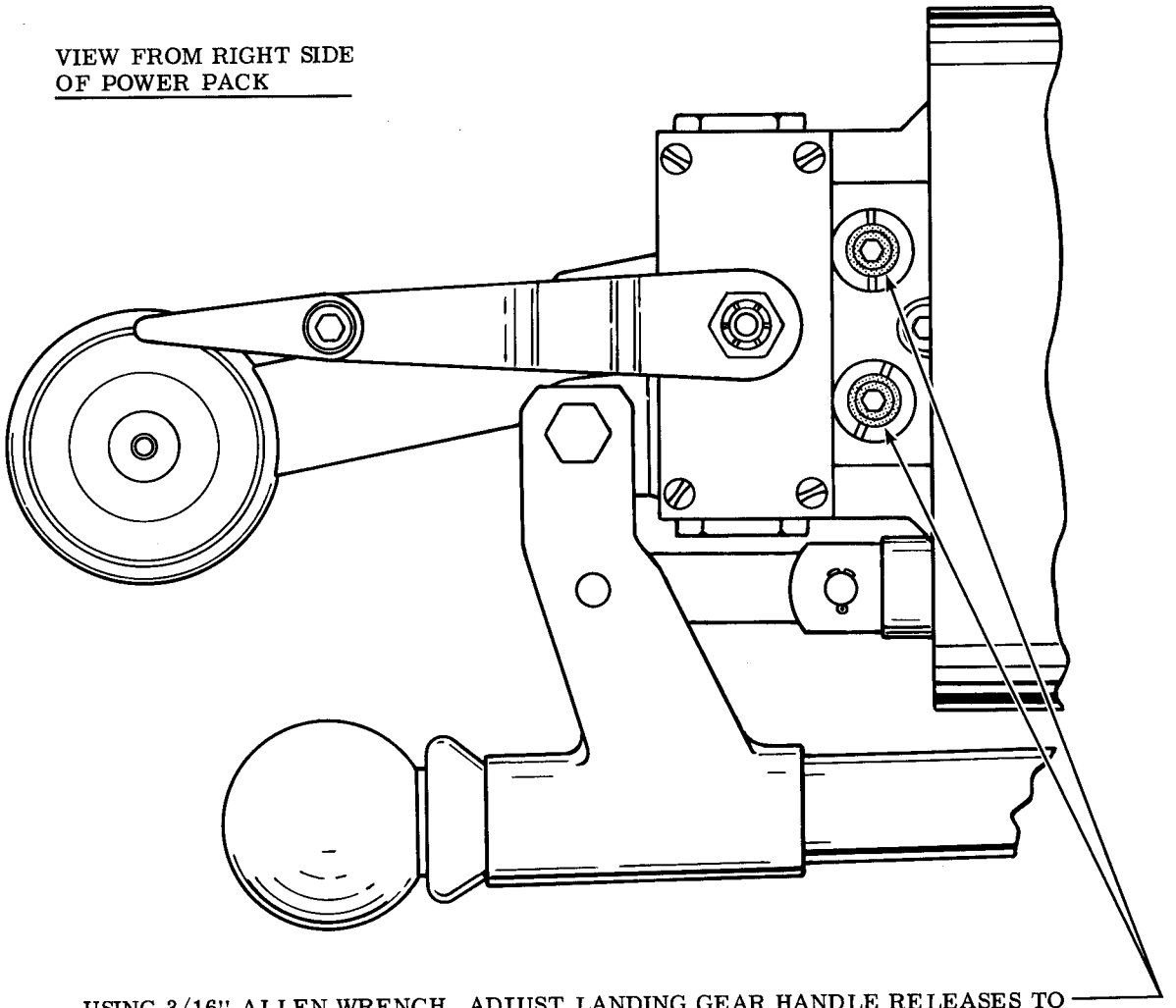


Figure 5-3A. Landing Gear Handle Release Adjustments

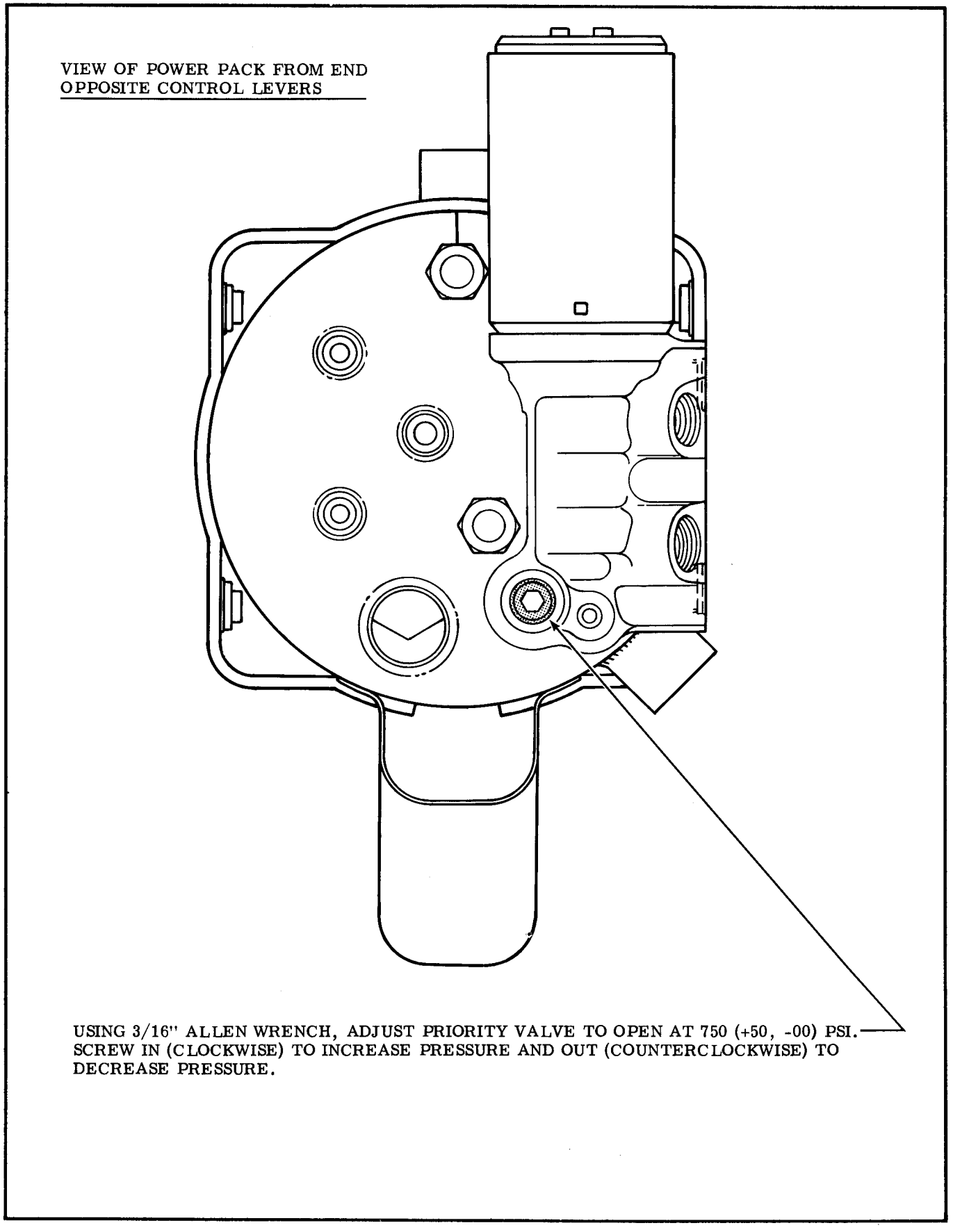


Figure 5-3B. Priority Valve Adjustment

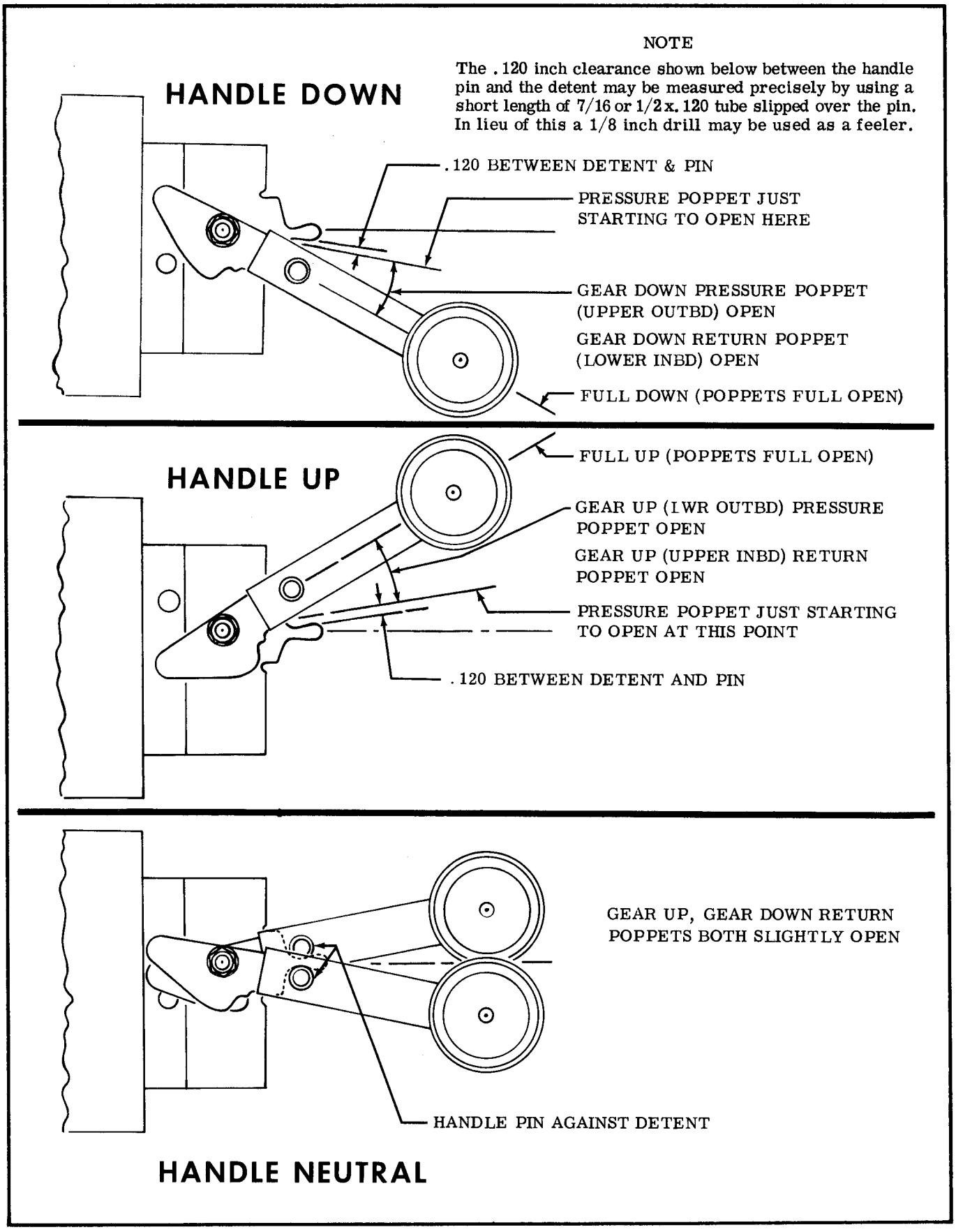


Figure 5-3C. L.G. Control Handle Relationship To Poppet Opening

5-4. HYDRAULIC POWER SYSTEM COMPONENTS.

5-5. The hydraulic power system includes all equipment required to provide a flow of pressurized hydraulic fluid to the retractable landing gear and to the wing flap systems. Main components of the system are listed in the chart which follows.

ITEM	PURPOSE	LOCATION AND ACCESS
Engine-driven hydraulic pump.	To provide a flow of pressurized hydraulic fluid to the system.	Right rear accessory pad of engine. Remove upper cowling.
Hydraulic filter.	To filter fluid from the pump before entering remainder of system.	Upper right side of firewall in engine compartment. Remove the upper engine cowling.
Unloader valve.	To regulate fluid pressure.	Located in accumulator aft, right hand side of firewall.
Accumulator.	To dampen pressure surge and serve as a pressure reservoir.	Aft, right hand side of firewall.
Hydraulic Power Pack.	(1) To serve as a reservoir of hydraulic fluid. (2) To afford control of landing gear and flap operating systems through the use of valves built into the unit. (3) To provide emergency hydraulic pressure through the use of the hand pump in the unit.	Center of instrument panel.

5-6. ENGINE-DRIVEN HYDRAULIC PUMP.

5-7. The gear-type hydraulic pump is mounted on the right rear accessory pad on the engine. Driven at approximately 1-1/2 times crankshaft speed, the pump supplies a controlled flow to the Power Pack and hydraulic operating systems whenever either the wing flap or the landing gear control is operated. When neither control is actuated the unloader valve allows the pump to cycle the fluid. Pump flow is controlled to approximately one-gallon-per-minute.

5-8. REMOVAL AND INSTALLATION.

a. Remove upper cowling and induction airbox for access to hydraulic pump.

b. Disconnect hydraulic lines and hoses from pump and cap and plug openings.

c. Remove mounting nuts and pull pump aft to remove.

d. To install the pump, install a new mounting gasket, grease drive splines lightly with general purpose grease, and slide pump into position. Rotate pump shaft as necessary for smooth meshing of splines, and reverse the preceding steps. To prevent initial dry-running of the pump:

1. Loosen suction hose fitting at pump inlet.
2. Remove Power Pack reservoir overboard vent line from fitting at top of firewall.
3. Connect suitable filler unit to reservoir filler block.
4. Hold finger over open end of overboard vent line fitting and fill reservoir until fluid is forced from loosened end of suction hose.
5. Tighten suction hose, reconnect reservoir vent line, and disconnect filler unit.

5-9. DISASSEMBLY AND REPAIR. Refer to Appendix A for disassembly and repair of the hydraulic pump.

5-10. HYDRAULIC FILTER.

5-11. The hydraulic filter, located in the pump pressure line, is mounted on a bracket on the forward side of the firewall. It filters the hydraulic fluid before it enters the Power Pack. The filter contains a bypass valve which will open and supply the hydraulic system with fluid if the filter element should become clogged.

NOTE

Bendix-Skinner or Purolator filter assemblies are used interchangeably in the aircraft. Both take the same filter element, but the bowl-sealing O-ring installation differs. The difference is depicted in figure 5-5.

5-12. REPLACEMENT.

NOTE

Ordinarily it will not be necessary to replace the entire filter assembly, but merely to replace the element.

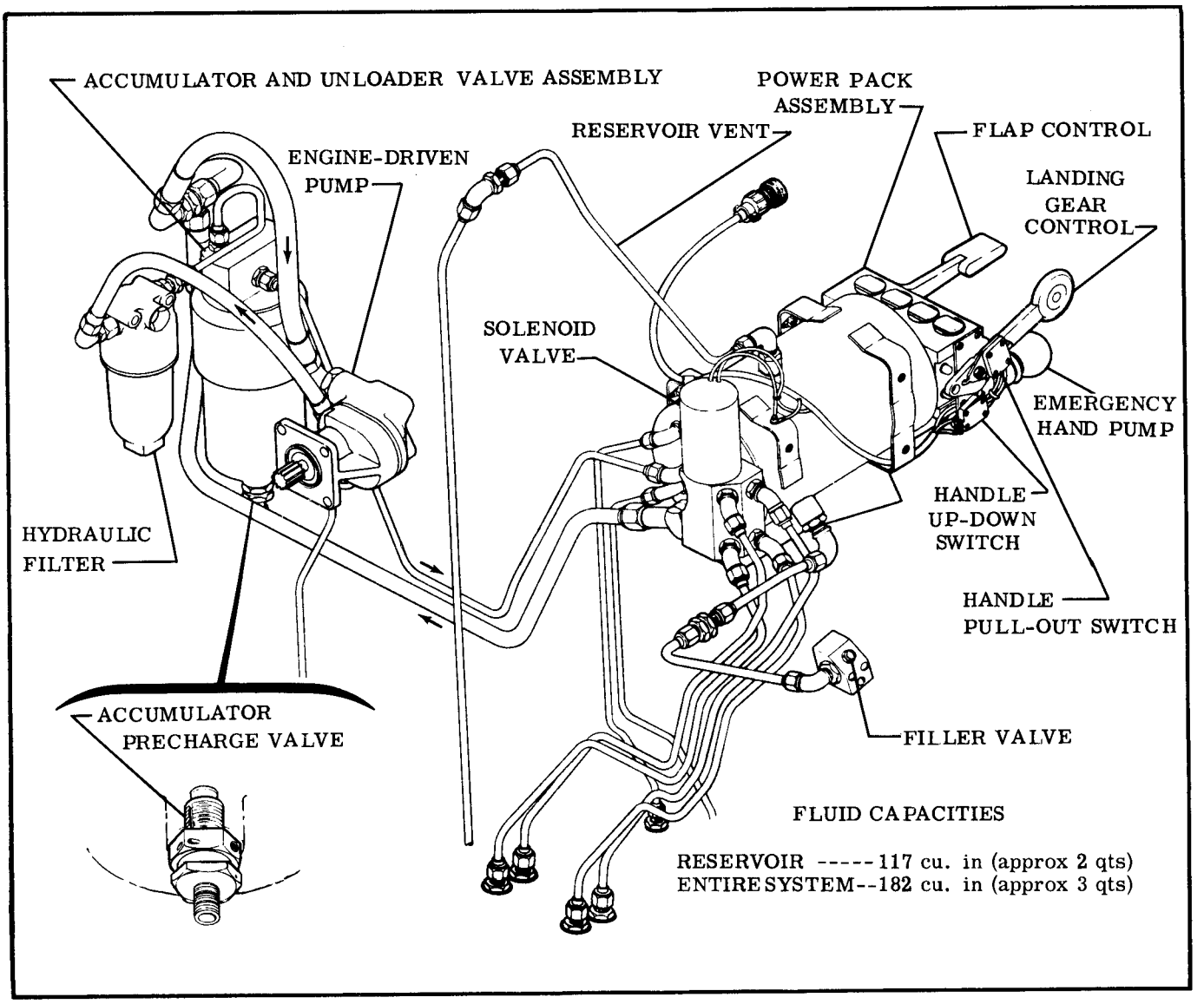


Figure 5-4. Hydraulic Power System Components

a. Remove upper right hand engine cowling, disconnect hose from inlet tee on filter and line and bulkhead nut from outlet nipple.
b. Remove bolts securing filter to mounting bracket.
c. To install the filter, reverse the preceding steps.

5-13. FILTER ELEMENT REPLACEMENT.

NOTE

Bendix-Skinner or Purolator filter assemblies are used interchangeably on the airplane. Check the filter on the airplane and refer to figure 5-5 before changing the element. The two filters use identical elements, but the bowl is sealed with different O-rings.

a. Remove the right cowling to gain access to the filter.
b. Check whether the unit is Bendix-Skinner or Purolator.
c. Unscrew bowl and remove filter element.
d. Wipe out bowl and flush with clean fluid. Replace filter element. Install O-rings carefully on bowl. Half-fill the bowl before screwing it into place.
c. Operate the engine to check filter for leaks, then safety the bowl.

5-14. ACCUMULATOR.

5-15. The accumulator serves two purposes. Through action of a built-in "unloader" valve, it serves as a pressure regulator for fluid pressurized by the engine-driven hydraulic pump, holding pressure between 1250 and 1500 psi in the system, but allowing the pump to unload to minimum pressure. The accumulator also dampens pressure surge and serves as a reservoir to offset normal leak-down in Power Pack valves. The accumulator is mounted on the right aft side of the firewall.

5-16. REMOVAL AND INSTALLATION.

CAUTION

Before removing accumulator plumbing, expend pressure in the accumulator by operating flaps. To do this, operate flaps until they cease to move, then move flaps manually in the direction the flap lever indicates until they hang limp, thus indicating a lack of hydraulic pressure in the operating cylinders.

a. Remove the right forward seat and spread a drip cloth over the forward carpet. Drain the Power Pack as outlined in step "a" and "b" of paragraph 5-19.
b. Remove the glove box.
c. Open accumulator precharge valve to bleed off 600 psi nitrogen gas pressure.
d. Remove lines and hoses attached to fittings on the accumulator.
e. Remove four bolts attaching accumulator to the firewall. These bolts are threaded into nutplates on the firewall.
f. Install the accumulator by reversing the procedures outlined above. After installation, precharge the accumulator to 600 plus zero, minus 100 psi, with nitrogen.

NOTE

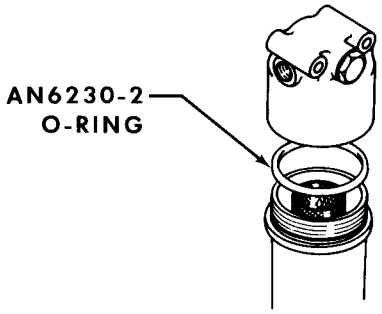
Nitrogen is preferable to compressed air for charging the accumulator, since nitrogen is an inert, moisture free gas which prevents water condensation or oxidation contamination in the accumulator. A nitrogen bottle regulator, gauge and filler hose are available from the Spare Parts Department.

5-17. HYDRAULIC POWER PACK.

5-18. The hydraulic Power Pack (see figure 5-4) is a multi-purpose control unit in the hydraulic system. It contains a hydraulic reservoir, valves which control flow of pressurized fluid to the landing gear and wing flap systems, handle position switches connected to gear warning lights and horn, and an emergency hand pump permitting extension of the landing gear if hydraulic pressure fails. Besides these major features, the Power Pack includes pressure and thermal relief valves to relieve excessive system pressure. A built-in valve prevents the gear from starting its retraction cycle until pressure has been applied to open the landing gear doors. Associated with this valve, but not dependent on it, is a solenoid operated valve which maintains correct sequence of landing gear and door operation.

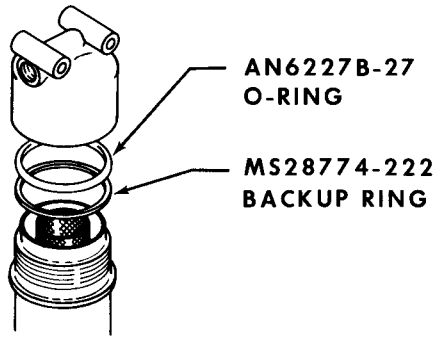
NOTE

With the accumulation of operation hours, a black discoloration and even O-ring particles may show up on the filtering element. If the hydraulic system is still functioning properly, this need cause no great concern; it indicates that the filter is doing its job of collecting and filtering impurities.



PUROLATOR FILTER

COAT THREADS
WITH VV-P-236
PETROLATUM



BENDIX FILTER

BOTH FILTERS TAKE AN6235-2A ELEMENT

Figure 5-5. Hydraulic Filter Details

OPERATING PRESSURE 1500 PSI
PROOF PRESSURE 3500 PSI
BURST PRESSURE 6000 PSI
REGULATOR PRESSURE
CUT-IN = 1250+50-0 PSI (EA 1330 Accumulator Serial Nos. up to 418).
CUT-IN = 1150±50 PSI (EA 1330 Accumulator Serial Nos. 419 and on and EA 1330-1 Serial Nos. 1 and on).
CUT-OUT = 1550+50-0 PSI
PRECHARGE = 600 PSI (NITROGEN OR AIR)

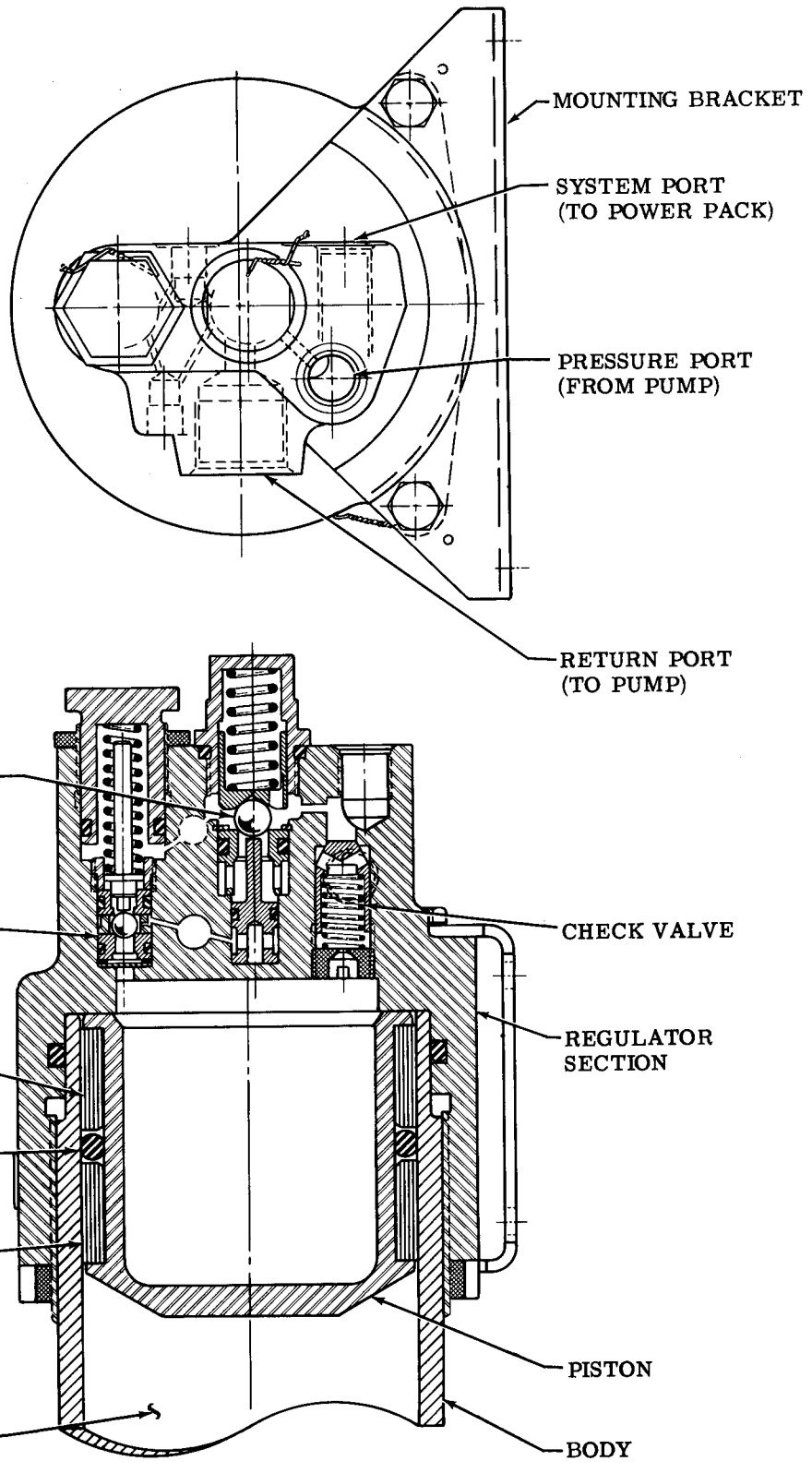


Figure 5-5A. Accumulator Details.

5-19. REMOVAL.

CAUTION

Before removing Power Pack plumbing, expend pressure in the accumulator by operating flaps. To do this, operate flaps until they cease to move, then move flaps manually in the direction the flap lever indicates until they hang limp, thus indicating a lack of hydraulic pressure in the operating cylinders.

a. Remove the front seats and spread a drip cloth over the forward carpet.
b. Position a gallon can under the filler line. Loosen the nut and drain the reservoir fluid into the can.

NOTE

The reservoir contains approximately a half-gallon of fluid.

c. Remove the Power Pack knobs and decorative cover.
d. Unplug electrical connection to the Power Pack.
e. Remove or loosen the filler line aft of the firewall. Swing the line aside to clear the Power Pack.
f. Remove all lines from power pack fittings.

NOTE

Tag lines as they are disconnected to ensure correct reinstallation.

g. Remove six bolts attaching Power Pack to its mounting brackets and work it down and out of the airplane.

5-20. DISASSEMBLY AND REPAIR. Refer to Appendix A for disassembly and repair of the Power Pack.

5-21. INSTALLATION.

NOTE

When installing a new Power Pack, leave the bulkhead fittings loose on the tubing fittings. This will allow proper positioning of these fittings, making it easier to align and connect the hydraulic lines. See figure 5-9.

a. Position the Power Pack within its brackets and install the six bolts which attach it to its mount.
b. Install all fluid lines to fittings in the Power Pack. Make sure that all fittings are tight.
c. Plug in and safety the electrical connector.

NOTE

If the switches on the landing gear control lever are not already installed on the Power Pack they should be installed prior to step "d." See paragraph 5-31 for adjustment of switches.

d. Install decorative panel and knobs.

5-22. SHIMMING POWER PACK POPPETS.

5-23. A thorough comprehension of the action of the Power Pack poppets is essential before any shimming adjustment is made on a poppet. Remember, too thick a shim will not allow a poppet to open. Note also that the gear return poppets are slightly open even when the gear is in gear up or gear down neutral position, with the handle pin against the detent barrier. When installing poppet shims, the poppet body (outside part of the poppet) must be held firmly against the shims. Apply a lighter pressure to the poppet plunger to hold it against the handle cam. Then move the handle. Pressure poppets should just unseat as the handle pin reaches a point 0.120 inch away from the detent barrier. Use care when checking poppet opening. To check and install poppet shims proceed as follows:
a. Dissipate residual hydraulic pressure in the system by operating the wing flaps, then by moving the wing flaps manually up and down, with the flap control handle in the same relative position. Spread a drip cloth over the carpeting below the Power Pack.
b. Remove decorative cover from Power Pack.
c. Remove poppet cap of the poppet suspected of malfunction. Remove poppet spring just under the poppet cap.
d. Refer to figure 5-3C. This figure gives desired point-of-opening of the poppets.

NOTE

To check the .120 clearance shown in figure 5-3C, a short length of 7/16 or 1/2 x .120 tube slipped over the handle pin, may be used. In lieu of this, a gage may be fabricated of wire or sheet of the proper thickness, or a No. 31 drill bit shank may be used as a feeler.

e. Holding outer poppet body against the shims and applying a lighter pressure to hold the poppet plunger against the cam, operate the control handle to "feel" the movement of the poppet. Check handle-versus-poppet position using .120 inch clearance between detent and handle pin. This is the point at which pressure poppets should just begin to unseat.
f. If poppet opens too soon, add shims. If it opens too late, remove shims, or replace with thinner shims. Some trial and error may be necessary before just the right shim combination is obtained.
g. When shimming is completed, test operate landing gear system with Hydro Test unit.

5-24. PRIMARY RELIEF VALVE ADJUSTMENT. If the primary 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 Section 2 of Appendix A.

5-25. PRIORITY VALVE ADJUSTMENT. The priority valve may be adjusted while the Power Pack is installed in the airplane.
a. Jack the airplane and connect Hydro Test in

accordance with paragraph 2-45.

b. Check priority valve setting in accordance with paragraph 2-50 and figure 5-3B.

c. If adjustment is required, turn priority valve adjusting screw (see figure 5-3B) in (clockwise) to increase pressure at which priority valve opens, and turn the adjusting screw out (counterclockwise) to decrease pressure at which the valve opens. Adjust so that the valve opens at 750+50-0 psi as noted on Hydro Test gage.

d. Cycle the landing gear to check for proper operation, then lower the gear.

e. Fill reservoir and disconnect Hydro Test.

f. Remove airplane from jacks.

5-26. LANDING GEAR HANDLE-RELEASE ADJUSTMENT. Adjustment of the landing gear handle release mechanism may be accomplished as outlined in paragraphs 2-48 and 2-49 and figure 5-3A.

5-27. SYSTEM PRESSURE REGULATOR ADJUSTMENT. (See figure 5-5A.) Adjustment of system pressure regulator may be accomplished as outlined in paragraph 2-48 and figure 5-5A. Refer to Appendix A for repair of the accumulator and system pressure regulator.

5-28. EMERGENCY HAND PUMP. The emergency hand pump is internally mounted in the Power Pack. Refer to Appendix A for repair of the emergency hand pump.

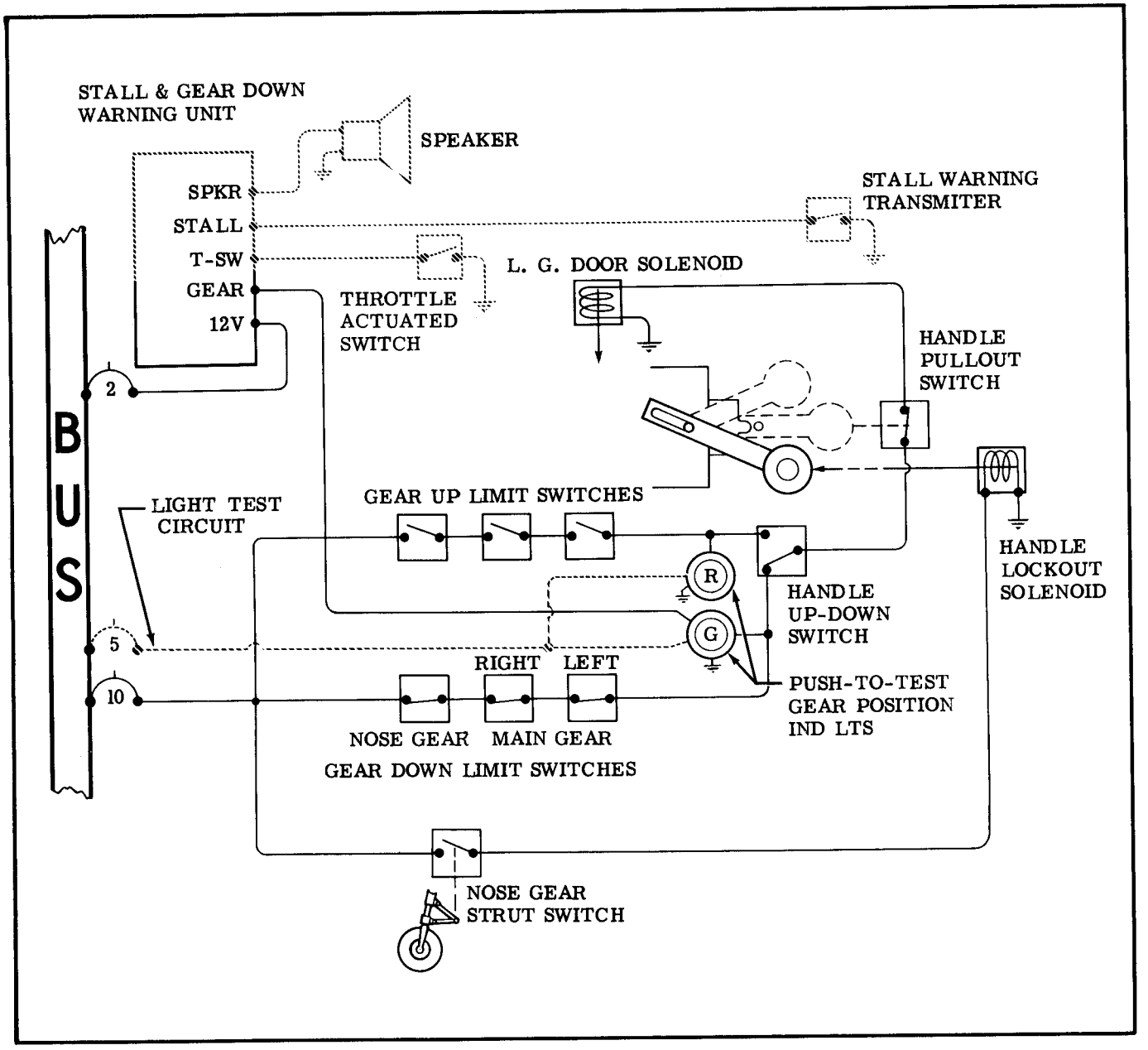


Figure 5-6. Simplified Schematic of Landing Gear Electrical Circuits

5-29. LANDING GEAR ELECTRICAL CIRCUITS.

5-30. The landing gear electrical circuits are shown in figure 5-6, which shows the switches in the gear down and locked, weight-on-gear condition. The following chart describes what each electrical component in the circuit does, and what causes it to operate.

ITEM	OPERATED BY	FUNCTION
Up limit switches - Nose and main Gear.	Gear in near-retracted position.	Close circuit to gear up (red) indicator light and to "NO" terminal of handle up-down limit switch.
Down limit switches - Nose and Main Gear.	Gear in down and locked position.	Close circuit to gear down (green) indicator light and to "NC" terminal of handle up-down limit switch.
Handle up-down limit switch.	Arm on landing gear control handle.	"Preselect" up or down circuit according to handle position.
Handle pull-out switch.	Pin on landing gear control lever.	"Prebreak" the circuit to the solenoid valve.
Solenoid valve (on Power Pack).	Valve is normally in door closed position but moves to door-open position when circuit is broken by handle pull out switch or gear limit switches.	Directs hydraulic flow to open the landing gear doors in proper sequence with landing gear actuation up or down.

NOTE

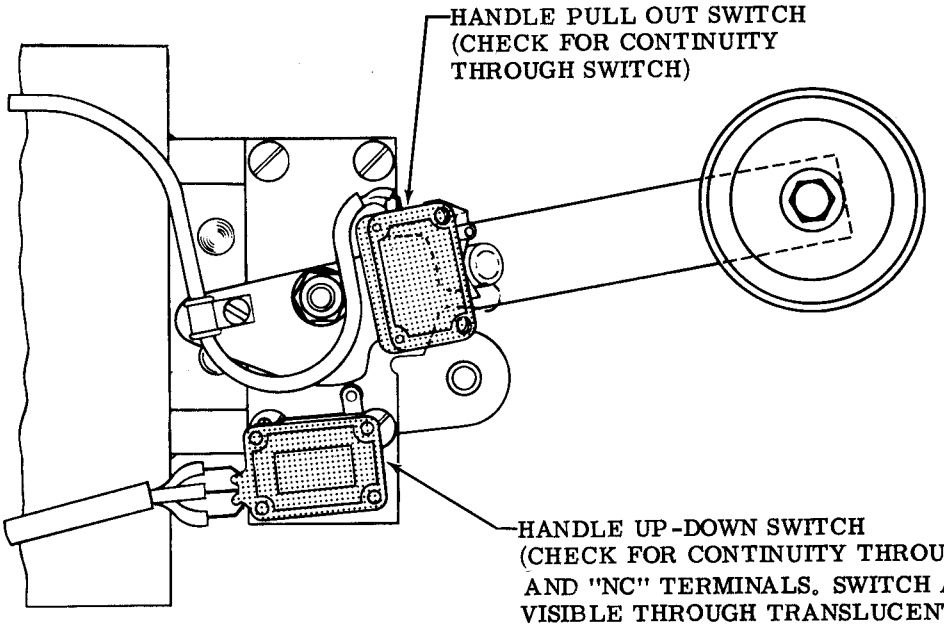
The solenoid valve diverts flow from the gear control valve to sequence the doors open and closed. Movement of the gear control handle across the neutral position detent operates the handle-up-down switch to select the circuit to control the solenoid valve; that is, the switch has closed its contacts to re-energize the solenoid when the last limit switch of the selected up or down circuit has been closed. The handle pull out switch "prebreaks" the solenoid circuit to permit the solenoid to have ample time to operate before hydraulic flow is directed to it from the gear control valve. Design of the circuit causes the doors to open on the first flow of hydraulic fluid if an electrical failure occurs in the system or in the airplane electrical system. In the event of such failure, the doors will remain open after their initial actuation.

NOTE

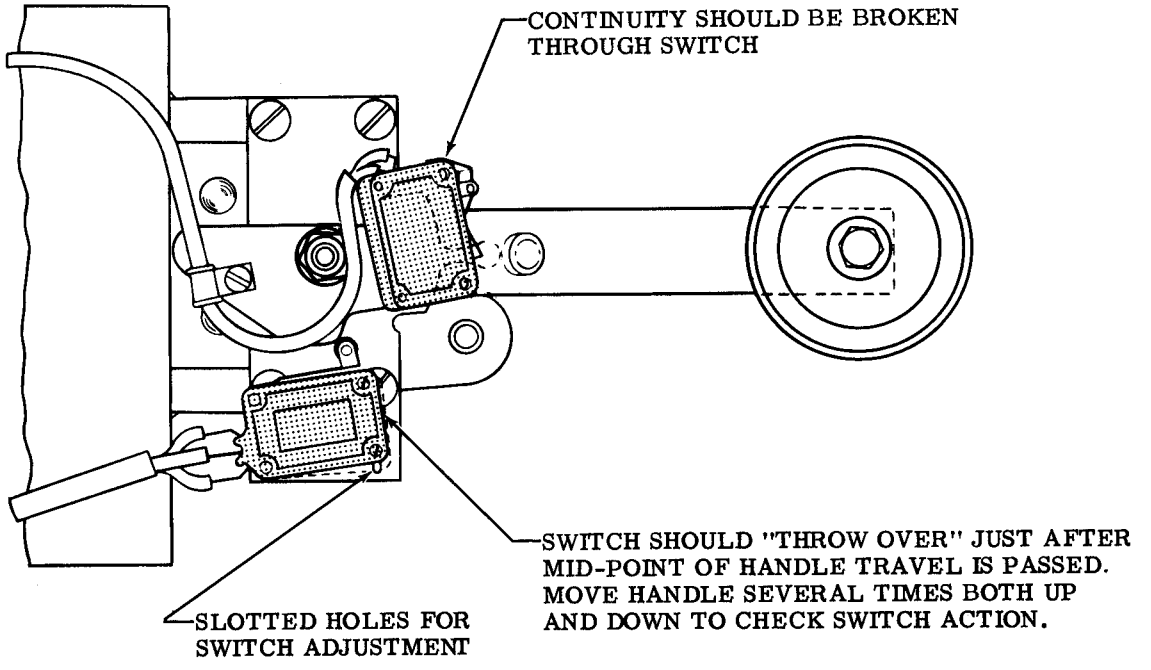
Remember this simple rule: Closed circuit = closed doors; open circuit = open doors. Applying this rule, with the gear handle down, doors can be opened or closed at will by simply turning the master switch on or off and supplying the hydraulic pressure necessary to move the doors with the emergency hand pump.

Nose gear strut switch.	Compression of nose gear strut causes switch to open. As airplane becomes airborne, strut extends and switch is closed.	When airplane weight is on gear switch is open preventing unlocking of handle lock out solenoid, which prevents handle from being moved to gear-up position.
Handle lock-out solenoid.	Nose gear strut switch.	Prevents upward movement of gear handle from gear-down range when airplane weight is on gear.

HANDLE UP



HANDLE PULLED OUT, CENTERED SQUARELY OVER DETENT



NOTE:
WITH HANDLE BELOW DETENT, PULL-OUT SWITCH SHOULD AGAIN BE CLOSED, HANDLE UP-DOWN SWITCH SHOULD BE OPEN BETWEEN "COMM" AND "NO," CLOSED BETWEEN "COMM" AND "NC" TERMINALS.

Figure 5-7. Adjustment of Power Pack Switches

5-31. ADJUSTMENT OF POWER PACK SWITCHES. (See figure 5-7.)

NOTE

The following checks and adjustments are made with the Power Pack decorative cover removed.

a. Handle up-down limit switch: this switch is mounted to the left of and below the landing gear lever and is in circuit with the main gear limit switches and the handle pull out switch. The switch is cam-actuated by the handle lever. The switch mounting holes are slotted to afford a precise adjustment of the switch. With the handle in the position shown in the lower detail of figure 5-7, the switch should be adjusted to break contact between the "Comm" and "NC" terminals.

b. Handle pull-out limit switch: this switch is mounted on the switch lever and is actuated by the pin protruding from the pull-out part of the switch lever. No adjustment of the switch is provided, but a continuity check of the switch may be performed to see that continuity is broken in the switch when the gear handle is pulled out for movement over the detent.

5-32. UP AND DOWN LIMIT SWITCHES are of various types, but all such switches (see figure 5-6) are installed in series to make or break the circuit to the handle up-down switch at a given point in the retraction-extension cycle. Since it is a series circuit, any one of the three switches in either the up or down circuit can leave the circuit open. This guarantees that each landing gear member is in the position shown by the red and green indicator lights.

CAUTION

Be sure you install the correct switch; check the part number carefully. Microswitches of the same appearance and size have different characteristics — and part numbers.

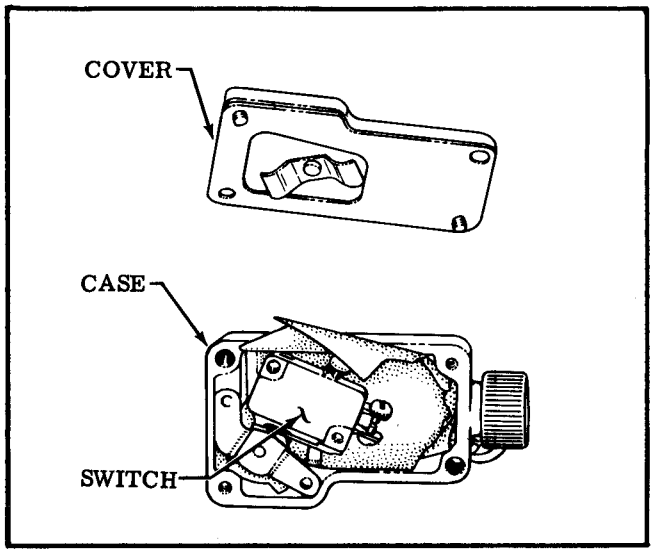


Figure 5-8. Weatherproofing Microswitches

5-33. WEATHERPROOFING MICROSWITCHES. (See figure 5-8.) Encased microswitches in the gear circuits should be packed at installation with DC-4 compound around wire end of switch as a further safeguard against moisture and possible icing.

5-34. HYDRAULIC TOOLS AND EQUIPMENT.

5-35. HYDRO TEST UNIT. A special portable hydraulic servicing unit is available from the Cessna Spare Parts Department. It 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 and wing flap systems.

WARNING

When using the Hydro Test, make sure personnel are in the clear before cycling the 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.

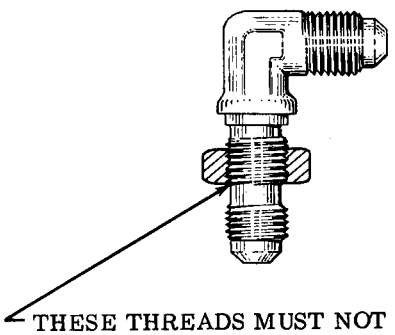
A hydraulic test unit may be assembled locally if desired. Specifications for a test unit are given below:

1.	Flow	1.25 -.50 gpm
2.	Accumulators	None
3.	Reservoir	1 gallon
4.	Check Valve	Aft of Pump in pressure line.
5.	Filter	3 gpm, 10 micron in pressure line after pump and before relief valve.
6.	Relief Valve	Pressure line after filter and discharging to suction line.
7.	Relief Valve Setting	1700 - 00 crack to 1500 psi (min) reseat
8.	Pressure Gage	2000 psi dial on pressure line and snubbed.
9.	Temperature Gage	50 to 200°F at pump outlet.
10.	Suction Hose and Lines	-8 (1/2 inch tube size) (min)
11.	Pressure Hose and Line	-4 (1/4 inch tube size) (min)
12.	Power Input	2 hp (min)

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

1

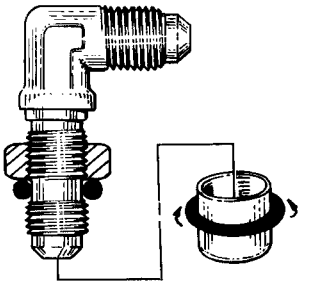
INSTALL NUT



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

2

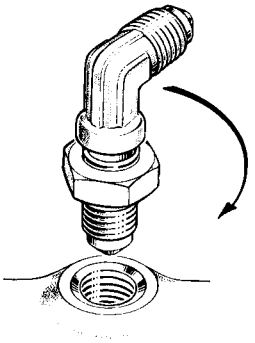
POSITION O-RING



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

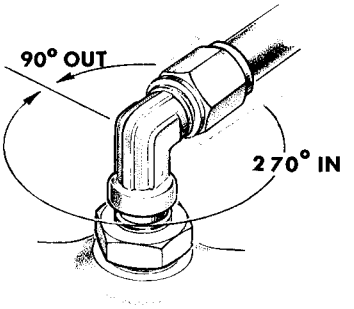
INSTALL ELBOW IN THREADS UNTIL O-RING CONTACTS CHAMFER, AND NUT CONTACTS FACE OF BOSS



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

4

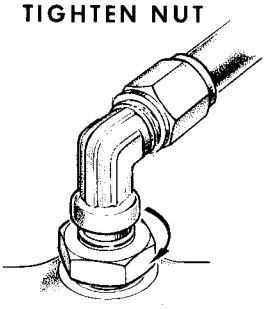
ATTACH LINE TO ELBOW (ELBOW MAY BE TURNED TO LIMITS SHOWN TO ALIGN WITH HOSE OR LINE)



HOLD NUT STATIONARY, TURN FITTING TO DESIRED POSITION.

5

TIGHTEN NUT

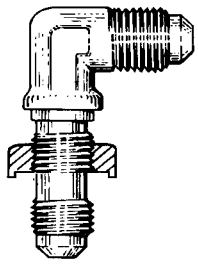


INSTALL O-RINGS CAREFULLY. MOST HYDRAULIC LEAKS ARE CAUSED BY CARELESS INSTALLATION.

Figure 5-9. Installation of Hydraulic Fittings (Sheet 1 of 2)

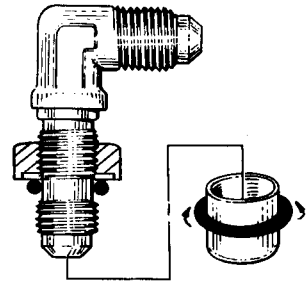
1

INSTALL NUT



2

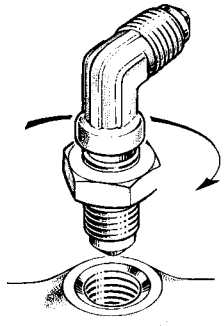
POSITION BACK-UP RING & O-RING



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

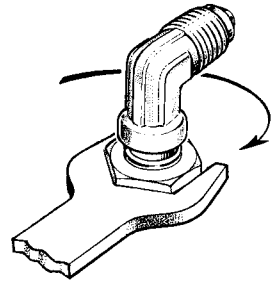
INSTALL ELBOW IN THREADS UNTIL O-RING CONTACTS FACE OF BOSS



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

4

WITH NUT HELD, TURN FITTING IN 1½ TURNS

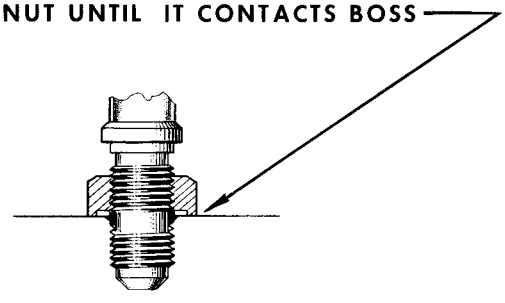


1-1/2 TURNS PLUS A MAXIMUM OF 1 ADDITIONAL TURN TO ALIGN WITH HYDRAULIC LINE.

ATTACH LINE TO FITTING.

5

TIGHTEN NUT UNTIL IT CONTACTS BOSS



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

Figure 5-9. Installation of Hydraulic Fittings (Sheet 2 of 2)

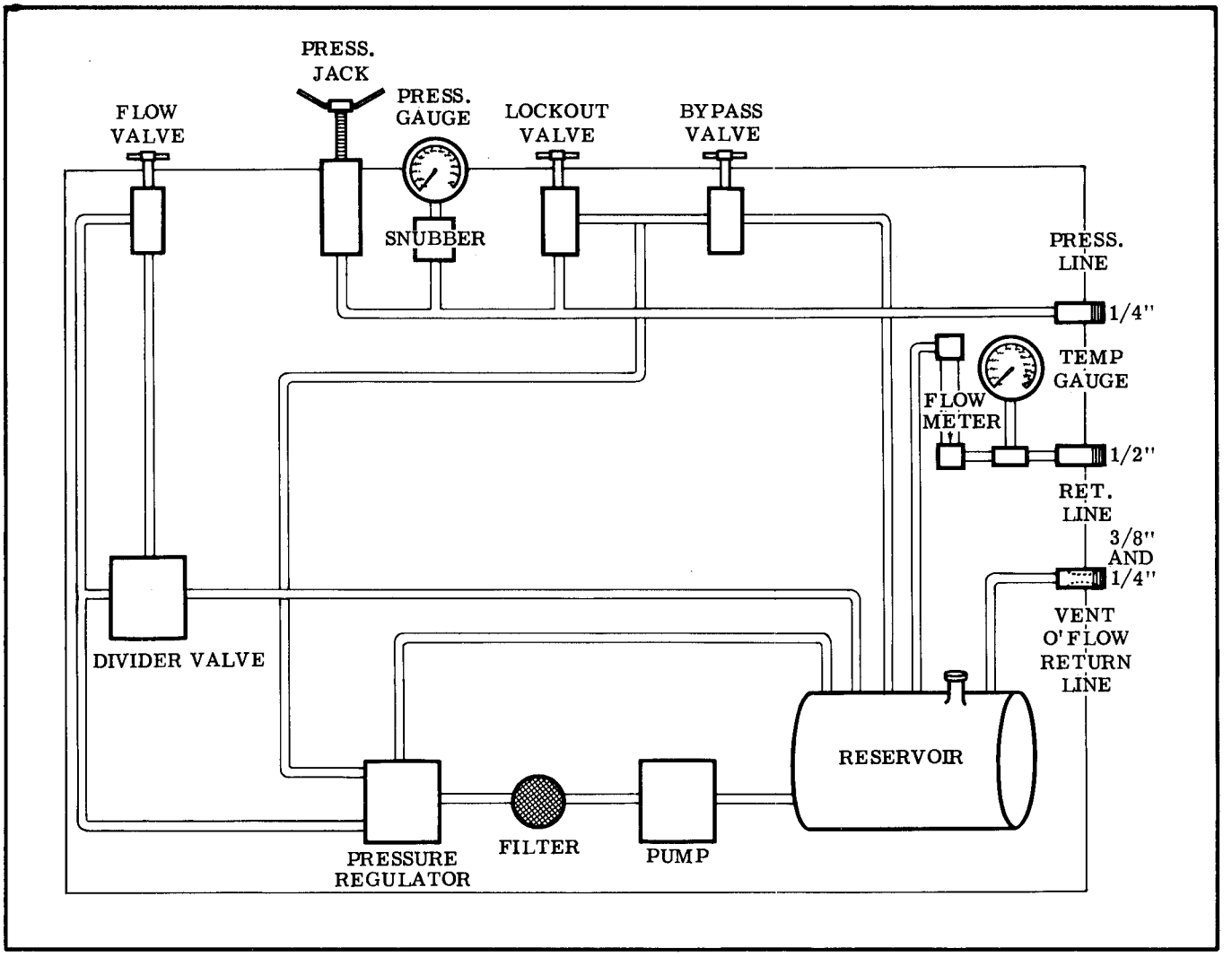


Figure 5-9A. Simplified Schematic of Hydro Test Unit

5-36. HYDROFILL. A special filler can with a manually operated pump is available from the Cessna Spare Parts Department. In addition to providing a handy means of filling hydraulic reservoirs, the unit may be used to bleed brake systems.

5-37. HYDRAULIC LINE BLEED AND TEST PROCEDURES.

CAUTION

1. When proof testing any actuator, with pressure to be applied 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 area across the piston. (The rod side of the piston has less area than the head side. Thus, pressure applied to the head side of the piston may apply a far greater pressure to fluid on the rod side of the piston.)
2. The total of line assemblies, fittings, actuators and any other part subject to hydrostatic pressure shall be deemed faulty due to overstressing if hydraulic pressure in that immediate subsystem is allowed to exceed 2275 psi for any period of time.
3. Use only clean filtered hydraulic fluid per specifications MIL-H-5606 in the system.
4. Hydraulic Oil Preservative, per MIL-O-6083 may be used for flushing and storage of hydraulic components.

5-38. BLEEDING THE LANDING GEAR RETRACTION AND EXTENSION SYSTEM.

NOTE

Bleeding of the hydraulic system may be accomplished by jacking the airplane and using the Hydro Test to cycle the landing gear, door, and wing flap systems through several complete cycles, or by the following procedure.

There are ten actuating cylinders in the entire hydraulic system (including the wing flap system) giving a total of twenty bleed points. Before any attempts are made to bleed the hydraulic system, keep in mind the following rule and always apply it when bleeding any actuating cylinders.

NOTE

"Bleed a cylinder at the end where the piston is." The reason for this is simple. The piston having traveled the full extent of its travel will have pushed practically all the fluid out of the end of the cylinder and back into the line now functioning as a return line. Any air that might have been in this cylinder will also be pushed out into the return line. The air is now in the line and it will be an easy matter to bleed it from the line by disconnecting this line at the cylinder. Reverse the sequence so that this line now becomes the pressure line. Apply a very small amount of pressure and the fluid will flow from the line and expel the air with it. When nothing but clear fluid flows, stop bleeding and reconnect the line. You have now successfully bled the portion of the hydraulic system to that actuator. One more rule before we attempt to bleed. Once a line has been disconnected, take care to insure that the actuator piston remains at the full end of its travel and is not allowed to move, otherwise if it does move, it will draw air back into the cylinder and defeat your purpose.

There is only one reason to have to bleed the hydraulic system, the entrance of considerable air into the hydraulic system. The most probable means for air getting into the system are as follows:

Allowing the reservoir fluid level to become so low the pump picks up air.

Air leaks in the pump suction lines or pump.

Poor maintenance procedures when disconnecting lines, removal and installation of actuators, lines, components, etc.

For bleeding purposes, the hydraulic system can be broken down into three individual sub-systems.

The landing gear system - three actuators.

The landing gear door system - five actuators.

The flap system - two actuators.

a. To bleed accumulator and Power Pack assembly, the airplane need not be placed on wing jacks. Connect Hydro Test and proceed as follows:

1. Expend all hydraulic pressure from system by operating wing flaps.
2. Place landing gear handle in full down position.
3. Place drip cloth over floor carpet on pilot's side.
4. Disconnect gear down line from Power Pack and provide suitable container for fluid to drain into.
5. Slowly apply hydraulic pressure until fluid flows at desired rate. Continue until no more air appears.
6. Stop flow and reconnect line.
7. Wipe line and Power Pack clean of any spilled fluid.
8. Apply hydraulic pressure of 1500 psi and hold for a period of five (5) minutes. If no leaks occur at fitting previously disconnected, bleeding is completed.
9. Remove drip cloth and disconnect Hydro Test unit.

NOTE

It may also be necessary to bleed the engine-driven pump suction hose. If necessary, follow the procedure outlined in paragraph 5-8.

b. To bleed the landing gear system, place airplane on jacks, connect the Hydro Test unit and proceed as follows:

NOTE

In the event a Hydro Test is not available, bleeding can be accomplished with the emergency hand pump. This is not, however, the desired method since it does not afford a suitable means of proof testing for leaks at line connections after completion of bleeding.

1. Disconnect the left hand nose strut door and place landing gear in retracted position.
2. Expend hydraulic pressure from accumulator by operating wing flaps.
3. Place landing gear handle in full down position.
4. Disconnect nose gear down line at actuating cylinder and provide container for fluid to drain into.
5. Slowly apply sufficient pressure with Hydro Test or hand pump until fluid flows at desired rate. Continue until no more air appears.
6. Stop flow and reconnect down line to nose gear actuator.
7. Wipe lines and actuator clean of any spilled fluid.
8. Disconnect gear down line from one main gear actuator.
9. Repeat step 5.
10. Stop flow and reconnect main gear line.
11. Repeat step 7.
12. Repeat steps 8, 5, 6, and 7, on remaining main gear actuators.
13. Apply pressure to extend gear to full down position.
14. Turn off master switch and apply 1500 psi. Handle will remain down as long as master switch is off.
15. Check all three lines previously disconnected for evidence of leaking at connection to actuator. Hold pressure for five minutes. If no leaks appear, release pressure.

Bleeding the gear up lines will require the following procedure:

16. Place landing gear in full extended position.
17. Expend all hydraulic pressure by operating wing flaps.
18. Place gear handle in full up position.
19. Disconnect nose gear up line.

NOTE

Since fluid must pass through the main gear unlocking valve in bleeding the gear up lines, it will be necessary to support the gear to pre-

vent its dropping aft after the unlocking valve has released. Failure to do so will result in these actuating cylinders moving away from the desired position and pulling the air back into the cylinders.

20. Slowly apply pressure until fluid begins to flow at desired rate. More pressure will be needed to unseat the priority valve. Continue until no more air appears.
21. Stop flow and reconnect line.
22. Wipe lines and actuator clean of any spilled fluid.
23. Reconnect left hand nose strut door.
24. Disconnect gear up line from one main gear actuator. Keep in mind the above note.
25. Repeat steps 20, 21, and 22.
26. Repeat steps 24, 20, 21, and 22 on remaining gear actuator again keeping in mind the note above. Be certain to remove before retracting.
27. Apply pressure to retract gear to full up position.
28. Turn off master switch and apply 1500 psi for five minutes.
29. Check all three lines previously disconnected for evidence of leaks at connection to actuating cylinders.
30. If no leaks appear, you have completed all the steps necessary to purge all air from the landing gear actuating system.
31. The airplane may now be removed from the jacks.
32. If reason exists to suspect air has entered the Power Pack and pump, refer to the procedure for bleeding the Power Pack and regulator assemblies.

c. To bleed the landing gear door system, the airplane need not be placed on jacks. Connect Hydro-Test unit and proceed as follows:
1. Place gear handle in full down position, turn master switch off and apply pressure as necessary to open gear doors fully.
2. Disconnect nose wheel doors from actuating rods and main gear wheel doors from actuating cylinders. Do not detach main gear strut doors from actuating cylinders; the linkage is spring loaded.
3. Expend all pressure from accumulator by operating flaps.
4. Disconnect door closed line from nose wheel door actuating cylinders.
5. Turn master switch on and slowly apply pressure until fluid beings to flow at desired rate. Continue until no more air appears.
6. Stop flow and reconnect line.
7. Wipe line and actuator clean of any spilled fluid.
8. Disconnect door closed line on left hand main gear strut door actuating cylinder and repeat steps 5, 6, and 7.
9. Disconnect door closed line on right hand main gear strut door actuating cylinder and repeat steps 5, 6, and 7.
10. Disconnect door closed line on left hand main wheel door and repeat steps 5, 6, and 7.
11. Disconnect door closed line on right hand main wheel door and repeat steps 5, 6, and 7.
12. This completes the bleeding procedures for the door closed side of the system.
13. Hold gear handle in full down position and apply 1500 psi for five minutes. No leaks should occur at any of the five connections previously disconnected. If not, proceed with bleeding the door open side of the system.
14. With gear handle in full down position, place master switch on and allow door actuating cylinders to return to door closed position.
15. Expend all pressure by operating wing flaps and turn off master switch.
16. Beginning with nose wheel door actuating cylinder, bleed all five door cylinders from door open side of system with same procedures as used for bleeding the doors closed side of the system.
17. Upon completion of bleeding all five door cylinders, hold gear handle down, master switch off and apply 1500 psi for five (5) minutes. If no leaks occur, this completes bleeding of the landing gear door system.
18. Reconnect all doors to actuating cylinder and or actuating rods.

d. To bleed the wing flap system, see Section 7.

5-39. CHECKING HYDRAULIC FLUID CONTAMINATION. At the first 100 hour inspection; thereafter at each 500 hours or one year, whichever comes first, the hydraulic fluid should be checked in accordance with the following steps:

a. Disconnect a door actuator hose and drain a small quantity of fluid by actuating the hand pump. If the fluid is clear and is not appreciably darker in color than new fluid, continue to use the present fluid.

b. If the fluid coloration is doubtful, place fluid sample in a non-metallic container and insert a strip of polished copper in the fluid. Keep copper in the fluid for six hours at a temperature of 70°F or more. A slight darkening is permissible but there should be no pitting or etching visible up to 20x magnification.

5-40. MAIN LANDING GEAR.

5-41. Main landing gear struts rotate aft and inboard to stow the wheels in the lower fuselage beneath the baggage compartment. The struts are held in the extended position by the downlock pawls which are released by the single-acting lock cylinder prior to extension of the gear. A rotary actuator composed of a double-acting hydraulic cylinder powering a rack and pinion gear rotates each landing gear.

5-42. REMOVAL OF MAIN WHEELS. (See figure 5-11.)

NOTE

This paragraph involves removing the wheel from the axle. The procedure may be used for tire replacement, wheel bearing replacement, and replacement of wheel brake parts.

a. Jack the wheel, using the universal jack point.
b. Remove the outer dust cover.
c. Remove cotter pins and axle nut.

d. Pull the wheel assembly off the axle, leaving the brake disc in place in the brake assembly. Cantilever brake clips must be disengaged from disc.

5-43. DISASSEMBLY OF MAIN WHEELS.

a. Completely deflate the tire by inserting inflation needle and removing inflation needle valve core.

WARNING

Injury can result from attempting to separate wheel halves with tire inflated. Avoid damaging wheel flanges when loosening tire beads.

b. Break tire beads loose.

c. Remove thru-bolts and separate wheel halves.

d. Remove tire.

e. Remove bearing retaining rings, grease seals, and bearing cones.

NOTE

To remove the bearing cups, heat the wheel half in boiling water for 15 minutes. Using an arbor press, if available, press out the bearing cup and press in the new one while the wheel is still hot.

5-44. INSPECTION AND REPAIR OF MAIN WHEELS.

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

b. Inspect wheel halves for cracks. Cracked wheel halves should be replaced. Sand out nicks, gouges, and corroded areas. Where the protective coating has been removed, the area should be cleaned thoroughly, primed with zinc chromate primer, and repainted with aluminum lacquer.

c. Brake discs should be replaced if excessively scored or warped. Small nicks and scratches should be sanded smooth.

d. Bearing cups and cones should be inspected carefully for damage and discoloration. After cleaning, repack bearing cones with clean bearing grease before installation in the wheel.

5-45. ASSEMBLY OF MAIN WHEELS.

a. Place outboard wheel half in tire. Insert thru-bolts, position inboard wheel half, and secure with nuts and washers. Torque to value marked on wheel.

CAUTION

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

b. Clean and repack bearing cones with clean wheel bearing grease.

c. Assemble bearing cones, seals, and retainers into the wheel halves.

5-46. INSTALLATION OF MAIN WHEELS.

a. Place wheel on axle.

b. Position disc in the wheel as the wheel is being slipped into place. The cantilever anti-rattle disc clips must be raised at one end while installing the disc.

c. Make sure outer bearing, seal, and retaining parts are in place, then install axle nut and tighten until a slight bearing drag is obvious when the wheel is turned. Back off the nut to the nearest castellation and install cotter pins.

d. Install the outer dust cover. Remove jack.

5-47. REMOVAL OF MAIN WHEEL AND AXLE.

a. Disconnect, drain, and plug the hydraulic brake line at the brake cylinder.

b. Remove the wheel in accordance with paragraph 5-42.

c. Remove the nuts and bolts securing axle and brake components to the spring strut. Note the number and position of the wheel alignment shims. Mark these shims or tape them together carefully so they will be reinstalled in exactly the same position to ensure that wheel alignment is not disturbed. Remove axle and brake components.

5-48. INSTALLATION OF MAIN WHEEL AND AXLE.

a. Secure axle and brake components to spring strut, making sure that wheel alignment shims are reinstalled in their original positions.

b. Install the wheel assembly in accordance with paragraph 5-46.

c. Connect brake line. Fill and bleed the brake system.

5-49. REMOVAL OF MAIN GEAR AND ACTUATOR.

a. Jack the aircraft.

b. Remove the rear seat, the rear carpet over the raised portion of the floorboard, and the access plate over the actuator.

c. Remove the main wheel and strut in accordance with the following steps:

1. Disconnect the brake line from the elbow threaded into the saddle plate assembly.

2. Disconnect the leads to the microswitch mounted above the inboard end of the strut.

3. Press downlock pawl inboard to release gear as necessary to remove cone bolt through gear and saddle. Retain switch, bracket and nut.

4. Remove the bolts securing the cap which clamps the strut to the saddle.

NOTE

On early serials, the cap is bonded to the strut. If the strut is defective and will be replaced, the cap may be knocked loose from the strut after the strut is removed.

5. Remove the main landing gear spring with the wheel attached.

d. Disconnect hydraulic lines at actuator ports.

e. Disconnect brake line at swivel fitting. Remove swivel fittings.

f. Remove bolts attaching saddle assembly flange to the rotary actuator flange.

g. Remove bolts attaching actuator mounting flange to the bulkhead casting, and holding saddle assembly in place, move the actuator inboard to separate the actuator from the saddle assembly. Work the actuator free and remove. Note position of O-ring seal between the mating flanges of the rotary actuator and the saddle plate.

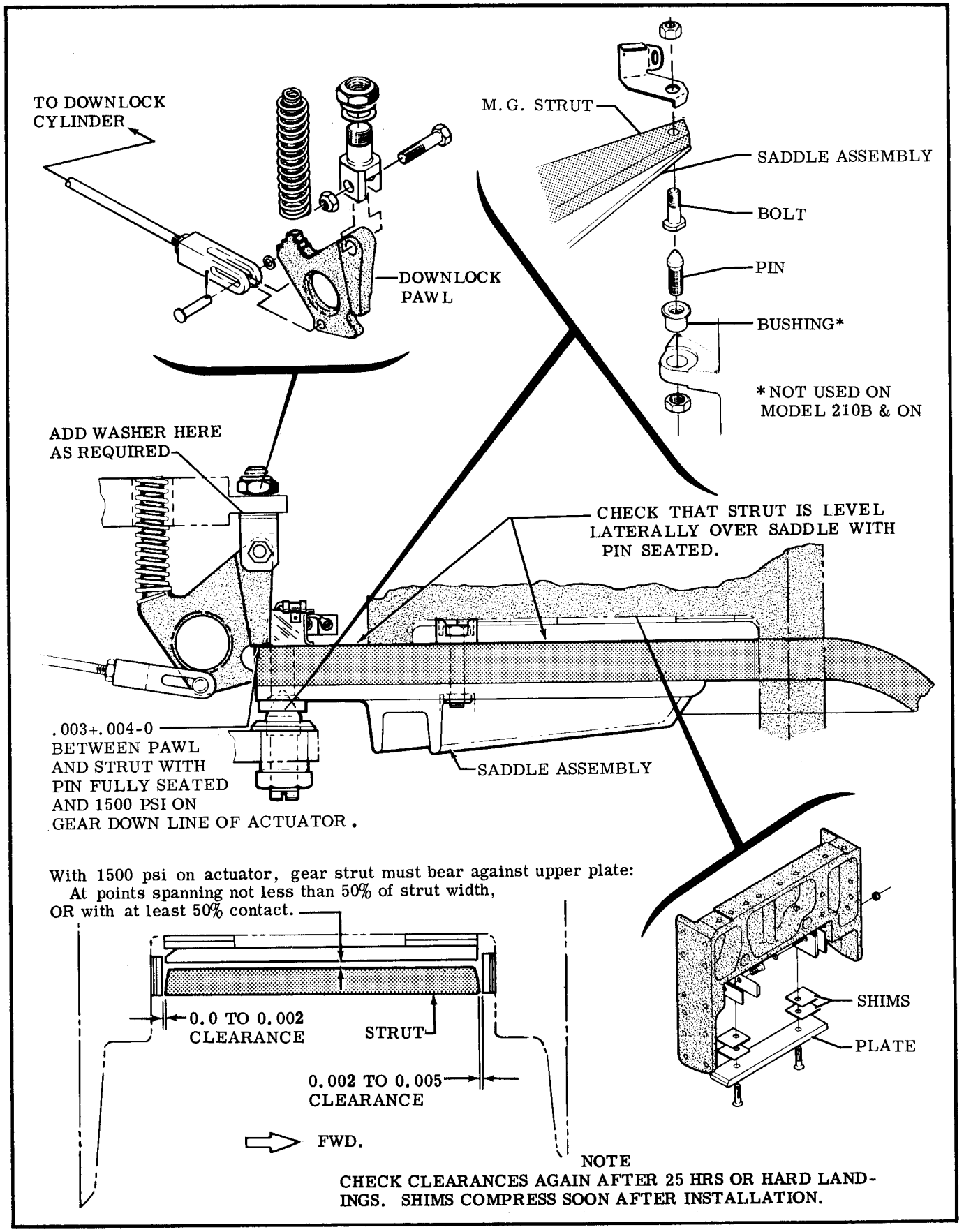
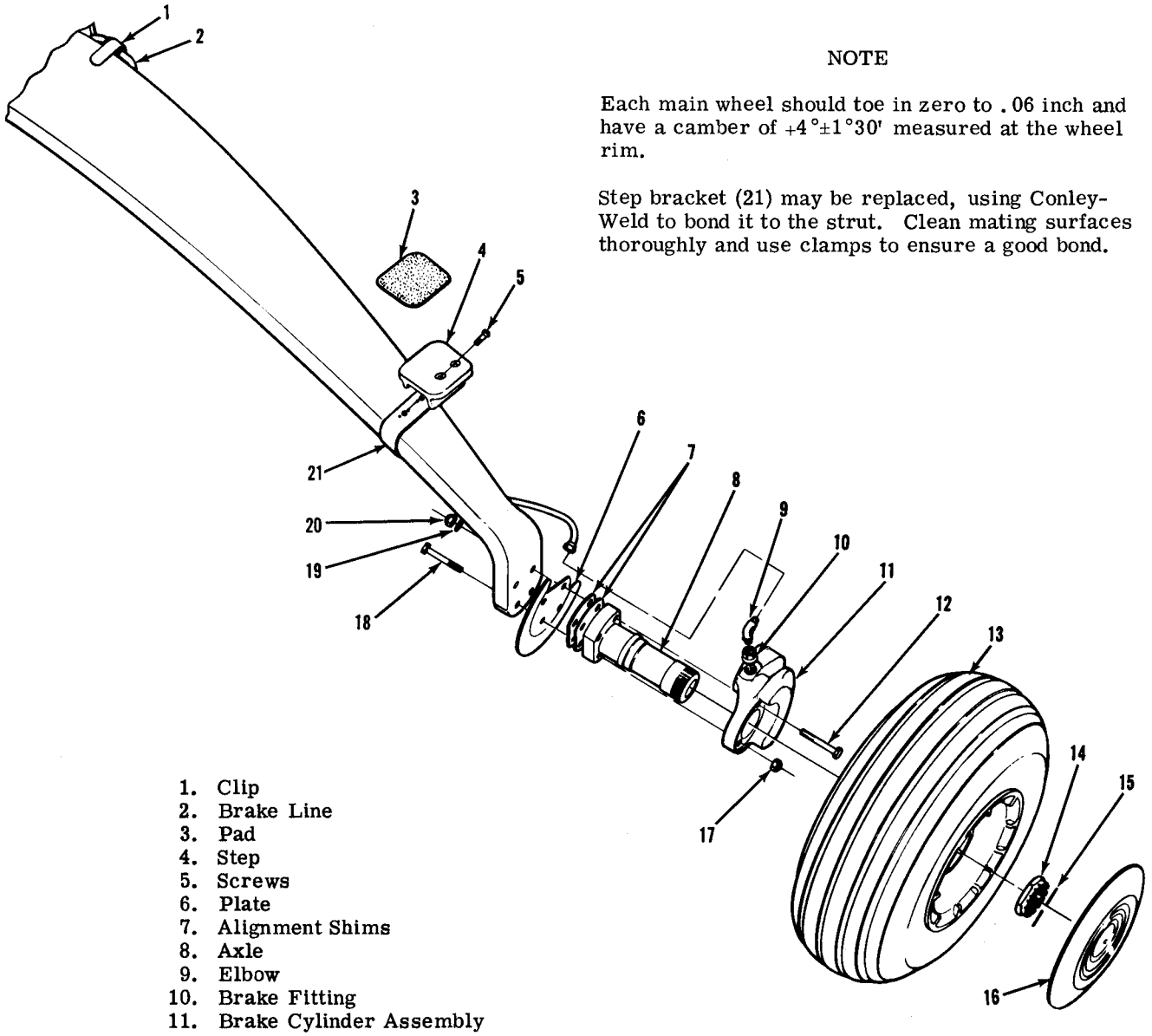


Figure 5-10. Main Gear Alignment Details



NOTE

Each main wheel should toe in zero to .06 inch and have a camber of +4°±1°30' measured at the wheel rim.

Step bracket (21) may be replaced, using Conley-Weld to bond it to the strut. Clean mating surfaces thoroughly and use clamps to ensure a good bond.

1. Clip
2. Brake Line
3. Pad
4. Step
5. Screws
6. Plate
7. Alignment Shims
8. Axle
9. Elbow
10. Brake Fitting
11. Brake Cylinder Assembly
12. Bolt
13. Main Wheel Assembly
14. Axle Nut
15. Cotter Pins
16. Hub Cap
17. Nut
18. Bolt
19. Washer
20. Nut
21. Step Bracket

NOTE

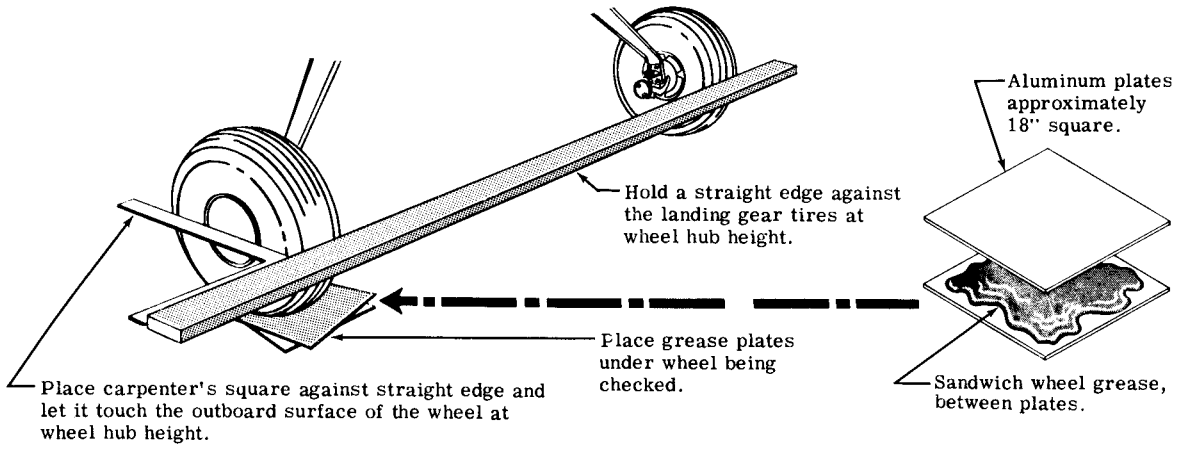
Goodyear Wheel balancing kits are available:
#9524859 is used for the nose wheel
#9524877 is used for each main wheel

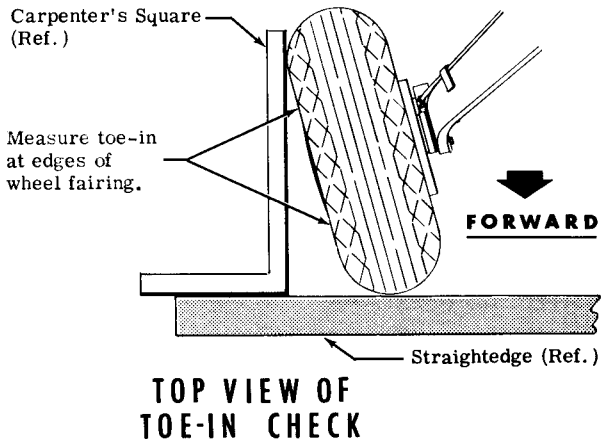
Figure 5-11. Main Wheel Installation

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

NOTE

Setting toe-in and camber in accordance with the chart while the cabin and fuel tanks are empty will give approximately zero toe-in and zero camber at gross weight. Ideal setting is zero toe-in and zero camber at normal operating 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 condition under which the airplane normally operates.





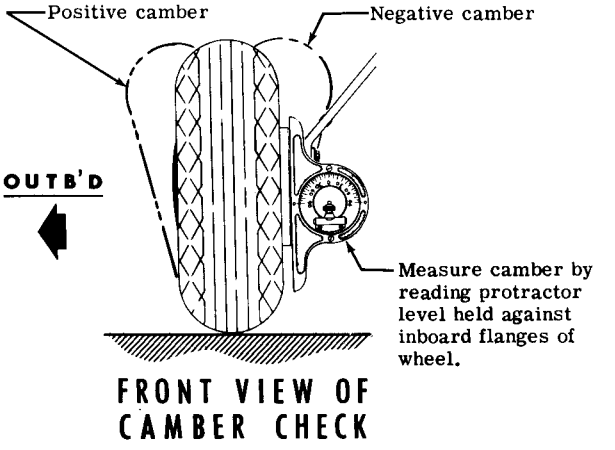


Figure 5-11A. Checking Wheel Alignment

SHIM CHART FOR ➧ MODEL 210 AIRCRAFT PRIOR TO SERIAL 21057841

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	.06"	----	----	0°3'
	FWD	----	.06"	0°3'	----
0541157-2	UP	.006"	----	0°30'	----
	DOWN	----	.006"	----	0°30'
1241061-1	UP & FWD	.03"	----	2°50'	----
	UP & AFT	.06"	----	2°49'	----
	DOWN & FWD	----	.06"	----	2°49'
	DOWN & AFT	----	.03"	----	2°50'
0411139-5	UP & FWD	----	.11"	0°25'	----
	UP & AFT	.12"	----	0°11'	----
	DOWN & FWD	----	.12"	----	0°11'
	DOWN & AFT	.11"	----	----	0°25'
0441139-6	UP & FWD	----	.22"	0°50'	----
	UP & AFT	.24"	----	0°22'	----
	DOWN & FWD	----	.24"	----	0°22'
	DOWN & AFT	.22"	----	----	0°50'

SHIM CHART FOR ➧ MODEL 210 SERIAL 21057841 & ON, AND 205 & 206 SERIES

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	.06"	----	----	0°3'
	FWD	----	.06"	0°3'	----
0541157-2	UP	.006"	----	0°30'	----
	DOWN	----	.006"	----	0°30'
1241061-1	UP & FWD	.008"	----	2°50'	----
	UP & AFT	.04"	----	2°49'	----
	DOWN & FWD	----	.04"	----	2°49'
	DOWN & AFT	----	.008"	----	2°50'
0441139-5	UP & FWD	----	.11"	0°25'	----
	UP & AFT	.12"	----	0°11'	----
	DOWN & FWD	----	.12"	----	0°11'
	DOWN & AFT	.11"	----	----	0°25'
0441139-6	UP & FWD	----	.22"	0°50'	----
	UP & AFT	.24"	----	0°22'	----
	DOWN & FWD	----	.24"	----	0°22'
	DOWN & AFT	.22"	----	----	0°50'

Figure 5-11B. Alignment Correction Imposed on Wheel by Various Shims

h. Slide the saddle assembly inboard, free of the bearing.

NOTE

Seal or tape the exposed saddle bearing to exclude dirt.

5-50. INSTALLATION OF MAIN GEAR AND ACTUATOR.

NOTE

Examine and understand the rigging checks depicted in Figure 5-21 before beginning this installation.

a. Level the aircraft laterally on jacks. Connect Hydro Test or other hydraulic power source to the system.
b. Carefully clean the bronze saddle bearing and journal, coat the bearing with MIL-G-7711 grease, and insert the saddle journal in the bearing.
c. Work the actuator into position, make sure O-ring seal is in groove on actuator flange, and install bolts which attach saddle and actuator flanges.
d. Install and safety bolts which attach the actuator to the structure.
e. Connect hydraulic lines to the actuator.
f. Install brake line swivel fitting and line at shaft fitting.
g. Install support pin in threaded bushing, but do not tighten locknut.
h. Mix and apply Conley Weld to bond the switch bracket to the spring, then install the cone-bolt up through the saddle, landing gear spring, and downlock switch bracket.
i. Install cap, but do not tighten nuts, for further shifting of the spring on the saddle may be necessary.
j. Using C-bar (Special Tool SE-587-1) and a spirit level, check that gear is level laterally over the saddle with 1500 psi hydraulic pressure on down-port of actuator. This is to ensure full seating of the pin support bolt and cone bolt. Adjust the pin support bolt up or down to achieve this, then tighten locknut.
k. Manually move the gear to retracted position to check its fit in the gear bay. Adjust this alignment if necessary, then tighten down the bolts which clamp the cap over the landing gear strut. Torque nuts to 170-180 in. lb.
l. Install downlock pawl. Have the cone bolt seated on pin. (with 1500 psi on gear down port of actuator, clearance between the pawl and strut spring is .003 +.004-000.) Add or remove washers between fork bolt and structure as necessary.

NOTE

Refer to figure 5-21. Check that the end of the strut will clear the fork bolt as it goes through its retraction arc. Sometimes it is necessary to file away a corner of the fork bolt to achieve proper clearance.

m. Check that pawl is centered in bulkhead slot. Turn the fork bolt to align the pawl in slot.
n. Adjust the downlock switch per figure 5-21.
o. Adjust downlock pawl linkage, using .060 feeler gauge (SE587-3 checking gauge) between pawl and inboard end of L.G. strut as strut is beginning to retract. The downlock actuator must be compressed. This ensures that the gear will not hang up on the pawl.
p. With gear down locked and 1500 psi on down port of main gear actuator, check clearance between main gear strut and shim plates. Proper clearances are given in figure 5-10. Shim the plates as necessary.

NOTE

The gear is designed to have the weight of the airplane supported by the structure at the shim plates and the support pin. If shimming here is inadequate, excessive load will be applied to the saddle and actuator. If shimming is excessive, the gear will not down-lock. With the gear properly rigged, the saddle and actuator serve to actuate the gear but do not bear the landing load.

q. Install elbow at saddle, connect brake line and bleed to the brake system.
r. Check main gear uplock in accordance with figure 5-21.
s. Check main wheel alignment in accordance with paragraph 5-59 and figure 5-11A.

5-51. SADDLE BEARING REPAIR. A worn saddle bearing may necessitate reaming the bearing oversize and installing an oversize bushing to fit the bearing. The bearing should be hand-reamed after the landing gear, saddle assembly and gear actuator have been removed to gain access to the bronze bearing.

5-52. REAMING A NEW SADDLE. When replacing a main landing gear saddle assembly it is essential that the cone bolt hole in the saddle be directly centered over the landing gear inboard support pin. This will ensure that the inboard support pin and the cone bolt fit snugly when the landing gear is extended. Saddle assemblies are manufactured with only a pilot hole in the cone bolt location and the actual cone bolt hole is reamed to fit each individual installation. Since reaming the cone bolt hole in a new saddle assembly requires pulling the reamer through the saddle from the top instead of pushing up from below, a special tool kit has been prepared and is furnished if a new saddle assembly is ordered. This special tool kit (A22952) is furnished as Service Kit, SK210-7, and contains instructions, and components necessary to locate and ream the cone bolt hole. The tools are furnished on a loan basis.

5-53. DISASSEMBLY AND REPAIR OF MAIN GEAR ACTUATOR. Refer to Appendix A for disassembly and repair of the main gear actuators.

5-54. REMOVAL AND INSTALLATION OF MAIN GEAR UPLOCK MECHANISM. Figure 5-13 shows details of the main gear and main wheel door uplock mechanism and may be used as a guide during replacement of parts. To remove the lock cylinder, proceed as follows:

NOTE

This uplock cylinder and latching mechanism is located on the forward bulkhead of the main wheel well.

a. Disconnect hydraulic lines attached to the lock cylinder.
b. Remove the cotter and clevis pins attaching the hydraulic cylinder rod to the bellcrank link.
c. Remove the two nuts and bolts attaching the hydraulic cylinder to the bulkhead.
d. Remove the nut, washers and bolt attaching the bellcrank to the bulkhead.
e. Remove latch springs from each latch plate.
f. Remove screws and bolts attaching latch plate to the bulkhead. Remove bellcranks, linkage and latches.
g. Install uplock latch system by reversing the steps outlined above.
h. Adjust the uplock hooks in accordance with paragraph 5-110.

5-55. DISASSEMBLY AND REPAIR OF MAIN GEAR UPLOCK CYLINDER. Refer to Appendix A for disassembly and repair of the main landing gear uplock cylinder.

5-56. REMOVAL AND INSTALLATION OF MAIN GEAR DOWNLOCK RELEASE CYLINDER. Removal of the main gear downlock release cylinder consists of disconnecting the hydraulic lines and push-pull rods to the downlock pawls. Then remove mounting bolts and work actuator from airplane. Reverse procedure to install cylinder.

5-57. DISASSEMBLY AND REPAIR OF DOWNLOCK RELEASE CYLINDER. Refer to Appendix A for disassembly and repair of the main gear downlock release cylinder.

5-58. MAIN GEAR RIGGING. Refer to paragraph 5-106 for rigging and adjustments to the main landing gear.

5-59. MAIN WHEEL ALIGNMENT should be achieved after the gear strut is aligned. Correct alignment is obtained through the use of tapered shims between gear strut and the flange of the axle. See figure 5-11A for procedure to use in checking alignment. Wheel shims are listed on figure 5-11A. See figure 5-11B for alignment correction imposed on the wheel by the various shims.

NOTE

Failure to obtain acceptable wheel alignment through the use of the shims indicates a deformed or badly aligned main gear strut.

5-60. MAIN GEAR DOOR SYSTEM.

5-61. Main gear doors, shown in figure 5-12, open for main gear retraction or extension and return to closed position at the completion of either cycle. The strut doors are opened and closed by double-acting hydraulic actuators. These doors have no lock-cylinder, but are secured by a spring-loaded mechanism. The main wheel doors are opened and closed by double-acting hydraulic actuators. These doors are held in the closed position by spring-loaded hooks which are released hydraulically just before the main gear uplock hooks are released.

5-62. REMOVAL AND INSTALLATION OF MAIN WHEEL DOORS.
a. Disconnect actuating linkage by removing nut and bolt at each door.
b. Working from inside the tailcone, unsafety and pull the hinge pin aft. Door will fall free.
c. Reinstall door by reversing the preceding procedure.
d. Refer to paragraph 5-107 for main gear door system rigging and adjustments.

5-63. MAIN WHEEL DOOR ACTUATOR REMOVAL AND INSTALLATION.
a. Disconnect hoses from actuator.
b. Disconnect actuating rod by removing attaching nut and bolt at each door.
c. Remove nut and bolt securing actuator to fuselage bracket and remove actuator.
d. Install actuator by reversing the procedures outlined above.

5-64. DISASSEMBLY AND REPAIR OF ACTUATOR. Refer to Appendix A for disassembly and repair of door actuating cylinders.

5-65. REMOVAL AND INSTALLATION OF MAIN GEAR STRUT DOORS.
a. Disconnect actuator linkage from each door by removing the attaching cotter and clevis pins.

CAUTION

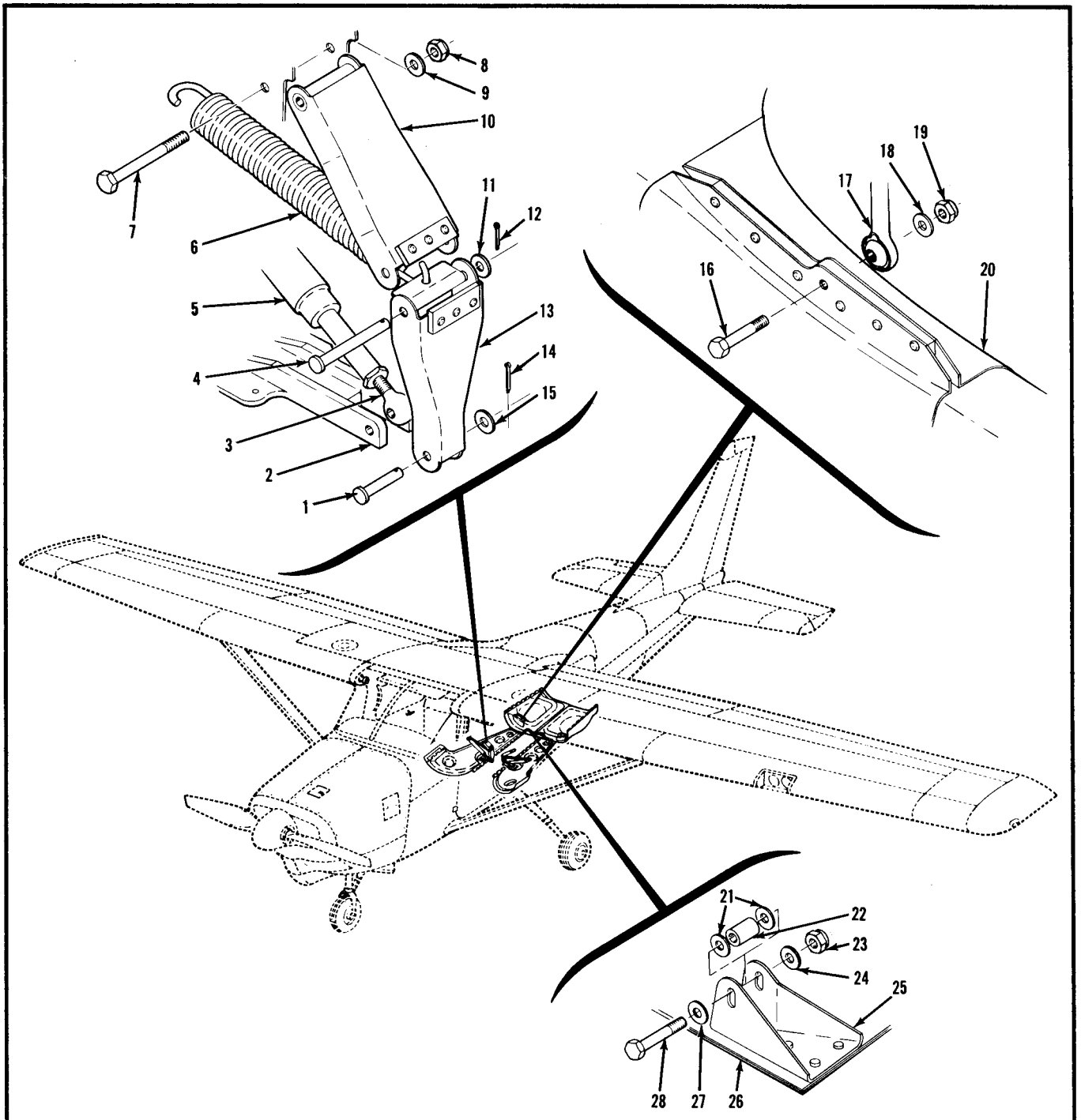
Actuating arm linkage is spring-loaded and will swing outboard rapidly when actuator is detached. Stay clear to avoid injury.

b. Remove small cotter pins at each end of hinge pin, then pull hinge pin aft for removal. Door will fall free.
c. Reverse procedures listed above to install each strut door.

5-66. REMOVAL AND INSTALLATION OF MAIN GEAR STRUT DOOR ACTUATORS.
a. Disconnect hydraulic hoses at the actuator.
b. Remove pin attaching actuator rod end to the door arm.

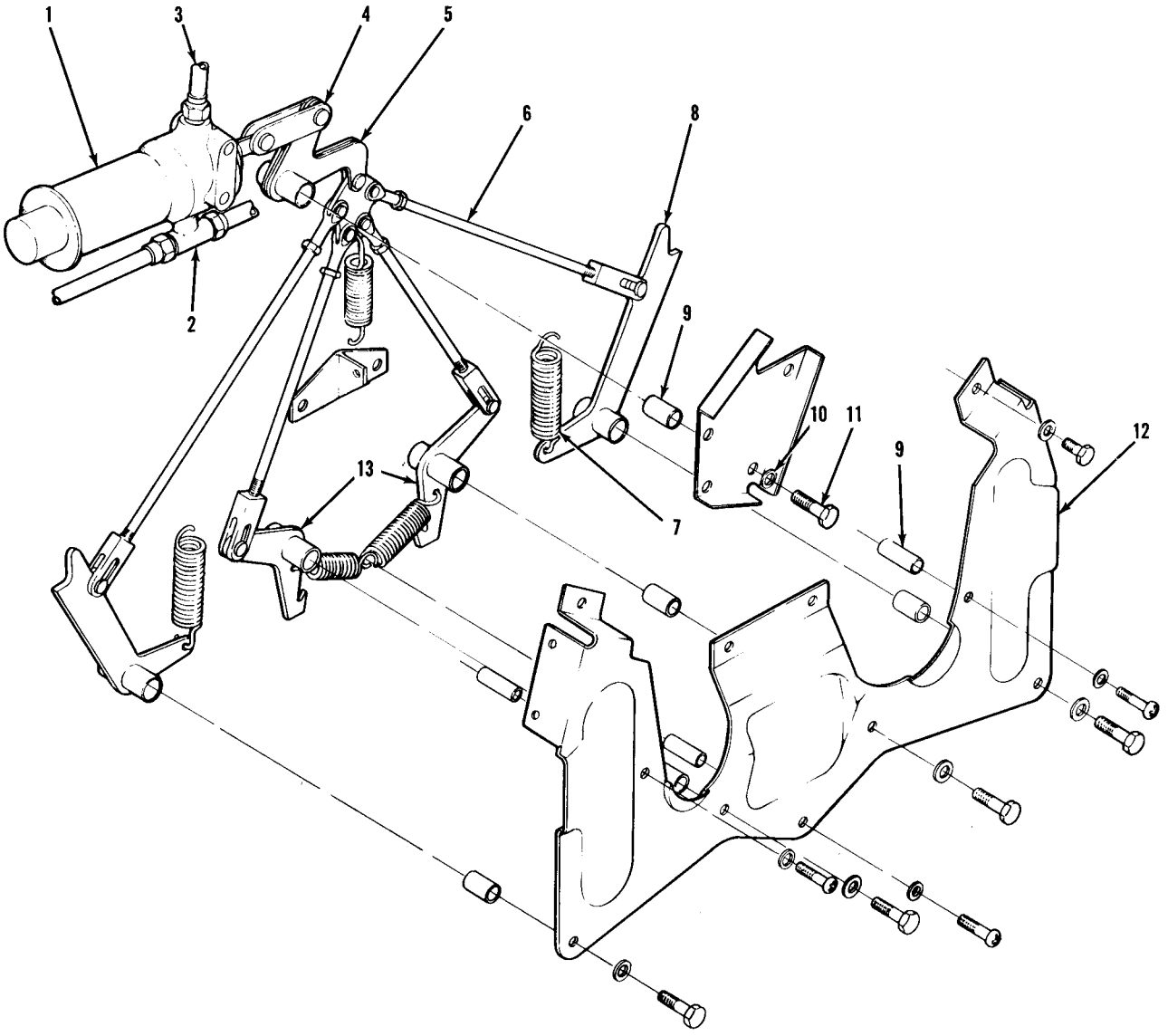
CAUTION

This linkage is spring-loaded and will swing outboard rapidly when clevis pin is removed. Stay clear to avoid injury.



1. Pin
2. Strut Door Arm
3. Actuator Rod End
4. Pin
5. Actuator
6. Spring
7. Bolt
8. Nut
9. Washer
10. Counterbalance Arm
11. Washer
12. Cotter Pin
13. Counterbalance Arm
14. Cotter Pin
15. Washer
16. Bolt
17. Wheel Door Actuator
18. Washer
19. Nut
20. Wheel Door
21. Washers
22. Uplock Bushing
23. Nut
24. Washer
25. Bracket
26. Wheel Door
27. Washer
28. Bolt

Figure 5-12. Main Gear Doors



1. M. G. Uplock Cylinder
2. Tee (To M. G. Actuator)
3. Line (From Strut Door Open Actuator)
4. Link
5. Bellcrank
6. M. G. Uplock Push Pull Tie Rod
7. Stop Spring
8. M. G. Stop Assembly
9. Spacer
10. Washer
11. Bolt
12. Plate
13. Door Latches

Figure 5-13. Main Gear and Wheel Door Uplocks

c. Remove nut and bolt attaching actuator to the fuselage structure and remove the actuator.
d. Install the actuator by reversing the procedures listed above.

5-67. DISASSEMBLY AND REPAIR OF ACTUATORS. Refer to Appendix A for disassembly and repair of door actuating cylinders.

5-68. NOSE GEAR.

5-69. The nose gear shock strut is pivoted just forward of the firewall. The nose gear is extended and retracted by a double-acting hydraulic cylinder, the forward end of which contains the nose gear downlock. Initial action of the cylinder disengages the downlock before retraction begins. A separate single-acting hydraulic cylinder unlocks the nose gear uplock hook. Main components of the nose gear are listed in the Chart which follows:

ITEM	PURPOSE	LOCATION AND ACCESS
N. G. Shock strut.	To support the nose wheel, cushion landing shock by air-oil suspension action and afford nose wheel steering through use of rudder pedals.	
Actuator (double-acting hydraulic cylinder).	(1) Extend and retract the nose gear. (2) Serve as a rigid drag strut in gear-down position.	Aft of nose gear shock strut.
Up lock cylinder.	(1) To engage and hold nose gear strut in up position. (2) To lock N.G. forward doors in closed position.	Midway forward in nose gear well.

NOTE

Study the foldout illustrations at the end of the section. The landing gear control lever regulates the extension and retraction of the nose gear. These figures illustrate the close integration and the sequence of operation of the gear mechanism.

5-70. REMOVAL AND INSTALLATION OF NOSE WHEEL.
a. Depress and tie down or weight the tail of the airplane to raise the nose wheel off the ground.
b. Remove nose wheel axle bolt.
c. Use a rod or long punch inserted in ferrule to tap the opposite ferrule out of the fork. Remove both ferrules and pull nose wheel from the fork.
d. Remove spacers and axle tube before disassembling the nose wheel.
e. Reverse the preceding step to install the nose wheel. Tighten the axle bolt until a slight bearing drag is obvious when the wheel is turned. Back off the nut to the nearest castellation and install the cotter pin.

5-71. DISASSEMBLY OF NOSE WHEEL.
a. Completely deflate the tire and break tire beads loose.

WARNING

Injury can result from attempting to separate wheel halves with tire inflated. Avoid damaging wheel flanges when breaking tire beads loose.

b. Remove thru-bolts and separate wheel halves.
c. Remove tire.
d. Remove bearing retaining rings, grease seals, and bearing cones.

NOTE

The bearing cups are a press fit in the wheel halves and should not be removed unless replacement is necessary. To remove, heat the wheel half in boiling water for 15 minutes. Using an arbor press, if available, press out the bearing cup and press in the new one while the wheel is still hot.

5-72. INSPECTION AND REPAIR OF NOSE WHEEL. Instruction given in paragraph 5-44 for the main wheels may be used as a guide for inspection and repair of the nose wheel.

5-73. ASSEMBLY OF NOSE WHEEL.
a. Place tire on wheel half. Insert thru-bolts, position other wheel half, and secure with nuts and washers. Torque bolts to value marked on wheel.

CAUTION

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

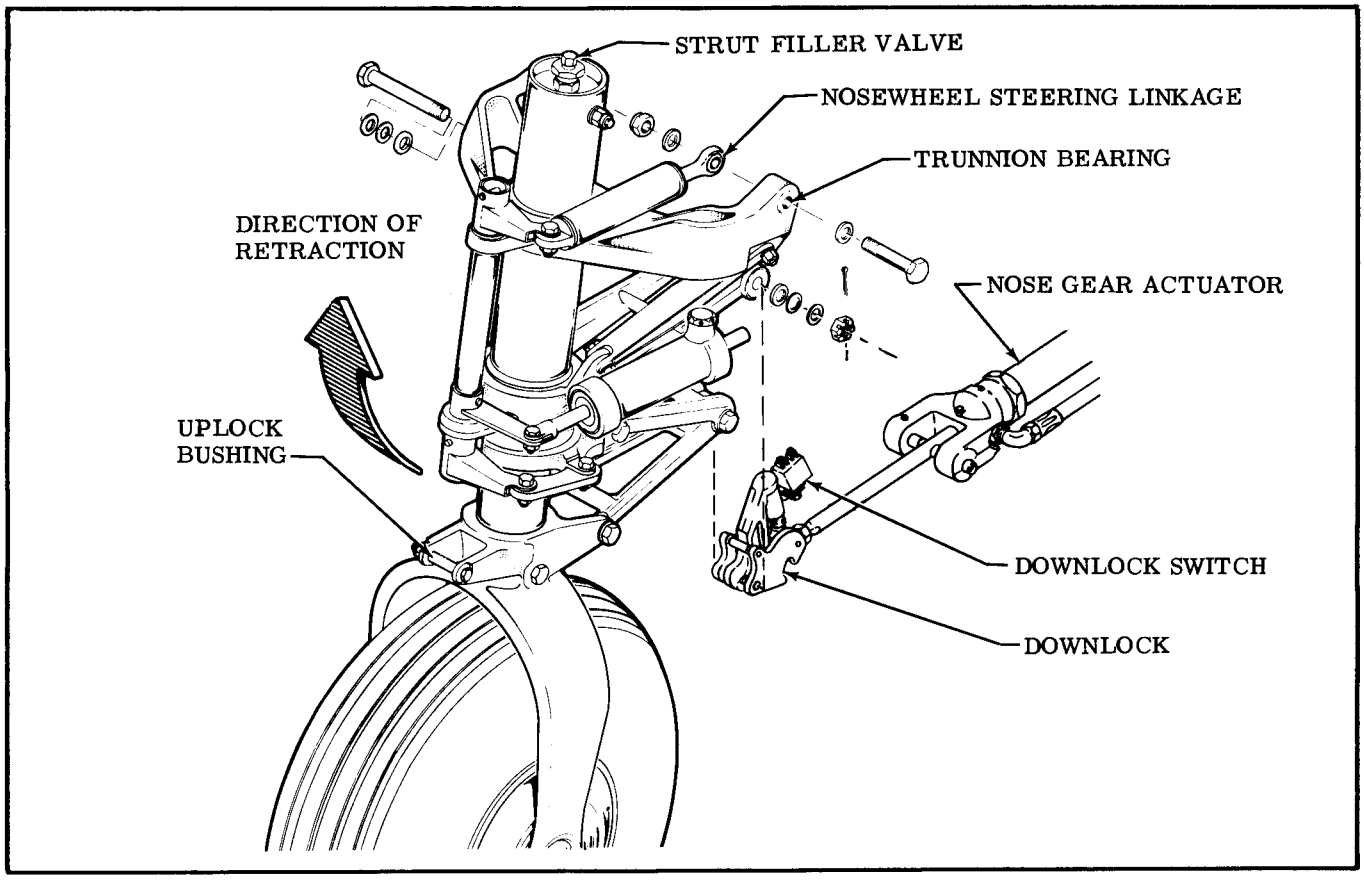


Figure 5-14. Nose Gear Details

b. Clean and repack bearing cones with clean wheel bearing grease.
c. Assemble bearing cones, seals, and retainers into the wheel half.
d. Inflate tire to seat tire beads, then adjust to correct pressure.

5-74. BALANCING NOSE WHEEL. Refer to paragraph 5-94 for nose wheel balancing.

5-75. REMOVAL AND INSTALLATION OF NOSE GEAR ASSEMBLY. (See figure 5-14.)

5-76. DISASSEMBLY OF NOSE GEAR STRUT. The following procedure applies to the nose gear shock strut after it has been removed from the airplane, and the nose wheel has been removed. In many cases, separating the upper and lower struts will permit inspection and parts replacement without removal or complete disassembly.
a. Remove torque links. Note position of washers, spacers, and bushings.

WARNING

Deflate strut completely before removing bolt (64), lock ring (31), or bolt (42).

b. Remove shimmy dampener.
c. Remove steering shaft (75) by driving out roll pins (9, 72, and 76) and removing arms (10 and 71), and link (22).
d. Remove lock ring (31) from groove inside of lower end of upper strut (61). A small hole is provided at the lock ring groove to facilitate removal.

NOTE

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

e. Using a straight, sharp pull, remove lower strut from upper strut. Invert lower strut and drain hydraulic fluid.
f. Remove lock ring (67), bearing (66) and extend stop (65) from upper end of lower strut (49).
g. Slide packing support ring (25), scraper ring (29), retainer ring (30), and lock ring (31) from lower strut (49). Note relative position and top side of each ring and bearing to aid reassembly.
h. Remove back up rings (26 and 28) and O-rings (24 and 27) from packing support ring.
i. Remove metering pin (53) and base plug (51) by removing bolt (42) from lower strut and fork. Lower strut and fork are press fitted; do not disassemble.
j. Remove metering pin (53) and O-rings (52 and 52A) from base plug (51).
k. Remove orifice support (68) by removing bolt (64). Remove O-ring (73) from orifice support.
l. Remove snap ring (23) from lower end of upper strut (61) and remove washers (57 and 59), shims if

SHOP NOTES:

References for Figure 5-15.

1. Bushing
2. Bolt
3. Washer
4. Nut
5. Brace
6. Nut
7. Washer
8. Bolt
9. Roll Pins
10. Steering Arm
11. Upper Trunnion
12. Roll Pin
13. Bearing
14. Bolt
15. Nut
16. Washers
17. Brace Arm
18. Nut
19. Washers
20. Bolt
21. Roll Pin
22. Steering Link
23. Snap Ring
24. O-Ring
25. Pack Support Ring
26. Back Up Ring
27. O-Ring
28. Back Up Ring
29. Scraper Ring
30. Retainer Ring
31. Lock-Ring
32. Torque Link
33. Squat Switch
34. Nut
35. Washers
36. Bolt
37. Washers
38. Torque Link
39. Washers
40. Washers
41. Bolt
42. Bolt
43. Bolt
44. Uplock Bushing
45. Spacer
46. Nut
47. Nut
48. Nut
49. Lower Shock Strut
50. Nut
51. Plug Pin Base
52. O-Ring
52A. O-Ring
53. Metering Pin
54. Washers
55. Bolt
56. Washer
57. Washer
58. Steering Collar
59. Washer
60. Nut
61. Upper Strut
62. Nut
63. Washer
64. Bolt
65. Extend Stop
66. Bearing
67. Retainer Ring
68. Orifice Support
69. Nut
70. Bolt
71. Steering Arm
72. Roll pins
73. O-Ring
74. Bushing
74A. Pin
75. Steering Shaft
76. Roll Pin
77. Lower Trunnion

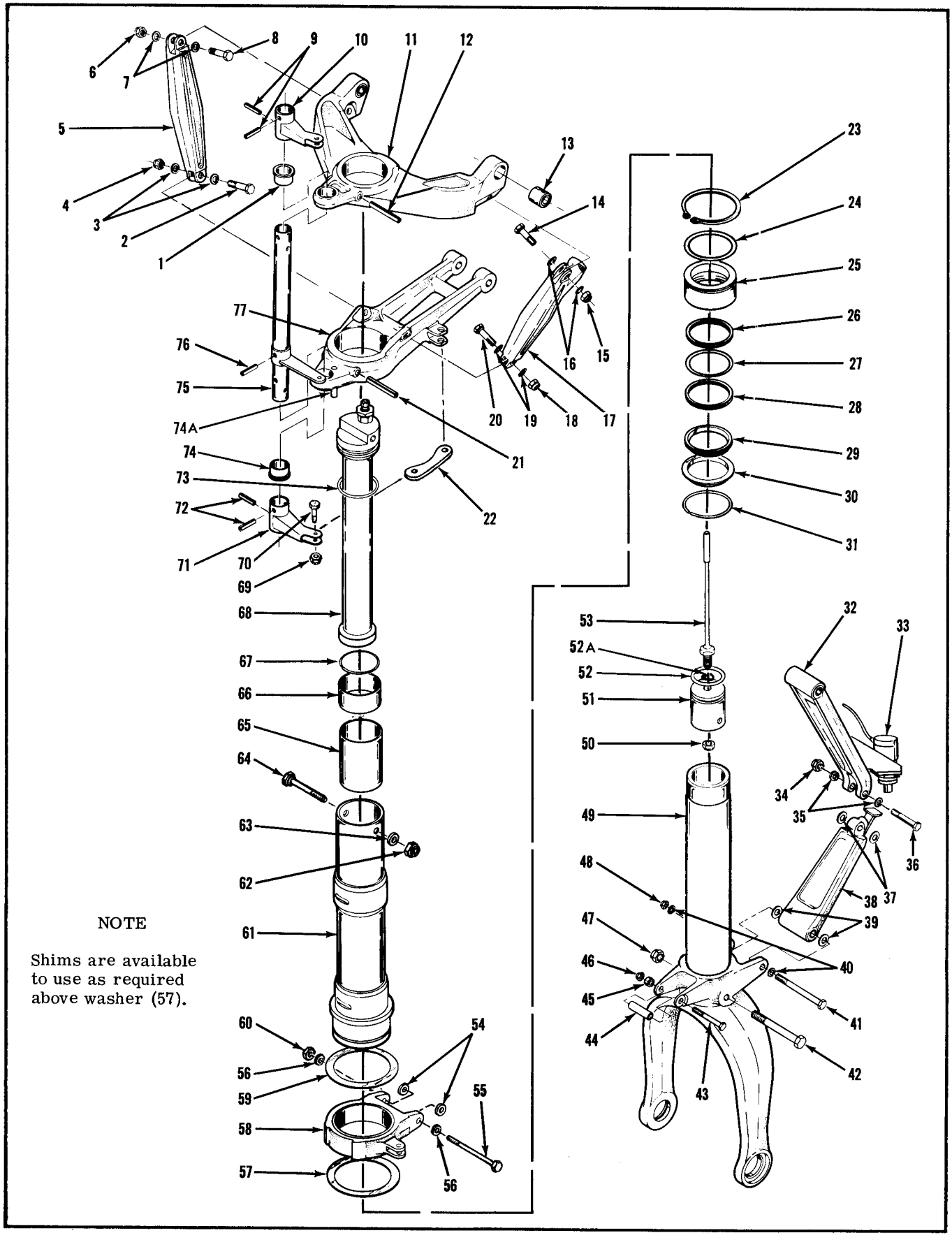


Figure 5-15. Nose Wheel Strut

installed, and steering collar (58).

m. Bushings and bearings in upper trunnion (11), lower trunnion (77), and collar (58) may be replaced as required. Needle bearings in steering collar (58) should not be replaced; replace the steering collar if needle bearing is defective.

NOTE

Upper and lower trunnions (11 and 77) are press-fitted to the upper strut (61), with braces (5 and 17) installed during assembly. Pin (74A) is also press-fitted to the lower trunnion.

5-77. ASSEMBLY OF NOSE GEAR STRUT.

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.

b. Assemble the strut by reversing the order of the procedure outlined in paragraph 5-76 with the exception that special attention must be paid to the following procedures.

c. Replace back-up rings in packing support ring with the contoured rubber back-up rings, one on each side of O-ring (27).

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.

d. 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.

e. When installing bearing (66) at top of the lower strut, be sure that beveled edge of bearing is up next to retainer ring (67). This applies to all nose gears using this type of bearing and retainer ring.

f. Sharp metal edges should be smoothed with No. 400 emery paper, then thoroughly cleaned.

g. Lubricate needle bearings with MIL-G-7711 grease (or equivalent) before installing. Add shims as necessary to remove excessive clearance between collar (58) and washer (57).

h. Do not tighten shimmy dampener attach bolts to a torque value in excess of 10 pound-inches.

i. Tighten torque link center bolt snug then tighten to next castellation and install cotter pin.

j. Service shock strut with hydraulic fluid (MIL-H-5606) and compressed air and install strut in airplane.

NOTE

It is easier to service the shock strut just before installation, although it may be serviced after installation if desired. See Section 2 for strut servicing.

k. When assembling and attaching the nose gear actuator and downlock mechanism, lubricate and torque attaching bolt as shown in figure 2-7.

5-78. REMOVAL AND INSTALLATION OF SHIMMY DAMPENER.

a. Remove the cotter pin, nut, and bolt attaching shimmy dampener rod to the arm on the steering torque tube.

b. Remove the cotter pin, nut and bolt attaching the shimmy dampener barrel to the strut.

c. Reinstall the dampener by reversing the steps outlined above, service the dampener as prescribed in Section 2.

5-79. REMOVAL OF NOSE GEAR ACTUATOR.

a. Jack the airplane or weight or tie-down the tailcone to relieve weight from the nose gear.

b. Remove cotter pin, castellated nut, washers and bolt attaching strut to actuator.

c. Disconnect hydraulic hoses from actuator; cap or seal actuators and hoses to prevent the entry of dirt and dust.

d. Disconnect wires to microswitch on the actuator.

e. Remove nut and washer, tap bolt with a fiber drift or mallet to remove it. With this bolt removed the actuator is free for removal.

5-80. DISASSEMBLY AND REPAIR OF NOSE GEAR ACTUATOR. Refer to Appendix A for disassembly and repair of the nose gear actuator.

5-81. INSTALLATION OF NOSE GEAR ACTUATOR.

NOTE

Fill the actuator with fluid (MIL-H-5606) before installing the actuator, and check the condition and fit of attaching bolts and bushings. Replace any defective parts.

a. Install the rear of the actuator to its mounting with bolt, washer, and nut.

b. Connect hydraulic hoses to actuator.

c. Connect electrical wires to switch.

d. Attach actuator to strut with bolt, washers, and nut. Safety nut with a cotter pin.

NOTE

When assembling and attaching the nose gear downlock mechanism to strut, lubricate and torque attaching bolt as shown in figure 2-7.

e. Adjust downlock switch in accordance with paragraph 5-113.

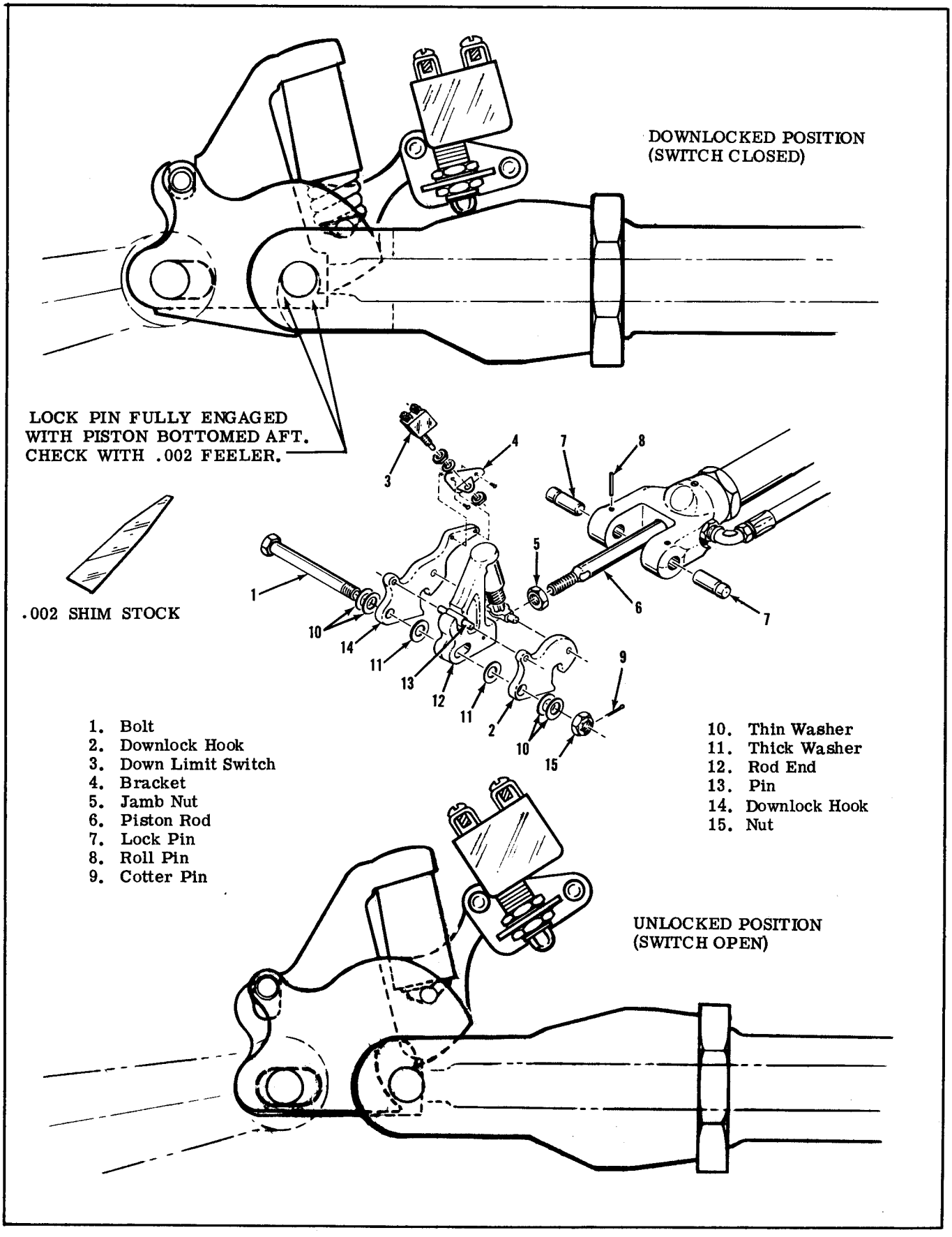


Figure 5-16. Nose Gear Downlock

5-82. REMOVAL AND INSTALLATION OF NOSE GEAR UPLOCK AND DOOR MECHANISM. (See figure 5-17.)

NOTE

The nose gear lock torque tube is the aft one of the pair of torque tubes in the nose wheel well. The forward torque tube is the nose wheel door actuating torque tube. The nose gear uplock cylinder is mounted on the left side of the wheel well and is connected to the aft torque tube. The nose wheel door actuating cylinder is mounted on the right side of the wheel well.

a. Remove engine cowling.
b. Remove the nose gear uplock spring (21).
c. Disconnect torque tube arm from actuator by removing cotter pin, clevis pin, and washers.
d. Remove nuts and bolts at each torque tube pivot and remove torque tube (14).
e. Disconnect and cap or plug hydraulic lines at cylinder (19).
f. Remove two bolts attaching actuator to the structure and remove actuator.
g. Installation of the torque tube and actuator is the reversal of the preceding procedure. Adjust linkage in accordance with paragraph 5-117.

5-83. DISASSEMBLY AND REPAIR OF UPLOCK ACTUATOR. Refer to Appendix A for disassembly and repair of the nose gear uplock actuator.

5-84. RIGGING. Refer to paragraph 5-113 for nose gear rigging and adjustments.

5-85. NOSE GEAR DOOR SYSTEM. (See figure 5-18.) The nose gear forward doors open for nose gear retraction or extension and close again when the cycle is completed. These doors are held in closed position by spring-loaded latches which are released hydraulically by the nose gear uplock cylinder. Actuation of the nose gear forward doors is by a double-acting hydraulic cylinder. The nose gear aft doors are linked mechanically to the nose gear trunnion. These doors open as the gear extends and close as it is retracted.

5-86. REMOVAL AND INSTALLATION OF NOSE WHEEL DOORS.
a. Remove the engine cowl.
b. Disconnect actuating linkage from each door by removing cotter pin, nut and bolt. Washers will drop free.
c. Remove nuts and bolts securing each hinge pivot. Work from upper side of cowl opening to remove bolts.
d. To replace the nosewheel doors, reverse the procedure outlined above.

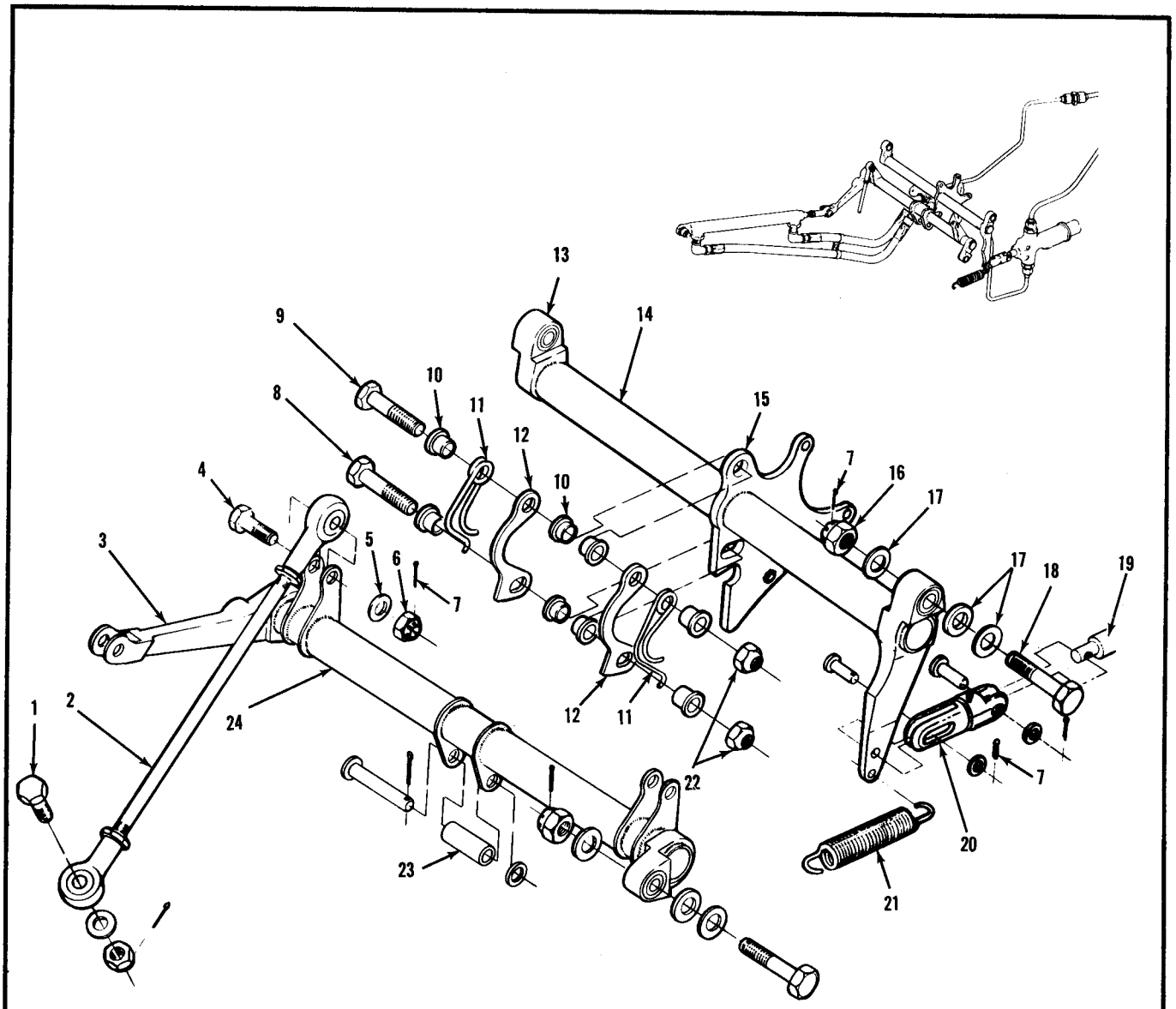
5-87. REMOVAL AND INSTALLATION OF NOSE WHEEL DOOR MECHANISM.
a. Disconnect actuator from torque tube by removing cotter and clevis pins.
b. Remove hydraulic hoses from actuator.
c. Remove cotter pin, nut, bolt and spacers securing actuator barrel to its mounting bracket.
d. Remove the torque tube by removing nuts and bolts attaching it to its mounting brackets.
e. For installation, reverse the steps listed above.

5-88. DISASSEMBLY AND REPAIR OF NOSE WHEEL DOOR ACTUATOR. Refer to Appendix A for disassembly and repair of the nose wheel door actuator.

5-89. REMOVAL AND INSTALLATION OF NOSE GEAR STRUT DOOR.
a. Disconnect the linkage from each door by removing cotter and clevis pins.
b. Remove screws and nuts holding hinge strips to each door.
c. Remove linkage connecting door to trunnion by removing nut at tie-rod end. Do not change length of tie rod unless necessary; changing this length will make readjustment necessary on reinstallation.
d. Install the strut doors and linkage by reversing the steps outlined above.

5-90. RIGGING. Refer to paragraph 5-117 for nose gear door system rigging and adjustments.

SHOP NOTES:



1. Bolt
2. Nosewheel Door Linkage
3. Actuator Arm
4. Bolt
5. Washer
6. Nut
7. Cotter Pin
8. Bolt
9. Bolt
10. Bushing
11. Spring
12. Door Latch
13. Bearing
14. N.G. and Doors Uplock Torque Tube
15. Gear Latch
16. Nut
17. Washer
18. Bolt
19. Uplock Cylinder
20. Clevis Assembly
21. Spring
22. Nuts
23. Door Uplock Bushing
24. Nosewheel Door Torque Tube

Figure 5-17. Nose Wheel Door and Nose Gear Lock Torque Tubes (Sheet 1 of 2)

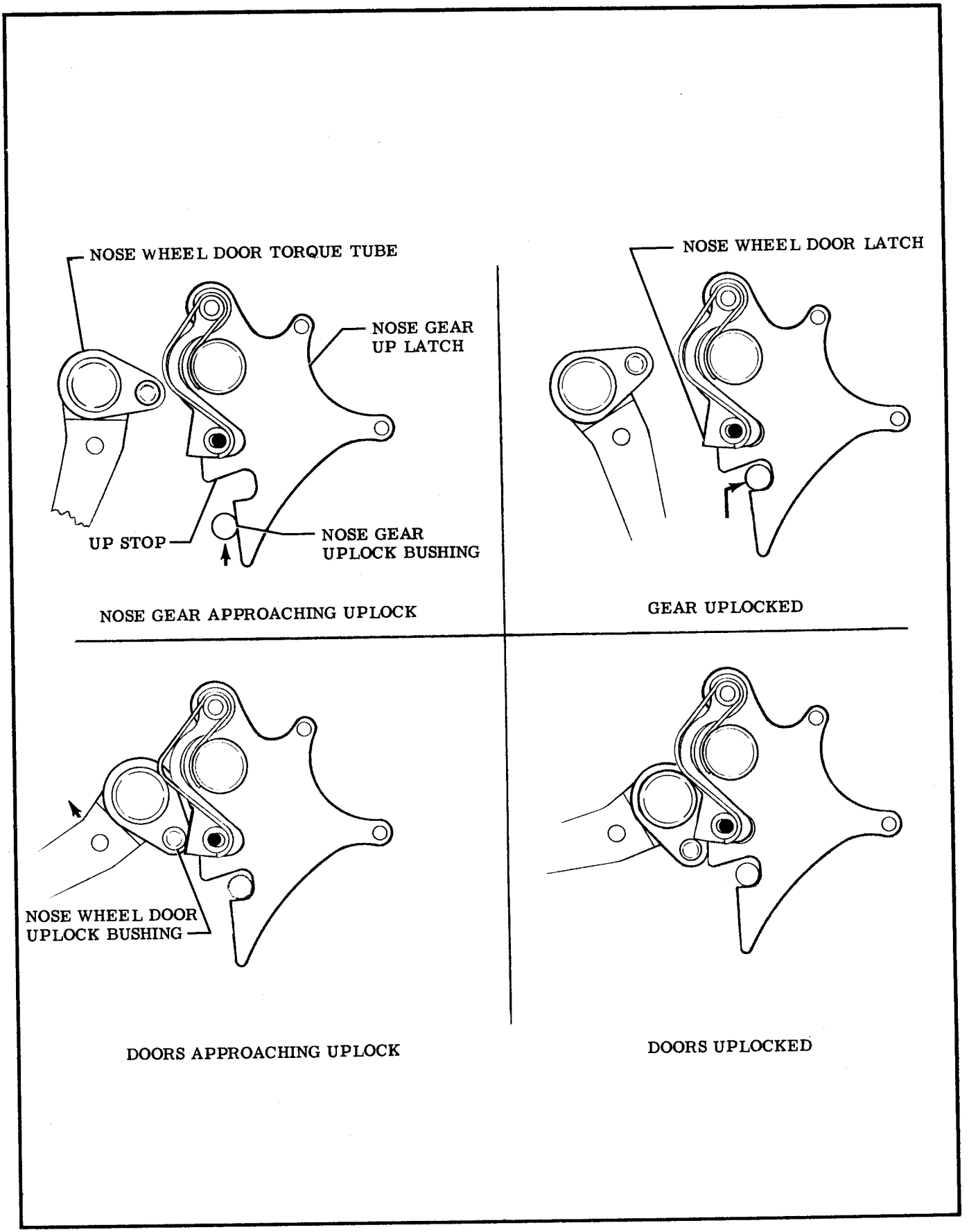
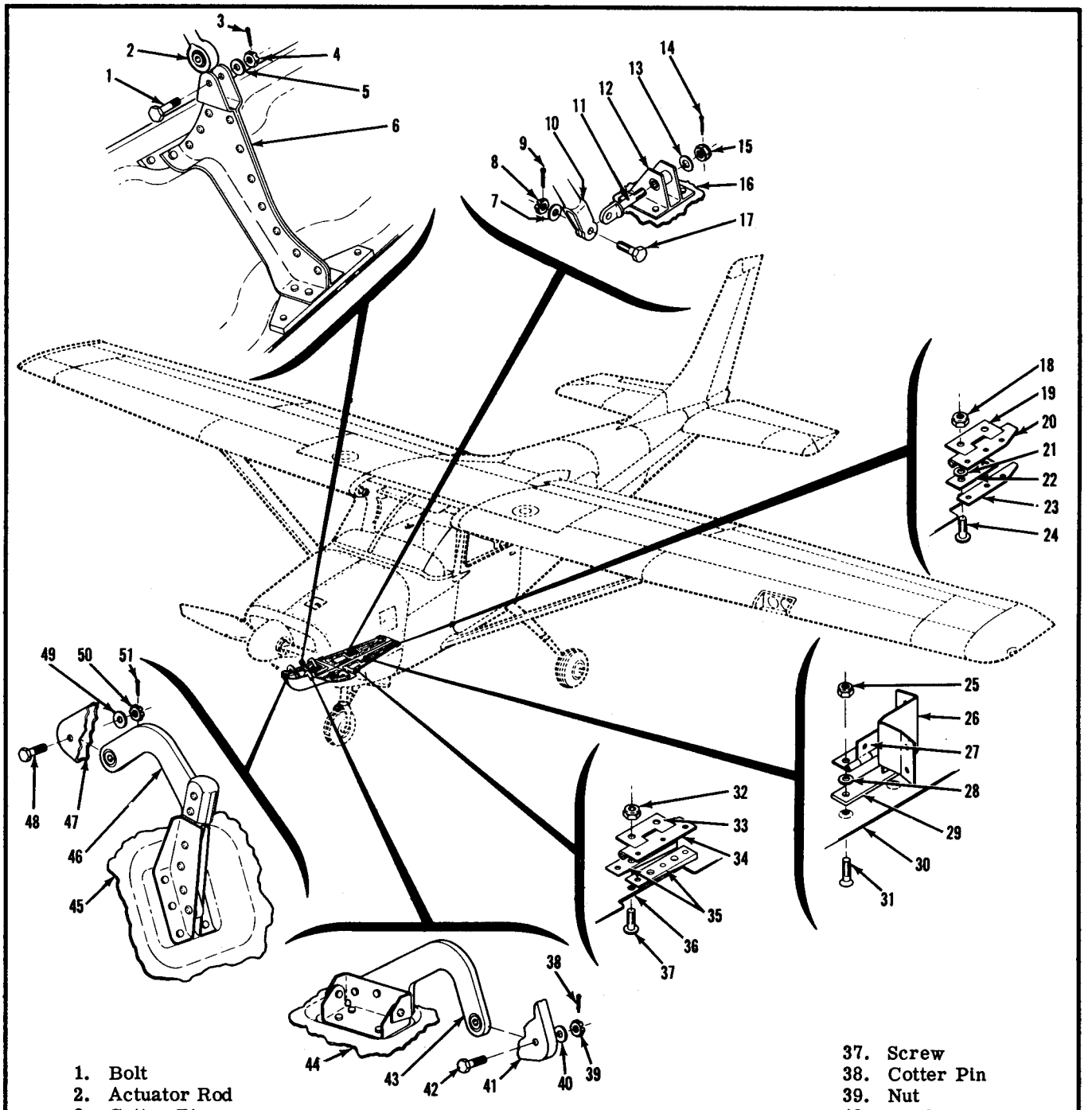


Figure 5-17. Uplock Action of Torque Tubes (Sheet 2 of 2)



1. Bolt
2. Actuator Rod
3. Cotter Pin
4. Castellated Nut
5. Washer
6. Nose Wheel Door
7. Washer
8. Nut
9. Cotter Pin
10. Push Pull Rod
11. Eyebolt
12. Bracket
13. Washer
14. Cotter Pin
15. Nut
16. Nose Gear Aft Door
17. Bolt
18. Nut
19. Doubler
20. Hinge
21. Washer
22. Shim
23. Shim
24. Screw
25. Nut
26. Tunnel Doubler
27. Hinge
28. Washer
29. Hinge Doubler
30. Nose Gear Aft Door
31. Screw
32. Nut
33. Doubler
34. Hinge
35. Tapered Shims
36. Door Skin
37. Screw
38. Cotter Pin
39. Nut
40. Washer
41. Hinge Bracket
42. Bolt
43. Hinge Arm - Aft
44. Nose Wheel Door
45. Nose Wheel Door
46. Hinge Arm
47. Hinge Bracket
48. Bolt
49. Washer
50. Nut
51. Cotter Pin

Figure 5-18. Nose Gear Doors

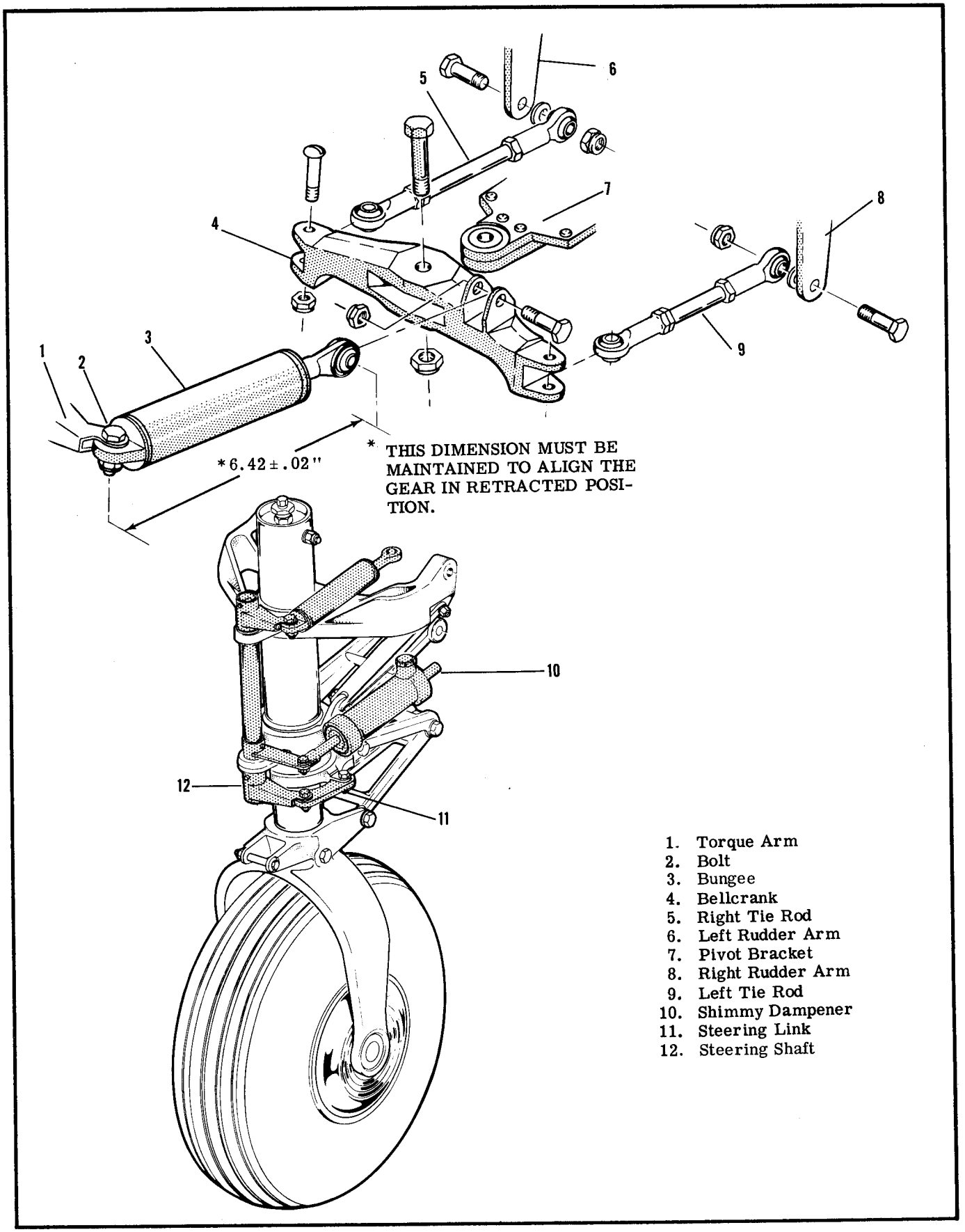


Figure 5-19. Nose Wheel Steering System

5-91. NOSE WHEEL STEERING SYSTEM.

5-92. The nose wheel steering system links the rudder pedals to the nose wheel fork, affording steering control through the use of the rudder pedals. The nose wheel is steerable up to approximately 12 degrees either side of neutral after which brakes may be used for a maximum deflection of approximately 30 degrees each side of neutral. The steering linkage straightens the nose wheel as the landing gear is retracted.

5-93. REMOVAL AND INSTALLATION. Figure 5-19 shows details of the nose wheel steering system and may be used as a guide during replacement of parts.

5-93A. RIGGING. Since the nose wheel steering is connected to the rudder control system, refer to Section 10 for rigging.

5-94. WHEEL BALANCING.

5-95. 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 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, automotive type wheel balancing equipment may be used to establish the point of maximum unbalance. Use automotive type balance weights to balance the wheel and tire assembly. Be sure to install the weights securely; if necessary, reshape the weights to fit the rim contour.

5-96. BRAKE SYSTEM.

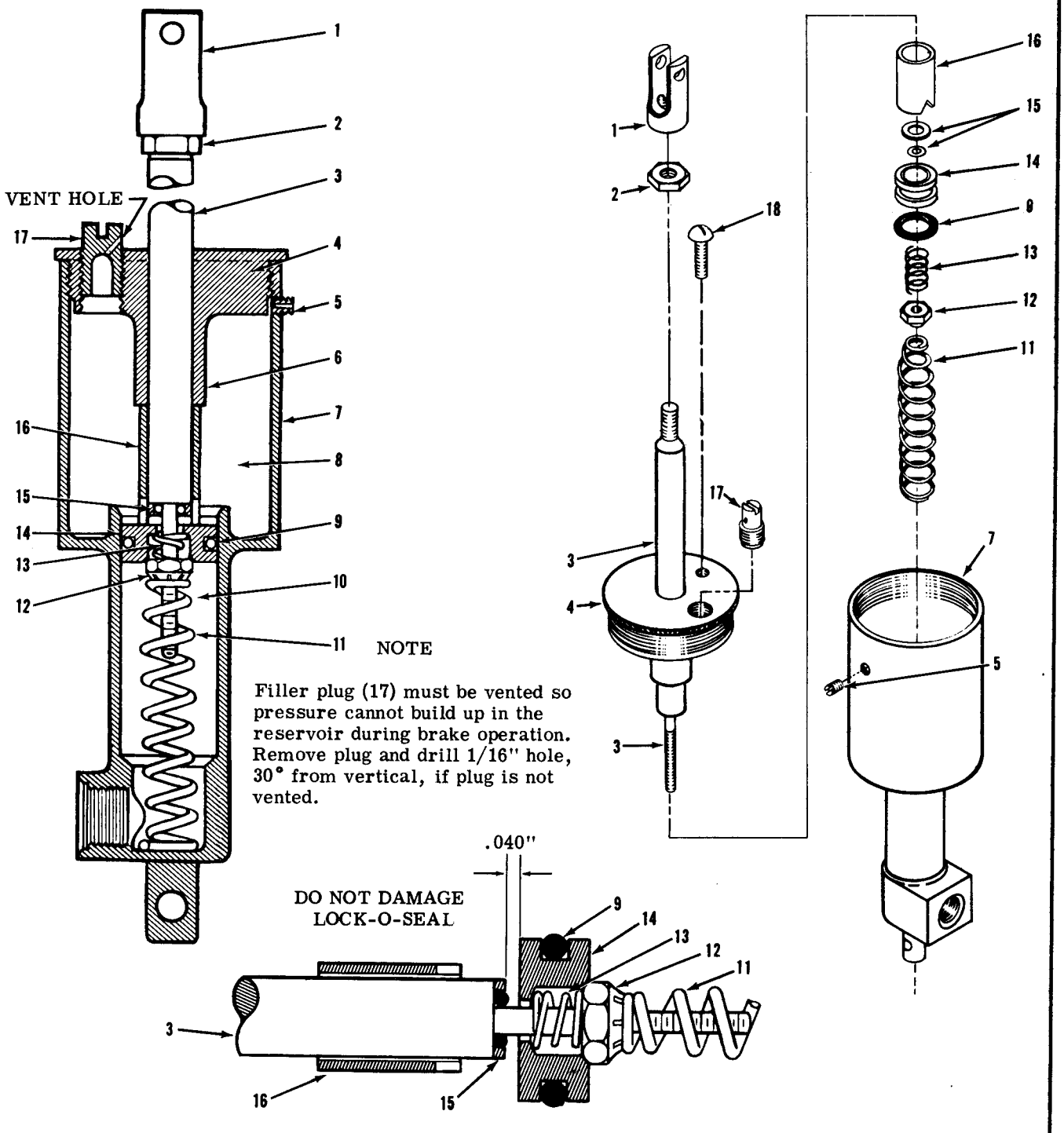
5-97. A conventional hydraulic brake system is installed in the aircraft. Individual, single-disc brakes on each main wheel are controlled by toe-operation of the rudder pedals. Each master brake cylinder, located forward of the pilot's pedals, is connected by hoses and lines to its respective wheel brake. A swivel fitting, located on each main gear actuator, routes the hydraulic fluid through the pinion shaft of the actuator, through the saddle assembly, and into the brake line to the wheel cylinder.

5-98. TROUBLE SHOOTING BRAKE SYSTEM.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
DRAGGING BRAKES.		
Brake pedal binding.	If brake pedals fail to return properly, check pedal for binding.	Check and adjust properly.
Parking brake linkage holding brake pedal down.	Check parking brake if pedal fails to return when released.	Check and adjust properly.
Worn or broken piston return spring. (In master cylinder.)	If brake pedals fails to return after it is released and linkage is not binding, the master cylinder is faulty.	Repair or replace master cylinder.
Insufficient clearance at Lock-O-Seal in master cylinder.	If pressure remains in brake system when pedals are released, disassemble master cylinder and check Lock-O-Seal clearance.	Adjust as shown in figure 5-20.
Restriction in hydraulic lines or restriction in compensating port in master brake cylinders.	Jack up wheel to be checked. Have someone apply and then release brakes. Wheel should rotate freely as soon as brakes are released. If wheel fails to rotate freely, loosen brake line at brake housing to relieve any pressure trapped in the line. If wheel now turns freely, the brake line is restricted or there is a restriction in the brake master cylinder.	Drain brake lines and clean the inside of the brake line with filtered compressed air. Fill and bleed brakes. If cleaning the lines fails to give satisfactory results, the master cylinder may be faulty and should be repaired.

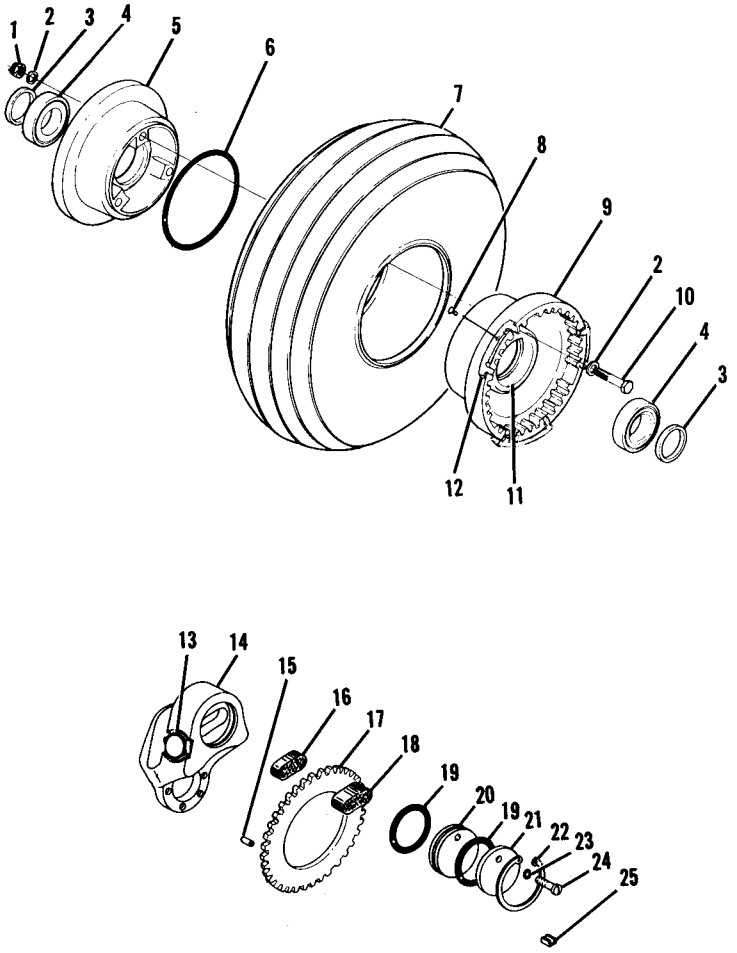
PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
DRAGGING BRAKES (Cont.)		
Worn scored, or warped brake discs.	Visually check discs.	Replace brake discs and linings.
Damage or accumulated dirt restricting free movement of wheel brake parts.	Check parts for freedom of movement.	Clean and repair or replace parts as necessary.
BRAKES FAIL TO OPERATE.		
Leak in system.	Check entire system for leaks.	If brake master cylinders or wheel brake assemblies are leaking, they should be replaced or repaired.
Air in system.		Bleed system.
Lack of fluid in master cylinders.	Check fluid level.	Fill and bleed if necessary.
Master cylinder defective.		Repair or replace master cylinder.

SHOP NOTES:



1. Clevis
2. Jamb Nut
3. Piston Rod
4. Cover
5. Setscrew
6. Cover Boss
7. Body
8. Reservoir
9. O-Ring
10. Cylinder
11. Piston Return Spring
12. Nut
13. Piston Spring
14. Piston
15. Lock-O-Seal
16. Compensating Sleeve
17. Filler Plug
18. Screw

Figure 5-20. Brake System (Sheet 1 of 3)

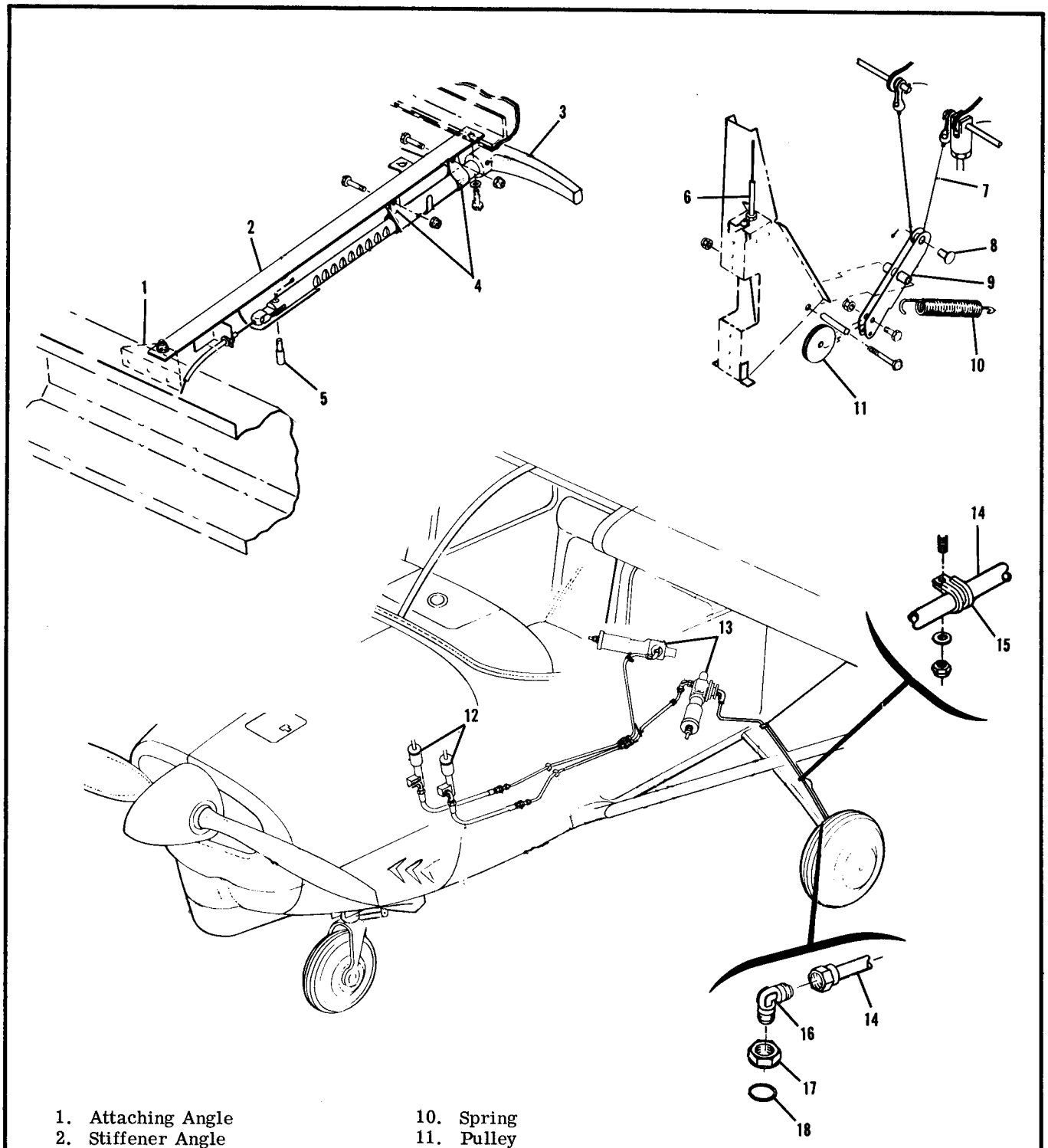


NOTE

Brake disc clip (12) used on Model 210B, while brake disc clip (25) is used on models prior to the Model 210B.

1. Nut
2. Washer
3. Bearing Seal
4. Bearing Cone
5. Outboard Wheel Half
6. O-Ring
7. Tubeless Tire
8. Rivet
9. Inboard Wheel Half
10. Bolt
11. Bearing Cup
12. Brake Disc Clip
13. Drain Plug
14. Brake Housing
15. Bushing
16. Anvil Brake Lining
17. Brake Disc
18. Piston Brake Lining
19. O-Ring
20. Piston
21. Cylinder Head
22. Snap Ring
23. Bleeder Seal
24. Bleeder Screw
25. Brake Disc Clip

Figure 5-20. Brake System (Sheet 2 of 3)



1. Attaching Angle
2. Stiffener Angle
3. Parking Brake Handle
4. Clamp
5. Positioning Pin
6. Tube Assembly
7. Parking Brake Cable
8. Clevis Pin
9. Bellcrank Assembly
10. Spring
11. Pulley
12. Brake Master Cylinders
13. Main Gear Actuators
14. Brake Line
15. Clamp
16. Fitting
17. Nut
18. O-Ring

Figure 5-20. Brake System (Sheet 3 of 3)

5-99. REMOVAL AND INSTALLATION OF MASTER CYLINDERS.

a. Drain hydraulic fluid from brake system.
b. Remove front seats and rudder bar shield to gain access to master cylinders.
c. Disconnect parking brake linkage and master cylinders from rudder pedals.
d. Disconnect master cylinders at bottom attachment point.
e. Disconnect hydraulic hoses from master cylinders and remove cylinders.
f. Plug and cap hydraulic fittings, lines, and hoses to prevent entry of foreign materials.
g. Reverse the steps listed above to install master cylinders, then fill and bleed brake system.

5-100. DISASSEMBLY AND REPAIR OF MASTER CYLINDERS. Figure 5-20 may be used as a guide during disassembly and assembly. Repair is limited to replacement of parts, cleaning, and adjustment. Use clean hydraulic fluid (MIL-H-5606) as a lubricant during assembly.

5-101. REMOVAL AND DISASSEMBLY OF WHEEL BRAKES. Goodyear wheel brake assemblies are secured with the axle attaching bolts. To remove, remove the wheel and axle in accordance with paragraph 5-42. Details of the wheel brake assembly are shown in figure 5-20, which may be used as a guide during assembly.

NOTE

Use of compressed air applied to the brake line fitting is permissible when removing the piston from the brake cylinder.

5-102. INSPECTION AND REPAIR OF WHEEL BRAKES.

a. Clean all parts except brake linings and O-rings in dry cleaning solution and dry thoroughly.
b. O-rings are usually replaced at each overhaul. If their re-use is necessary, they should be wiped with a clean oiled cloth and inspected for damage.

NOTE

Thorough cleaning is important. Dirt and chips are the greatest cause of malfunctions in hydraulic brake systems.

c. Check brake linings for deterioration and maximum permissible wear (see paragraph 5-104.)
d. Inspect brake cylinder bore for scoring. A scored cylinder may leak or cause rapid O-ring wear. A scored brake cylinder should be replaced.

5-103. ASSEMBLY AND INSTALLATION OF WHEEL BRAKES.

a. Lubricate parts with MIL-H-5606 hydraulic fluid during reassembly and assemble components with care to prevent damage to O-rings. Use figure 5-20 as a guide during assembly.
b. Install brake assembly as the wheel and axle are installed. Refer to paragraph 5-46.
c. After installation, bleed brakes.

5-104. BRAKE LINING WEAR. To check Goodyear brake linings for wear, set parking brakes and attempt to insert a strip of 5/16 inch material between the inboard face of the brake disc and the brake housing. Replace the linings when the 5/16 inch material can be inserted.

5-105. BRAKE BLEEDING. Standard bleeding, with a clean hydraulic pressure source connected to the wheel cylinder bleeder, is recommended.

a. Remove the master cylinder filler plug and screw a flexible hose with a suitable fitting into the filler hole. Immerse the free end of the hose in a can containing enough hydraulic fluid to cover the end of the hose.
b. Connect a clean hydraulic pressure source, such as a hydraulic hand pump, to the bleeder provision in the wheel cylinder.

NOTE

Either a bleeder valve or a bleeder screw is provided in the wheel cylinder.

c. As fluid is pumped into the system, observe the immersed end of the hose at the master cylinder for evidence of air bubbles being forced from the brake. system. When bubbling has ceased, remove the bleeder source from the brake wheel cylinder and tighten the bleeder valve or install the bleeder screw with a new seal.

NOTE

Ensure that the free end of the hose from the master cylinder remains immersed during the entire bleeding process.

d. Remove hose from master cylinder and replace filler plug.

5-106. PARKING BRAKE SYSTEM. The parking brake system is essentially a ratchet-held handle which depresses and holds the brake master cylinders in the compressed position. No adjustment is provided in the system; replacement of worn or defective parts will restore the system to its correct operation.

5-107. RIGGING OF MAIN LANDING GEAR.

CAUTION

Never apply more than 2275 psi hydraulic pressure to any line or component of the hydraulic system. Exceeding this pressure will overstress the part, requiring its replacement.

5-108. RIGGING MAIN GEAR DOWNLOCK PAWL. (See figure 5-21.)

NOTE

Before rigging the downlock pawl, refer to paragraph 5-50 to ascertain that the main landing gear strut is correctly installed.

The main landing gear downlock pawl is spring-loaded to lock the gear strut firmly in down position. The pawl is disengaged from the gear strut by action of a hydraulic cylinder which pulls the pawl out of engagement. The pawl is adjusted up or down with relation to the gear strut by inserting or removing washers on the fork-bolt that attaches the pawl to the fuselage structure. The correct clearance between the pawl and gear strut is .003 + .004 -.00 inches when 1500 psi is applied to the gear down port of the main gear actuator (to ensure that the gear is in full down position). Pawl clearance during the retracting cycle of the gear is shown in figure 5-21.

5-109. RIGGING MAIN GEAR DOWNLOCK SWITCH.

NOTE

The down lock pawl mechanism must be adjusted in accordance with the preceding paragraph before the switch can be adjusted.

a. Loosen neck-mounting nuts on switch and adjust it to close contact when the pawl is engaged with .156 travel remaining. (See figure 5-21.)
b. Tighten mounting nuts and check switch continuity in pawl-engaged and disengaged positions. Check that the switch bracket is mounted firmly to the landing gear strut.

NOTE

The switch bracket is bonded to the strut. If replacement of the bracket is necessary, use Conley-Weld in accordance with the manufacturer's instructions.

5-110. RIGGING MAIN GEAR AND WHEEL DOOR UPLOCKS.
a. Use hand pump to hold the uplock actuator in fully compressed position.
b. Lift main gear strut manually past the uplock latch.
c. Adjust uplock latch to clear strut .19 inch and to disengage both struts simultaneously.
d. Detach door actuators from doors and door uplock link from door latches. Adjust the door bushing until the doors will fair to contour when engaging the uplock hook.
e. Attach the door uplock link rod and adjust until the point of the hook clears the door bushing just prior to the release of the main gear struts from the uplcok latches.
f. Remove hydraulic pressure from the uplock actuator and check that it is fully extended.
g. Slam wheel doors by hand to check uplock engagement. If door bushing does not cam into hook, shorten link rod until it will.
h. Attach and adjust door actuator to close and fair the door. Shorten linkage one-half turn and tighten check nut.

5-111. RIGGING MAIN GEAR UP LIMIT SWITCHES.
a. Install main gear strut bumper button so that the uplock latch will latch beneath the strut with not more than .005 clearance. Leave strut latched.
b. Adjust main gear up limit switch as specified in figure 5-21.

5-112. RIGGING MAIN GEAR STRUT DOORS.
a. With the door held closed manually, the door lever arm should not fall within .12 inch of the lower fuselage skin at the inboard end.
b. Attach scissor links, spring and actuator.
c. Shorten rod end to shortest actuator length.
d. Adjust rod end out, by short increments, until the door will fully close and the spring will hold the door closed.
e. Apply hydraulic pressure at the fixed end of the actuator. At 1500 psi, the door should not be deformed nor should the door lever arm be forced within .06 inch of the lower fuselage skin at the inboard end.
f. Open door and apply hydraulic pressure to rod end port of actuator. At 1500 psi, the door shall clear the entrance step on the strut by not less than .12 inch.

5-113. RIGGING NOSE GEAR DOWNLOCK. (See figure 5-22.)
a. Jack the aircraft.
b. Check that locks engage lock pins with piston fully bottomed. Use a .002" feeler gauge to check clearance forward and aft of lock pins as shown in the figure. This ensures that lock pins are centered in slots.
c. If necessary, adjust rod end (12) on piston rod (6), Figure 5-16, to achieve correct engagement of downlock. Adjust rod end full out, then shorten until lock slots engage lock pins; shorten rod-end one-half turn more and tighten nut on shaft.

NOTE

The piston shaft is flattened near the threads to provide a wrench-holding surface. Do not grip the round part of the shaft with pliers or wrenches, for tool marks and galling of the shaft will cut shaft seals in the cylinder.

5-114. RIGGING NOSE GEAR DOWNLOCK SWITCH. The switch should be actuated with not more than .06 inch travel remaining in lock slot. The neck-mounted downlock switch may be run up or down in its bracket to achieve this. Figure 5-22 depicts a gage formed from music wire which may be used to obtain a precise setting of the switch.

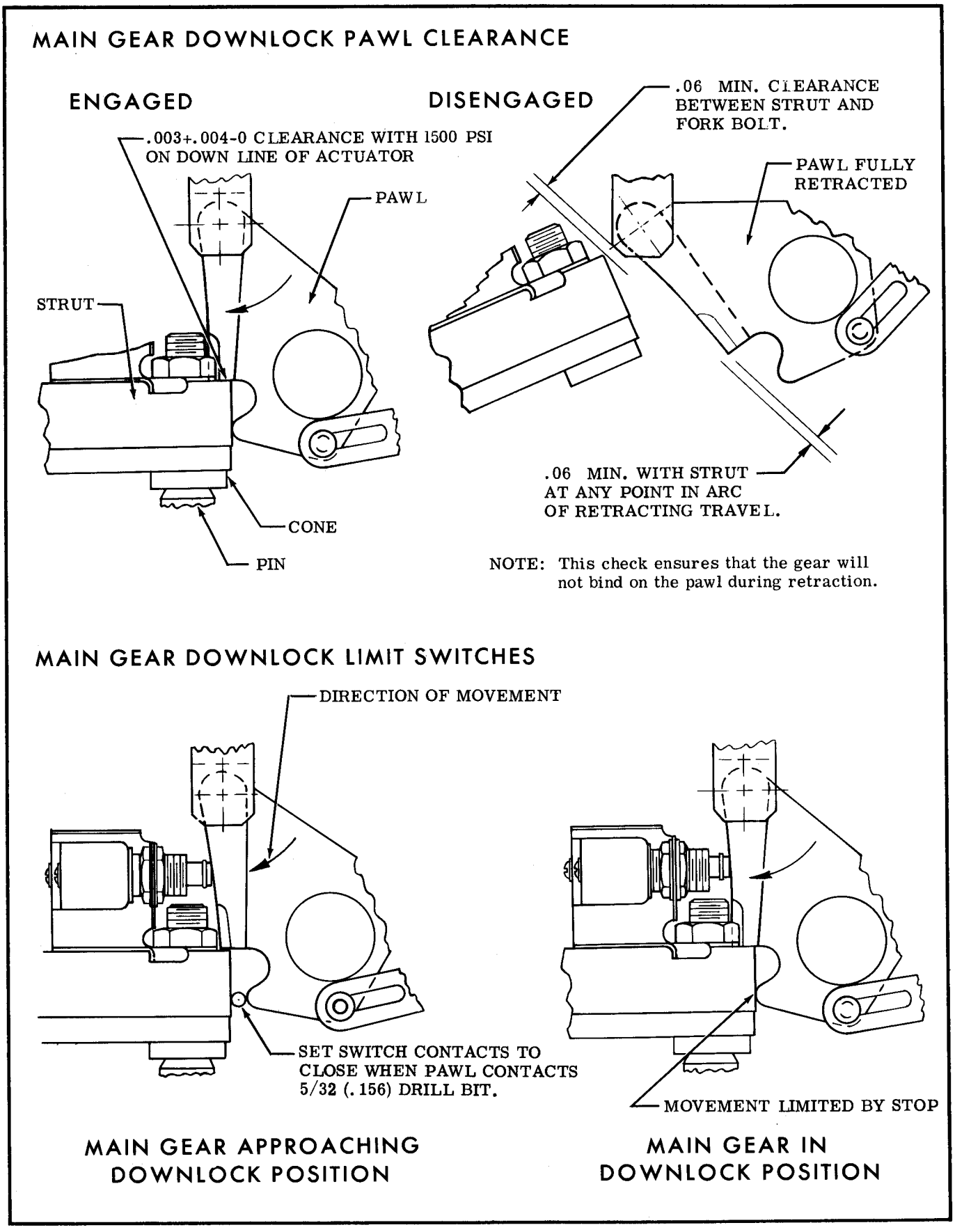


Figure 5-21. Main Gear Rigging Details (Sheet 1 of 2)

5-115. RIGGING NOSE GEAR UPLOCK. (See figure 5-22.)

a. Check nose gear strut for proper inflation.

b. Tape SE-587-7 checking gauge to nose gear uplock hook as shown in figure 5-22.

c. Move gear into uplocking position. Uplock bushing should just clear gage. If necessary, adjust clevis on uplock actuator.

5-116. RIGGING NOSE GEAR UP LIMIT SWITCH. (See figure 5-22.) Rig nose gear up limit switch as shown in figure 5-22.

5-117. RIGGING NOSE WHEEL DOOR UPLOCK.

NOTE

This adjustment should begin with the nose gear left in uplock position.

a. Rotate the nose gear door uplock torque tube to place the bushing in lock position.

b. Withdraw nose gear uplock hook and hold at the point of release of the nose gear.

c. Adjust nose gear door latches to release just before the nose gear uplock disengages the bushing. Do this by loosening bolt (8 figure 5-17) and sliding it fore or aft in its slotted hole.

d. With the nose gear uplock bushing fully engaged on the gear uplock hook, check that door torque tube bushing will cam against and lock under latches without disturbing nose gear uplock.

e. With door torque tube in latched position adjust length of push-pull rods to close and fair the nose gear doors.

f. With the door actuator rod set at maximum length, use hand pump to retract doors. Shorten actuator rod end adjustment until door torque tube will engage up-latches, then set actuator one-half turn shorter and tighten check nut on piston rod.

5-118. RIGGING NOSE GEAR STRUT SWITCH. The safety switch, which is electrically connected to the landing gear handle lockout solenoid, is operated by an actuator attached to the lower torque link. Adjust the switch to actuate when the strut is between 1/8 and 1/4 inch from the fully extended position.

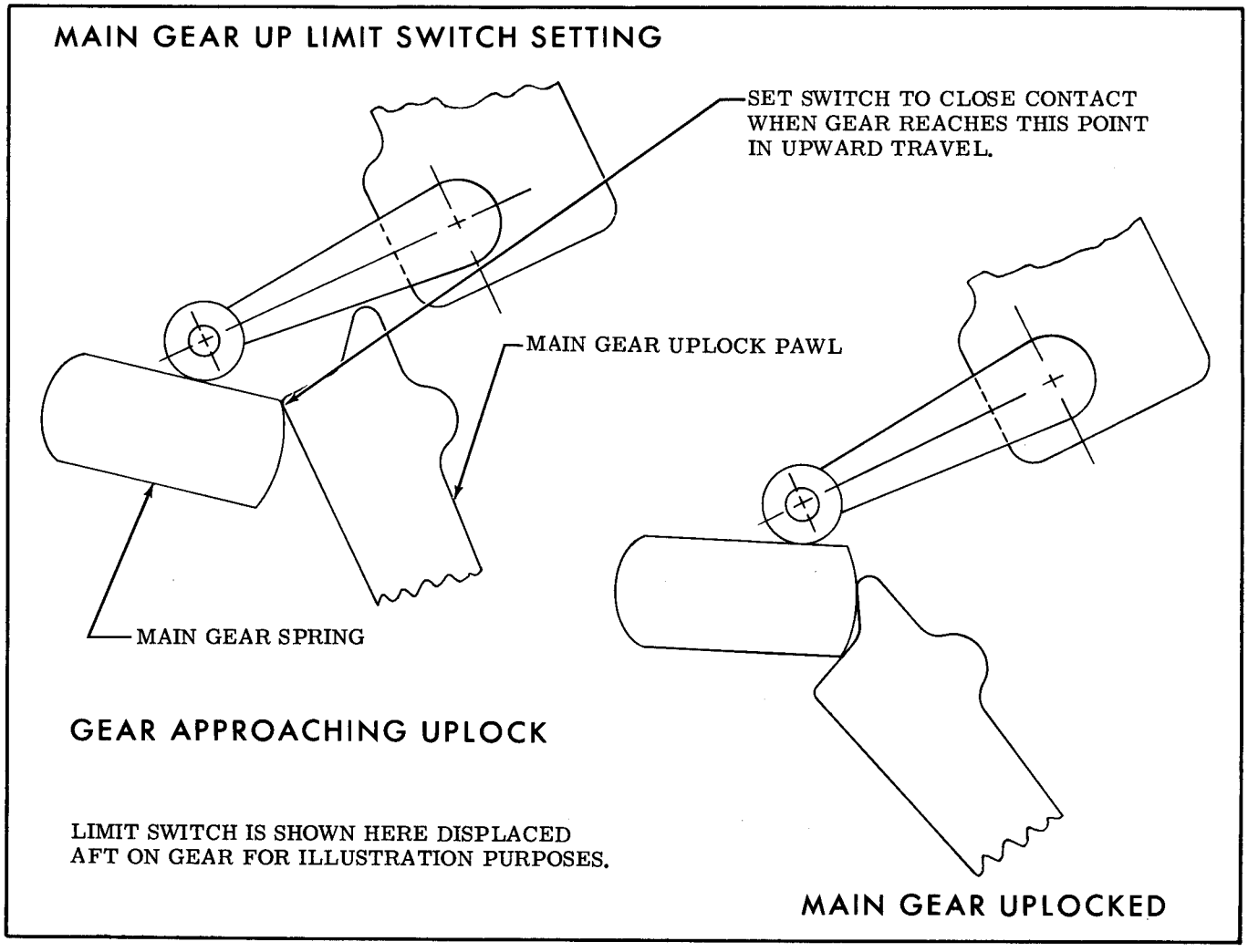
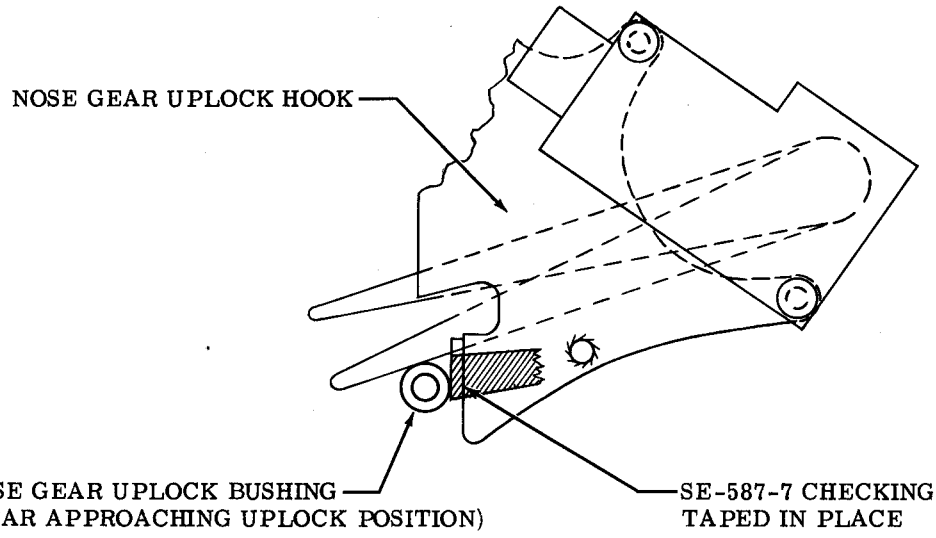


Figure 5-21. Main Gear Rigging Details (Sheet 2 of 2)

NOSE GEAR UPLOCK HOOK CLEARANCE



NOTE: BUSHING SHOULD JUST BRUSH THE TAPE USED TO SECURE THE CHECKING GAUGE.

NOSE GEAR UP LIMIT SWITCH SETTING

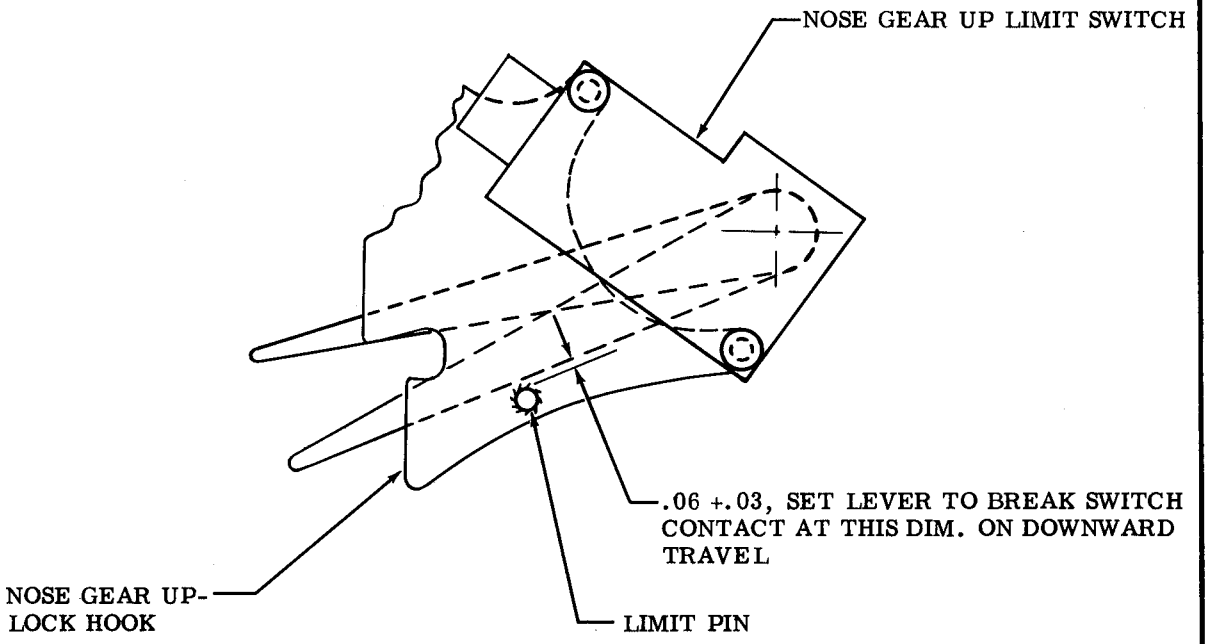
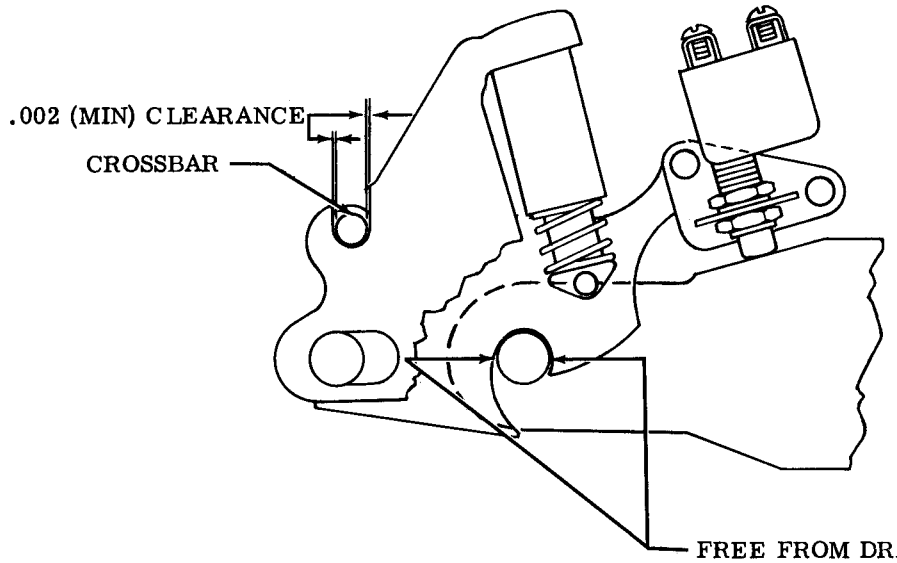


Figure 5-22. Nose Gear Rigging Details (Sheet 1 of 2)

NOSE GEAR DOWNLOCK CLEARANCE

1. The nose gear strut shall be properly inflated prior to rigging.
2. With 500 psig applied to the gear extend port of nose gear actuator, locks shall completely engage lock pins freely and cross bar shall rotate freely to indicate it is not bearing on rod end.



NOSE GEAR DOWN LIMIT SWITCH SETTING

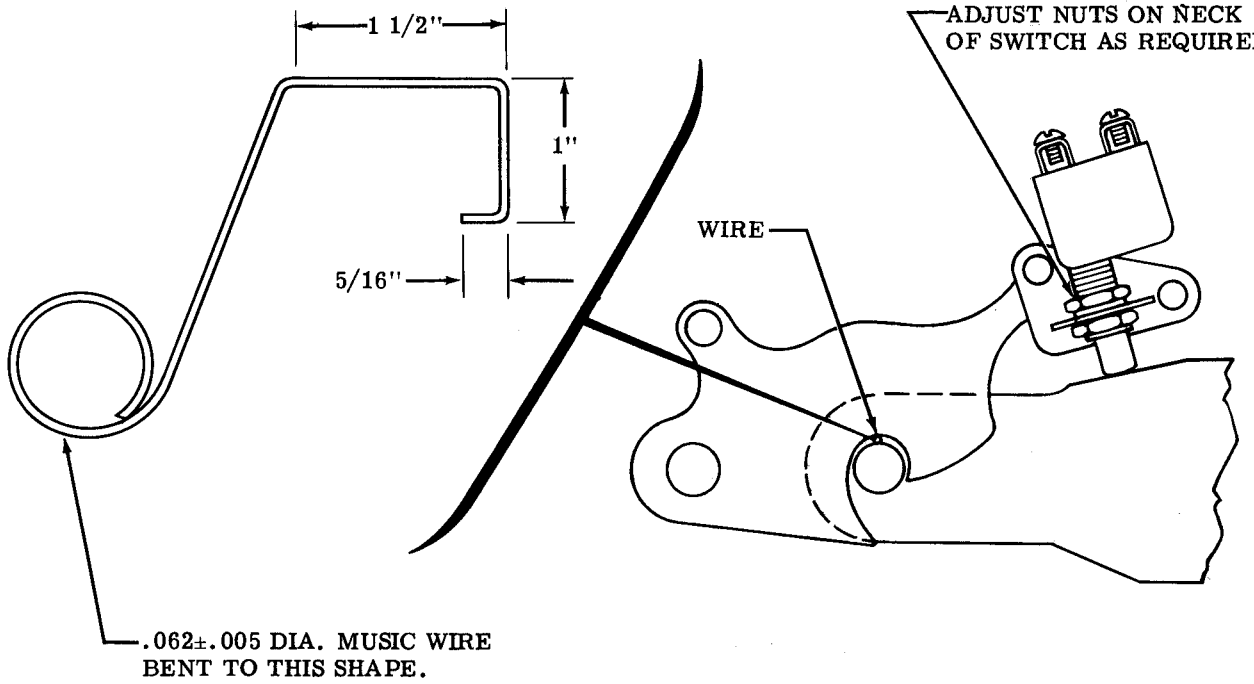


Figure 5-22. Nose Gear Rigging Details (Sheet 2 of 2)

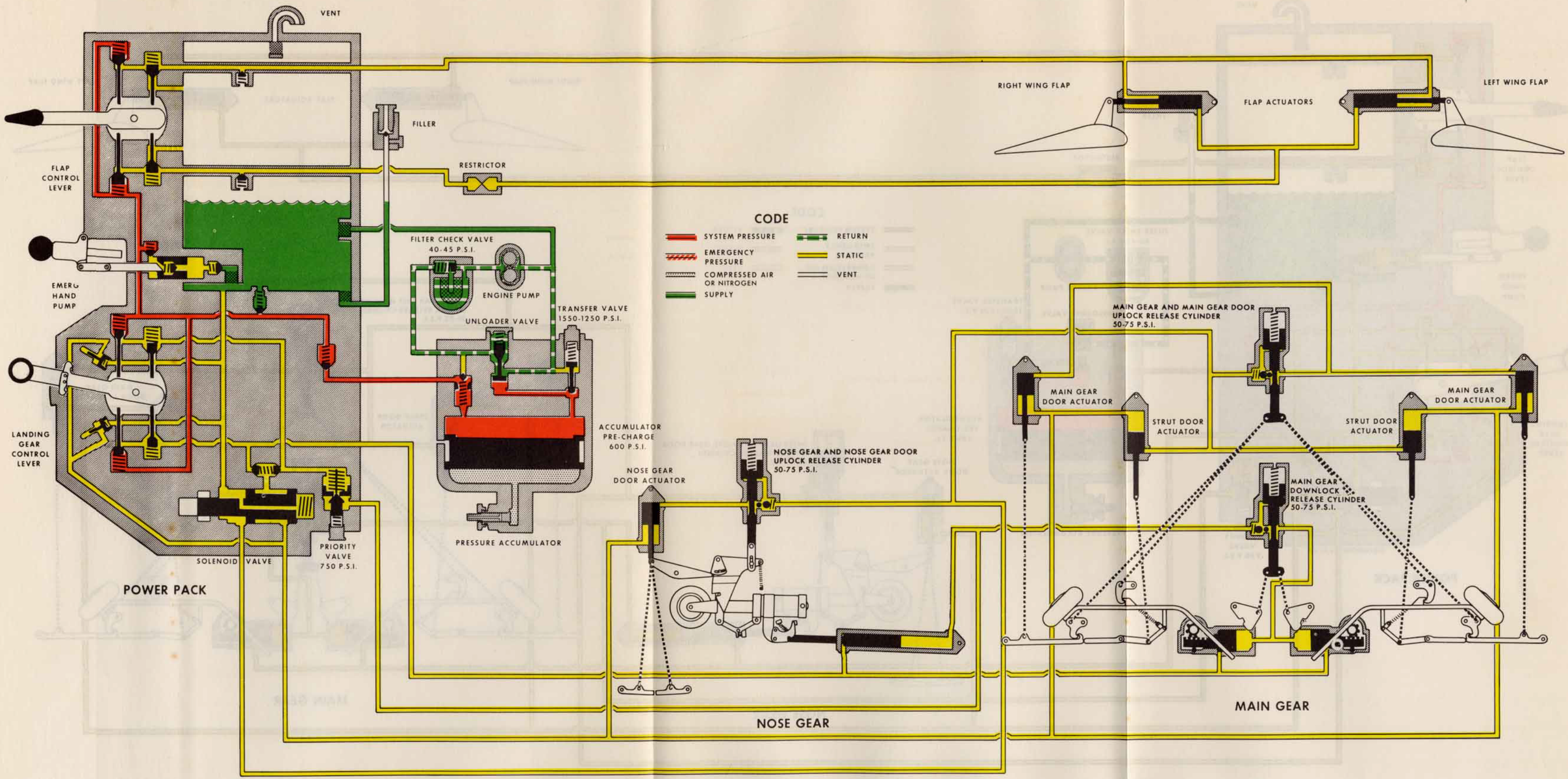
THIS DIAGRAM SHOWS:

(a) The landing gear up and locked.

(b) The flaps neutral.

Since no hydraulic power is being used, the combined action of the transfer valve and unloader valve has "unloaded" the pump, allowing fluid to cycle back through the pump.

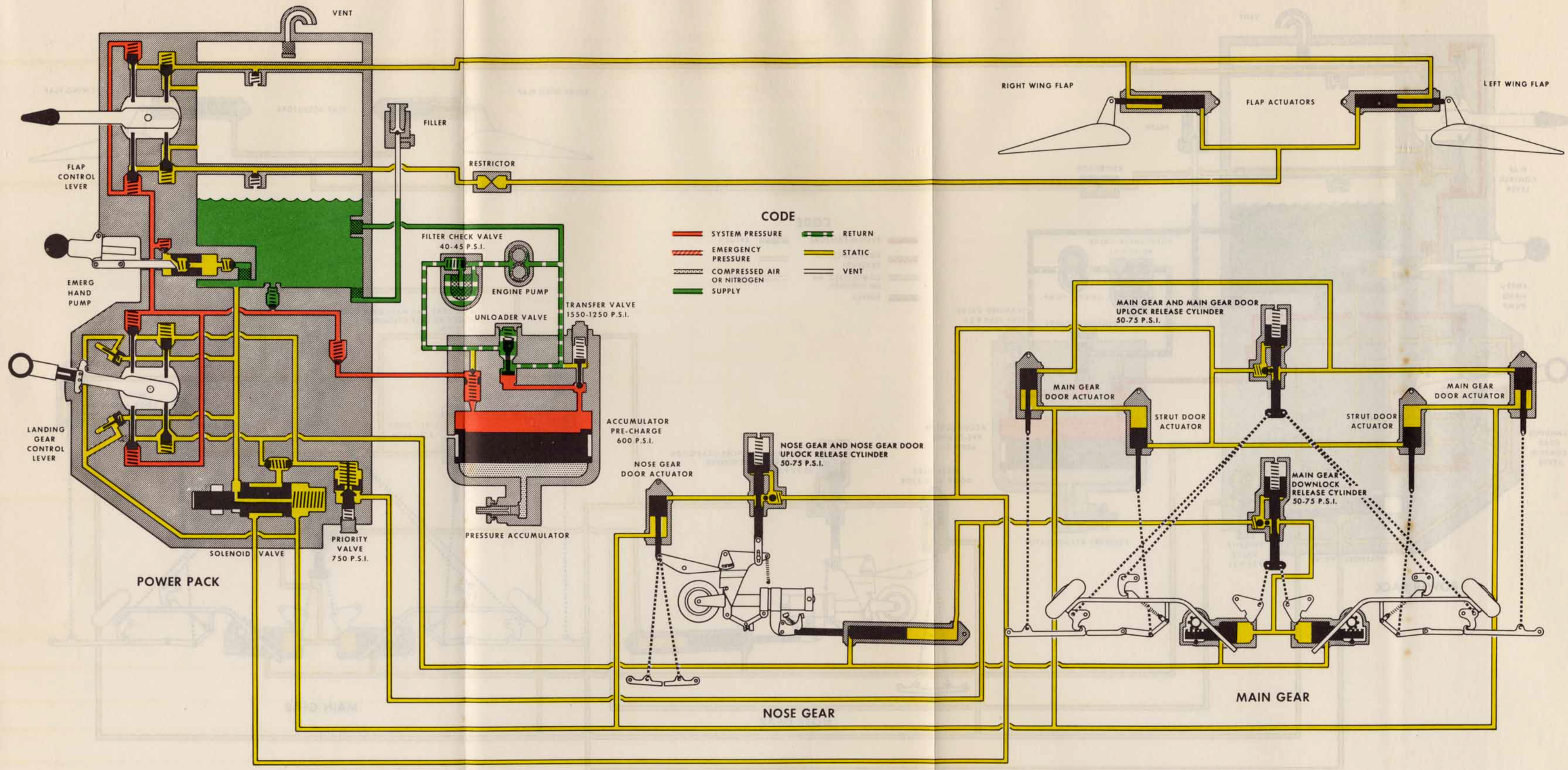
Note that all pressure poppets are closed and the hydraulic system is "at rest."



GEAR UP, LOCKED & LANDING GEAR CONTROL LEVER RELEASED TO UP NEUTRAL POSITION

- FLAP CONTROL LEVER NEUTRAL - PUMP UNLOADED

Figure 5-23. Hydraulic System Schematic (Sheet 1 of 10)



LANDING GEAR CONTROL LEVER IN UP NEUTRAL POSITION & PULLED OUT PRIOR TO MOVING INTO DOWN POSITION - FLAP CONTROL LEVER NEUTRAL - PUMP UNLOADED.

Figure 5-23. Hydraulic System Schematic (Sheet 2 of 10)

This diagram shows exactly the same conditions as the preceding one except that pulling out the handle has broken the circuit to the solenoid valve and caused the valve spool to shift position. This position of the valve spool will cause initial flow of hydraulic fluid to unlock and open the doors when the gear control lever is placed down. See figure 5-6, which shows a simplified diagram of the landing gear electrical circuits.

THIS DIAGRAM SHOWS:

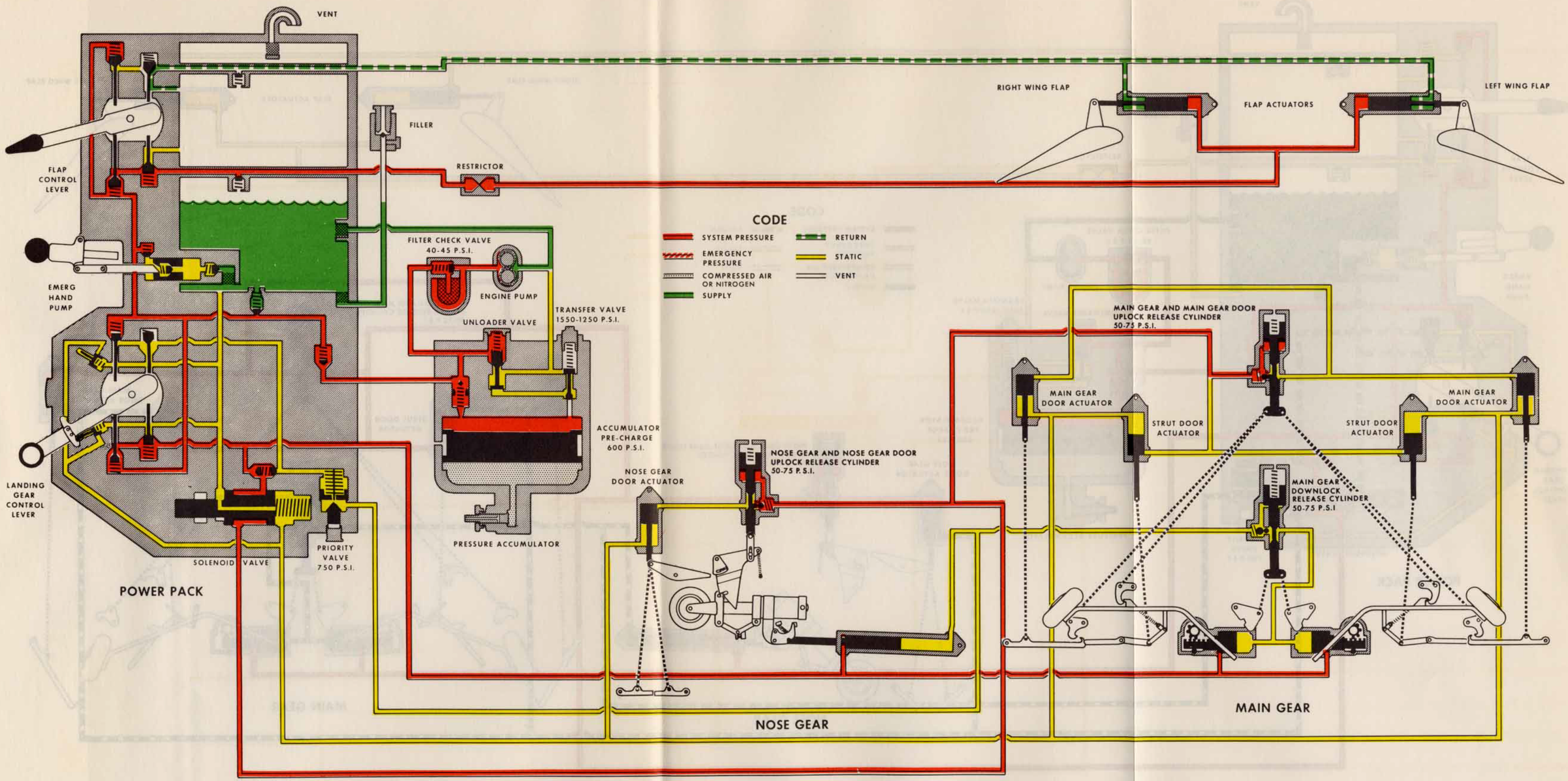
a. The landing gear down pressure poppet and the gear down return poppet open.

b. The solenoid valve in door-open position, to cause hydraulic flow to open doors before hydraulic pressure is applied to the main and nose gear actuators.

c. The priority valve is closed until increased pressure, caused by door cylinders being full open, is built up for gear actuation.

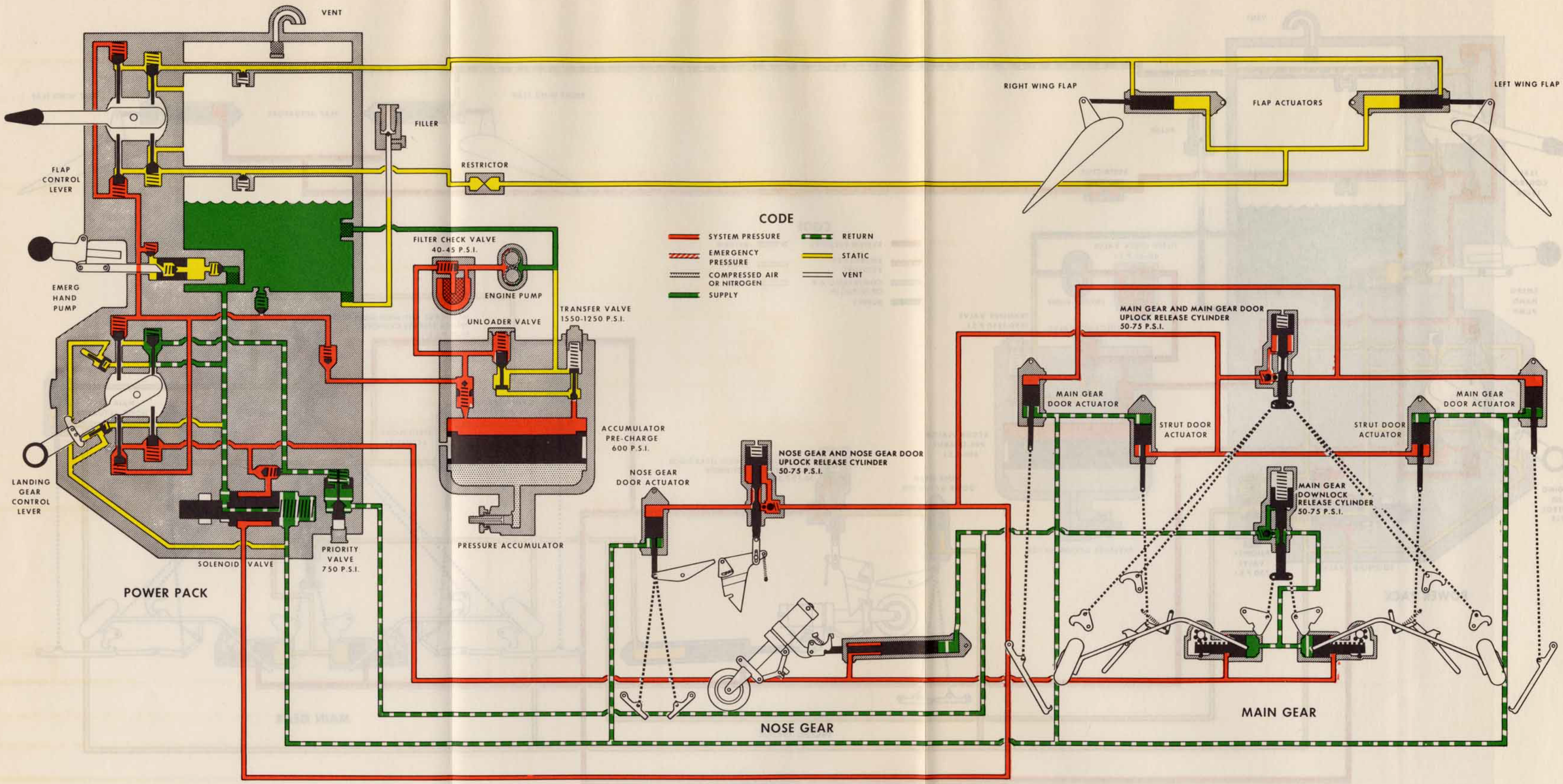
d. The flap down pressure poppet and flap down return poppet are open.

Accumulator pressure has been partially expended by the use of hydraulic pressure, thus the transfer valve and unloader valve "load" the pump, causing the pump to build up pressure to be fed into the accumulator.



LANDING GEAR CONTROL LEVER FULL DOWN WITH DOORS & GEAR UNLOCKING - FLAP CONTROL LEVER DOWN & FLAPS EXTENDING - PUMP LOADED

Figure 5-23. Hydraulic System Schematic (Sheet 3 of 10)



LANDING GEAR CONTROL LEVER FULL DOWN WITH DOORS OPENING & GEAR EXTENDING - FLAP CONTROL LEVER NEUTRAL WITH FLAPS DOWN - PUMP LOADED

Figure 5-23. Hydraulic System Schematic (Sheet 4 of 10)

THIS DIAGRAM SHOWS:

a. Hydraulic pressure applied to the landing gear actuators to extend the gear. The priority valve is open.

b. The flaps are fully extended and the flap handle has been returned to neutral.

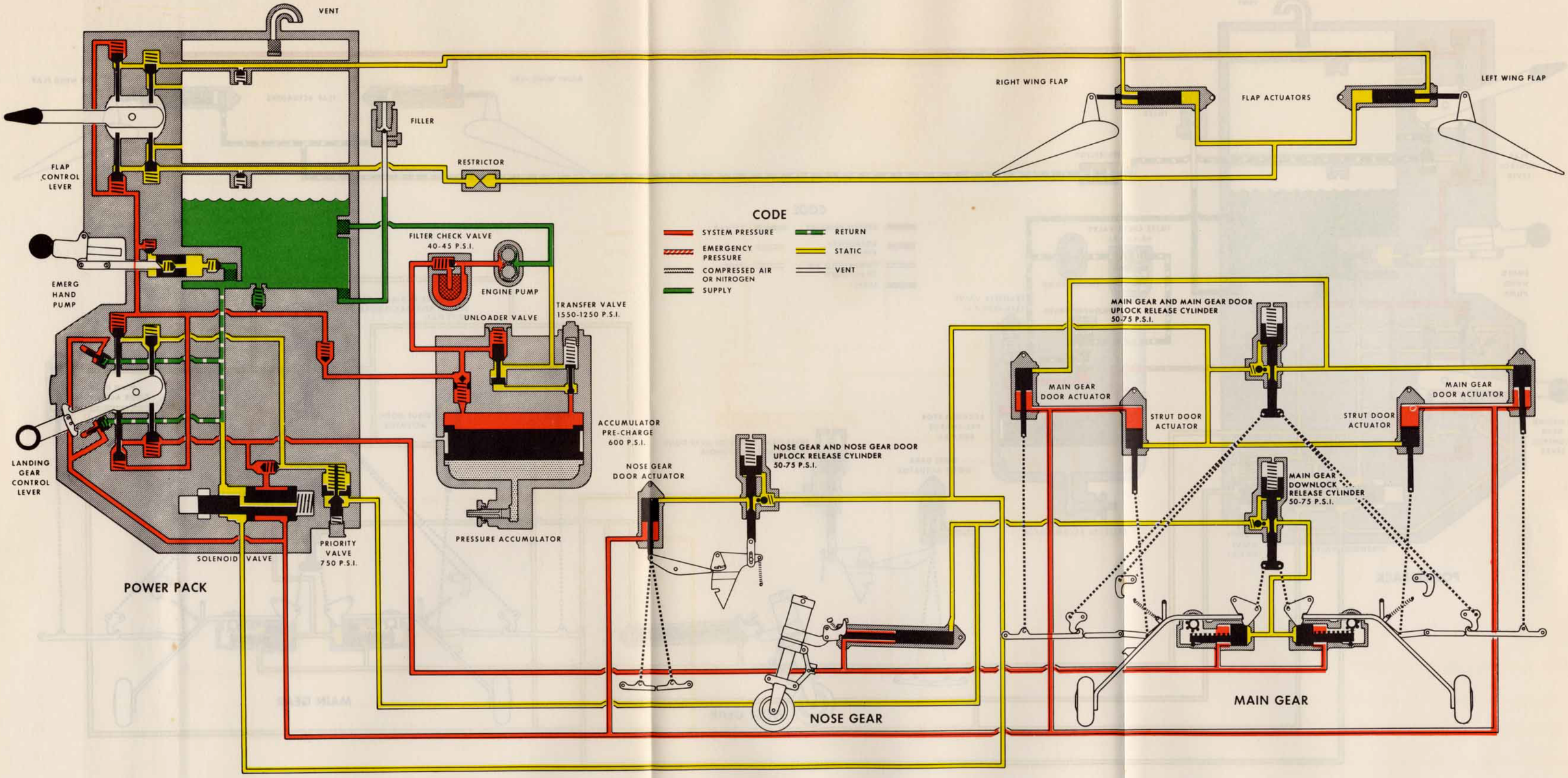
c. The pump is still loaded, due to the action of the transfer and unloader valves, because fluid is being used to operate the actuators.

THIS DIAGRAM SHOWS:

a. The gear just reaching the downlocked condition, with the doors just closed.

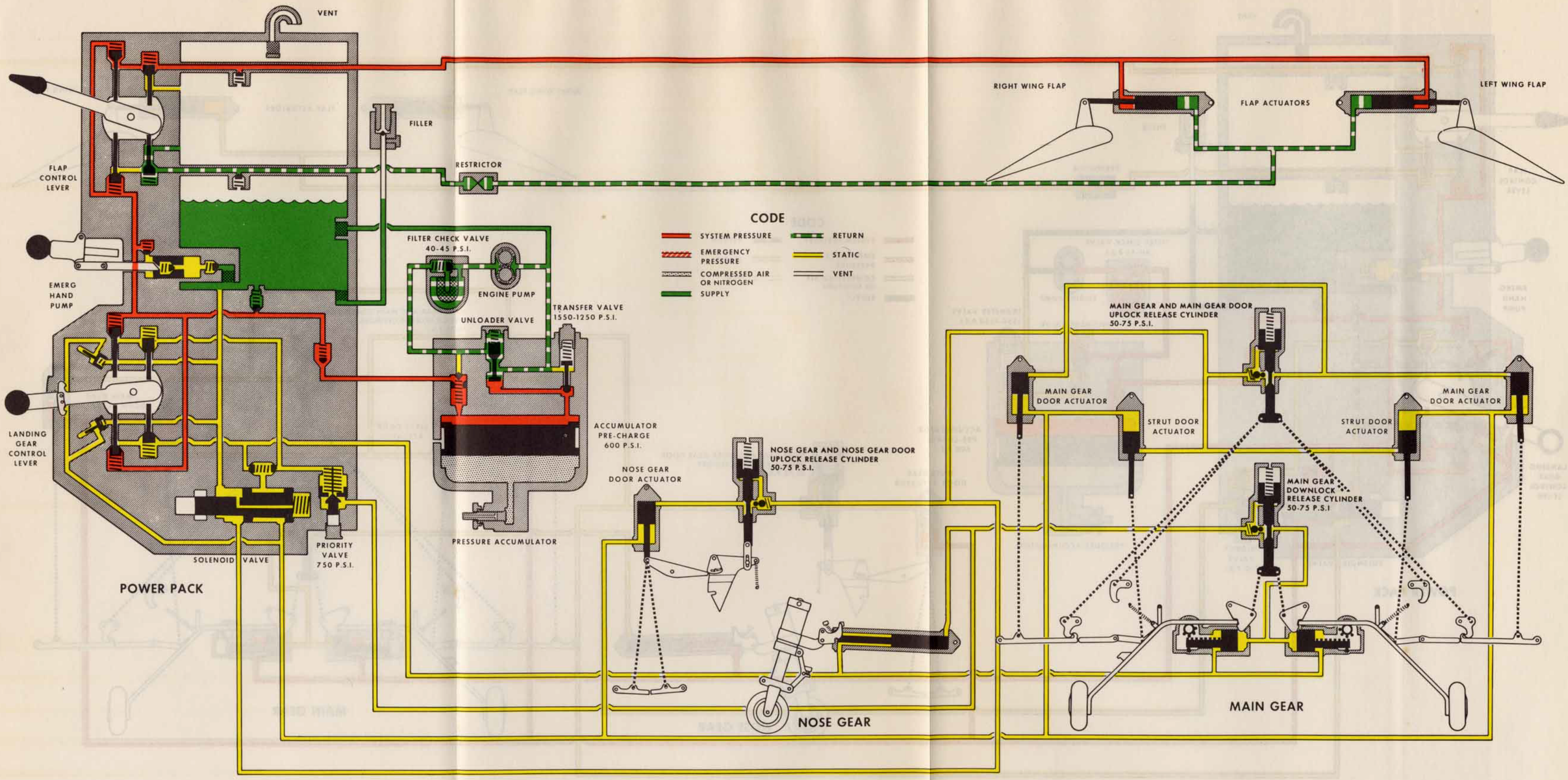
b. Pressure has built up to release the landing gear control lever from the full down position. The poppets are shown still slightly open; about to close as the handle returns to neutral.

c. The pump is still loaded, rebuilding pressure in the accumulator.



LANDING GEAR CONTROL LEVER RELEASING FROM FULL DOWN WITH GEAR EXTENDED & DOORS JUST CLOSED - FLAP CONTROL LEVER NEUTRAL WITH PARTIAL FLAPS - PUMP LOADED

Figure 5-23. Hydraulic System Schematic (Sheet 5 of 10)



LANDING GEAR CONTROL LEVER IN DOWN NEUTRAL POSITION WITH GEAR LOCKED EXTENDED & DOORS LOCKED CLOSED - FLAP CONTROL LEVER UP WITH FLAPS RETRACTING - PUMP UNLOADED.

Figure 5-23. Hydraulic System Schematic (Sheet 6 of 10)

THIS DIAGRAM SHOWS:

a. The pump unloaded and retraction of the flaps being powered by accumulator pressure alone.

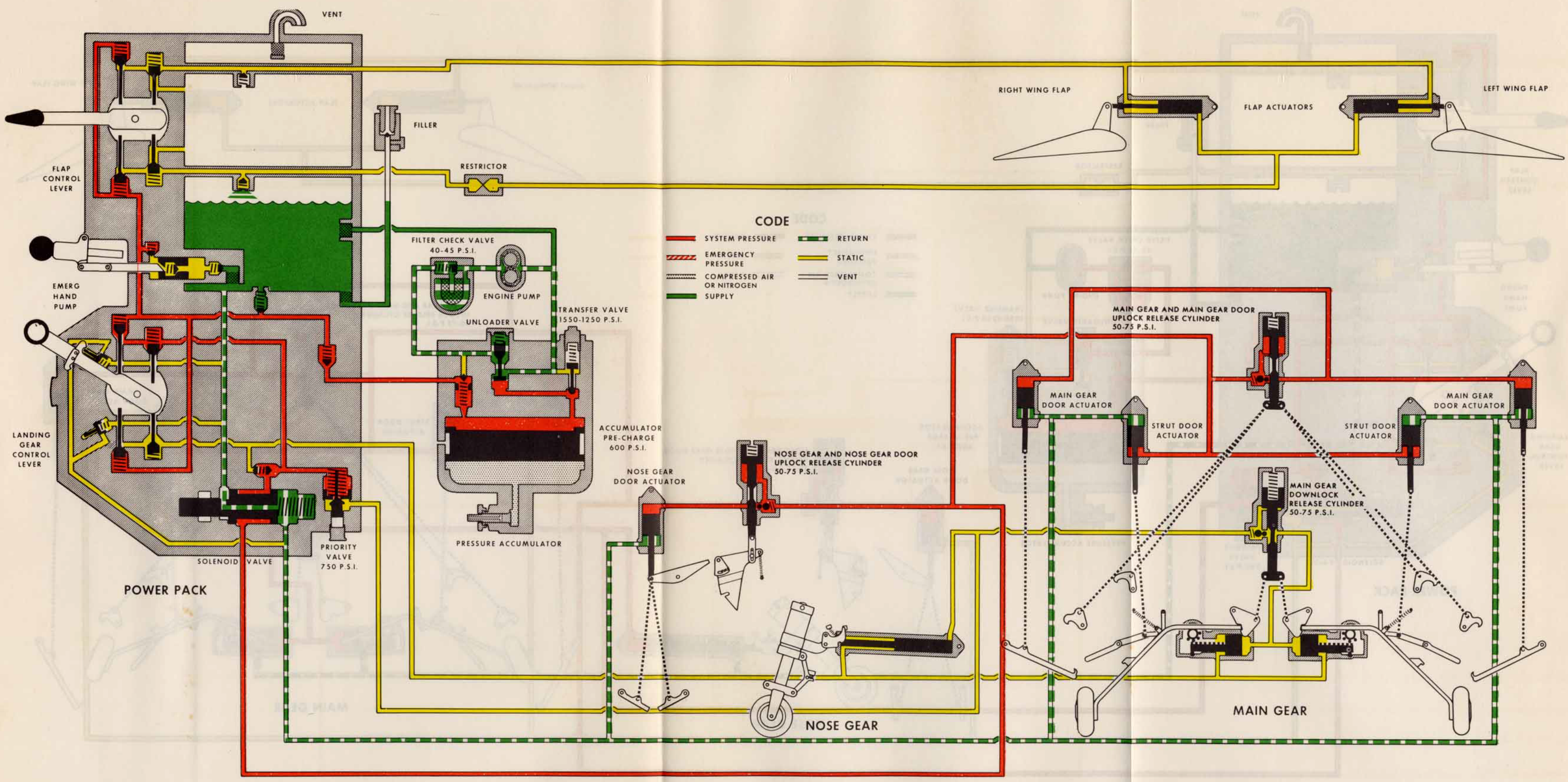
b. The landing gear control lever has returned to neutral. All landing gear pressure poppets are closed.

THIS DIAGRAM SHOWS:

a. The landing gear up pressure and up return poppets open.

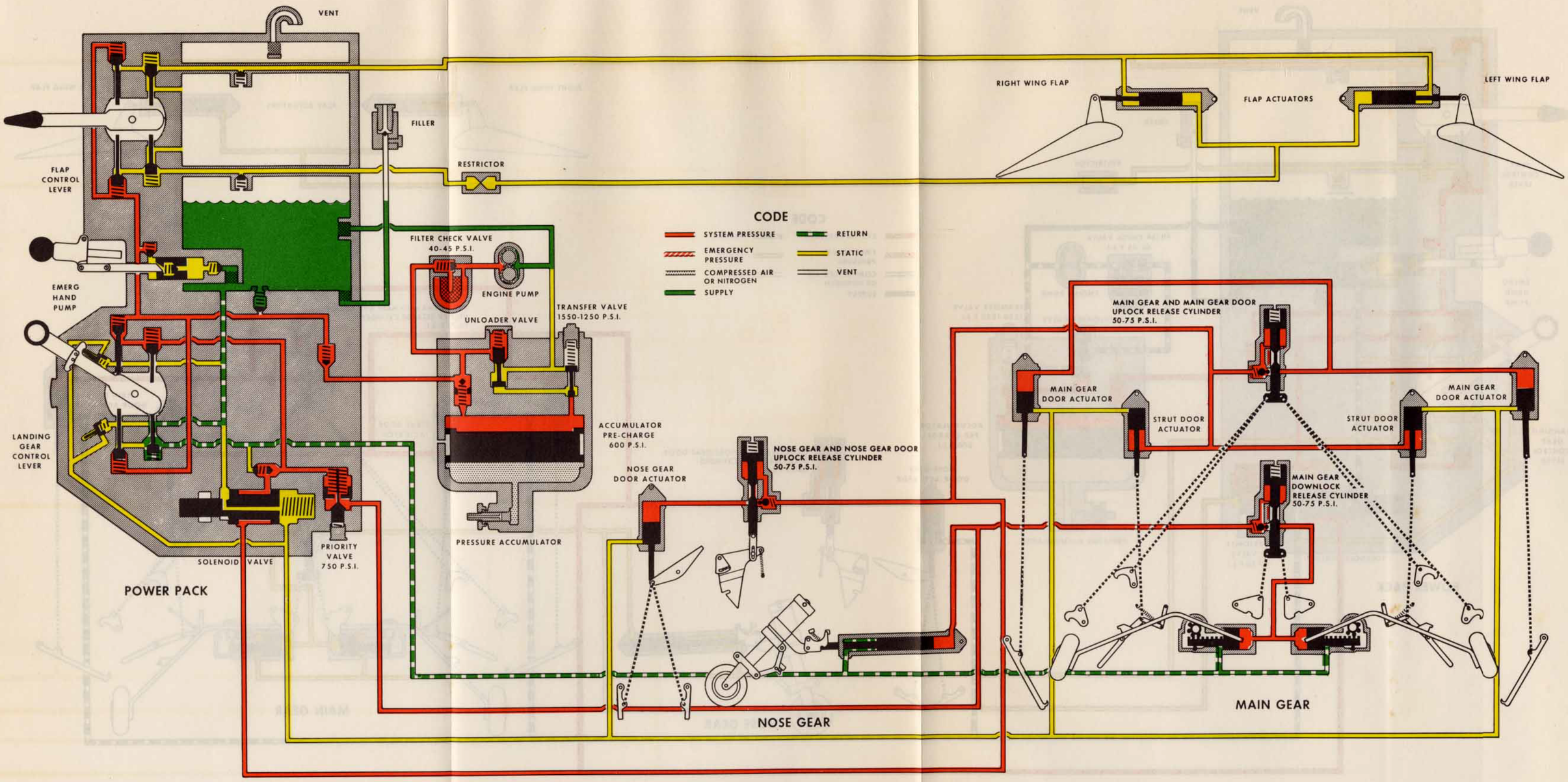
b. The door solenoid in door open position.

The landing gear control lever has been placed in the up position and the door open system is in operation. Since the priority valve does not open until system pressure reaches 750 psig, the doors must open and pressure must increase to this value before the landing gear will retract.



LANDING GEAR CONTROL LEVER FULL UP WITH DOORS UNLOCKING & OPENING & SYSTEM PRESSURE LESS THAN 750 PSIG
- FLAP CONTROL LEVER NEUTRAL WITH FLAPS RETRACTED & FLAP-UP THERMAL PRESSURE RELIEF VALVE OPERATING
- PUMP UNLOADED.

Figure 5-23. Hydraulic System Schematic (Sheet 7 of 10)



LANDING GEAR CONTROL LEVER FULL UP WITH GEAR UNLOCKED & RETRACTING WITH DOORS HELD OPEN - FLAP CONTROL LEVER NEUTRAL WITH FLAPS PARTIALLY EXTENDED - PUMP LOADED.

Figure 5-23. Hydraulic System Schematic (Sheet 8 of 10)

THIS DIAGRAM SHOWS:

a. The gear up pressure and up return poppets open.

b. Door solenoid still in door open position.

c. Priority valve open to unlock and retract gear. Due to the increased demand for hydraulic pressure, the transfer valve and unloader valve have "loaded" the pump.

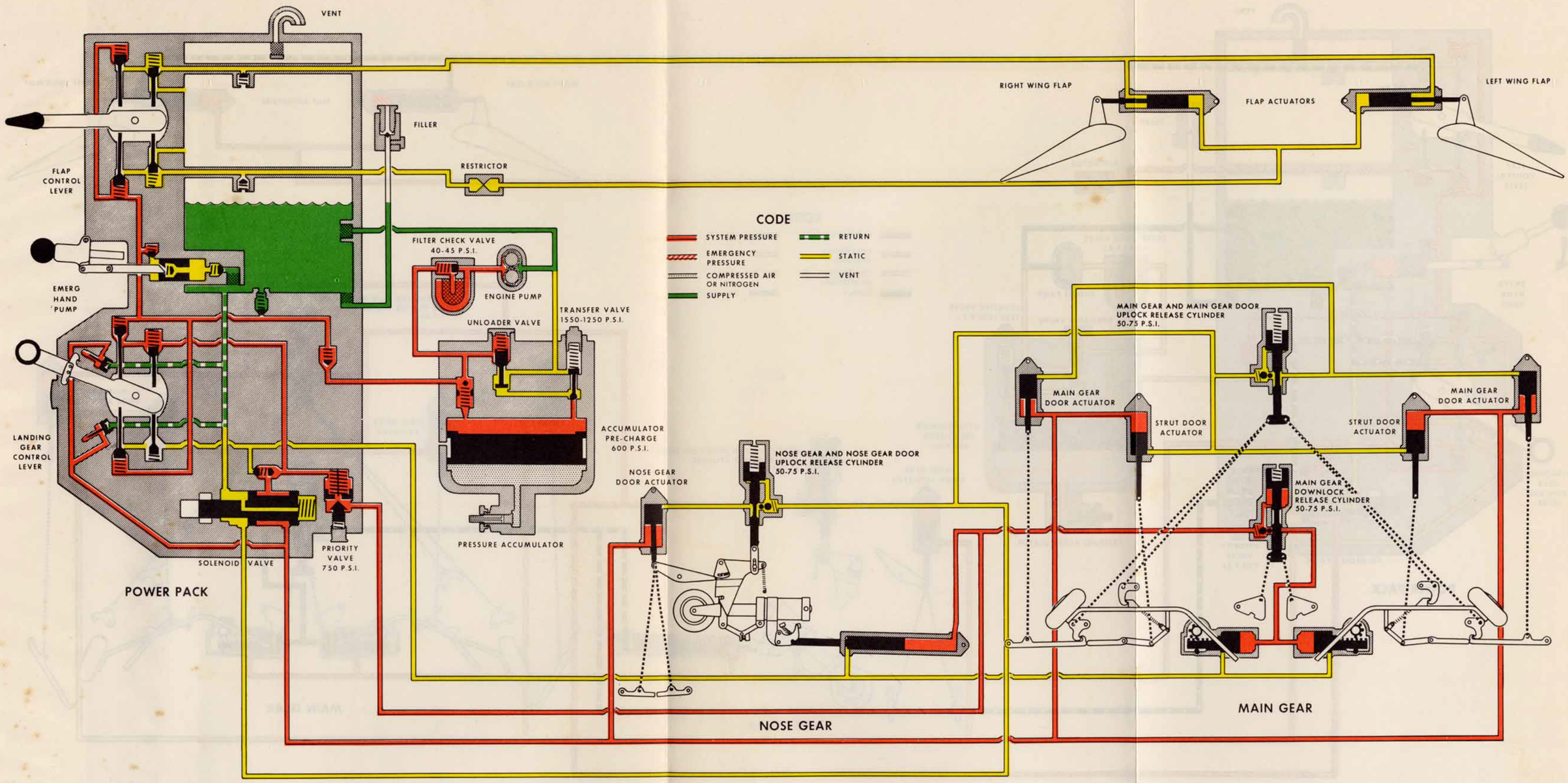
THIS DIAGRAM SHOWS:

a. The gear and doors locked up.

b. The door solenoid shifted to door-close position.

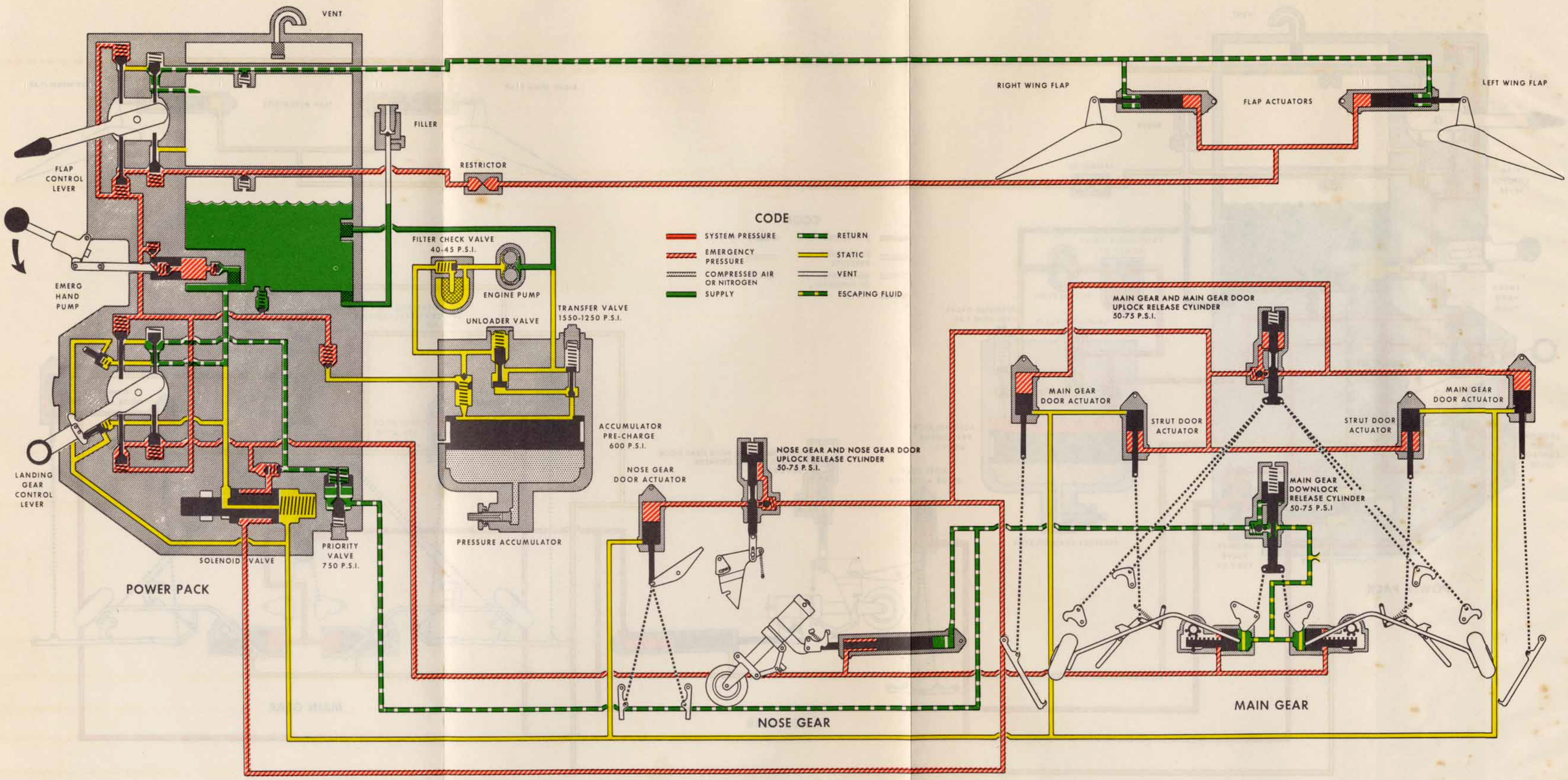
c. The pressure built up as a result of the gear actuators bottoming has acted on the handle release mechanism; the handle has just released from full up.

d. The pump is still "loaded," rebuilding system pressure to 1550 psi.



LANDING GEAR CONTROL LEVER RELEASING FROM FULL UP POSITION WITH GEAR RETRACTED & DOORS JUST CLOSED - FLAP CONTROL LEVER NEUTRAL WITH FLAPS PARTIALLY EXTENDED - PUMP LOADED.

Figure 5-23. Hydraulic System Schematic (Sheet 9 of 10)



LANDING GEAR CONTROL LEVER FULL DOWN - FLAP CONTROL LEVER DOWN - DEAD ENGINE OR HYDRAULIC PUMP FAILURE - ELECTRICAL SYSTEM & HYDRAULIC RETURN LINE FAILURE - EMERGENCY HAND PUMP SUPPLYING PRESSURE FOR GEAR AND FLAP EXTENSION.

Figure 5-23. Hydraulic System Schematic (Sheet 10 of 10)

THIS DIAGRAM SHOWS:

Several emergency conditions:

a. A dead engine or failed hydraulic pump.

b. Electrical system failure.

c. A burst hydraulic return line.

The emergency hand pump is used for lowering the gear. With electrical current off, the door solenoid goes automatically to door open position.

Note that a part of the fluid reservoir is available only to the emergency hand pump, thus an ample supply of fluid is reserved for emergency extension of the gear.

In this condition the doors will not close and the gear position indicator lights will not function, but the gear will be lowered and locked for a safe landing.

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SECTION 5A

HYDRAULICS AND LANDING GEAR

THIS SECTION IS APPLICABLE TO MODELS 210B, 210C, AND 210D. SEE SECTION 5C FOR MODEL 210D EQUIPPED WITH ALTERNATE HYDRAULIC COMPONENTS.

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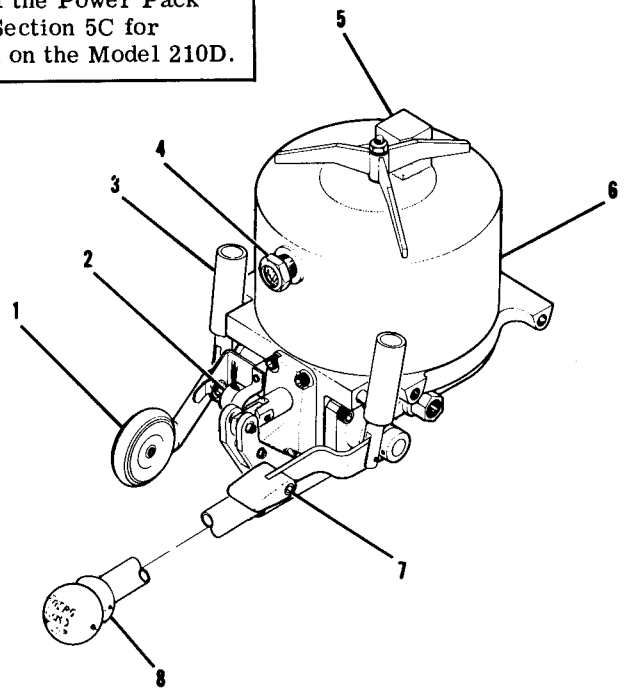
NOTE

Power Pack has been redesigned to eliminate the wing flap control portion of the Power Pack on the Model 210D. Refer to Section 5C for the alternate Power Pack used on the Model 210D.



1. Landing Gear Control Handle
2. Handle Lock-Out Solenoid
3. Handle Return Bungee
4. Fluid Level Window
5. Reservoir Vent
6. Hydraulic Reservoir
7. Wing Flap Control Handle
8. Emergency Hand Pump Handle

Figure 5A-1. Hydraulic Power Pack

5A-1. LANDING GEAR RETRACTION SYSTEMS.

5A-2. MODEL 210B. Beginning with the Model 210B an improved engine pump and Power Pack combination eliminates the accumulator in the system. "Loading" and "Unloading" of the engine pump, as shown in the schematic diagrams (figure 5A-17) is accomplished within the Power Pack whenever the landing gear or flap control is actuated. Down-locking of the main landing gear is made doubly-secure by additional downlock cylinders released by pressure in the door-close lines. The landing gear system is entirely hydraulically operated, but is electrically synchronized through the landing gear limit switches working in combination with the door-solenoid valve within the Power Pack.

5A-3. MODEL 210C. The Model 210C hydraulic system, except for an internally-improved Power Pack, is identical to the Model 210B hydraulic system. In the Model 210C Power Pack, a time-delay valve retards landing gear control lever release to neutral, thus ensuring that the landing gear doors are closed before hydraulic pressure in the door-close lines is transfered to the landing gear control handle-release circuit.

5A-4. MODEL 210D. The Model 210D hydraulic system differs from the Model 210C system in that the hydraulic wing flap system has been removed from the hydraulic system. This change includes removal of all wing flap hydraulic components such as the wing flap control valve, thermo relief valve, weep valve, wing flap control lever, and bungee spring from the Power Pack. Provisions for the wing flap components and parts have been eliminated from the Power Pack body. The Power Pack components that were common to the landing gear and wing flap operating systems, such as the primary and secondary relief valves, as well as landing gear system components such as the door solenoid and priority valves, remain in the Power Pack and are unchanged in their size, function, operation, or position. The wing flap actuation system for the Model 210D employs an electrically-driven system. All references to wing flap operation and maintenance shall be deleted in this section of the manual for maintenance of the Model 210D. See Section 7A for wing flap maintenance for the Model 210D and on.

5A-5. TROUBLE SHOOTING.

NOTE

Use the Hydro Test for trouble shooting landing gear malfunction. When the Hydro Test is employed to power the hydraulic system, landing gear operation can be slowed down to a "slow motion" during which hydraulic pressure can be noted precisely and mechanical action can be observed.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
GEAR EXTENDS AND LOCKS BUT GREEN LIGHT FAILS TO LIGHT UP.		
If doors close, green light bulb is defective.	"Press To Test"	Replace bulb.
If doors fail to close, down limit switch circuit is defective or switch is open.	Check continuity through switch circuit.	Readjust switch, replace switch or repair wiring circuit. Any open switch or interruption in the L. G. limit switch circuit will not allow the door-close solenoid valve to go into door-close position.
DOORS WILL NOT OPEN, GEAR WILL NOT ACTUATE.		
Electrical short-circuit holding solenoid valve in door-close position.	Switch off master switch and attempt gear operation.	Check gear circuits.
Engine pump or pump line failure.	Check visually, test operate system using Hydro Test or emergency hand pump. If system functions, engine pump is faulty.	Repair, replace pump or broken pump line. Refill reservoir.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
DOORS WILL NOT OPEN, GEAR WILL NOT ACTUATE (Cont.)		
Pump unloader valve in pack jammed in "unload" position.	Actuate gear and flap levers several times with engine running to free unloader valve, if necessary attempt gear actuation with emergency hand pump.	Repair unloader section in pack.
Defective control disc valve in pack or defective isolation check valve.	If even emergency hand pump pressure will not actuate gear, difficulty is within internal valves in pack.	Overhaul or replace power pack.
Bad leak in door open pressure line.	Check visually for spilled fluid.	Repair line.
DOORS OPEN, BUT GEAR WILL NOT ACTUATE.		
Internal leakage in pack.	Check gear operation using Hydro Test.	Repair power pack.
Unloader valve leaking.	Check gear operation using Hydro Test.	Repair power pack.
Bad leak in gear up or down line or actuators.	Check visually for spilled fluid.	Repair line or component.
Pump pressure not adequate for gear actuation.	Check gear operation using Hydro Test.	Overhaul pump.
GEAR OPERATES BUT DOORS WILL NOT CLOSE, INDICATOR LIGHT OUT.		
Defective limit switch circuit.	Check circuit breaker, then check circuit continuity to isolate open in circuit.	Repair defective component in circuit.
Solenoid burned out.	Check solenoid current drain.	Replace solenoid.
Solenoid armature jammed.	Unscrew solenoid and check operation.	Free armature or replace solenoid.
Solenoid valve jammed or sticking in door open position.	Switch master switch on and off to free jammed valve by solenoid hammering; if this fails to dislodge valve spool, pack must be removed for repair of jammed valve.	Repair solenoid valve.

SHOP NOTES:

NOTE

For the Model 210D, delete the hydraulic wing flap components. The Model 210D utilizes an electric motor-driven wing flap system.

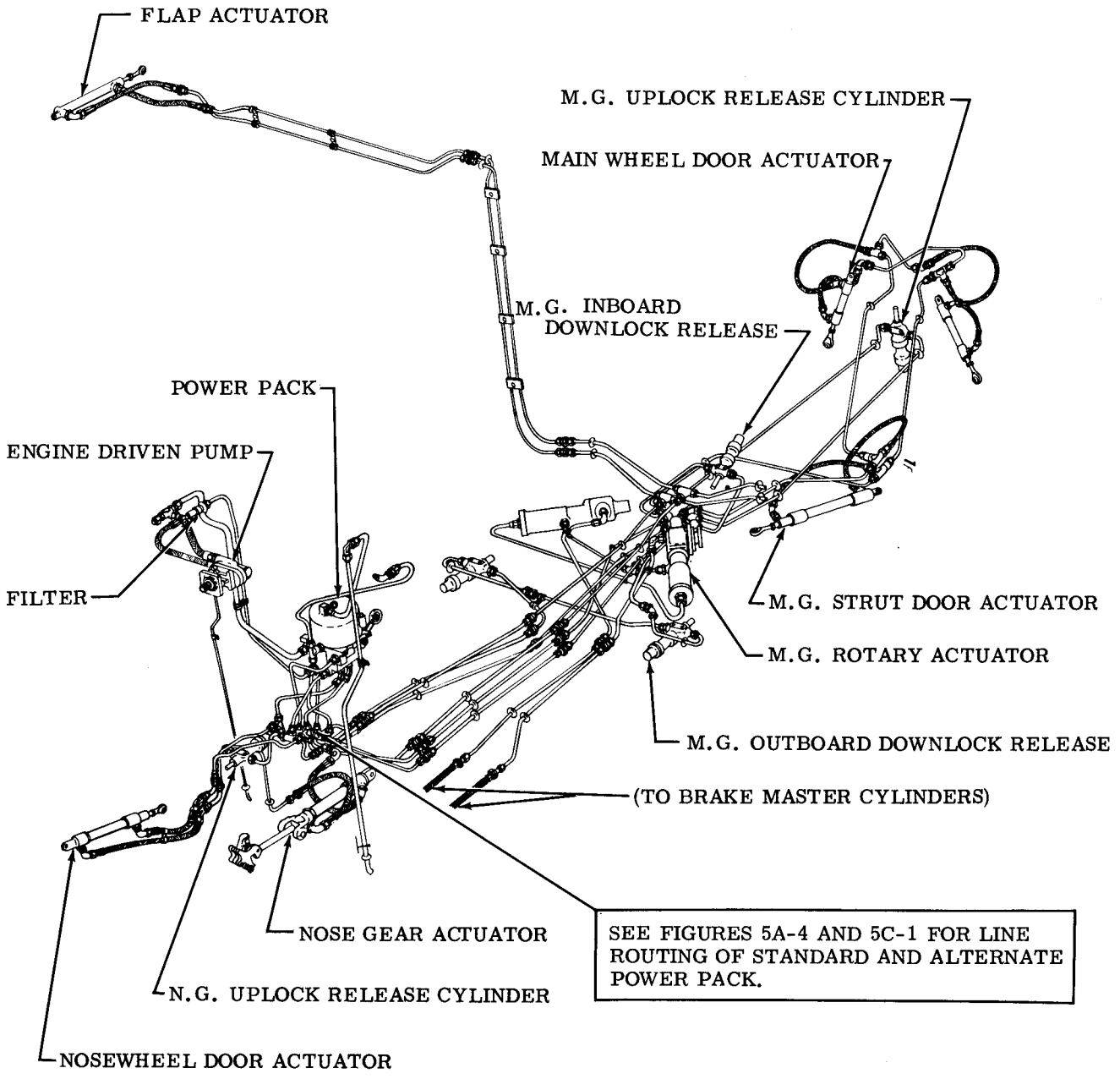


Figure 5A-2. Hydraulic System

5A-6. HYDRAULIC POWER SYSTEM COMPONENTS.

5A-7. The hydraulic power system includes all equipment required to provide a flow of pressurized hydraulic fluid to the landing gear operating system and to the wing flap system for models prior to the Model 210D.

ITEM	PURPOSE	LOCATION AND ACCESS
Engine-driven hydraulic pump.	To provide a flow of pressurized hydraulic fluid to the system.	Right rear accessory pad of engine. Remove upper cowling.
Hydraulic filter.	To filter fluid from the pump before entering remainder of system.	Upper right side of firewall in engine compartment. Remove the upper engine cowling.
Hydraulic Power Pack.	(1) To "load" the engine-driven pump when the landing gear or flap control lever is actuated. (2) To provide a reservoir of hydraulic fluid. (3) To afford control of landing gear and flap operating systems through the use of valves built into the unit. (4) To provide emergency hydraulic pressure through the use of the hand pump in the unit.	At top of pedestal. Partially accessible for adjustment with Royalite decorative cover and pedestal front panels removed.

5A-8. ENGINE-DRIVEN HYDRAULIC PUMP.

5A-9. The gear-type hydraulic pump is mounted on the right rear accessory pad of the engine. Driven at approximately 1-1/2 times engine crankshaft speed, the pump supplies a controlled flow to the Power Pack and hydraulic systems whenever the landing gear or wing flap control handles is operated. While the handles are in neutral, the pump bypass in the Power Pack allows the pump to cycle the fluid. Pump flow is controlled to approximately one gallon-per-minute.

5A-10. REMOVAL AND INSTALLATION. Refer to paragraph 5-8 for removal and installation of the hydraulic pump.

5A-11. DISASSEMBLY AND REPAIR. Refer to Appendix B for disassembly and repair of the hydraulic pump.

5A-12. HYDRAULIC FILTER.

5A-13. Two types of filters (see figure 5A-4) are installed in the pump pressure line at the firewall to filter the fluid before it enters the Power Pack. The earlier filter screen was a 78 micron filter. Filter now used is a 31 micron screen capable of passing fluid at the rate of approximately 1.12 gallon-per-minute.

5A-14. REMOVAL AND CLEANING. The screen in the hydraulic filter should be removed and cleaned with solvent (Federal Specification P-S-661, or equivalent) at the first 25 hours, the first 50 hours, and at each 100-hour inspection thereafter. Figure 5A-4 shows details of the filter and may be used as a guide during, removal, disassembly, and installation.

5A-15. POWER PACK.

5A-16. The hydraulic Power Pack (see figure 5A-1) is a multi-purpose control unit in the hydraulic system. It contains a hydraulic reservoir, valves which control flow of pressurized fluid to the landing gear and wing flap systems, handle position switches connected to gear indicator lights and warning horn, and an emergency hand pump permitting extension of the landing gear in the event the hydraulic system pressure should fail. Besides these major features, the Power Pack includes pressure and thermal relief valves to relieve excessive system pressure. A built-in valve prevents the gear from starting its retraction cycle until pressure has been applied to open the landing gear doors. Associated with this valve, but not dependent on it, is a solenoid operated valve, which maintains the correct sequence of landing gear and door operation. The Model 210C has a time-delay valve which delays the landing gear handle trip back to neutral 3 to 9 seconds after the landing gear doors have closed. On the Model 210D and on the wing flap portion of the Power Pack has been deleted.

5A-17. REMOVAL.

a. Remove the front seats and spread a drip cloth over the forward carpet.

b. Position a gallon can under filler tee fitting. Loosen the nut and drain the reservoir fluid into the can.

c. Remove the landing gear and flap control knobs from the control arms.

d. Remove the decorative cover from the pedestal.

THE GEAR DOWN PRIORITY VALVE SHOULD UNSEAT AT 550 ± 50 PSI

THE GEAR UP PRIORITY VALVE SHOULD UNSEAT AT 750 + 50-0 PSI

NOTE

The wing flap section of the Power Pack is deleted on the Model 210D. Refer to Section 5C for alternate Power Pack used on the Model 210D.

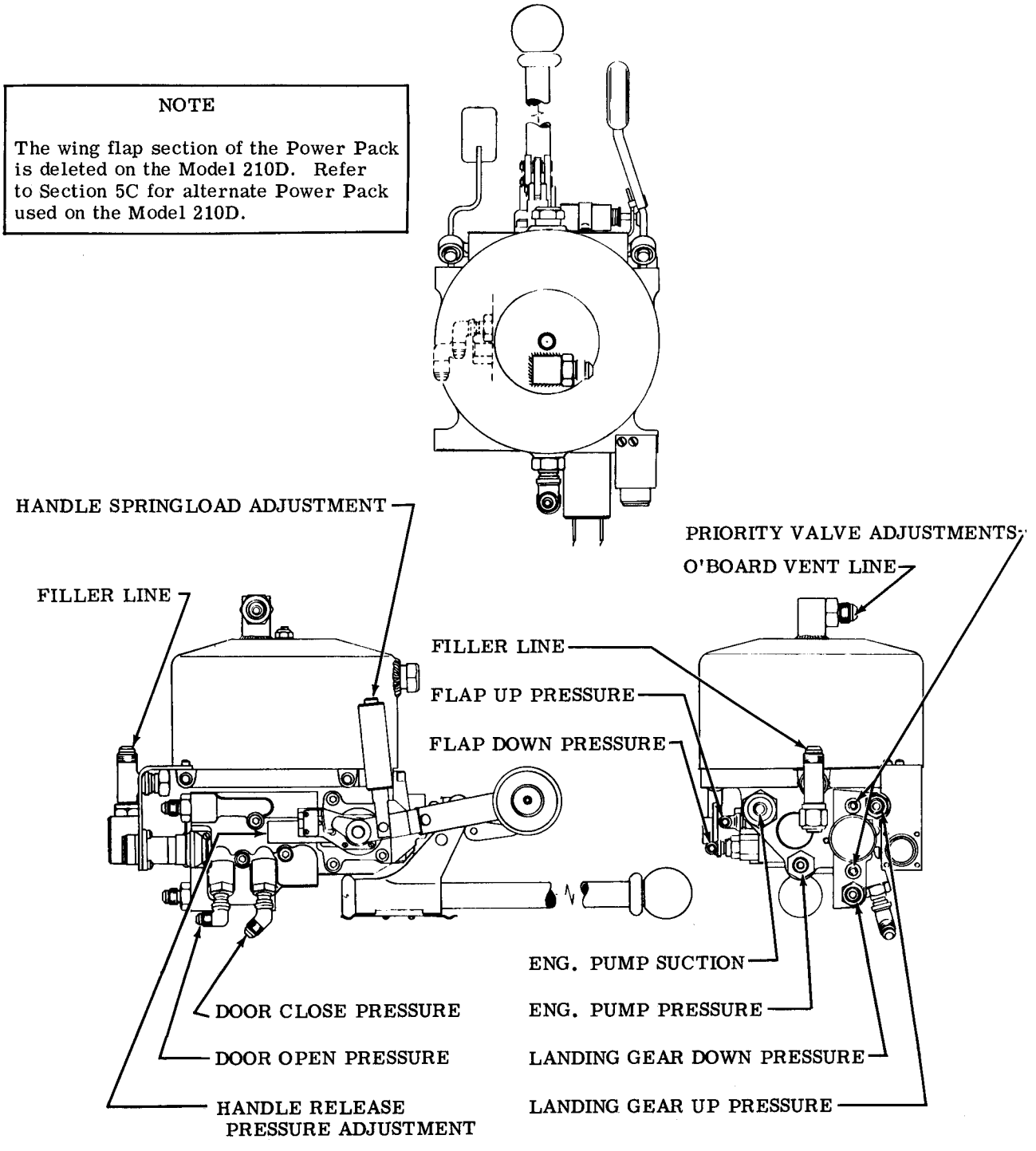


Figure 5A-3. Location of Power Pack Fittings

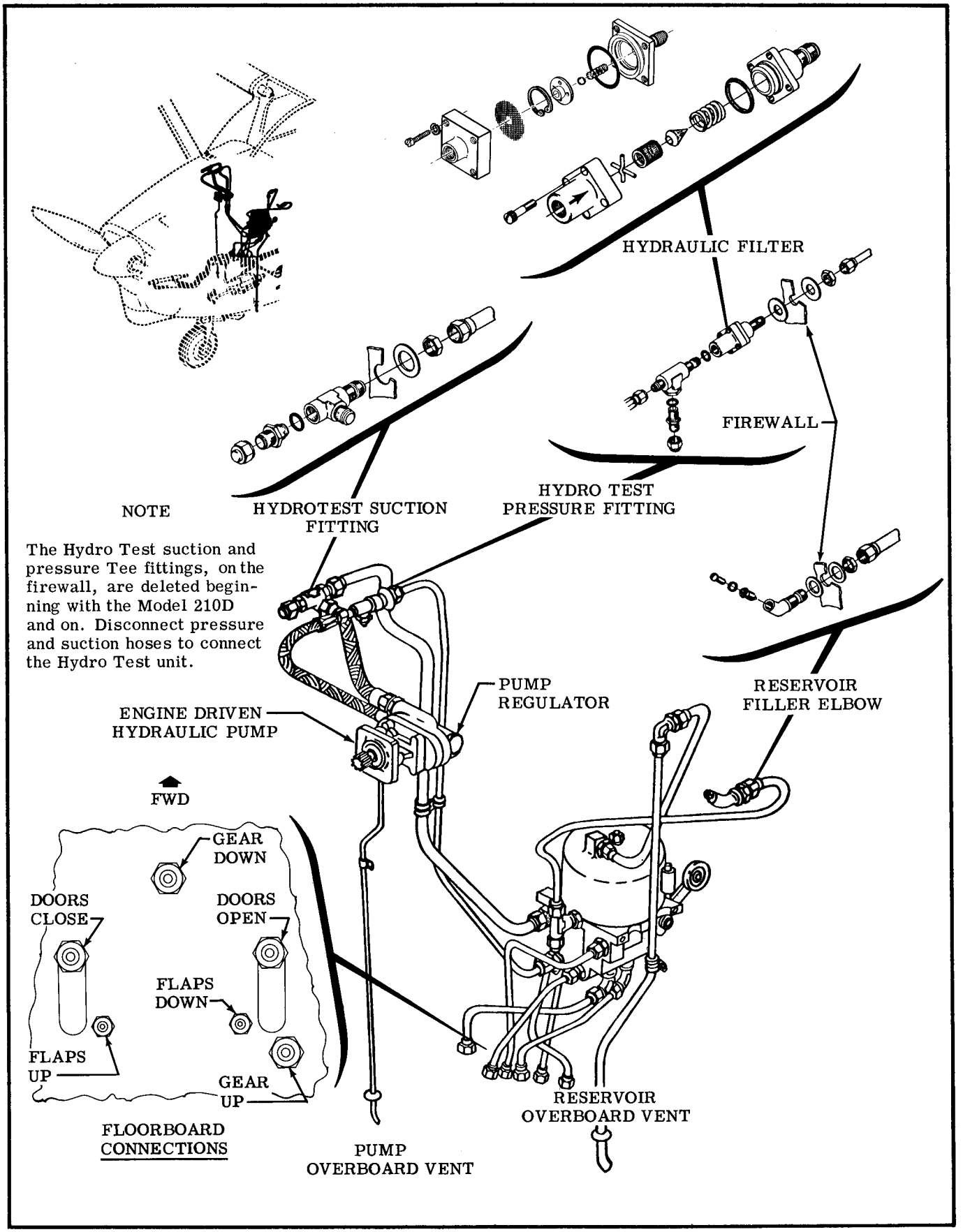


Figure 5A-4. Hydraulic Power System

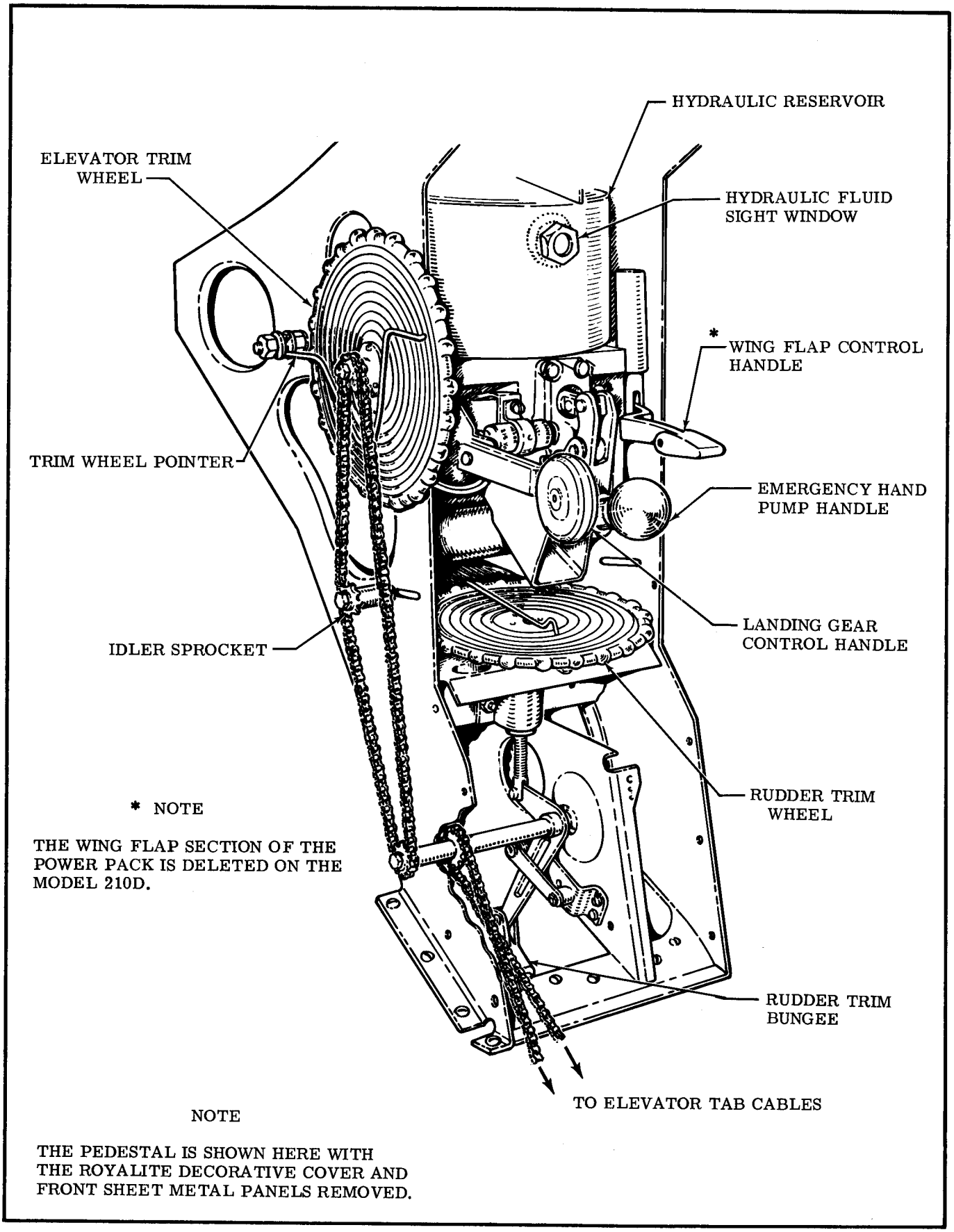


Figure 5A-5. Pedestal Items

e. Disconnect cannon plug at back of Power Pack.
f. Disconnect and cap or plug all hydraulic lines from Power Pack to prevent entry of dirt.
g. Remove front sheet metal shield of pedestal.
h. Remove the three studs and one bolt securing the pack to the pedestal side members then work the pack aft, out of the pedestal.

NOTE

The two studs on the left side of the pack serve also as pivots for the elevator trim wheel and pointer. The studs may be unscrewed from the power pack threads without major disturbance to the elevator trim system components by using an end wrench to remove them. The stud on the right side of the pack is the pivot for the cowl flap control arm. The cowl flap control must be removed from the pedestal side structure to remove this stud.

5A-18. DISASSEMBLY AND REPAIR. Refer to Appendix B for disassembly and repair of the Power Pack.

5A-19. INSTALLATION.

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 the hydraulic lines. See figure 5-9.

a. Work the pack into position and install the three studs and one bolt that attach it to the sides of the pedestal.

NOTE

The three studs serve as pivots for the elevator trim wheel, the trim wheel pointer, and the cowl flap control arm. Adjust these systems and controls as necessary, according to instructions contained in appropriate sections of this handbook, before installing the pedestal decorative cover.

b. Attach all hydraulic lines to pack fittings. Make sure fittings are properly installed, with jam nuts tight, after lines are attached.
c. Connect and safety cannon plug at rear of pack.
d. Install sheet metal front shield of pedestal.
e. Fill reservoir and bleed lines.
f. With aircraft on jacks, and Hydro Test supplying hydraulic power, test operate landing gear and flaps to check for proper operation and tight plumbing connections.
g. Check elevator trim operation and cowl flap operation.
h. Install decorative cover and Power Pack control knobs.

5A-20. POWER PACK ADJUSTMENTS.

5A-21. LANDING GEAR HANDLE - RELEASE MECHANISM. (See figure 5A-5A.) Proper adjustment of the landing gear handle-release mechanism is necessary because a badly-adjusted handle release can cause continuous "loading" of the engine-driven hydraulic pump, or, if it releases too soon, cause the handle to release before the doors are closed. Proper release setting depends on a balancing of factors. On the Model 210B, the hydraulic pressure build-up as the door cylinders reach their limit of travel in the closed position disengages a spring-loaded plunger engaged with the handle-release cam, and at this time the spring load applied by the handle centering bungee pushes the handle back to a neutral position. Beginning with the Model 210C and on and Model 210B airplanes retrofitted with a Model 210C Power Pack, a time-delay valve is incorporated in the reservoir of the Power Pack and delays, for a period of 3 to 9 seconds, the pressure buildup in the door-closed circuit actuating the landing gear handle release. This time-delay makes adjustment of the handle-release mechanism pressure much less critical. The spring load on the release plunger and

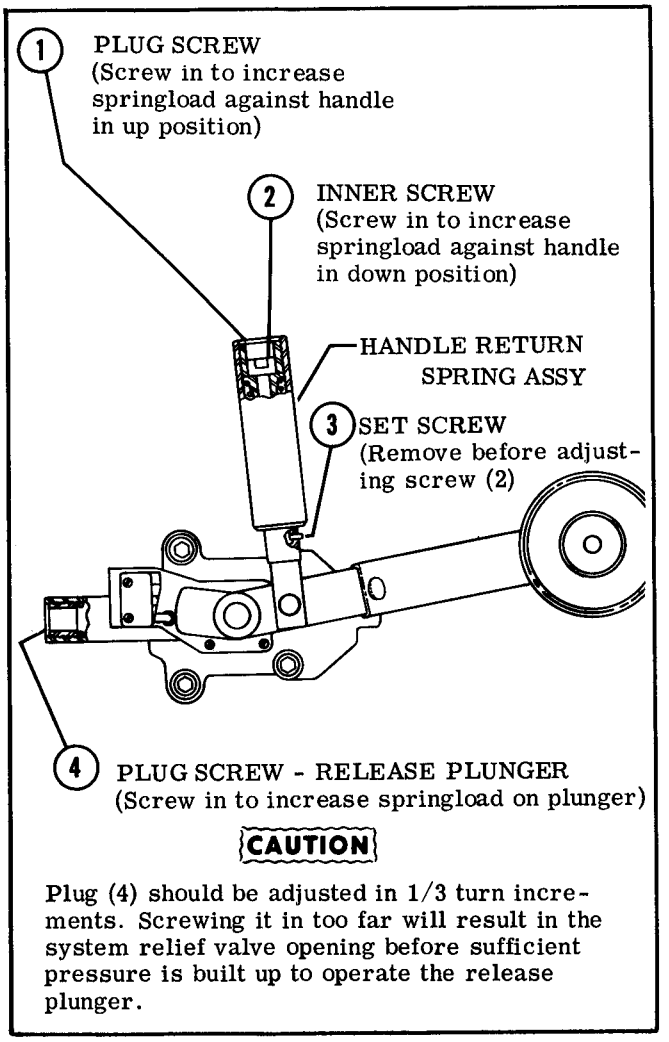


Figure 5A-5A. Handle Release Adjustment

the spring load on the centering bungee are adjustable. The following procedural steps outline the handle-release adjustment.

a. Jack the airplane and connect the Hydro Test unit as outlined in Section 2.

b. Remove pedestal decorative cover to gain access to Power Pack and remove set screw (3) from bungee.

c. Turn inner screw (2) in 4 to 8 complete turns so that inner screw will not interfere with adjustment of screw plug (1).

d. Turn plug screw (1) in until it bottoms (full down), then back plug screw (1) out one complete turn from bottomed position.

e. With landing gear handle pulled out to end of barrier and lock-out solenoid disengaged, adjust inner screw (2) out until all free play is removed.

NOTE

Adjust inner screw (2) by turning it out, intermittently checking for free play. If inner screw (2) is adjusted out too far it will then add free play to handle instead of removing the free play.

f. After free play has been removed from gear handle, install and tighten set screw (3) in bungee.

g. Using the Hydro Test, check the pressure at which the handle-release plunger disengages the detents. Use a very slow flow, and be sure time is allowed for time-delay valve to open. In the Model 210B this pressure should be 1300±50 psi. In the Model 210C and on, the Model 210B airplanes that have been retrofitted with a Model 210C Power Pack, the pressure is 750 to 1250 psi.

h. Adjust plug screw (4) as necessary to obtain the pressures listed in step "g." Cycle landing gear between each adjustment.

i. Handle must hold in both the up and down positions until the release plunger has released at the correct pressure setting, and then return to the neutral position with a positive snap.

5A-22. PRIMARY AND SECONDARY RELIEF VALVES. If the primary or secondary relief valve should get out of adjustment, fluid contamination, wear of parts, or defective parts should be suspected. Remove Power Pack, disassemble, repair and adjust as outlined in Appendix B.

5A-23. GEAR UP PRIORITY VALVE ADJUSTMENT. (See figure 5A-3.) The gear up priority valve may be adjusted while the Power Pack is installed in the airplane, or if removed, the valve may be adjusted as outlined in Appendix B.

a. Jack airplane and connect Hydro Test in accordance with paragraph 2-60.

b. Check gear up priority valve setting in accordance with paragraph 2-70 and figure 5A-3.

c. If adjustment is required, turn upper priority valve adjusting screw (figure 5A-3) in (clockwise) to increase pressure at which priority valve opens, or turn the adjusting screw out (counterclockwise) to decrease pressure at which the valve opens. Adjust so that valve opens at 750 +50 -0 psi as read on the Hydro Test gage.

d. Cycle landing gear to check for proper operation, then lower the gear.

e. Fill reservoir and disconnect Hydro Test.

f. Remove airplane from jacks.

5A-24. GEAR DOWN PRIORITY VALVE ADJUSTMENT. The gear down priority valve may be adjusted while the Power Pack is installed in the airplane, or if removed, the valve may be adjusted as outlined in Appendix B.

a. Jack airplane and connect Hydro Test in accordance with paragraph 2-60.

b. Check gear down priority valve setting in accordance with paragraph 2-71 and figure 5A-3.

c. If adjustment is required, turn lower priority valve adjusting screw (figure 5A-3) in (clockwise) to increase pressure at which gear down priority valve opens, or turn adjusting screw out (counterclockwise) to decrease pressure at which gear down priority valve opens. Adjust so that the gear down priority valve opens at 550±50 psi as noted on Hydro Test gage.

d. Cycle landing gear to check proper operation, then lower gear.

e. Fill reservoir and disconnect Hydro Test.

f. Remove airplane from jack.

5A-25. EMERGENCY HAND PUMP. The emergency hand pump may be repaired while in the airplane. Refer to Appendix B for repair and disassembly.

SHOP NOTES:

5A-26. LANDING GEAR ELECTRICAL CIRCUITS.

5A-27. Landing gear electrical circuits are shown in figure 5A-6, which shows the switches in the gear down and locked, weight-on-gear condition. The table below describes what each electrical components in the circuit does, and what causes it to operate.

ITEM	OPERATED BY	FUNCTION
Up limit switches - Nose and main gear.	Gear in up and locked position.	Close circuit to gear up (red) indicator light and to "NO" terminal of handle up-down limit switch.
Down limit switches - Nose and Main Gear.	Gear in down and locked position.	Close circuit to gear down (green) indicator light and to "NC" terminal of handle up-down limit switch.
Handle up-down limit switch.	Arm on landing gear control handle.	With master switch on, completes circuit to solenoid valve when landing gear reaches the full up or full down position selected by landing gear handle. Opens circuit when handle returns to neutral.
Solenoid valve (on Power Pack).	Valve is normally in door open position but moves to door-close position when circuit is energized by handle switch and all gear limit switches being all closed.	Directs hydraulic flow to operate landing gear doors in proper sequence with landing gear actuation up or down.

NOTE

The solenoid valve diverts flow from the gear control valve to sequence the doors open and closed. Movement of the gear control handle across the neutral position detent operates the handle up-down switch to select the circuit to control the solenoid valve; that is, the switch has closed its contacts to re-energize the solenoid when the last limit switch of the selected up or down circuit has been closed by the gear being completely locked up or down. Design of the circuit causes the doors to open on the first flow of hydraulic fluid if an electrical failure occurs in the system or in the airplane electrical system. In the event of such failure, the doors will remain open after their initial actuation.

Remember this rule: Closed circuit = closed doors; open circuit = open doors. Applying this rule, with the gear handle down (handle in down neutral on alternate Power Pack), doors can be opened or closed at will by simply turning the master switch on or off and supplying the hydraulic pressure necessary to move the doors with the emergency hand pump.

Nose gear strut switch.	Compression of nose gear strut causes switch to open. As airplane becomes airborne, strut extends and switch is closed.	When airplane weight is on gear switch is open preventing unlocking of handle lock out solenoid, which prevents handle from being moved from the gear-down range.
Handle lock-out solenoid.	Nose gear strut switch.	Prevents upward movement of gear handle from gear-down range when airplane weight is on gear.

5A-28. ADJUSTMENT OF POWER PACK SWITCH. Refer to figure 5-7. Handle pull-out switch is not used on Model 210B and on.

5A-29. UP AND DOWN LIMIT SWITCHES. Refer to figures 5A-13, 5A-14, and 5A-16.

5A-30. WEATHER PROOFING MICROSWITCHES. Refer to Section 5.

5A-31. HYDRAULIC TOOLS AND EQUIPMENT. Refer to Section 5.

5A-32. HYDRO TEST. Refer to Section 5 and Section 2 for operation of the Hydro Test unit.

5A-33. HYDRO FILL. Refer to Section 5.

5A-34. HYDRAULIC LINE BLEED AND TEST PROCEDURES. Refer to Section 5 for line bleed and test procedures.

5A-35. BLEEDING THE LANDING GEAR RETRACTION AND EXTENSION SYSTEM. Refer to Section 5 for bleeding the landing gear and wing flap systems.

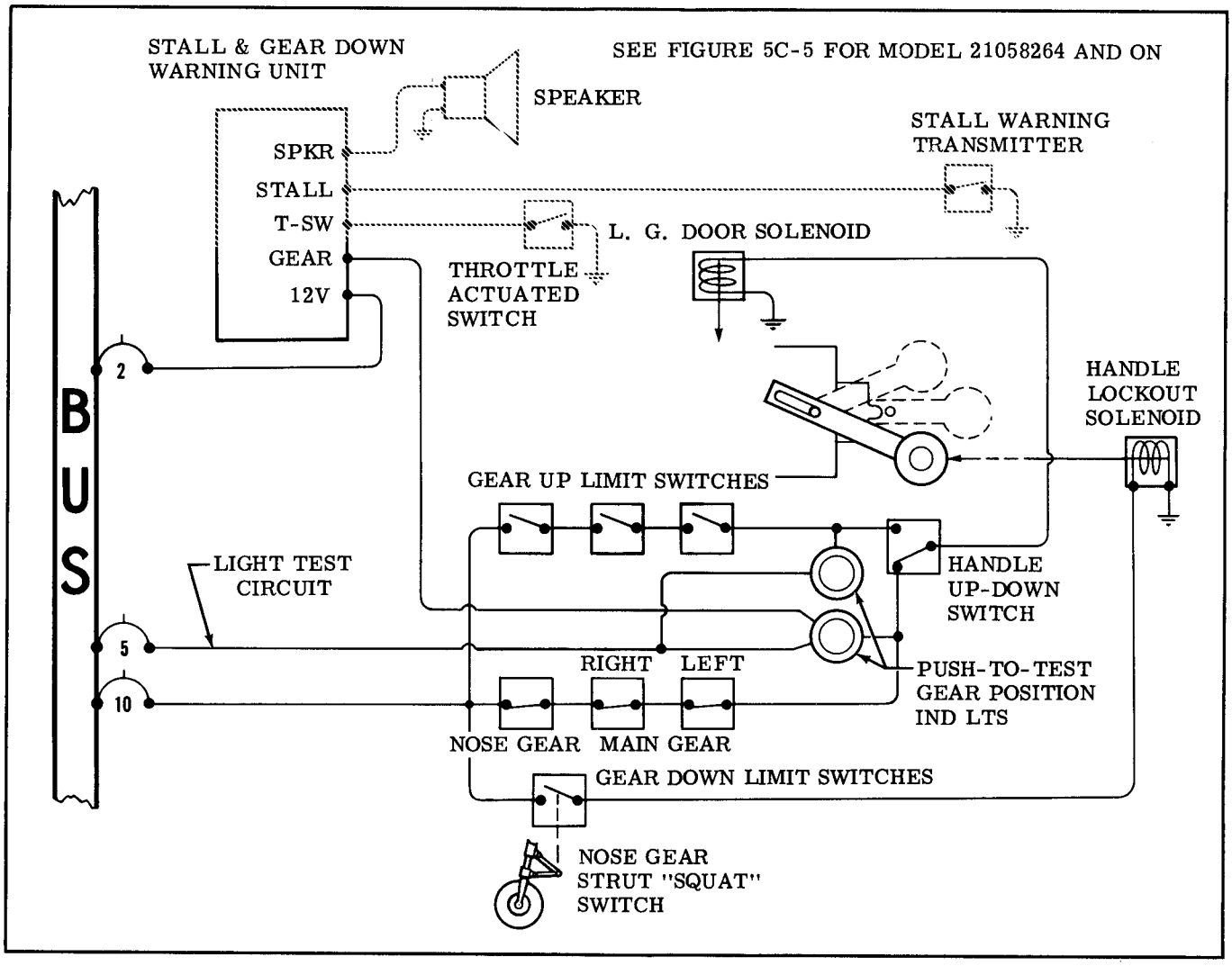


Figure 5A-6. Simplified Schematic of Landing Gear Circuits

5A-36. CHECKING HYDRAULIC FLUID CONTAMINATION. Refer to Section 5 and Section 2 for hydraulic fluid contamination check.

5A-37. MAIN LANDING GEAR.

5A-38. Main landing gear struts rotate aft and inboard to stow the main wheels beneath the baggage compartment. Struts are down-locked by spring loaded pawls at the inboard edge of the strut and by an additional pawl which wedges the strut securely at the outboard support. Uplocks are located on the main wheel stowage bay forward bulkhead. Uplocking pawls here hold the strut in stowed position. Rotation of the gear to extend or retract it is achieved by saddles which are in turn bolted to the shaft flange of the hydraulic rotary actuators.

NOTE

As an additional down-lock safety feature, the inboard downlocks are released by "gear up pressure" and the outboard downlocks are on the "door-open pressure" circuit.

5A-39. MAIN WHEELS AND BRAKES. The Model 210B airplane utilize tubless tires and Goodyear tooth type wheels and brakes. The Model 210C and on use tube-type tires and Cleveland wheels and brakes. To transmit braking force from the brake disc to the wheel, Goodyear assemblies use a gear-tooth arrangement. Goodyear brakes contain a fixed brake housing with a floating brake disc. The Cleveland brake assemblies use a disc which is affixed to the wheel and the brake housing is a floating assembly.

5A-40. REMOVAL OF MAIN WHEELS. Refer to Section 5 for removal of Goodyear wheels. Refer to Section 5B for removal of Cleveland wheels.

5A-41. DISASSEMBLY OF MAIN WHEEL. Refer to Section 5 for disassembly of main wheels on models prior to the Model 210C. Refer to Section 5B for disassembly of the main wheels on the Model 210C and on.

5A-42. INSPECTION AND REPAIR OF MAIN WHEEL Refer to Section 5 for inspection and repair of main

wheels on models prior to the Model 210C. Refer to Section 5B for inspection and repair of main wheels on the Model 210C and on.

5A-43. ASSEMBLY OF MAIN WHEELS. Refer to Section 5 for assembly of main wheels on models prior to the Model 210C. Refer to Section 5B for assembly of main wheels on the Model 210C and on.

5A-44. INSTALLATION OF MAIN WHEELS. Refer to Section 5 for installation of main wheels on models prior to the Model 210C. Refer to Section 5B for installation of main wheels on the Model 210C and on.

5A-45. REMOVAL AND INSTALLATION OF MAIN WHEEL AND AXLE. Removal and installation of main wheel and axle may be accomplished as outlined in Section 5 or Section 5B.

5A-46. REMOVAL OF MAIN GEAR STRUT AND WHEEL.

a. Jack the aircraft securely.
b. With master switch off and landing gear control lever full up, employ emergency hand pump to open doors and release downlocks. Allow gear to drop to an intermediate position.
c. Remove bolts securing strut to saddle.
d. Disconnect strut brake line from elbow at top of saddle.
e. Remove strut and wheel assembly.

5A-47. INSTALLATION OF MAIN GEAR STRUT AND WHEEL is accomplished by reversing the steps outlined in paragraph 5A-46, followed by re-rigging, if necessary, of downlock as covered in paragraph 5A-98.

5A-48. REMOVAL OF MAIN GEAR ACTUATOR AND SADDLE.

a. Perform all steps outlined under strut removal.
b. Remove the rear seat, the rear carpet over the raised portion of the floorboard, and the access plate over the actuator.
c. Disconnect hydraulic lines at actuator ports.
d. Disconnect brake line at swivel fitting. Remove swivel fittings.
e. Remove bolts attaching saddle assembly flange to the rotary actuator flange.
f. Remove bolts attaching actuator mounting flange to the bulkhead casting, and holding saddle assembly in place, move the actuator inboard to separate the actuator from the saddle assembly. Work the actuator free and remove. Note position of O-ring seal between the mating flanges of the rotary actuator and the saddle flange.
g. Slide the saddle assembly inboard, free of the bearing.

NOTE

Seal or tape the exposed bearing surface of the saddle to exclude dirt.

5A-49. SADDLE BEARING REPAIR. Refer to Section 5 for saddle bearing repair.

5A-50. DISASSEMBLY AND REPAIR OF MAIN GEAR ACTUATOR. Refer to Appendix B for disassembly and repair of the main gear actuator.

5A-51. INSTALLATION OF MAIN GEAR ACTUATOR AND SADDLE.

a. Slide the saddle assembly in place, in the hole in the bulkhead forging.
b. Work the actuator into position, make sure O-ring seal is in groove on actuator flange, and install bolts which attach saddle and actuator flanges.
c. Install bolts which attach the actuator to the structure. Bend tangs of washers to safety the bolts.
d. Connect hydraulic lines to the actuator.
e. Install brake line swivel fitting and line at shaft fitting.
f. Install strut and wheel as outlined in paragraph 5A-47.
g. Align main wheels per paragraph 5-59.
h. Bleed brake and actuating hydraulic lines and test operate.

5A-52. REMOVAL AND INSTALLATION OF MAIN GEAR UPLOCK MECHANISM. Figure 5A-9 shows details of the main gear uplock mechanism and may be used as a guide during replacement of parts.

5A-53. DISASSEMBLY AND REPAIR OF MAIN GEAR UPLOCK CYLINDER. Refer to Appendix B for disassembly and repair of the main landing gear uplock cylinder.

5A-54. MAIN GEAR DOWNLOCKS AND DOWNLOCK RELEASE CYLINDERS. One cylinder releases both the right and left inboard downlock and is operated by pressure in the gear up lines. The outboard downlocks are released by a cylinder on each side and the cylinder is operated by pressure in the door open lines.

5A-55. REMOVAL AND INSTALLATION OF MAIN GEAR DOWNLOCK RELEASE CYLINDERS. Removal of the main gear downlock release cylinders consists of disconnecting the hydraulic lines and push-pull rods to the downlock pawls. Then remove mounting bolts and work actuator from airplane. Reverse procedure to install cylinder.

5A-56. DISASSEMBLY AND REPAIR OF DOWNLOCK RELEASE CYLINDERS. Refer to Appendix B for disassembly and repair of the main gear downlock release cylinders.

5A-57. MAIN GEAR RIGGING. Refer to paragraph 5A-98 for rigging and adjustments to main landing gear.

5A-58. MAIN WHEEL ALIGNMENT. Refer to paragraph 5-59 for alignment of main wheels.

5A-59. MAIN GEAR DOOR SYSTEM.

5A-60. Main gear doors, shown in figure 5A-12, open for main gear retraction or extension and return to closed position at the completion of either

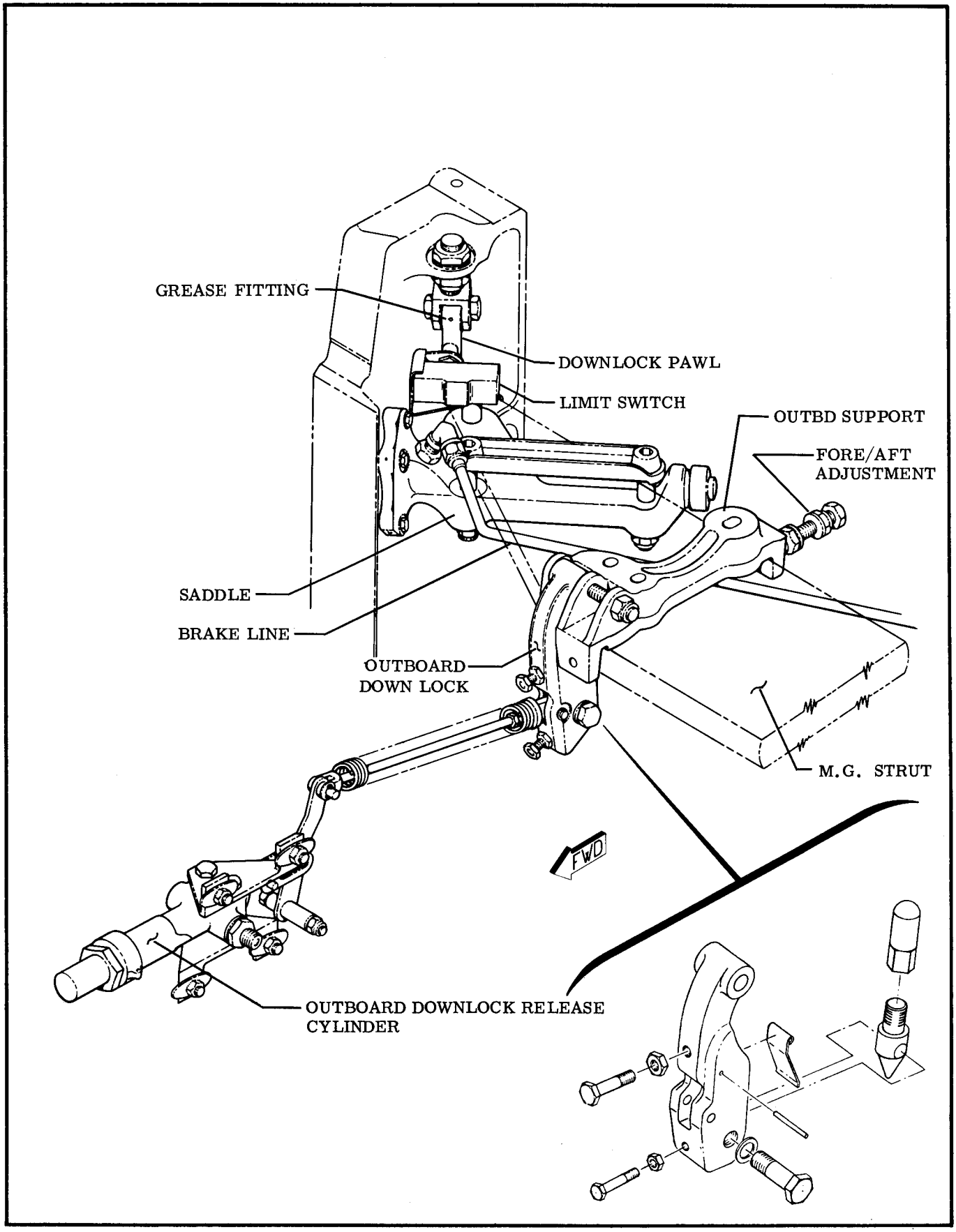


Figure 5A-7. Main Gear Down Locks

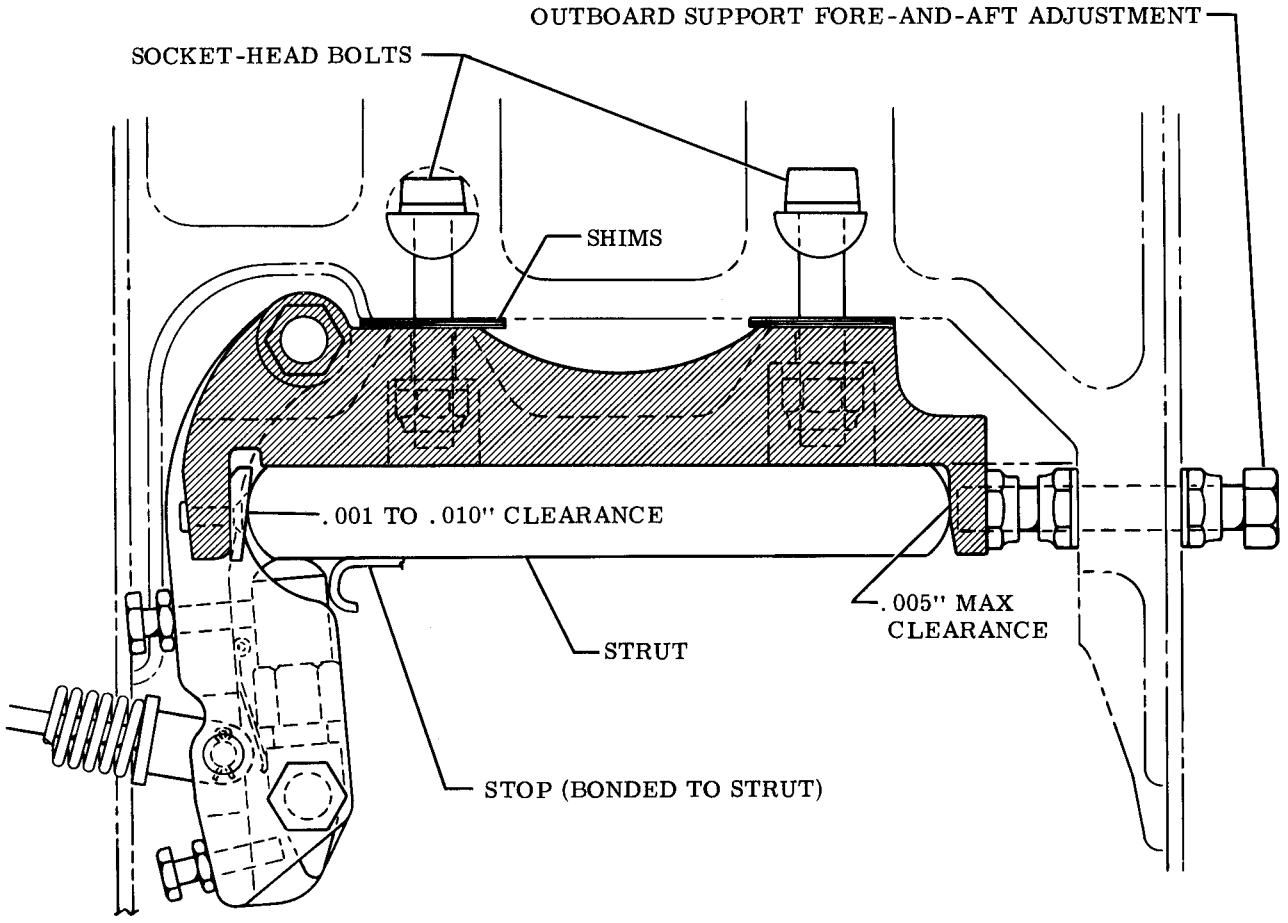


Figure 5A-8. Main Gear Outboard Support and Downlock

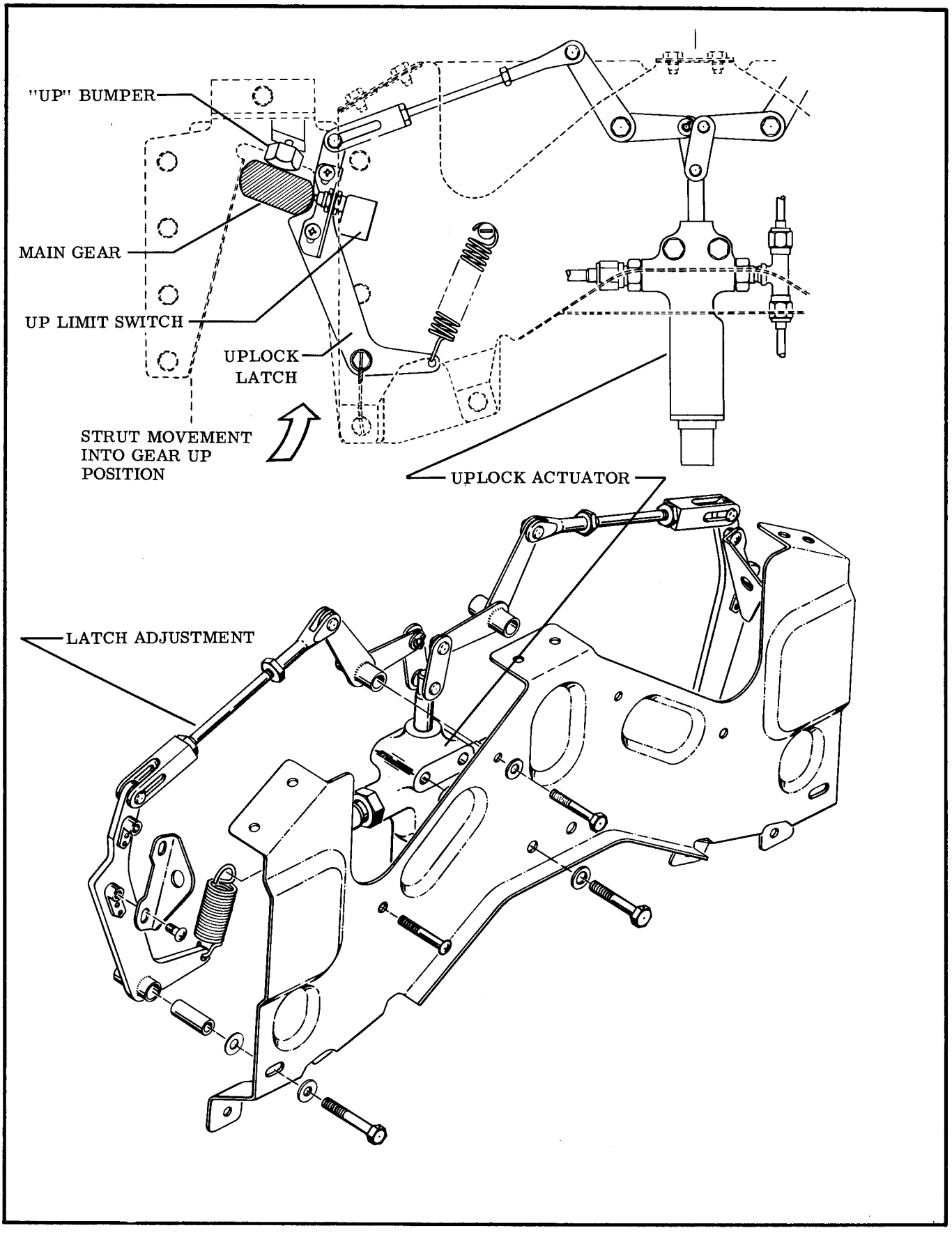


Figure 5A-9. Main Gear Uplock Details

cycle. The strut doors are opened and closed by a double-acting hydraulic actuator. The wheel doors are actuated by a double-actuating hydraulic actuator for each door. Each door actuator contains an internal locking device to hold the doors in the closed position when the actuator is retracted. This lock is released on first flow of hydraulic pressure to the door system.

5A-61. REMOVAL AND INSTALLATION OF MAIN WHEEL DOORS.

a. Open the doors by moving gear handle full up or down, leaving the master switch off, and exercising the emergency hand pump to supply door open pressure.

NOTE

With electrical power off, the door solenoid valve is always in the "door open" position. To close the doors it will be necessary to switch ON the master switch, then apply hydraulic pressure.

b. Disconnect door from actuator linkage by removing pin or bolt.
c. Remove door hinge pins or bolts.
d. Install doors by reversing the process listed above.
e. Lengthen or shorten actuator-to-door linkage to ensure a good fit in closed position.

5A-62. MAIN WHEEL DOOR ACTUATOR REMOVAL AND INSTALLATION.

a. Open doors by moving gear handle full up or down, leaving the master switch off, and actuating the emergency hand pump to supply pressure to open the doors.

NOTE

With electrical power off, the door solenoid valve is always in the "door open" position. To close the doors it will be necessary to switch ON the master switch, then apply hydraulic pressure.

b. Disconnect and cap or plug hydraulic hoses at actuator.
c. Disconnect actuator rod by removing attaching nut and bolt at each door.
d. Remove nut and bolt attaching actuator to fuselage bracket and remove actuator.
e. Install actuator by reversing the preceding steps.

NOTE

Fill actuator with hydraulic fluid (MIL-H-5606) before installing.

5A-63. DISASSEMBLY AND REPAIR OF DOOR ACTUATOR. Refer to Appendix B for disassembly and repair of door actuating cylinders.

5A-64. REMOVAL AND INSTALLATION OF MAIN GEAR STRUT DOORS. Refer to paragraph 5-65 for removal and installation of main gear strut doors.

5A-65. REMOVAL AND INSTALLATION OF MAIN GEAR STRUT DOOR ACTUATOR.

a. Remove carpet and access covers as required for access to actuator.
b. Disconnect and cap or plug hydraulic hoses at actuator.
c. Disconnect actuator rod by removing nut and bolt attaching rod to bellcrank.
d. Remove nut and bolt attaching actuator to fuselage bracket and work actuator from airplane.
e. Install actuator by reversing the preceding steps.

NOTE

Fill actuator with hydraulic fluid (MIL-H-5606) before installing.

5A-66. DISASSEMBLY AND REPAIR OF MAIN GEAR STRUT DOOR ACTUATOR. Refer to Appendix B for disassembly and repair of the main gear strut door actuator.

5A-67. RIGGING. Refer to paragraph 5A-102 for rigging and adjustments to the main wheel and gear strut doors.

5A-68. NOSE GEAR.

5A-69. Beginning with the Model 210B, a more positive uplock (figure 5A-15), directly actuated nose wheel doors, and an improved nose gear actuator are incorporated in the nose gear installation.

5A-70. REMOVAL AND INSTALLATION OF NOSE WHEEL. Refer to Section 5 for removal and installation of the nose wheel.

5A-71. DISASSEMBLY OF NOSE WHEEL. Refer to Section 5 for disassembly of nose wheel on aircraft prior to the Model 210C. Refer to Section 5B for disassembly of nose wheel on the Model 210C and on.

5A-72. INSPECTION AND REPAIR OF NOSE WHEEL. Refer to paragraph 5-72 for inspection and repair of the nose wheel.

5A-73. ASSEMBLY OF NOSE WHEEL. Refer to Section 5 for assembly of nose wheel on aircraft prior to the Model 210C. Refer to Section 5B for assembly of nose wheel on the Model 210B and on.

5A-74. BALANCING NOSE WHEEL. Refer to Section 5B for nose wheel balance.

5A-75. REMOVAL AND INSTALLATION OF NOSE GEAR ASSEMBLY. Figure 5A-10 may be used as a guide for removal and installation of the nose gear assembly.

5A-76. DISASSEMBLY OF NOSE GEAR STRUT. Refer to paragraph 5-76 for disassembly of the nose gear strut.

5A-77. ASSEMBLY OF NOSE GEAR STRUT. Refer to paragraph 5-77 for assembly of the nose gear strut.

5A-78. REMOVAL AND INSTALLATION OF SHIMMY DAMPENER. Refer to paragraph 5-78 for removal and installation of shimmy dampener. Refer to Section 5B for disassembly of the shimmy dampener.

5A-79. NOSE GEAR ACTUATOR. The Model 210B and on nose gear actuator and drag strut is basically similar to that used on Models prior to the Model 210B except that the actuator piston is position-locked within the cylinder until hydraulic pressure of approximately 125 psi is applied to the anchor end (gear up) port of the actuator. The familiar claw-hook is retained on the actuator in the Model 210B and on.

5A-80. REMOVAL OF NOSE GEAR ACTUATOR. Refer to Section 5 for removal of the nose gear actuator.

5A-81. DISASSEMBLY AND REPAIR OF NOSE GEAR ACTUATOR. Refer to Appendix B for disassembly and repair of the nose gear actuator.

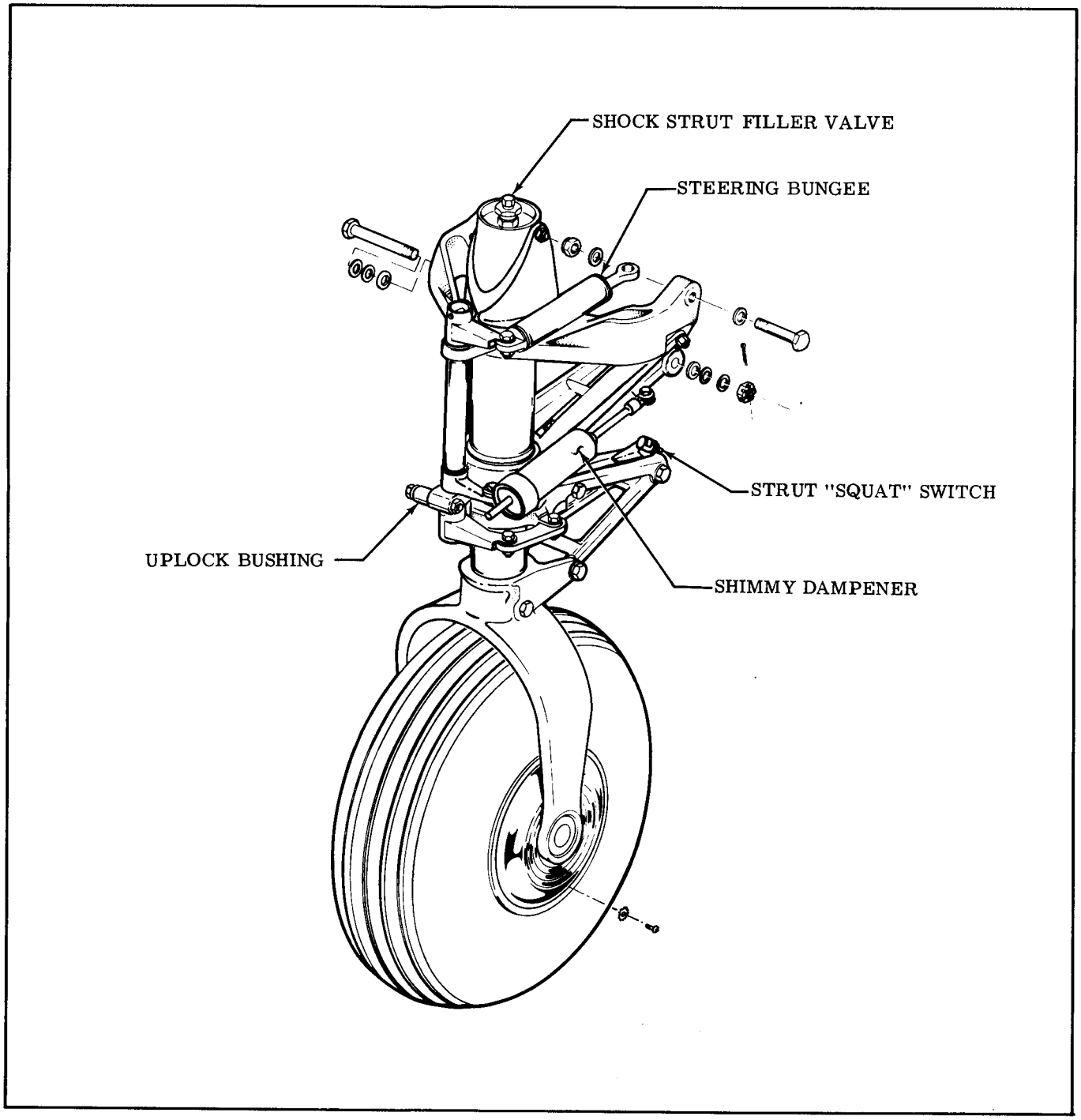
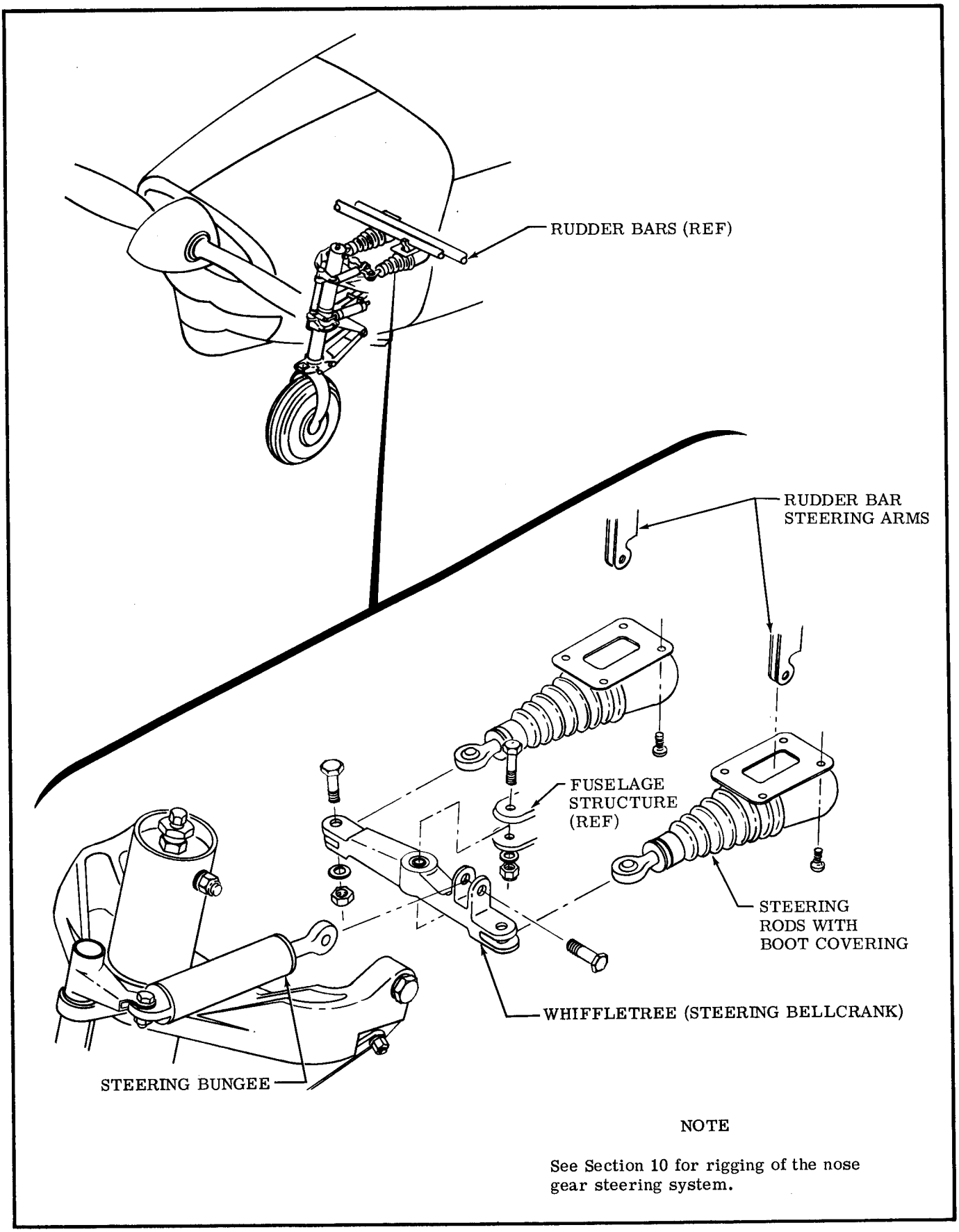


Figure 5A-10. Nose Gear Details



NOTE

See Section 10 for rigging of the nose gear steering system.

Figure 5A-11. Nose Wheel Steering

5A-82. INSTALLATION OF NOSE GEAR ACTUATOR. Install nose gear actuator as outlined in paragraph 5-81.

NOTE

When assembling and attaching the nose gear downlock mechanism to strut, lubricate and torque attaching bolt as shown in figure 2-7.

5A-83. NOSE GEAR UPLOCK MECHANISM. (See figure 5A-15.) A more positive nose gear uplock mechanism is incorporated in the Model 210B and on. The uplock hook is located at the top of the nose wheel well and is released by a hydraulically operated actuator.

5A-84. REMOVAL AND INSTALLATION OF NOSE GEAR UPLOCK AND RELEASE ACTUATOR.

a. Disconnect uplock spring.

b. Disconnect and cap or plug hydraulic lines at actuator.

c. Disconnect and tag electric wires at up limit switch.

d. Remove four nuts and washers attaching uplock mechanism to top of nose wheel well. Remove uplock mechanism and release actuator from airplane.

e. Remove cotter pin and clevis pin attaching actuator to uplock mechanism.

f. Remove nuts, washers, and screws attaching actuator to uplock mechanism.

g. Install uplock mechanism and actuator by reversing the preceding steps.

h. Rig up limit switch as shown in figure 5A-15.

5A-85. DISASSEMBLY AND REPAIR OF UPLOCK RELEASE ACTUATOR. Refer to Appendix B for disassembly and repair of uplock release actuator.

5A-86. RIGGING. Refer to paragraph 5A-105 for nose gear rigging and adjustments.

5A-87. NOSE GEAR DOOR SYSTEM. (See figure 5A-12.) The nose gear forward doors open for

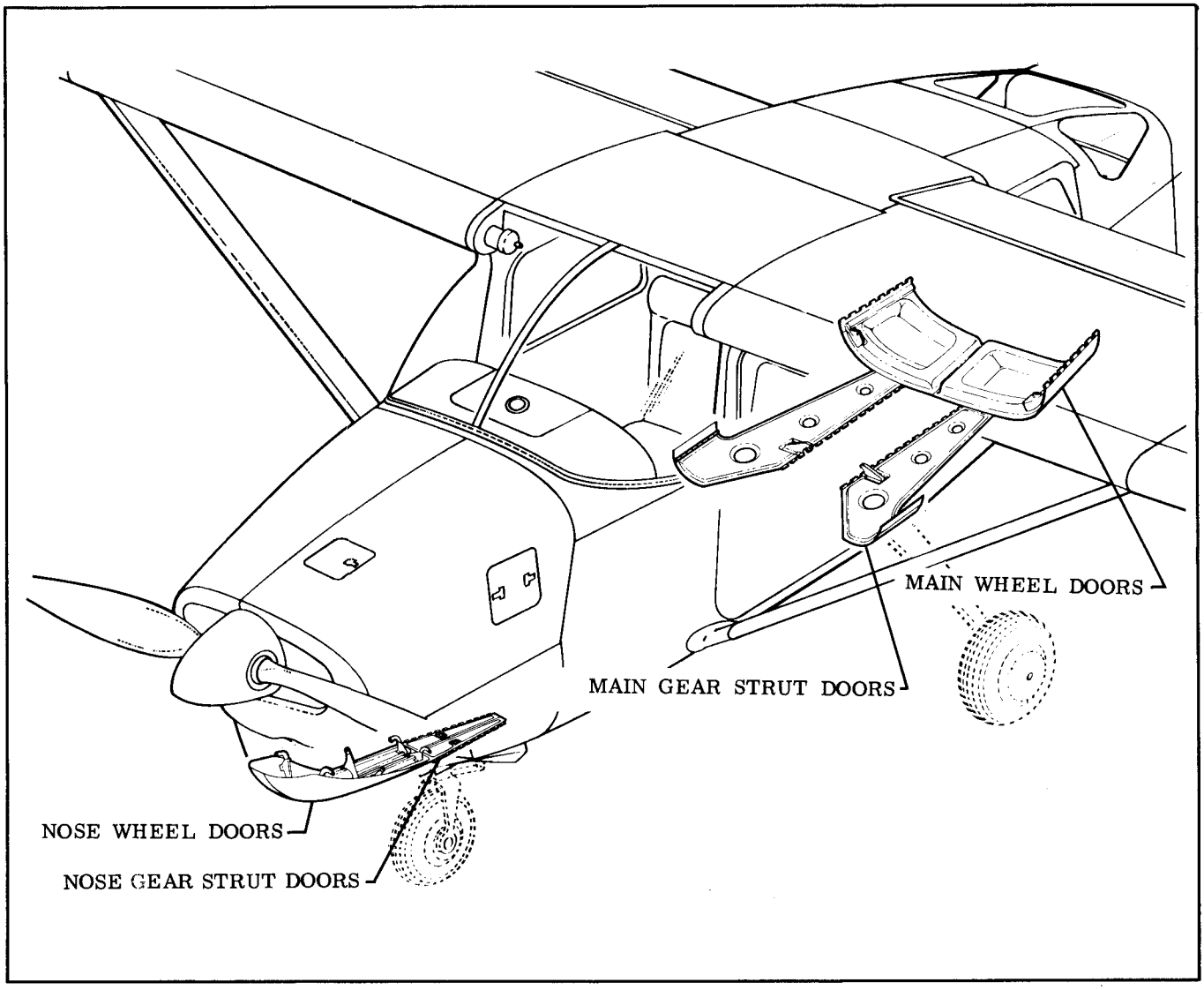


Figure 5A-12. Landing Gear Doors

nose gear retraction or extension and close again when the cycle is completed. These doors are held in closed position by an internal lock in the actuator until hydraulic pressure of approximately 125 psi is applied to the anchor port of the actuator. Actuation of the nose gear forward doors is by a double-acting hydraulic cylinder. The nose gear aft doors are linked mechanically to the nose gear trunnion. These doors open as the gear extends and close as it is retracted.

5A-88. REMOVAL AND INSTALLATION OF NOSE WHEEL DOORS. The nose wheel doors may be removed and installed as outlined in paragraph 5-86.

5A-89. REMOVAL AND INSTALLATION OF NOSE WHEEL DOORS ACTUATOR.

a. Disconnect and cap or plug hydraulic hoses at actuator in right side of nose wheel well.

b. Disconnect actuator rod end from bellcrank by removing nut and bolt.

c. Open right cowling and disconnect actuator from bracket.

d. Install actuator by reversing the preceding steps.

5A-90. DISASSEMBLY AND REPAIR OF NOSE WHEEL DOOR ACTUATOR. Refer to Appendix B for disassembly and repair of the nose wheel door actuator.

5A-91. REMOVAL AND INSTALLATION OF NOSE GEAR STRUT DOORS. The nose gear strut doors may be removed as outlined in paragraph 5-89.

5A-92. RIGGING. Rig nose gear door system to accomplish results noted in paragraph 5A-102 for main door system.

5A-93. NOSE WHEEL STEERING SYSTEM. Refer to paragraph 5-91 and figure 5A-11 for nose wheel steering system. Figure 5A-11 shows details of the nose wheel steering system and may be used as a guide for parts replacement.

5A-94. RIGGING. Since the nose wheel steering is connected to the rudder control system, refer to Section 10 for rigging of the system.

5A-95. WHEEL BALANCING. Refer to paragraph 5-95 for wheel balancing.

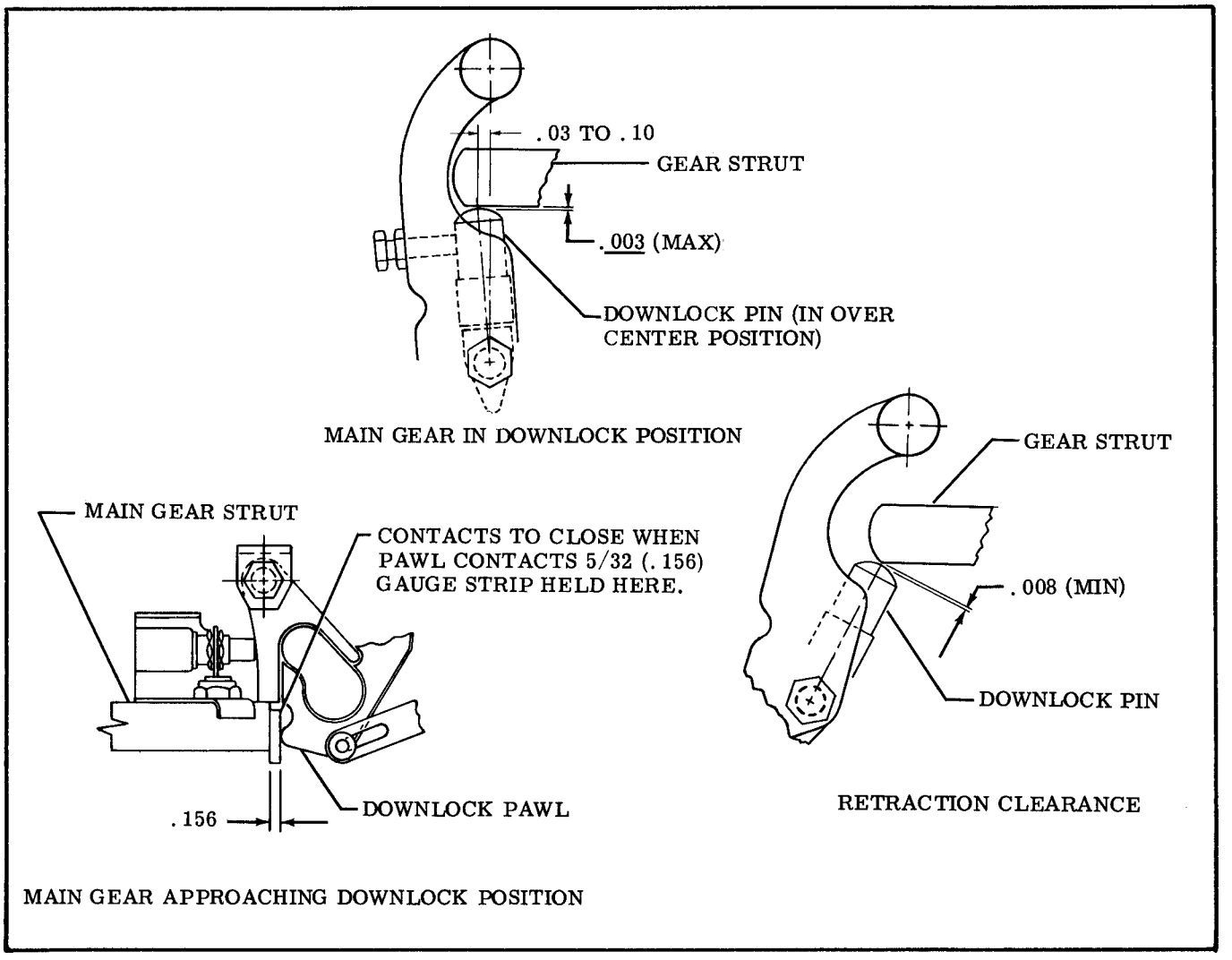


Figure 5A-13. Main Gear Downlock Clearances

5A-96. BRAKE SYSTEM.

5A-97. Refer to Section 5 for brake system on aircraft prior to the Model 210C. Refer to Section 5B for the brake system on the Model 210C and on.

5A-98. RIGGING OF MAIN LANDING GEAR.

NOTE

All of the following rigging adjustments should be accomplished with the airplane on jacks. To rig the main gear downlock pawls it is necessary that the airplane be level. Since the engine-driven pump can not be used to supply pressure for these rigging procedures, a Hydro Test or other ground hydraulic power source should be used.

5A-99. RIGGING OF ADJUSTING SUPPORT. (See figure 5A-8.) The adjusting support is bolted to the outboard forging and forms the down stop for the main gear.

NOTE

The spring strut must be installed and secured before rigging the adjusting support. Also, check that gear is level laterally over the saddle, using C-bar (Special Tool No. SE-578-1) and the spirit level, with 1500 psi hydraulic pressure applied to gear down port of the main gear actuator.

a. Check for contact between flat surface of strut and lower surface of adjusting support. Minor gaps may exist as long as 50% of strut is in contact with

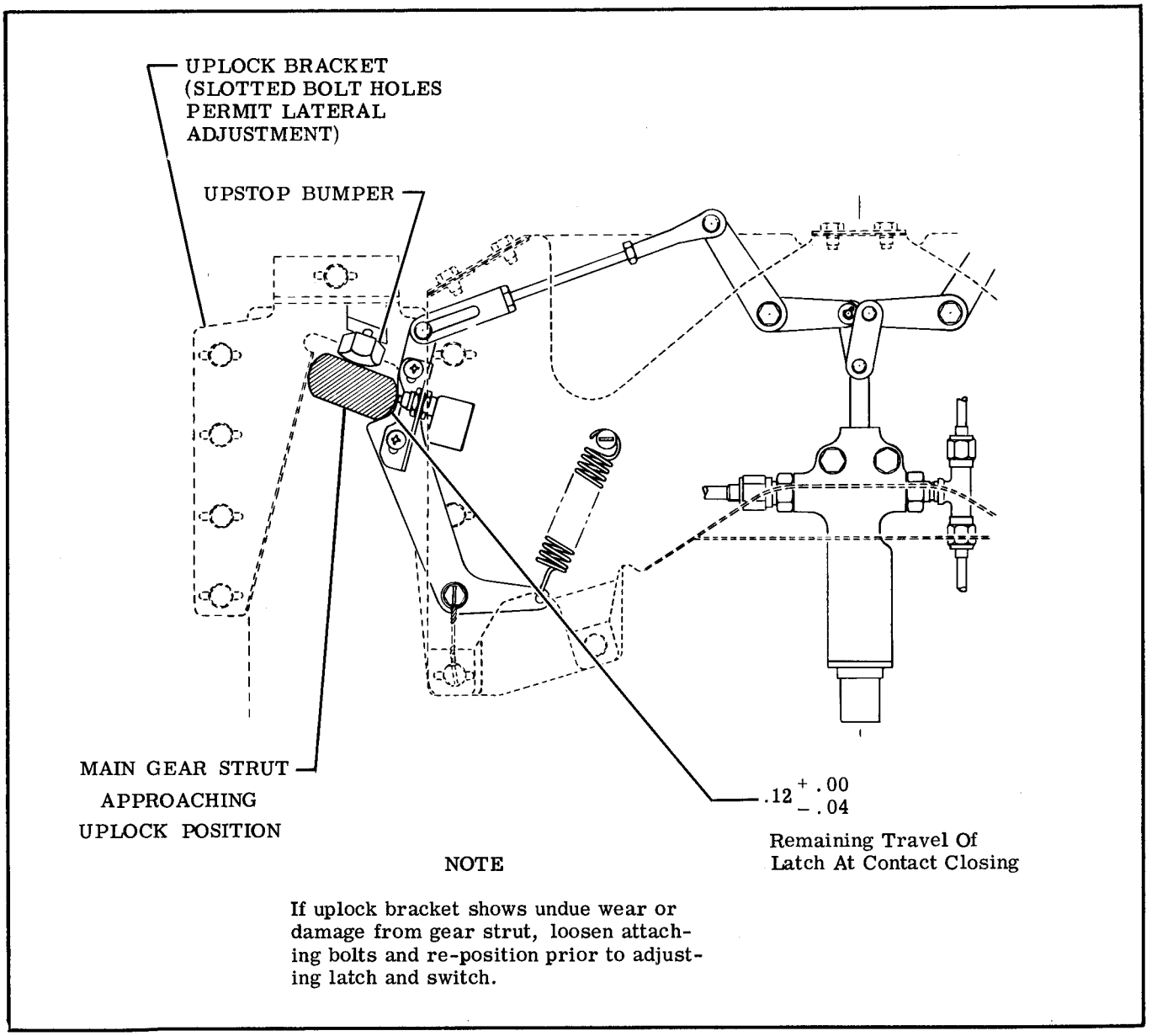
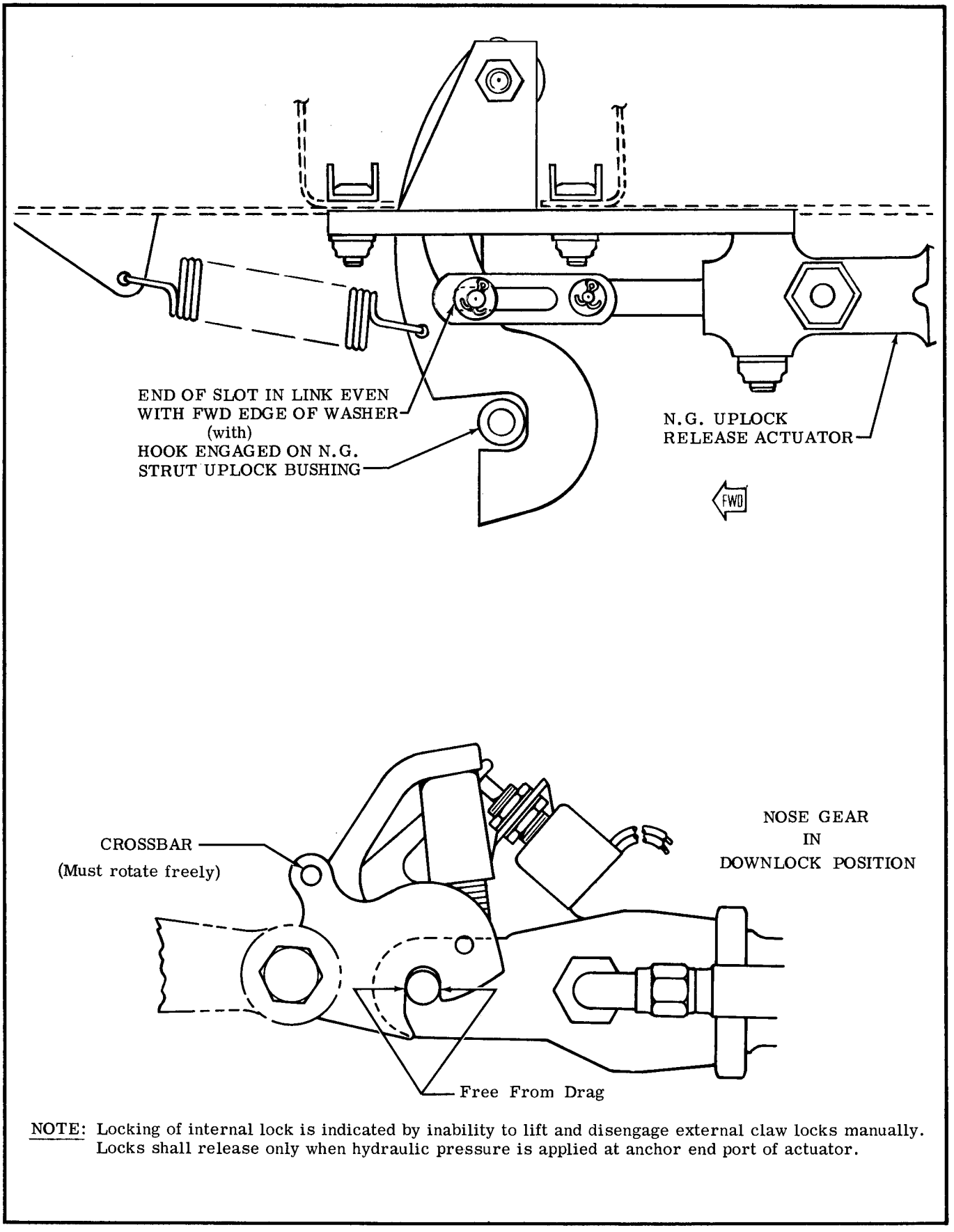


Figure 5A-14. Main Gear Uplock and Uplock Limit Switch Clearance



NOTE: Locking of internal lock is indicated by inability to lift and disengage external claw locks manually. Locks shall release only when hydraulic pressure is applied at anchor end port of actuator.

Figure 5A-15. Nose Gear Up and Downlock Clearances

support. Shim as required between outboard forging and adjusting support.

b. Check that the aft edge of strut contacts adjusting support (.005 inch maximum clearance) as shown, when gear is down. To shift adjusting support fore and aft, first loosen bolts securing support (elongated holes are provided in the support), then adjust the two jam nuts as required and retighten the mounting bolts.

c. Check that the forward edge of strut contacts wedge (.001 to .010 inch clearance) as shown, when gear is down. If adjustment is necessary, locate, drill, and countersink a new wedge, and install with one MS20426AD rivet.

NOTE

No drag is permissible as gear reaches the full down position.

5A-100. RIGGING OF DOWNLOCK MECHANISM. The inboard and outboard downlocks are hydraulically operated pawls containing adjustable downlock pins which wedge against the strut to lock the gear in the down position. Jack the airplane and rig as follows:

a. Rig inboard downlock pawl as outlined in paragraph 5-108.

b. Check that outboard downlock pin reaches the overcenter position shown in figure 5A-13 (.03 to .10 inch). Adjust upper stop bolt as required to obtain this position.

c. With outboard downlock pin fully retracted, check that pin clears strut at least .008 inch as shown in figure 5A-13.

d. Check over-all length of downlock pin as shown in figure 5A-13 (snugly against strut to .003 inch maximum clearance), with hydraulic pressure on gear. Downlock pin assembly must be removed to change over-all length.

e. Check that inboard downlock pawls release the struts simultaneously.

5A-101. RIGGING OF UPLOCK MECHANISM. (See figure 5A-14.) The main gear uplocks are located on the main wheel stowage bay forward bulkhead. The uplock pawls are spring-loaded to lock position and hydraulically operated to the unlocked position. Jack airplane and rig the uplock mechanism as follows:

a. While retracting landing gear, check that landing gear strut edge contacts uplock bracket at the last 0.375 inch of strut travel before strut contacts uplock bumper.

NOTE

If uplock bracket shows excessive damage from gear strut, loosen attaching bolts and re-position prior to adjusting uplock pawls and switch.

b. With main gear strut firmly against the upstop bumper, the uplock pawl should extend easily into the locking position. Adjust upstop bumper so that locking face of uplock pawl clears strut by .002 to .005 inch.

c. With release actuator retracted, adjust push-pull rod so that uplock pawls release landing gear struts simultaneously.

NOTE

When gear strut is extending, it should clear the uplock pawls at least .09 inch at the closest point.

5A-102. RIGGING OF MAIN LANDING WHEEL AND STRUT DOORS. After jacking the airplane, main landing gear door adjustments 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 and extension at least 1/2 inch.

5A-103. RIGGING OF MAIN GEAR DOWN INDICATOR SWITCH. Main gear down indicator switches are mounted on brackets attached to strut and actuated by the inboard downlock pawl. Adjust switch as shown in figure 5A-13.

5A-104. RIGGING MAIN GEAR UP INDICATOR SWITCHES. Main landing gear up indicator switches are mounted on brackets attached to the uplock pawls. After jacking the airplane and retracting the landing gear, adjust the switches as shown in figure 5A-14.

5A-105. RIGGING OF NOSE GEAR.

NOTE

The nose gear shock strut must be properly inflated prior to rigging of the nose gear.

5A-106. RIGGING OF DOWNLOCK MECHANISM. (See figure 5A-15.) 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 overcenter. Jack the airplane and rig downlock mechanism as follows:

a. Check that the hooks and crossbar are free from drag as illustrated. Adjust rod end of actuator piston rod as required.

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 seal in the actuator.

5A-107. RIGGING OF NOSE GEAR UPLOCK. (See figure 5A-15.)

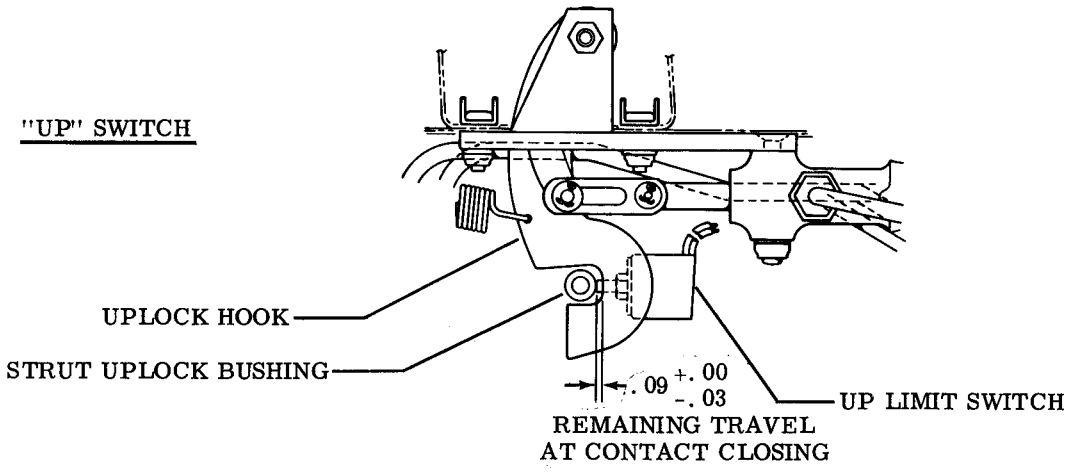
a. Check uplock hook adjustment. With uplock fully retracted, the nose gear uplock bushing should clear the uplock hook .06 to .09 inch and strike the flat surface of upstop side of hook.

5A-108. RIGGING OF DOWN INDICATOR SWITCH. (See figure 5A-16.) The nose gear down indicator switch is operated by an arm on the downlock mechanism. After jacking the airplane, adjust the switch to actuate with .04 to .06 inch travel of the downlock hooks remaining, as illustrated.

5A-109. RIGGING OF UP INDICATOR SWITCH. (See figure 5A-16.) The nose gear up indicator switch is attached to the uplock hook. After jacking the airplane, adjust the switch to actuate with .06 to .09 travel of the uplock hook remaining as shown in figure 5A-16.

5A-110. RIGGING OF SAFETY SWITCH. The safety switch, which is electrically connected to the landing gear handle lockout solenoid, is operated by an actuator attached to the lower torque link. Adjust the switch to actuate when the strut is between 1/8 and 1/4 inch from the fully extended position.

SHOP NOTES:



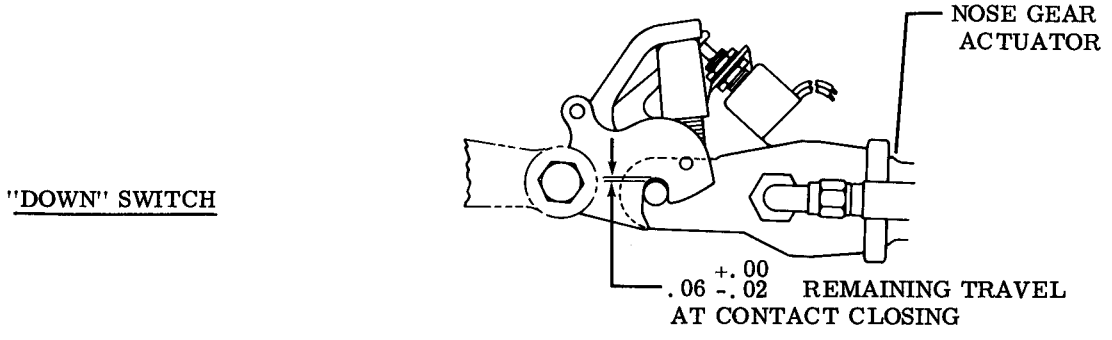


Figure 5A-16. Rigging Nose Gear Limit Switches

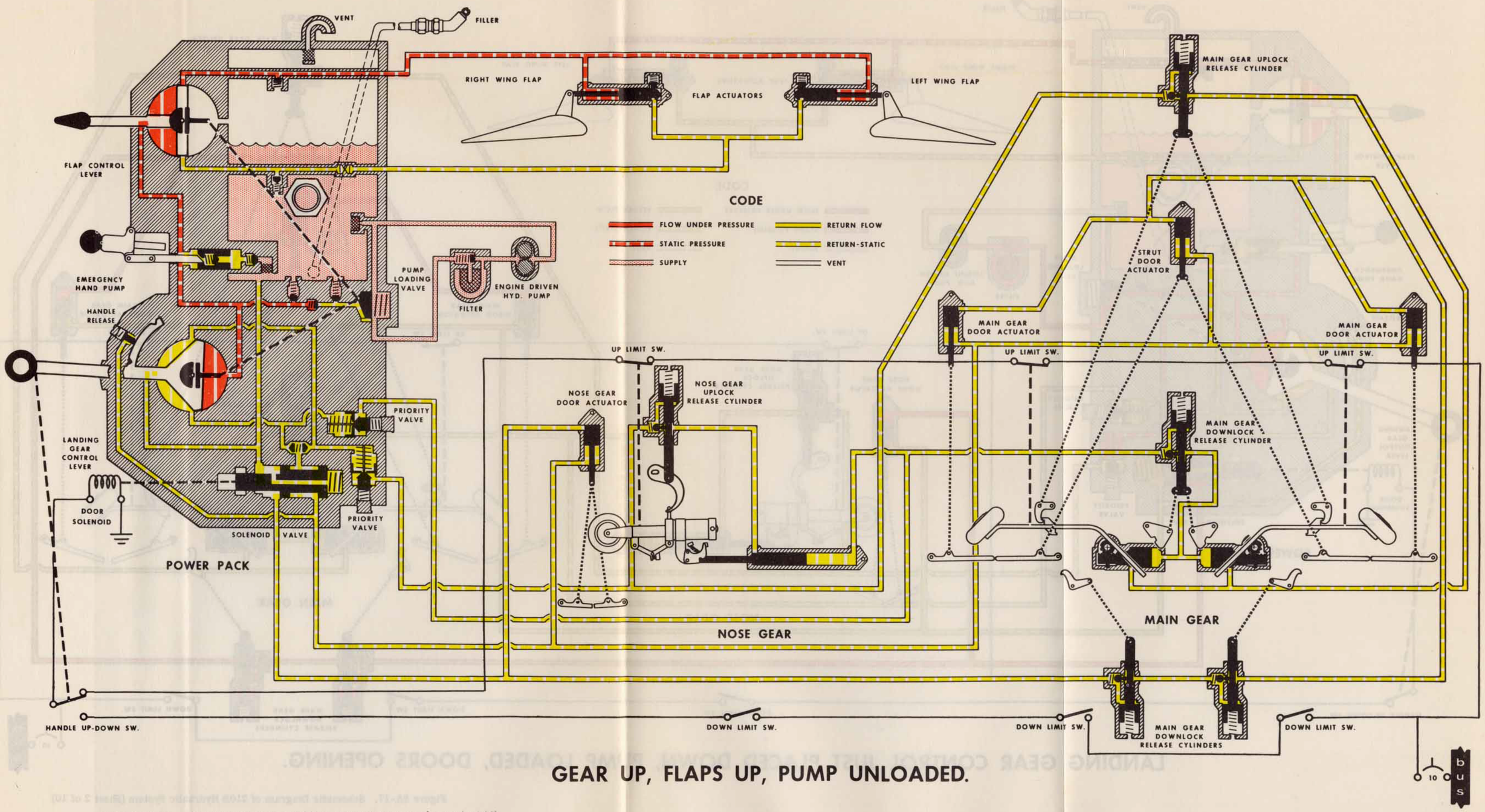
HYDRAULIC SYSTEM SCHEMATICS

The next ten fold-out pages contain color-coded schematic diagrams of the hydraulic system used first in the Model 210B. However, the Model 210B may be retrofitted with the Model 210C Power Pack, which differs from the original Power Pack as discussed below.

The schematic diagrams are also applicable to the Model 210C. However, a time-delay valve is installed, inside the Model 210C Power Pack, to delay handle return to gear-up and gear-down neutral positions by three to nine seconds, thus ensuring that landing gear doors are fully closed before the landing gear handle returns to indicated neutral. Pressure from door-close passage operates time-delay valve prior to releasing handle.

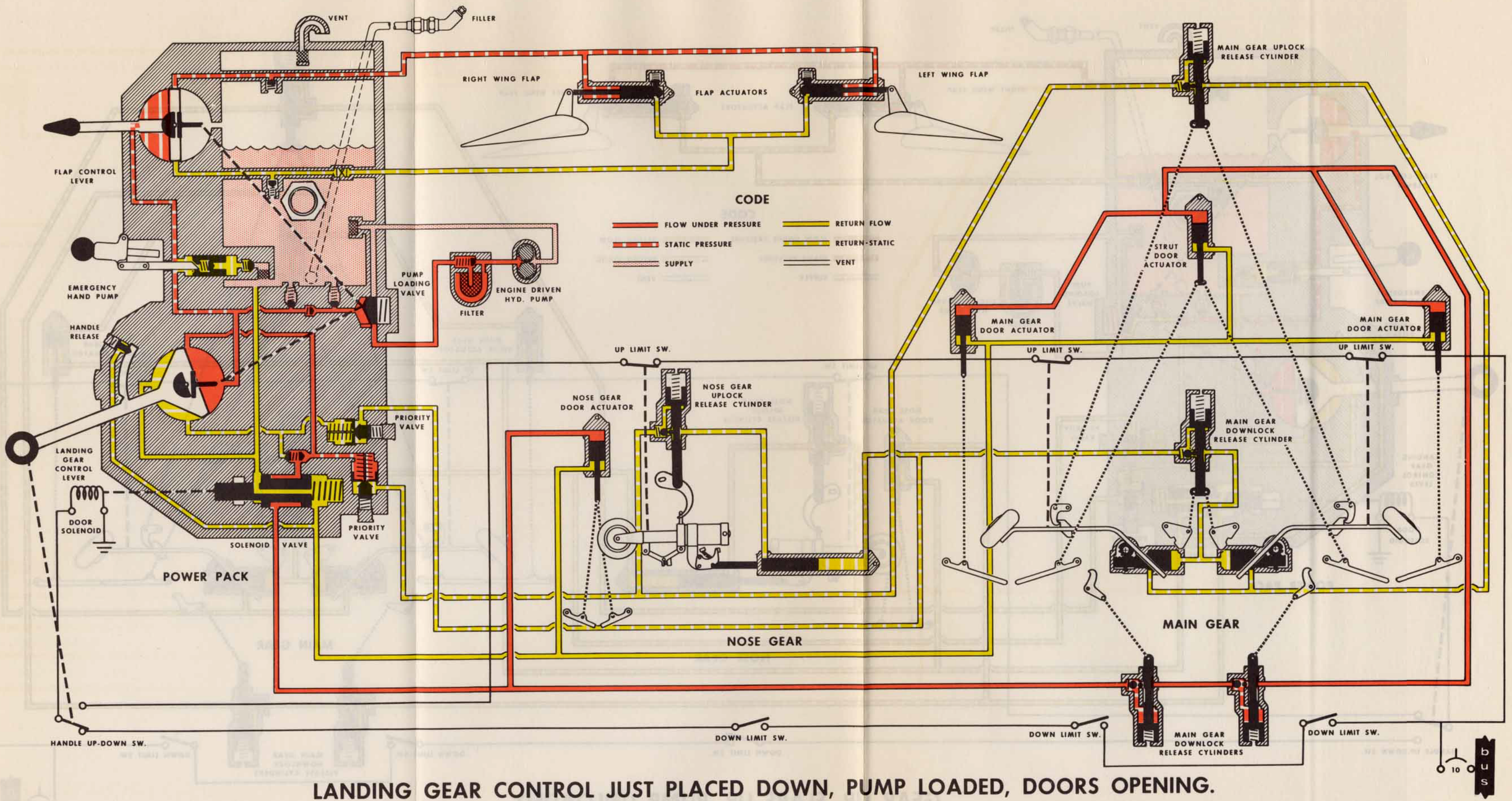
The schematic diagrams are also applicable to the Model 210D equipped with the standard Power Pack. However, the wing flap section of the Power Pack and wing flap hydraulic actuators and lines are removed, since the electric motor-driven wing flaps are used on the Model 210D and on.

Refer to the schematic diagrams in Section 5C for the Model 210D equipped with the Model 210E Power Pack as alternate equipment.



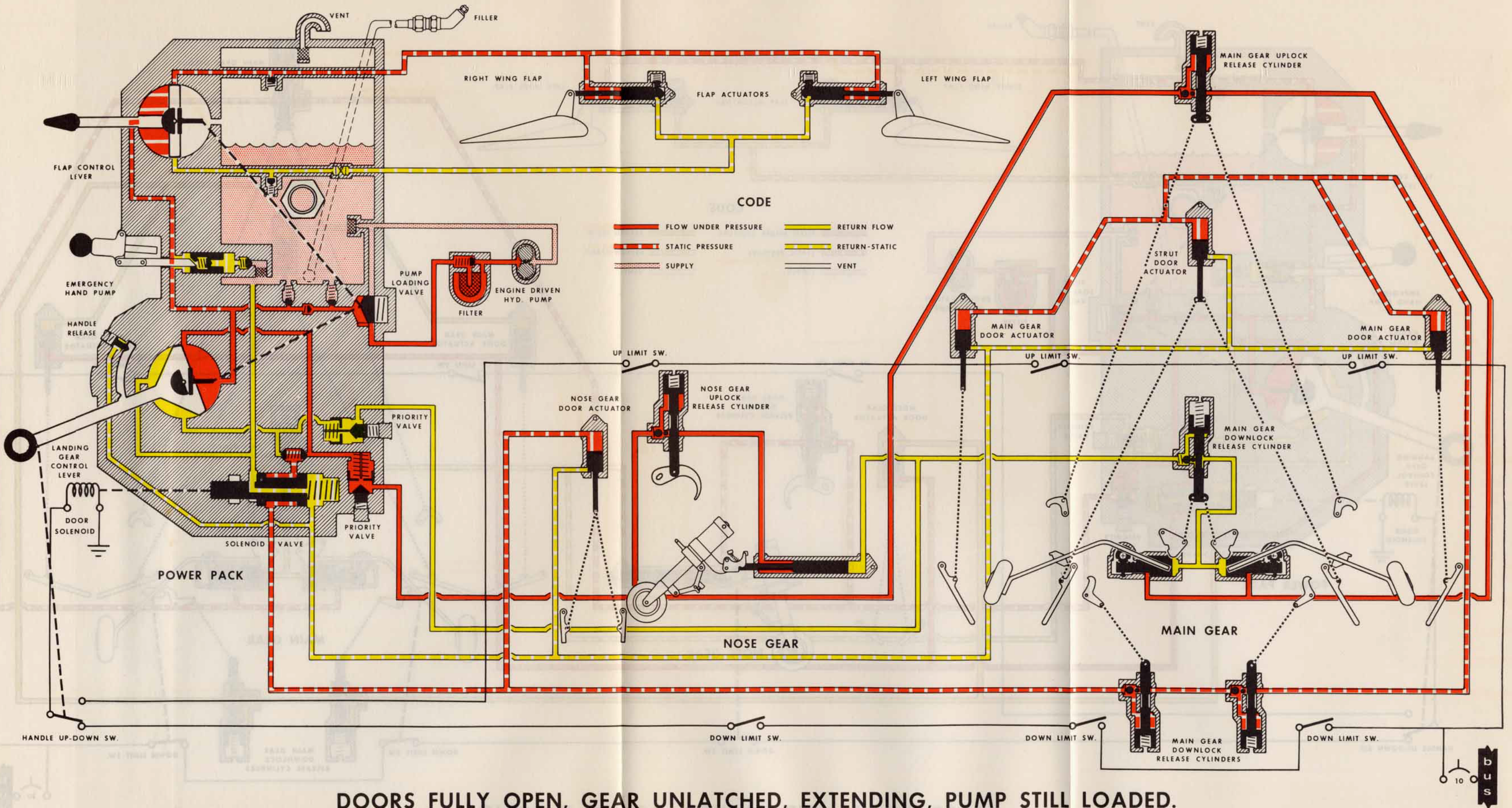
GEAR UP, FLAPS UP, PUMP UNLOADED.

Figure 5A-17. Schematic Diagram of 210B Hydraulic System (Sheet 1 of 10)



LANDING GEAR CONTROL JUST PLACED DOWN, PUMP LOADED, DOORS OPENING.

Figure 5A-17. Schematic Diagram of 210B Hydraulic System (Sheet 2 of 10)



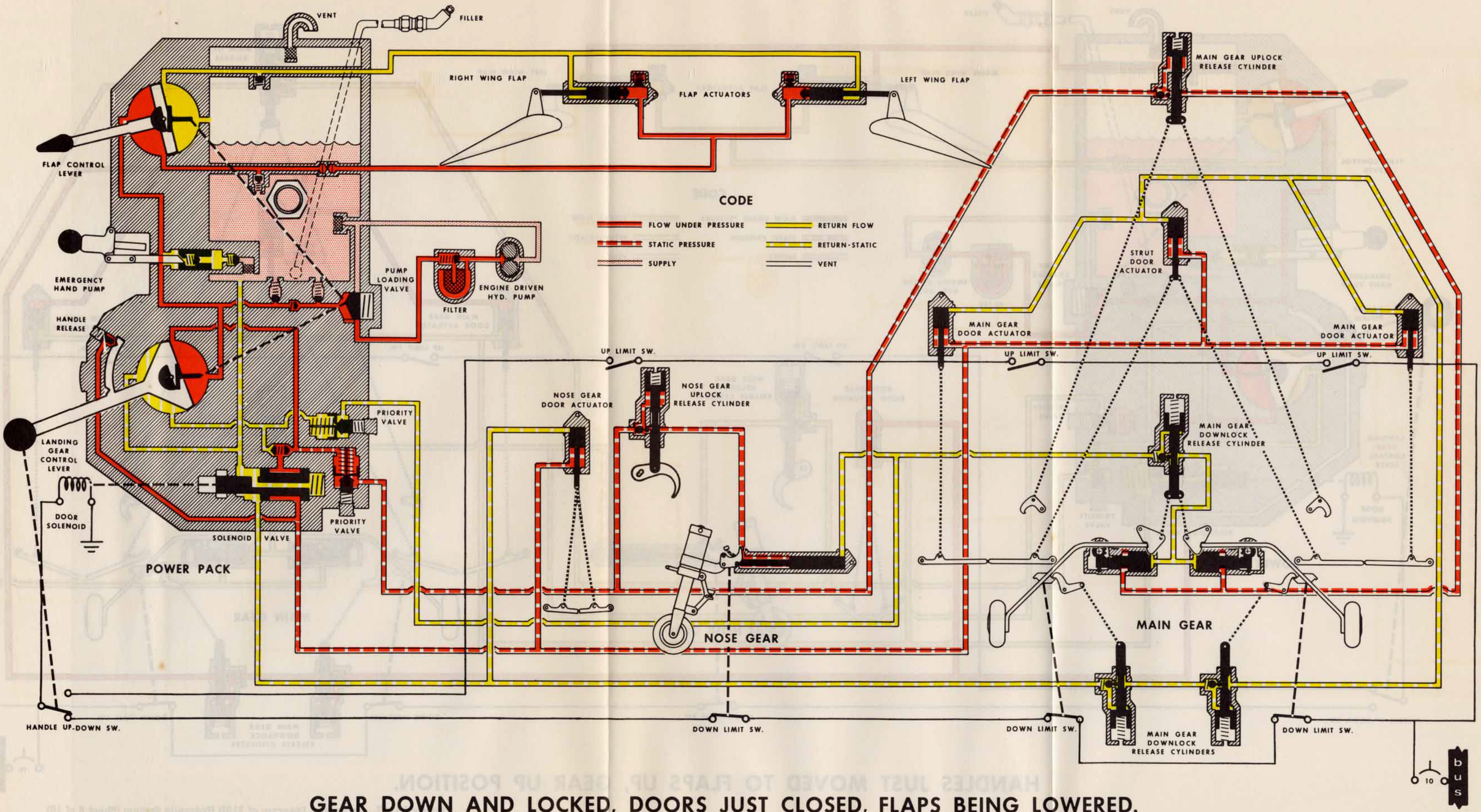
DOORS FULLY OPEN, GEAR UNLATCHED, EXTENDING, PUMP STILL LOADED.

Figure 5A-17. Schematic Diagram of 210B Hydraulic System (Sheet 3 of 10)

VENT
FILLER
RIGHT WING FLAP
FLAP ACTUATORS
LEFT WING FLAP
MAIN GEAR UPLOCK RELEASE CYLINDER
FLAP CONTROL LEVER
CODE
FLOW UNDER PRESSURE
STATIC PRESSURE
SUPPLY
RETURN FLOW
RETURN-STATIC
VENT
EMERGENCY HAND PUMP
PUMP LOADING VALVE
ENGINE DRIVEN HYD. PUMP
FILTER
STRUT DOOR ACTUATOR
HANDLE RELEASE
MAIN GEAR DOOR ACTUATOR
UP LIMIT SW.
UP LIMIT SW.
UP LIMIT SW.
NOSE GEAR DOOR ACTUATOR
NOSE GEAR UPLOCK RELEASE CYLINDER
PRIORITY VALVE
MAIN GEAR DOWNLOCK RELEASE CYLINDER
LANDING GEAR CONTROL LEVER
DOOR SOLENOID
SOLENOID VALVE
PRIORITY VALVE
POWER PACK
NOSE GEAR
MAIN GEAR
HANDLE UP-DOWN SW.
DOWN LIMIT SW.
DOWN LIMIT SW.
MAIN GEAR DOWNLOCK RELEASE CYLINDERS
DOWN LIMIT SW.
10
bus

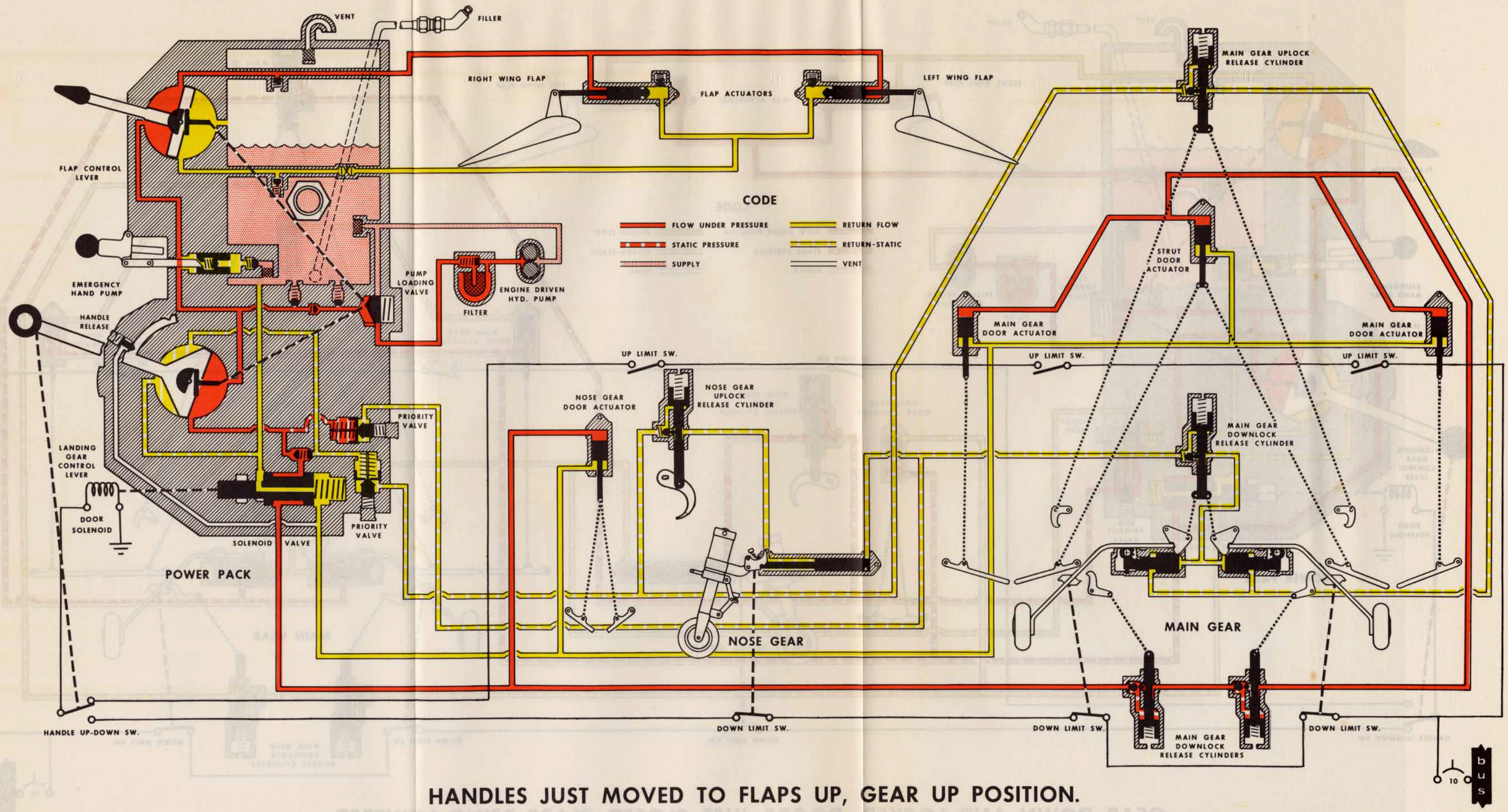
GEAR DOWN AND LOCKED, DOORS CLOSING.

Figure 5A-17. Schematic Diagram of 210B Hydraulic System (Sheet 4 of 10)



GEAR DOWN AND LOCKED, DOORS JUST CLOSED, FLAPS BEING LOWERED.

Figure 5A-17. Schematic Diagram of 210B Hydraulic System (Sheet 5 of 10)



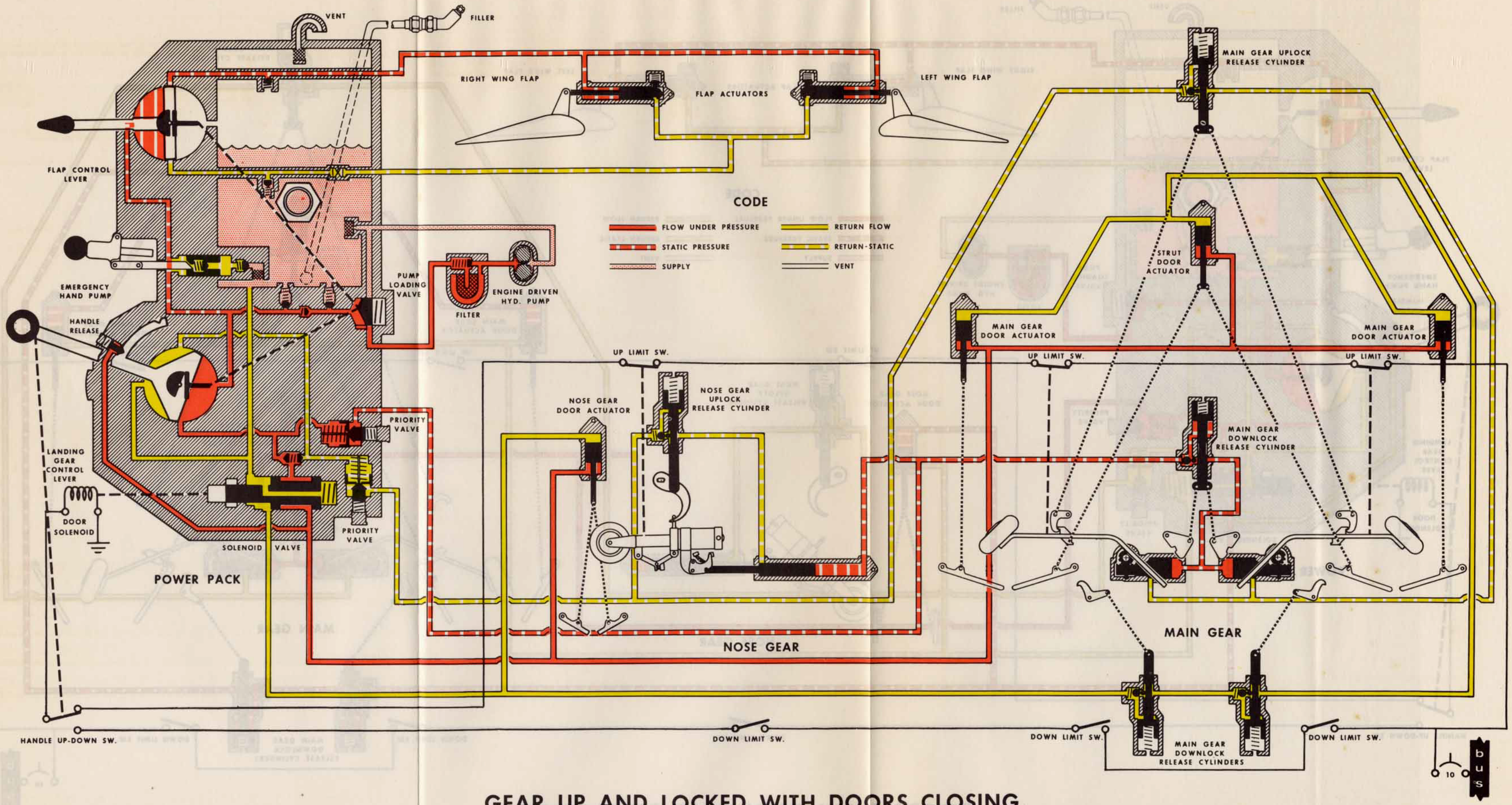
HANDLES JUST MOVED TO FLAPS UP, GEAR UP POSITION.

Figure 5A-17. Schematic Diagram of 210B Hydraulic System (Sheet 6 of 10)

VENT
FILLER
RIGHT WING FLAP
FLAP ACTUATORS
LEFT WING FLAP
FLAP CONTROL LEVER
CODE
FLOW UNDER PRESSURE
STATIC PRESSURE
SUPPLY
RETURN FLOW
RETURN-STATIC
VENT
EMERGENCY HAND PUMP
HANDLE RELEASE
PUMP LOADING VALVE
FILTER
ENGINE DRIVEN HYD. PUMP
MAIN GEAR UPLOCK RELEASE CYLINDER
STRUT DOOR ACTUATOR
MAIN GEAR DOOR ACTUATOR
UP LIMIT SW.
NOSE GEAR DOOR ACTUATOR
NOSE GEAR UPLOCK RELEASE CYLINDER
MAIN GEAR DOWNLOCK RELEASE CYLINDER
PRIORITY VALVE
LANDING GEAR CONTROL LEVER
DOOR SOLENOID
SOLENOID VALVE
PRIORITY VALVE
POWER PACK
NOSE GEAR
MAIN GEAR
HANDLE UP-DOWN SW.
DOWN LIMIT SW.
MAIN GEAR DOWNLOCK RELEASE CYLINDERS
10
bus

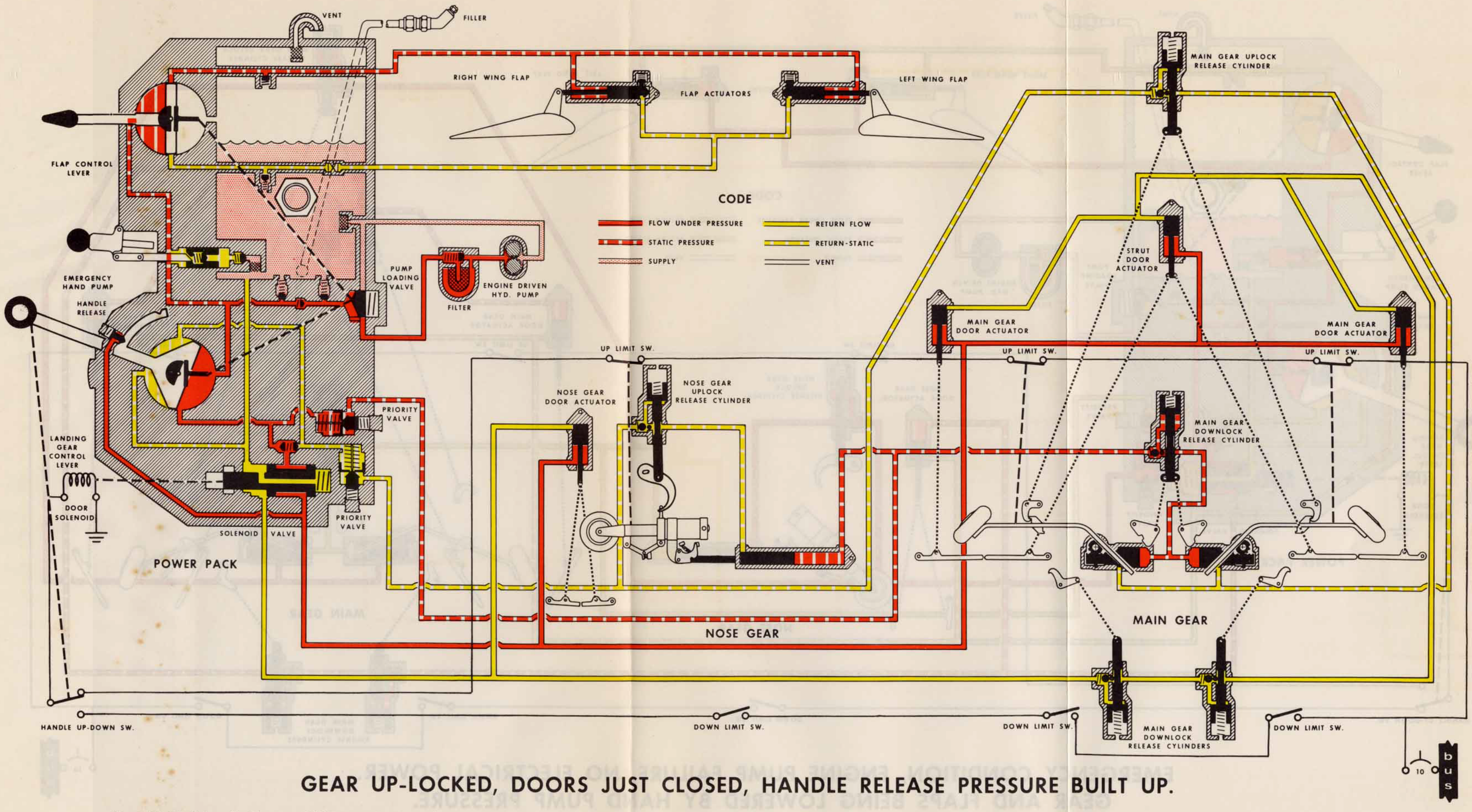
DOORS FULLY OPEN, GEAR RETRACTING.

Figure 5A-17. Schematic Diagram of **210B** Hydraulic System (Sheet 7 of 10)



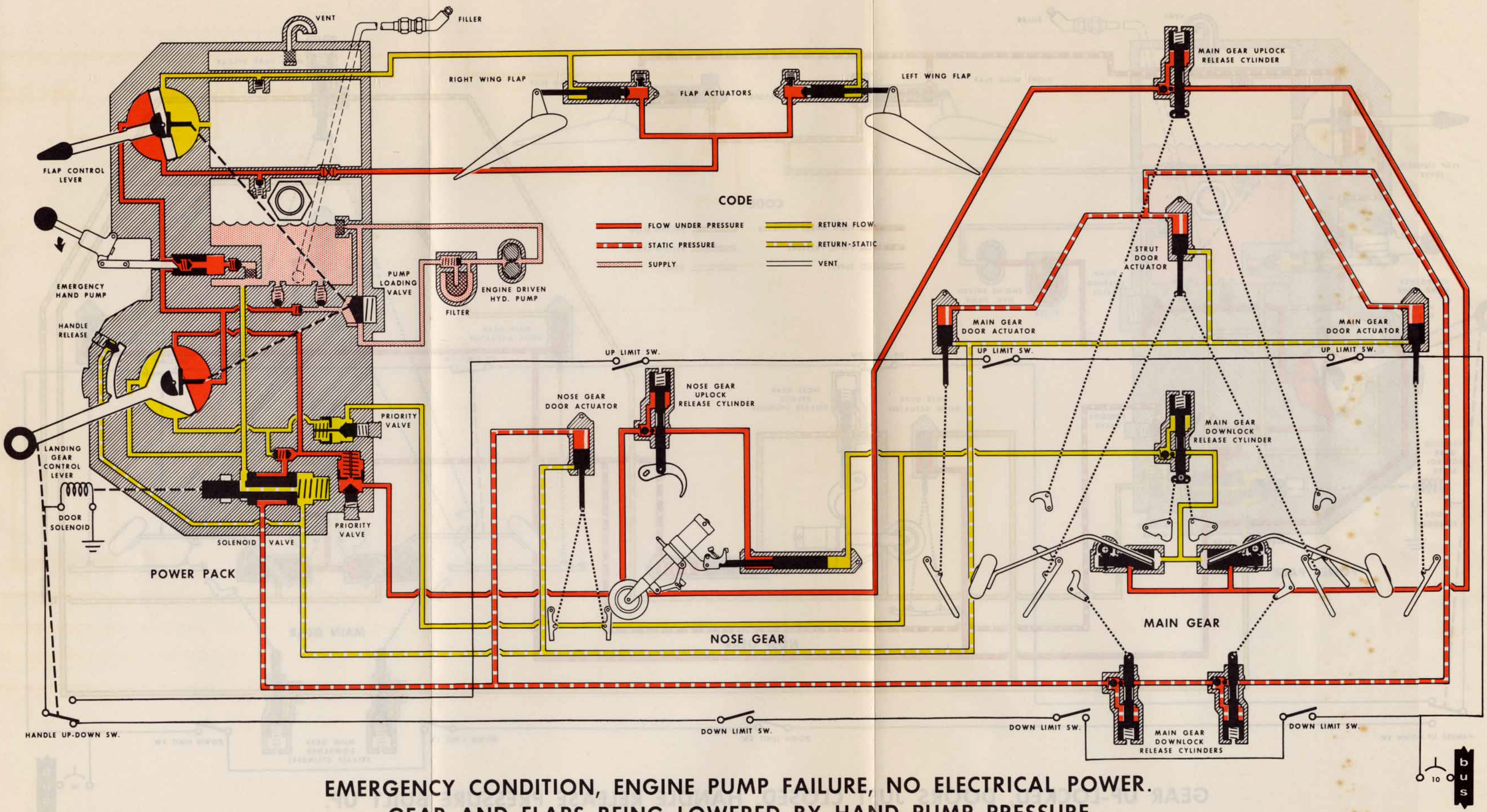
GEAR UP AND LOCKED WITH DOORS CLOSING.

Figure 5A-17. Schematic Diagram of 210B Hydraulic System (Sheet 8 of 10)



GEAR UP-LOCKED, DOORS JUST CLOSED, HANDLE RELEASE PRESSURE BUILT UP.

Figure 5A-17. Schematic Diagram of 210B Hydraulic System (Sheet 9 of 10)



EMERGENCY CONDITION, ENGINE PUMP FAILURE, NO ELECTRICAL POWER. GEAR AND FLAPS BEING LOWERED BY HAND PUMP PRESSURE.

Figure 5A-17. Schematic Diagram of 210B Hydraulic System (Sheet 10 of 10)

SECTION 5B

LANDING GEAR

THIS SECTION IS APPLICABLE TO MODEL 205 SERIES AND MODEL 206 SERIES.

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5B-1. LANDING GEAR.

5B-2. Conventional tricycle landing gear, utilizing the familiar Cessna spring-steel main landing gear struts and an air-oil nose gear shock strut, is employed on the aircraft. Cleveland wheels and brake assemblies with tube-type tires are installed. On the Model 205 speed fairings were optional equipment. On the Models 205A and 206 series speed fairings are standard equipment with the standard landing gear. Oversize speed fairings are available for the optional heavy-duty nose gear and the optional oversize main wheels.

5B-3. MAIN GEAR.

5B-4. REMOVAL OF MAIN GEAR. (See figure 5B-1.)

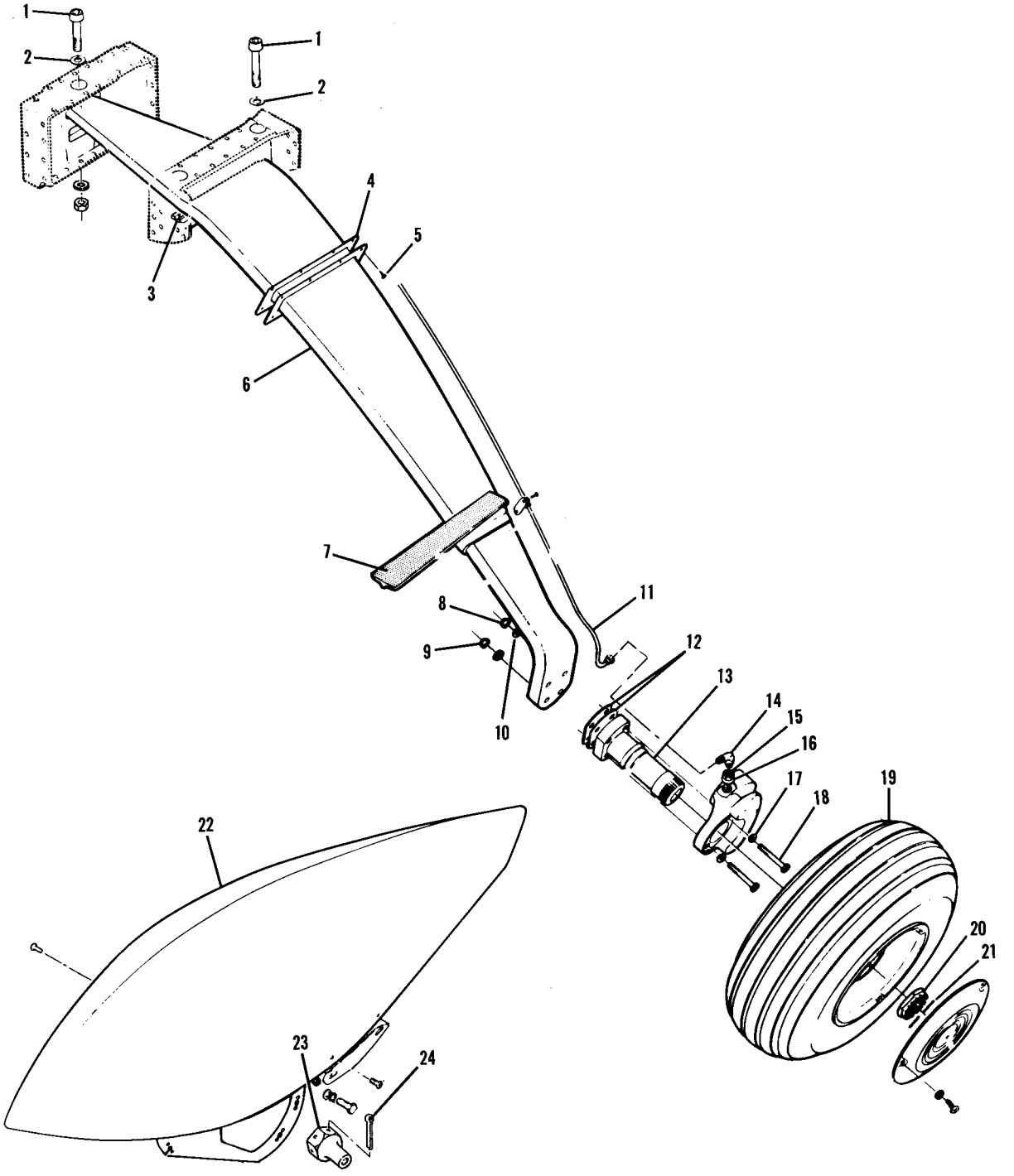
a. Hoist or jack airplane as outlined in Section 2.

b. Remove brake bleed screw and drain hydraulic brake fluid from gear being removed.

c. Peel back carpet and remove access plates as necessary for access to strut attaching bolts and nuts.

d. Disconnect and cap or plug brake line at bulkhead fitting in fuselage.

e. Remove screws attaching landing gear strut fairing and gasket to fuselage.



1. Bolt
2. Countersunk Washer
3. Channel
4. Gasket & Fairing
5. Screw
6. Main Gear Strut
7. Step
8. Nut
9. Nut
10. Washer
11. Brake Line
12. Alignment Shims
13. Axle
14. Elbow
15. Nut
16. Washer
17. Washer
18. Bolt
19. Wheel Assembly
20. Axle Nut
21. Cotter Pins
22. Wheel Fairing
23. Nut
24. Cotter Pin

Figure 5B-1. Main Landing Gear

f. Remove inboard bolt; loosen two outboard bolts and work strut out to remove. Use care when removing strut to prevent damage to hydraulic brake line. Retain any shims under inboard bolt.

5B-5. INSTALLATION OF MAIN GEAR. To install the main landing gear, reverse the procedure outlined in paragraph 5B-4, paying special attention to the following:

a. When installing the main landing gear strut, the outboard channel attaching bolts should be tightened to a torque value of 600-750 pound-inches.

NOTE

The convex surface of the outboard channel is installed against the lower side of the strut. When channel attaching bolts are torqued to 600-750 pound-inches, the channel should have a minimum of 80 per cent contact with the lower side of the strut.

b. Shims are installed, if necessary, between the gear strut and inboard forging to level the wing tips.

NOTE

Shims (Part No. 0541105) are installed between landing gear strut and inboard forging as required (Maximum of 2 shims) to level the wing tips within a tolerance of three inches. If it was necessary to install any shims during assembly, at the factory, the number of shims originally installed is stamped on the extreme end of the strut.

c. After installation, bleed affected brake system using clean hydraulic fluid (MIL-H-5606).

5B-6. REMOVAL AND INSTALLATION OF MAIN WHEEL SPEED FAIRINGS. The main wheel speed fairings may be removed by removing the screws attaching the inboard side of the fairing to the adapter plate, and removing the bolt securing the outboard side to the axle nut. Installation of the speed fairing is the reversal of the removal. Refer to Service Kit No. SK 182-12 for repair of speed fairings. Scraper to tire clearance on both the standard and heavy duty main wheels should be adjusted to 0.40 to 0.60 inch. Elongated holes in the scraper are provided for adjustment.

CAUTION

Always check scraper clearance after installing speed fairings, whenever a tire has been changed, and whenever scraper adjustment has been disturbed.

5B-7. REMOVAL OF MAIN WHEELS.

NOTE

It is not necessary to remove the wheel to reline brakes or remove brake parts (other than the brake disc or torque plate) on Cleveland wheel and brake assemblies.

a. Jack the wheel, using the universal jack point.
b. Remove speed fairing (if installed), or dust cover.
c. Remove cotter pins and axle nut.
d. Remove bolts and washers attaching back plates and shim (shim used only on 1963 Model 205) and remove back plates and shim. Pull wheel from axle, removing bearing cone as the wheel is removed.

5B-8. DISASSEMBLY.

a. Deflate tire and break tire beads loose.

CAUTION

Avoid damaging wheel flanges when breaking tire beads loose. A scratch, gouge, or nick may cause wheel failure.

b. Remove thru-bolts and separate wheel halves, removing tire and tube and brake disc.
c. Remove the grease seal ring, felt and plate, and the bearing cone from the inner wheel half.

NOTE

The bearing cups are a press fit in the wheel halves and should not be removed unless replacement is necessary. To remove the bearing cups, heat the wheel half in boiling water for 15 minutes. Using an arbor press, if available, press out the bearing cup and press in the new one while the wheel is still hot.

5B-9. INSPECTION AND REPAIR.

a. Clean all metal parts and the grease seal felts in solvent and dry thoroughly.
b. Inspect wheel halves for cracks. Cracked wheel halves should be replaced. Sand out nicks, gouges, and corroded areas. Where the protective coating, has been removed, the area should be cleaned thoroughly, primed with zinc chromate primer, and repainted with aluminum lacquer.
c. Brake disc should be replaced if excessively scored or warped. Small nicks and scratches should be sanded smooth.
d. Bearing cups and cones should be inspected carefully for damage and discoloration. After cleaning, repack bearing cones with clean bearing grease before installation in the wheel.

5B-10. ASSEMBLY.

a. Insert thru-bolts through brake disc and position in the inner wheel half, using the bolts to guide the disc. Assure that the disc is bottomed in the wheel half.
b. Position the tire with the inflation valve through hole in outboard wheel half. Place the other wheel half in position. Apply a light force to bring the wheel halves together. Maintaining the light force, assemble a washer and nut on one thru-bolt and tighten snugly. Assemble the remaining nuts and washers on the thru-bolts and torque to the value marked on the wheel.

CAUTION

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

c. Clean and repack bearing cones with clean wheel bearing grease.
d. Assemble the bearing cone, grease seal plate, felt, and ring into the inner wheel half. Assemble bearing cone into the outer wheel half as the wheel is installed on the axle.
e. Inflate tire to seat tire beads, then adjust to correct pressure.

5B-11. INSTALLATION OF MAIN WHEELS.
a. Place wheel on axle and install bearing cone.
b. Install axle nut and tighten until a slight bearing drag is obvious when the wheel is rotated. Back off nut to the nearest castellation and install cotter pins.
c. On airplanes without speed fairings, install dust cover.
d. Place brake shim (shim used only on 1963 Model 205) and back plates in position and secure with bolts and washers. Safety wire the bolts.

CAUTION

Always check scraper clearance after installing speed fairings, whenever a tire has been changed, and whenever scraper adjustment has been disturbed. Set clearance between tire and scraper at 0.40 to 0.60 inch. Elongated holes in the scraper are provided for adjustment.

5B-12. WHEEL ALIGNMENT. Wheel alignment is obtained through the use of tapered shims installed between the strut and axle. Refer to paragraph 5-59 and figures 5-11A and 5-11B for correct procedures to align the wheels.

5B-13. NOSE GEAR.

NOTE

Nose gear shock strut assemblies shown in figure 5B-3 through 5B-6 are original equipment on the specified model, model year, and serial number. The shock strut assembly shown in figure 5B-5 (1965 and on) will be furnished as a replacement shock strut assembly instead of the shock strut assemblies shown in figures 5B-3 and 5B-4. When installing the later shock strut assembly, the nose gear tunnel must be modified in accordance with Service Kit No. SK206-6, and some parts must be replaced as noted in the applicable Parts Catalog. However, individual parts for original shock strut assemblies are still available for spare parts.

5B-14. REPLACEMENT OF NOSE GEAR. (See figure 5B-2.)
a. Remove access plates around gear and tie-down tail to raise nose wheel off the ground.
b. Disconnect nose gear steering bungee from steering arm.
c. Remove bolt (9) to disconnect drag strut.
d. Remove bolts (17) to disconnect upper trunnion from fuselage structure.
e. Install gear by reversing the procedures listed above.

5B-15. STANDARD NOSE WHEEL SPEED FAIRING REPLACEMENT.
a. Tie down or weight the tail of the airplane to raise the nose wheel off the ground.
b. Remove nose wheel axle stud.
c. Deflate strut completely.

WARNING

Be sure strut is deflated completely before removing bolt that attaches speed fairing to strut or disconnecting the torque link.

d. Disconnect lower torque link from fork hub and remove removable plate.
e. Remove bolt attaching speed fairing to fork hub. This is the bolt that attaches the fork as well as the tow-bar spacers.
f. Slide speed fairing up and remove the nose wheel. Loosen scraper if necessary. Use a rod or long punch inserted through one ferrule to tap the opposite one out of the fork. Remove both ferrules and pull the nose wheel from the fork.
g. Rotate speed fairing 90° and work it down over the nose gear fork.
h. Install speed fairing by reversing the preceding steps. Tighten axle stud until a slight bearing drag is obvious when the wheel is turned. Back off the nut to the nearest castellation and install cotter pins.
i. Service shock strut after installation of speed fairing.

CAUTION

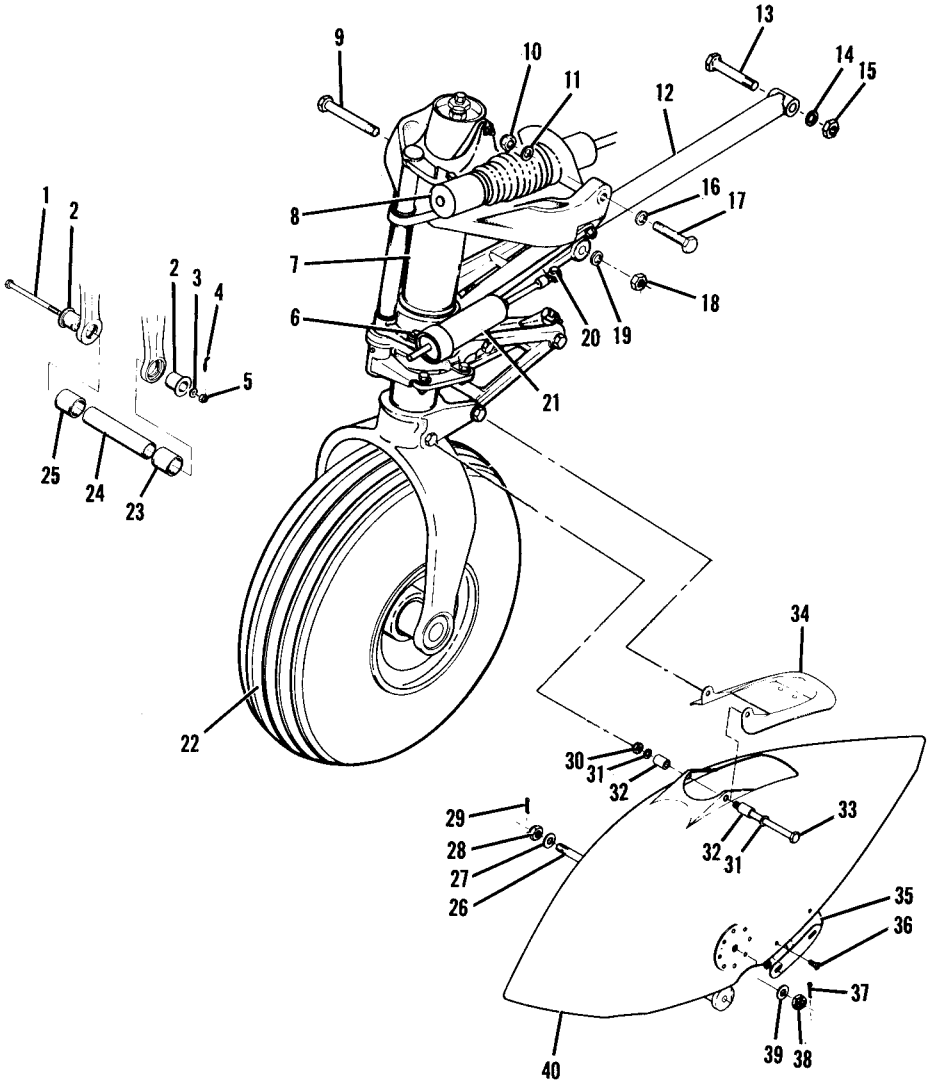
Always check scraper clearance after installing speed fairings, whenever a tire has been changed, and whenever scraper adjustment has been disturbed. Set clearance between tire and scraper at 0.38 inch. Elongated holes in scraper are provided for adjustment.

5B-16. HEAVY-DUTY NOSE WHEEL SPEED FAIRING REPLACEMENT.
a. Tie down or weight tail of the airplane to raise nose wheel off ground.
b. Remove nose wheel axle stud.
c. Deflate strut and disconnect lower torque link from fork hub.

WARNING

Be sure strut is deflated completely before disconnecting torque link.

d. Remove bolt securing speed fairing to fork hub. The speed fairing is attached to the lugs on the forward side of the fork hub and the tow-bar spacers are also attached with same bolt.
e. Slide speed fairing up and remove the nose wheel. Loosen scraper if necessary. Use a rod or long punch inserted through one ferrule to tap the opposite one out of the fork. Remove both ferrules and pull the nose wheel from the fork.



1. Axle Bolt
2. Axle Ferrule
3. Washer
4. Cotter Pin
5. Nut
6. Bolt
7. Nose Gear Strut
8. Steering (Rudder Trim) Bungee
9. Bolt
10. Nut
11. Washer
12. Drag Link
13. Bolt
14. Washer
15. Nut
16. Washer
17. Bolt
18. Nut
19. Washer
20. Bolt
21. Shimmy Dampener
22. Nose Wheel
23. Axle Spacer
24. Axle Tube
25. Axle Spacer
26. Axle Bolt
27. Washer
28. Nut
29. Cotter Pin
30. Nut
31. Washer
32. Spacer (Tow Bar)
33. Bolt
34. Cover Plate
35. Mud Scraper
36. Screw
37. Cotter Pin
38. Nut
39. Washer
40. Fairing

Figure 5B-2. Nose Landing Gear

f. Remove bolts attaching wheel fork to fork hub and remove fork and speed fairing.
g. Install speed fairing by reversing the preceding steps. Tighten axle stud until a slight bearing drag is obvious when the wheel is turned. Back off the nut to the nearest castellation and install cotter pin.
h. Service shock strut after installation of speed fairing.

CAUTION

Always check scraper clearance after installing speed fairings, whenever a tire has been changed, and whenever scraper adjustment has been disturbed. Set clearance between tire and scraper at 0.38 inch. Elongated holes in the scraper are provided for adjustment.

5B-17. REMOVAL OF NOSE WHEEL. Removal of the nose wheel may be accomplished as outlined in paragraphs 5B-15 or 5B-16.

5B-18. DISASSEMBLY OF NOSE WHEEL.
a. Remove valve core and completely deflate tire and break tire beads loose.

WARNING

Injury can result from attempting to separate wheel halves with tire inflated. Avoid damaging wheel flanges when breaking tire beads loose.

b. Remove thru-bolts and separate wheel halves.
c. Remove tire and tube.
d. Remove bearing retaining rings, grease seals and bearing cones.

NOTE

The bearing cups are a press fit in the wheel halves and should not be removed unless replacement is necessary. To remove, heat wheel half in boiling water for 15 minutes. Using an arbor press, if available, press out the bearing cup and press in the new one while the wheel is still hot.

5B-19. INSPECTION AND REPAIR. Instructions given in paragraph 5B-9 for the main wheels may be used as a guide for inspection and repair of the nose wheel.

5B-20. ASSEMBLY OF NOSE WHEEL.
a. Place tube inside tire and align balance marks.
b. Place tire and tube on wheel half with tube valve stem through hole in wheel half.
c. Insert thru-bolts, position other wheel half, and secure with nuts and washers. Torque bolts to valve marked on wheel.

WARNING

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

d. Clean and repack bearing cones with clean wheel bearing grease.
e. Assemble bearing cones, seals, and retainers into wheel half.
f. Inflate tire to seat tire beads, then adjust to correct pressure.

5B-21. INSTALLATION OF NOSE WHEEL. Installation of the nose wheel may be accomplished as outlined in paragraphs 5B-15 or 5B-16.

5B-22. MODEL 205 NOSE GEAR STRUT DISASSEMBLY. (See figure 5B-3 and paragraph 5B-13.) The following procedure applied to the 1963 Model 205 nose gear shock strut after it has been removed from the airplane, and the speed fairing and nose wheel have been removed. In many cases, separating the upper and lower struts will permit inspection and parts replacement without removal or complete disassembly.
a. Remove torque links. Note position of washers and spacers.

WARNING

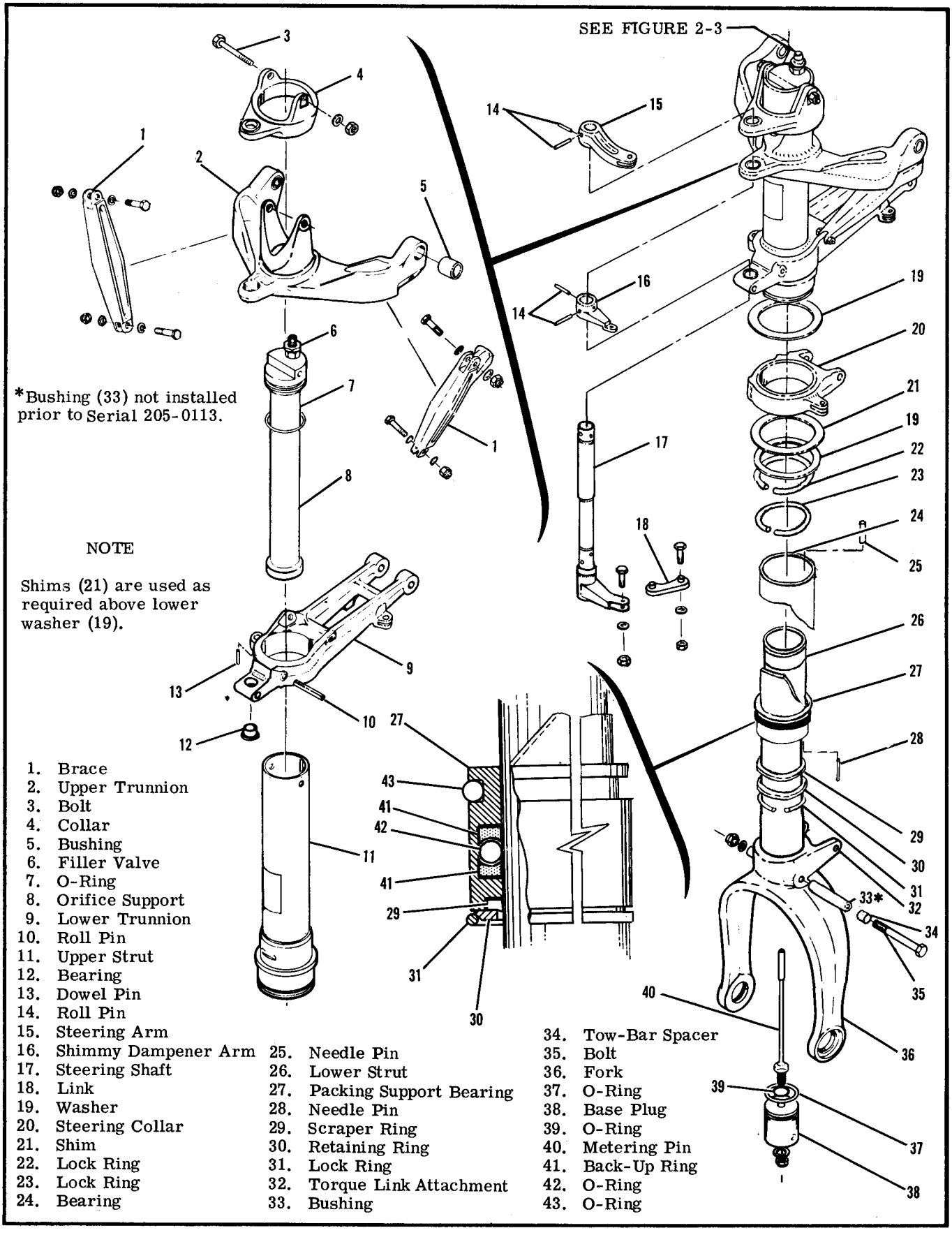
Deflate strut completely before removing bolt (3), lock ring (31), or bolt (35). Do not disconnect torque links until strut is completely deflated.

b. Remove shimmy dampener.
c. Remove steering shaft (17) by driving out roll pins (14) and removing arms (15 and 16) and link (18).
d. Remove lock ring (31) from groove inside of lower end of upper strut (11). A small hole is provided at the lock ring groove to facilitate removal.

NOTE

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

e. Using a straight, sharp pull, remove lower strut from upper strut. Retain needle pin (28) as the strut is separated. This pin locks the packing support bearing (27) to prevent rotation of bearing. Invert lower strut and drain hydraulic fluid.
f. Remove lock ring (23), bearing (24) and needle pin (25) from upper end of lower strut (26). Pin (25) locks bearing (24) to prevent rotation. When the strut extends, bearing (24) and the packing support bearing mate to straighten the nose wheel in the fore and aft position.
g. Slide packing support bearing (27), scraper ring (29), retainer ring (30), and lock ring (31) from lower strut (26). Note relative position and top side of each ring and bearing to aid reassembly.
h. Remove back up rings (41) and O-rings (42 and 43) from packing support bearing.
i. Remove metering pin (40) and base plug (38) by removing bolt (35) and bushing (33) from lower strut and fork. Lower strut and fork are press fitted, do not disassemble.



1. Brace
2. Upper Trunnion
3. Bolt
4. Collar
5. Bushing
6. Filler Valve
7. O-Ring
8. Orifice Support
9. Lower Trunnion
10. Roll Pin
11. Upper Strut
12. Bearing
13. Dowel Pin
14. Roll Pin
15. Steering Arm
16. Shimmy Dampener Arm
17. Steering Shaft
18. Link
19. Washer
20. Steering Collar
21. Shim
22. Lock Ring
23. Lock Ring
24. Bearing
25. Needle Pin
26. Lower Strut
27. Packing Support Bearing
28. Needle Pin
29. Scraper Ring
30. Retaining Ring
31. Lock Ring
32. Torque Link Attachment
33. Bushing
34. Tow-Bar Spacer
35. Bolt
36. Fork
37. O-Ring
38. Base Plug
39. O-Ring
40. Metering Pin
41. Back-Up Ring
42. O-Ring
43. O-Ring

Figure 5B-3. Nose Gear Strut - Model 205

NOTE

Nose gear shock struts installed on Model 205 airplanes prior to serial number 205-0113 did not have bushing (33) installed. However, if the nose gear shock strut has been replaced, bushing (33) may be installed. Heavy-duty shock struts do not employ bushing (33).

j. Remove metering pin (40) and O-rings (37 and 39) from base plug (38).
k. Remove orifice support (8) by removing bolt (3) and collar (4). Remove O-ring (7) from orifice support.
l. Remove lock ring (22) from lower end of upper strut (11) and remove washers (19), shims (21), and steering collar (20).
m. Bushings and bearings in upper trunnion (2), lower trunnion (9), and collar (4) may be replaced as required. Needle bearings in steering collar (20) should not be replaced; replace the steering collar if needle bearing is defective.

NOTE

Upper and lower trunnions (2 and 9) are press-fitted to the upper strut (11), with braces (1) installed during assembly. Pin (13) is also press-fitted to the lower trunnion.

5B-23. MODEL 205 NOSE GEAR STRUT ASSEMBLY. (See figure 5B-3.)
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.
b. Assemble the strut by reversing the order of the procedure outlined in paragraph 5B-22.
c. Replace back-up rings in packing support ring with the contoured rubber back-up rings, one on each side of the O-ring (42).

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.

d. Lubricate needle bearing in steering collar (20) with MIL-G-7711 grease (or equivalent) before installing the collar. Add shims (21) as necessary to remove excessive clearance between collar (20) and washers (19).
e. 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.
f. Sharp metal edges should be smoothed with #400 emery paper, then cleaned.
g. Cleanliness and proper lubrication, along with careful workmanship, are important during assembly of the shock strut.
h. When installing lock ring (31), position the lock ring so one of its ends covers the small access hole in the lock ring groove.
i. When installing bearing (24) on lower strut (26), position gap of lock ring (23) on the opposite side of pin (25).
j. It is easier to service the shock strut just before installation, although it may be serviced after installation if desired.
k. Do not tighten shimmy dampener attach bolts to a torque value in excess of 10 pound-inches.
l. Tighten center bolt on torque links snug, then tighten to next castellation and install cotter pin.

5B-24. MODELS 205A AND 206 STANDARD NOSE GEAR.

5B-25. The standard nose gear for the Model 205A serial number 205-0481 through 205-0565 and the Model 206 serial number 206-0001 through 206-0156 is shown in figure 5B-4. The optional heavy duty nose gear, discussed later in this Section, is shown in figure 5B-6. Replacement of the nose gear assembly may be accomplished as outlined in paragraph 5B-14.

5B-26. MODELS 205A AND 206 STANDARD NOSE GEAR DISASSEMBLY. (See figure 5B-4 and paragraph 5B-13.) The following procedure applies to the nose gear shock strut after it has been removed from the airplane, and the speed fairing and nose wheel have been removed. In many cases, separating the upper and lower struts will permit inspection and parts replacement without removal or complete disassembly.

WARNING

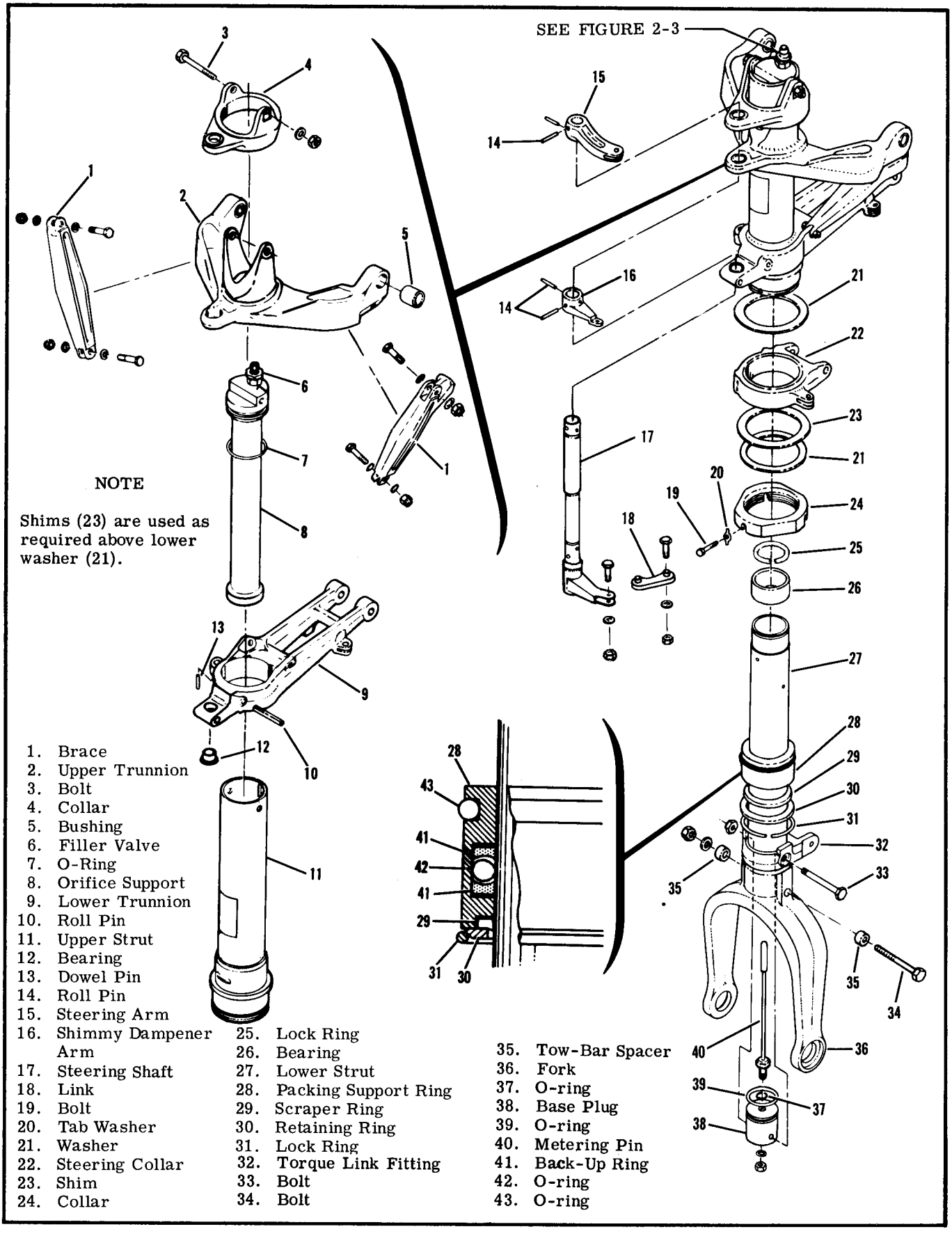
Deflate strut completely before removing bolt (3), lock ring (31), or bolt (33). Also deflate strut before disconnecting torque links.

a. Remove torque links. Note position of washers and spacers.
b. Remove shimmy dampener.
c. Steering shaft (17) may be removed after driving out roll pins and removing arms (15 and 16) and link (18).
d. Remove lock ring (31) from groove inside lower end of upper strut. A small hole is provided at the lock ring groove to facilitate removal.

NOTE

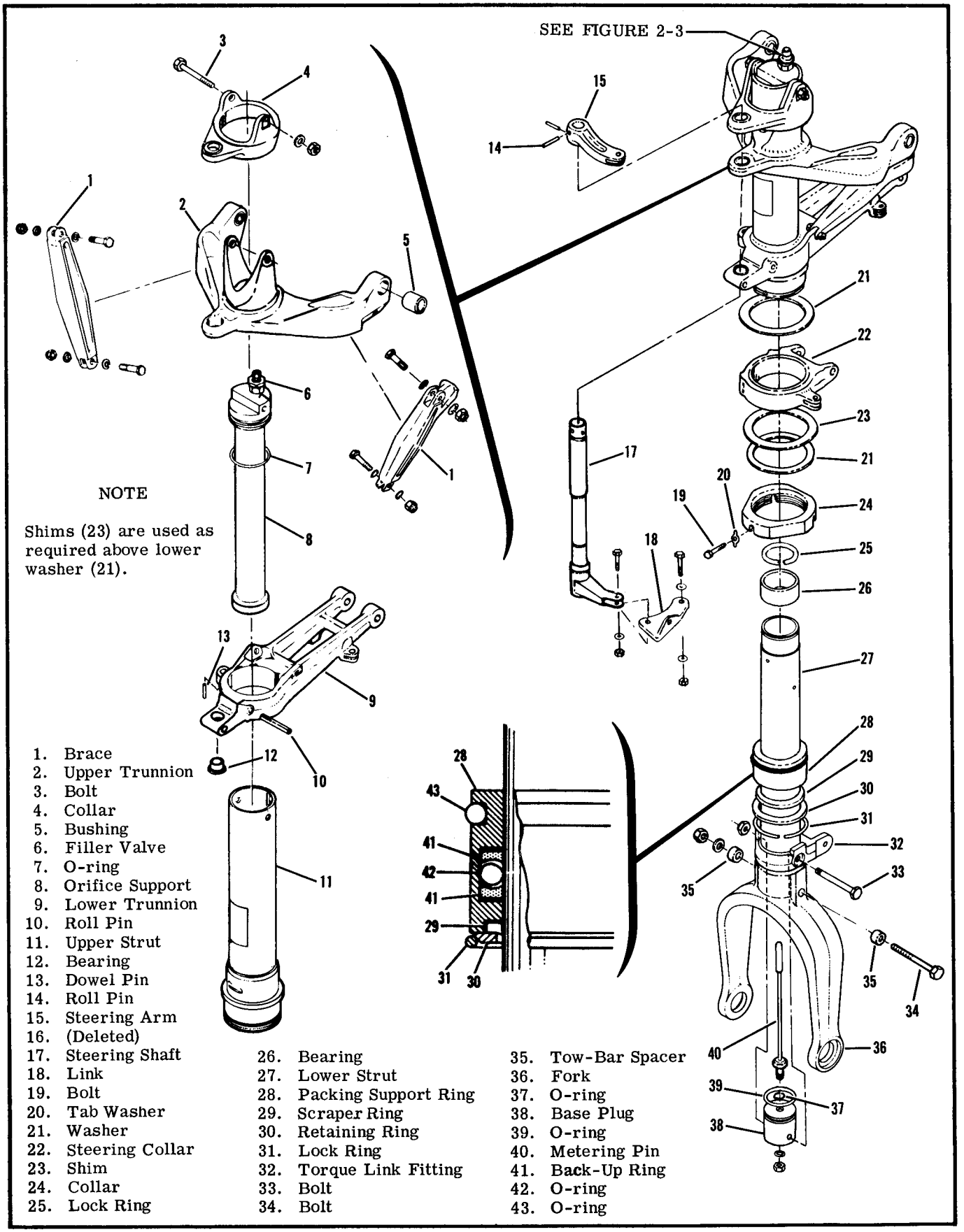
Hydraulic fluid will drain as lower strut is pulled from upper strut.

e. Use a straight, sharp pull to separate upper and lower struts. Invert lower strut and drain remaining hydraulic fluid.
f. Remove lock ring (25) and bearing (26) from



1. Brace
2. Upper Trunnion
3. Bolt
4. Collar
5. Bushing
6. Filler Valve
7. O-Ring
8. Orifice Support
9. Lower Trunnion
10. Roll Pin
11. Upper Strut
12. Bearing
13. Dowel Pin
14. Roll Pin
15. Steering Arm
16. Shimmy Dampener Arm
17. Steering Shaft
18. Link
19. Bolt
20. Tab Washer
21. Washer
22. Steering Collar
23. Shim
24. Collar
25. Lock Ring
26. Bearing
27. Lower Strut
28. Packing Support Ring
29. Scraper Ring
30. Retaining Ring
31. Lock Ring
32. Torque Link Fitting
33. Bolt
34. Bolt
35. Tow-Bar Spacer
36. Fork
37. O-ring
38. Base Plug
39. O-ring
40. Metering Pin
41. Back-Up Ring
42. O-ring
43. O-ring

Figure 5B-4. Standard Nose Gear Strut - Model 205 & 206



1. Brace
2. Upper Trunnion
3. Bolt
4. Collar
5. Bushing
6. Filler Valve
7. O-ring
8. Orifice Support
9. Lower Trunnion
10. Roll Pin
11. Upper Strut
12. Bearing
13. Dowel Pin
14. Roll Pin
15. Steering Arm
16. (Deleted)
17. Steering Shaft
18. Link
19. Bolt
20. Tab Washer
21. Washer
22. Steering Collar
23. Shim
24. Collar
25. Lock Ring
26. Bearing
27. Lower Strut
28. Packing Support Ring
29. Scraper Ring
30. Retaining Ring
31. Lock Ring
32. Torque Link Fitting
33. Bolt
34. Bolt
35. Tow-Bar Spacer
36. Fork
37. O-ring
38. Base Plug
39. O-ring
40. Metering Pin
41. Back-Up Ring
42. O-ring
43. O-ring

Figure 5B-5. Standard Nose Gear Strut - 1965 Model 206 Series

top end of lower strut.

g. Slide packing support ring (28), scraper ring (29), retaining ring (30), and lock ring (31), from lower strut, noting relative position and top side of each ring; wire together if desired.

h. Remove O-rings and back-up rings from packing support ring (28).

i. Remove bolt (33) and slide torque link fitting (32) from lower strut.

j. Remove metering pin (40) and base plug (38). Remove O-rings and metering pin from base plug.

NOTE

Lower strut and fork are a press fit, drilled on assembly. Separation of these parts is not recommended, except for replacement of parts.

k. Remove bolt (19) and tab washer (20), unscrew collar (24), and remove shim (23), washers (21), and steering collar (22).

l. If installed, remove clamps attaching filler extension valve and disconnect from filler valve at top of strut.

m. Remove bolt (3) at top of strut, and remove collar (4) and orifice support (8). Remove O-ring and valve from orifice support.

n. Bushings and bearings in lower trunnion (9), upper trunnion (2), and collar (4) may be replaced as required. Needle bearing in steering collar (22) should not be replaced; replace the steering collar if needle bearing is defective.

NOTE

Upper and lower trunnions (2 and 9) are press-fitted to the upper strut (11), with braces (1) installed during assembly. Pin (13) is also press-fitted to the lower trunnion.

5B-27. ASSEMBLY OF STANDARD SHOCK STRUT. (See figure 5B-4.)

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.

b. Assemble the strut by reversing the order of the procedure outlined in paragraph 5B-26.

c. Sharp metal edges should be smoothed with #400 emery paper, then cleaned.

d. Used sparingly, Dow Corning DC-4 compound is recommended for O-ring lubrication. All other internal parts should be liberally coated with hydraulic fluid (MIL-H-5606) during assembly.

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

f. Replace back-up rings in packing support ring with the contoured rubber back-up rings, one on each side of the O-ring (42).

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.

g. When installing bronze bearing at top of the lower strut, be sure that beveled edge of bearing is up next to the lock ring.

h. Lubricate needle bearing in steering collar (22) with MIL-G-7711 grease (or equivalent) before installing collar.

i. When installing collar (24), screw it onto the upper strut, to the nearest one-third turn. Use shims (23) as required to fill gap between collars. Use a new tab washer (20) to safety bolt (19).

j. When installing lock ring (31), position the lock ring so one of its ends covers the small access hole in the lock ring groove.

k. Do not tighten shimmy dampener attach bolts to a torque value in excess of 10-pound-inches

l. Tighten center bolt on torque links snug then tighten to next castellation and install cotter pin.

m. It is easier to service the shock strut just before installation, although it may be serviced after installation. See Section 2 for nose gear strut servicing.

5B-28. 1965 MODEL 206 SERIES STANDARD NOSE GEAR.

5B-29. The standard nose gear shock for the 1965 Model 206 Series airplanes is shown in figure 5B-5. The optional heavy-duty nose gear, discussed later in this Section, is shown in figure 5B-6. Replacement of the nose gear assembly may be accomplished as outlined in paragraph 5B-14.

5B-30. 1965 MODEL 206 SERIES STANDARD NOSE GEAR DISASSEMBLY. (See figure 5B-5 and paragraph 5B-13.) The nose gear strut may be disassembled using figure 5B-5 and paragraph 5B-26 as a guide

5B-31. ASSEMBLY OF STANDARD NOSE GEAR. The nose gear strut may be assembled using figure 5B-5 and paragraph 5B-27 as a guide.

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.

5B-32. HEAVY-DUTY NOSE GEAR. The optional heavy-duty nose gear available for the Model 205 and 206 Series is shown in figure 5B-6, which may be used as a guide during maintenance. Replacement and disassembly procedures are the same as those given for the standard nose gear except for the differences shown in the illustration. Refer to paragraph 5B-16 if heavy-duty nose gear is equipped with speed fairings.

5B-33. HEAVY-DUTY NOSE GEAR DISASSEMBLY. The heavy nose gear shock strut is shown in figure 5B-6 and may be used as a guide during disassembly and assembly. Parts not shown are similar to the standard nose gear shock struts shown in figures 5B-3 through 5B-5.

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.

5B-34. 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 specific amount of static unbalance. The lightweight point of the tire is marked with a red dot on the tire sidewall, and the heavy weight point of the tube is marked with a contrasting color line (usually near the valve stem). When installing a new tire and tube, place these marks adjacent to each other. If a wheel becomes unbalanced during service, automotive type wheel balancing equipment may be used to spin a mounted wheel to establish the point of maximum unbalance. Use automotive type balance weights to balance the wheel and tire assemblies. Be sure to install weights securely, if necessary, reshape the weights to fit the wheel rim contour.

5B-35. TORQUE LINKS. The torque links are illustrated in figure 5B-7, which may be used as a guide for removal, disassembly, assembly, and installation. Grease fittings and torque link bushings should not be removed except for replacement. Excessively worn parts should be replaced. Always deflate nose gear before disconnecting torque links.

5B-36. SHIMMY DAMPENER. The shimmy dampener illustrated in figure 5B-8 may be used as a guide for removal, disassembly, assembly and installation. Replace any parts found defective. When assembling shimmy dampener use new O-rings. Lubricate parts during assembly with clean hydraulic fluid (MIL-H-5606). Refer to Section 2 for filling procedure of shimmy dampener.

5B-37. NOSE WHEEL STEERING SYSTEM.

5B-38. The nose wheel steering system links the rudder pedals to the nose wheel fork, affording steering control through the use of the rudder pedals and brakes. When moving the airplane by hand never turn the nose wheel more than 35° either side of center.

5B-39. REMOVAL AND INSTALLATION. Figure 5B-9 shows details of the nose wheel steering system and may be used as a guide during replacement of parts.

5B-40. RIGGING. Since the nose wheel steering is connected to the rudder control system, refer to Section 10 for rigging.

5B-41. BRAKE SYSTEMS.

5B-42. The hydraulic brake system consists of two master cylinders, brake lines connecting each master cylinder to its wheel brake cylinder, and the single-disc type brake assemblies, located on each main landing gear.

5B-43. TROUBLE SHOOTING of the brake systems may be accomplished as outlined in paragraph 5-98.

5B-44. BRAKE MASTER CYLINDERS. The brake master cylinders, located just forward of the pilot's rudder pedals are actuated by applying toe pressure at the top of the rudder pedals. A small reservoir is incorporated into each master cylinder to supply it with fluid. Where dual brakes are installed mechanical linkage permits the copilot's pedals to operate the master cylinders.

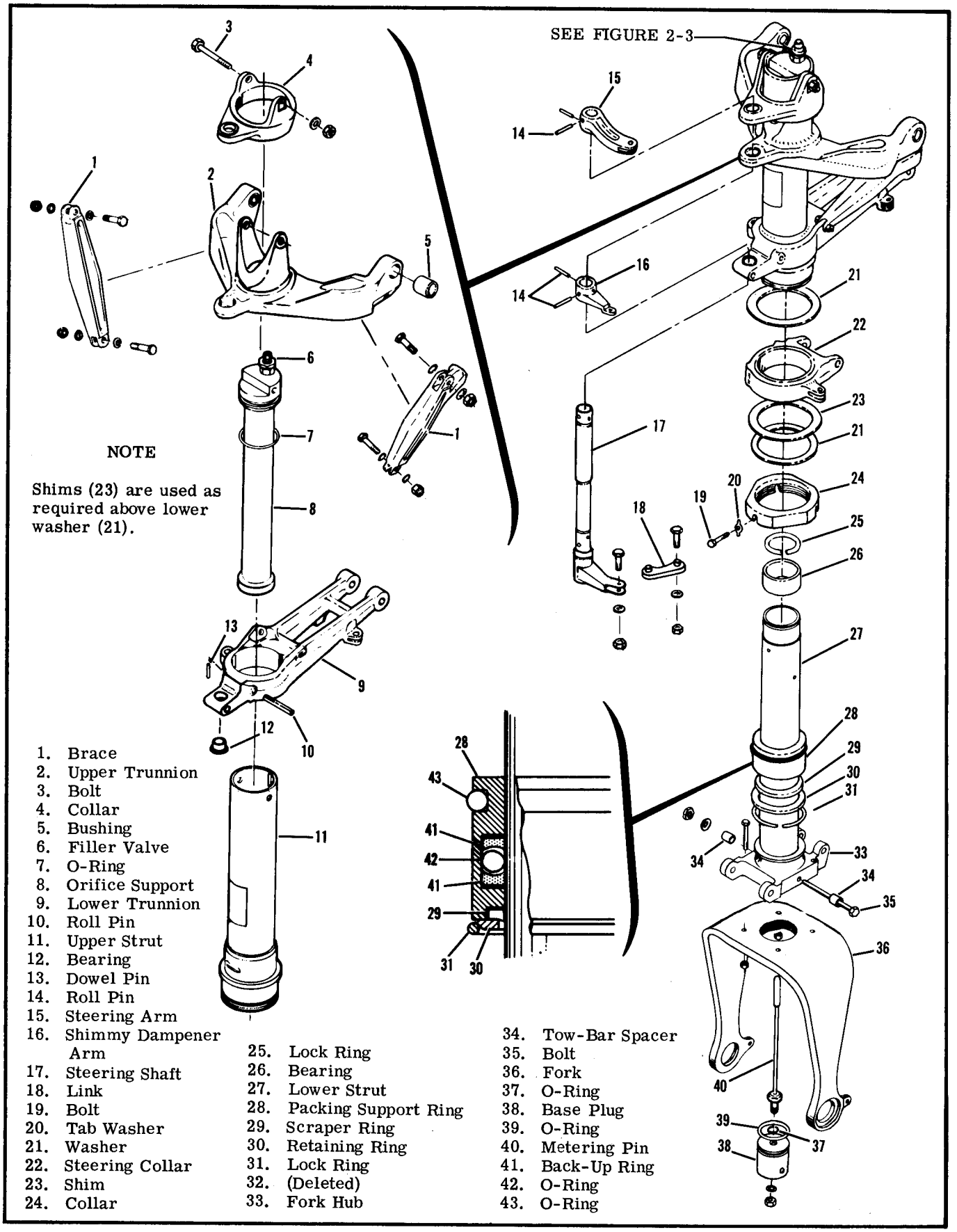
5B-45. REMOVAL AND INSTALLATION OF MASTER CYLINDERS.
Brake master cylinders may be removed and installed as outlined in paragraph 5-99.

5B-46. DISASSEMBLY AND REPAIR OF MASTER CYLINDERS. Figure 5-20 may be used as a guide during disassembly and assembly of the master cylinders. Repair is limited to replacement of parts, cleaning, and adjustment. Use clean hydraulic fluid (MIL-H-5605) as a lubricant during assembly of the cylinders.

5B-47. HYDRAULIC BRAKE LINES are of rigid aluminum tubing, except for flexible hoses used at the master cylinders. A separate line is used to connect each master cylinder to its corresponding wheel brake cylinder.

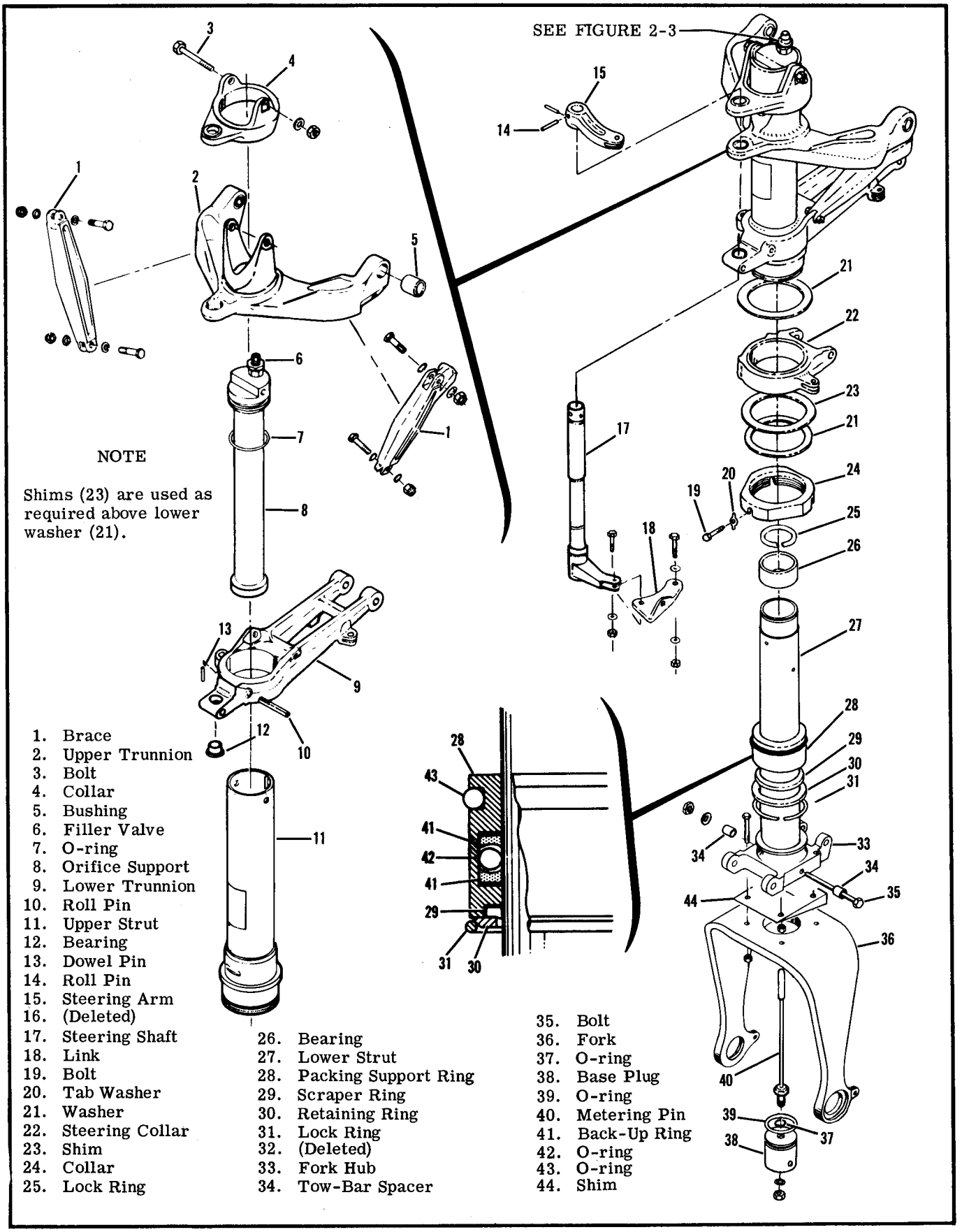
5B-48. WHEEL BRAKE ASSEMBLIES. Cleveland brakes use a disc which is affixed to the wheel, and a floating brake assembly. See figure 5B-10.

5B-49. REMOVAL OF WHEEL BRAKES. Cleveland brake assemblies are a floating type and can be removed after disconnecting the brake line and removing back plates.



1. Brace
2. Upper Trunnion
3. Bolt
4. Collar
5. Bushing
6. Filler Valve
7. O-Ring
8. Orifice Support
9. Lower Trunnion
10. Roll Pin
11. Upper Strut
12. Bearing
13. Dowel Pin
14. Roll Pin
15. Steering Arm
16. Shimmy Dampener Arm
17. Steering Shaft
18. Link
19. Bolt
20. Tab Washer
21. Washer
22. Steering Collar
23. Shim
24. Collar
25. Lock Ring
26. Bearing
27. Lower Strut
28. Packing Support Ring
29. Scraper Ring
30. Retaining Ring
31. Lock Ring
32. (Deleted)
33. Fork Hub
34. Tow-Bar Spacer
35. Bolt
36. Fork
37. O-Ring
38. Base Plug
39. O-Ring
40. Metering Pin
41. Back-Up Ring
42. O-Ring
43. O-Ring

Figure 5B-6. Heavy-Duty Nose Gear Strut (Sheet 1 of 2)



1. Brace
2. Upper Trunnion
3. Bolt
4. Collar
5. Bushing
6. Filler Valve
7. O-ring
8. Orifice Support
9. Lower Trunnion
10. Roll Pin
11. Upper Strut
12. Bearing
13. Dowel Pin
14. Roll Pin
15. Steering Arm
16. (Deleted)
17. Steering Shaft
18. Link
19. Bolt
20. Tab Washer
21. Washer
22. Steering Collar
23. Shim
24. Collar
25. Lock Ring
26. Bearing
27. Lower Strut
28. Packing Support Ring
29. Scraper Ring
30. Retaining Ring
31. Lock Ring
32. (Deleted)
33. Fork Hub
34. Tow-Bar Spacer
35. Bolt
36. Fork
37. O-ring
38. Base Plug
39. O-ring
40. Metering Pin
41. Back-Up Ring
42. O-ring
43. O-ring
44. Shim

Figure 5B-6. Heavy-Duty Nose Gear Strut (Sheet 2 of 2) 1965 & On

NOTE

On Cleveland brakes, the brake disc can be removed after wheel removal and disassembly. To remove the torque plate, remove the wheel and axle.

5B-50. INSPECTION AND REPAIR OF WHEEL BRAKES.

a. Clean all parts except brake linings and O-rings in dry cleaning solution and dry thoroughly.

b. O-rings are usually replaced at each overhaul. If their re-use is necessary, they should be wiped with a clean oiled cloth and inspected for damage.

NOTE

Thorough cleaning is important. Dirt and chips are the greatest cause of malfunctions in hydraulic brake systems.

c. Check brake linings for deterioration and maximum permissible wear.

d. Inspect brake cylinder bore for scoring. A scored cylinder may leak or cause rapid O-ring wear. A scored brake cylinder should be replaced.

e. If the anchor bolts on Cleveland brakes are nicked or gouged, they should be sanded smooth to prevent binding with the pressure plate or torque plate. When the anchor bolts are replaced, they should be pressed out. New ones can be installed by tapping them in place with a soft hammer.

5B-51. ASSEMBLY OF WHEEL BRAKES. Lubricate parts with the type of hydraulic fluid used in the system and assemble components with care to prevent damage to O-rings.

5B-52. INSTALLATION OF WHEEL BRAKES. Place the brake assembly in position with pressure plate in place, then install shim (1963 Models Only) and back plate, and safety their attaching bolts. If the torque plate was removed, install as the wheel and axle are installed. If the brake disc was removed from the wheel, install as the wheel is assembled.

5B-53. CHECKING BRAKE LININGS. Cleveland brake linings should be replaced when they are worn to a minimum thickness of 3/32 inch. Visually compare a 3/32 inch strip of material held adjacent to each lining to measure the thickness of the lining. The shank end of correct size drill bits make excellent tools for checking minimum thickness of brake linings.

5B-54. BRAKE LININGS REPLACEMENT. Replace brake linings on Cleveland brakes as follows:

a. Remove bolts, washers, back plate, and shim.

b. Pull the brake cylinder out of torque plate and slide pressure plate off anchor bolts.

c. Place back plate on a table with lining side down flat. Center a 9/64 inch (or slightly smaller) punch in the rolled rivet, and hit the punch crisply with a hammer. Punch out all rivets securing the linings to the back plate and pressure plate in the same manner.

NOTE

A rivet setting kit, Part No. R561, is available from the Cessna Spare Parts Department. This kit consists of an anvil and punch.

d. Clamp the flat sides of the anvil in a vise.

e. Align new lining on back plate and place brake rivet in the center hole with the rivet head in the lining. Place rivet head against the anvil.

f. Center the rivet setting punch on the lips of the rivet. While holding the back plate 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 the back plate.

g. Realign the lining on the back plate and install the remaining rivets.

h. Install a new lining on pressure plate in the same manner.

i. Position pressure plate on anchor bolts, and place cylinder in position so the anchor bolts slide into torque plate.

j. Install shim and back plate with bolts and washers. Safety the bolts.

5B-55. BRAKE BLEEDING. Standard bleeding, with a clean hydraulic pressure source connected to the wheel cylinder bleeder, is recommended.

a. Remove the master cylinder filler plug and screw a flexible hose with a suitable fitting into the filler hole. Immerse the free end of the hose in a can containing enough hydraulic fluid to cover the end of the hose.

b. Connect a clean hydraulic pressure source, such as a hydraulic hand pump, to the bleeder provision in the wheel cylinder.

NOTE

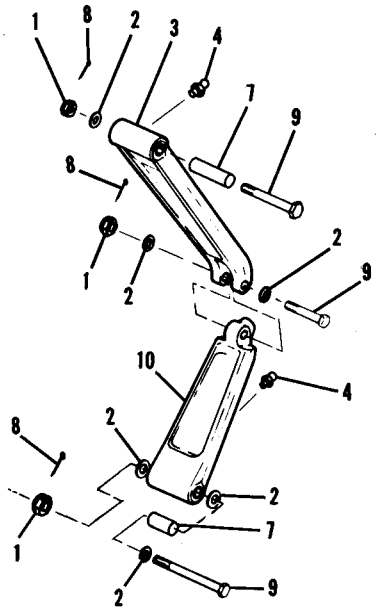
A bleeder valve or a bleeder screw is provided in the wheel cylinder.

c. As fluid is pumped into the system, observe the immersed end of the hose at the master cylinder for evidence of air bubbles being forced from the brake system. When bubbling has ceased, remove the bleeder source from the brake wheel cylinder and tighten the bleeder valve or install the bleeder screw with a new seal.

NOTE

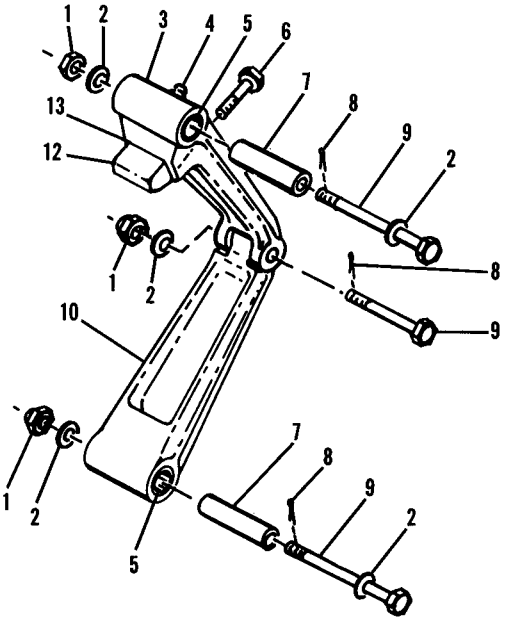
Insure that the free end of the hose from the master cylinder remains immersed during the entire bleeding process.

d. Remove hose from master cylinder and replace filler plug.



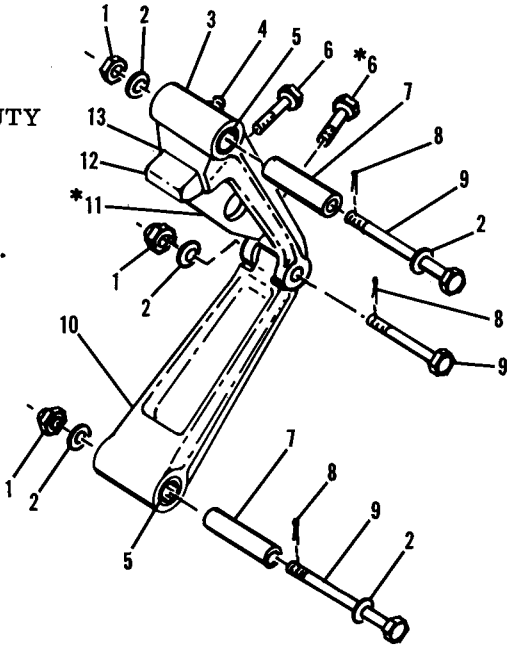
MODEL 205

STANDARD



MODEL 205A & 206 SERIES

HEAVY-DUTY

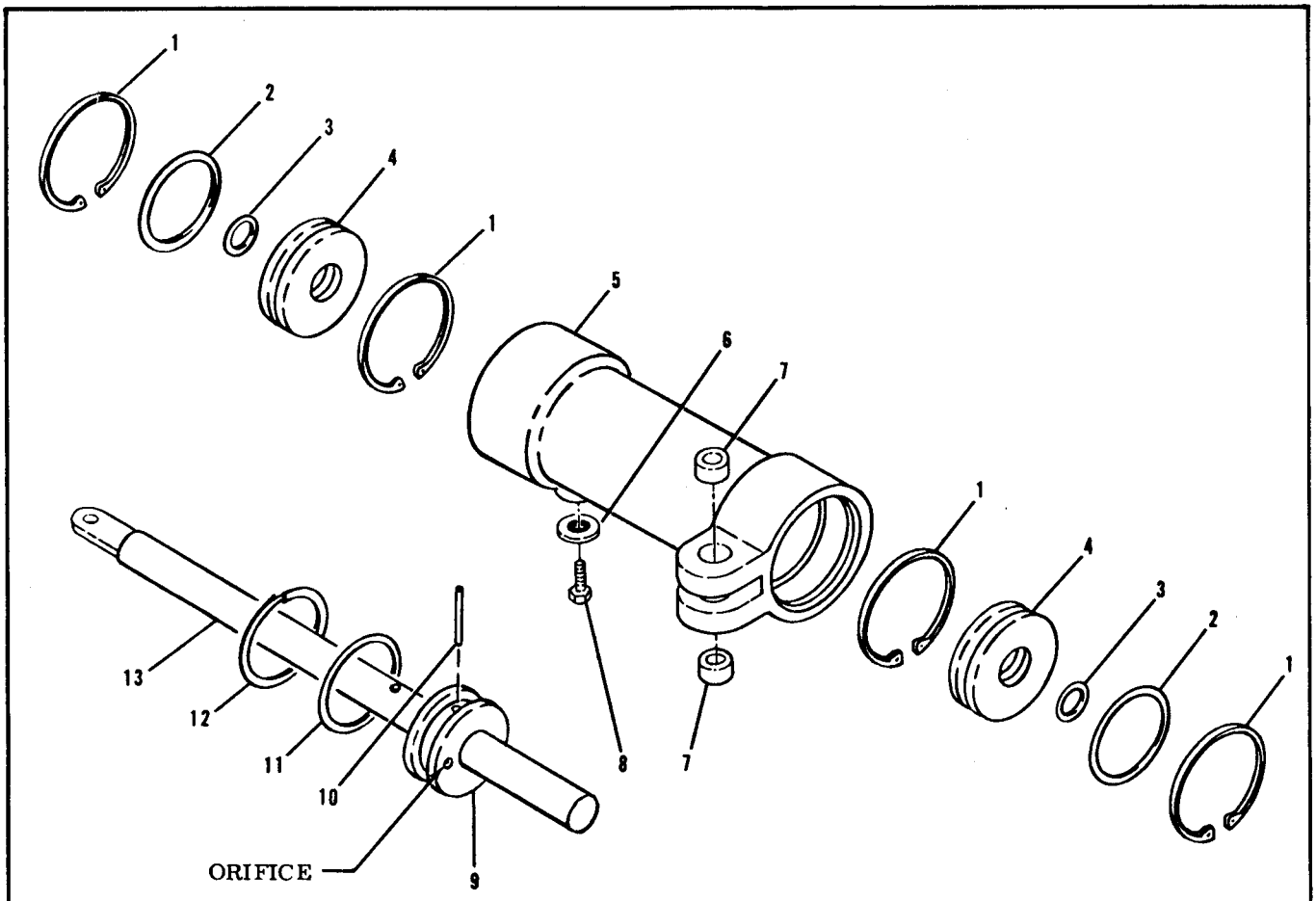


MODEL 205A & 206 SERIES

*Used only with heavy-duty nose gear.

1. Nut
2. Washer
3. Upper Torque Link
4. Grease Fitting
5. Bushing
6. Bolt
7. Spacer
8. Cotter Pin
9. Bolt
10. Lower Torque Link
11. Weld Assembly
12. Centering Lug
13. Shim

Figure 5B-7. Torque Links



1. Retaining Ring
2. O-Ring
3. O-Ring
4. Bearing Head
5. Barrel
6. Lock-O-Seal
7. Bushing
8. Bolt
9. Piston
10. Roll Pin
11. O-Ring
12. Back-Up Ring
13. Piston Shaft

Figure 5B-8. Shimmy Dampener

SHOP NOTES:

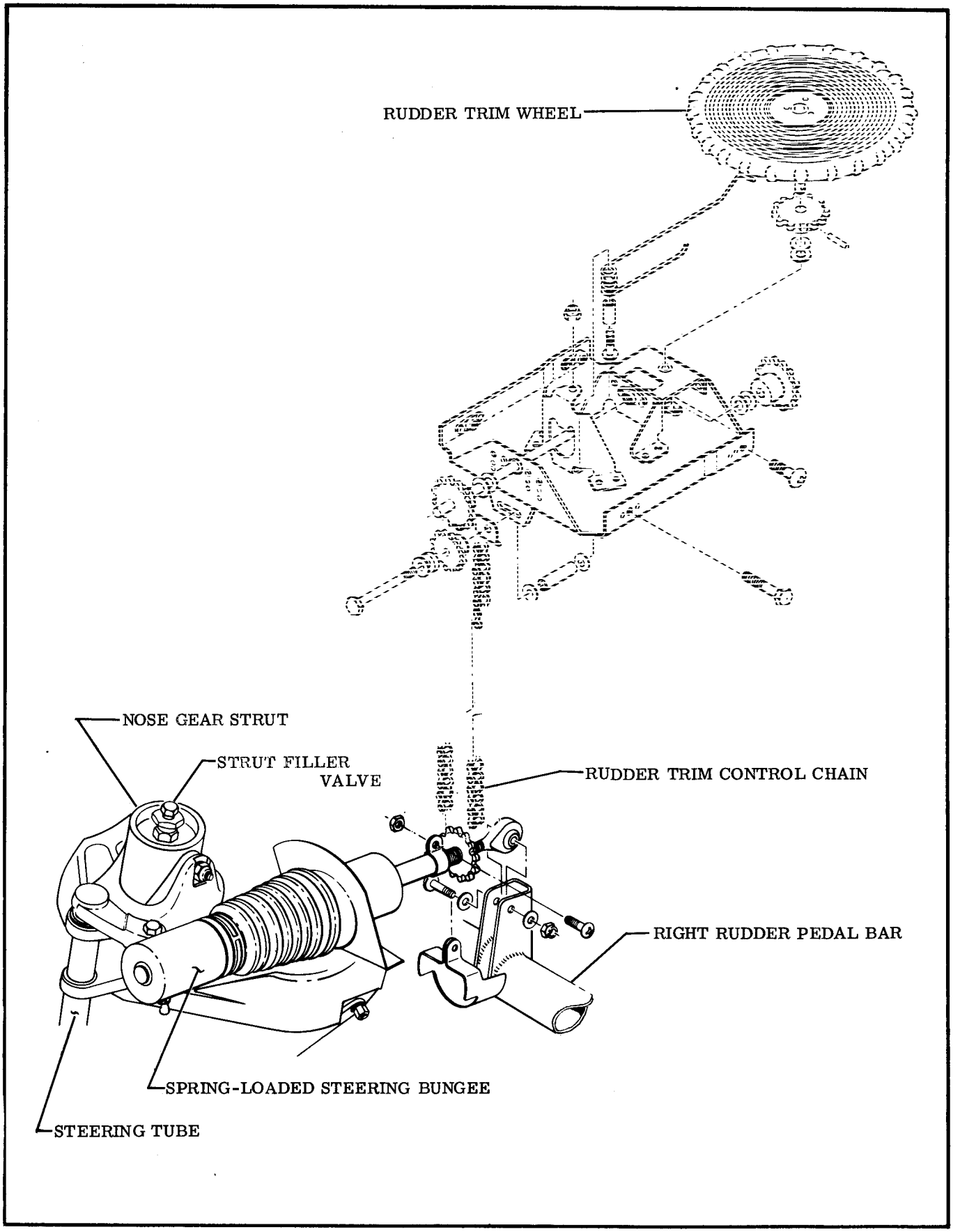
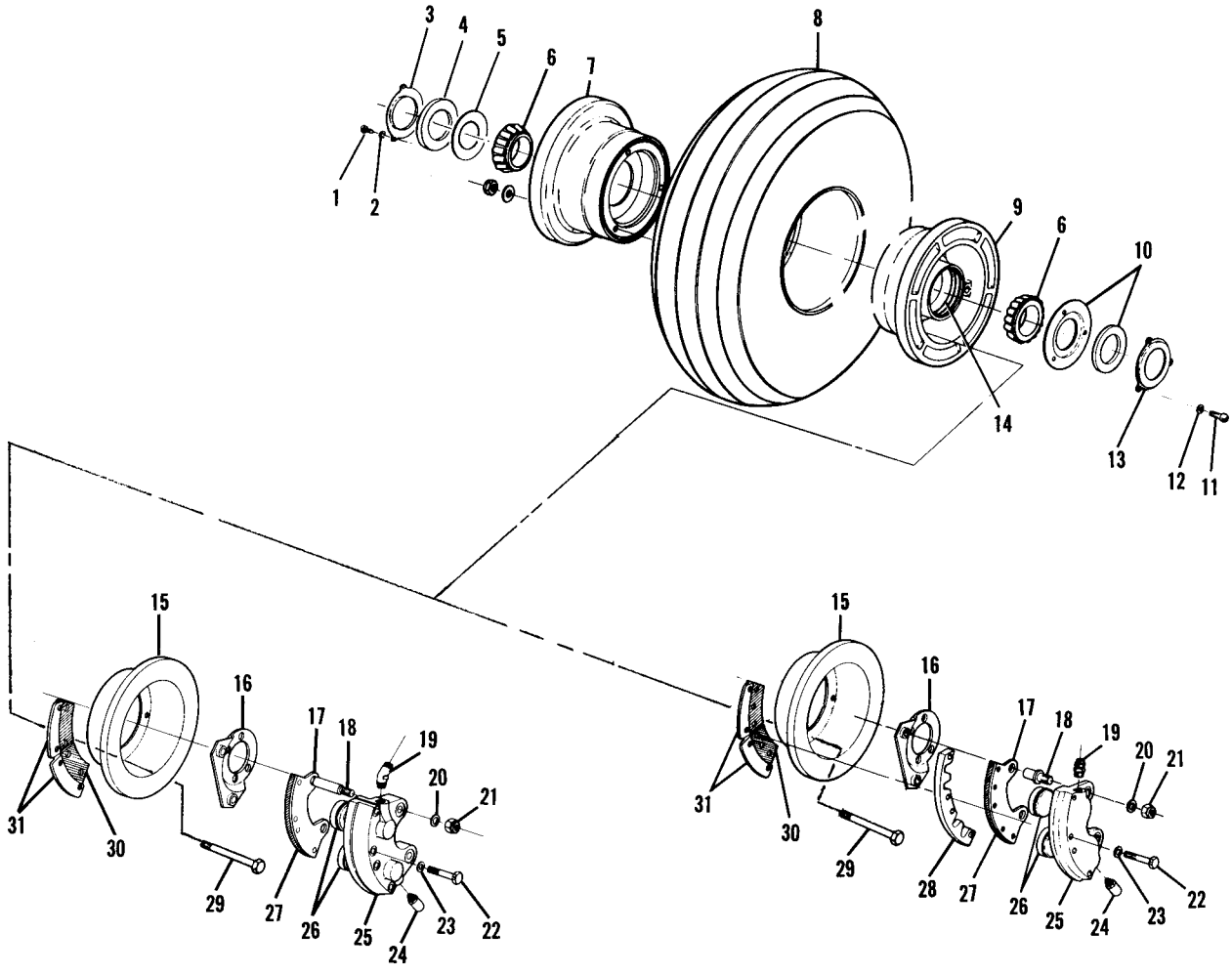


Figure 5B-9. Nose Wheel Steering System



1. Screw
2. Lockwasher
3. Grease Seal Ring
4. Felt Seal
5. Grease Seal Ring
6. Bearing Cone
7. Outer Wheel Half
8. Tire and Tube
9. Inner Wheel Half
10. Grease Seal Plate and Felt
11. Screw
12. Washer
13. Grease Seal Ring
14. Bearing Cup
15. Brake Disc
16. Torque Plate
17. Pressure Plate
18. Anchor Bolt
19. Hydraulic Fitting
20. Washer
21. Nut
22. Bolt
23. Washer
24. Bleeder Cap
25. Brake Cylinder
26. Piston
27. Brake Lining
28. Shim
29. Bolt
30. Brake Lining
31. Back Plate

Figure 5B-10. Cleveland Wheel and Brake

SECTION 5C

HYDRAULICS AND LANDING GEAR

THIS SECTION IS APPLICABLE TO MODEL 210E AND ON, AND MODEL 210D EQUIPPED WITH ALTERNATE HYDRAULIC COMPONENTS.

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NOTE

Interchangeable, alternate components may be installed in the hydraulic system. Beginning with the Model 210B, alternate main and nose gear actuators, door actuators and locking cylinders may be used. Beginning with the Model 210D, an alternate Power Pack may be used.

When replacing a nose gear actuator, door actuator, or locking cylinder, the alternate component is completely interchangeable.

When replacing a main gear actuator, it is first necessary to establish whether the existing actuator is a standard or alternate actuator. Check the Part No. appearing on the actuator. Part No. 1280501-1 or -2 is a standard actuator; Part No. 1280511-3 or -4 is an alternate actuator. The main gear actuators must be used in pairs; that is, either right and left standard actuators or right and left alternate actuators must be used together. When replacing standard main gear actuators with the alternate ones, a reducer, an O-ring gasket, and a different gear-up line must be used at the forward end of each main gear actuator.

When replacing the Power Pack, it is first necessary to establish whether the existing Power Pack is a standard or alternate Power Pack. An easy way to determine this is to check the top of the reservoir. The standard Power Pack is equipped with a three-pronged crowfoot which secures the reservoir, and the alternate Power Pack is equipped with a reservoir cover secured by a cap nut. When replacing a standard Power Pack with the alternate one, several other changes are required. A new emergency hand pump handle guard, a new pedestal decorative cover, a new support plate at the upper aft side of the pedestal, and six new hydraulic lines at the Power Pack must be used with the alternate Power Pack. The new lines are the gear-up, gear-down, door-open, and door-close lines routed from the Power Pack to the first line connections. A new filler line and a new suction line from the firewall to the Power Pack are also required.

It is sometimes necessary to open or close the landing gear doors while the airplane is on the ground with the engine stopped. Operate the doors with the landing gear handle in the "down" or "down-neutral" position. To open the doors, turn off the master switch and operate hand pump until the doors open. To close the doors, turn the master switch on and operate the hand pump.

NOTE

Position of the master switch for gear door operation is easily remembered by the following rule: OPEN circuit = OPEN doors; CLOSED circuit = CLOSED doors.

5C-1. LANDING GEAR RETRACTION SYSTEM.

5C-2. OPERATIONAL DESCRIPTION. The Model 210E Power Pack contains internal parts that are quite different from internal parts of the Model 210D Power Pack, resulting in a change in the method of accomplishing identical functions. Refer to the schematic diagrams to trace the flow of hydraulic fluid as outlined in the following steps.

a. Fluid from the hydraulic pump enters the Power Pack where a passage connects to the primary relief valve. With landing gear control lever in 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 the 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. After landing gear is in full up or full down position, limit switches are actuated to cause the door control valve to move to the door-close position, and fluid then 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 handle returns to neutral, it moves a shaft which again permits fluid to circulate back through the pump (unloaded).

NOTE

A secondary relief valve, which also serves as the emergency hand pump relief valve, opens at a higher pressure than the primary relief valve.

h. When extending the landing gear with the emergency hand pump, fluid flows directly to the door control valve and the gear priority valve, where it first opens the doors then extends the landing 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.

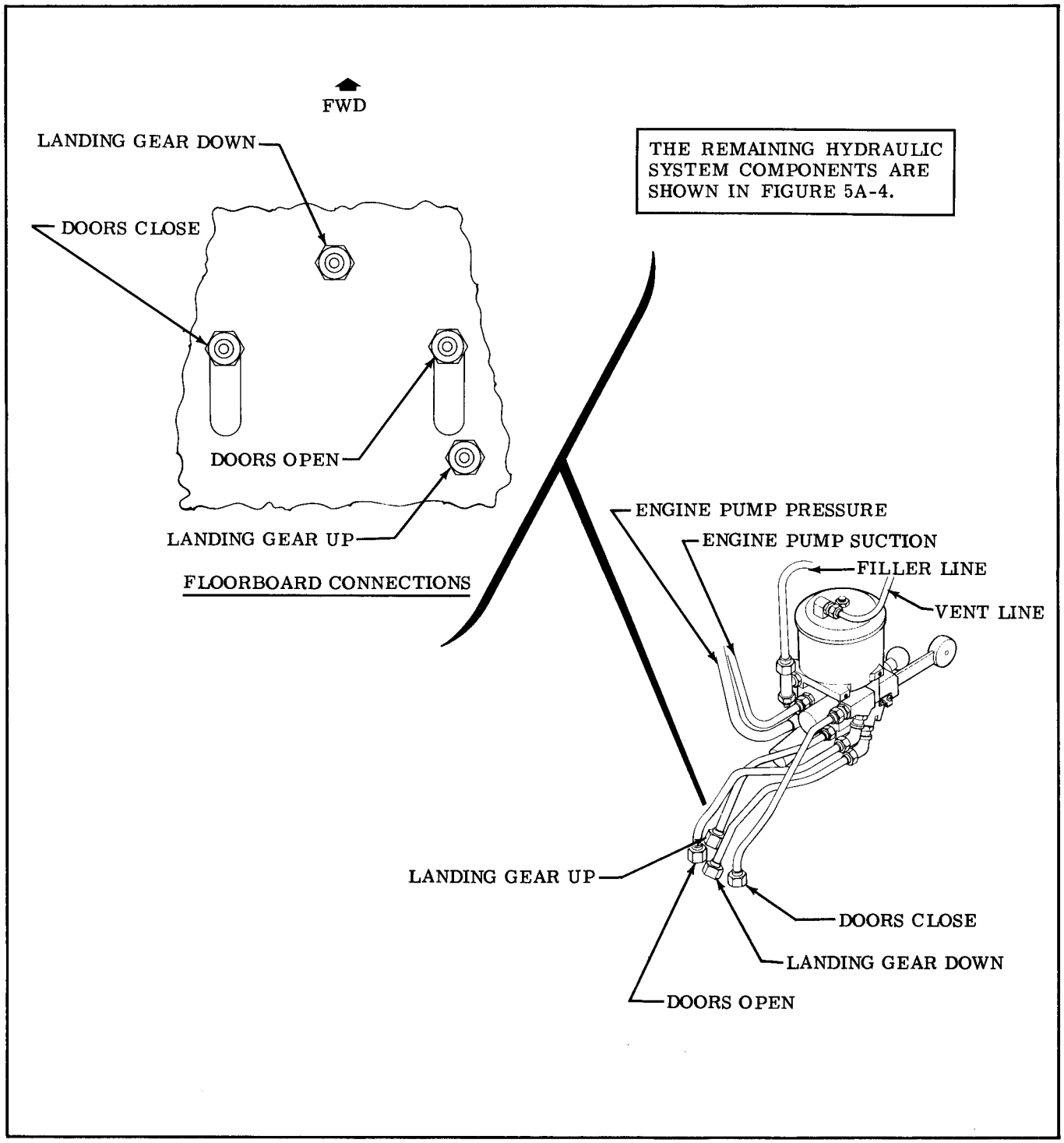


Figure 5C-1. Hydraulic Power System

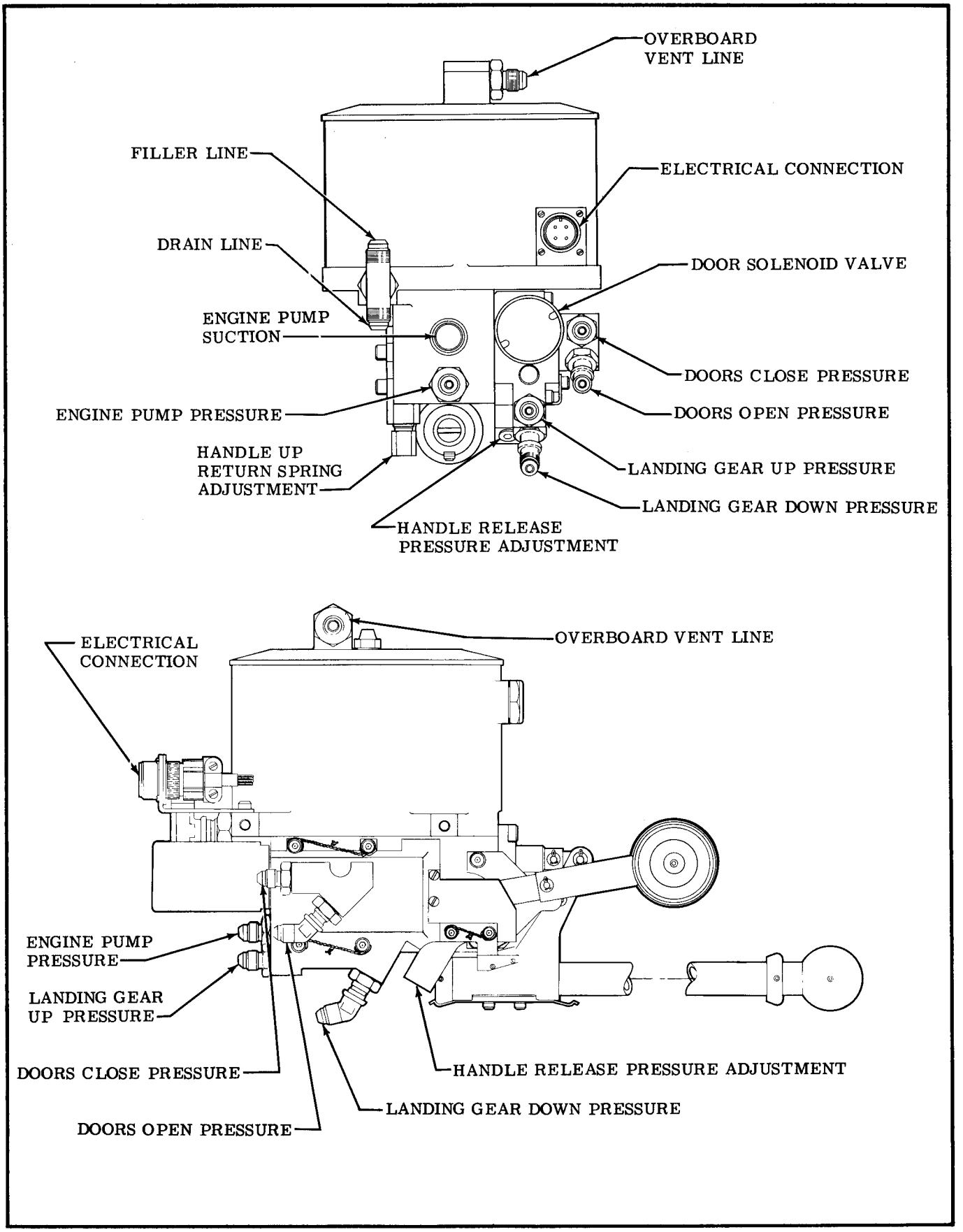


Figure 5C-2. Location of Power Pack Fittings

5A-3A. TROUBLE SHOOTING.

NOTE

Use the Hydro Test for trouble shooting landing gear malfunction. When the Hydro Test is employed to power the hydraulic system, landing gear operation can be slowed down to a "slow motion" during which hydraulic pressures can be noted precisely and mechanical action can be observed.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
ENGINE PUMP WILL NOT OPERATE GEAR BUT EMERGENCY HAND PUMP WILL OPERATE GEAR.		
Fluid level low in reservoir.	Check fluid level through sight-gage on reservoir.	Refill reservoir.
Engine pump or pump line failure.	Refer to paragraph 2-75.	Repair, replace pump or broken pump line. Refill reservoir.
Faulty primary relief valve.	Refer to paragraph 2-73.	Remove Power Pack, repair or replace primary relief valve.
ENGINE PUMP OR EMERGENCY PUMP WILL NOT BUILD PRESSURE IN SYSTEM.		
No fluid in reservoir.	Check fluid level.	Refill reservoir.
Broken gear or door line.	Check visually.	Repair or replace hydraulic line.
Door solenoid valve jammed or sticking at mid travel.	Switch master switch on and off to free jammed valve by solenoid hammering; if this fails to dislodge valve spool, remove Power Pack for repair of jammed valve.	Repair solenoid valve.
Faulty secondary relief valve.	Refer to paragraph 2-74.	Remove Power Pack, repair or replace secondary relief valve.
DOORS WILL NOT CLOSE, GEAR INDICATOR LIGHT NOT ILLUMINATED.		
Master switch not on.	Check visually.	Turn master switch on.
Defective limit switch circuit.	Check circuit breaker, then check circuit continuity to isolate open in circuit.	Repair defective component in circuit.
DOORS WILL NOT CLOSE, GEAR INDICATOR LIGHT ILLUMINATED.		
Defective handle up-down (pre-select) switch or wiring circuit.	Check circuit breaker, then check circuit continuity to isolate open circuit.	Repair or replace defective switch or wiring.
Defective door solenoid.	Place a steel scale against solenoid, checking for magnetic field. If magnetic field is not present solenoid is defective.	Replace solenoid.
Door solenoid valve stuck.	Place a steel scale against solenoid check for magnetic field. If magnetic field is present solenoid valve is stuck.	Remove Pack, repair or replace solenoid valve.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
GEAR OPERATES BUT DOORS WILL NOT OPEN.		
Solenoid valve jammed or stuck in door-closed position.	Turn master switch on and off to free jammed valve by solenoid hammering; if this fails to dislodge valve spool, Power Pack must be removed for repair of jammed valve.	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.	Check setting using the Hydro Test.	Adjust valve.
Priority valve leaking or stuck open.	Check valve using the Hydro Test.	Remove Power Pack and repair or replace valve.
LANDING GEAR HANDLE WILL NOT LOCK IN UP OR DOWN DETENT.		
Handle release valve plunger setting too low or incorrect return spring adjustment.	Check using the Hydro Test.	Adjust handle release valve and return springs. See paragraph 5C-18.
LANDING GEAR HANDLE RETURNS TO NEUTRAL BEFORE DOORS CLOSE.		
Fluid low in reservoir causing air in time-delay valve.	Check visually.	Fill reservoir and purge time-delay valve as outlined in paragraph 2-63.
Time-delay valve stuck or will not hold fluid charge due to faulty time-delay valve ball seat.	Bleed time-delay valve per paragraph 2-63. If not corrected ball seat is faulty or valve is stuck open.	Remove Power Pack and repair or replace time-delay valve.
LANDING GEAR HANDLE FAILS TO RETURN TO NEUTRAL AFTER DOORS CLOSE (3 TO 9 SECONDS).		
Landing gear handle release pressure too high.	Refer to paragraph 2-69.	Adjust handle release pressure.
Landing gear handle return springs setting too low.	Handle does not return to neutral sharply after handle has tripped.	Adjust return springs.
Landing gear handle shaft binding.	Move handle up and down feeling for binding or jerky movement.	Remove Power Pack, repair or replace handle shaft. Also see Appendix D.
Landing gear selector spool binding.	See preceding isolation procedure.	Remove Power Pack and replace manifold, selector spool and time-delay valve plunger as an assembly only.

NOTE

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.

PROBABLE CAUSE	ISOLATION PROCEDURE	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.	Repair or replace parts as needed.
Faulty system inlet check valve or hand pump inlet check valve.	If plunger assembly is not defective, either the system inlet check valve or the hand pump inlet check valve is defective.	Remove Power Pack and repair or replace check valves.
LANDING GEAR OPERATION EXTREMELY SLOW.		
Reservoir fluid level low.	Check fluid level through sight gage.	Refill reservoir.
Engine-driven pump failure or internal leakage.	Refer to paragraph 2-75.	Repair or replace engine pump.
Air leakage in engine pump suction line.	Refer to paragraph 2-75.	Repair or replace suction lines or fittings.
Fluid leak in door or gear line.	Check visually for spilled fluid.	Tighten or replace lines.
Defective piston seal in door or gear cylinder.	Refer to paragraph 2-76.	Repair or replace defective parts.
Excessive internal Power Pack leakage.	Refer to paragraph 2-76.	Remove and repair or replace Power Pack.
POWER PACK EXTERNAL LEAKAGE.		
SLIDING SEALS. (Seals having a moving part.)		
Handle release plunger.	Check visually.	Remove release plunger and replace O-rings.
Hand pump plunger gland.	Check visually.	Remove hand pump plunger and replace O-rings.
Landing gear selector spool.	Check visually.	Remove Power Pack and replace O-ring on spool and in manifold.
Priority valve.	Check visually.	Remove Power Pack and replace priority valve seals.

SHOP NOTES:

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
POWER PACK EXTERNAL LEAKAGE (Cont).		
STATIC SEALS. (Seals with no moving parts.)		
All fittings.	Check visually.	Remove and replace O-rings and back-up rings as required.
Hand pump gland.	Check visually.	Remove hand pump and replace O-rings.
Door solenoid.	Check visually.	Replace O-ring.
Transfer tubes between manifold and body.	Check visually.	Remove Power Pack, disassemble and replace O-rings.
Time-delay valve.	Check manually.	Remove Power Pack, disassemble and replace O-rings.
Reservoir cover.	Check visually.	Remove Power Pack and remove cover. Replace seals.
POWER PACK LOSES FLUID WITH NO EVIDENCE OF LEAKAGE.		
Air leak at engine pump shaft seal.	Refer to paragraph 2-75.	Repair or replace engine pump.
Air leak in suction line to engine pump.	Refer to paragraph 2-75.	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.	

HYDRAULIC SYSTEM PRESSURES

COMPONENT	OPENING PRESSURE	RESEATING PRESSURE
Handle Release Valve.	750 to 1250 psi.	-------
Priority Valve.	750 to 800 psi.	-------
Primary Relief Valve.	1800 psi. (Max.)	1450 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.)

5C-4. HYDRAULIC POWER SYSTEM COMPONENTS

5C-5. The hydraulic power system includes equipment required to provide a flow of pressurized hydraulic fluid to retractable landing gear system. Main components of the system are listed in the following chart.

ITEM	PURPOSE	LOCATION AND ACCESS
Engine-driven hydraulic pump.	To provide a flow of pressurized hydraulic fluid to the system.	Right rear accessory pad of engine. Remove upper cowling.
Hydraulic filter.	To filter fluid from the pump before entering remainder of system.	Upper right side of firewall in engine compartment. Remove the 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.	At top of pedestal. Partially accessible for adjustment with the decorative cover and pedestal front panels removed.
Emergency hand pump.	(4) To provide emergency hydraulic pressure through use of hand pump in the unit.	

5C-6. ENGINE-DRIVEN HYDRAULIC PUMP. Refer to paragraph 5A-9 deleting all references to the wing flap system.

5C-7. REMOVAL AND INSTALLATION. Refer to paragraph 5-8 for removal and installation of the hydraulic pump.

5C-8. DISASSEMBLY AND REPAIR. Refer to Appendix D for disassembly and repair of the hydraulic pump.

5C-9. HYDRAULIC FILTER. Refer to paragraph 5A-13 for description of hydraulic filter.

5C-10. REMOVAL AND CLEANING. Refer to paragraph 5A-14 for removal and cleaning of the hydraulic filter.

5C-11. POWER PACK.

5C-14. The hydraulic Power Pack is a multi-purpose control unit in the hydraulic system. It contains a hydraulic reservoir, valves which control flow of pressurized fluid to various actuators in the door and landing gear system, and an electrical switch connected to gear warning horn and indicator lights. An emergency hand pump uses reservoir fluid to permit extension of the landing gear if hydraulic pressure should fail.

5C-13. REMOVAL. Refer to paragraph 5A-17 for removal of the Power Pack.

5C-14. DISASSEMBLY AND REPAIR. Refer to Appendix D for disassembly and repair of the Power Pack.

5C-15. INSTALLATION. Refer to paragraph 5A-19 for installation of the Power Pack.

5C-16. PRIMARY AND SECONDARY RELIEF VALVE ADJUSTMENT. If the primary or secondary 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 Appendix D.

5C-17. PRIORITY VALVE ADJUSTMENT. The priority valve may be adjusted while the Power Pack is installed in the airplane.

a. Jack airplane and connect Hydro Test in accordance with paragraph 2-72.
b. Check priority valve setting in accordance with paragraph 2-71.
c. If adjustment is required, turn priority valve adjusting screw (see figure 5C-4) in to increase pressure at which priority 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 the Hydro Test gage.
d. Cycle the landing gear to check for proper operation, then lower the gear.
e. Fill reservoir and disconnect Hydro Test in accordance with paragraph 2-61.
f. Remove airplane from jacks.

5C-18. HANDLE-RELEASE ADJUSTMENT. (See figure 5C-3.) Correct adjustment of the landing 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 in the gear handle, and a handle return spring then pushes the handle back to neutral. 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:

a. Jack airplane and connect Hydro Test.

b. Remove pedestal decorative cover to gain access to adjusting plugs at bottom of Power Pack.

c. If Power Pack is being installed or if reservoir fluid level has been low, fill reservoir and bleed time-delay valve in accordance with paragraph 2-63.

d. Using Hydro Test, 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. Check that the handle can be moved manually into the detent positions. If it cannot, loosen handle-return spring adjusting plugs (2 and 3) until the handle will engage the detents. 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.

e. Using the Hydro Test, check the pressure at which the handle-release plunger disengages the detents, and readjust handle-release detent spring adjusting plug (1) as necessary to obtain a release pressure of approximately 1000 psi. Tolerance is 750psi to 1250 psi. Use a very slow flow, and be

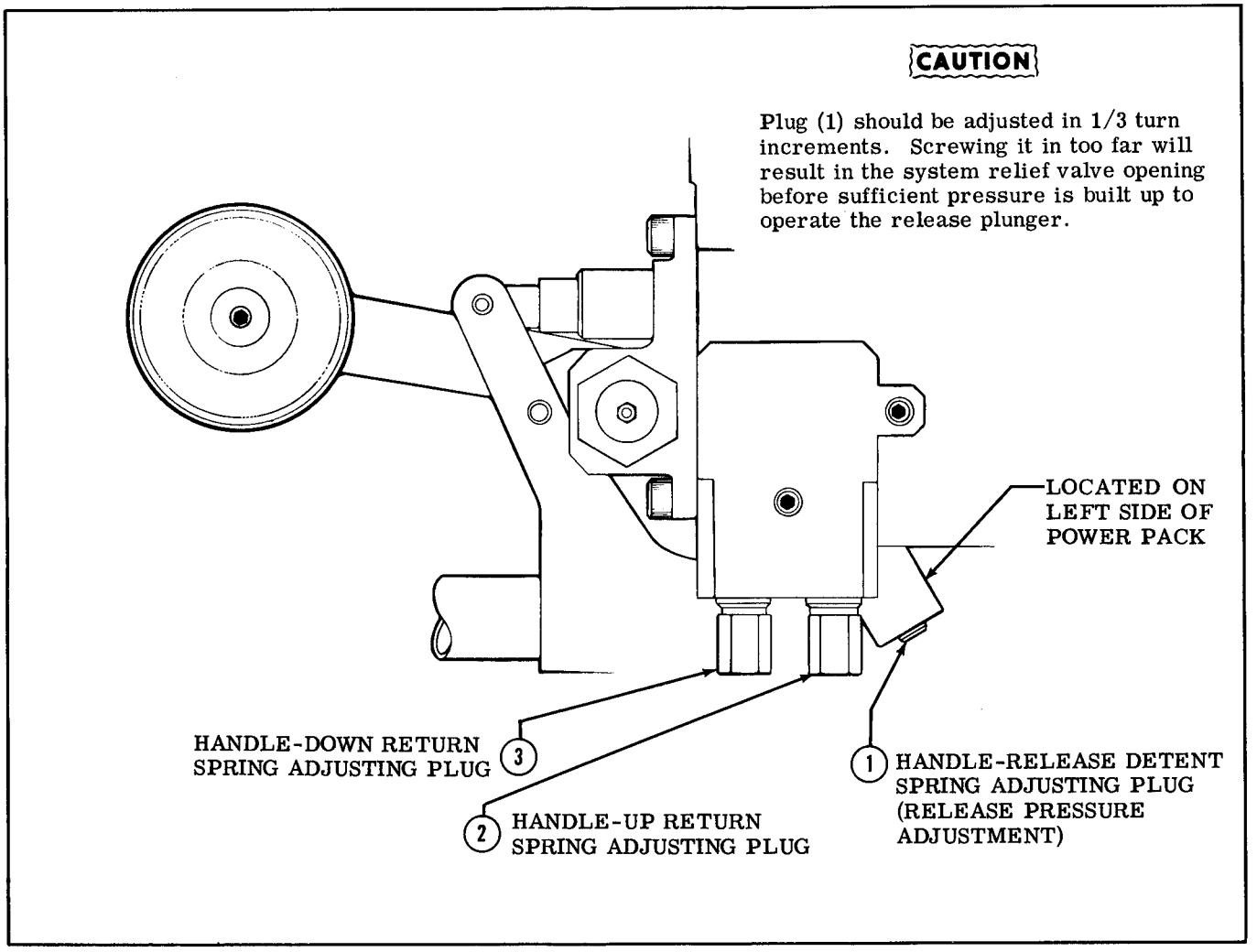


Figure 5C-3. Handle Release Adjustment

sure time is allowed for time-delay valve to open. Cycle the landing gear between each adjustment.

f. Readjust handle-return spring adjusting plugs (2 and 3) until handle trips back from up and down positions with a positive snap. Again, cycle the landing gear between each adjustment.

g. Recheck the handle-release pressure specified in step "e."

h. Operate landing gear through several cycles, lower the landing gear, and remove airplane from jacks.

i. Disconnect Hydro Test and install decorative cover on pedestal.

5C-19. EMERGENCY HAND PUMP. The emergency hand pump may be repaired while in the airplane. Refer to Appendix D for disassembly and repair.

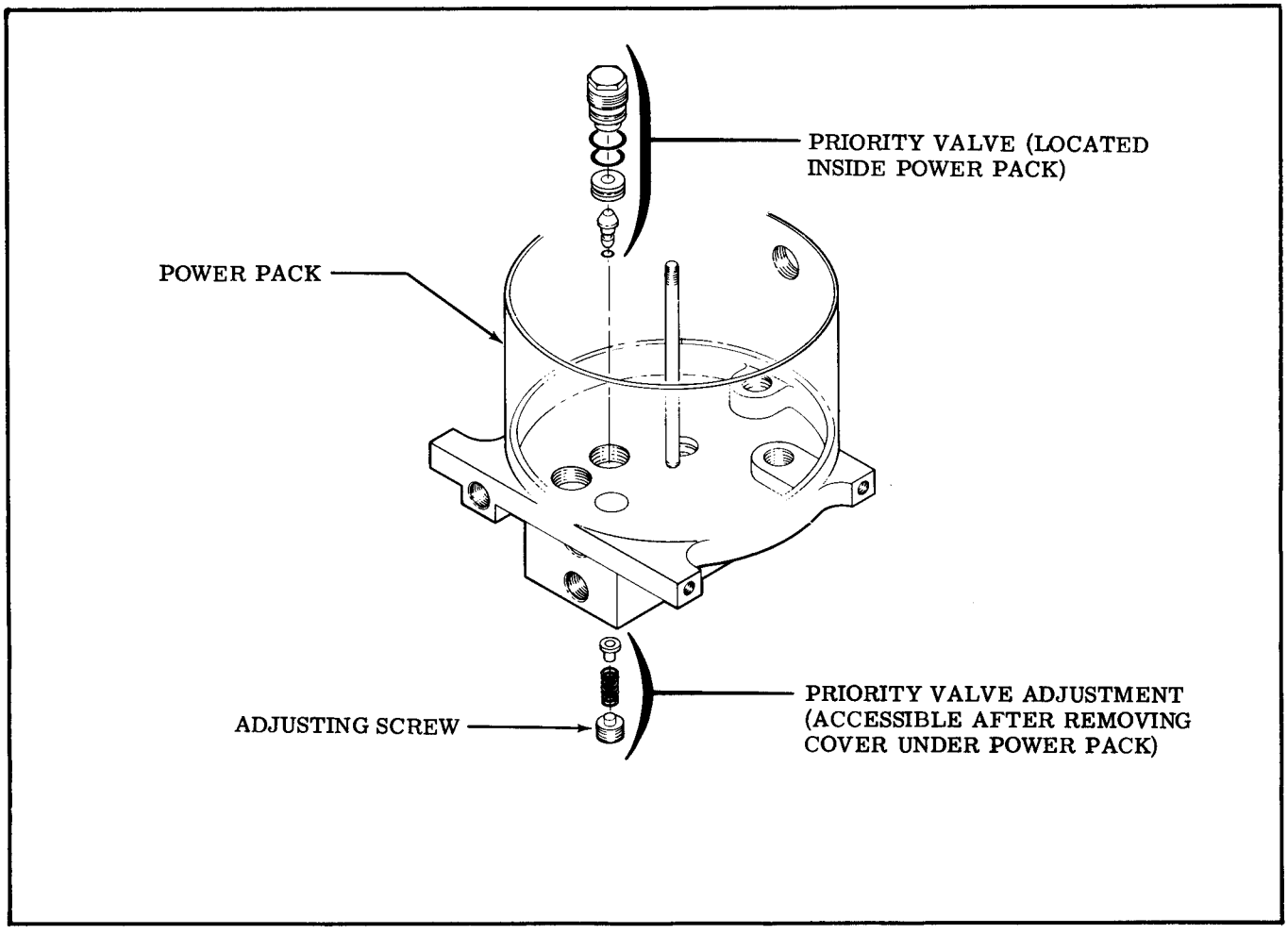


Figure 5C-4. Priority Valve Adjustment

SHOP NOTES:

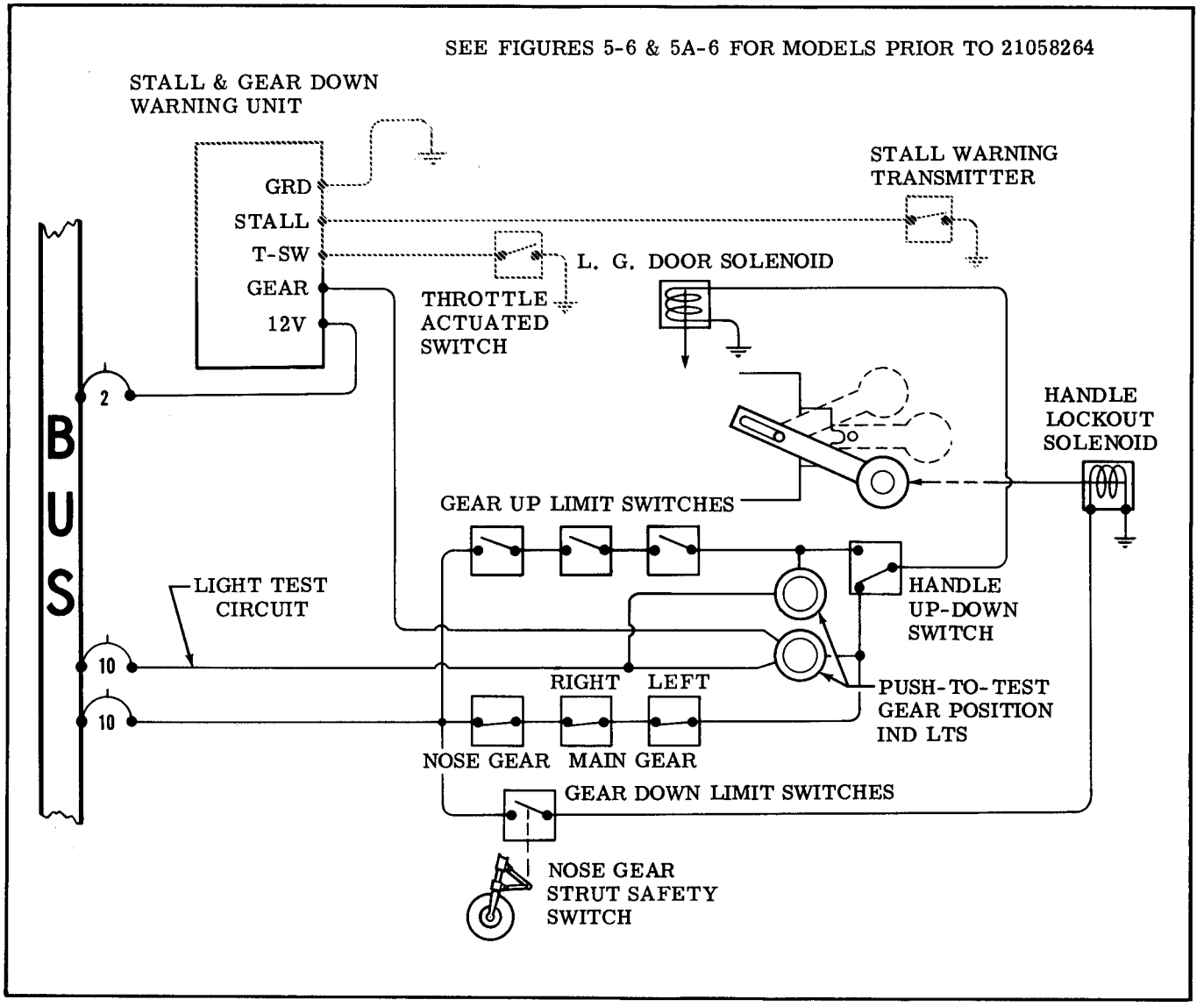


Figure 5C-5. Simplified Schematic of Landing Gear Circuit

SHOP NOTES:

5C-20. LANDING GEAR ELECTRICAL CIRCUITS.

5C-21. Landing gear electrical circuits are shown in figure 5C-5, which shows the switches in the gear down and locked, weight-on-gear condition. The following chart describes what each electrical component in the circuit does, and what causes it to operate.

ITEM	OPERATED BY	FUNCTION
Up indicator switches.	Gear in up and locked position.	Closes circuit to gear up indicator light, handle up-down switch, and door solenoid valve.
Down indicator switches.	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.

NOTE

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.

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.

CAUTION

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.

5C-22. ADJUSTMENT OF SWITCHES. 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 5A-96. Adjustment of the throttle actuated switch is contained in paragraph 12-57A.

5C-23. HYDRAULIC TOOLS AND EQUIPMENT.

5C-24. HYDRO TEST UNIT. Refer to paragraph 5-35.

5C-25. BLEEDING AND LEAK-TESTING.

NOTE

Refer to paragraph 2-41 for Hydro Test operation.

5C-26. BLEEDING OF THE HYDRAULIC SYSTEM. Bleeding may be accomplished by jacking the airplane and using the Hydro Test to cycle the landing gear and door systems through several complete cycles. Refer to paragraph 2-63 for bleeding of time-delay valve inside the Power Pack. Use only clean, filtered hydraulic fluid (MIL-H-5606) in the hydraulic system. Hydraulic fluid preservative (MIL-H-6083) may be used for flushing and storage of hydraulic components.

NOTE

There is only one reason to have to bleed the hydraulic system, the entrance of considerable air into the hydraulic system. The most probable means for air getting into the system are: permitting reservoir fluid level to become low, air leaks in the engine-driven pump or pump suction line, and poor maintenance procedures when connecting lines and installing actuators, etc.

5C-27. BLEEDING OF THE EMERGENCY HAND PUMP may be accomplished by operating the hand pump until all air has been expelled from the pump. This will usually require approximately 15 complete cycles of the hand pump.

5C-28. LEAK-TESTING. When testing a system for leakage, the Power Pack must be bypassed. Connect Hydro Test into applicable system to be tested, apply a pressure of 2200 psi, and hold for 5 minutes. Refer to paragraph 2-66 for Hydro Test operation during leak-testing. When checking an actuating cylinder for internal leakage, connect the Hydro Test to one port of unit and leave other port open.

CAUTION

When leak-testing any actuator, with pressure applied 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 area across the piston. (The rod side of the piston has less area than the head side. Thus, pressure applied to the head side of the piston may apply a far greater pressure to fluid on the rod side of the piston.)

The total of line assemblies, fittings, actuators, and any other part subject to hydrostatic (dead end) pressure shall be deemed faulty due to overstressing if hydraulic pressure in that immediate sub-system is allowed to exceed 2275 psi for any period of time.

5C-29. CHECKING HYDRAULIC FLUID CONTAMINATION. Refer to paragraph 5-39 for hydraulic fluid contamination check.

5C-30. MAIN LANDING GEAR.

5C-31. Refer to paragraph 5A-38 for description of main landing gear.

5C-32. REMOVAL OF MAIN WHEELS. Refer to paragraph 5B-7 for removal of main wheels.

5C-33. DISASSEMBLY. Refer to paragraph 5B-8 for disassembly of main wheels.

5C-34. INSPECTION AND REPAIR. Refer to paragraph 5B-9 for inspection and repair of the main wheels.

5C-35. ASSEMBLY OF MAIN WHEELS. Refer to paragraph 5B-10 for assembly of the main wheel.

5C-36. INSTALLATION OF MAIN WHEELS. Refer to paragraph 5B-11 for installation of the main wheels.

5C-37. REMOVAL AND INSTALLATION OF MAIN WHEEL AND AXLE. Refer to paragraphs 5-47 and 5-48 for removal and installation of the main wheel and axle.

5C-38. REMOVAL OF MAIN GEAR STRUT AND WHEEL. Refer to paragraph 5A-46 for removal of main gear strut and wheel.

5C-39. INSTALLATION OF MAIN GEAR STRUT AND WHEEL. Refer to paragraph 5A-47 for installation of main gear strut and wheel.

5C-40. REMOVAL OF MAIN GEAR ACTUATOR AND SADDLE. Refer to paragraph 5A-48 for removal of main gear actuator and saddle.

5C-41. SADDLE BEARING REPAIR. Refer to paragraph 5-51 for repair of a saddle bearing.

5C-42. REAMING A NEW SADDLE. Refer to paragraph 5-52 when reaming a new saddle for installation.

5C-43. DISASSEMBLY AND REPAIR OF MAIN GEAR ACTUATOR. Refer to Appendix D for disassembly and repair of the main gear actuator.

5C-44. INSTALLATION OF MAIN GEAR ACTUATOR AND SADDLE. Refer to paragraph 5A-51 for installation of the main gear actuator and saddle.

5C-45. MAIN GEAR SNUBBER. An adjustable metering pin is installed in each main landing gear actuator cylinder. This metering pin causes a snubbing action in the actuator the final .5 to 1.0 second up travel of the main landing gear.

5C-46. ADJUSTMENT OF MAIN GEAR SNUBBER. With the landing gear rigged and the limit switches adjusted as outlined in paragraphs 5A-98 through

5A-110, adjust main actuator snubbers so that snubbing action occurs during the final .5 to 1.0 second of main gear up travel. This may be done as follows:

a. With airplane on jacks and Hydro Test connected, retract landing gear and see that both main gears lock at the same time in the up position.

b. If the main gears are not locking at the same time, but both main gears are snubbing, adjust the slower gear as follows:

1. Loosen door line and locknut at end of actuator.

2. Adjust metering pin in (clockwise facing cylinder head end of actuator) until main gears lock simultaneously in the up position. Cycle landing gear after each adjustment.

NOTE

When adjusting metering pin, wait a minimum of 30 seconds between each up or down cycle of the landing gear. This allows time for the time-delay valve cavity to refill.

c. If one main gear is not snubbing, adjust the faster main gear as follows:

1. Loosen door line and locknut at end of actuator.

2. Adjust metering pin out (counterclockwise facing cylinder head end of actuator) until main gears lock simultaneously in the up position. Cycle landing gear after each adjustment.

CAUTION

When adjusting metering pin out, use care to prevent damage to the snap ring on the metering pin. Adjust out only until snap ring bottoms against actuator cylinder head. DO NOT FORCE. Approximately two threads will be showing through locknut with snap ring against cylinder head of actuator.

NOTE

If there is not enough snubbing action with snap ring against actuator cylinder head, it is permissible to loosen lock screw in actuator cylinder head and back cylinder head out one complete turn or .062 inch maximum out from flush with end of actuator. Retighten lock screw in end of actuator.

d. After adjustments are completed, tighten locknut and door line on actuators and resafety metering pin locknut.

NOTE

Snubbing time is determined by observing the Hydro Test pressure gage. A sudden increase in pressure during the gear up cycle indicates the start of the snubbing action and a sudden decrease indicates that the gear is up and locked.

5C-47. REMOVAL AND INSTALLATION OF MAIN GEAR UPLOCK MECHANISM. Refer to paragraph 5A-52 for removal and installation of the main gear uplock mechanism.

5C-48. DISASSEMBLY AND REPAIR OF MAIN GEAR UPLOCK CYLINDER. Refer to Appendix D for disassembly and repair of the main landing gear uplock cylinder.

5C-49. MAIN GEAR DOWNLOCKS AND DOWNLOCK RELEASE CYLINDERS. One cylinder releases both the right and left inboard downlock and is operated by pressure in the gear up lines. The outboard downlocks are released by a cylinder on each side and the cylinder is operated by pressure in the gear up lines.

5C-50. REMOVAL AND INSTALLATION OF MAIN GEAR DOWNLOCK RELEASE CYLINDERS. Refer to paragraph 5A-55 for removal and installation of main gear downlock release cylinders.

5C-51. DISASSEMBLY AND REPAIR OF DOWNLOCK RELEASE CYLINDERS. Refer to Appendix D for disassembly and repair of the main gear downlock release cylinders.

5C-52. MAIN GEAR RIGGING. Refer to paragraph 5-107 for rigging and adjustments to main landing gear.

5C-53. MAIN WHEEL ALIGNMENT. Refer to paragraph 5-59 for alignment of main wheels.

5C-54. MAIN GEAR DOOR SYSTEM. Refer to paragraph 5A-60 for description of main gear doors.

5C-55. REMOVAL AND INSTALLATION OF MAIN WHEEL DOORS. Refer to paragraph 5A-61 for removal and installation of main wheel doors.

5C-56. REMOVAL AND INSTALLATION OF MAIN WHEEL DOOR ACTUATORS. Refer to paragraph 5A-62 for removal and installation of the main gear wheel door actuators.

5C-57. DISASSEMBLY AND REPAIR OF DOOR ACTUATOR. Refer to Appendix D for disassembly and repair of door actuating cylinders.

5C-58. REMOVAL AND INSTALLATION OF MAIN GEAR STRUT DOOR. Refer to paragraph 5A-64 for removal and installation of the main gear strut doors.

5C-59. REMOVAL AND INSTALLATION OF MAIN GEAR STRUT DOOR ACTUATOR. Refer to paragraph 5A-65 for removal and installation of main gear strut door actuator.

5C-60. DISASSEMBLY AND REPAIR OF MAIN GEAR STRUT DOOR ACTUATOR. Refer to Appendix D for disassembly and repair of the strut door actuator.

5C-61. RIGGING. Refer to paragraph 5A-102 for rigging and adjustments to the main wheel and gear strut doors.

5C-62. NOSE GEAR.

5C-63. The nose gear shock strut is pivoted just forward of the firewall. Retraction and extension of the nose gear is accomplished by a double-acting hydraulic cylinder, the forward end of which contains the nose gear downlock. Initial action of the cylinder disengages the downlock before retraction begins. A separate single-acting hydraulic cylinder unlocks the nose gear uplock hook.

5C-64. REMOVAL AND INSTALLATION OF NOSE WHEEL. Refer to paragraph 5B-17 for removal and 5B-21 for installation of the nose gear.

5C-65. DISASSEMBLY OF NOSE WHEEL. Refer to paragraph 5B-18 for disassembly of the nose wheel.

5C-66. INSPECTION AND REPAIR OF NOSE WHEEL. Instructions given in paragraph 5-44 for the main wheels may be used as a guide for inspection and repair of the nose wheel.

5C-67. ASSEMBLY OF NOSE WHEEL. Refer to paragraph 5B-19 for assembly of the nose wheel.

5C-68. BALANCING NOSE WHEEL. Refer to paragraph 5B-34 for nose wheel balancing.

5C-69. REMOVAL AND INSTALLATION OF NOSE GEAR ASSEMBLY. Figure 5A-10 may be used as a guide for removal and installation of the nose gear strut assembly.

5C-70. DISASSEMBLY OF NOSE GEAR STRUT. The following procedure applies to the nose gear shock strut after it has been removed from the airplane, and the nose wheel has been removed. In many cases, separating the upper and lower struts will permit inspection and parts replacement without removal or complete strut disassembly.

a. Remove torque links. Note position of washers, shims, spacers, and bushings.

WARNING

Deflate strut completely before removing bolt (33), lock ring (31), or bolt (2).

b. Remove shimmy dampener.

c. Disconnect link (18) from steering shaft (17) and collar (21).

d. Remove steering shaft (17) by driving out roll pins (13) and removing steering arm (14).

e. Remove lock ring (31) from the groove inside of lower end of upper strut (10). A small hole is provided at the lock ring groove to facilitate removal.

NOTE

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

f. Using a straight, sharp pull, remove lower strut from upper strut. Invert lower strut and drain hydraulic fluid.

g. Remove lock ring (24), bearing (25), and extend stop (26) from lower strut (27).

h. Slide packing support ring (28), scraper ring (29), retaining ring (30), and lock ring (31) from lower strut. Note relative position and top side of each ring and bearing to aid reassembly.

i. Remove and discard O-rings and back-up rings from packing support ring (28).

j. Remove metering pin (38) and base plug (36) by removing bolt (33) from lower strut and fork. Lower strut (27) and fork (34) are press fitted; do not disassemble.

k. Remove and discard metering pin O-ring (35) and base plug O-ring (37) from base plug.

l. Remove orifice support (7) by removing bolt (2). Remove and discard O-ring (6) from orifice support.

m. Remove snap ring (23) from lower end of upper strut (10) and remove washer (20), shims (22), if installed and steering collar (21).

n. Bushings and bearings in upper trunnion (3) and lower trunnion (8) may be replaced as required. Needle bearing in steering collar (21) should not be replaced; replace the steering collar if needle bearing is defective.

NOTE

Upper and lower trunnions (3 and 8) are press-fitted to the upper strut (10), with braces (1) installed during assembly. Pin (12) is also press-fitted to the lower trunnion.

5C-71. ASSEMBLY OF NOSE GEAR STRUT.

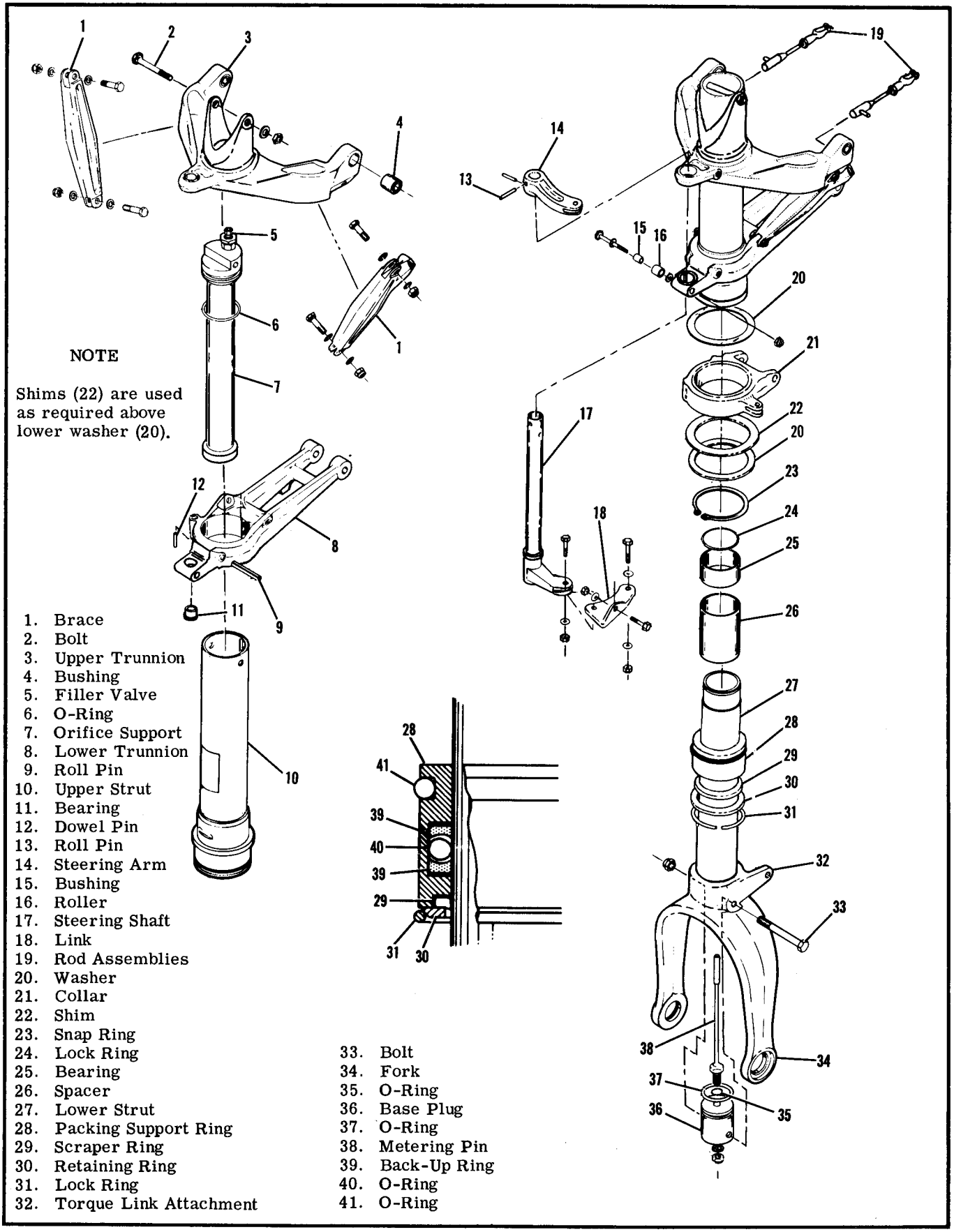
a. Thoroughly clean all parts in solvent and examine them carefully. Replace all worn or defective parts, and all rubber or plastic seals and O-rings with new parts.

b. Assemble the strut by reversing the order of the procedure outlined in paragraph 5C-70 with the exception that special attention must be paid to the following procedures.

c. Replace back-up rings in packing support ring with the contoured rubber back-up rings, one on each side of O-ring (40).

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.



NOTE

Shims (22) are used as required above lower washer (20).

1. Brace
2. Bolt
3. Upper Trunnion
4. Bushing
5. Filler Valve
6. O-Ring
7. Orifice Support
8. Lower Trunnion
9. Roll Pin
10. Upper Strut
11. Bearing
12. Dowel Pin
13. Roll Pin
14. Steering Arm
15. Bushing
16. Roller
17. Steering Shaft
18. Link
19. Rod Assemblies
20. Washer
21. Collar
22. Shim
23. Snap Ring
24. Lock Ring
25. Bearing
26. Spacer
27. Lower Strut
28. Packing Support Ring
29. Scraper Ring
30. Retaining Ring
31. Lock Ring
32. Torque Link Attachment
33. Bolt
34. Fork
35. O-Ring
36. Base Plug
37. O-Ring
38. Metering Pin
39. Back-Up Ring
40. O-Ring
41. O-Ring

Figure 5C-6. Nose Gear Shock Strut

d. 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.

e. When installing bearing (25) at top of the lower strut, be sure that beveled edge of bearing is up next to lock ring (24). This applies to all nose gears using this type of bearing and lock ring.

f. Sharp metal edges should be smoothed with No. 400 emery paper, then thoroughly cleaned.

g. Lubricate needle bearings with MIL-G-7711 grease (or equivalent) before installing. Add shims as necessary to remove excessive clearance between collar (21) and lower washer (20).

h. Do not tighten shimmy dampener attach bolts to a torque value in excess of 10 pound-inches.

i. Tighten torque link center bolt snug then tighten to next castellation and install cotter pin.

j. Service shock strut with hydraulic fluid (MIL-H-5606) and compressed air and install strut in airplane.

NOTE

It is easier to service the shock strut just before installation, although it may be serviced after installation if desired. See Section 2 for strut servicing.

k. When assembling and attaching the nose gear actuator and downlock mechanism, lubricate and torque attaching bolt as shown in figure 2-7.

5C-72. TORQUE LINKS. Figure 5C-7 illustrates the torque links used on the Model 210E. The figure may be used as a guide for replacement of parts.

5C-73. REMOVAL AND INSTALLATION OF SHIMMY DAMPENER. Refer to paragraph 5B-36 for removal, disassembly, and installation of the shimmy dampener.

5C-74. REMOVAL OF NOSE GEAR ACTUATOR. Refer to paragraph 5-79 for removal of nose gear actuator.

5C-75. DISASSEMBLY AND REPAIR OF NOSE GEAR ACTUATOR. Refer to Appendix D for disassembly and repair of nose gear actuator.

5C-76. INSTALLATION OF NOSE GEAR ACTUATOR. Install nose gear actuator as outlined in paragraph 5-81.

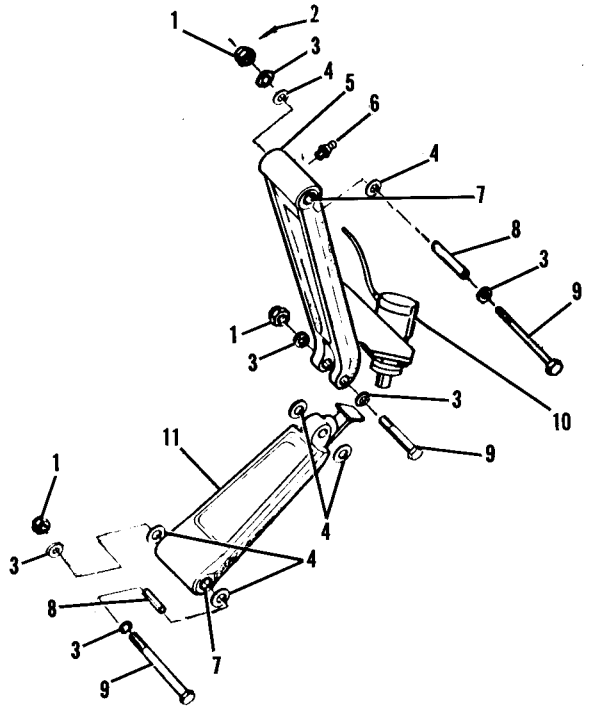
NOTE

When assembling and attaching the nose gear downlock mechanism to strut, lubricate and torque attaching bolt as shown in figure 2-7.

5C-77. REMOVAL AND INSTALLATION OF NOSE GEAR UPLOCK AND RELEASE ACTUATOR. Refer to paragraph 5A-84 for removal and installation of the nose gear uplock and release cylinder.

5C-78. DISASSEMBLY AND REPAIR OF UPLOCK RELEASE ACTUATOR. Refer to Appendix D for disassembly and repair of uplock release actuator.

5C-79. RIGGING. Refer to paragraph 5A-105 for nose gear rigging and adjustments.



NOTE

Shims (4) are available to use as required between torque link and nose gear fork to remove any looseness.

1. Nut
2. Cotter Pin
3. Washer
4. Shim
5. Upper Torque Link
6. Grease Fitting
7. Bushing
8. Spacer
9. Bolt
10. Squat Switch
11. Lower Torque Link

Figure 5C-7. Torque Links

5C-80. NOSE GEAR DOOR SYSTEM. Refer to paragraph 5A-87.

5C-81. REMOVAL AND INSTALLATION OF NOSE WHEEL DOORS. Refer to paragraph 5-86 for nose wheel door removal and installation.

5C-82. REMOVAL AND INSTALLATION OF NOSE WHEEL DOOR ACTUATOR. Refer to paragraph 5A-89 for removal and installation of the nose wheel door actuator.

5C-83. DISASSEMBLY AND REPAIR OF NOSE WHEEL DOOR ACTUATOR. Refer to Appendix D for disassembly and repair of the nose wheel door actuator.

5C-84. REMOVAL AND INSTALLATION OF NOSE GEAR STRUT DOORS. Refer to paragraph 5-89 for nose gear strut door removal and installation.

5C-85. RIGGING. Refer to paragraph 5A-105 for nose gear door rigging and adjustments.

5C-86. NOSE WHEEL STEERING SYSTEM. Refer to paragraph 5A-93 for the nose gear steering system.

5C-87. RIGGING. Since the nose wheel steering system is connected to the rudder control system, refer to Section 10 for rigging of the system.

5C-88. BRAKE SYSTEM. Refer to paragraph 5B-41 for the brake system.

5C-89. RIGGING OF MAIN LANDING GEAR. Refer to Section 5A, paragraphs 5A -98 through 5A-104, for rigging of the main landing gear.

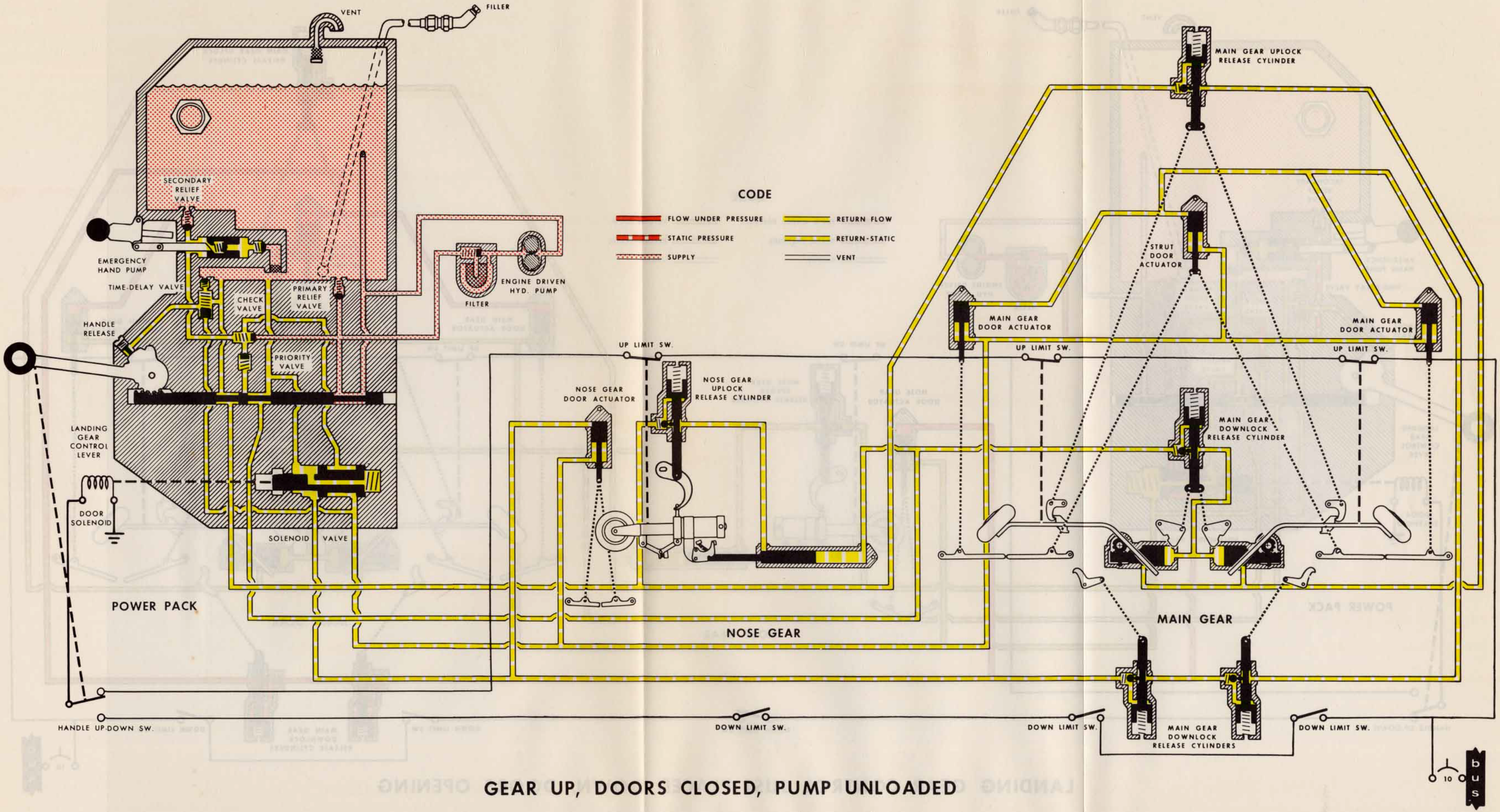
5C-90. RIGGING OF NOSE GEAR. Refer to Section 5A, paragraphs 5A-105 through 5A-110, for rigging of the nose gear.

SHOP NOTES:

HYDRAULIC SYSTEM SCHEMATICS

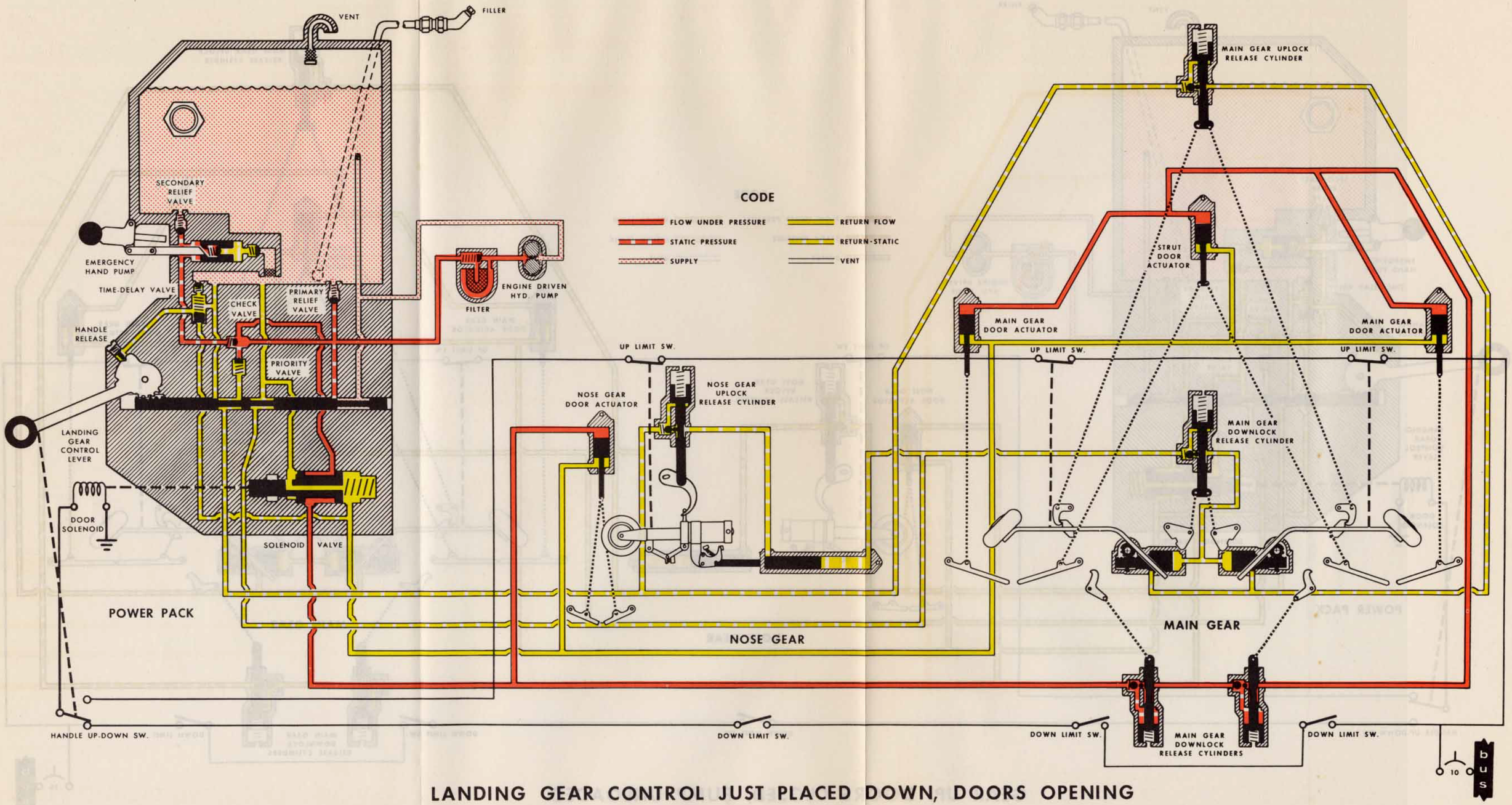
The next 10 fold-out pages contain color-coded schematic diagrams of the hydraulic system used on the Model 210E and on. They are also applicable to those Model 210D airplanes on which the 210E Power Pack is used as an alternate.

Sheet 1 shows the system "at rest" with the landing gear up. Sheets 2 thru 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.



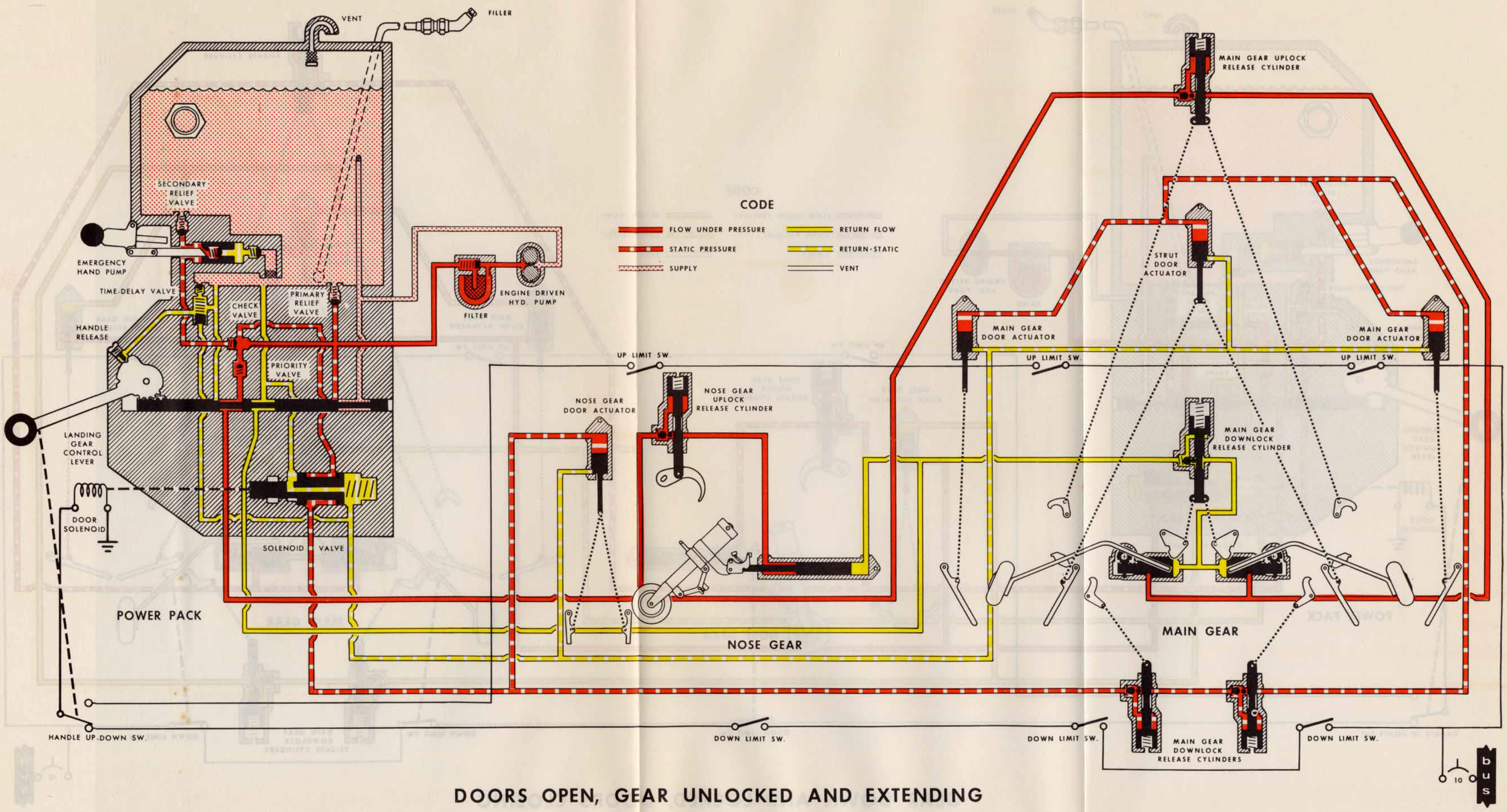
GEAR UP, DOORS CLOSED, PUMP UNLOADED

Figure 5C-8. Hydraulic System Schematic (Sheet 1 of 10)



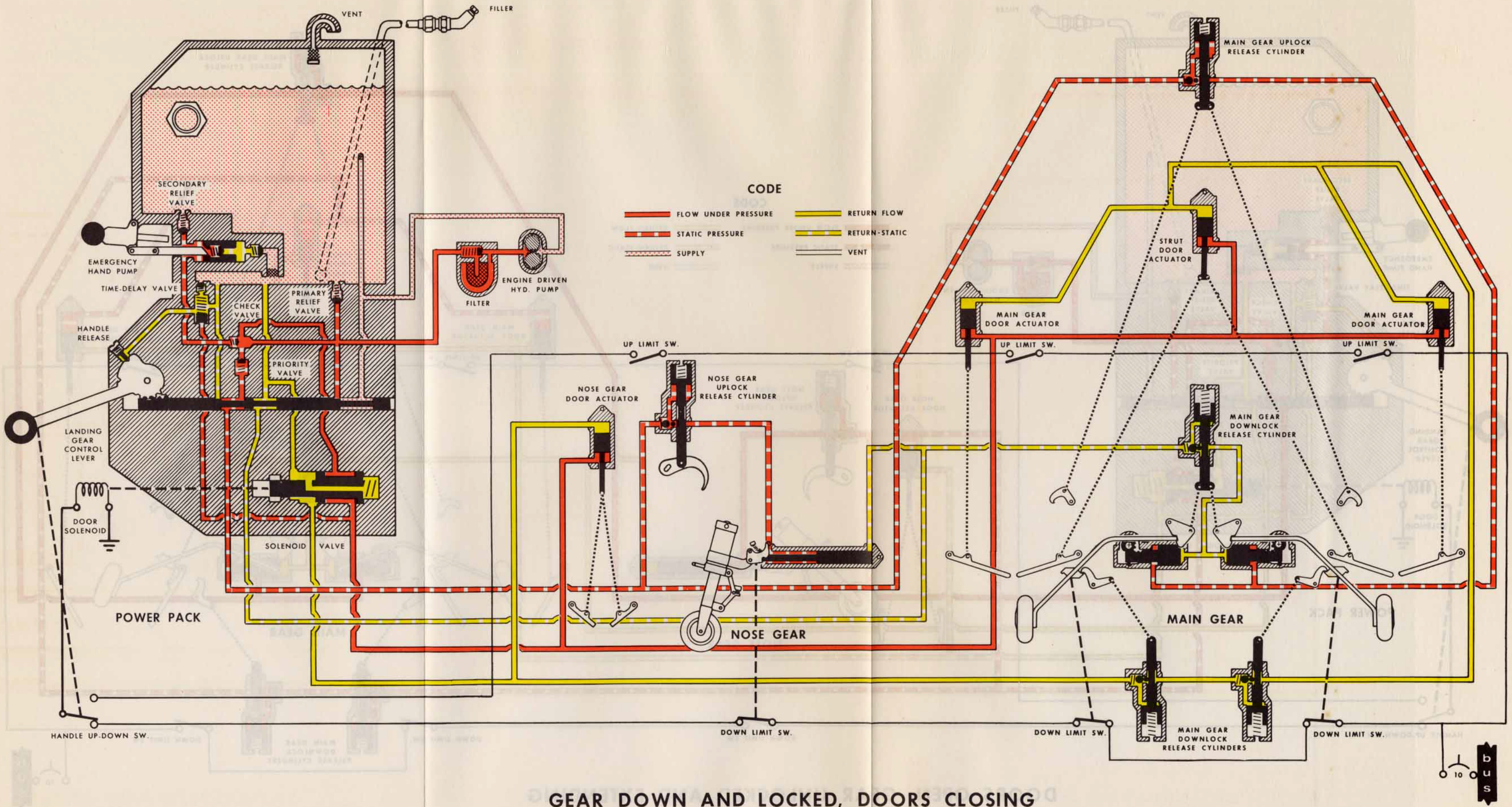
LANDING GEAR CONTROL JUST PLACED DOWN, DOORS OPENING

Figure 5C-8. Hydraulic System Schematic (Sheet 2 of 10)



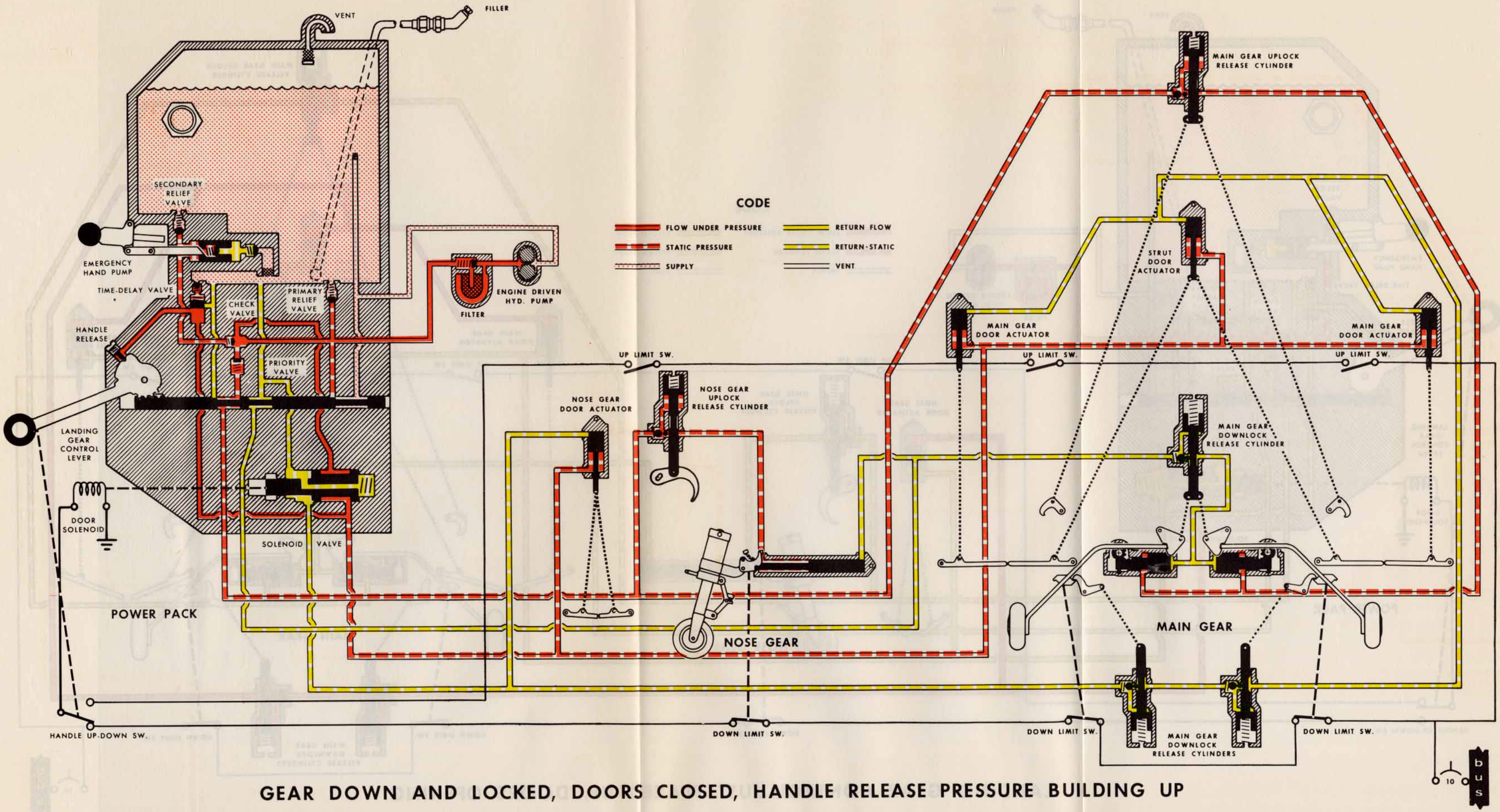
DOORS OPEN, GEAR UNLOCKED AND EXTENDING

Figure 5C-8. Hydraulic System Schematic (Sheet 3 of 10)



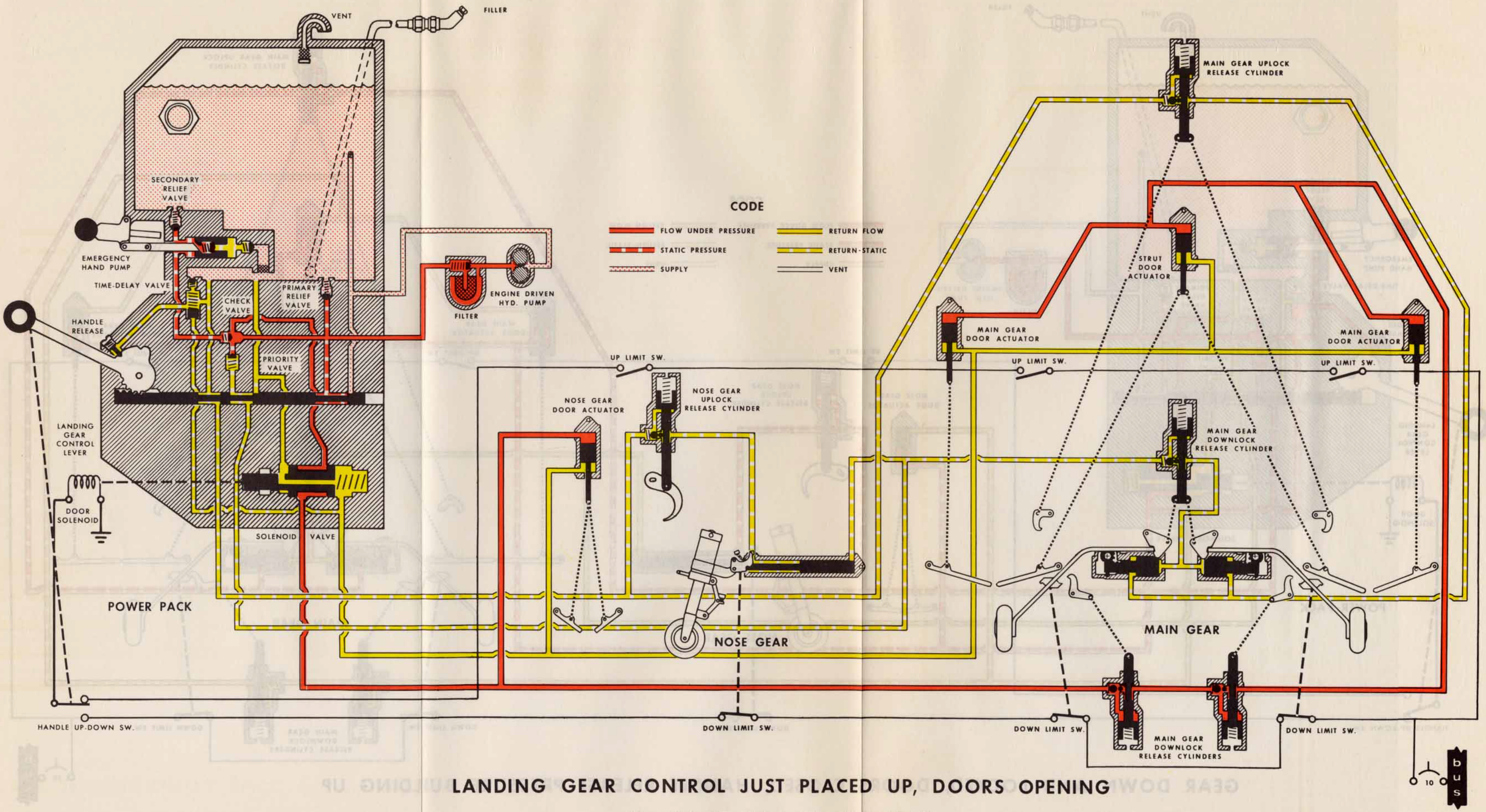
GEAR DOWN AND LOCKED, DOORS CLOSING

Figure 5C-8. Hydraulic System Schematic (Sheet 4 of 10)



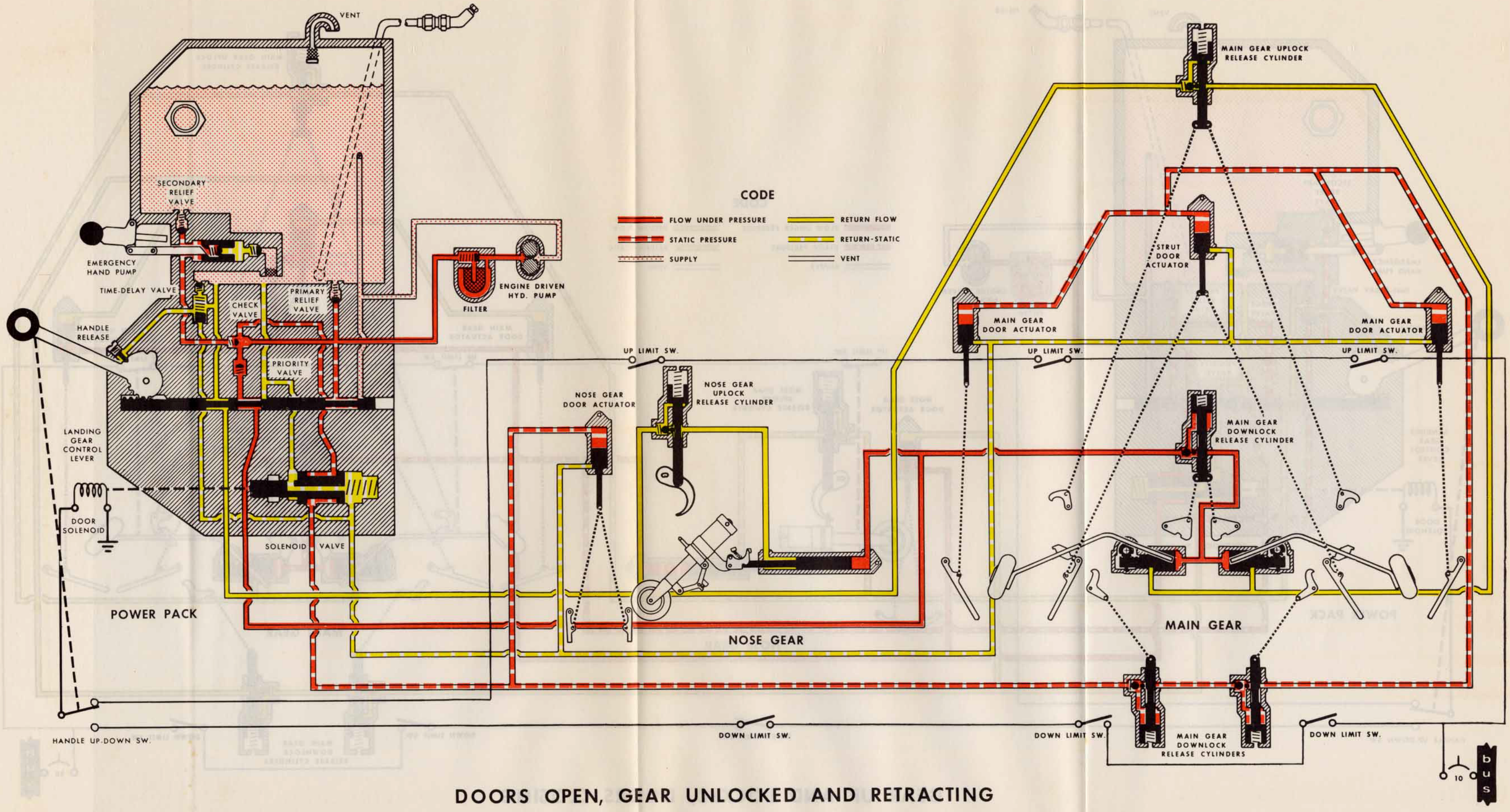
GEAR DOWN AND LOCKED, DOORS CLOSED, HANDLE RELEASE PRESSURE BUILDING UP

Figure 5C-8. Hydraulic System Schematic (Sheet 5 of 10)



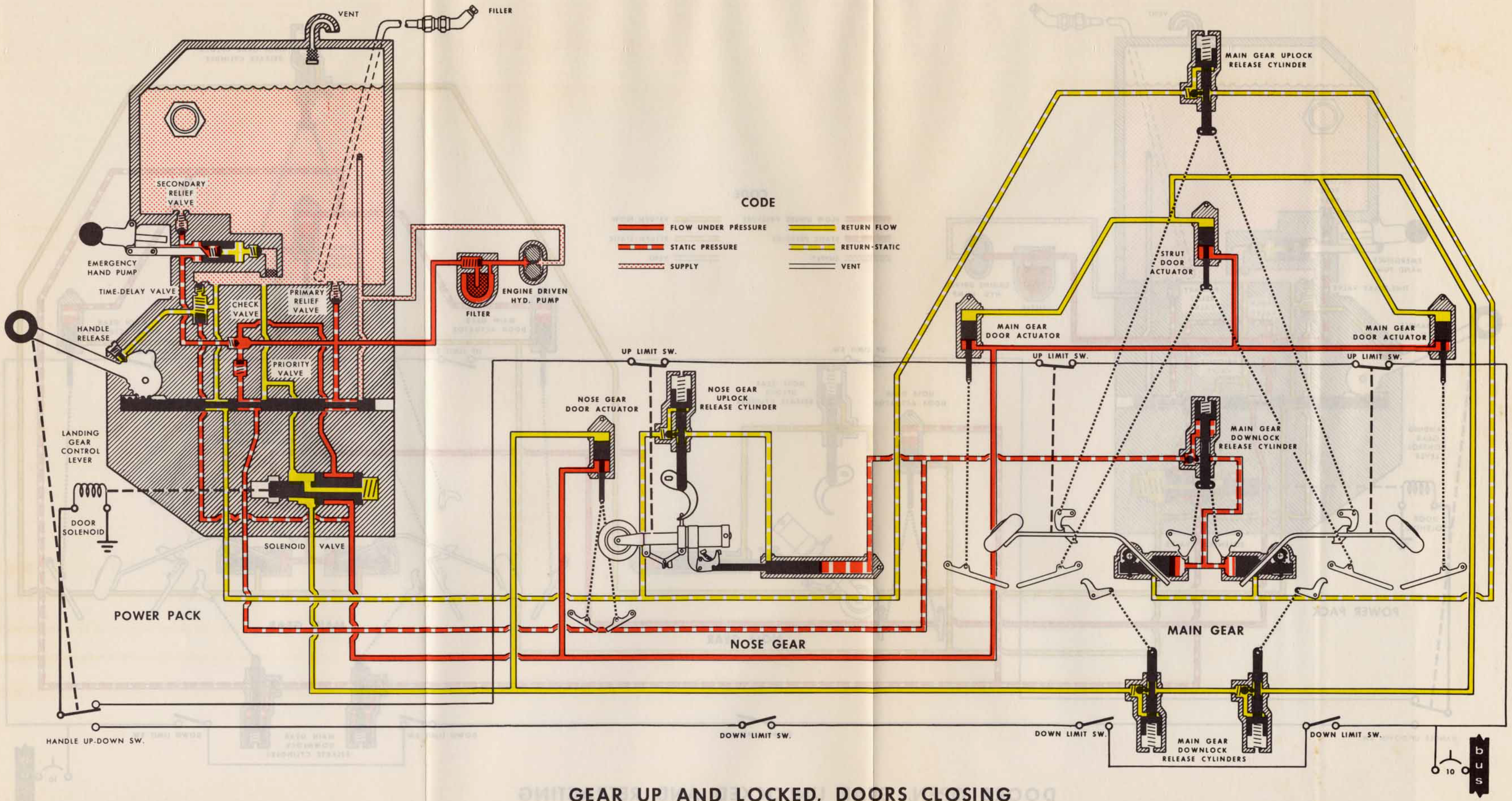
LANDING GEAR CONTROL JUST PLACED UP, DOORS OPENING

Figure 5C-8. Hydraulic System Schematic (Sheet 6 of 10)



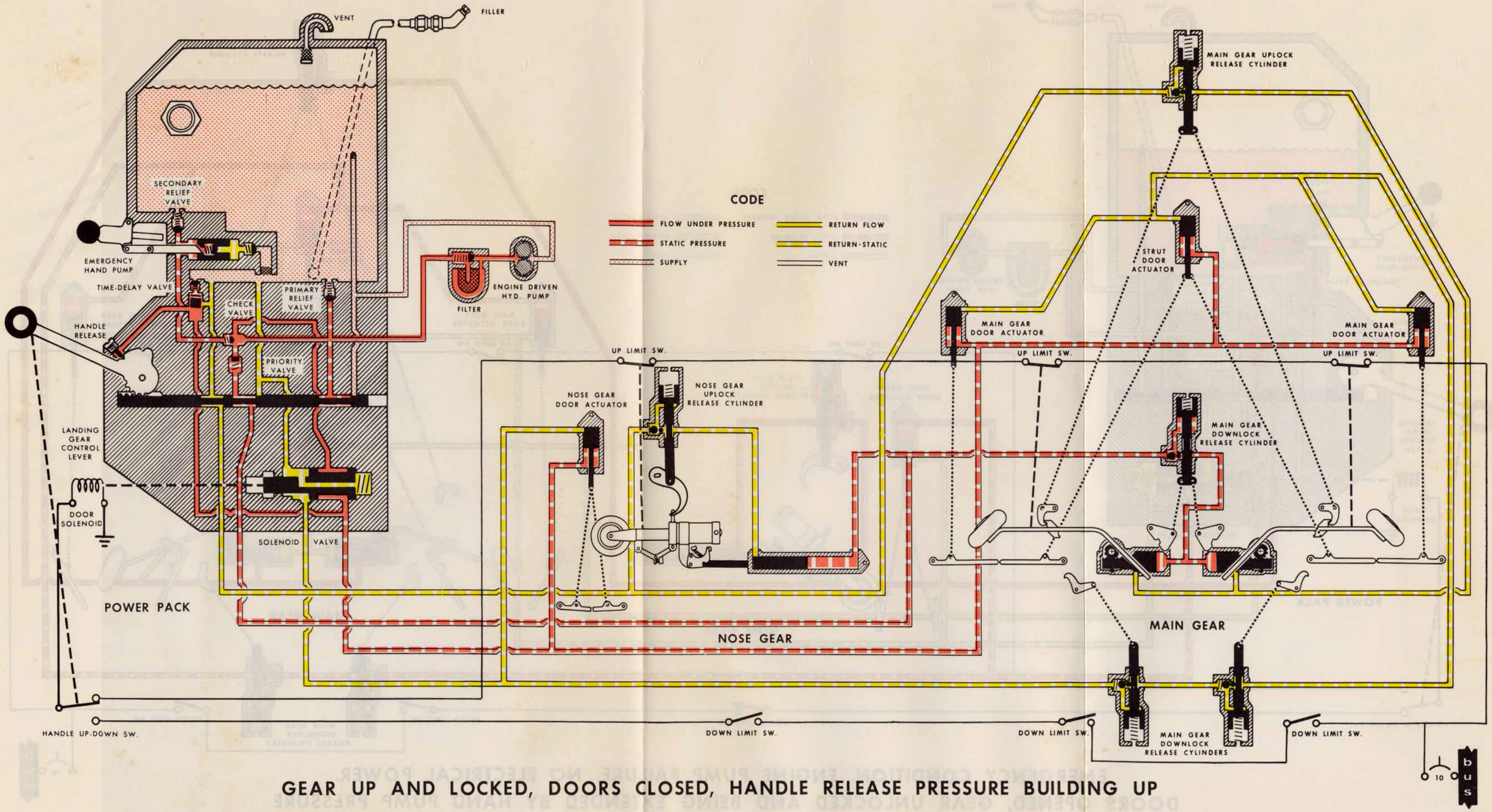
DOORS OPEN, GEAR UNLOCKED AND RETRACTING

Figure 5C-8. Hydraulic System Schematic (Sheet 7 of 10)



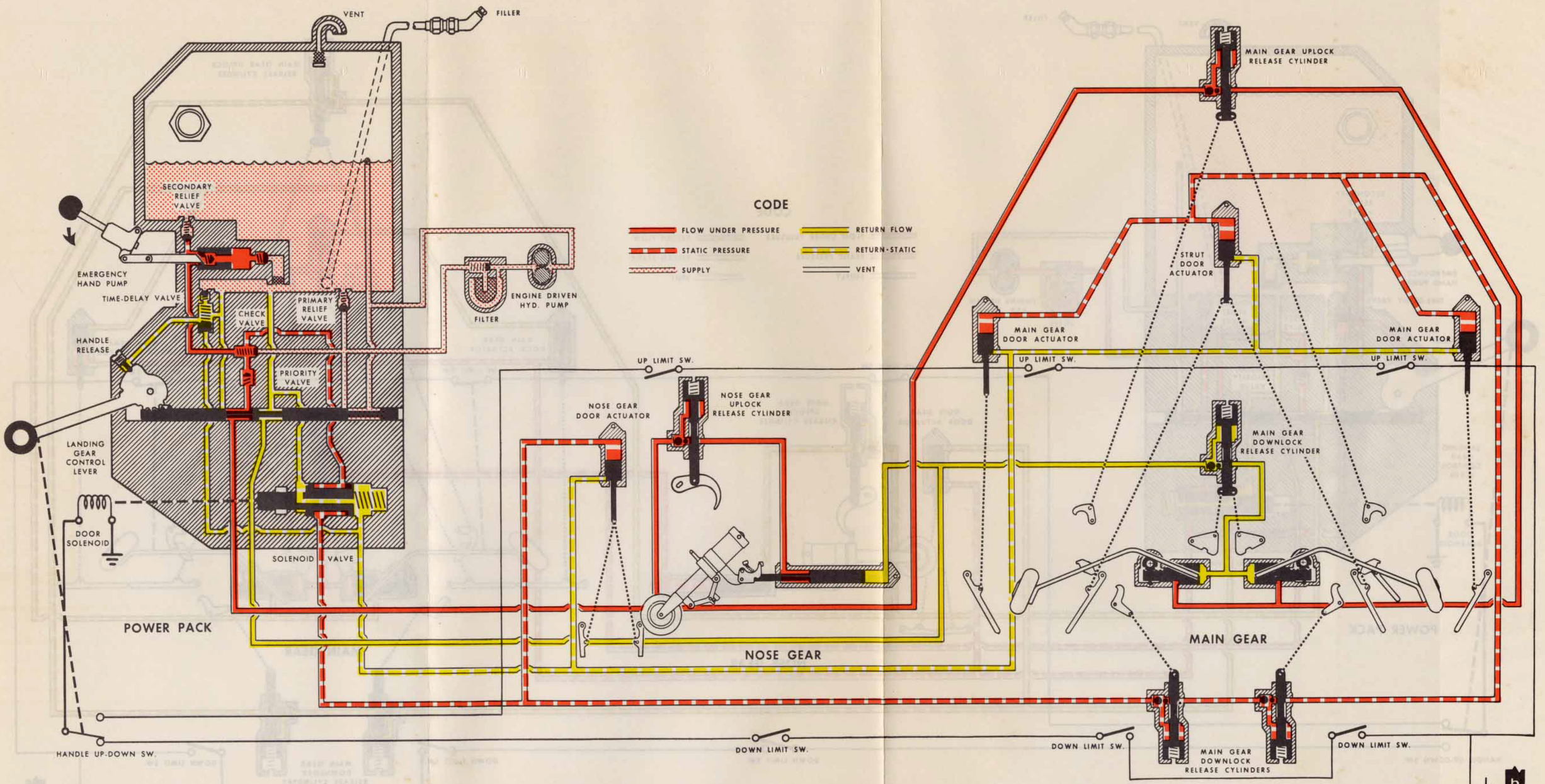
GEAR UP AND LOCKED, DOORS CLOSING

Figure 5C-8. Hydraulic System Schematic (Sheet 8 of 10)



GEAR UP AND LOCKED, DOORS CLOSED, HANDLE RELEASE PRESSURE BUILDING UP

Figure 5C-8. Hydraulic System Schematic (Sheet 9 of 10)



EMERGENCY CONDITION. ENGINE PUMP FAILURE, NO ELECTRICAL POWER.
DOORS OPENED, GEAR UNLOCKED AND BEING EXTENDED BY HAND PUMP PRESSURE

Figure 5C-8. Hydraulic System Schematic (Sheet 10 of 10)

SECTION 6

AILERON CONTROL SYSTEM

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6-1. AILERON CONTROL SYSTEM.

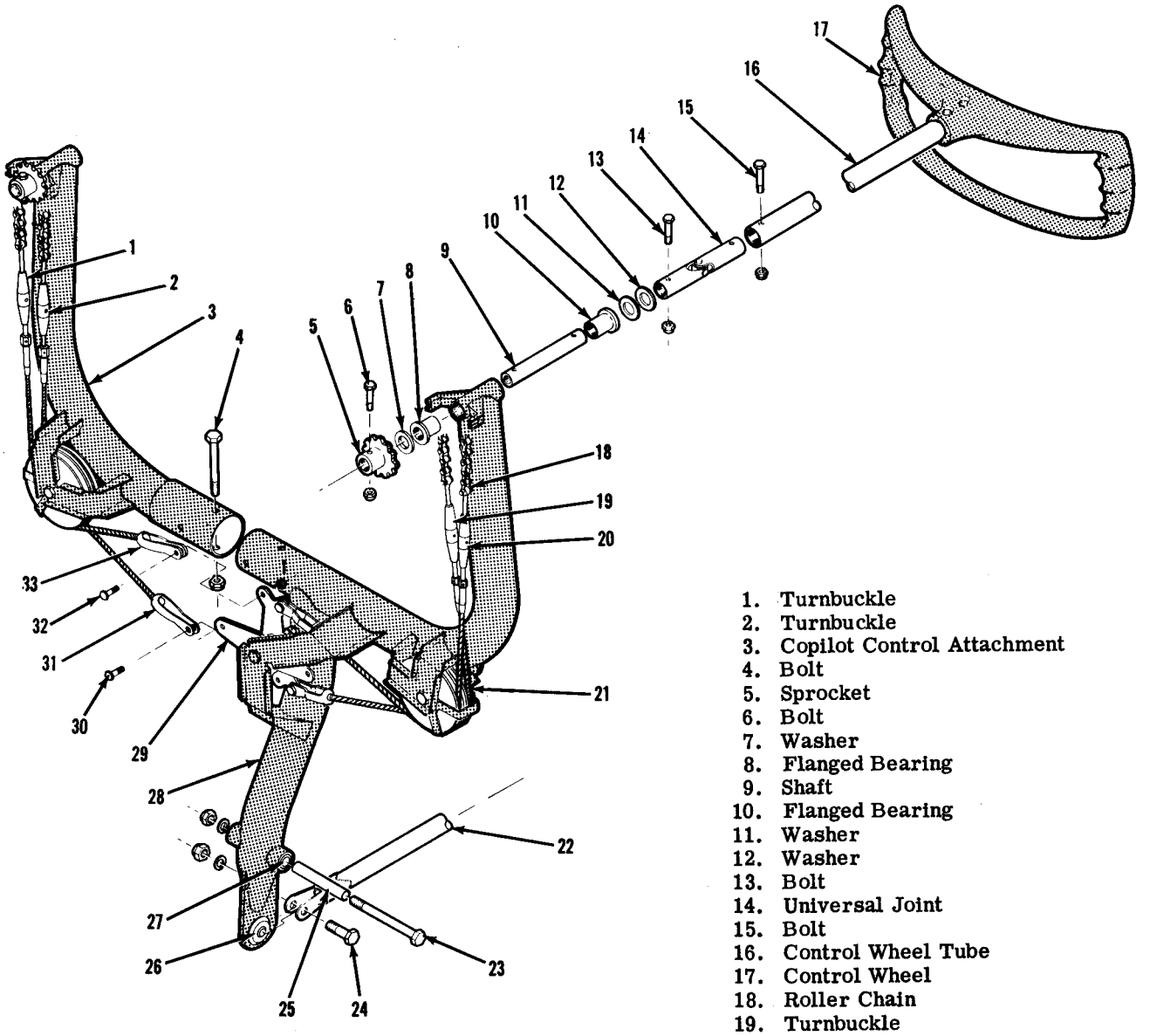
6-2. The aileron control systems are illustrated in figures 6-3, 6-4, and 6-5. The control tee and the control column are shown in figures 6-1 and 6-2.

6-3. CONTROL TEE. The control tee, used in the Models 210 and 210A, connects the control wheels, and through a roller chain, cable, and bellcrank arrangement, transmits control wheel rotation to the aileron direct cables. The control tee is pivoted to afford fore-and-aft motion to operate the elevator control system.

6-4. CONTROL COLUMN. Beginning with the Model 210B, and on all Model 205 and 206 series, a control column is used. Details are shown in figure 6-2. Rotation of the control wheel rotates four needle bearing rollers on the end of the control wheel tube which, in turn, rotate a square tube inside and extending from the control wheel tube. Attached to this square tube is a sprocket which operates the aileron system. The same arrangement is provided for both control wheels and synchronization is obtained by the interconnecting roller chains and sprockets. The sprocket end of the square tube is mounted in a bearing block on the firewall and does not move fore and aft but rotates with the control wheel. The four needle bearing rollers on the end of the control wheel tube prevent friction as the control wheel is moved fore and aft for elevator system operation. A sleeve weld assembly, containing bearings which permit the control wheel tube to rotate within it, is secured to the control wheel tube by a sleeve and retaining ring in such a manner that it moves fore and aft with the control wheel tube. This movement allows the push-pull tube attached to the weld assembly to operate an elevator arm assembly, to which one elevator cable is attached. A torque tube connects this arm assembly to the opposite one, to which the other elevator cable is attached. When dual controls are installed, the copilot's control wheel is linked to the aileron and elevator control systems in the same manner as the pilot's control wheel.

6-5. CABLES AND BELLCRANKS. The aileron cables are routed differently in the basic systems used on the various models. Refer to the illustration applicable to a specific model. Aileron bellcranks and drive pulleys vary with each system. The bellcranks and drive pulleys are also shown in the basic systems illustration.

6-6. AILERONS. Two different types of ailerons are used. The piano-hinged ailerons are used on all airplanes except the Model 206 series, and the Model 210 beginning with the 210D. The latter are equipped with Frise type ailerons which pivot on two hinges located on brackets extending from each wing. The ailerons are shown in figures 6-6 and 6-7.



1. Turnbuckle
2. Turnbuckle
3. Copilot Control Attachment
4. Bolt
5. Sprocket
6. Bolt
7. Washer
8. Flanged Bearing
9. Shaft
10. Flanged Bearing
11. Washer
12. Washer
13. Bolt
14. Universal Joint
15. Bolt
16. Control Wheel Tube
17. Control Wheel
18. Roller Chain
19. Turnbuckle
20. Turnbuckle
21. Pulley
22. Elevator Push-pull Tube
23. Bolt
24. Bolt
25. Spacer
26. Bearing
27. Needle Bearing
28. Control Tee
29. Bellcrank
30. Bolt
31. Clevis
32. Bolt
33. Clevis

NOTE

The copilot's control wheel is installed in the same manner as the pilot's control wheel. When dual controls are not installed, the right half of the control tee (items 1 thru 4 and 30 thru 33) are deleted.

Figure 6-1. Control Tee (Prior to 210B)

6-7. TROUBLE SHOOTING THE AILERON SYSTEM.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
LOST MOTION IN CONTROL WHEEL.		
Loose control cables.	Check cable tension.	Adjust cables to proper tension.
Broken pulley or bracket, cable off pulley, or worn rod end bearings.	Check visually.	Replace worn or broken parts, install cables correctly.
RESISTANCE TO CONTROL WHEEL MOVEMENT.		
Cables too tight.	Check cable tension.	Adjust cables to proper tension.
Pulleys binding or cable off.	Observe motion of the pulleys. Check cables visually.	Replace defective pulleys. Install cables correctly.
Bellcrank distorted or damaged.	Check visually.	Replace bellcrank.
Defective chain or sprocket assembly.	Check visually.	Replace.
Defective universal joint.	Check visually.	Replace.
Clevis bolts in system too tight.	Check connections where used.	Loosen, then tighten properly and resafety.
CONTROL WHEEL NOT LEVEL WITH AILERONS NEUTRAL.		
Improper adjustment of cables.	Check rigging.	Readjust cable turnbuckles.
Improper adjustment of aileron push-pull rods.	Check rigging.	Adjust push-pull rods to obtain proper alignment.
DUAL CONTROL WHEELS NOT COORDINATED.		
Chain not properly adjusted on sprockets.	Check rigging of chain.	Adjust chain on sprockets.
INCORRECT AILERON TRAVEL.		
Bellcranks or push-pull rods not adjusted properly.	Check rigging.	Adjust in accordance with rigging procedure.

6-8. REMOVAL OF CONTROL TEE. (See figure 6-1.)

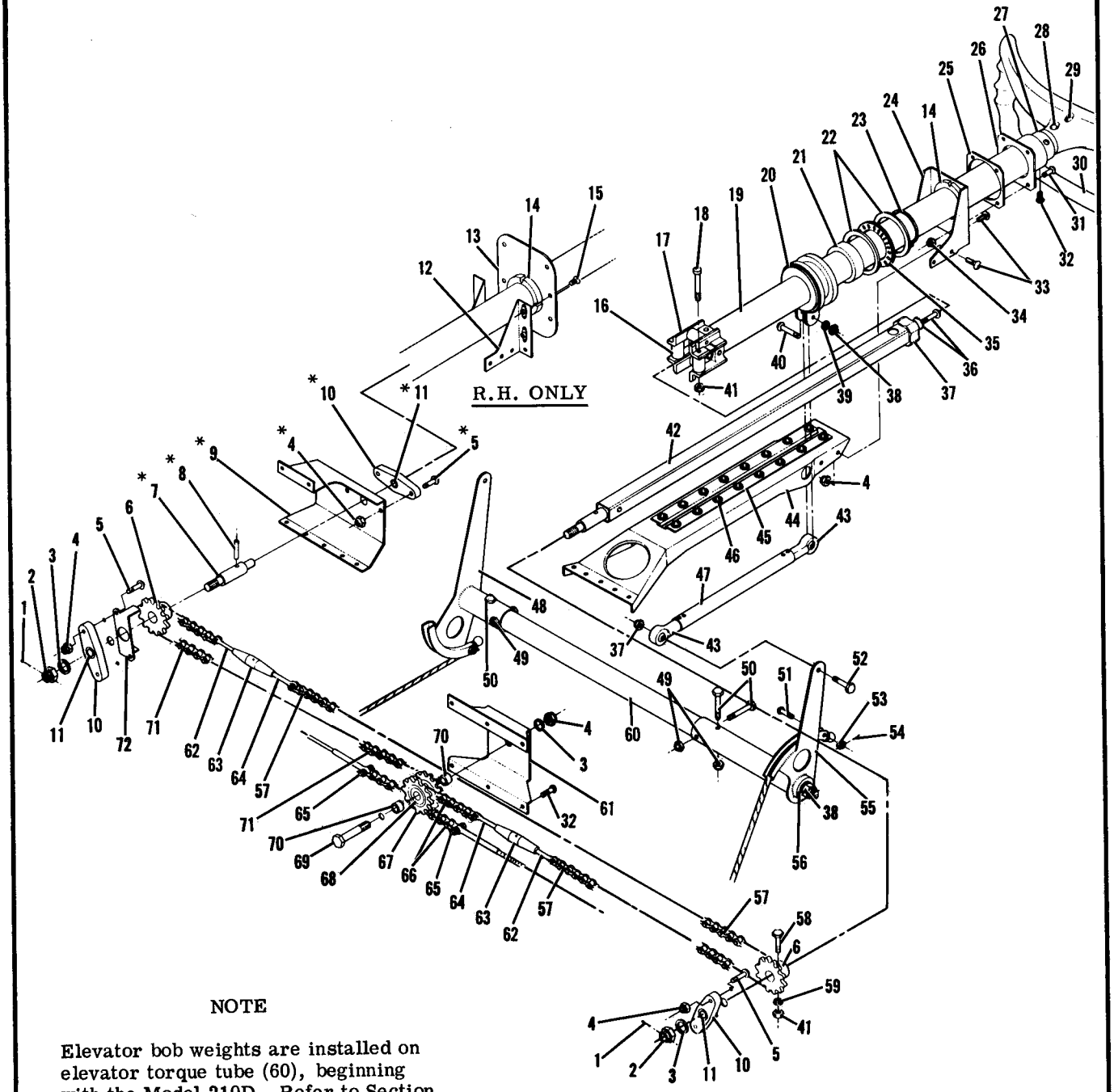
a. Disconnect the two aileron control cables from the bellcrank (29).

b. Remove bolt (24) which attaches the elevator push-pull tube (22) to control tee (28).

c. Remove bolt (15) which attaches each control wheel tube (16) to universal joint (14).

d. Remove the control tee pivot bolt (23).

6-9. REPLACEMENT OF CONTROL TEE. (See figure 6-1.) To replace the control tee reverse the procedure as outlined in paragraph 6-8. Before proceeding with rigging, it may be necessary to adjust the length of the turnbuckles (1, 2, 19, and 20) to line up the control wheels. Control tee cable tension should be only enough to remove slack without binding. Rig the aileron system per paragraph 6-20.



NOTE

Elevator bob weights are installed on elevator torque tube (60), beginning with the Model 210D. Refer to Section 8 for the bob weights installation.

*USED ONLY ON AIRPLANES WITHOUT DUAL CONTROL WHEEL INSTALLATION.

Figure 6-2. Control Column (Except Prior to Model 210B)

6-10. REMOVAL OF CONTROL COLUMN. (See figure 6-2.)

a. Remove three screws attaching control wheel to control wheel tube and remove the control wheel.

b. Remove shock-mounted instrument panel in accordance with paragraph 16-5.

c. Remove screws securing plate (24).

d. Remove push-pull rod (47).

e. Loosen turnbuckle (63) and disengage chain from sprocket (6).

f. Remove nut and washer from shaft protruding through bearing on forward side of firewall.

g. Pull control wheel tube assembly aft to remove. Remove the copilot's control wheel tube in a similar manner.

h. Remove eight screws securing arms (55) and slide the sleeves inboard, clear of the elevator arm assemblies to remove torque tube (60).

i. Disconnect elevator cables from the elevator arm assemblies and remove screws and nuts (38) to remove the arm assemblies.

j. After removal, detail parts may be removed or replaced as required.

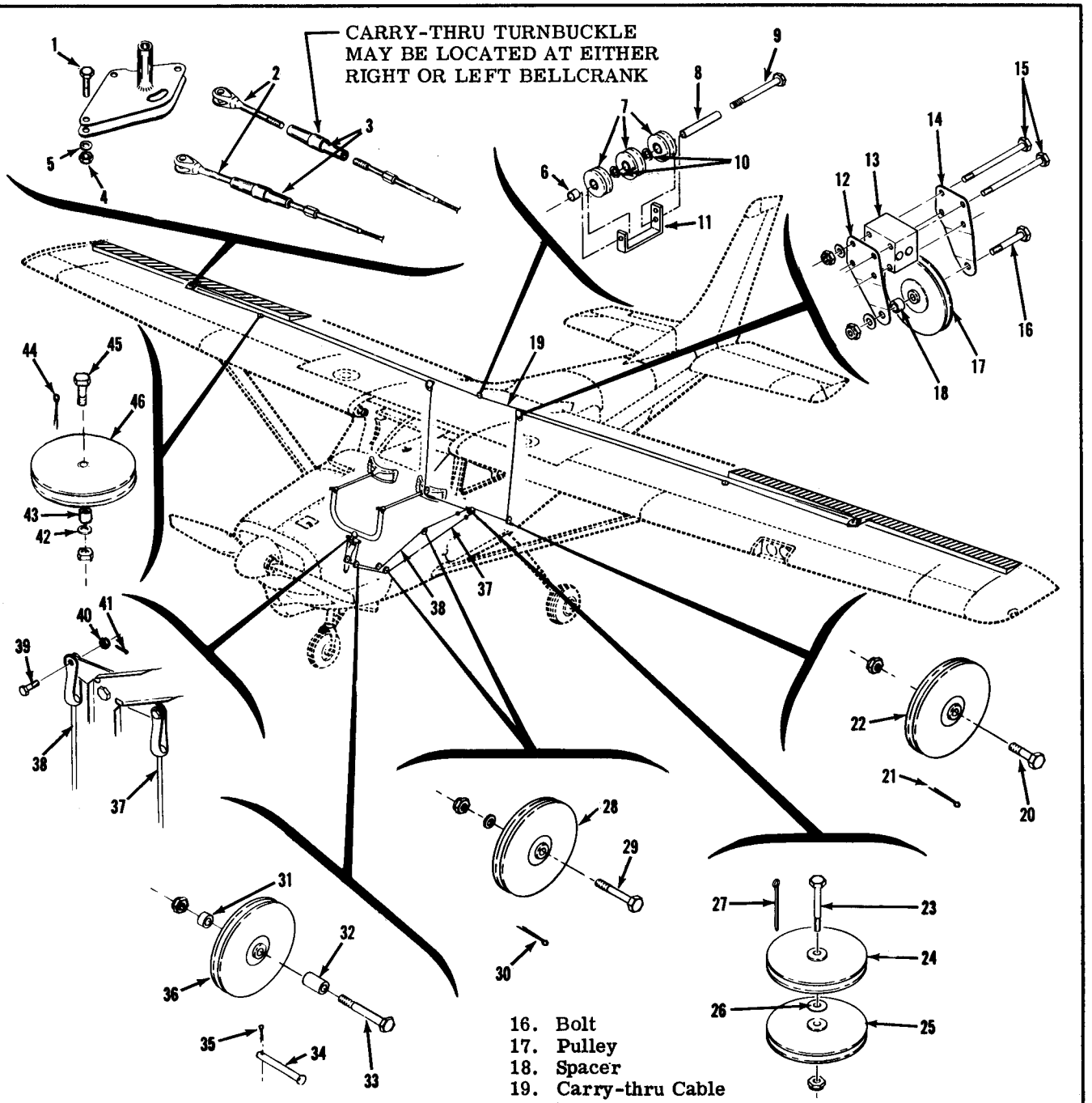
6-11. REPLACEMENT OF CONTROL COLUMN may be accomplished by reversing the removal procedure. Be sure to resafety all parts that were safetied. Check elevator and aileron systems for correct rigging. Nut (2, figure 6-2) should be tightened snugly, then loosened the least amount required to eliminate binding, but not more than .030 inch maximum clearance.

6-12. REPAIR OF CONTROL TEE OR COLUMN. Worn, damaged, or defective shafts, bearings, bushings, sprockets, roller chains, universal joints, and other components should be replaced. Refer to the lubrication diagram in Section 2 for lubrication recommendations.

SHOP NOTES:

References for Figure 6-2

1. Cotter Pin
2. Nut
3. Washer
4. Nut
5. Screw
6. Sprocket
7. Idler Shaft
8. Roll Pin
9. Support
10. Bearing Block
11. Bearing
12. Bracket
13. Panel Plate
14. Grommet
15. Screw
16. (Roller)Bearing
17. Retainer
18. Screw
19. Tube and Bearing Assy
20. Sleeve Assembly
21. Bearing
22. Bearing Race
23. Snap Ring
24. Support Plate
25. Spacer
26. Collar
27. Wheel Adapter
28. Rivet
29. Rivet
30. Control Wheel
31. Screw
32. Screw
33. Screw
34. Nut
35. Bearing
36. Tapered Plug and Screw
37. (Nylon) Control Glide
38. Nut
39. Washer
40. Screw
41. Nut
42. Tube-Inner
43. Rod End
44. Guide Assembly
45. Rub Strip
46. Washer
47. Push-Pull Rod
48. Elevator Arm Assembly
49. Nut
50. Bolt
51. Screw
52. Screw
53. Nut
54. Cotter Pin
55. Arm
56. Bearing
57. Roller Chain
58. Bolt
59. Washer
60. Elevator Torque Tube
61. Support
62. Turnbuckle Terminal
63. Turnbuckle Barrel
64. Turnbuckle Terminal
65. Bolt
66. Roller Chain
67. Sprocket
68. Bearing
69. Bolt
70. Spacer
71. Chain
72. Chain Guard

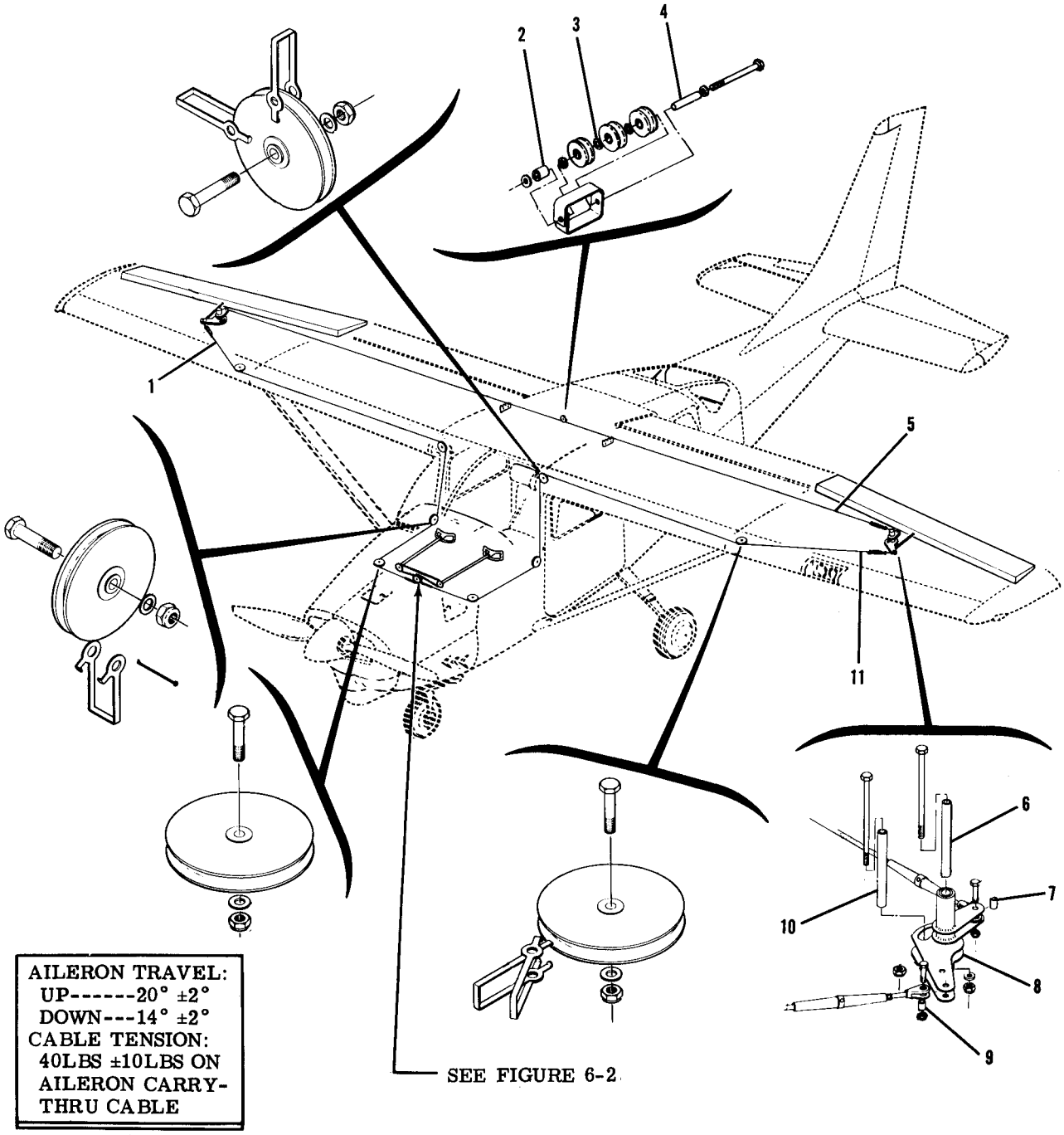


1. Bolt
2. Turnbuckle Forks
3. Turnbuckle Barrels
4. Nut
5. Washer
6. Spacer
7. Pulleys
8. Bushing
9. Bolt
10. Washers
11. Cable Guard
12. Bracket
13. Block
14. Bracket
15. Bolts

AILERON TRAVEL:
UP------20° ±2°
DOWN---14° ±2°
CABLE TENSION:
40LBS ±10LBS ON
AILERON CARRY-
THRU CABLE

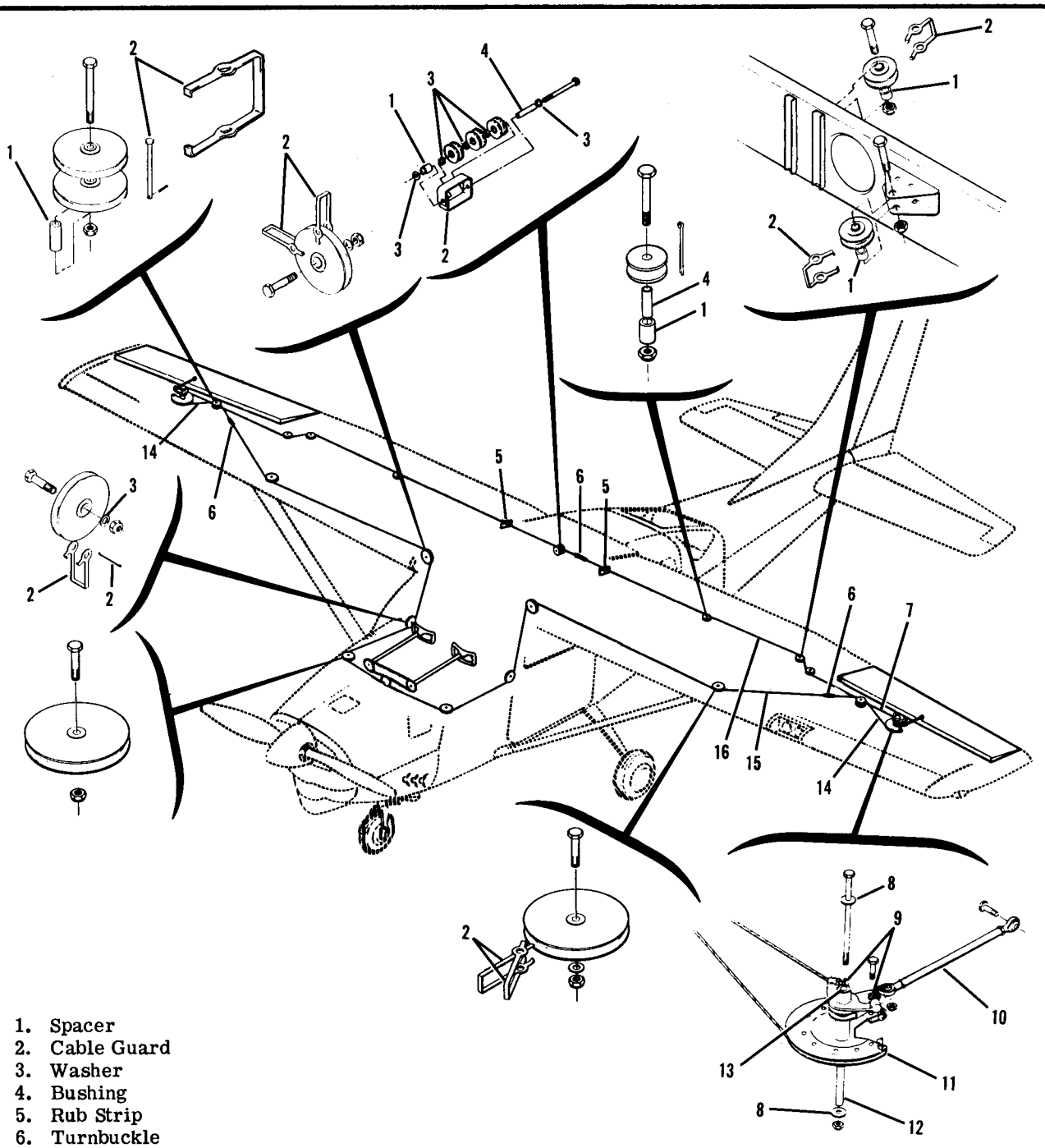
16. Bolt
17. Pulley
18. Spacer
19. Carry-thru Cable
20. Bolt
21. Cotter Pin
22. Pulley
23. Bolt
24. Pulley
25. Pulley
26. Washer
27. Cotter Pin
28. Pulley
29. Bolt
30. Cotter Pin
31. Spacer
32. Spacer
33. Bolt
34. Clevis Pin
35. Cotter Pin
36. Pulley
37. Right Aileron Cable
38. Left Aileron Cable
39. Bolt
40. Nut
41. Cotter Pin
42. Washer
43. Spacer
44. Cotter Pin
45. Bolt
46. Pulley

Figure 6-3. Aileron Control System (Models 210 and 210A)



1. Right Direct Cable
2. Spacer
3. Washer
4. Bushing
5. Carry-Thru Cable
6. Bushing
7. Bushing
8. Bellcrank
9. Bushing
10. Stop Bushing
11. Left Direct Cable

Figure 6-4. Aileron Control System (Models 210B, 210C, and 205 Series)



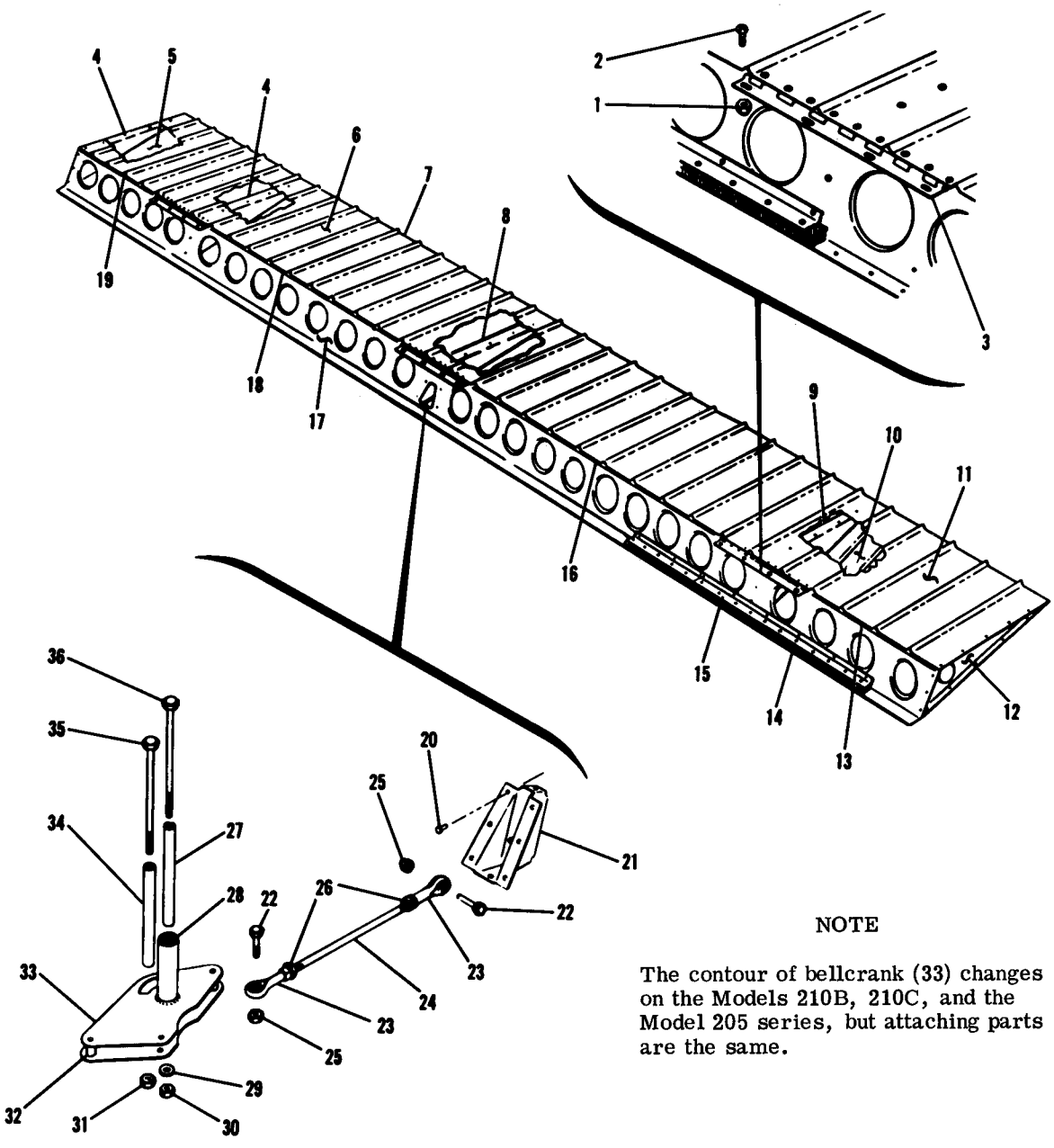
1. Spacer
2. Cable Guard
3. Washer
4. Bushing
5. Rub Strip
6. Turnbuckle
7. Outboard Carry-Thru Cable
8. Brass Washer
9. Stop Bolt
10. Push-Pull Rod
11. Bellcrank
12. Bushing
13. Bearing
14. Outboard Direct Cable
15. Direct Cable
16. Carry-Thru Cable

NOTE

On Model 206 series and 210D and on, push-pull rod (10) is adjustable at the aileron end only.

AILERON TRAVEL:
UP------21° ±2°
DOWN---14.5° ±2°
CABLE TENSION:
40LBS ±10LBS ON AILERON CARRY-THRU CABLE

Figure 6-5. Aileron Control System (Models 210D & On, and 206 Series)



NOTE

The contour of bellcrank (33) changes on the Models 210B, 210C, and the Model 205 series, but attaching parts are the same.

1. Nut
2. Screw
3. Hinge Assembly
4. Rib
5. Lower Inboard Skin
6. Upper Inboard Skin
7. Left Wing Aileron Assembly
8. Aileron Rib
9. Rib
10. Lower Outboard Skin
11. Upper Outboard Skin
12. Rib
13. Spacer
14. Aileron Balance Weight
15. Bracket
16. Spacer
17. Spar
18. Spacer
19. Spacer
20. Rivet
21. Bracket
22. Bolt
23. Rod End
24. Rod
25. Nut
26. Check Nut
27. Bushing
28. Bearing
29. Washer
30. Nut
31. Bellcrank Stop Crank
32. Bushing
33. Bellcrank Assembly
34. Bellcrank Stop Bushing
35. Bellcrank Stop Bolt
36. Bolt

Figure 6-6. Aileron Installation (Except Frise Type)

6-13. REMOVAL OF AILERON BELLCRANK OR DRIVE PULLEY.

a. Remove access cover at bellcrank or drive pulley.

b. Disconnect control cables. On drive pulleys, it may be necessary to disconnect cables after the drive pulley has been detached from the wing.

c. Detach aileron push-pull rod from bellcrank or drive pulley.

d. Remove bolts, washers, and nuts securing the bellcrank or drive pulley to the wing. Remove stop bushing used with bellcrank installation.

e. Remove bellcrank or drive pulley through the access opening, using care that the bushing is not dropped. One or more brass washers may be used as shims between wing structure and bellcrank or drive pulley.

NOTE

Protect needle bearings from dust or dirt by covering open ends with tape.

6-14. REPAIR. Repair of aileron bellcranks or drive pulleys consists of the replacement of defective parts. If needle bearings are dirty or need grease, clean thoroughly and lubricate as specified in Section 2.

6-15. REPLACEMENT OF AILERON BELLCRANK OR DRIVE PULLEY.

a. If a drive pulley is being installed, attach the control cables to it before positioning it in the wing.

b. Place stop bushing in bellcrank and position bellcrank in wing.

c. Install brass washers as required to shim out excessive clearance between bellcrank or drive pulley and wing, then install pivot bolt.

d. Position bellcrank stop bushing and install the attaching bolt.

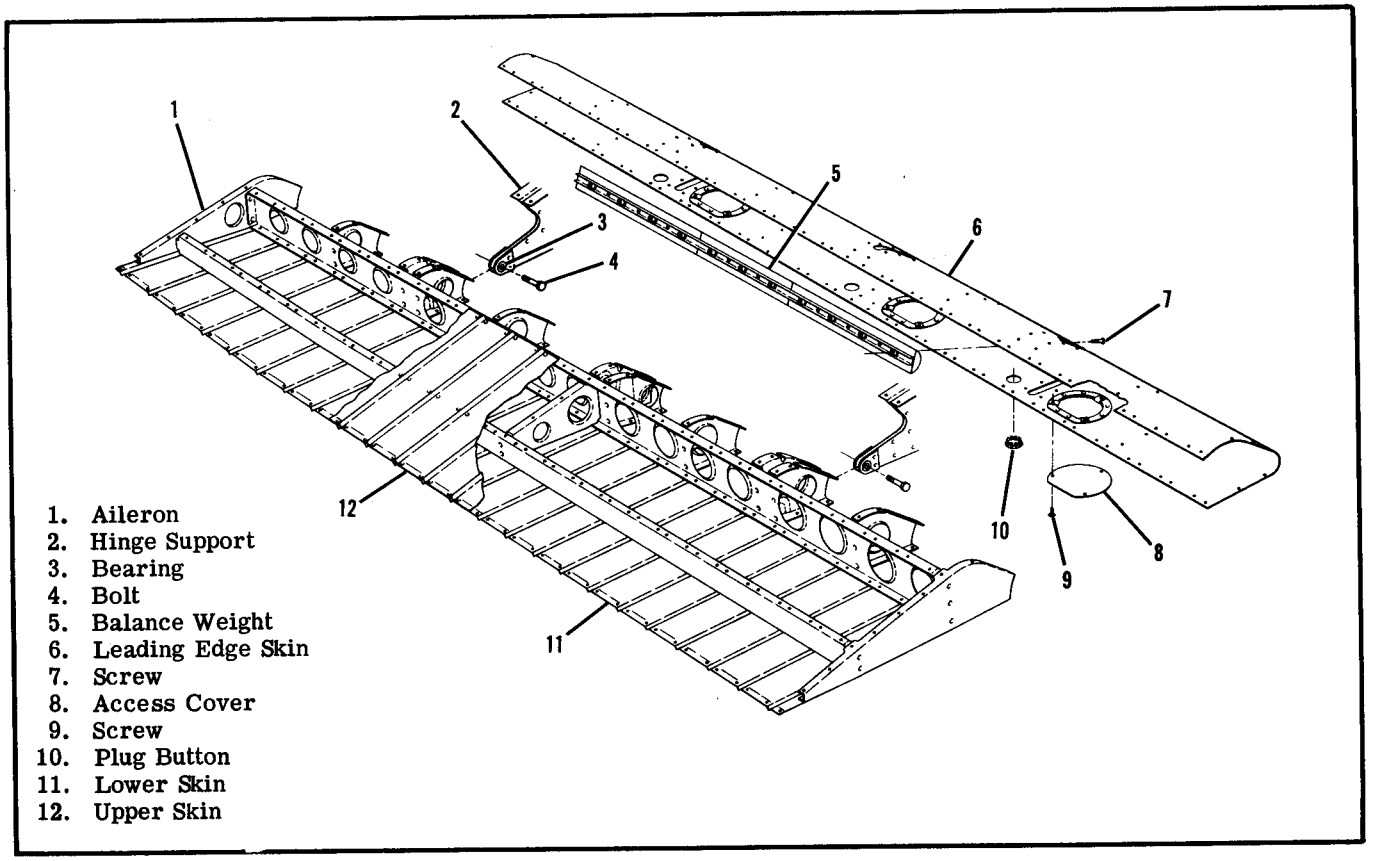
e. Connect aileron cables, aileron push-pull rod, and rig the aileron system.

6-16. REPLACEMENT OF AILERON CABLES AND PULLEYS. Aileron cables may be removed after disconnecting both ends of the cables and removing cable guards and pulleys as necessary to work the cables free of the airplane. When installing a cable, be sure cable is in pulley groove and cable guards are properly installed. Rig the aileron system after installation.

NOTE

To ease rerouting of cables, a length of wire may be attached to the end of the cable before it is withdrawn from the airplane. Leave the wire in place, routed through the structure; then attach it to the cable being installed and use it to pull the cable into position.

6-17. REMOVAL OF AILERON. Ailerons are shown in figures 6-6 and 6-7. Removal is accomplished by disconnecting push-pull rod, then either removing screws and nuts attaching aileron hinge strips to the trailing edge of wing or removing aileron hinge bolts.



1. Aileron
2. Hinge Support
3. Bearing
4. Bolt
5. Balance Weight
6. Leading Edge Skin
7. Screw
8. Access Cover
9. Screw
10. Plug Button
11. Lower Skin
12. Upper Skin

Figure 6-7. Frise Type Aileron Installation

6-18. REPAIR OF AILERON. Repair may be accomplished in accordance with instructions contained in Section 19. After an aileron has been repaired, check static balance and rebalance if necessary. Before installation, check hinge strips and balance weights for security.

6-19. REPLACEMENT OF AILERON. After aileron hinge strips or hinge bolts have been installed, connect push-pull rod. If push-pull rod adjustment was not disturbed, it should not be necessary to rig the system. Check aileron travel and alignment, and rerig if necessary.

6-20. RIGGING OF AILERON CONTROL SYSTEM.

a. (See figure 6-1.) On the control tee, adjust turnbuckles (19 and 20) to level the pilot's control wheel, and turnbuckles (1 and 2) to level the copilot's control wheel, with bellcrank (29) centered. The chains should be engaged so that they have an equal number of links extending from the sprockets.

b. (See figure 6-2.) On the control column, check that upper left chain (57) is engaged with left aileron sprocket (6) in accordance with figure 6-8. With pilot's control wheel in neutral, adjust turnbuckles (63) so that both control wheels are synchronized in neutral.

NOTE

Adjust turnbuckles so that tension is only enough to remove slack without binding.

c. Engage control lock or tape a bar across both control wheels to hold them in neutral.

d. On systems with bellcranks, adjust the turnbuckles at the bellcranks simultaneously until the bellcrank stop bushings are centered in both bellcrank slots, with 40 ± 10 pounds tension on aileron carry-thru cable. Refer to figure 6-9. After the stop bushings have been centered in slots, adjust each aileron push-pull rod until ailerons are neutral with reference to the trailing edge of the wing flaps, while flaps are up.

e. On systems with drive pulleys, set the aileron push-pull rods at 8.57" between centerlines of rod end bolt holes, and install. Adjust the turnbuckles at the drive pulleys to obtain 40 ± 10 pounds tension on aileron carry-thru cable, while maintaining the ailerons in neutral with reference to the trailing edge of the wing flaps, while flaps are up.

f. Remove control lock or bar taped across control

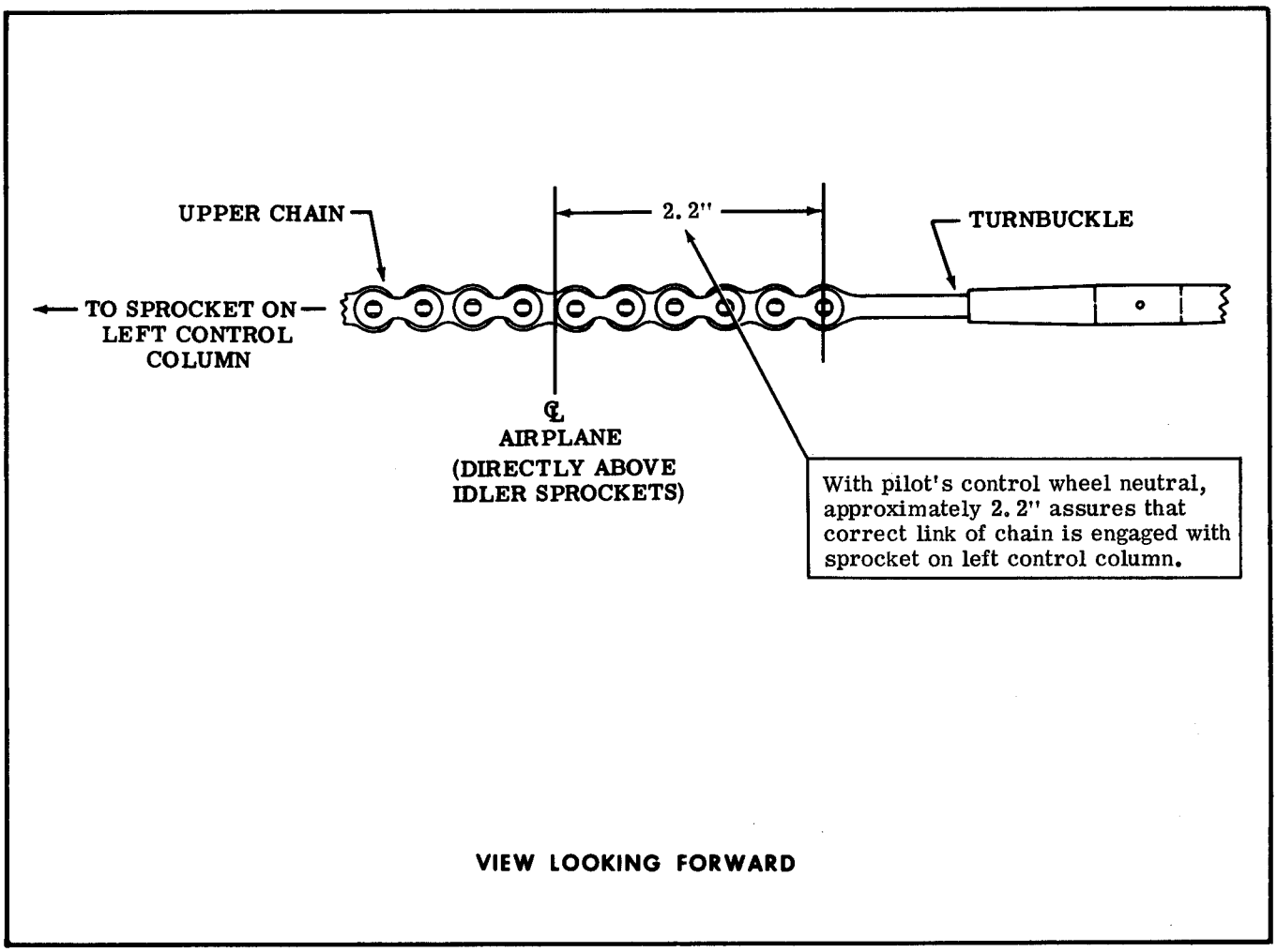


Figure 6-8. Neutral Position for Rigging (Control Column)

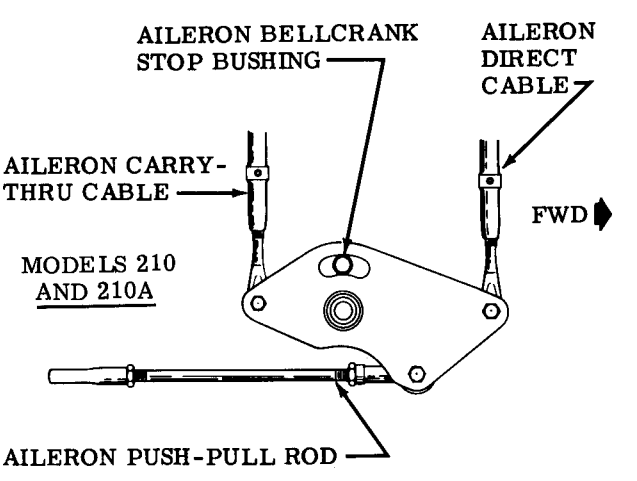
wheels, and check aileron travel.

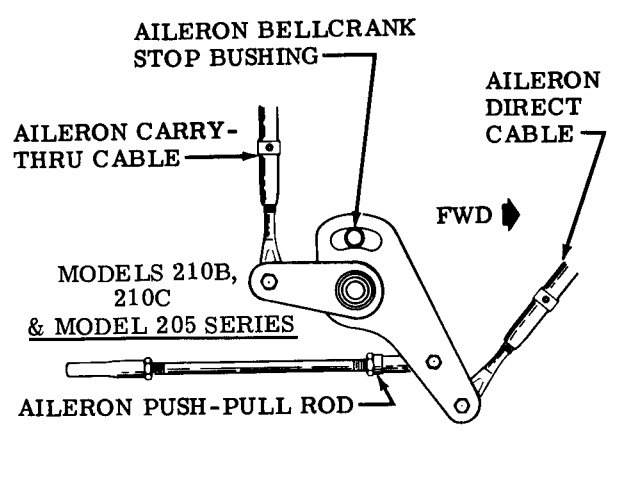
g. On systems with drive pulleys, adjust stop bolts at both drive pulleys to obtain correct aileron travel.

h. Be sure all turnbuckles are safetied, all cables and cable guards are properly installed, and all jam nuts are tightened, then replace all parts removed for access.

WARNING

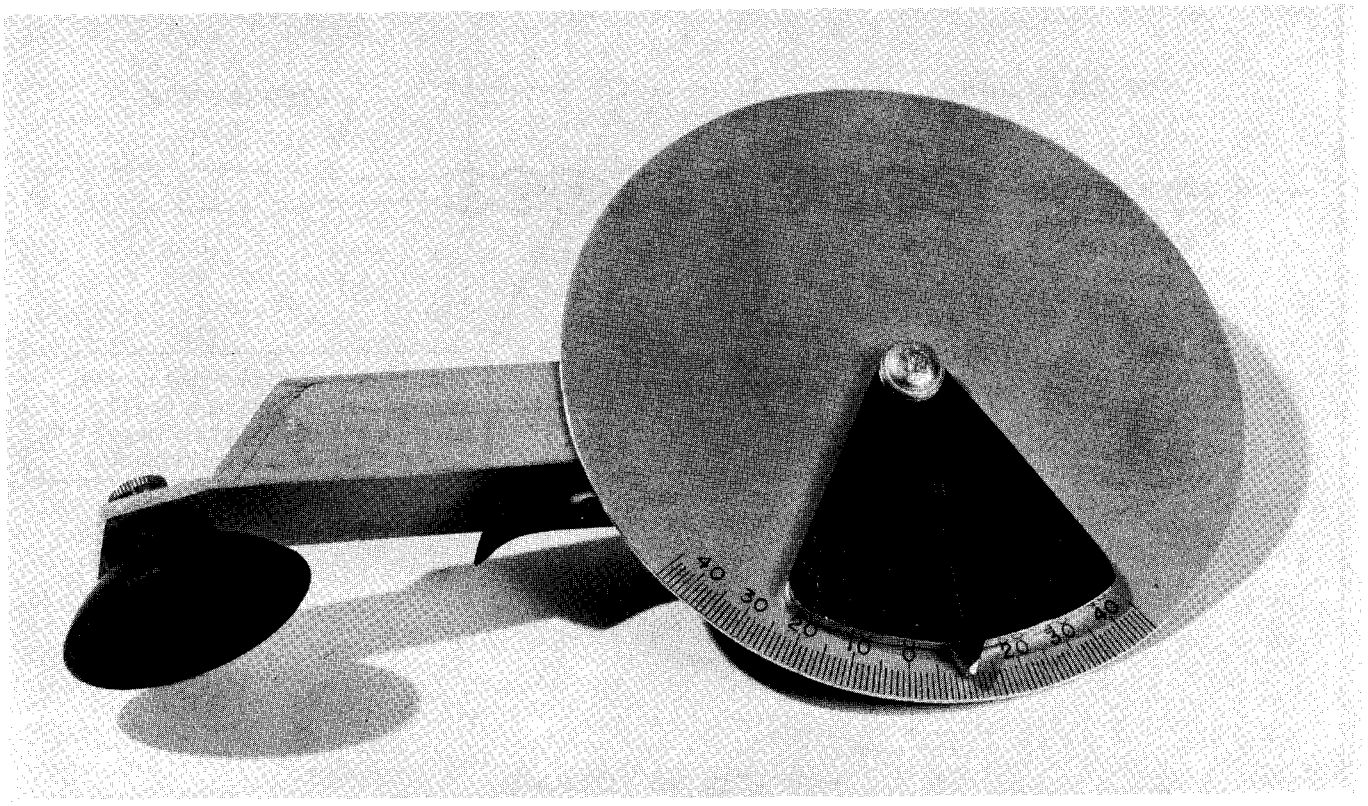
Be sure ailerons move in the correct direction when operated by the control wheel.





Center stop bushings in slots of aileron bellcranks in each wing when control wheels are neutral, with 40 ±10 pounds tension on aileron carry-thru cable. Push-pull rods are then adjusted to rig ailerons neutral.

Figure 6-9. Aileron Bellcrank Rigging



AVAILABLE FROM CESSNA SPARE PARTS DEPARTMENT (TOOL NO. SE 716)

Figure 6-10. Inclinometer for Measuring Control Surface Travels

SECTION 7

HYDRAULIC FLAP CONTROL SYSTEMS

NOTE

SEE SECTION 7A FOR ELECTRIC FLAP CONTROL SYSTEMS

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7-1. FLAP CONTROL SYSTEMS.

7-2. Hydraulically operated wing flaps are used on Model 210 airplanes prior to the Model 210D. The system is operated by a lever on the right side of the Power Pack, which is located at the lower center part of the instrument panel. An electrically operated flap position indicator shows flap position whenever the master switch is turned on.

7-3. FLAP HYDRAULIC SYSTEM. Hydraulic pressure, furnished by an engine-driven hydraulic pump and controlled by the Power Pack, operates the wing flaps through double-acting actuator cylinders. A restrictor in the system controls flap actuation speed. Improvements were made to the Power Pack used on the Models 210B and 210C, and hydraulic lines were also rerouted and increased in size for better cold weather operation. The system is shown in figure 7-1.

7-4. FLAP SYNCHRONIZING SYSTEM. Control cables, bellcranks, and push-pull rods link the left and right wing flaps in a "closed" system to ensure synchronized wing flap positioning. The system is shown in figure 7-2.

7-5. FLAP POSITION INDICATING SYSTEM. A wing flap position transmitter, located in the left wing and controlled by the mechanical synchronizing system, delivers an electrical signal to the flap position indicator on the instrument panel. The position indicator, marked in 10-degree increments, shows flap position from zero to 40 degrees.

7-6. TROUBLE SHOOTING WING FLAPS.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
	NOTE Beginning with '61 models, creeping flaps are prevented by flap cylinders equipped with a locking device which prevents cylinder extension until flap-down pressure releases the lock. These cylinders are provided as spares for all aircraft. Trouble-shooting procedures below may still be used, for even the improved cylinders may allow the flaps to creep down from an intermediate lowered position.	
FLAPS CREEP UP OR DOWN.		
Air in flap system	Place flaps partially down, then release flap control lever to neutral. If flaps can be moved manually but tend to return to their original position, air in the system is being compressed with the resultant spongy feeling.	Bleed flap system.
External leak in flap system.	Pressure test flap system.	Repair or replace leaking component.
O-ring in flap actuating cylinder leaking.	If there are no external leaks, *expend accumulator pressure by operating flaps, move flaps to partly down with aircraft hand pump, then release flap control lever to neutral. Manually pull down on flaps. If flaps move down and do not tend to return to their original position, one of the flap actuating cylinders may have internal leakage. Remove flap up line from right cylinder and cap line. Plug cylinder port tightly. With flap control lever held down, manually pull down on flaps. If flaps continue to move down, the right cylinder has a leaking piston O-ring. If the flaps do not move down, reconnect the line and repeat the procedure on the left cylinder. If flaps continue to move down, left cylinder has faulty O-ring. If flaps do not move down, the cylinders are not at fault. Reconnect the line and check for the next cause of creeping flaps.	Repair or replace actuating cylinder.
Flap control valve or thermal relief valve leaking.	If there are no external leaks and the flap actuating cylinders are not leaking internally, a return poppet valve or a thermal relief	Replace defective flap valve assembly (210B and 210C) or poppet (210 and 210A) or thermal relief valve (all models).

*Unnecessary on the 210B and 210C.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
FLAPS CREEP UP OR DOWN (Cont).		
	valve is leaking. There is no quick way to tell which of the two is leaking. Use the following procedure to determine whether the leaking control return valve or thermal relief valve is in the flap up system or flap down system. Partially extend flaps with aircraft hand pump, then release flap control lever to neutral. Manually push up on the flaps. If they continue to move up, the faulty valve is in the up system. If they cannot be moved up, pull down on the flaps. If they continue to move down, the faulty valve is in the down system.	
Pressure side of control valve leaking.	Release accumulator pressure by operating flaps, partially extend flaps with aircraft hand pump, then release flap control lever to neutral. Manually try to move flaps. If flaps will not move, start engine and actuate flaps through at least three complete cycles, ending with flaps approximately half extended.	Replace flap control valve in the 210B and 210C. In 210 and 210A airplanes, with engine driven pump supplying pressure and flap control neutral, if flaps creep down, replace flap down pressure poppet. If flaps creep up from intermediate-lowered position when handle is returned to neutral, replace flaps-up pressure poppet.
FLAPS WILL NOT EXTEND OR RETRACT.		
Ruptured or leaking line, fitting or component.	Pressure check flap system.	Repair or replace as required.
Insufficient fluid in reservoir or excessive air in system.	Check fluid level; check for spongy flaps.	Fill reservoir and bleed hydraulic system.
Defective hydraulic pump, power pack, or accumulator.	Refer to Section 5 or 5A.	Refer to Section 5 or 5A.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
ONE FLAP MOVES WITH DIFFICULTY AND LAGS BEHIND OTHER FLAP DURING EXTENSION AND RETRACTION.		
Synchronizing system defective or not rigged properly.	Check synchronizing system for proper rigging and defective parts.	Repair or replace defective parts and rig properly.
Damaged flap tracks, brackets, or defective rollers.	Inspect visually.	Repair or replace defective parts as necessary.
Binding flap actuator.	Release accumulator pressure by operating flaps and partially extend flaps with aircraft hand pump. Disconnect actuator from flap. With flap control lever held up, push in on piston rod. It should move steadily inward when pushed manually, and with flap control lever held down, it should move steadily outward when pulled manually.	Repair or replace binding actuator.
Hydraulic line restricted.	Visually check for kinks and dents.	Replace damaged line.
FLAP POSITION INDICATOR SYSTEM MALFUNCTIONS.		
Defective flap position indicator.	Check with one known to be good.	Replace defective indicator.
Defective flap position transmitter.	Check with one known to be good.	Replace defective transmitter.
Flap position transmitter out of adjustment.	Flap position does not agree with indicated position.	Adjust in accordance with paragraph 7-22.
Circuit shorted or open.	Check continuity.	Repair or replace defective wiring.

NOTE

For hydraulic system troubles not listed in this trouble shooting chart, refer to the hydraulic power trouble shooting chart in Section 5 or 5A.

SHOP NOTES:

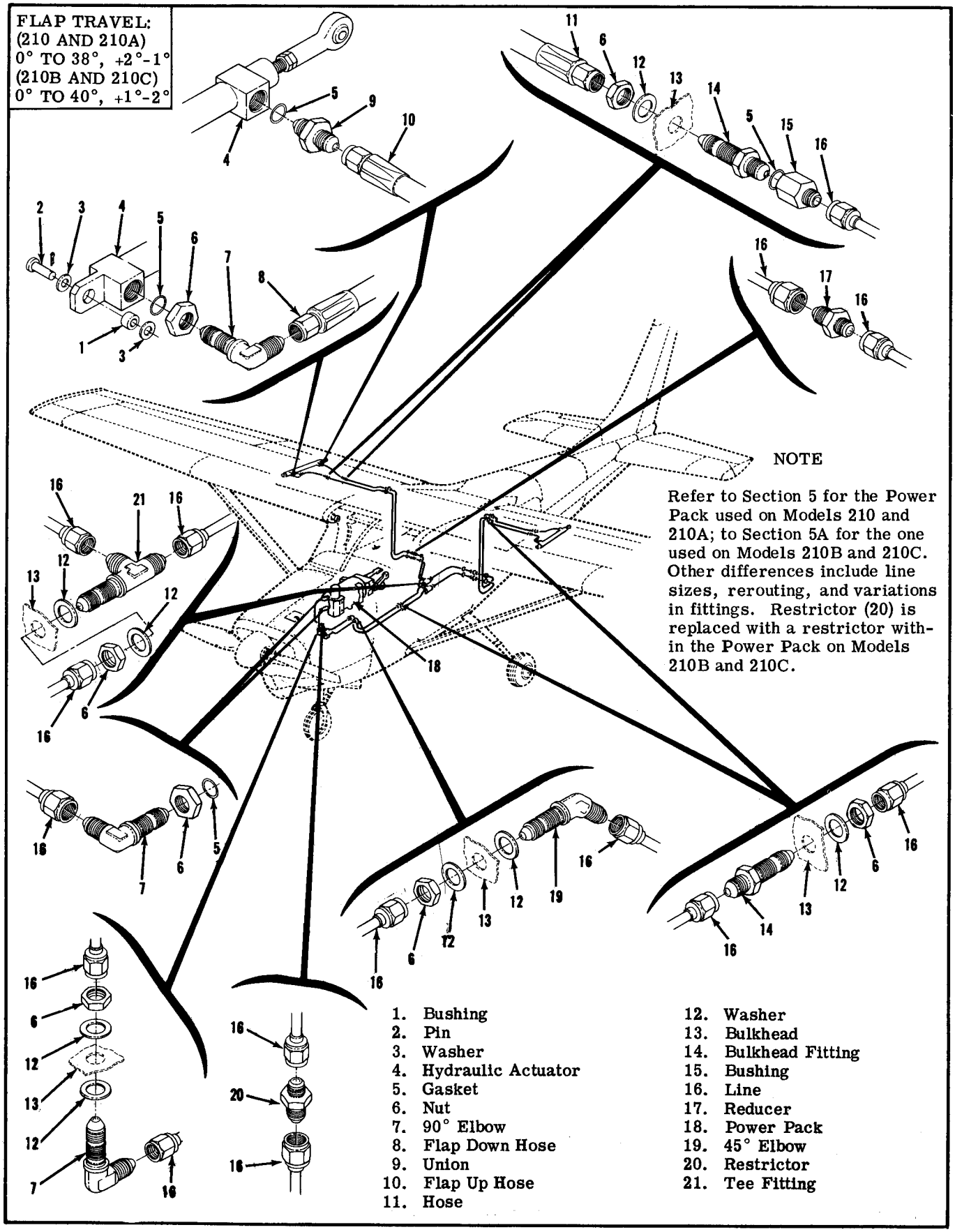
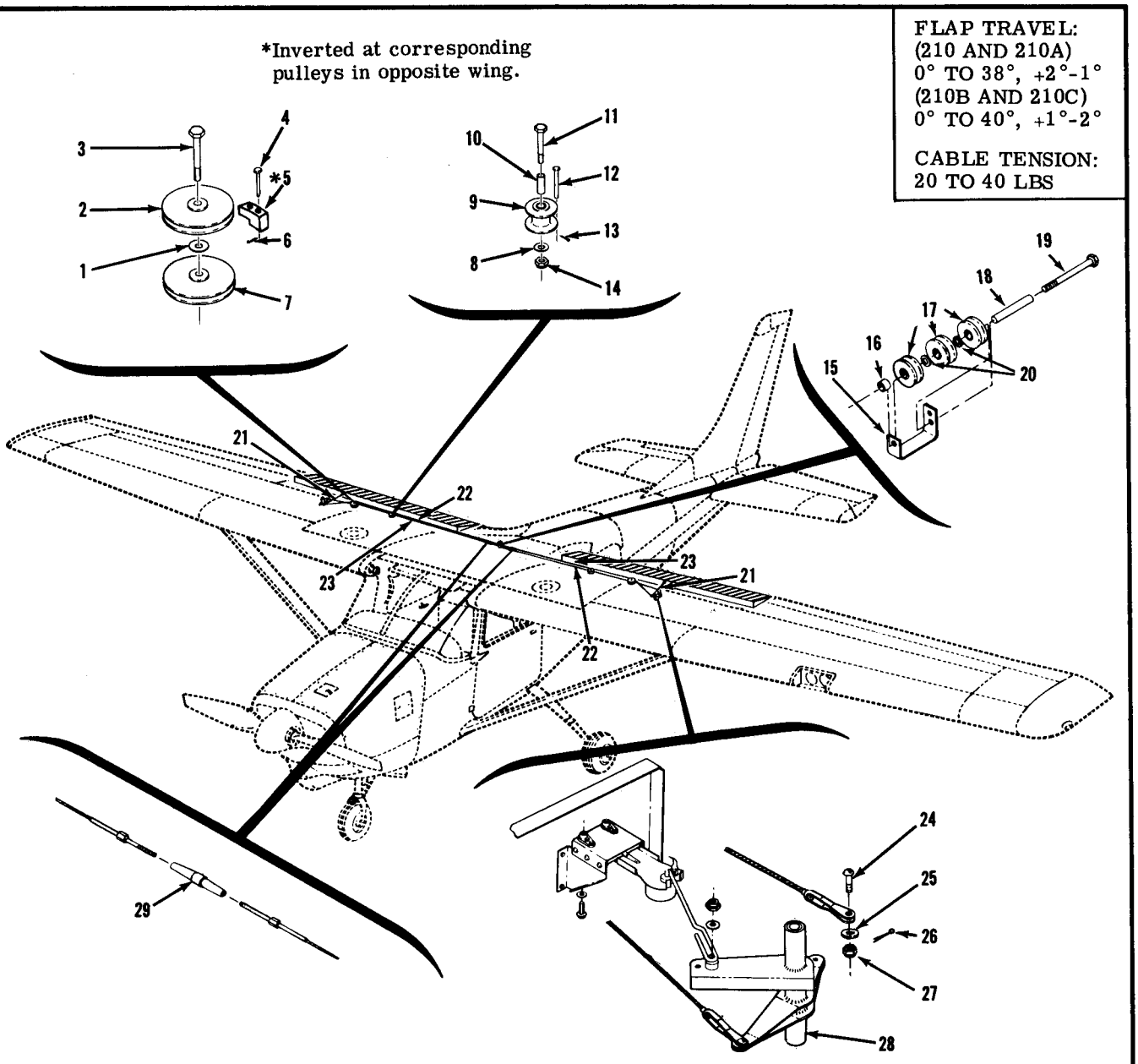
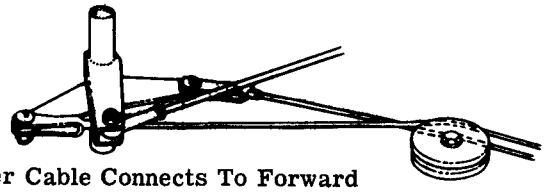


Figure 7-1. Flap Hydraulic System Components





Upper Cable Connects To Forward Bellcrank Arm In Right Wing, Aft Bellcrank Arm In Left Wing.

1. Washer
2. Pulley
3. Bolt
4. Pin
5. Guard
6. Cotter Pin
7. Pulley
8. Washer
9. Pulley
10. Bushing
11. Bolt
12. Pin
13. Cotter Pin
14. Nut
15. Cable Guard
16. Spacer
17. Pulley
18. Bushing
19. Bolt
20. Washer
21. Rod
22. Cable
23. Cable
24. Bolt
25. Washer
26. Cotter Pin
27. Nut
28. Bellcrank
29. Turnbuckle Barrel

Figure 7-2. Flap Synchronizing System

7-7. REMOVAL OF FLAP HYDRAULIC SYSTEM. (See figure 7-1.) Removal of flap hydraulic lines, fittings, and actuators may be accomplished using figure 7-1 as a guide.

7-8. REPAIR OF FLAP HYDRAULIC SYSTEM. Any worn, damaged, or defective components of the flap hydraulic system should be replaced.

7-9. INSTALLATION OF FLAP HYDRAULIC SYSTEM. (See figure 7-1.) Installation of the flap hydraulic lines, fittings, and actuators may be accomplished using figure 7-1 as a guide.

7-10. FILLING THE HYDRAULIC RESERVOIR. Refer to Section 2 for procedure on filling the hydraulic reservoir.

7-11. WING FLAP HYDRAULIC SYSTEM BLEEDING. There are two actuating cylinders in the flap hydraulic system, giving a total of four bleed points. Always apply the following rule when bleeding any actuating cylinder.

NOTE

"Bleed any actuating cylinder at the end where the piston is." The reason for this is simple. The piston, having attained its full travel, will have pushed practically all the fluid out of that end of the cylinder and back into the line now functioning as a return line. Any air that might have been in this cylinder will also have been pushed out into the return line. The air is now in the line and it will be an easy matter to bleed it from the line by disconnecting this line at the cylinder. Reverse the sequence so that this line now becomes the pressure line. Apply a very small amount of pressure and the fluid will flow from the line and expell the air with it. When nothing but clear fluid flows, stop bleeding and reconnect the line. You have now successfully bled the portion of the hydraulic system to that actuator. One more rule before attempting to bleed. Once a line has been disconnected, insure that the actuator piston remains at the full end of its travel and is not allowed to move, otherwise if it does move, it will draw air back into the cylinder and defeat your purpose.

There is only one reason to have to bleed the hydraulic system, the entrance of considerable air into the hydraulic system. The most probable means for air getting into the system are as follows:

Allowing the reservoir to become too low on fluid, where the pump begins picking up air.

Air leaks in the pump suction lines or pump.

Poor maintenance procedures when disconnecting lines, removal and installation of actuators, lines, components, etc.

To bleed the wing flap hydraulic system, the airplane need not be on jacks. The following procedure is for use with the Hydro Test connected to the hydraulic system. If a Hydro Test is not available, bleeding can be accomplished with the hand pump on the power pack. However, this is not the desired method, since it does not afford a suitable means of testing for leaks after bleeding.

NOTE

The following procedure is to bleed only the flap lines and actuating cylinders. If air has entered the power pack, accumulator, or engine hydraulic pump, refer to Section 5 and bleed those units first.

CAUTION

Do not subject any of the Model 210 hydraulic systems to a pressure of more than 2275 psi. To do so will require that all components in the system exposed to such pressure be replaced.

a. Operate wing flaps to expend all hydraulic pressure.
b. Hold wing flap handle in down position and place wing flaps manually in down position.
c. Disconnect flap up line at actuating cylinder on left hand wing.
d. Provide a suitable container for fluid to drain into.
e. Hold flap handle in up position and slowly apply pressure until fluid begins to flow at desired rate. Continue until no more air appears.
f. Stop flow and reconnect line.
g. Wipe line and actuator clean of any spilled fluid.
h. Repeat steps "c" through "g" on the right hand flap.
i. Place flaps in up position and apply 1500 psi for a period of five (5) minutes. If no leaks occur, bleeding of the flap up side of the system is complete.
j. Repeat step "a."
k. Hold wing flap handle in up position and place flaps manually in up position.
l. Disconnect flap down line at actuating cylinder on left hand wing.
m. Provide a suitable container for fluid to drain into.
n. Hold flap handle in down position and slowly apply pressure until fluid begins to flow at desired rate. Continue until no more air appears.
o. Repeat steps "f" and "g."
p. Repeat steps "l, d, n, f, and g" on right hand flap.
q. Place flap handle in down position and apply 1500 psi for a period of five (5) minutes. If no leaks occur, this completes bleeding of the flap system.

7-12. ALTERNATE FLAP BLEEDING PROCEDURE. As mentioned in the preceding paragraph the emergency hand pump on the power pack should only be used to bleed the flap hydraulic system when a Hydro Test is not available. Use the procedure contained in paragraph 7-11, except omit the steps referring to pressure testing for leaks. It is recommended that after bleeding in this manner, all connections be checked for leaks after ground operating the flaps several times using the engine-driven hydraulic pump.

NOTE

Remember to replenish the hydraulic fluid in the reservoir often when using the power pack hand pump for bleeding purposes.

7-13. RIGGING THE FLAP CONTROL SYSTEM. (See figure 7-3.)

a. Hold the flap control lever down and operate the hand pump until the flaps are almost down, then remove the bolts to disconnect hydraulic system and synchronizing system from both flaps. Pull the flaps completely down.

b. Place the rod ends where they will not damage the flaps, then again operate the system with the hand pump to extend the actuating cylinder piston rods fully.

c. Release the flap control lever to trap fluid under pressure against the extended rods. Adjust the piston rod ends so that the attaching bolts will pass freely through the rod ends and the flap brackets while the flaps are down. Do not cause the flap rollers to load hard against the down ends of the flap tracks.

d. Attach the synchronizing system push-pull rods and the actuating cylinder piston rods to each flap bracket with the parts illustrated. Hold the flap control lever up and slowly apply pressure with the hand pump to retract the flaps. Check that flap rollers reach the ends of the flap tracks just before actuating cylinder pistons bottom out. The rollers should load against the ends of the flap tracks in the retracted position, but the actuator pistons should bottom out without deforming wing or flap skins.

NOTE

Adjusting the actuating cylinder piston rod ends will necessitate readjustment of the synchronizing system push-pull rod ends. Refer to figure 7-4 for this adjustment.

e. After rigging, check that the flaps operate freely and attain full travel.

NOTE

An inclinometer for measuring control surface travels is available from the Cessna Spare Parts Department. Refer to figure 6-10.

f. Be sure that all lock nuts are tight, all rod ends have sufficient thread engagement (a check hole is provided on the rod end shank), and all attaching parts are secure. Refer to paragraph 7-22 for flap position transmitter adjustment.

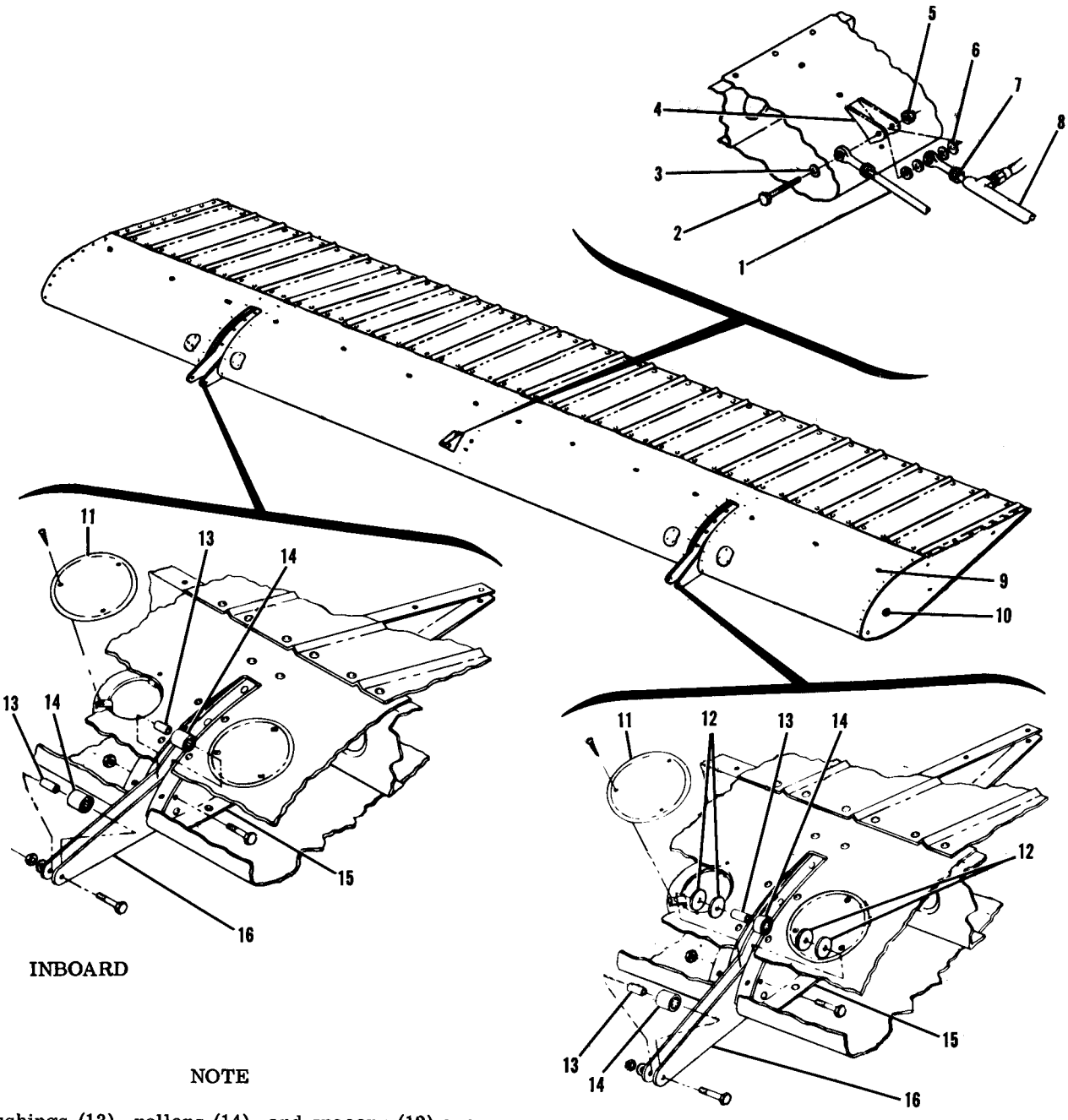
7-14. REMOVAL OF FLAP SYNCHRONIZING SYSTEM. (See figure 7-2.) Removal of cables and pulleys in the flap synchronizing system may be accomplished using figure 7-2 as a guide.

7-15. REPAIR OF FLAP SYNCHRONIZING SYSTEM. Any worn, damaged, or defective components of the flap synchronizing system should be replaced.

7-16. INSTALLATION OF FLAP SYNCHRONIZING SYSTEM. Installation of pulleys and bellcranks in the flap synchronizing system may be accomplished using figure 7-2 as a guide. Install and route the cables as follows:

a. Connect cable to forward end of right flap bellcrank. Route this cable through groove in aft side of upper pulley, in front of spacer pulley, and into the cabin top, where the forward pulley is used. From the forward pulley, route the cable into the left wing, in front of spacer pulley, through the groove in the aft side of upper pulley, and connect it to the aft end of the left flap bellcrank.

b. Connect the remaining cable to the aft end of the right flap bellcrank. Route this cable through the lower pulley, aft of spacer pulley, and into the cabin top, where the middle pulley is used. From the middle pulley, route the cable into the left wing, aft of spacer pulley, through the lower pulley, and connect it to the forward end of the left flap bellcrank.



NOTE

Bushings (13), rollers (14), and spacers (12) are first positioned through slots in flap tracks, then are secured to the flap roller supports with attaching bolts, washers, and nuts. Nylon plug buttons (9) prevent wing flap from chafing wing trailing edge.

1. Synchronizing Rod
2. Bolt
3. Washer
4. Bracket
5. Nut
6. Washer
7. Rod End
8. Hydraulic Actuator
9. Nylon Plug Button
10. Plug Button
11. Cover Plate
12. Spacer
13. Bushing
14. Roller
15. Rib Assembly
16. Roller Support

Figure 7-3. Wing Flap Installation

7-17. RIGGING THE FLAP SYNCHRONIZING SYSTEM. (See figure 7-2.) The flap hydraulic system rigging must be correct before rigging the flap synchronizing system. Since both systems are attached to each flap with the same bolts, any change in one system will affect the other.

a. Hold the flap control lever up and use the hand pump to make sure the flaps are retracted fully, then release the control lever to trap pressure in the flaps up system.

b. Loosen cables (22 and 23) at turnbuckles (29).

c. Adjust both flap synchronizing system push-pull rods to attain .69 inch clearance as shown in figure 7-4. Tighten the rod end lock nuts after checking for sufficient thread engagement, and reconnect.

d. Tighten turnbuckles (29) evenly to obtain approximately 30 pounds tension on each cable. Safety the turnbuckles and operate the flaps, checking cable tension at various flap positions. Cable tension must be not less than 20 pounds nor more than 40 pounds in any flap position.

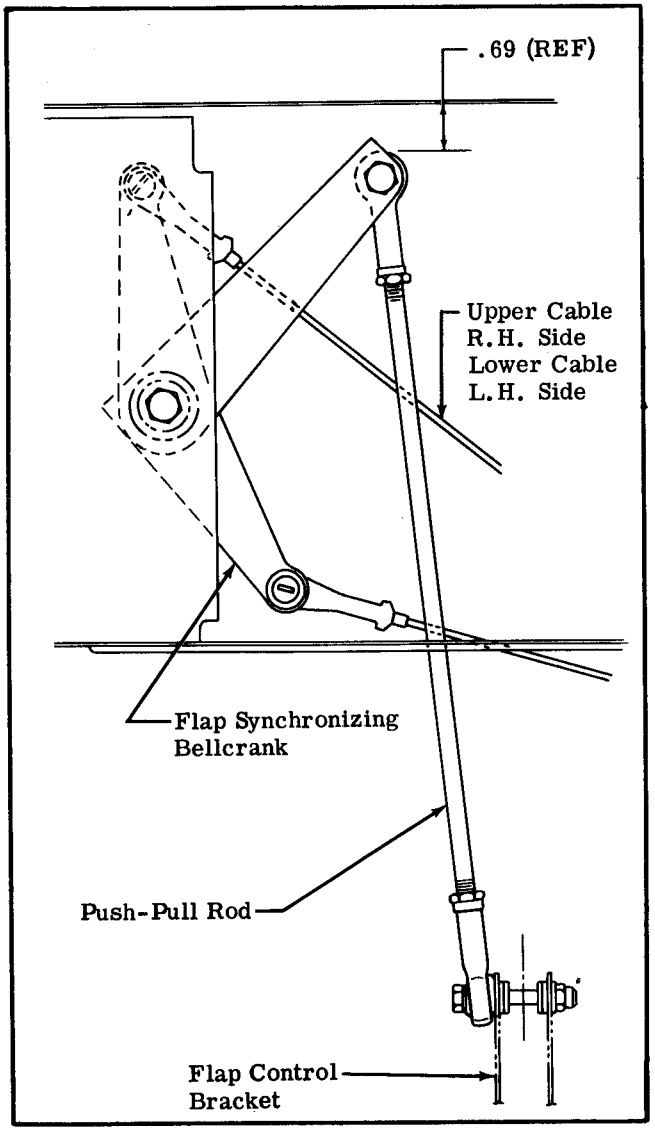


Figure 7-4. Synchronizing Adjustment

e. Check that rigging has not disturbed flap position transmitter adjustment. If necessary, readjust in accordance with paragraph 7-22 to make the indicating system agree with flap position.

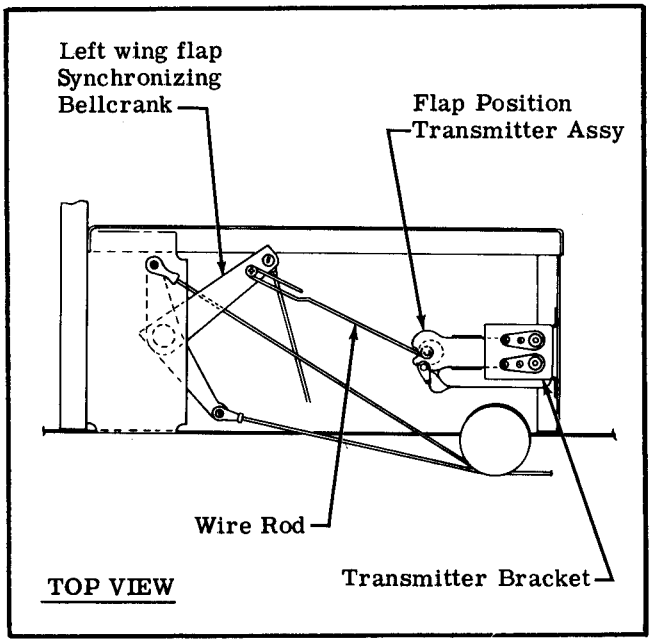


Figure 7-5. Flap Position Transmitter

7-18. REMOVAL OF FLAP. (See figure 7-3.)

a. Lower the flaps. (The flaps may be lowered by use of the emergency hand pump.)

b. Disconnect synchronizing rod (1) and hydraulic actuator (8) from bracket (4) by removing bolt (2).

c. Open access covers and remove the rear flap roller assemblies.

d. Remove the forward flap rollers (14) by removing attaching bolts from supports (16).

7-19. REPAIR OF FLAP. Repair of a damaged flap may be accomplished in accordance with instructions contained in Section 19.

7-20. INSTALLATION OF FLAP. (See figure 7-3.) To install the wing flaps reverse the procedure as outlined in paragraph 7-18.

7-21. FLAP POSITION TRANSMITTER. The flap position transmitter is mounted on a bracket in the left wing. The transmitter, basically a rheostat, is operated by a mechanical connection to the flap synchronizing bellcrank. A flap position indicator, located in the instrument panel, receives an electrical signal from the transmitter and indicates flap position from 0 to 40 degrees.

7-22. FLAP POSITION TRANSMITTER ADJUSTMENT. (See figure 7-5.) Elongated holes, where the transmitter assembly attaches to the transmitter bracket, are provided for minor adjustment. Also, the wire rod which connects the transmitter to the flap synchronizing bellcrank may be bent slightly for minor adjustment. The transmitter is factory calibrated and should be replaced if error is excessive.

SECTION 7A

ELECTRIC FLAP CONTROL SYSTEMS

NOTE

SEE SECTION 7 FOR HYDRAULIC FLAP CONTROL SYSTEMS

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7A-1. FLAP CONTROL SYSTEMS.

7A-2. Electrically operated wing flaps are used on all Models 205 and 206, and on the Model 210 beginning with the 210D. An electric motor and transmission assembly, located in the right wing is connected to the right flap drive pulley which operates the flap control system. The Model 210D and on, and the Model 206 series, are equipped with larger span flaps than the Model 205 series, and these flaps require an extra set of flap tracks and two interconnected bellcranks operating two push-pull rods at each flap. The systems are illustrated in figures 7A-1 and 7A-2.

CAUTION

Prior to the Serial No. 206-0196, the front cargo door must be either in full open or full closed position before operating wing flaps, or damage will result. All other airplanes with cargo doors contain a flap interrupt switch, mounted on the front cargo door frame, which prevents flap operation while the front cargo door is open. As noted in Service Letter 65-1, the switch and electrical wiring may be installed on earlier serials. If the airplane is operated with cargo doors removed, a spoiler kit (AK206-1) must be installed. The kit contains a switch depressor to retain use of the flaps.

7A-3. OPERATIONAL CHECKOUT OF FLAP CONTROL SYSTEM.

a. Operate flaps through full range of travel, observing for uneven or jumpy motion, binding and lost motion in system. Make sure flaps are moving together through full range of travel.

b. Deliberately overrun motor at each end of stroke to make sure transmission is free wheeling.

c. Check to see that flaps are not sluggish in operation. In flight at 100 mph, indicated airspeed, the flaps should take approximately 8.7 seconds to extend and 7.6 seconds to retract. On the ground with engine running, the flaps take approximately 6.5 seconds to extend or retract.

d. Raise flaps and check to see that they are completely up. Check flap position indicator to see that it reads 0°. Mount an inclinometer on one flap and set to 0°.

e. Lower flaps to extreme down position and check flap down angle with inclinometer. Down angle is 40°+1°-2°.

f. Open the flap drive pulley and bellcrank access openings and attempt to rock pulley or bellcrank to disclose internal bearing play.

g. Examine rollers and tracks for defective parts.

7A-4. TROUBLE SHOOTING THE FLAP CONTROL SYSTEM.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
BOTH FLAPS FAIL TO MOVE.		
Popped circuit breaker.	Check circuit breaker.	Reset circuit breaker.
Defective switch.	Place jumper across switch.	Replace switch.
Defective motor.	Remove and bench test motor.	Replace motor.
Broken or disconnected wires.	Run continuity check of wiring.	Connect or repair wiring.
Defective or disconnected transmission.	Check to see transmission is connected to flap system. If connected, remove for bench test.	Connect or replace transmission.
Defective flap interrupt switch (used with cargo doors).	Check continuity.	Replace switch.
LEFT FLAP FAILS TO MOVE.		
Disconnected or broken cable.	Check cable tensions.	Connect or replace cable.
Disconnected push-pull rod.	Check push-pull rod attachment.	Attach push-pull rod.
BINDING IN SYSTEM AS FLAPS ARE RAISED AND LOWERED.		
Cables not riding on pulleys.	Open access covers and observe pulleys.	Route cables correctly over pulleys.
Broken or binding pulleys.	Check pulleys for free rotation or breaks.	Replace defective pulleys.
Frayed cable.	Check condition of cables.	Replace defective cable.
Bind in drive pulleys.	Check drive pulleys in motion.	Replace drive pulley.
Flaps binding on tracks.	Observe flap tracks and rollers.	Replace defective parts.
INCORRECT FLAP TRAVEL.		
Incorrect rigging.		Rig flaps correctly.

SHOP NOTES:

7A-5. REMOVAL, INSTALLATION, AND ADJUSTMENT OF FLAP POSITION TRANSMITTER. (See figure 7A-1.)

a. Remove access covers from bottom of right wing below right drive pulley (6).

b. Remove two bolts (10) which secure flap position transmitter (11).

c. Remove cotter pin (14) and pin (13) which secure wire rod (12) to arm (15).

d. Disconnect two wires at the quick-disconnects and remove the transmitter from the wing.

e. Installation of flap position transmitter may be accomplished by reversing the steps listed above, after which it should be adjusted as described in paragraph 7A-11. Reinstall all parts removed for access.

7A-6. REMOVAL, REPAIR, AND INSTALLATION OF MOTOR AND TRANSMISSION ASSEMBLY. (See figure 7A-1.)

a. Transmission (3), motor (1), tube (4), and hinge (2) are removed as one assembly if standard fuel tanks are installed. With long range tanks installed, it is necessary to detach the assembly from hinge (2) before removing motor and transmission from wing and to attach them to the hinge after positioning them in wing.

b. Remove access covers from bottom of right wing under drive pulley and motor assembly.

c. Remove bolt securing tube (4) to drive pulley (6).

d. Remove bolt securing hinge (2) to the wing, or if long range fuel tanks are installed, remove bolt securing transmission to the hinge.

e. Disconnect electrical wires at quick-disconnects and remove screw securing ground wire. Remove assembly from wing.

f. Repair of the transmission and motor assembly consists of replacement of the motor (1), transmission (3) or tube (4). Bearings in hinge (2) may be replaced.

g. Installation may be accomplished by reversing the preceding steps and rigging the flap control system in accordance with paragraph 7A-11 or paragraph 7A-12.

7A-7. REMOVAL, REPAIR, AND INSTALLATION OF DRIVE PULLEYS. (See figure 7A-1.)

NOTE

The right drive pulley (6) must be removed to detach flap position transmitter arm (15) from the drive pulley assembly.

a. Remove access covers under right drive pulley.

b. Remove the bolts securing push-pull rod (7) to drive pulley (6) and lower flap gently. On the Model 206 series and on the Model 210 series beginning with the 210D, also disconnect the outboard push-pull rods from the outboard bellcranks.

c. Remove bolt securing tube (4) to drive pulley (6).

d. Remove pin (13) to disconnect flap position transmitter rod (12) from arm (15).

e. Loosen turnbuckles (21 and 23) and detach cables (8 and 9) from drive pulley by removing bolts and pins.

f. Remove bolt securing drive pulley (6) to wing and remove drive pulley. On the Model 206 series and on the Model 210 series beginning with the 210D, also remove bolt attaching synchronizing push-pull tube (2, figure 7A-2) to the drive pulley.

g. To remove a left drive pulley, use this same procedure, omitting steps "c" and "d," for the left side.

h. Repair of drive pulleys is limited to replacement of needle bearings.

i. Installation may be accomplished by reversing the preceding steps and rigging per paragraph 7A-11 or 7A-12. Cables may be attached to drive pulleys before installing them in the wings.

NOTE

Transmitter arm (15) must be attached to right drive pulley (6) before installing the drive pulley.

7A-8. REMOVAL, REPAIR, AND INSTALLATION OF OUTBOARD BELLCRANKS – MODEL 206 SERIES, AND 210D AND ON. (See figure 7A-2.)

a. Remove access covers under outboard bellcranks.

b. Remove bolt securing outboard push-pull rod (7) to bellcrank (17). Also remove bolt attaching inboard push-pull rod (7) to drive pulley (6). Lower flap gently.

c. Remove bolt attaching synchronizing push-pull tube (2) to bellcrank (17).

NOTE

To remove synchronizing push-pull tube (2), disconnect it at both ends and position it through lightening holes until it can be removed through the access hole.

d. Remove bellcrank pivot bolt and remove bellcrank through access hole.

e. Repair of bellcranks is limited to replacement of needle bearings.

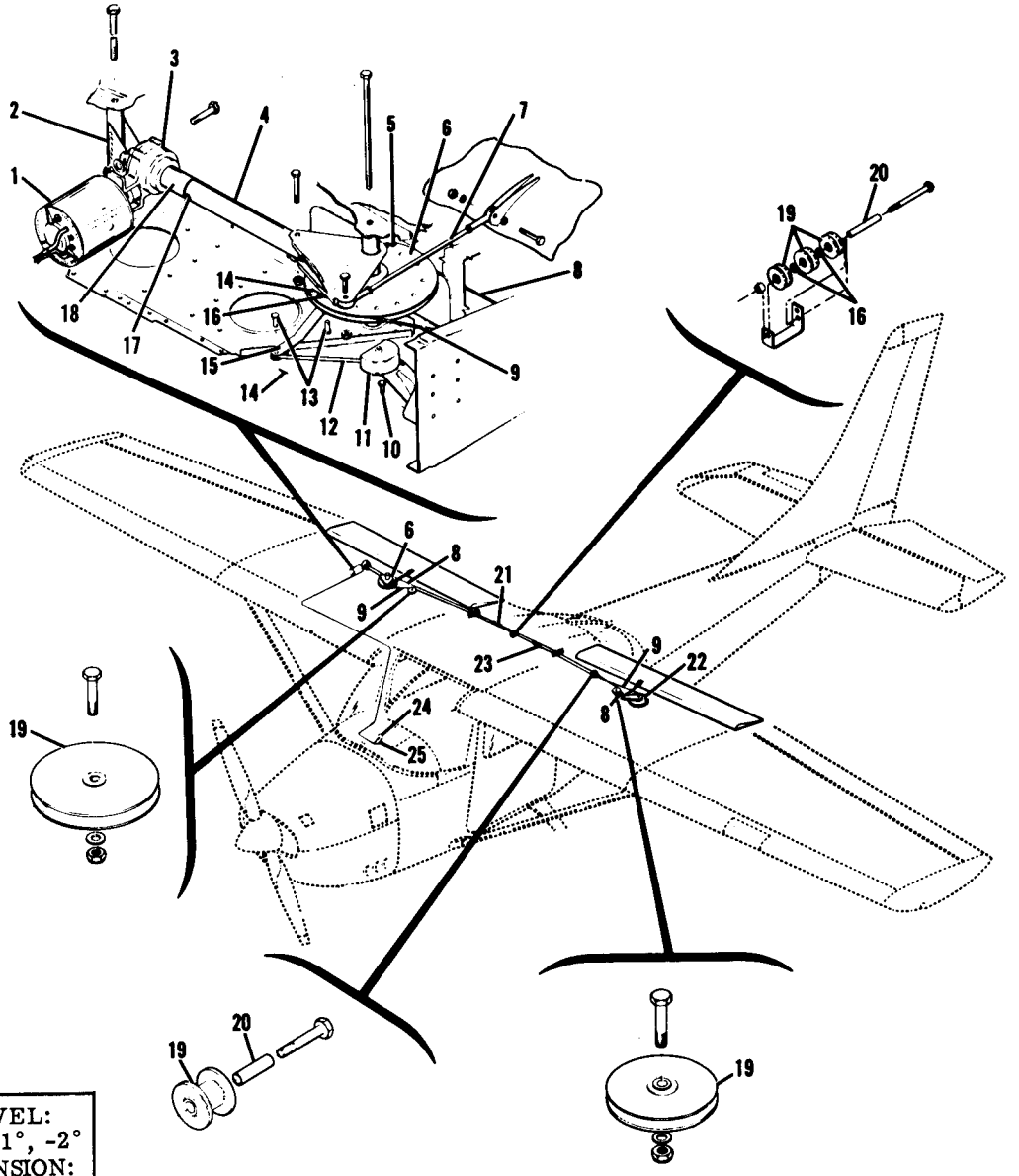
f. Installation may be accomplished by reversing the preceding steps and rigging per paragraph 7A-12.

7A-9. REPLACEMENT OF FLAP CABLES AND PULLEYS may be accomplished while using figure 7A-1 or 7A-2 as a guide. Refer to paragraph 7A-11 or 7A-12 for proper cable attachment.

NOTE

To ease rerouting of cables, a length of wire may be attached to the end of the cable before it is withdrawn from the aircraft. Leave the wire in place, routed through the structure; then attach it to the new cable and use it to pull cable into place.

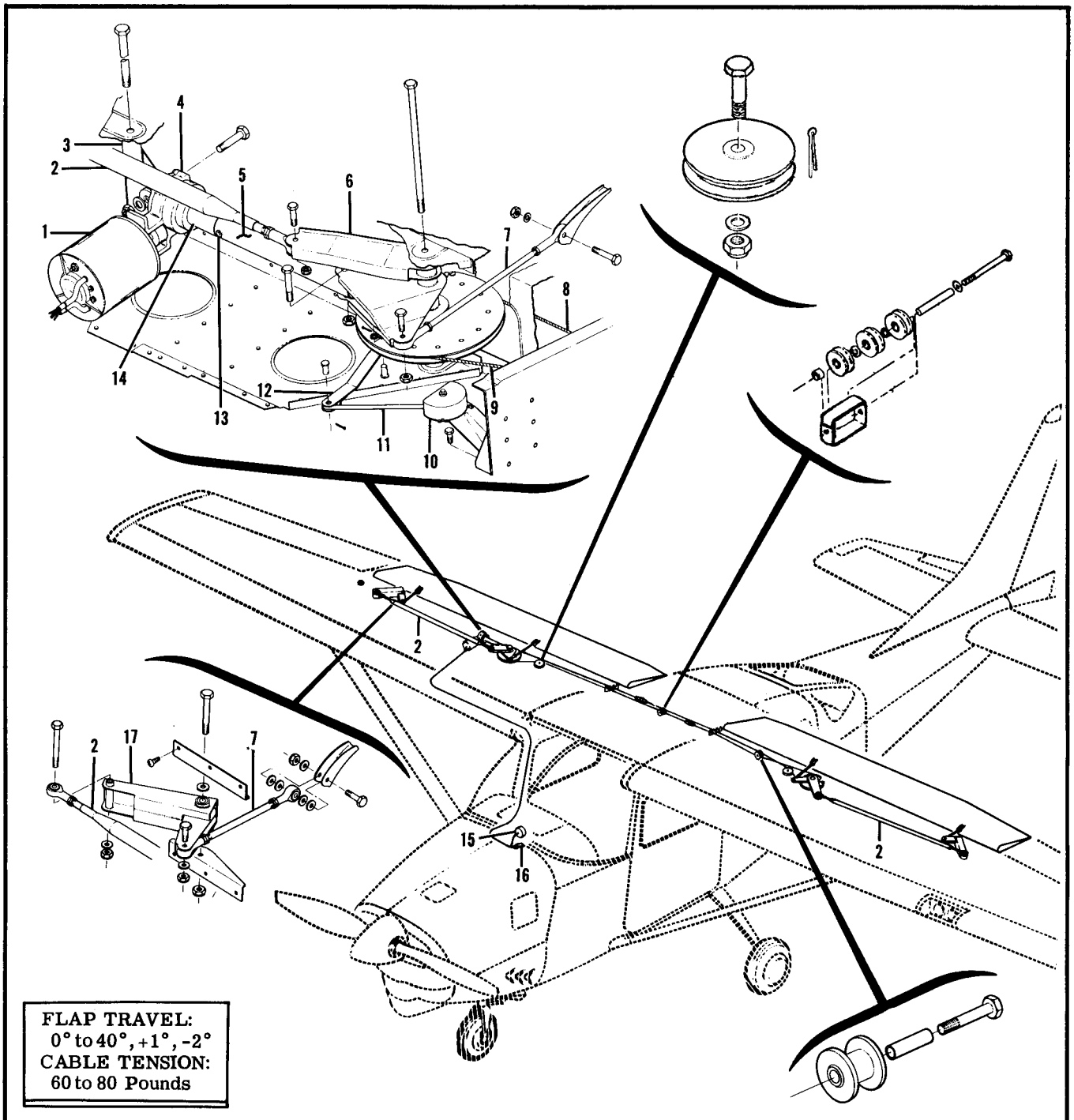
7A-10. REMOVAL, REPAIR, AND INSTALLATION OF FLAPS. Figures 7A-3 and 7A-4 show details of flap installations and may be used as guides during removal and installation of the flaps. If flap push-pull rod adjustment is not disturbed, it should not be necessary to rerig the flap system. Check flap



FLAP TRAVEL:
0° to 40°, +1°, -2°
CABLE TENSION:
20 to 40 Pounds

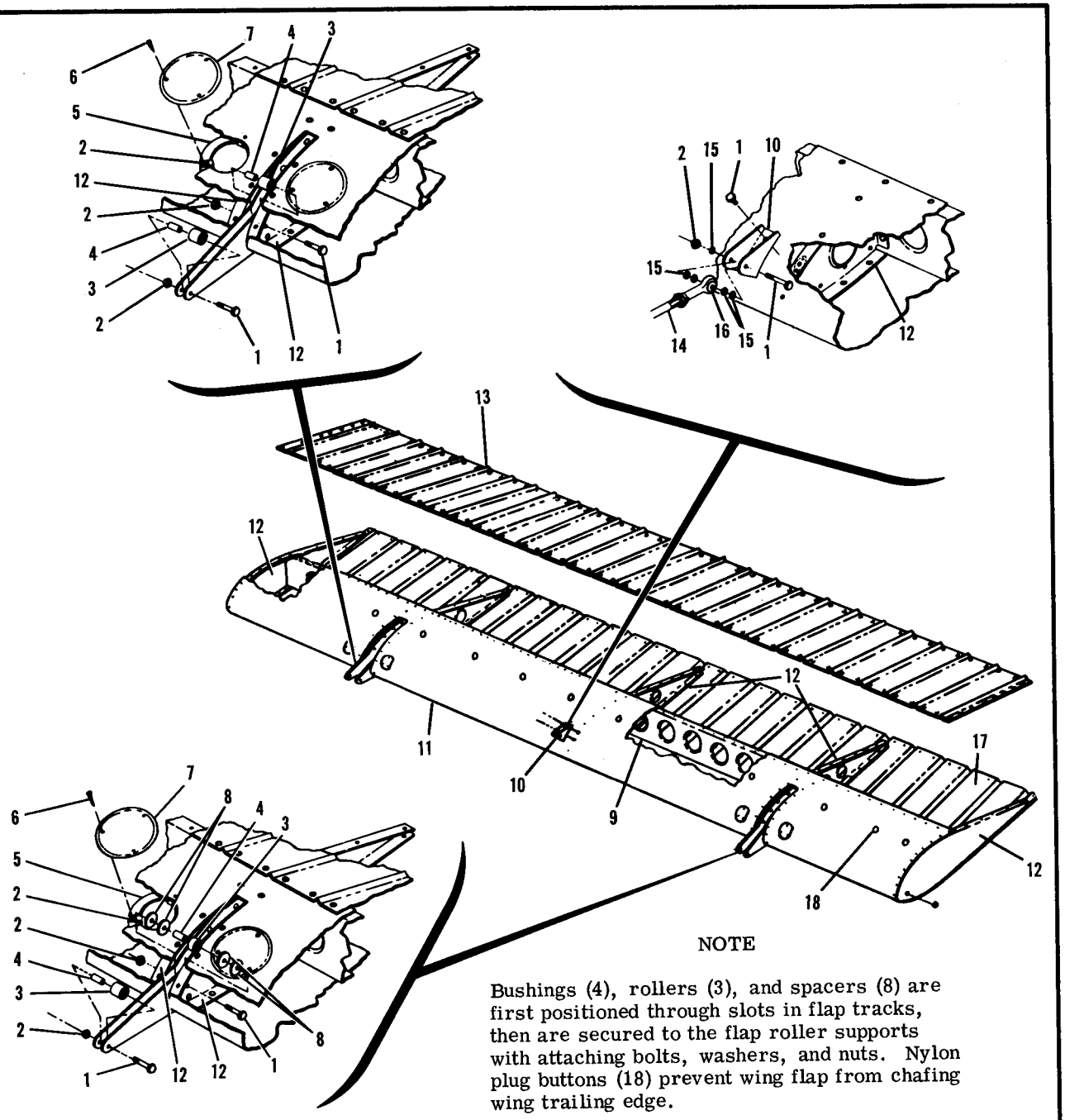
1. Motor
2. Hinge Assembly
3. Transmission
4. Tube Assembly
5. Bolt
6. Drive Pulley Assembly
7. Push-Pull Rod
8. Direct Cable
9. Retract Cable
10. Bolt
11. Flap Position Transmitter
12. Wire Rod
13. Pin
14. Cotter Pin
15. Flap Transmitter Arm
16. Washer
17. Set Screw
18. Nut and Ball Assembly
19. Pulley
20. Bushing
21. Turnbuckle
22. Drive Pulley Assembly
23. Turnbuckle
24. Flap Position Indicator
25. Flap Switch

7A-1. Flap Control System (Model 205 Series)



1. Flap Motor
2. Synchronizing Push-Pull Tube
3. Flap Motor Hinge
4. Transmission
5. Flap Motor Actuating Tube
6. Drive Pulley Assembly
7. Push-Pull Rod
8. Direct Cable
9. Retract Cable
10. Flap Position Transmitter
11. Wire Rod
12. Flap Position Transmitter Arm
13. Set Screw
14. Nut And Ball Assembly
15. Flap Position Indicator
16. Flap Switch
17. Bellcrank

Figure 7A-2. Flap Control System (Model 206 Series and Model 210D & On)

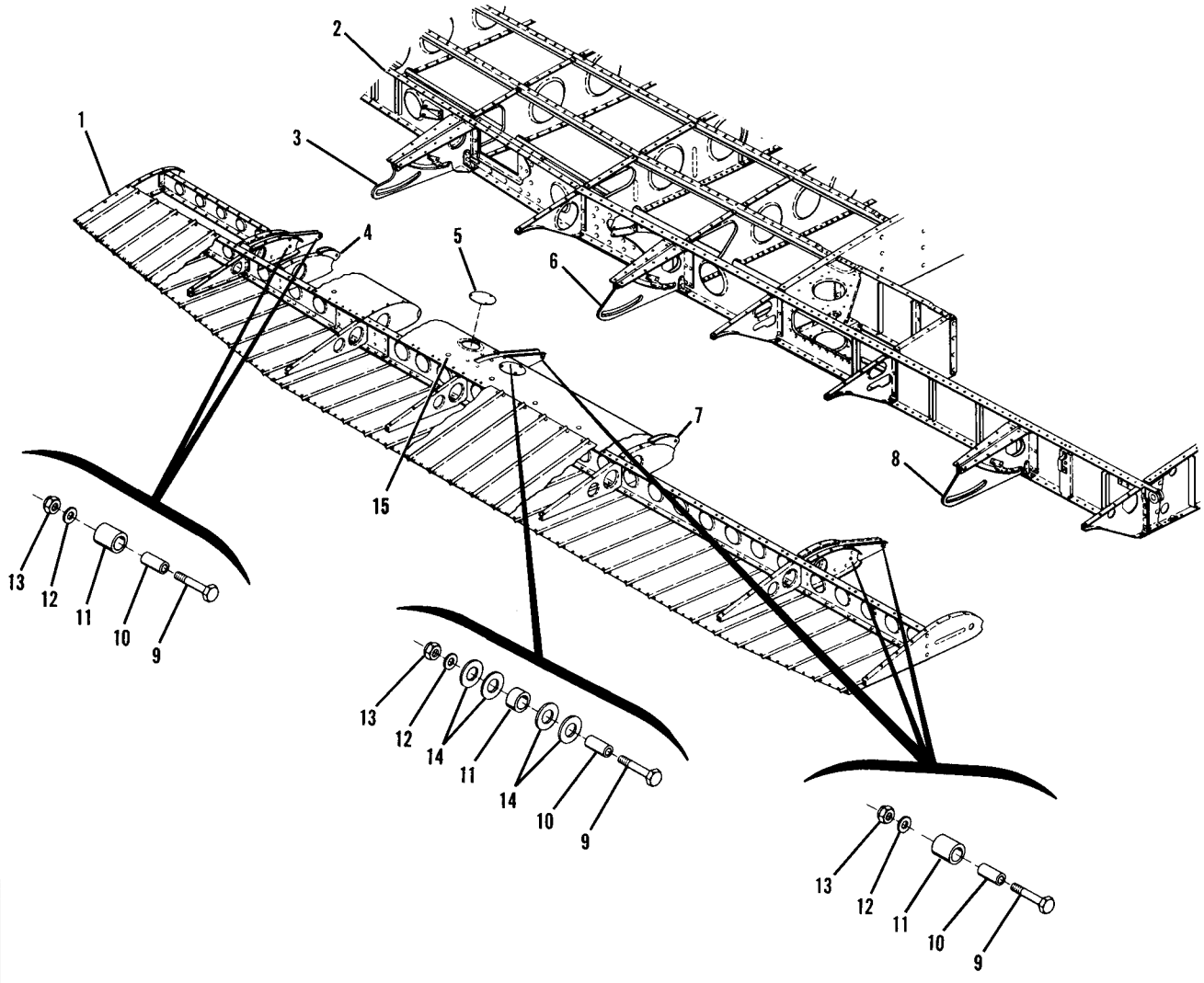


NOTE

Bushings (4), rollers (3), and spacers (8) are first positioned through slots in flap tracks, then are secured to the flap roller supports with attaching bolts, washers, and nuts. Nylon plug buttons (18) prevent wing flap from chafing wing trailing edge.

1. Bolt
2. Nut
3. Roller
4. Bushing
5. Doubler
6. Screw
7. Cover Plate
8. Spacer
9. Spar
10. Bracket
11. Leading Edge Skin
12. Rib
13. Upper Skin
14. Push-Pull Rod
15. Washer
16. Rod End
17. Lower Skin
18. Plug Button

Figure 7A-3. Flap Installation (Model 205 Series)



NOTE

Bushings (10), rollers (11), and spacers (14) are first positioned through slots in flap tracks, then are secured to the flap roller supports with attaching bolts, washers, and nuts. Nylon plug buttons (15) prevent wing flap from chafing wing trailing edge.

Beginning with Serial No. P206-0037, U206-0327, and 21058553, stiffeners are installed along the flap trailing edges.

1. Wing Flap
2. Wing Structure
3. Outboard Flap Track
4. Outboard Actuating Bracket
5. Access Cover
6. Center Flap Track
7. Inboard Actuating Bracket
8. Inboard Flap Track
9. Bolt
10. Bushing
11. Roller
12. Washer
13. Nut
14. Spacer
15. Nylon Plug Buttons

Figure 7A-4. Flap Installation (Model 206 Series and 210D & On)

travel and rerig if necessary. Repair of a damaged flap may be accomplished in accordance with instructions contained in Section 19.

7A-11. RIGGING FLAP CONTROL SYSTEM — MODEL 205 SERIES. (See figure 7A-1.)

NOTE

Before using this procedure, disconnect flap cables at turnbuckles above cabin headliner, disconnect flap push-pull rods at drive pulleys in both wings, and disconnect tube (4) from drive pulley (6).

a. If cables are not connected to drive pulleys, tube (4), left and right push-pull rods (7), and the flap transmitter arm must be disconnected before installing the cables. If drive pulleys are not installed, attach cables before installing drive pulleys in wings.
b. Connect the 3/32" retract cable (9) to forward side of the right drive pulley (6) and to aft side of left drive pulley (22).
c. Connect the 1/8" direct cable (8) to aft side of right flap drive pulley (6) and to forward side of left drive pulley (22).
d. Connect flap position transmitter rod (12) to right flap drive pulley arm (15).
e. Adjust push-pull rods (7) to 8 11/16 ± 1/8 inches between center of rod end bearings and tighten jam nuts on both ends. Install push-pull rods on flaps and on drive pulleys (6 and 22).

NOTE

Temporarily connect the flap cables at turnbuckles above cabin headliner, and test flaps by hand to see that flaps extend together. If they will not, cables are incorrectly attached to drive pulleys. Also see that right drive pulley rotates clockwise, when viewed from below, as flaps are lowered. Disconnect turnbuckles above cabin headliner again.

f. Using care not to cause damage, run flap motor to fully retract actuating tube (4) on motor (full up position).
g. Loosen set screw (17) and while manually holding right flap full up, rotate nut and ball assembly (18) in or out as required to align tube (4) with attaching hole in drive pulley, tighten set screw and attach tube to drive pulley.

NOTE

Apply Loctite Sealant Grade C (American Sealant Co., Hartford 11, Conn.) to threads of set screw (17) after final adjustments have been made.

h. If tube (4) does not retract enough to connect to the right drive pulley with flap full up, disconnect push-pull rod at flap drive pulley and connect tube (4) to flap drive pulley.
i. With flap motor full up, manually hold right flap up and readjust push-pull rod to align with attaching hole in drive pulley. Connect push-pull rod and tighten lock nuts.

NOTE

The right flap and motor must be correctly rigged before the flap cables and left flap can be rigged.

j. Operate flap motor to place right flap full up, manually hold left flap full up and connect flap cables at turnbuckles above headliner.
k. With flaps full up tighten flap cable turnbuckles to obtain 30±10 pounds cable tension on each cable. Adjust retract (3/32 inch) cable first.

NOTE

When tightening cable turnbuckles be sure the cables are in the pulley grooves and cable ends are correctly positioned at the drive pulleys.

l. Disconnect push-pull rod at left drive pulley. Run motor to extend flaps approximately 20° and check tension on each flap cable. If necessary readjust turnbuckles to maintain 30±10 pounds cable tension on each cable and safety turnbuckles.

NOTE

Rig cable tension to the average temperature for the area.

m. Fully retract right flap. Manually holding left flap up, readjust left push-pull rod to align with attaching hole in left drive pulley and connect push-pull rod to drive pulley. Tighten locknuts.
n. With flaps up, mount an inclinometer on right flap and set to 0°. Fully extend flaps and check flap down angle. See figure 7A-1 for wing flap travel. Repeat check on left flap.

NOTE

Since flap rollers may not bottom in flap tracks with flaps fully extended, some free play may be noticed in this position.

o. Raise flaps to full up position and adjust flap position transmitter to make indicator read 0°. Slotted holes in the transmitter bracket are provided for adjustment. If necessary, transmitter rod may be formed slightly for additional adjustment.
p. Perform an operational checkout of the flap control system, check all locknuts for tightness, check that all turnbuckles are safetied, and install all parts removed for access.

NOTE

An inclinometer for measuring control surface travel is available from the Cessna Spare Parts Department. (See figure 6-10.)

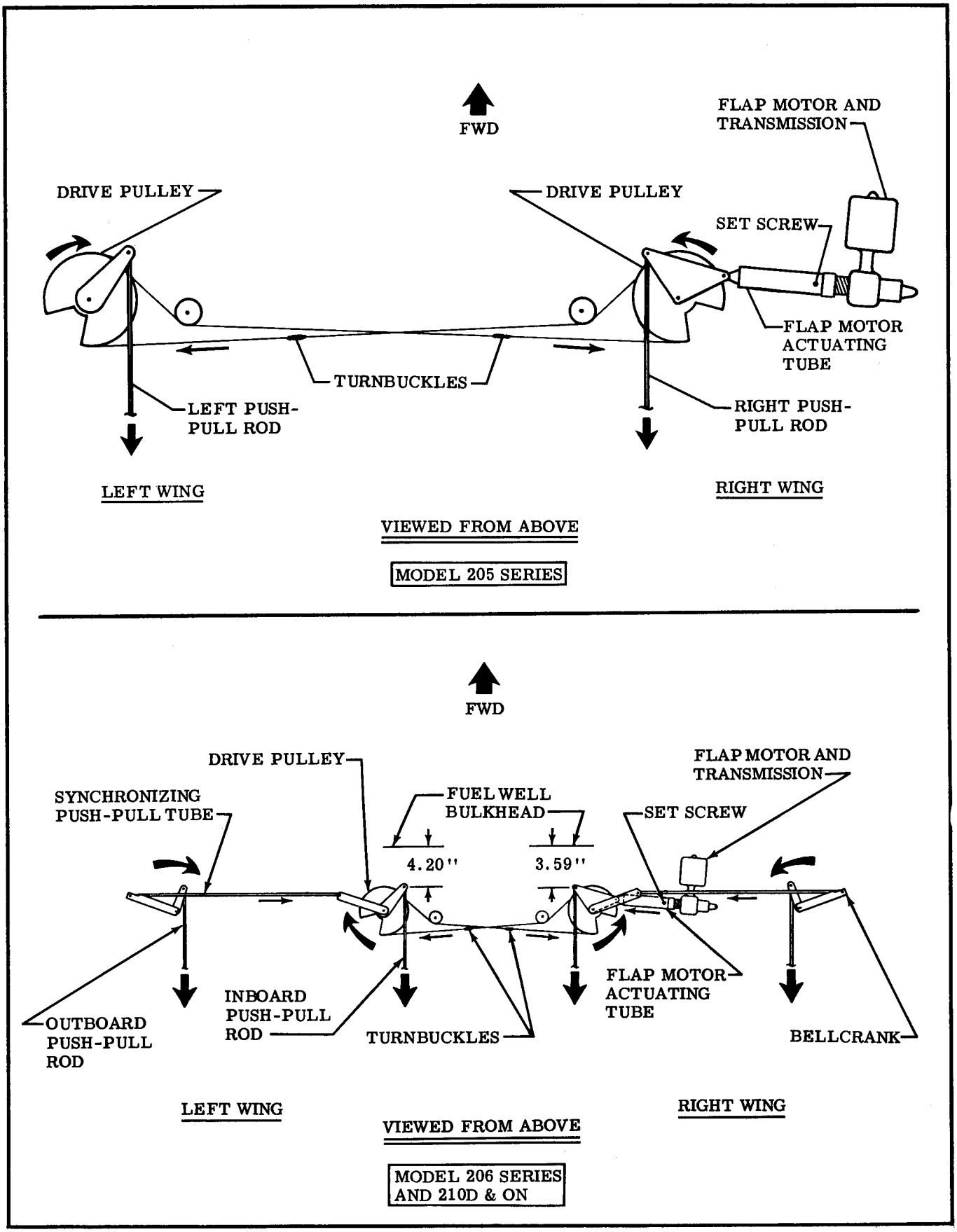


Figure 7A-5. Flap System Schematics

7A-12. RIGGING FLAP CONTROL SYSTEM -- MODEL 206 SERIES AND MODEL 210D AND ON. (See figure 7A-2.)

NOTE

Before using this procedure, disconnect flap cables at turnbuckles above cabin headliner, and disconnect flap push-pull rods at drive pulleys and bellcranks in both wings.

a. If cables are not connected to drive pulleys, it is necessary to disconnect parts attached to each drive pulley so it may be rotated beyond its normal range of travel to permit cable attachment. If drive pulleys are not installed, attach cables before installing the drive pulleys in the wings.
b. The 3/32" retract cable connects to the forward side of the right hand drive pulley and to the aft side of the left hand drive pulley.
c. The 1/8" direct cable connects to the aft side of the right hand drive pulley and to the forward side of the left hand drive pulley.
d. Adjust synchronizing push-pull tube in right wing to 48.69" between centers of rod end holes, tighten jam nuts, and install. If outboard bellcrank is not installed, the tube and bellcrank must be positioned in the wing and the tube attached to the bellcrank before the bellcrank is installed.
e. Using care not to cause damage, run flap motor to fully retract actuating tube (5) on motor (full up position). Loosen set screw (13) and rotate nut and ball assembly (14) in or out as required to position right flap drive pulley so that centerline of bolt hole for flap inboard push-pull rod attachment is 3.95 inches aft of the fuel well bulkhead. Tighten set screw (13).

NOTE

Apply Loctite Sealant Grade C (American Sealant Co., Hartford 11, Conn.) to threads of set screw (13) after final adjustments have been made.

f. Manually holding right flap full up, adjust right inboard push-pull rod to align with attaching holes, and install the push-pull rod. Tighten push-pull rod end locknut.
g. Repeat step "f" for the right outboard push-pull rod.

NOTE

The right wing flap and motor must be correctly rigged before the flap cables and left wing flap can be rigged.

h. Adjust synchronizing push-pull tube in the left wing to 48.69 inches between centers of rod end holes, tighten lock nut, and install tube. If outboard bellcrank is not installed, the tube and bellcrank must be positioned in the wing and the tube attached to the bellcrank before the bellcrank is installed.
i. Connect flap cables at turnbuckles above cabin headliner. Adjust turnbuckles to position left wing flap drive pulley so the centerline of the bolt hole for flap inboard push-pull rod attachment is 4.20 inches aft of the fuel well bulkhead, maintaining 70± 10 pounds cable tension.

NOTE

When tightening cable turnbuckles be sure the cables are in the pulley grooves and cable ends are correctly positioned at the drive pulleys. Rig cable tension to the average temperature for the area.

j. Manually holding left wing flap up, adjust left inboard push-pull rod to align with attaching holes and install the push-pull rod. Tighten push-pull rod end lock nut.
k. Repeat step "j" for the left outboard push-pull rod.
l. Check cable tension at intermediate flap positions to see that cable tension is within limits. Retract cable tension may increase to 90 pounds when flaps are fully retracted. Check that drive pulleys are in the positions specified in steps "e" and "i." Check that all locknuts are tight and all turnbuckles are safetied.

NOTE

Since flap rollers may not bottom in flap tracks with flaps fully extended, some free play may be noticed in this position.

m. With flaps up, mount an inclinometer on the right wing flap and set to 0°. Operate flaps to full down position and check flap down angle. See figure 7A-2 for wing flap travel. Repeat check on left flap.
n. (See figure 7A-2.) Connect wing flap position transmitter rod (11) to arm (12) on right wing drive pulley (6).
o. Raise wing flaps to full up position and adjust flap position transmitter to make position indicator read 0°. Slotted holes in the transmitter bracket are provided for adjustment. If necessary, transmitter rod may be formed slightly for additional adjustment.
p. Perform an operational checkout of the wing flap control system, check all locknuts for tightness, check that all turnbuckles are safetied, and reinstall all parts removed for access.

NOTE

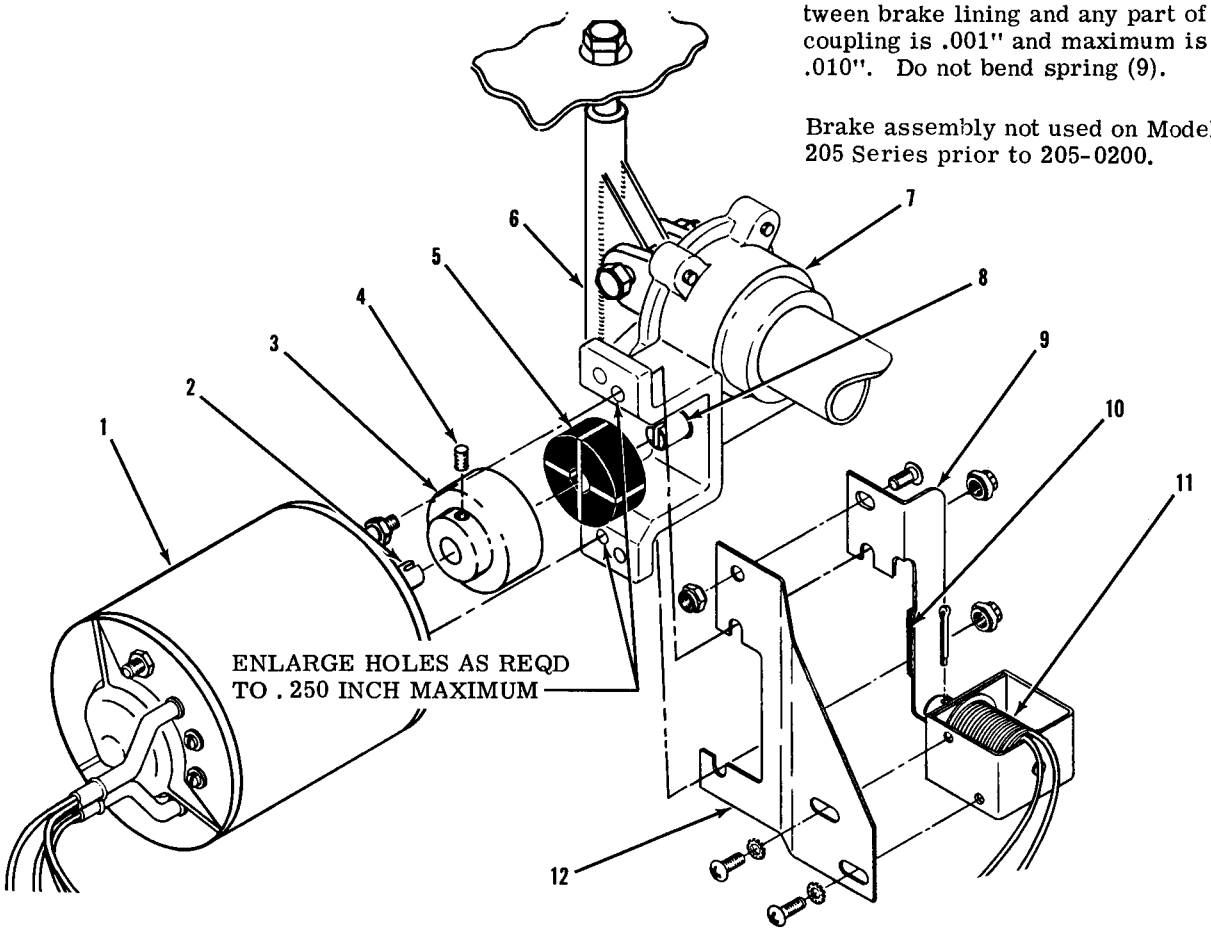
An inclinometer for measuring control surface travel is available from the Cessna Spare Parts Department. (See figure 6-10.)

7A-13. FLAP MOTOR BRAKE ADJUSTMENT. Refer to figure 7A-6 for adjustment of the flap motor solenoid-released brake assembly.

NOTE

Adjust brake assembly, with solenoid actuated, so minimum clearance between brake lining and any part of the coupling is .001" and maximum is .010". Do not bend spring (9).

Brake assembly not used on Model 205 Series prior to 205-0200.



NOTE

Alignment of flap motor shaft and transmission shaft is important. After reassembly, brake drum and coupling assembly must turn freely with brake released. It is permissible to enlarge the holes illustrated to a maximum of . 250" to obtain proper alignment.

1. Motor
2. Motor Shaft
3. Brake Drum
4. Setscrew
5. Coupling
6. Hinge
7. Transmission
8. Transmission Shaft
9. Spring Assembly
10. Brake Lining
11. Solenoid
12. Bracket

Figure 7A-6. Flap Motor Brake

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SECTION 8

ELEVATOR CONTROL SYSTEM

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8-1. ELEVATOR CONTROL SYSTEM.

8-2. The elevator control systems are illustrated in figures 8-1, 8-2, and 8-4. The aft parts of these systems are similar except for downspring installations, shown in figure 8-6. The forward parts of the systems are operated by two basically different installations. The control tee is shown in figure 6-1 and the control column in figure 6-2. In the Model 210D and on, weights are secured to the torque tube at the control column to improve the longitudinal stability of the aircraft.

8-3. TROUBLE SHOOTING THE ELEVATOR CONTROL SYSTEM.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
NO RESPONSE TO CONTROL WHEEL FORE-AND-AFT MOVEMENT.		
Forward or aft push-pull tube disconnected.	Check visually.	Attach push-pull tube and rig per paragraph 8-10.
Cables disconnected.	Check visually.	Attach cables and rig per paragraph 8-10.
BINDING OR JUMPY MOTION FELT IN MOVEMENT OF ELEVATOR SYSTEM.		
Defective forward bellcrank pivot bearing.	Check bellcrank; move to check for play or binding.	Replace bellcrank.
Defective rear bellcrank pivot bearing.	Check bellcrank; move to check for play or binding.	Replace bellcrank.
Defective elevator bellcrank pivot bearing.	Check bellcrank; move to check for play or binding.	Replace bellcrank.

BINDING OR JUMPY MOTION FELT IN MOVEMENT OF ELEVATOR SYSTEM (Cont).		
Cables slack.	Check for correct tension.	Adjust to correct tensions.
Cables not riding correctly on pulleys.	Check cable routing.	Route cables correctly on pulleys.
Defective elevator hinges.	Move elevator by hand, checking hinges.	Replace defective hinges.
Defective control tee pivot bearings.	Disconnect parts and check that control tee pivots freely.	Replace bearings.
Defective control column needle bearing rollers.	Check visually.	Replace rollers.
Defective control column torque tube bearings.	Disconnect parts and check that torque tube rotates freely.	Replace bearings.
ELEVATOR FAILS TO ATTAIN PRESCRIBED TRAVEL.		
Stops incorrectly set.		Rig per paragraph 8-10.
Cables unevenly tightened.		Rig per paragraph 8-10.
Interference at firewall or instruments.	Check visually.	Rig per paragraph 8-10.

8-4. REPLACEMENT OF COMPONENTS.

8-5. CONTROL TEE OR CONTROL COLUMN may be removed, repaired, and installed as outlined in Section 6.

8-6. CABLES, PULLEYS, AND BELLCRANKS. Cables, pulleys, and bellcranks, as well as other components of the elevator control systems, may be removed and installed while using the illustrations in this Section as a guide. Repair consists of replacement of defective parts. If rigging has been affected by replacement of components, rerig in accordance with paragraph 8-10.

NOTE

To ease rerouting of cables, a length of wire may be attached to the end of the cable before it is withdrawn from the airplane. Leave the wire in place, routed through the structure; then attach it to the cable being installed and use it to pull the cable into position.

8-7. ELEVATOR REMOVAL. (See figure 8-5.)

a. Remove stinger.

b. Disconnect elevator trim tab push-pull rod from trim tab.

NOTE

If precautions are taken to see that the elevator trim system is not moved and actuator screw is not turned, it will not be necessary to rerig the elevator trim control system.

c. Remove three bolts (12) securing right and left elevators to elevator bellcrank (10).

d. Remove elevator hinge bolts to remove elevator.

e. Elevator bellcrank (10) may be removed after disconnecting push-pull tube (9) and removing pivot bolt (11). Bolts (12) must be removed, but it is not necessary to remove elevators to remove the bellcrank.

8-8. ELEVATOR REPAIR may be accomplished as outlined in Section 19. Hinge bearings may be replaced as necessary. If repair has affected static balance, check static balance and rebalance as required.

8-9. ELEVATOR INSTALLATION. Reverse the procedure outlined in paragraph 8-7 to install the elevators. Check elevator and trim tab travel and rig if necessary. Trim system rigging is given in Section 9.

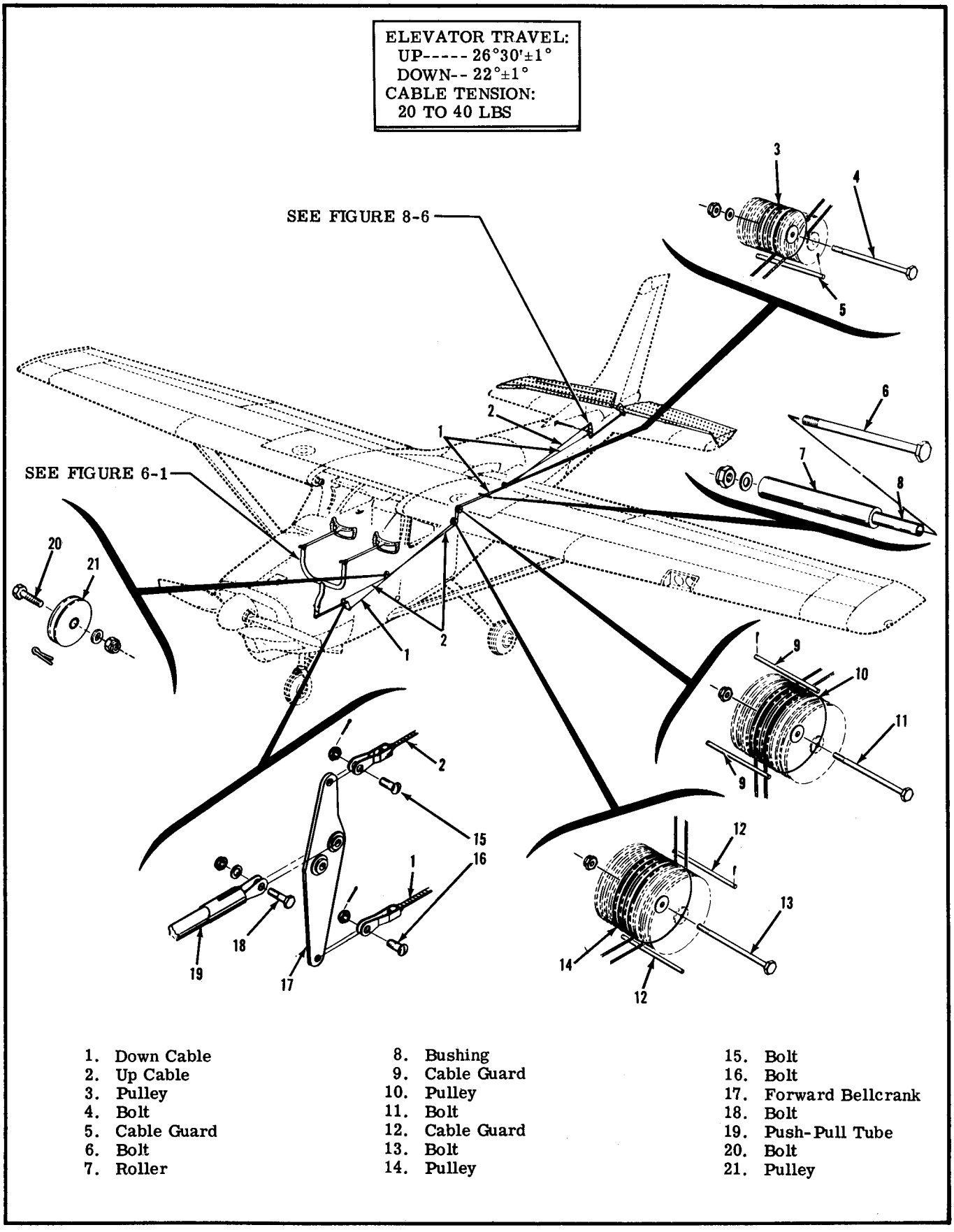


Figure 8-1. Elevator Control System (210 & 210A)

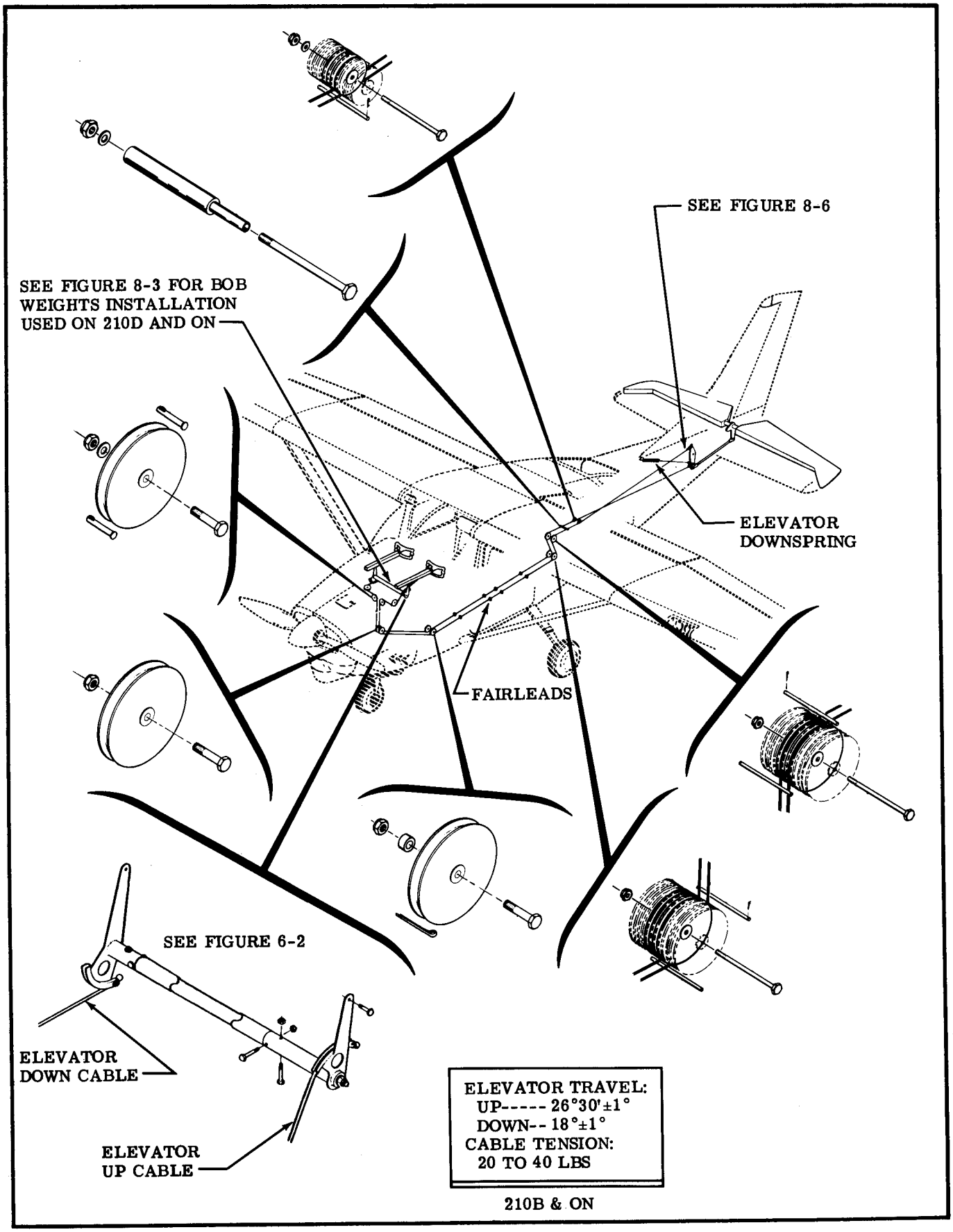


Figure 8-2. Elevator Control System (Model 210B and on)

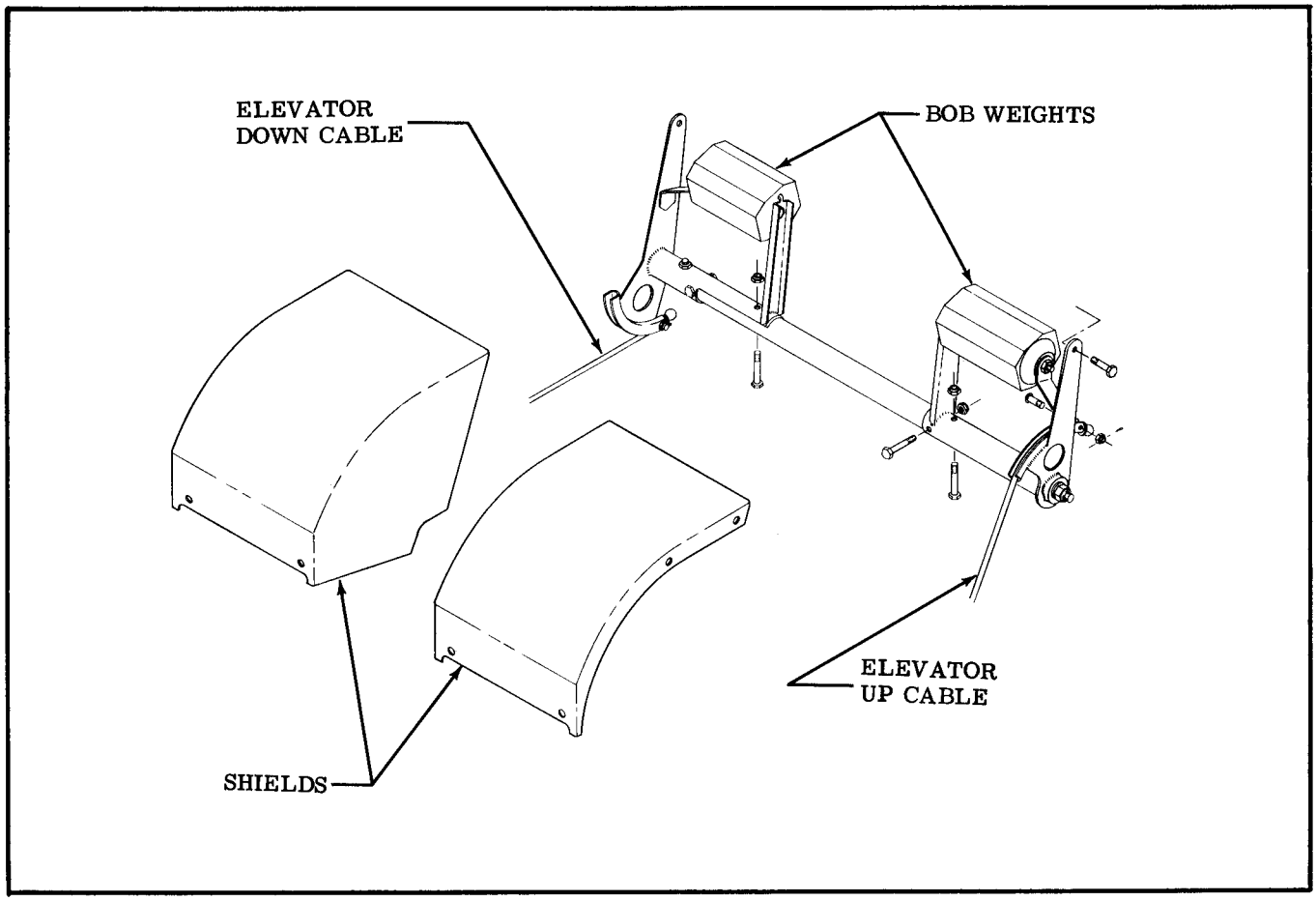


Figure 8-3. Elevator Bob Weights (Model 210D and on)

8-10. RIGGING. An inclinometer for measuring control surface travels is available from the Cessna Spare Parts Department. Refer to figure 6-10.

WARNING

Be sure elevators move in the correct direction when operated by the control wheel.

8-11. MODELS 210 AND 210A.

a. Set elevator stops to attain correct elevator travel as listed in figure 8-1. Also see figure 8-7.

b. Tighten elevator cable turnbuckles to a cable tension of 30 pounds, adjusting the turnbuckles so the control tee clears instruments in the full aft position and clears the firewall in the full forward position. Safety the turnbuckles.

c. Move control wheel through full range of travel and check cable tension in various positions. Tension should not be less than 20 pounds or more than 40 pounds in any position.

d. Check that all turnbuckles are safetied and all parts are secured, then reinstall all parts removed for access.

8-12. MODELS 205 AND 206 SERIES, AND 210B AND ON.

a. Lock control wheel tube in neutral by installing controls lock.

b. Adjust elevator cable turnbuckles to streamline elevators with horizontal stabilizer and to obtain 30 pounds cable tension, then safety the turnbuckles.

NOTE

On all Model 205 and 206 series airplanes, and the 210C and on, disregard the counterweight areas of the elevators when streamlining. These areas are contoured so that they will be streamlined at cruising speed (elevators approximately 3° down).

c. Mount an inclinometer on one elevator and set to zero degrees.

d. Remove controls lock, then adjust elevator travel stops to attain correct elevator travel as listed in figure 8-2 or 8-4. Also see figure 8-7.

e. On Model 206 series airplanes, and Model 210D and on, adjust elevator downspring turnbuckle (with elevators full down) as shown in figure 8-6. Safety the turnbuckle.

f. Move control wheel through full range of travel and check cable tension in various positions. Tension should not be less than 20 pounds or more than 40 pounds in any position.

g. Check that all turnbuckles are safetied and all parts are secured, then reinstall all parts removed for access.

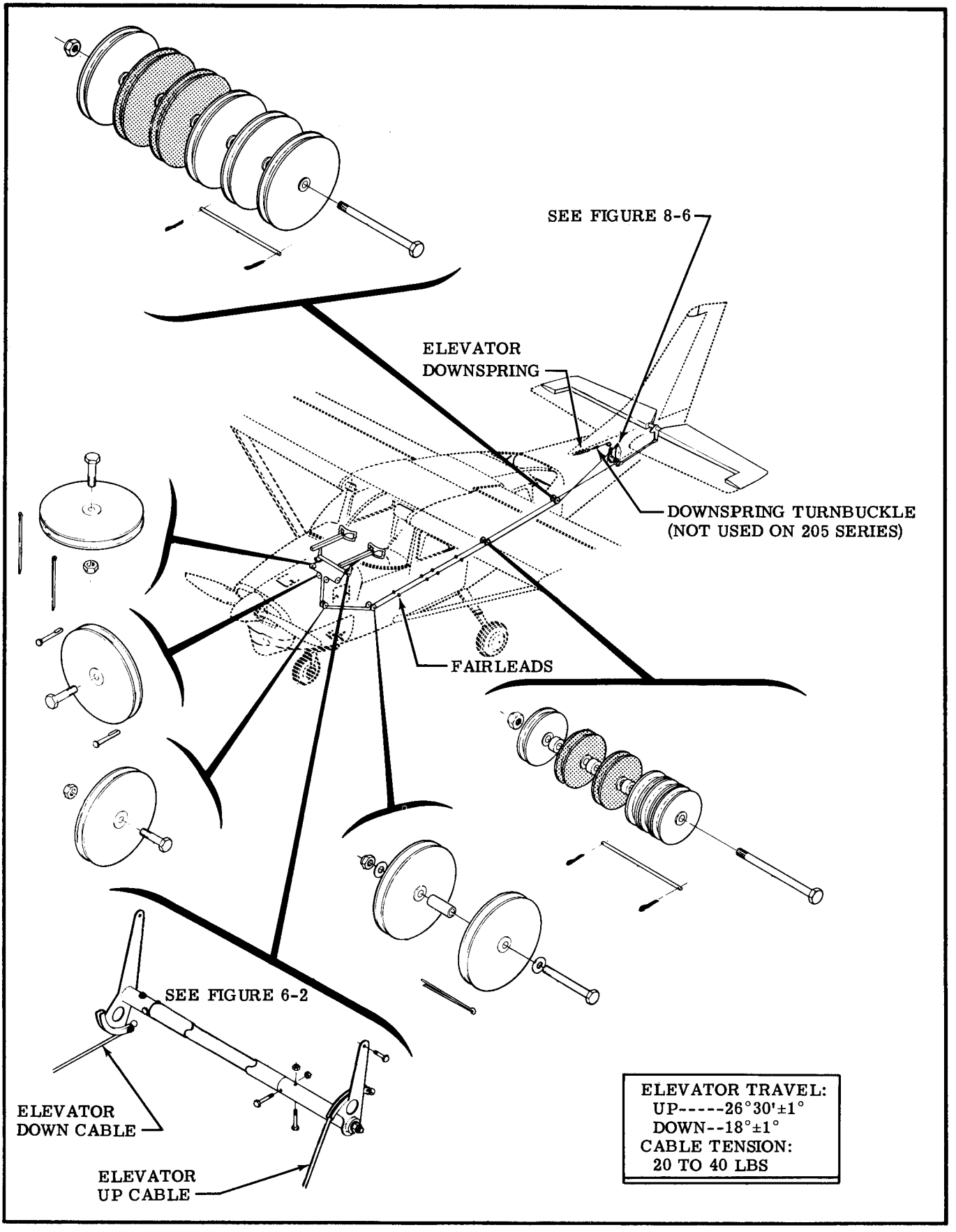
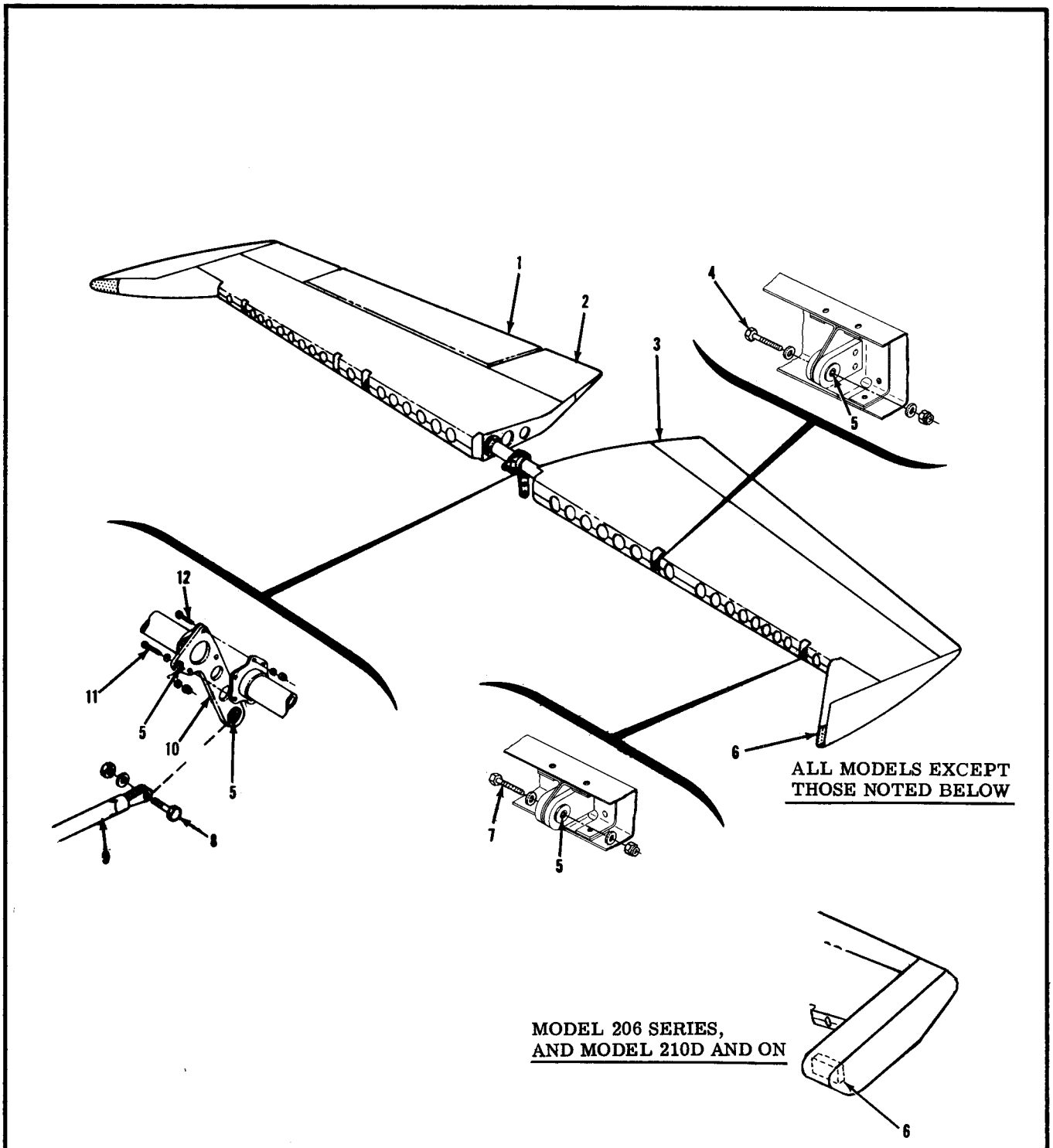


Figure 8-4. Elevator Control System (205 and 206 Series)



1. Elevator Trim Tab
2. Right Elevator
3. Left Elevator
4. Bolt
5. Needle Bearing
6. Static Balance Weight
7. Bolt
8. Bolt
9. Push-Pull Tube
10. Elevator Bellcrank
11. Bolt
12. Bolt

Figure 8-5. Elevator Installation

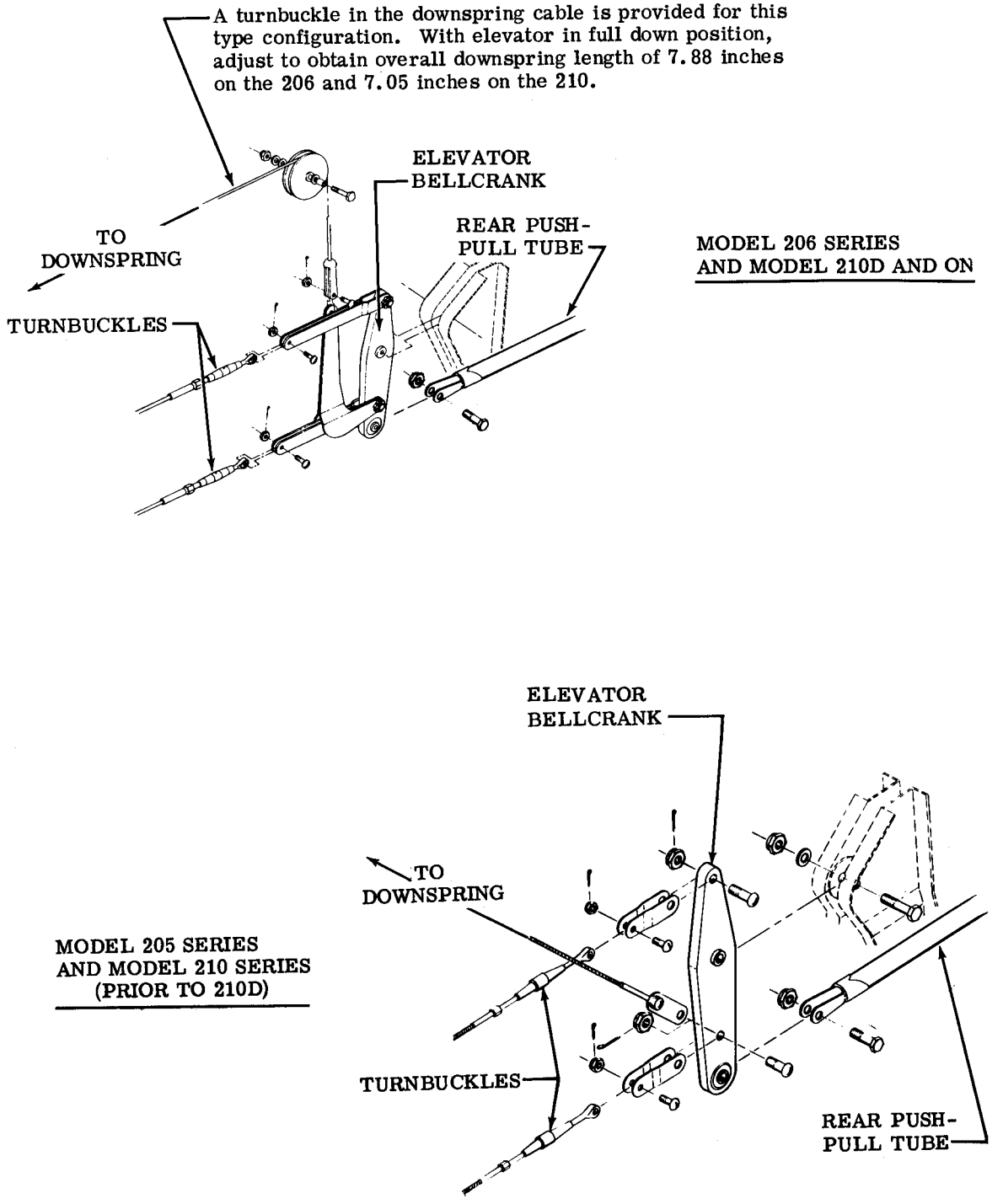
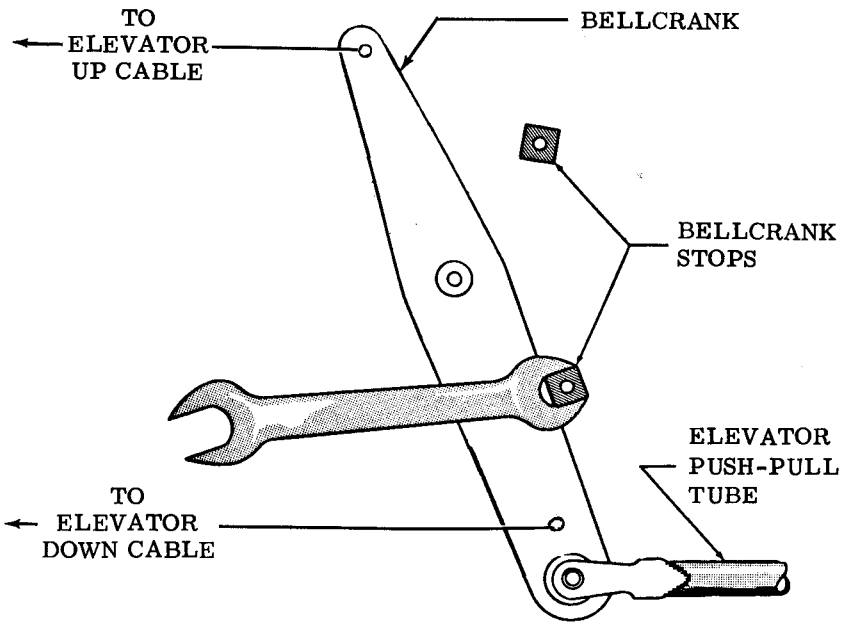


Figure 8-6. Elevator Bellcrank Installation



NOTE

The holes are drilled off center in the bellcrank stops to provide elevator travel adjustments. Every 90° of rotation of the bellcrank stop provides approximately 1° of control surface travel.

Figure 8-7. Travel Stops on Elevator Rear Bellcrank

SHOP NOTES:

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SECTION 9

ELEVATOR TRIM CONTROL SYSTEM

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9-1. ELEVATOR TRIM CONTROL SYSTEM.
The elevator trim tab is located on the right elevator and is controlled by a trim wheel, roller chains, screwjack actuator, and cable system arrangement. A position indicator in the trim wheel mechanism indicates nose attitude of the aircraft. Forward rotation of the wheel trims the nose down, and aft rotation of the wheel trims the nose up.

9-2. TROUBLE SHOOTING.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
EXCESSIVE RESISTANCE IN TRIM CONTROL WHEEL.		
Cable tension too high.	Check cable tension.	Adjust tension.
Pulleys binding or rubbing.	Check pulleys.	Repair or replace as necessary.
Cables not in place on pulleys.	Check visually.	Install cables correctly.
Trim tab hinge binding.	Disconnect actuator and move tab up and down to check hinge resistance.	Lubricate or replace hinge as necessary.
Defective trim tab actuator.	Remove chain from actuator sprocket and operate actuator manually.	Replace actuator.
Rusty chain.	Visually check chain.	Remove and replace rusty chain.
Damaged sprocket.	Visually check sprockets.	Remove and replace damaged sprockets.
Bent sprocket shaft.	Observe motion of sprockets.	Remove and replace bent sprocket shafts.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
LOST MOTION BETWEEN CONTROL WHEEL AND TRIM TAB.		
Cable tension too low.	Check cable tension.	Adjust tension.
Broken pulley.	Check pulleys.	Replace as necessary.
Cables not in place on pulleys.	Check visually.	Install cables correctly.
Actuator attachment loose.	Check actuator for security.	Tighten actuator attachment.
TRIM INDICATION INCORRECT.		
Indicator incorrectly engaged on wheel track.	Check visually.	Reset indicator.
INCORRECT TRIM TAB TRAVEL.		
Stop blocks loose or incorrectly adjusted.	Stop blocks should contact each other at correct travel.	Adjust stop blocks on cables.
Incorrect rigging.	Check rigging.	Rig system correctly.

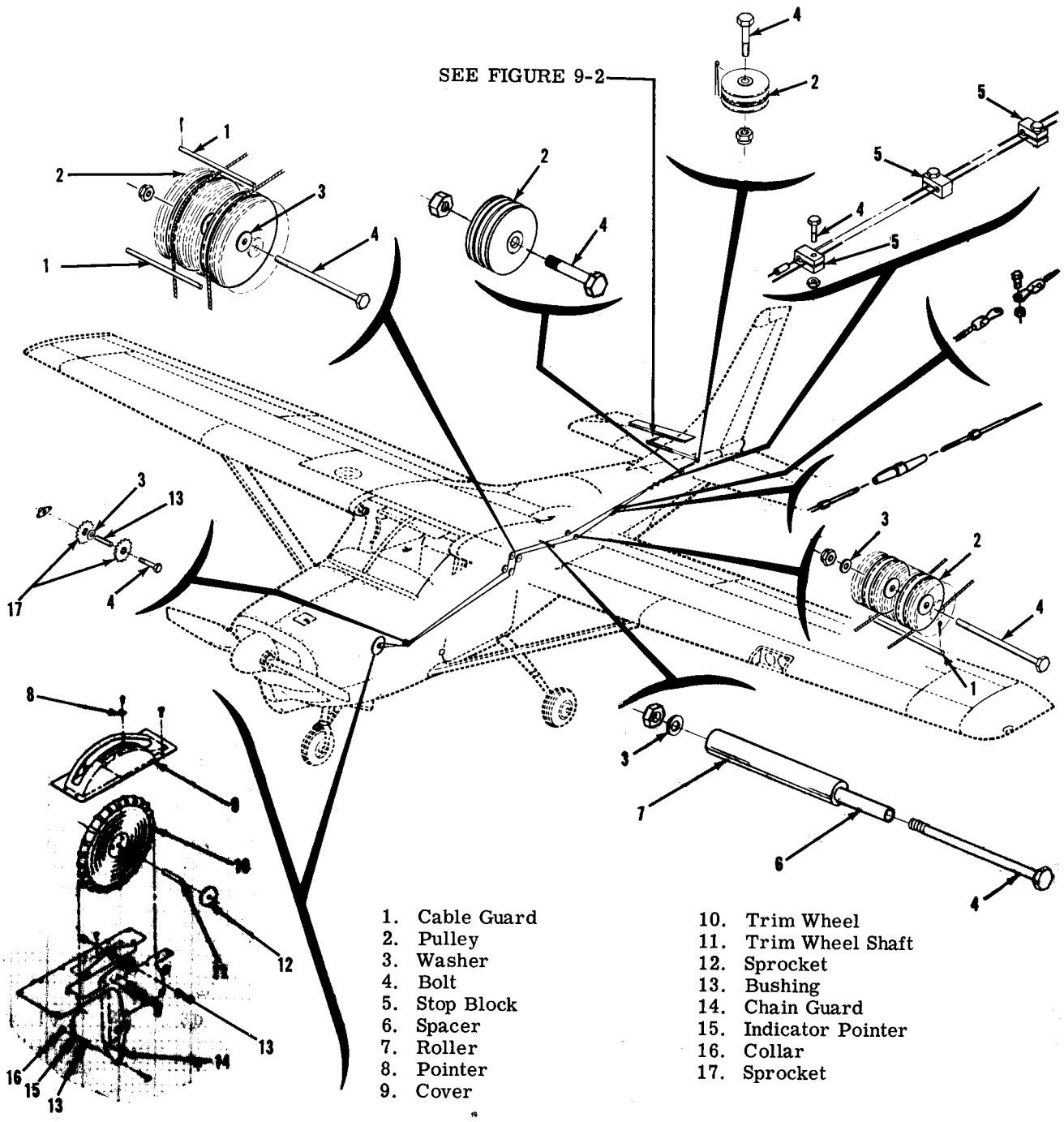
SHOP NOTES:

MODEL 210

TRIM TAB TRAVEL:
UP-----25°+1°-0°
DOWN -- 15°+1°-0°
CABLE TENSION:
15 TO 20 LBS

MODEL 210A

TRIM TAB TRAVEL:
UP-----10°+2°-0°
DOWN-- 25°+2°-0°
CABLE TENSION:
15 TO 20 LBS



1. Cable Guard
2. Pulley
3. Washer
4. Bolt
5. Stop Block
6. Spacer
7. Roller
8. Pointer
9. Cover
10. Trim Wheel
11. Trim Wheel Shaft
12. Sprocket
13. Bushing
14. Chain Guard
15. Indicator Pointer
16. Collar
17. Sprocket

Figure 9-1. Elevator Trim Control System (210 and 210A)

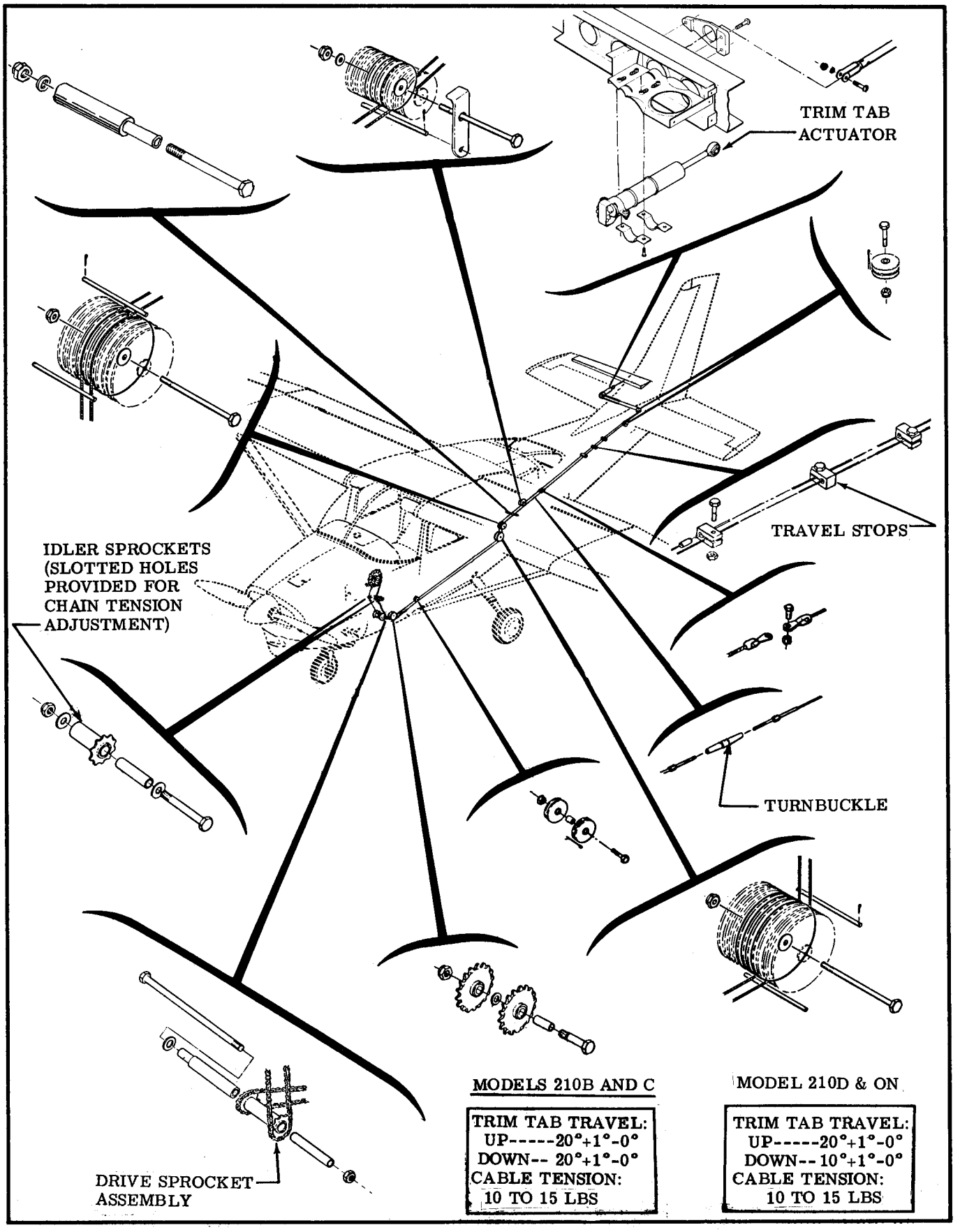


Figure 9-2. Elevator Trim Control System (210B and on)

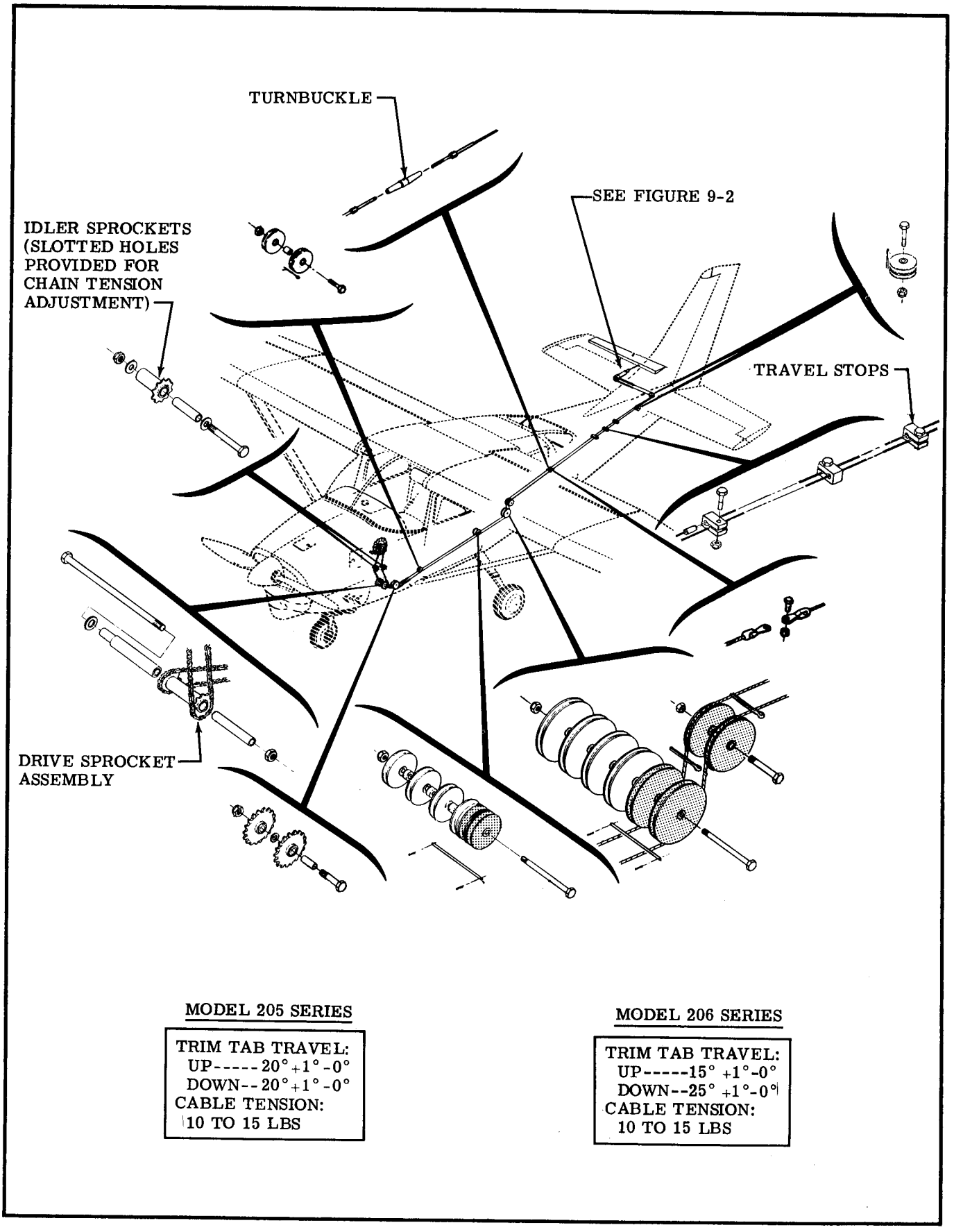


Figure 9-3. Elevator Trim Control System (205 and 206)

9-3. REMOVAL OF ELEVATOR TRIM CONTROL SYSTEM may be accomplished while using the illustrations in this Section as a guide.

9-4. REPAIR OF ELEVATOR TRIM CONTROL SYSTEM. Any worn, damaged, or defective components of the elevator trim control system should be replaced.

9-5. INSTALLATION OF ELEVATOR TRIM CONTROL SYSTEM may be accomplished while using the illustrations in this Section as a guide.

9-6. REMOVAL AND INSTALLATION OF ELEVATOR TRIM TAB.

a. Disconnect push-pull link from arm on trim tab.

NOTE

Tape or otherwise secure link from actuator screw so it cannot turn to retain proper rigging.

b. On the Model 210 series airplanes, remove screw from end of hinge pin and remove hinge pin. Trim tab and/or hinges may then be replaced as required.

c. On the Model 205 and 206 series airplanes, the ends of the hinges are crimped to retain the hinge pin. It is usually easier to drill out hinge attaching rivets, then spread crimped ends and remove hinge pin if necessary.

d. After installation, connect push-pull link. If the link was not rotated, it is not necessary to re-rig the elevator trim control system.

9-7. REMOVAL AND INSTALLATION OF ELEVATOR TRIM TAB ACTUATOR.

a. Release trim tab cable tension at turnbuckle.

b. Disconnect push-pull link from actuator.

c. Remove access cover on lower skin of stabilizer beneath trim tab actuator.

d. Loosen chain guard at forward end of actuator and disengage chain from actuator sprocket.

e. Remove screws and clamps attaching actuator to bracket and remove actuator.

f. To install the elevator trim tab actuator, reverse the preceding steps. Rig elevator trim system in accordance with paragraph 9-8 or 9-9.

9-8. RIGGING THE ELEVATOR TRIM CONTROL SYSTEM – 210 AND 210A. (See figure 9-1.)

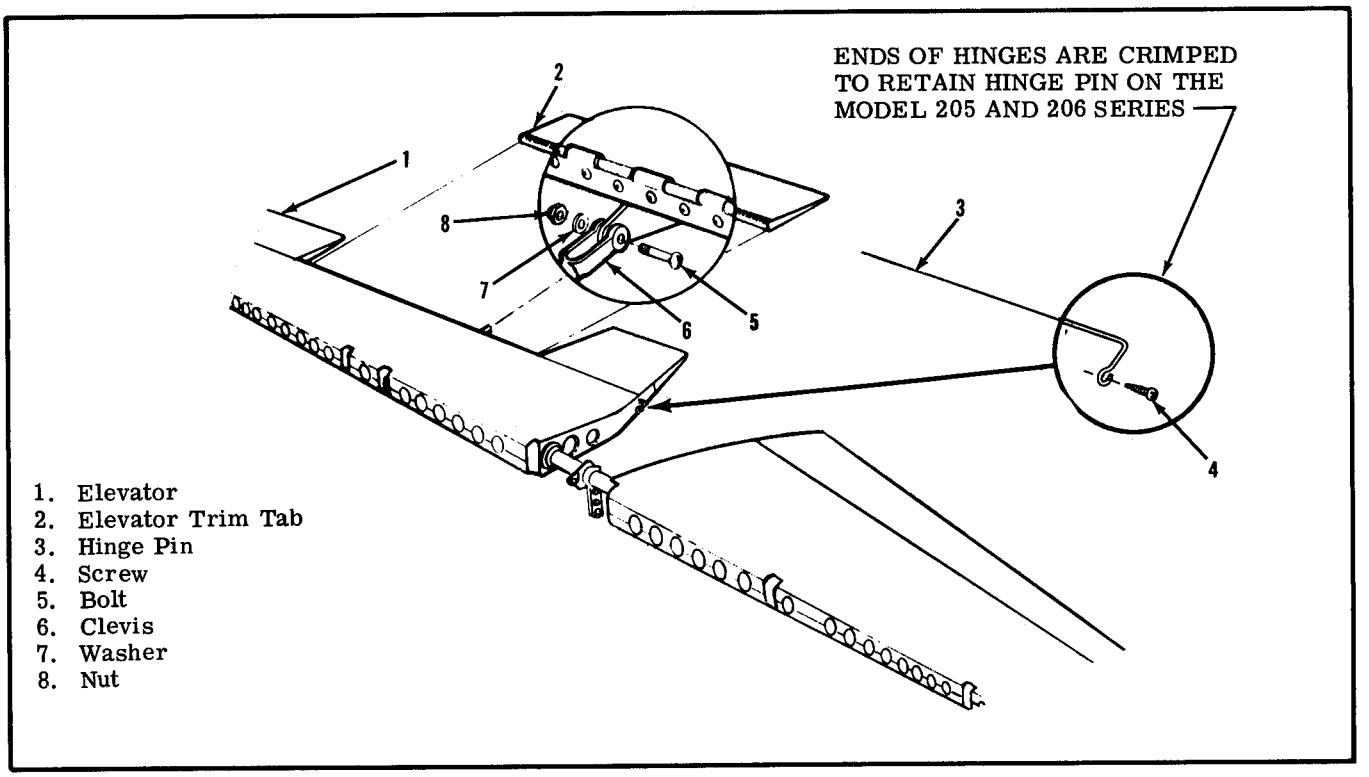
NOTE

An inclinometer for measuring control surface travels is available from the Cessna Spare Parts Department. Refer to figure 6-10.

a. Loosen stop blocks (5) and disconnect actuator screw from link to trim tab.

b. Check cable tension and readjust turnbuckle if necessary. Resafety turnbuckle. If chains and/or cables are being installed, permit actuator screw to rotate freely as chains and cables are connected, set cable tension with turnbuckle, and safety the turnbuckle.

c. Rotate trim control wheel full forward (nose down), making sure pointer does not restrict trim wheel movement. If necessary, use a thin screwdriver to pry trailing leg of pointer out of groove to



1. Elevator
2. Elevator Trim Tab
3. Hinge Pin
4. Screw
5. Bolt
6. Clevis
7. Washer
8. Nut

Figure 9-4. Elevator Trim Tab Installation

re-position pointer where it will not restrict trim wheel movement.

NOTE

Full forward (nose down) position of trim wheel is the position where further movement is prevented by chain or cable ends contacting sprockets or pulleys.

d. With elevator and trim tab both in neutral (streamlined), place inclinometer on tab and set to zero, then rotate actuator screw in or out as required to place trim tab up with a maximum of 2° overtravel, when actuator screw is connected to link from trim tab.

NOTE

Disregard the counterweight areas of the elevators when streamlining. On some airplanes, these areas are contoured so that they will be approximately 3° down at cruising speed.

e. Rotate trim control wheel to place trim tab up and down, readjusting actuator screw as required to obtain overtravel in both directions.

f. Position stop blocks and adjust as shown in figure 9-6 to limit travel as noted.

g. Check that trim wheel pointer travels the same distance from ends of slot in cover. Re-position trailing leg of pointer if necessary (refer to step "c").

h. Check that all safeties are installed and all parts are secure, then reinstall all parts removed for access.

WARNING

Be sure trim tab moves in correct direction when operated by trim control wheel. Nose down trim corresponds to tab up position.

9-9. RIGGING THE ELEVATOR TRIM CONTROL SYSTEM - 210B & ON, AND 205 & 206 SERIES. (See figures 9-2 and 9-3.)

NOTE

An inclinometer for measuring control surface travels is available from the Cessna Spare Parts Department. Refer to figure 6-10.

a. Loosen travel stop blocks on trim tab cables and disconnect actuator screw from link to trim tab.

b. Check cable tension and readjust turnbuckle if necessary. Resafety turnbuckle. If chains and/or cables are being installed, permit actuator screw to rotate freely as chains and cables are connected, set cable tension with turnbuckle, and safety the turnbuckle.

c. Rotate trim control wheel full forward (nose down), making sure pointer does not restrict trim wheel movement. If necessary to re-position pointer where it will not restrict trim wheel movement, proceed as follows:

1. Remove control pedestal cover. Refer to paragraph 11-4A.
2. Loosen nut at trim wheel pivot shaft.
3. Loosen screws securing chain guard (see figure 9-5) far enough that trim wheel can be moved 1/8 inch, then use a thin screwdriver to pry trailing leg of pointer out of groove in trim wheel.
4. Reinstall screws and nuts, but do not install pedestal cover until rigging has been completed.

NOTE

Full forward (nose down) position of trim wheel is the position where further movement is prevented by chain or cable ends contacting sprockets or pulleys.

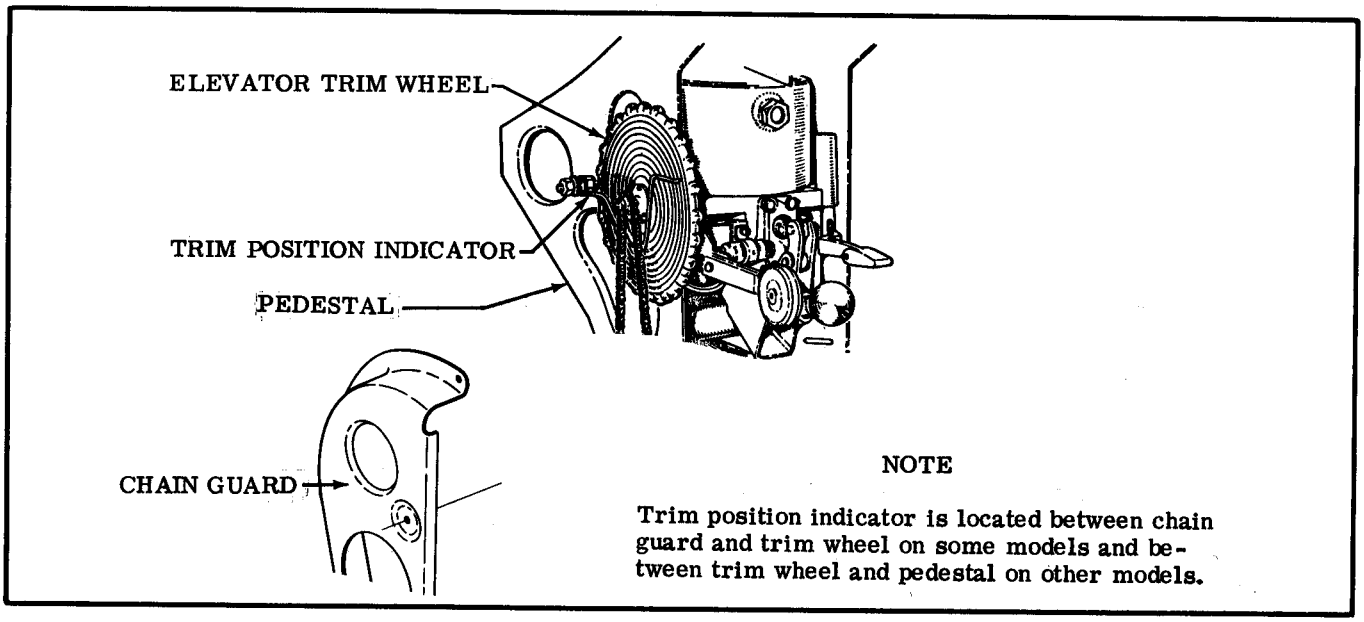


Figure 9-5. Elevator Trim Wheel Installation

d. With elevator and trim tab both in neutral (streamlined) place inclinometer on tab and set to zero, then rotate actuator screw in or out as required to place trim tab up with a maximum of 2° overtravel, when actuator screw is connected to link from trim tab.

NOTE

Disregard the counterweight areas of the elevators when streamlining. On some airplanes, these areas are contoured so that they will be approximately 3° down at cruising speed.

e. Rotate trim control wheel to place trim tab up and down, readjusting actuator screw as required to obtain overtravel in both directions.

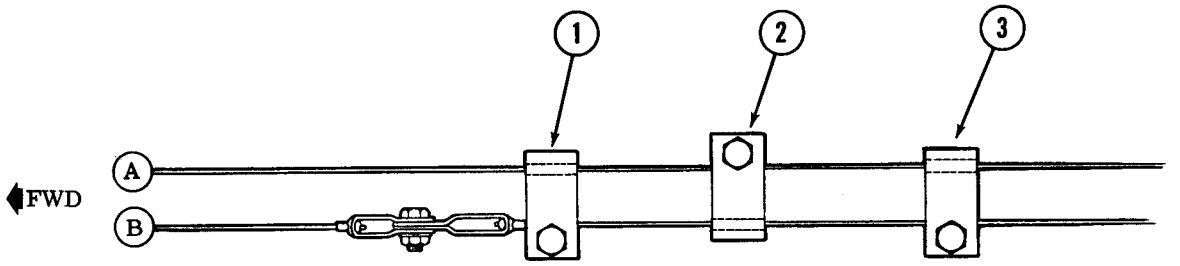
f. Position stop blocks and adjust as shown in figure 9-6 to limit travel as noted.

g. Install control pedestal cover and check that trim wheel pointer travels the same distance from ends of slot in cover. Re-position trailing leg of pointer if necessary (refer to step "c").

h. Check that all safeties are installed and all parts are secure, then reinstall all parts removed for access.

WARNING

Be sure trim tab moves in correct direction when operated by trim control wheel. Nose down trim corresponds to tab up position.



1. With elevators in neutral, set trim tab to neutral (streamlined).
2. Position stop block (1) against clevis on cable B and secure to cable B.
3. Place inclinometer on trim tab and lower tab to degree specified in table below.
4. Position stop block (2) against stop block (1) and secure to cable A.
5. Raise trim tab to specified degree, place stop block (3) against stop block (2) and secure to cable B.

TRIM TAB TRAVEL

MODEL	YEAR	TRAVEL		TOLERANCE
		UP	DOWN	
210	1960	25°	15°	+1°-0°
210A	1961	10°	25°	+2°-0°
210B-C	1962-63	20°	20°	+1°-0°
210D & ON	1964 & on	20°	10°	+1°-0°
205 SERIES	1963-64	20°	20°	+1°-0°
206 SERIES	1964 & on	15°	25°	+1°-0°

Figure 9-6. Elevator Trim Tab Travel Adjustment

SECTION 10

RUDDER CONTROL SYSTEM

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10-1. RUDDER CONTROL SYSTEM. Rudder control is maintained through use of conventional rudder pedals which also control nose wheel steering. Beginning with 1965 and on 200 series airplanes, when copilot controls are installed, stowable rudder pedals are installed.

10-2. TROUBLE SHOOTING.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
RUDDER DOES NOT RESPOND TO PEDAL MOVEMENT.		
Broken or disconnected cables.	Visually check cables.	Connect or replace cables.
UNDUE EFFORT REQUIRED TO ACTUATE RUDDER.		
Cables too tight.	Check cable tension.	Adjust cable tension.
Cables not riding properly on pulleys.	Check visually.	Route cables correctly on pulleys.
Binding, broken, or defective pulleys.	Check visually, rotate pulleys by hand to check for binding.	Replace defective pulleys.
Pedal bars need lubrication.		Lubricate with general purpose oil.
Defective rudder bar bearings.	Lubrication fails to eliminate binding.	Replace bearing blocks.
Defective rudder hinge bearings.		Replace defective rings.
LOST MOTION BETWEEN RUDDER PEDALS AND RUDDER.		
Rudder cables loose.	Check cable tension.	Adjust cable tension.

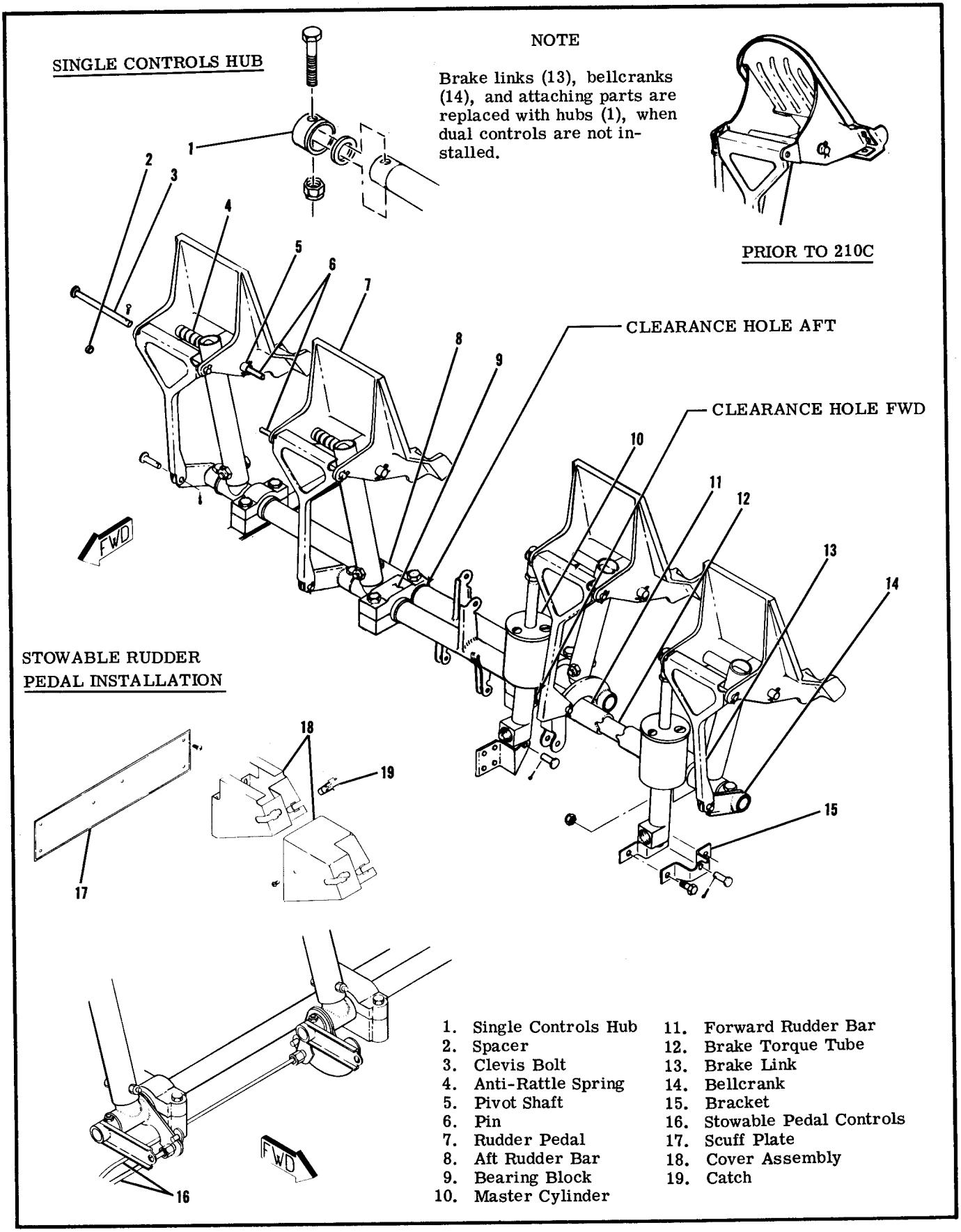
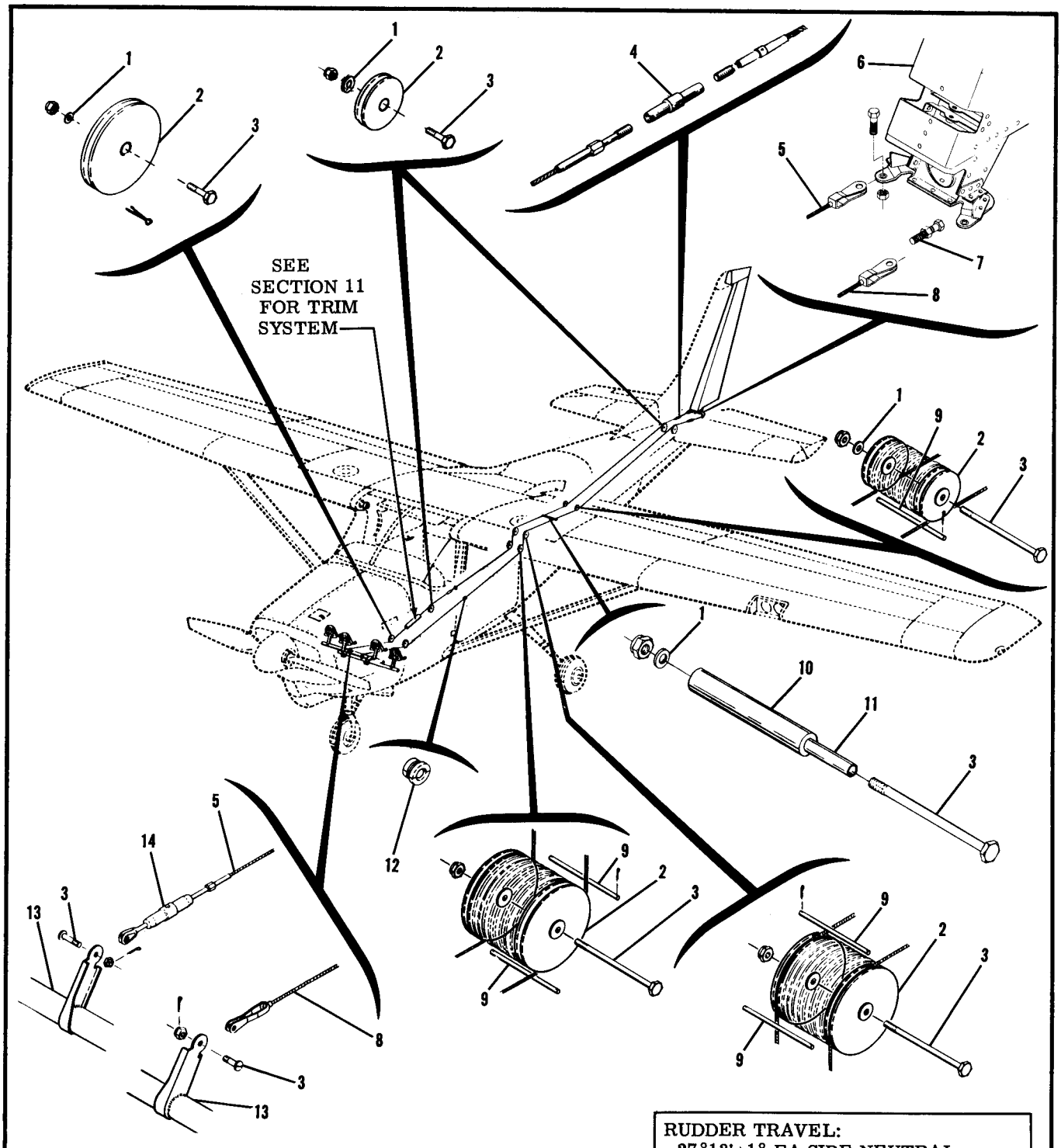


Figure 10-1. Rudder Pedals Installation



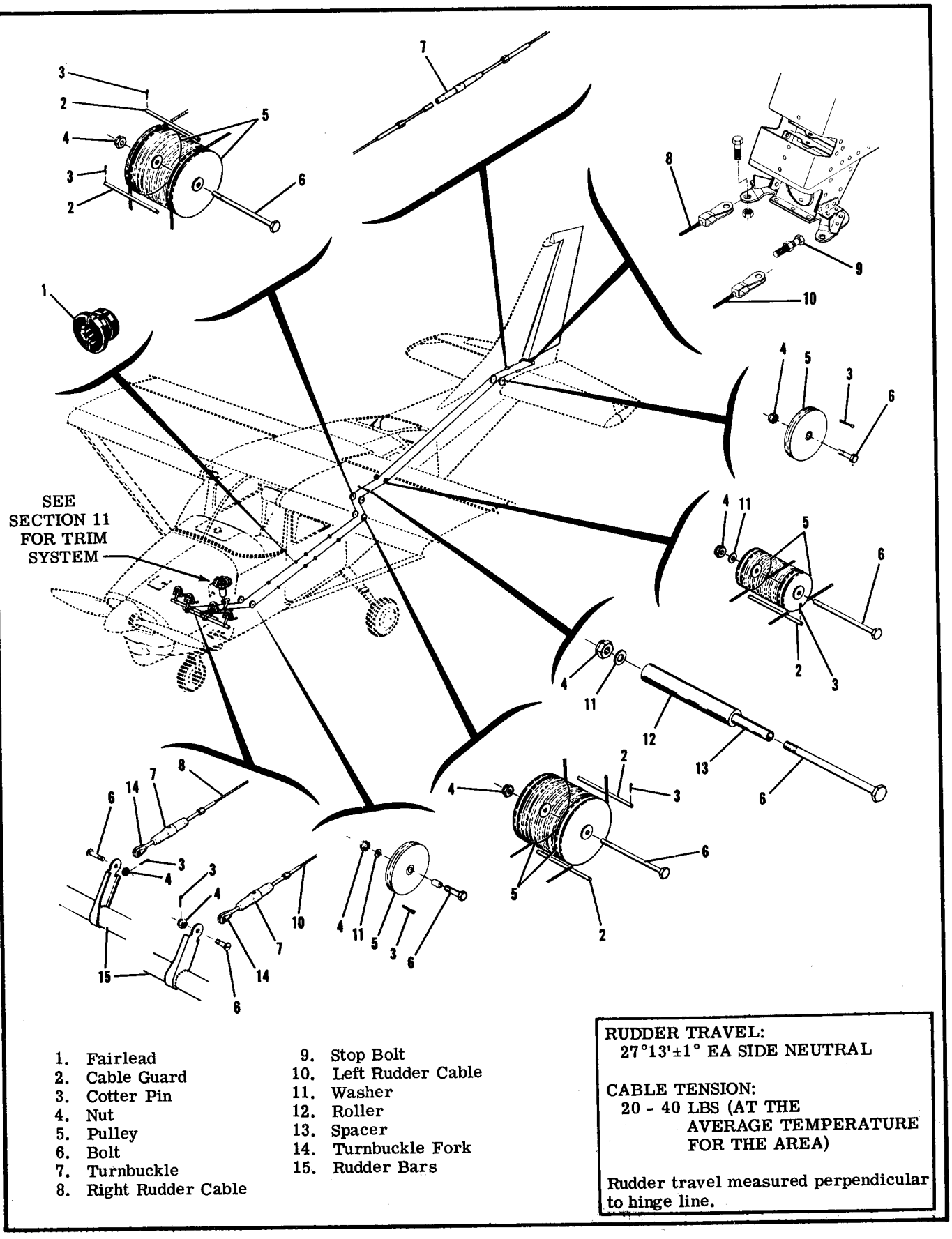
1. Washer
2. Pulley
3. Bolt
4. Barrel
5. Right Rudder Cable
6. Rudder
7. Stop Bolt
8. Left Rudder Cable
9. Cable Guard
10. Roller
11. Spacer
12. Fairlead
13. Rudder Bars
14. Turnbuckle

RUDDER TRAVEL:
27°13'±1° EA SIDE NEUTRAL

CABLE TENSION:
20 - 40 LBS (AT THE AVERAGE TEMPERATURE FOR THE AREA)

Rudder travel measured perpendicular to hinge line.

Figure 10-2. Rudder Control System Components (Prior to 210B)



1. Fairlead
2. Cable Guard
3. Cotter Pin
4. Nut
5. Pulley
6. Bolt
7. Turnbuckle
8. Right Rudder Cable
9. Stop Bolt
10. Left Rudder Cable
11. Washer
12. Roller
13. Spacer
14. Turnbuckle Fork
15. Rudder Bars

Figure 10-3. Rudder Control System Components (210B and on)

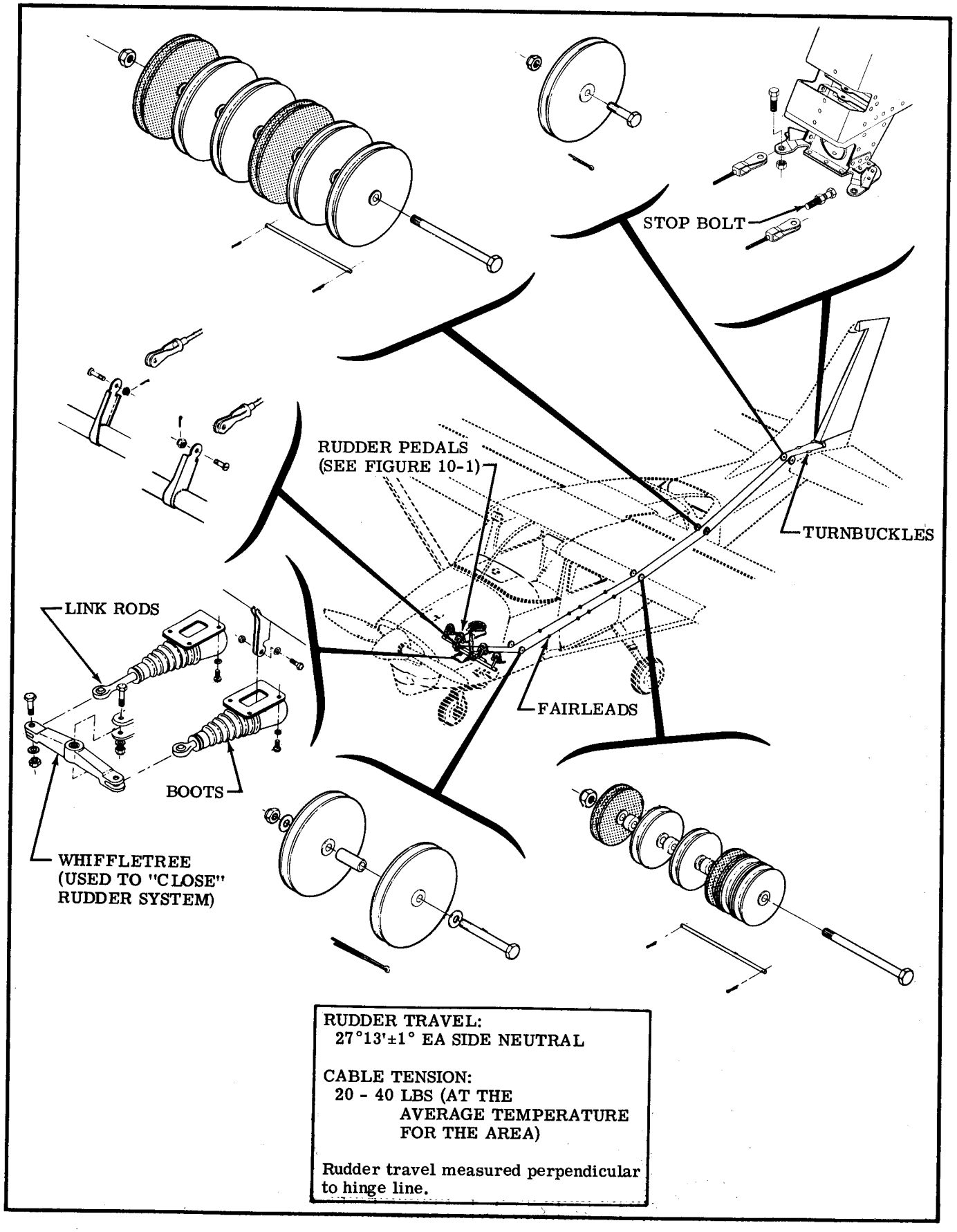


Figure 10-4. Rudder Control System (205 and 206)

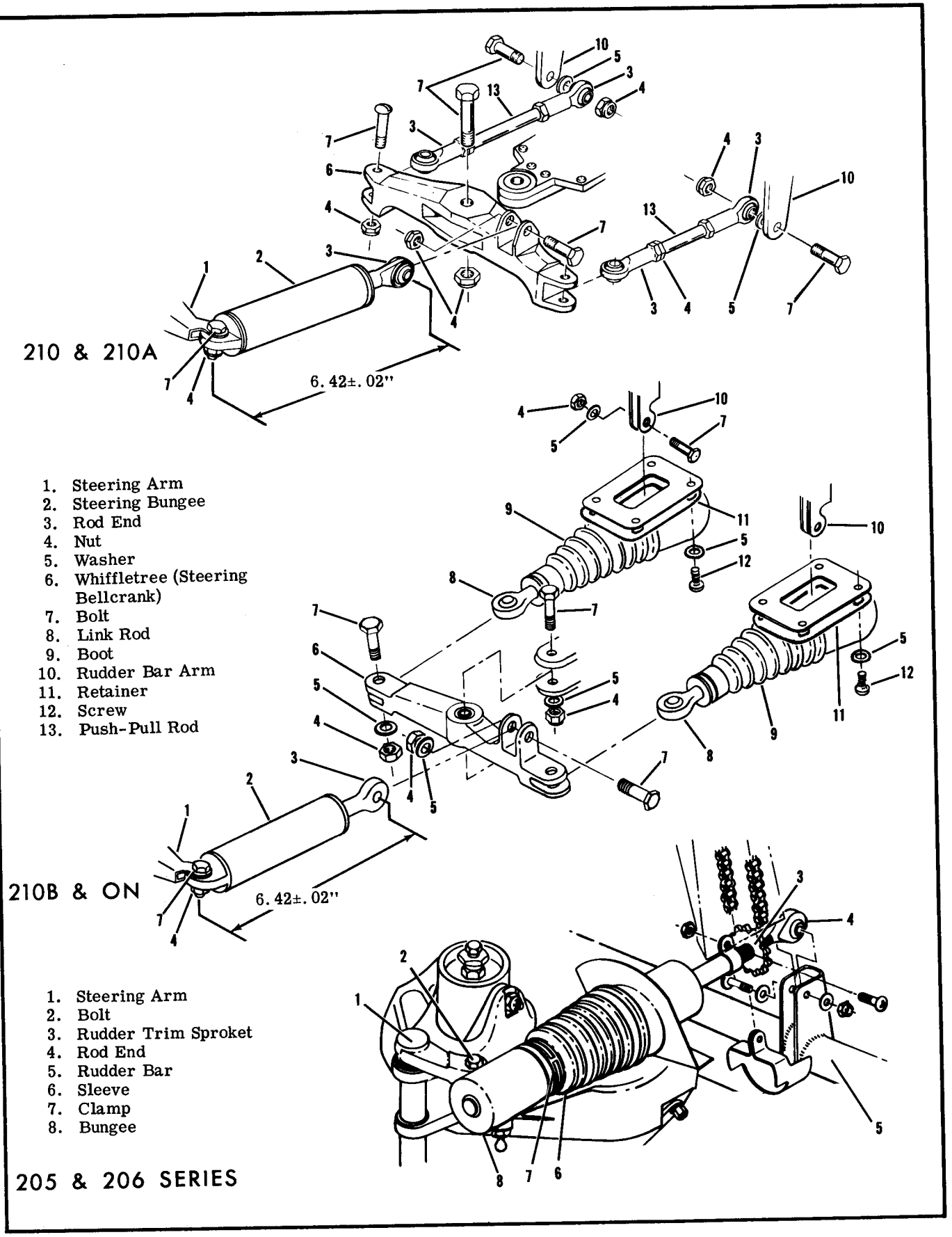


Figure 10-5. Nosewheel Steering Linkage

10-3. REMOVAL OF RUDDER PEDAL ASSEMBLY.

a. Remove carpeting, shields, and soundproofing from the rudder pedal and tunnel areas as necessary for access.

b. Disconnect the brake master cylinders and the parking brake cables at the pilot's rudder pedals, then remove the pilot's rudder pedals and copilot's rudder pedals and brake links if installed.

c. Slack off rudder system tension by loosening aft turnbuckles.

d. Disconnect the rudder cables and the nosewheel steering system push-pull rods from the rudder bars.

e. On the Model 205 and 206 series airplanes, and on the Model 210 series airplanes beginning with the 210B, disconnect the rudder trim bungee from the rudder bar. Note that on the Models 205 and 206 series, this is a dual-purpose bungee, serving as both rudder trim and nose gear steering.

f. On airplanes equipped with stowable rudder pedals, disconnect controls at the pedals.

g. Remove the bolts securing the rudder bar bearing blocks and work the rudder bars out of the tunnel area to remove.

NOTE

Since the two inboard bearing blocks contain clearance holes for the rudder bars at one end and a bearing hole at the other end, they should be tagged so they can be reinstalled in the same positions.

10-4. INSTALLATION OF RUDDER PEDAL ASSEMBLY.

NOTE

Rudder bar assemblies should be checked for lubrication before installation. Internal bearings are oilite bearings which should be saturated with engine oil. The bearing blocks are magnesium alloy bearing against the steel shafts and require no lubrication unless binding occurs. A few drops of general purpose oil will eliminate such binding.

a. Position the rudder bar assemblies and install bearing blocks in the same position from which they were removed.

b. On the 205, 206 series, and 210B and on, connect the rudder bungee to the rudder bar.

c. Connect the rudder cables and the nose wheel steering system push-pull rods to the rudder bars.

d. Install the copilot's rudder pedals and brake links if used, install the pilot's rudder pedals, then attach the brake master cylinders and parking brake cables to the pilot's rudder pedals.

e. Connect stowable rudder pedal controls, if installed.

f. Rig the system as outlined in paragraph 10-10.

g. Replace soundproofing, carpeting, and shields removed for access.

10-5. REMOVAL OF RUDDER CABLES. (See figures 10-2 thru 10-4.)

a. Disconnect cables at rudder bars and at the short cables near the rudder.

b. Prior to the 210B, disconnect the turnbuckle at the aft end of the rudder bungee cable.

c. Connect guide wires to the aft end of each rudder cable.

NOTE

The guide wires are used as an aid in reinstallation of the rudder cables. As the rudder cables are pulled forward, out of the aircraft, the guide wires are drawn into place and are left in the position formerly occupied by the cables.

d. Remove cable guards, pulleys, and fairleads as necessary to withdraw each cable.

10-6. INSTALLATION OF RUDDER CABLES. (See figures 10-2 thru 10-4.)

a. Connect aft end of each rudder cable to forward end of guide wires. Pull the cables through the fuselage with the wires and detach guide wires.

b. Check cable routing and install pulleys, cable guards, and fairleads.

c. Prior to the 210B, connect the turnbuckle at the aft end of the rudder bungee cable.

d. Connect the rudder cables to the rudder bars and to the short cables near the rudder.

e. Rig the system as outlined in paragraph 10-10.

10-7. REMOVAL OF RUDDER. (See figure 10-6.)

a. Remove the stinger and disconnect the tail-light wire.

b. Loosen the aft rudder cable turnbuckles and disconnect the rudder cables from the rudder.

c. With rudder supported, remove all rudder hinge bolts and lift the rudder free of the vertical fin.

10-8. REPAIR OF RUDDER may be accomplished in accordance with structural repair instructions contained in Section 19.

10-9. INSTALLATION OF RUDDER. (See figure 10-6.) To install the rudder, reverse the procedure outlined in paragraph 10-7. With the rudder pedals in neutral, rig rudder streamlined with 30 pounds tension on rudder cables. Safety turnbuckles.

10-10. RIGGING RUDDER CONTROL SYSTEM.

a. Loosen rudder cable aft turnbuckles to relieve tension on rudder system.

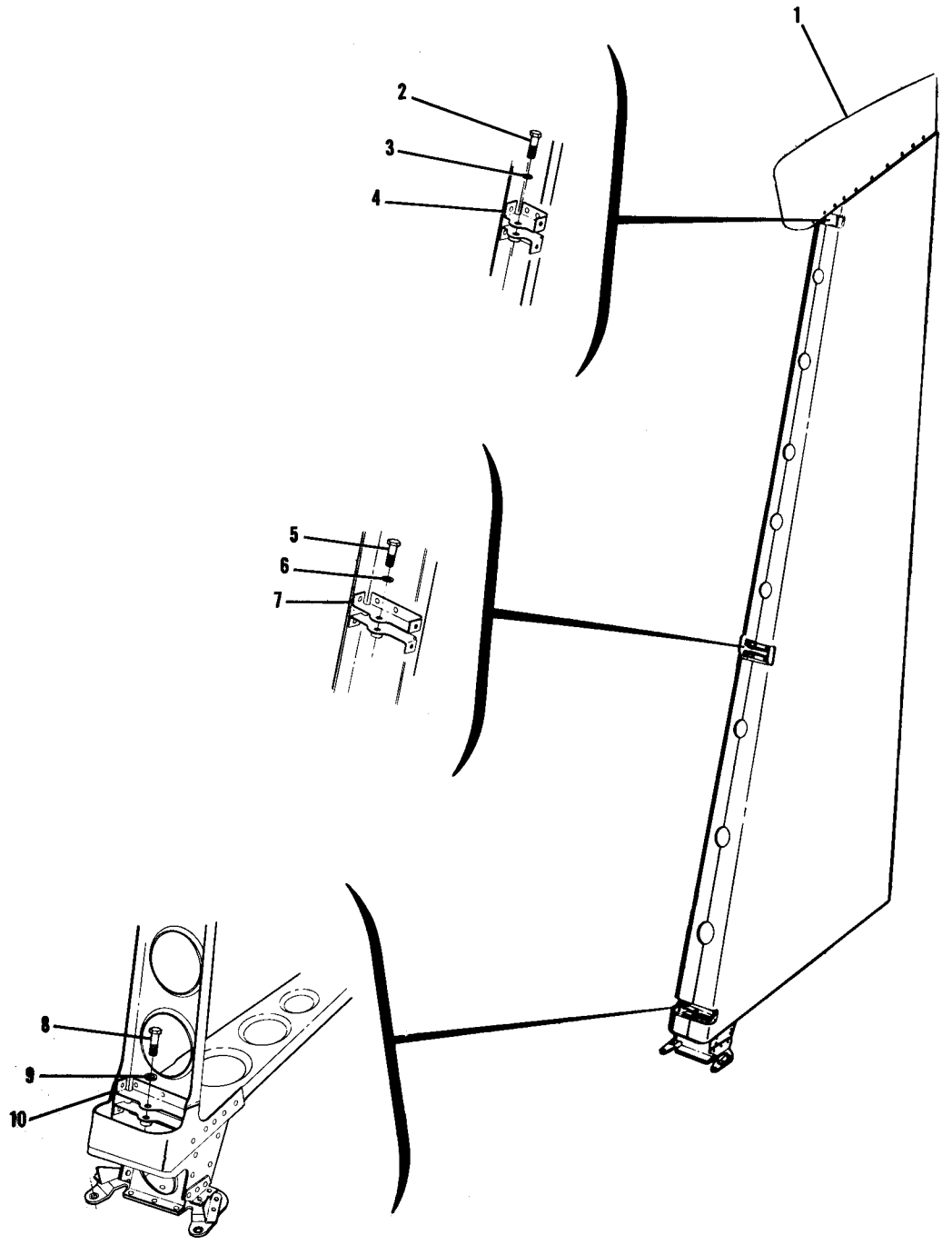
b. Weight the tail down to raise the nose wheel off the ground.

c. On the 210 and 210A, disconnect rudder trim linkage from rudder bungee. On the 210B and on, disconnect rudder trim bungee from rudder bar arm.

d. On all models, disconnect nose gear steering bungee.

e. On all 210 series, set free length of nose gear steering bungee at 6.42±.02 inches between centers of mounting holes at each end, as shown in figure 10-5, and reconnect steering bungee.

f. On the 210 and 210A, adjust push-pull rods (13, figure 10-5) to position rudder pedals 6 1/2 inches aft of the firewall, measured from pedal pivot points, while nose gear is aligned in a straight fore-and-aft



1. Rudder
2. Bolt
3. Washer
4. Upper Hinge
5. Bolt
6. Washer
7. Center Hinge
8. Bolt
9. Washer
10. Lower Hinge

Figure 10-6. Rudder Installation

direction. Reconnect push-pull rods.

g. Clamp rudder pedals in neutral with a board.

h. Adjust rudder cable aft turnbuckles to streamline rudder with 30 pounds tension on rudder cables.

i. Remove board used to clamp rudder pedals in neutral.

j. Set rudder stop bolts to obtain correct rudder travel.

k. On the 210 and 210A, reconnect the rudder trim linkage to the rudder bungee and rig. Refer to Section 11.

l. On the 210B and on, reconnect the rudder trim bungee to the rudder bar arm and rig. Refer to Section 11.

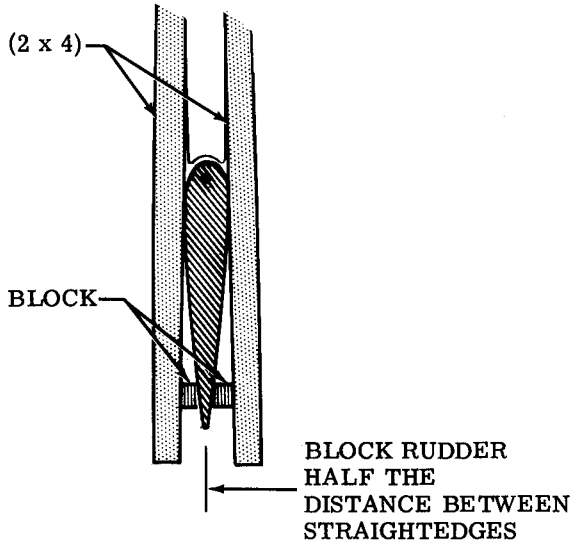
m. On all 205 and 206 series, reconnect and rig rudder trim and nose gear steering bungee. Refer to Section 11.

n. Operate rudder system, checking for ease of movement and full travel. Check cable tension with rudder in various positions. Cable tension should not be less than 20 pounds or more than 40 pounds in any position.

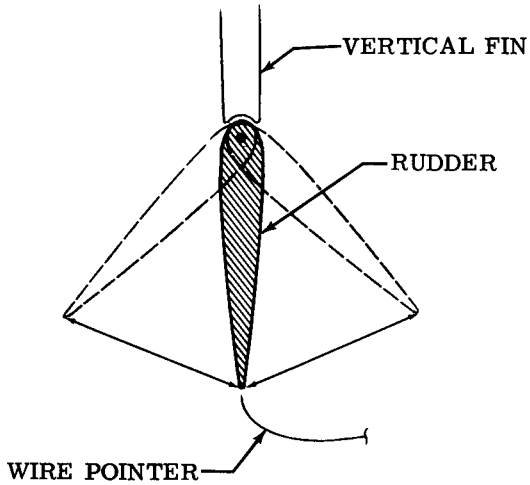
o. Check that all turnbuckles are safetied, all jam nuts are tight, and all parts removed for access are reinstalled, then lower nosewheel to the ground.

WARNING

Be sure rudder moves in correct direction when operated by the rudder pedals.



ESTABLISHING NEUTRAL POSITION OF RUDDER



MEASURING RUDDER TRAVEL

1. Establish neutral position of rudder by clamping straightedge (such as wooden 2 × 4) on each side of fin and rudder and blocking trailing edge of rudder half the distance between straightedges as shown.
2. Tape a length of soft wire to the stinger in such a manner that it can be bent to index at the lower corner of the rudder trailing edge.
3. Using soft lead pencil, mark rudder at point corresponding to soft wire indexing point (neutral).
4. Remove straightedges and blocks.
5. Hold rudder against right, then left, rudder stop. Measure distance from pointer to pencil mark on rudder in each direction of travel. Distance should be between 8.12" and 8.72".

Figure 10-7. Checking Rudder Travel

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SECTION 11

RUDDER TRIM CONTROL SYSTEMS

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11-1. RUDDER TRIM CONTROL SYSTEMS.

11-2. In the Model 210 and 210A, rudder trim is provided by a spring-loaded bungee in the right rudder cable. In the 210B and on, a spring-loaded bungee is attached directly to the left rudder bar arm. A trim knob is linked to the bungee in the 210 and 210A, and a trim wheel is linked to the bungee in the 210B and on. In the Models 205 and 206, the nose wheel steering bungee is utilized as a rudder trim bungee in flight. A trim wheel adjusts the overall length of the bungee through a sprocket and chain arrangement.

11-3. TROUBLE SHOOTING.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
FALSE READING ON POSITION INDICATOR.		
Improper rigging.		Rig in accordance with paragraph 11-6, 11-7, or 11-8.
Worn, bent, or disconnected linkage.	Observe visually.	Repair or replace as necessary.
HARD OR SLUGGISH OPERATION.		
Worn, bent, or binding linkage.	Observe visually.	Repair or replace as necessary.
Incorrect rudder cable tension.	Check rudder cable tension.	Adjust rudder cable tension as outlined in Section 10.
FULL TRAVEL NOT OBTAINED.		
Rudder trim system improperly rigged.		Rig in accordance with paragraph 11-6, 11-7, or 11-8.

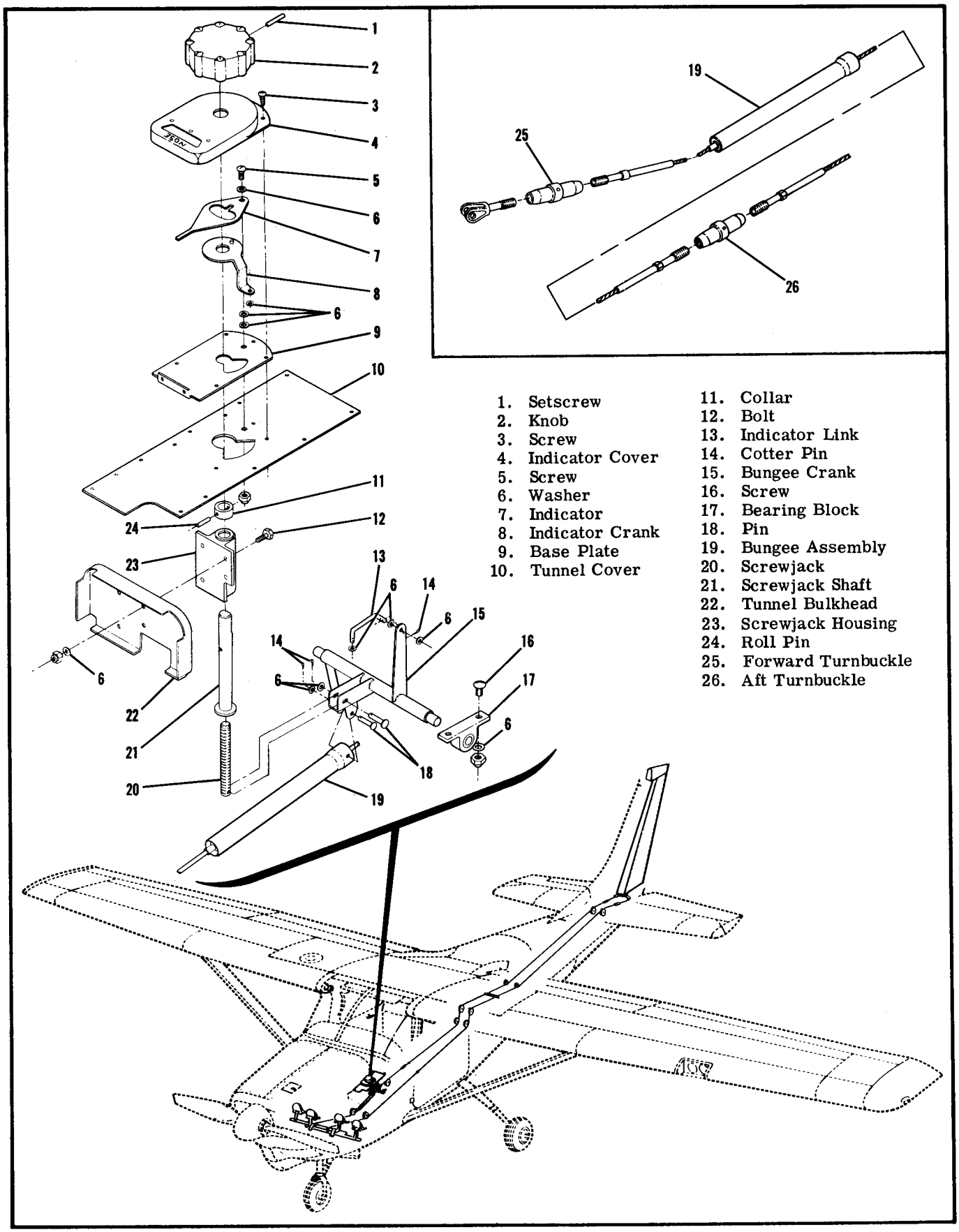


Figure 11-1. Rudder Trim Control System (210 and 210A)

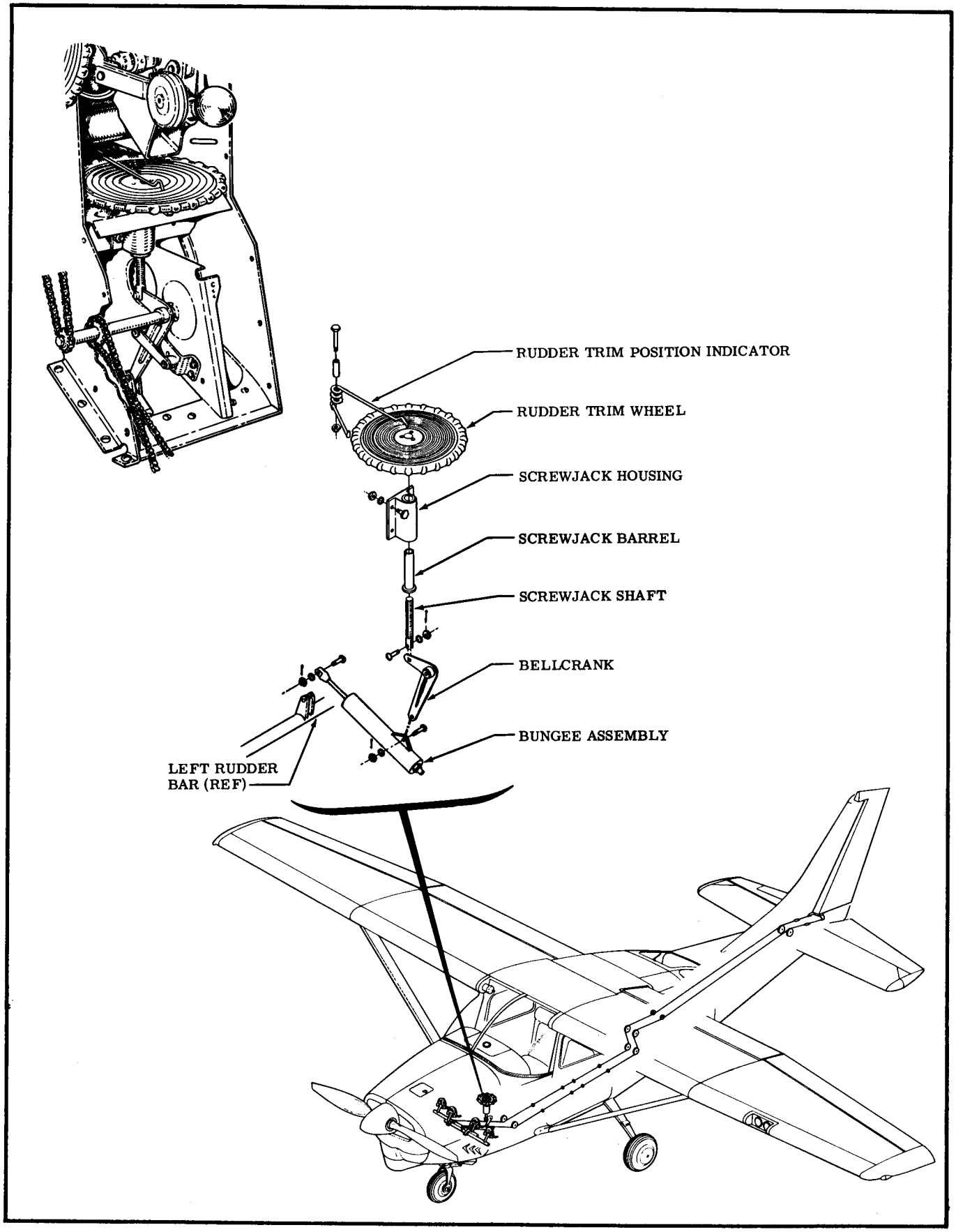
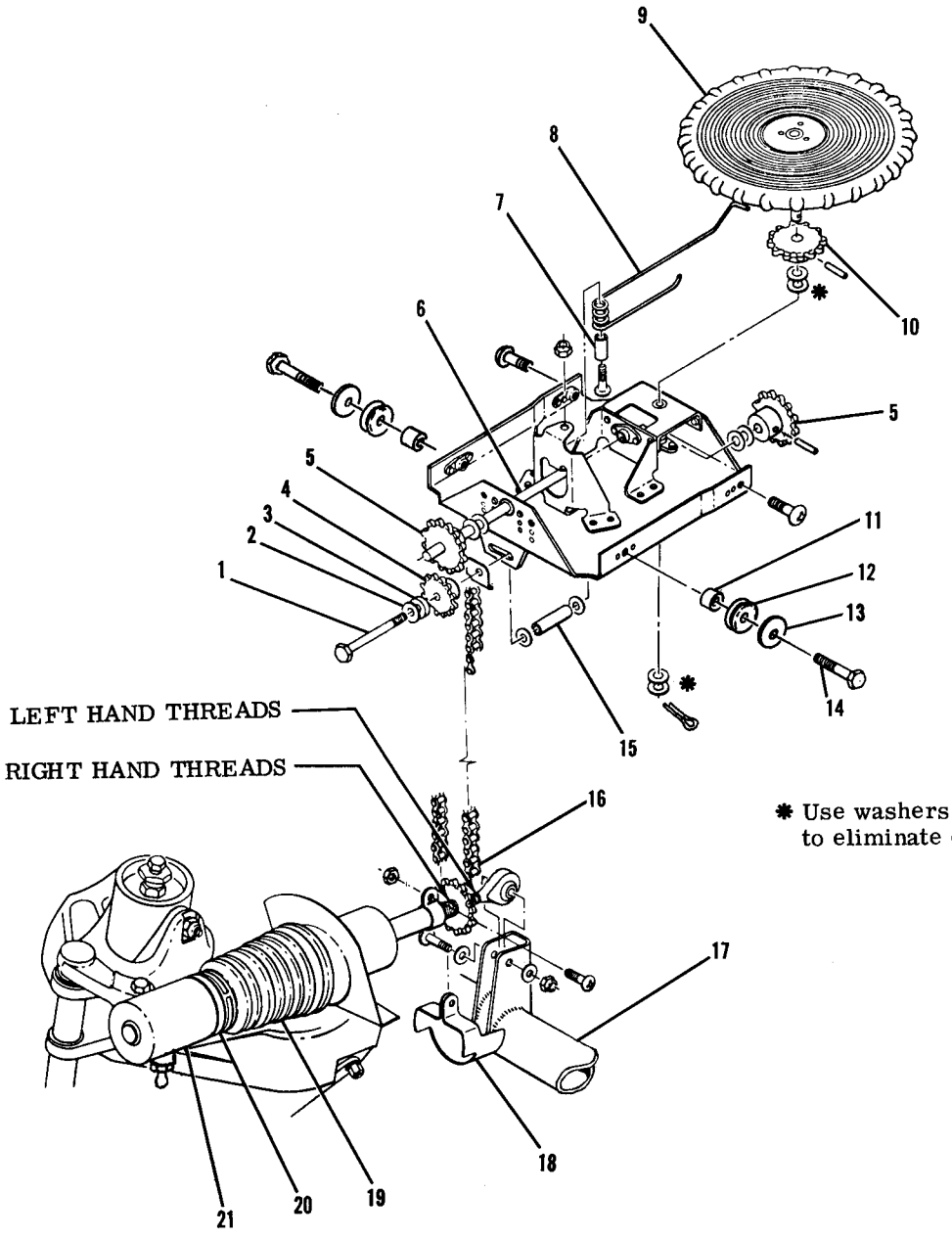


Figure 11-2. Rudder Trim Control System (210B and on)



1. Bolt
2. Washer
3. Bushing
4. Idler Sprocket
5. Sprocket
6. Shaft
7. Bushing
8. Indicator
9. Trim Wheel
10. Sprocket
11. Spacer
12. Grommet
13. Washer
14. Bolt
15. Bushing
16. Chain
17. Rudder Bar
18. Chain Guard
19. Sleeve
20. Clamp
21. Bungee

Figure 11-3. Rudder Trim Control System (205 and 206)

11-4. REPLACEMENT OF RUDDER TRIM SYSTEMS. The three basic types of trim systems are shown in figures 11-1, 11-2, and 11-3, and the illustrations may be used as a guide during removal and installation.

11-4A. REMOVAL AND INSTALLATION OF CONTROL PEDESTAL COVER.

a. Turn fuel selector valve to OFF, drain fuel strainer, then remove knurled nut from optional engine primer and pull plunger from primer. Protect primer from dirt.

b. Remove fuel selector handle by removing roll pin, and remove fuel selector plate or cup.

c. Remove cowl flap knob.

d. Remove nut from microphone jack when attached to cover.

e. Remove wing flap control knob (prior to 210D).

f. Remove screws securing pedestal cover and remove the cover.

g. Reverse the preceding steps to install the cover.

11-5. REPAIR OF RUDDER TRIM SYSTEMS. Any worn, damaged, or defective components of the rudder trim system should be replaced.

11-6. RIGGING THE RUDDER TRIM SYSTEM - MODELS 210 AND 210A. (See figure 11-1.)

NOTE

Check that the rudder control system is rigged properly before rigging the rudder trim control system.

a. Disconnect bungee (19) from crank assembly (15) by removing lower pin (18).

b. Weight the tail to raise nose wheel off ground.

c. Secure rudder in a streamlined position.

d. Center indicator (7) by rotating knob (2).

e. With rudder system neutral and indicator centered, adjust turnbuckles (25 and 26) to move bungee (19) forward or aft until hole for pin (18) aligns. Maintain correct rudder cable tension.

f. Install pin (18), washer (6), and cotter pin (14).

g. Safety turnbuckles, remove device used to secure rudder in streamlined position, and remove weight from tail to lower nose wheel to ground. Reinstall any parts removed for access.

11-7. RIGGING THE RUDDER TRIM SYSTEM - MODEL 210B AND ON. (See figure 11-2.)

NOTE

The only rigging adjustment possible, or necessary, on this rudder trim system is adjustment of the trim pointer to correspond with the spring-load being brought to bear on the rudder control system. The rigging method employed here involves merely "centering" the rudder and then "centering" the trim wheel indicator. Unless trim mechanism parts are deformed, this results in a correctly-rigged system. The rudder control system and nosewheel steering bungee must be properly rigged before rigging the rudder trim system.

a. Remove pedestal decorative cover and sheet metal covers to gain access to rudder trim components in pedestal.

b. Weight the tail to raise nosewheel off ground.

c. Turn rudder trim wheel until rudder is streamlined.

d. If necessary, readjust pointer by lifting "tracking" leg of pointer out of spiral groove in trim wheel. Set pointer to neutral.

e. Using trim wheel, run pointer through its full travel, checking to see that there is corresponding response of rudder.

f. Lower nosewheel to ground and reinstall all parts removed for access.

11-8. RIGGING THE RUDDER TRIM SYSTEM — MODEL 205 AND 206 SERIES. (See figure 11-3.)

a. Remove pedestal cover and pilot's rudder bar shield.

b. Disconnect nosewheel steering bungee from right rudder bar arm by removing nut, washer and bolt.

c. Raise nosewheel off ground and lock nose gear in neutral.

d. Loosen idler sprocket on roller chain connecting rudder trim wheel mechanism to steering bungee.

e. Block rudder in neutral position.

NOTE

The rudder control system must be correctly rigged prior to rigging of the trim system.

f. Screw bungee sprocket all the way into bungee shaft, then screw rod end all the way into sprocket threads.

NOTE

This sets the bungee at its shortest free length.

g. Holding rod end to prevent it from turning, rotate sprocket until the hole in rod end aligns exactly with attaching hole on right rudder bar arm. Install bolt, washer and nut.

h. With chain disengaged from bungee sprocket, set trim wheel to neutral position.

i. Without disturbing bungee or trim wheel sprocket, set chain on sprockets and tighten idler sprocket.

j. Unblock rudder, then run trim wheel through its full range of travel, observing that full pointer travel is reached before full bungee extension or contraction is attained.

k. Lower nosewheel to ground and reinstall all parts removed for access.

WARNING

Be sure rudder moves in proper direction when moved by trim control wheel.

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SECTION 12

POWERPLANT

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12-1. ENGINE COWLING.

12-2. The upper cowling is divided into four removable sections. The right and left nose caps are fastened to the lower section and to each other with screws. The right and left upper cowl sections are secured with quick release fasteners and either section may be removed individually. The left cowl section has two access doors, one at the upper front provides easy access to the engine oil filler neck, and one at the lower left provides easy access to the oil dipstick. The lower engine nacelle is an extension of the fuselage and provides fairing for the 210-series nose wheel in its retracted position.

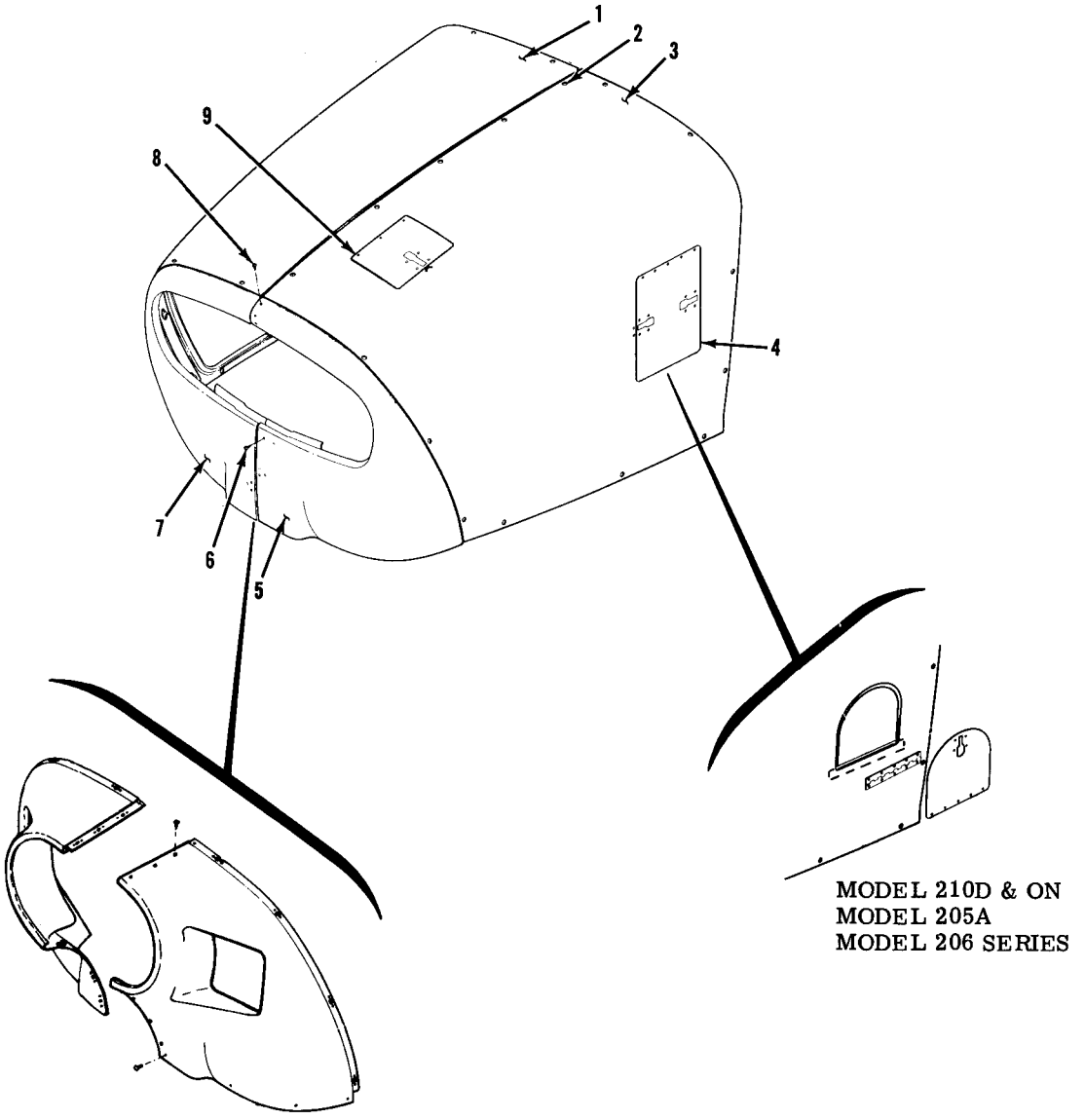
12-3. CLEANING, INSPECTION AND REPAIR OF ENGINE COWLING. The cowling should be cleaned by spraying with solvent (Federal Specification PS-661 or equivalent) and wiping clean with a cloth. After cleaning, inspect cowling for dents, cracks, and loose rivets. Repair all defects to prevent spread of damage.

12-4. ENGINE.

12-5. The Models 210, 205 and 206 series airplanes are powered by a six-cylinder Continental engine. Refer to paragraph 12-6 for engine data.

12-6. ENGINE DATA.	210, 210A	210B	210C, 205, 205A
Model (Continental)	IO-470-E	IO-470-S	IO-470-S
BHP at RPM	260 at 2625	Same	Same
Number of Cylinders	6 - horizontally opposed	Same	Same
Displacement	471 Cubic Inches	Same	Same
Bore	5.00 Inches	Same	Same
Stroke	4.00 Inches	Same	Same
Compression Ratio	8.6:1	Same	Same
Magnetos	Bendix S6RN-25 (210 only)		Slick # 662
	Bendix S6RN-201 (left)	Same	
	Bendix S6RN-205 (right)	Same	
Right Magneto	Fires 20° BTC Upper Right and Lower Left	Same	Same
Left Magneto	Fires 20° BTC Upper Left and Lower Right	Same	Same
Firing Order	1-6-3-2-5-4	Same	Same
Spark Plugs	SL-300A (.15 - .18 Gap)	Same	Same
Fuel Metering System	Continental Fuel Injection	Same	Same
Unmetered Fuel Pressure	9.0 to 11.0 PSI at 600 RPM	Same	Same
	25.3 to 26.8 PSI at 2625 RPM	Same	Same
Fuel	Aviation - 100/130 Grade (Min.)	Same	Same
Oil Sump Capacity	12 U.S. quarts	Same	Same
Tachometer	Type AS 54 mechanical drive	Same	Same
Generator	12 volt, 35 ampere	12 volt, 50 amp	Same
Dry Weight with Accessories (Approx)	465 pounds	Same	Same
Oil Pressure			
Minimum Idling	10 PSI	Same	Same
Normal	30 to 60 PSI	Same	Same
Oil Temperature			
Normal Operating	Within Green Arc	Same	Same
Maximum Permissible	Red Line (240°F)	Same	Same
Cylinder Head Temperature	460° F maximum	Same	Same
INSTRUMENT CONNECTION LOCATIONS:			
Oil Temperature	Below oil cooler	Same	Same
Oil Pressure	Between No. 2 and No. 4 cylinders	Same	Same
Cylinder Head Temp.	Lower side of No. 3 cylinder	Lower side of No. 1 cylinder	Same
Manifold Pressure	Right rear of intake manifold	Same	Same
Fuel Flow	At top of fuel metering unit	Fuel manifold valve	Same

ENGINE DATA. (Cont)	210D, 206	210E, P206, U206
Model (Continental)	IO-520A	IO-520A
BHP at RPM	285 at 2700	Same
Number of Cylinders	6 - Horizontally opposed	Same
Displacement	520 Cubic Inches	Same
Bore	5.25 Inches	Same
Stroke	4.00 Inches	Same
Compression Ratio	8.5:1	Same
Magnetos	Slick # 662	Same
Right Magneto	Fires 20° BTC Upper Right and Lower Left	Same
Left Magneto	Fires 20° BTC Upper Left and Lower Right	Same
Firing Order	1-6-3-2-5-4	Same
Spark Plugs	SL-350 (.15-.18 Gap)	Same
Fuel Metering System	Continental Fuel Injection	Same
Unmetered Fuel Pressure	9.0 - 11.0 PSI at 600 RPM	Same
	30.0 - 31.5 PSI at 2700 RPM	Same
Fuel	Aviation - 100/130 Grade (Min.)	Same
Oil Sump Capacity	12 U.S. quarts	Same
Tachometer	Type AS 54 mechanical drive	Same
Generator	12 volt, 35 ampere	---
Alternator	---	14 volt, 52 ampere
Dry Weight with Accessories (Approx)	471 Pounds	Same
Oil Pressure		
Minimum Idling	10 PSI	Same
Normal	30 to 60 PSI	Same
Oil Temperature		
Normal Operating	Within Green Arc	Same
Maximum Permissible	Red Line (240°F)	Same
Cylinder Head Temperature	460°F maximum	Same
INSTRUMENT CONNECTION LOCATIONS:		
Oil Temperature	Below Oil Cooler	Same
Oil Pressure	Between No. 2 and No. 4 cylinders	Same
Cylinder Head Temp.	Lower side of No. 1 cylinder	Same, except P206 in No. 2 cylinder
Manifold Pressure	Right Rear of Intake Manifold	Same
Fuel Flow	Fuel Manifold Valve	Same



MODEL 210D & ON
MODEL 205A
MODEL 206 SERIES

MODEL 210E & ON
MODEL P206 (SUPER SKYLANE) & ON

1. Right Cowl
2. Fastener
3. Left Cowl
4. Dipstick Access Door
5. Left Nose Cap
6. Screw
7. Right Nose Cap
8. Screw
9. Oil Filler Access Door

Figure 12-1. Typical Engine Cowling

12-7. TROUBLE SHOOTING.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
ENGINE WILL NOT START.		
No fuel to engine.	Check mixture control in full RICH position, auxiliary pump switch PRIME and operating, selector valve in correct position, tank fuel level.	Place controls and switches in proper position. Fill fuel tanks.
	Turn the auxiliary fuel pump ON and check fuel pressure indication. Loosen the line at an injection nozzle. If no fuel flow is apparent, proceed progressively toward the auxiliary fuel pump until the trouble is isolated.	Replace defective lines or units.
Engine flooded.	Check for strong odor of fuel if engine sputters but will not start.	Clear engine in accordance with paragraph 12-12 and repeat starting procedure.
Magnetos grounded.	Check magneto "P" leads for shorts. Check for shorting at the terminal connections on the magneto switch. Check the magneto switch for proper operation.	Repair or replace any defective wiring.
Magnetos incorrectly timed to the engine.	Spark plugs fire but engine will not start. Engine backfires or afterfires.	Time magnetos to engine.
Spark plugs fouled.	Engine is correctly timed and has fire to the spark plugs but will not run. Remove plugs and check visually.	Clean, gap and test spark plugs. Replace faulty plugs. Refer to paragraph 12-6 for spark plug gap.
Water in fuel.	Check fuel strainer.	Drain all water from strainer.
ROUGH IDLE.		
Nozzle air screens restricted.	Observe visually.	Remove and clean nozzles.
Improper idle mixture adjustment.		Set idle mixture as described in paragraph 12-35.
Mixture control set for lean mixture.	Check manually.	Use full rich mixture for all ground operations.
ENGINE WILL NOT RUN AT IDLING SPEED.		
Idle speed and/or idle mixture improperly adjusted.		Set idle speed and/or mixture as described in paragraph 12-35.
Propeller control set in low RPM position.	Check propeller control position.	Use high RPM setting for ground operation.
POOR ACCELERATION.		
Idle mixture too lean.	Engine lags on acceleration.	Adjust idle mixture.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
POOR ACCELERATION (Cont).		
Linkage worn.	Check manually.	Replace and/or tighten linkage.
ENGINE RUNS ROUGH.		
Restricted nozzles.	Check visually.	Clean nozzles.
Improper mixture.	Mixture control must be adjusted for smooth engine operation, or engine cannot be smoothed, even with mixture control.	See paragraph 12-35.
LOW FUEL PRESSURE.		
Restricted flow to metering valve.	Check mixture control for full travel. Check for clogged fuel filters.	Rig mixture control in accordance with paragraph 12-56. Clean fuel filters.
Inadequate flow from pump.	Operate the auxiliary fuel pump to determine that the fuel pressure gage is not at fault.	See paragraph 12-47.
HIGH FUEL PRESSURE.		
Restricted recirculation passage in pump.	Clean pump screens; if this fails to remedy, pump passages are clogged.	Replace pump.
FLUCTUATING GAGE.		
Vapor in system.	Operate auxiliary fuel pump. If not cleared with auxiliary pump check for clogged ejector jet in vapor separator cover.	Clean ejector jet with solvent only, do not use wires.
Air in gage line. Leak at gage connection.	Check gage connection. Check for air in line.	Bleed gage line and repair leak.
POOR IDLE CUT-OFF.		
Engine getting fuel.	Check mixture control to be in full idle cut-off. Check auxilary pump to be OFF. If neither, fuel manifold valve is defective.	Rig mixture control in accordance with paragraph 12-56. Turn auxiliary pump OFF. Clean or replace manifold valve.

SHOP NOTES:

12-8. ENGINE REMOVAL. (See figure 12-2 or 12-3.) Identify each item as it is disconnected to aid in replacement.

NOTE

Plug or cap all disconnected lines, hoses and fittings.

a. Turn all cabin switches and fuel selector valve OFF.
b. Open the battery circuit by disconnecting the ground cable.
c. Remove the engine cowling.

WARNING

Residual fuel draining from lines and hoses is a fire hazard. Use care to prevent the accumulation of such fuel when lines and/or hoses are disconnected.

d. Disconnect magneto ground wires at the magnetos and pull them aft clear of the engine baffle.

WARNING

These magnetos DO NOT have internal grounding springs. Ground the magneto points to prevent accidental firing.

e. Drain the engine oil.
f. Remove propeller (See paragraph 14-7 or 14-12.)
g. Disconnect the induction air control, the throttle control, the mixture control, and the propeller governor control in accordance with paragraph 12-51.
h. Disconnect wires and cables as follows:
1. Disconnect oil temperature connector located directly below oil cooler.
2. Disconnect tachometer drive from adapter.
3. Disconnect starter cable.
4. Remove cylinder head temperature bulb (See paragraph 12-6 for location on the different models.)
5. Disconnect generator or alternator cable and cable shielding ground.
6. Disconnect the throttle warning microswitch.
7. Remove all clamps attaching wires or cables to the engine. Pull all wires and cables aft to clear the engine assembly.
i. Disconnect lines and hoses as follows:
1. Disconnect hydraulic lines at the hydraulic pump. (Model 210 series)
2. Disconnect vacuum line at the vacuum pump.
3. Disconnect the oil drain line at the oil drain fitting, if used.
4. Disconnect the manifold pressure line.
5. Disconnect the fuel supply line and the vapor return line at the fuel pump.
6. Disconnect the fuel pressure line at the fuel control unit or the fuel manifold valve.
7. Disconnect oil pressure line at the engine.
8. Disconnect and remove the left and right manifold drain lines and the balance tube drain.
j. Remove clamps securing the induction air control, the throttle control, the mixture control, and the propeller governor control. Pull these controls free of the engine, using care not to damage them by bending too sharply.
k. Disconnect the flexible ducting at air horns.
l. Disassemble and remove the right and left exhaust stack assemblies.
m. Attach a hoist to the lifting eye at the top center of the engine crankcase. Lift the engine just enough to relieve the weight from the engine mounts.

CAUTION

Place a stand under the tail tie-down ring before removing the engine. The loss of engine weight will allow the tail to drop.

n. Remove the engine as follows: (See figure 12-4 or 12-5.)
1. Remove bolts and ground strap.
2. Hoist engine out of nacelle and clear of aircraft.

CAUTION

Hoist engine slowly and make sure all wires, lines, and hoses have been disconnected.

3. Remove mount pads, spacers, ground straps, and pins.

12-9. INSPECTION AND REPAIR. For specific items to be inspected refer to engine manufacturer's manual.
a. Inspect all hoses for internal swelling, chafing through protective plys, cuts and breaks. Replace any damaged or doubtful hoses.
b. Inspect all fittings for thread damage.
c. Visually inspect the engine for loose nuts, bolts, cracks, and fin damage.
d. For major repairs refer to the manufacturer's overhaul and repair manual.

12-10. ENGINE INSTALLATION. (See figure 12-2 or 12-3.)
a. Hoist engine to a point just above the nacelle.
b. Install engine on mount pads as follows: (See figure 12-4 or 12-5.)
1. Install mount pads, spacers, pins, and ground straps on engine mount.
2. Lower the engine slowly into place on the engine mounts.
3. Torque the engine shock mount bolts to the value shown in figure 12-4 or 12-5.
c. Install the flexible induction air tube on the shroud on the right muffler. Secure with clamp.
d. Connect the flexible ducting at air horns.
e. Route the propeller governor control cable along the inside of the left intake manifold and secure with two clamps.

f. Connect lines and hoses as follows:

1. Install and connect the hydraulic pump vent line. (Model 210 series)
2. Install and connect the left and right manifold drain lines and the balance tube drain.
3. Connect the oil pressure line at its fitting between No. 2 and 4 cylinders.

NOTE

Throughout the fuel system use a thread lubricant of graphite-petrolatum (Spec. MIL-T-5544 or equivalent) only if necessary. Anti-seize compound (Spec. JAN-A-669, or equivalent) may be used to seal a leaking connection. Apply sparingly to male fittings only, omitting the first two threads. Always be sure that a compound, the residue from a previously used compound, or any other foreign material cannot enter the system.

4. Connect the fuel pressure line at the fuel control unit or fuel manifold valve.
5. Connect the fuel supply line and the vapor return line at the fuel pump.
6. Connect the manifold pressure line.
7. Connect the oil drain line at the oil drain fitting if used.
8. Connect vacuum line at the vacuum pump.
9. Connect hydraulic lines at the hydraulic pump.

g. Connect wires and cables as follows:

WARNING

The magnetos DO NOT have internal grounding springs. If the magneto ground wires are not installed and the switch turned off, ground the magneto points to prevent accidental firing.

1. Connect the oil temperature connector located directly below the oil cooler.
2. Connect tachometer drive to adapter.
3. Connect starter cable.
4. Install cylinder head temperature bulb (See paragraph 12-6 for location on the different models.)
5. Connect generator or alternator cables and cable shielding ground.
6. Connect the throttle warning microswitch which is located on the right aft of the air intake box.
7. Install all clamps attaching wires or cables to engine.

h. Install the right and left exhaust stack assemblies. Use all new gaskets regardless of apparent condition of old gaskets.

i. Install the engine controls in accordance with paragraph 12-52.

j. Rig the engine controls in accordance with paragraph 12-53.

k. Connect the battery ground cable.

l. Make a magneto switch ground out and continuity check. Connect the magneto ground wires to the magnetos.

WARNING

Be sure the magneto switch is OFF.

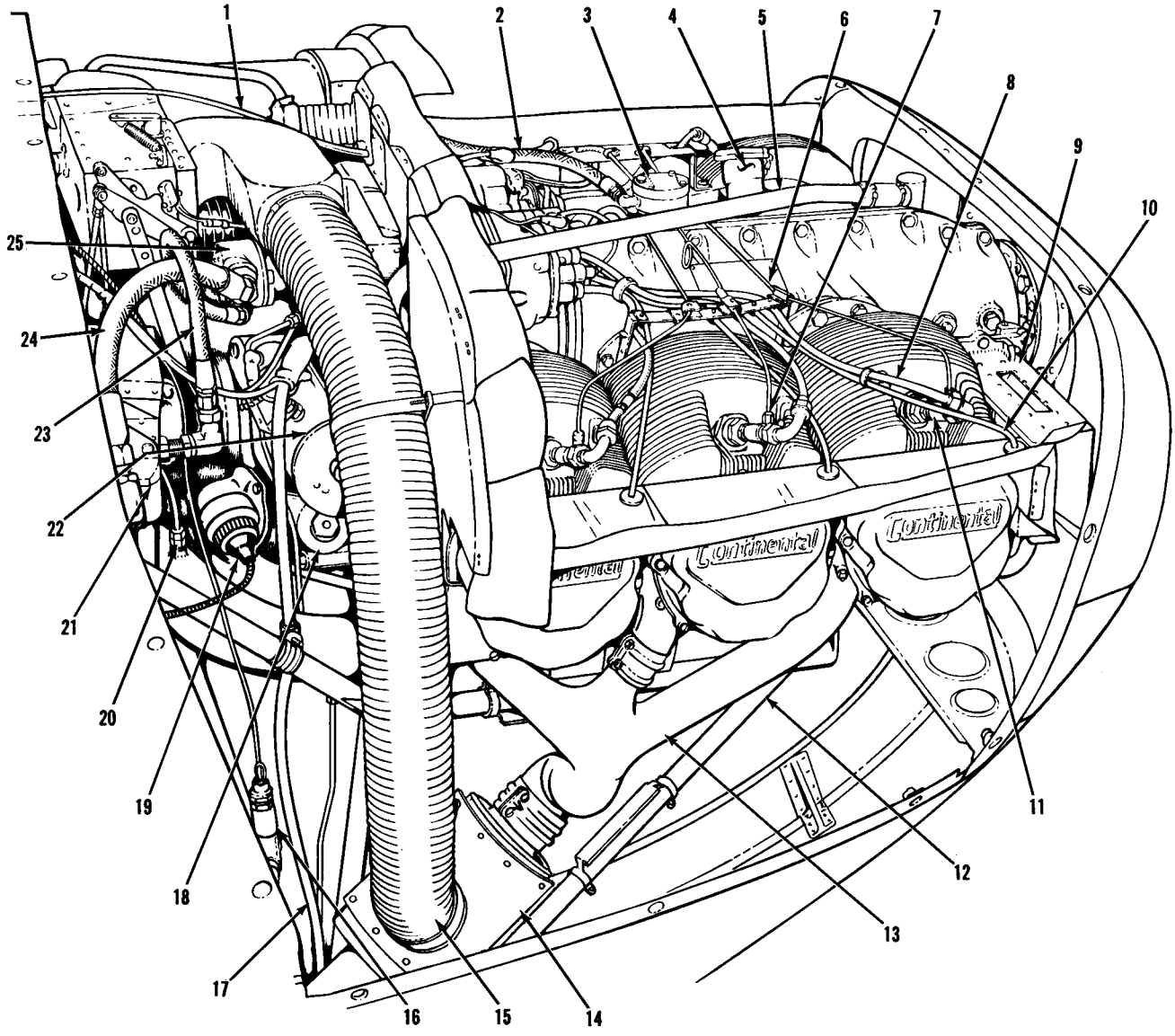
m. Install propeller. (See paragraphs 14-8 or 14-14.)

n. Service the engine in accordance with the applicable instructions in Section 2.

o. Inspect the engine installation as outlined in the following paragraph.

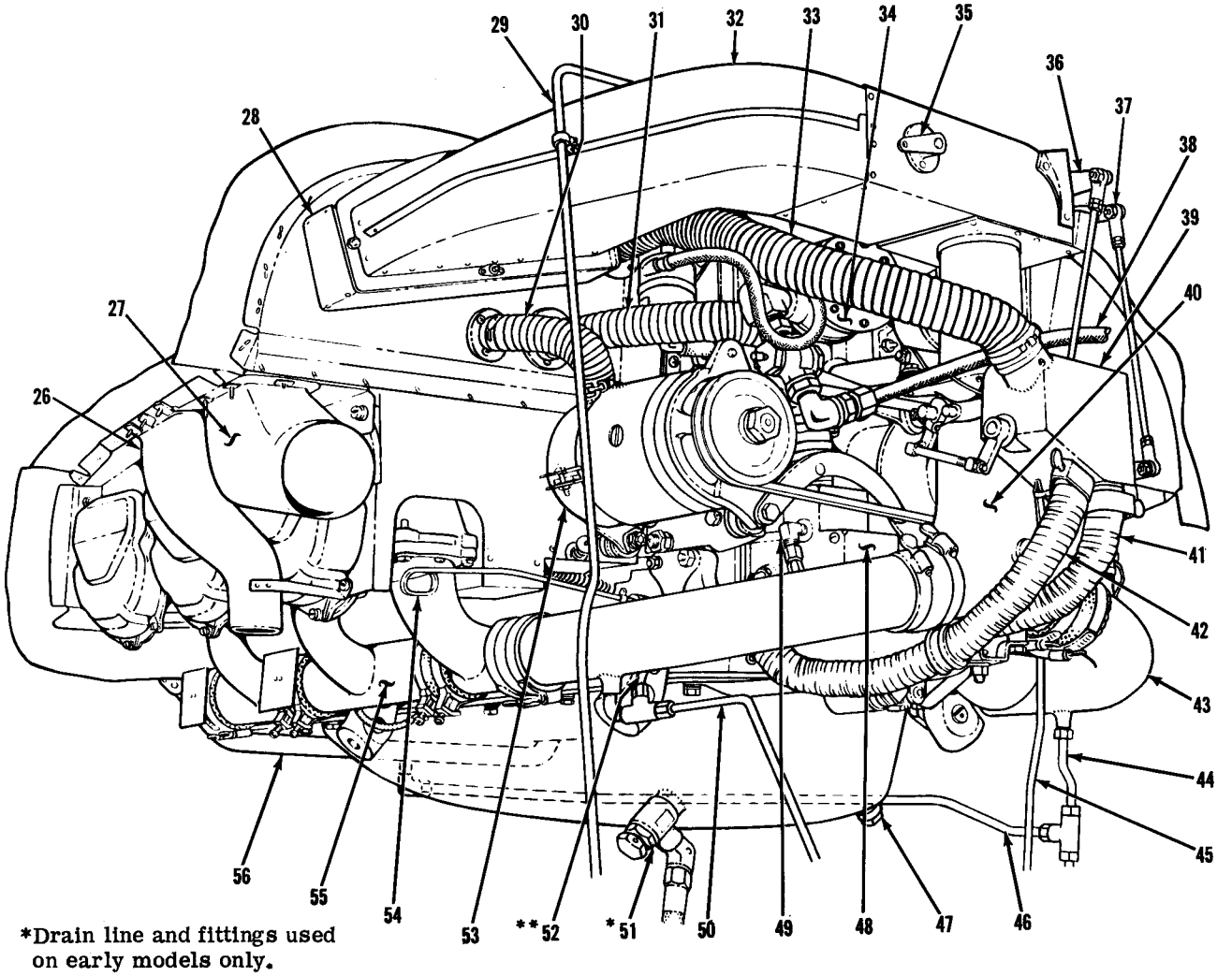
12-11. INSPECTION OF ENGINE INSTALLATION. The following check list may be used as a guide for inspecting the engine installation.

1. Propeller mounting bolts safetied.
2. Engine mounts secure.
3. Oil temperature bulb connector secure and safetied.
4. Oil pressure relief valve plug safetied.
5. Tachometer drive connection secured.
6. Starter cable connection secure and insulating boot in place.
7. Cylinder head temperature bulb installed.
8. Generator or alternator cable connections secure and cable shielding grounded.
9. All wiring securely clamped in place.
10. Fuel pump connections tight.
11. Manifold pressure line connections tight.
12. Oil pressure connections clamped and tight.
13. Fuel injection nozzles tight.
14. Fuel injection lines clamped and tight.
15. Fuel manifold secure.
16. Oil screen installed and safetied.
17. Crankcase breather line connections secure.
18. Air-oil separator exhaust line and return oil hose connections secure. (Optional equipment.)
19. Vacuum line and vacuum pump outlet hose conconnections secure. (Optional equipment.)
20. Oil dilution hose connections tight. (Optional equipment.)
21. Engine controls properly rigged.
22. Oil drain plugs tight and safetied.
23. Oil quantity check.
24. Hoses and lines secure at firewall.
25. Fuel-air control unit and air intake box and filter secure.
26. Shrouds installed on engine-driven fuel pump and fuel control unit. Ram air tubes installed and clamped.
27. Induction system clamps tight.
28. Exhaust system secure.
29. Spark plugs tight. Ignition harness connections tight and harness properly clamped.
30. Magneto ground wires connected and safetied.
31. Hydraulic lines secure.
32. Induction air tube installed and clamped.
33. Cabin air and cabin heat tubes installed and clamped.
34. Engine drain and vent lines secure at lower firewall.
35. Generator or alternator drive belt tight.
36. Engine nacelle for loose objects (tools, rags, etc.).
37. Cowling installed and secure.



1. Magneto Ground Wires
2. Fuel Line
3. Fuel Manifold Valve
4. Oil Filler
5. Crankcase Breather Line
6. Fuel Injection Line
7. Fuel Injection Discharge Nozzle
8. Upper Spark Plug Lead
9. Oil Cooler
10. Lower Spark Plug Lead
11. Spark Plug
12. Engine Mount
13. Right Exhaust Stack Assembly
14. Induction Air Heat Shroud
15. Induction Hot Air Duct
16. Fuel Solenoid - Vapor Return
17. Starter Cable
18. Oil Screen
19. Tachometer Drive
20. Manifold Pressure Fitting
21. Hydraulic Fluid Filter
22. Starter
23. Hydraulic Pressure Line
24. Hydraulic Return Line
25. Hydraulic Pump

Figure 12-2. Engine Assembly Model IO-470-E (Sheet 1 of 2)

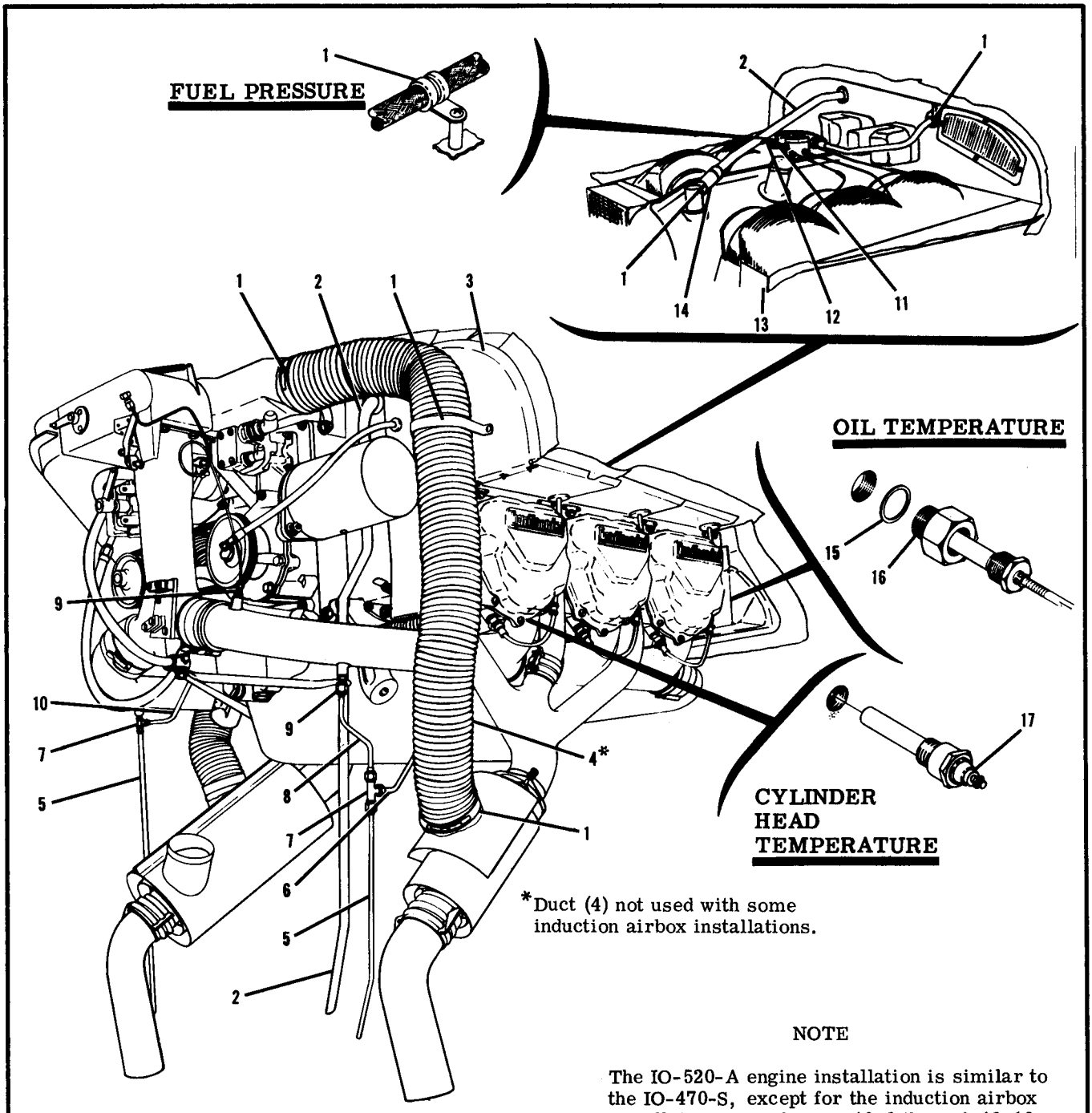


*Drain line and fittings used on early models only.

**Manifold and fuel pump drains moved aft on later models.

26. Cabin Heat Air Horn
27. Cabin Fresh Air Horn
28. Induction Air Filter
29. Vacuum Pump Vent
30. Generator Ram Air Duct
31. Fuel Pump Ram Air Duct
32. Airbox
33. Fuel Control Unit Ram Air Duct
34. Vacuum Pump
35. Induction Air Control
36. Throttle Control
37. Mixture Control
38. Vacuum Line
39. Fuel Control Unit
40. Air Control Unit
41. Fuel Return Line Ram Air Duct
42. Fuel Supply Line Ram Air Duct
43. Right Intake Manifold
44. Right Manifold Drain
45. Hydraulic Pump Vent
46. Balance Tube Drain (Manifold)
47. Right Oil Sump Plug
48. Fuel Pump
49. Fuel Supply Line (Tank to Pump)
50. Left Manifold Drain
51. Left Oil Sump Plug and Drain
52. Fuel Pump Drain
53. Generator
54. Oil Dipstick
55. Left Intake Manifold
56. Balance Tube (Manifold)

Figure 12-2. Engine Assembly IO-470-E (Sheet 2 of 2)

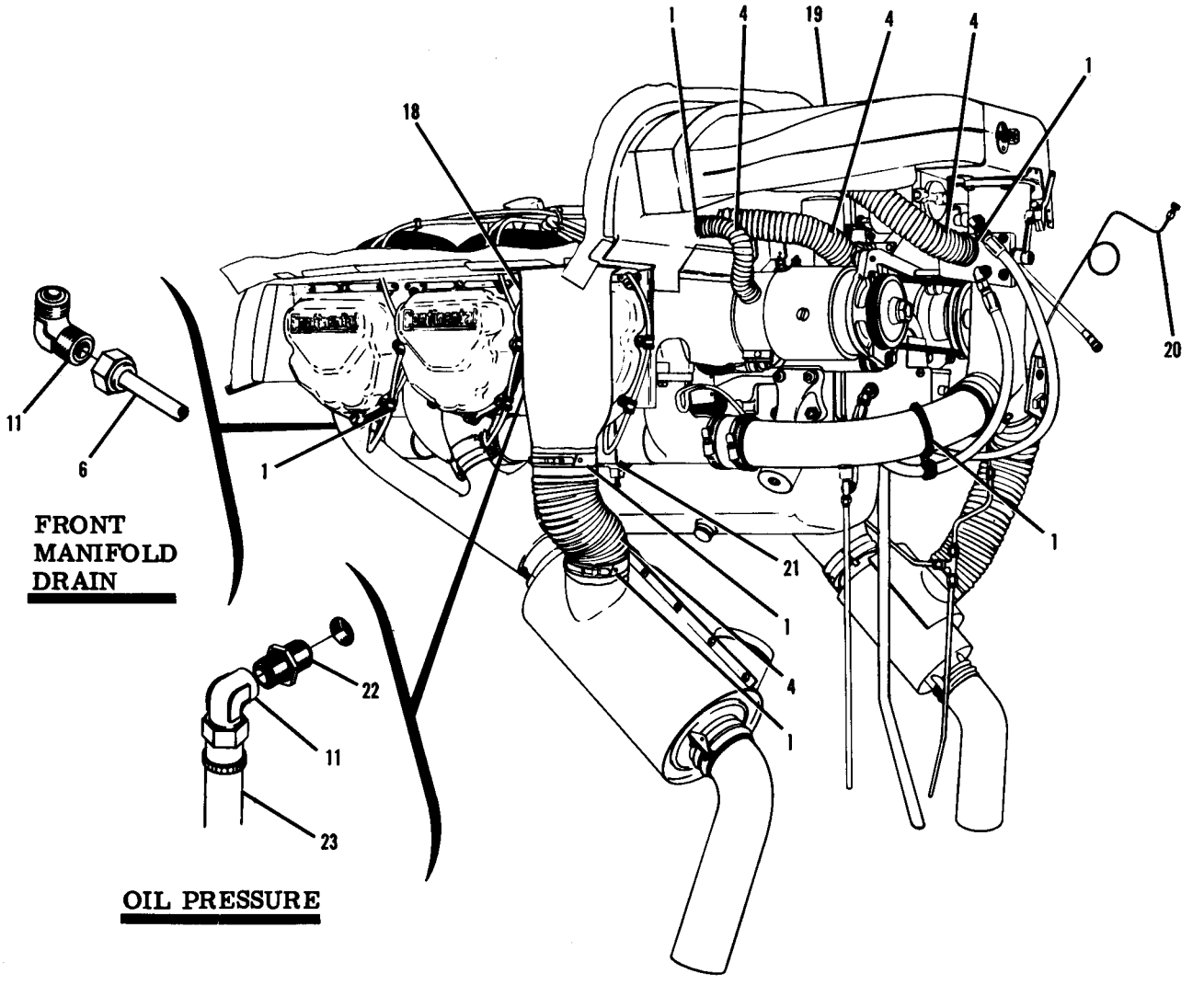


NOTE

The IO-520-A engine installation is similar to the IO-470-S, except for the induction airbox installation. See figures 12-6 through 12-10 for the induction airbox. See figure 12-12 for tailpipe braces.

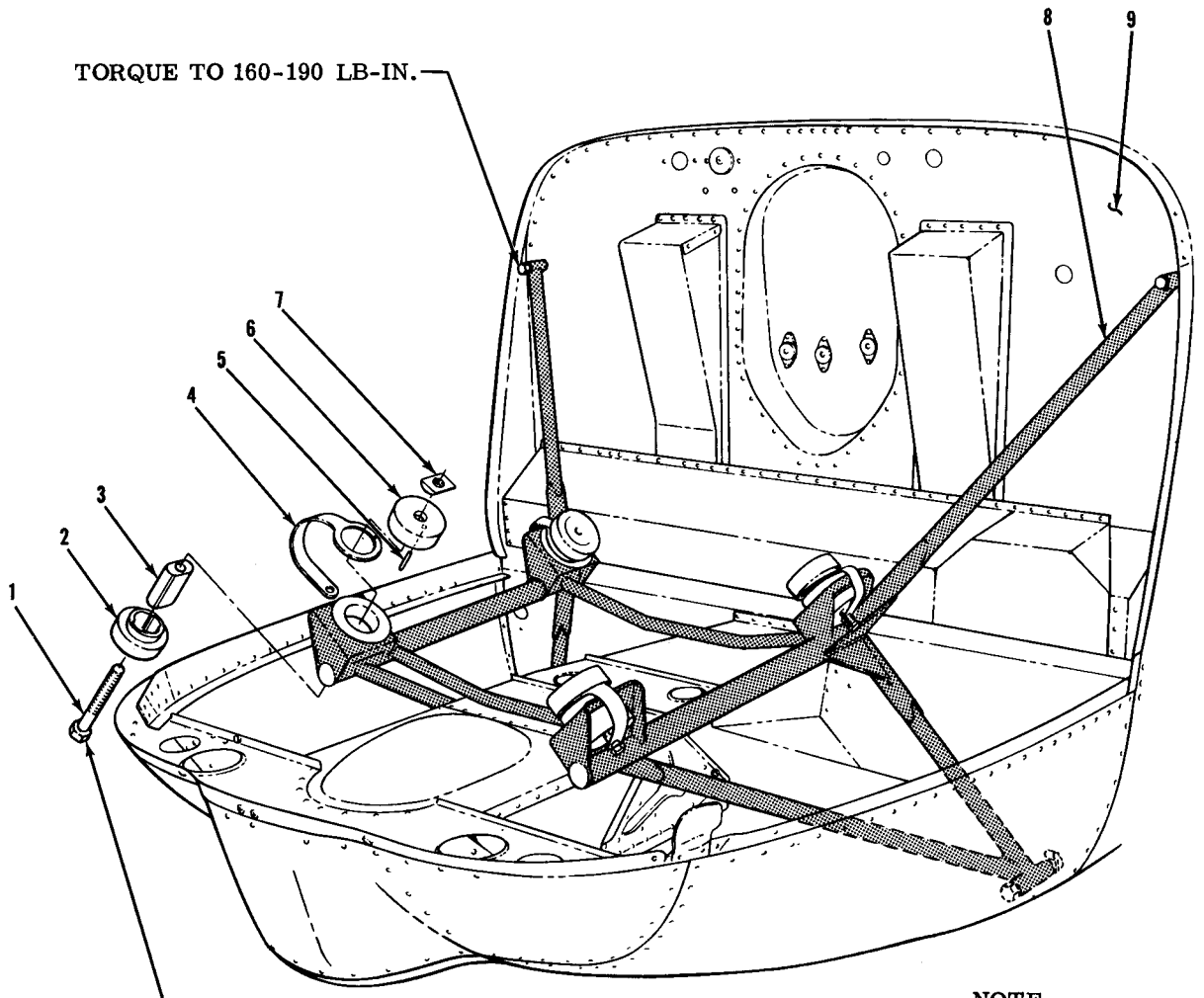
1. Clamp
2. Breather Tube
3. Baffle
4. Duct
5. Lower Manifold Drain Line
6. Forward Manifold Drain Line
7. Tee
8. Upper Manifold Drain Line
9. Nipple
10. Engine Pump Drain Line
11. Elbow
12. Fuel Pressure Hose

Figure 12-3. Engine Assembly - Models IO-470-S, and IO-520-A (Sheet 1 of 2)



13. Propeller Governor
14. Hose
15. Gasket
16. Oil Temperature Adapter
17. Cyl. Head Temperature Transmitter
18. Air Inlet Assembly
19. Induction Air Box
20. Manifold Pressure Line
21. Exhaust Heat Deflector
22. Bushing
23. Oil Pressure Hose

Figure 12-3. Engine Assembly - Models IO-470-S, and IO-520-A (Sheet 2 of 2)



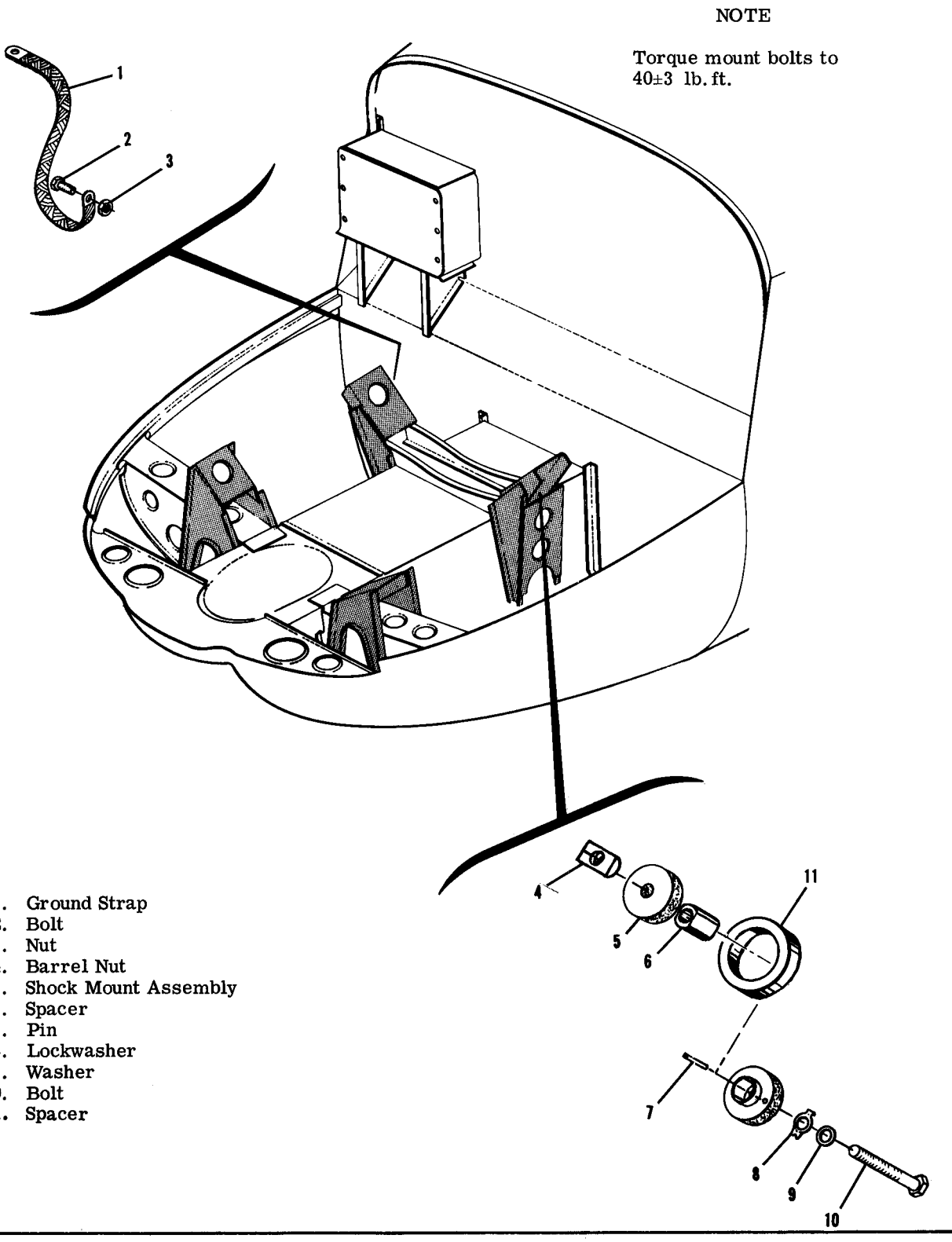
NOTE

ADD WASHERS UNDER BOLT HEADS AS NECESSARY TO KEEP BOLT THREADS FROM BOTTOMING.

TAB LOCKWASHERS ARE USED UNDER BOLT HEADS ON LATER SERIALS AS WELL AS REPLACEMENT SHOCK MOUNTS.

1. Bolt
2. Mount Pad
3. Spacer
4. Ground Strap
5. Pin
6. Mount Pad
7. Barrel Nut
8. Engine Mount
9. Firewall

Figure 12-4. Engine Mounts (210 and 210A)



1. Ground Strap
2. Bolt
3. Nut
4. Barrel Nut
5. Shock Mount Assembly
6. Spacer
7. Pin
8. Lockwasher
9. Washer
10. Bolt
11. Spacer

Figure 12-5. Engine Mounts (205 & 206 Series, and 210B & On)

12.12. ENGINE OPERATIONAL CHECK.

BEFORE STARTING ENGINE:

CAUTION

Ground operation should be held to a minimum to prevent overheating the engine. At no time should engine temperatures be allowed to exceed their maximum limits. Do not operate the engine with cowling removed.

a. Park airplane with nose headed into prevailing wind.
b. Install wheel chocks and position a fire extinguisher for easy access in event of engine fire.
c. Clear area directly in front and to rear of airplane of all objects that may be affected by propeller and propeller slipstream.

CAUTION

Avoid engine run-up with airplane parked in a loose gravel area. The propeller will pick up small stones which may damage propeller blades.

d. Release parking brake handle if previously set, and test operate brakes, noting any sponginess or excessive pedal travel. Reset parking brake handle after test.

CAUTION

Do not perform engine run-up if brake action is not normal. If airplane should jump chocks during run-up, brakes will be needed.

e. Position the following switches and controls as indicated:

Switch or Control	Setting
Ignition	OFF
Landing Gear	DOWN
Radio Switches	OFF
Auxiliary Fuel Pump	OFF
Master Switch	ON
Cowl Flaps	OPEN

(Never close or partially close cowl flaps to accelerate warm-up; engine damage can result)

f. Check all circuit breakers.
g. Check fuel quantity indicators for sufficient fuel.
h. Set fuel selector valve to fullest tank.
i. Check landing gear down (green) light for illumination.

NOTE

Turn master switch on before connecting generator type external power source. This will enable the battery to absorb transient voltages which otherwise might damage semiconductors in electronic equipment. Turn master switch off when using battery type external power.

STARTING ENGINE:

a. Start the engine in accordance with instructions in the Owner's Manual.
b. Check for oil pressure indication within 30 seconds in normal weather and 60 seconds in cold weather. If no indication appears, shut off engine and investigate.
c. After engine has started, disconnect external power source if used. If a battery type external power source was used, turn on master switch.

ENGINE WARM-UP AND OPERATIONAL CHECK:

a. Set throttle at 800 to 1000 RPM.

NOTE

The engine is set to idle at 600 rpm to insure satisfactory taxi control; however, prolonged idling should be done at 800 to 1000 rpm to insure satisfactory lubrication.

b. Leave induction air control in cold (full in) position.
c. Perform magneto ground-out check as follows:
1. Throttle engine back to idle (600 rpm).
2. Momentarily switch both magnetos OFF.

RESULT: The tachometer will indicate a sudden rpm drop when magnetos stop firing.

d. Advance throttle to 1700 rpm and perform a magneto check as follows:
1. Turn the magneto switch to left (L) and observe the rpm. Turn the magneto switch to BOTH to clear the plugs and then turn the magneto switch to right (R) and observe the rpm. Return the switch to BOTH.

RESULT: The rpm difference between the two magnetos operated singly should not differ more than 50 rpm. An absence of rpm drop may be an indication of faulty grounding or should be cause for suspicion of timing advanced beyond setting specified.

e. With engine at 1700 rpm, cycle propeller from high to low rpm, then return to high rpm.
RESULT: Watch for any indication of sluggish or erratic operation.

f. With engine still at 1700 rpm, pull induction air control out.
RESULT: Note drop in rpm. Return induction air control to cold (full in) position.

g. Make a mixture control check by slowly moving the mixture toward idle cut-off.
RESULT: When a slight drop in rpm is noted, indicating that fuel to the engine is being shut off, immediately return the mixture control to full rich.

h. Check that auxiliary fuel pump switch is OFF.
i. Idle at a reasonable speed two or three minutes to cool engine, then place mixture control in idle cutoff. After propeller stops, close throttle and turn ignition switch OFF. Turn all switches OFF.

12-13. AIR INDUCTION SYSTEM. (See figures 12-6 through 12-10.)

12-14. Ram air enters the induction air box at the upper left engine baffle and is ducted to the fuel-air control unit. An air filter is mounted between the air box and the upper left engine baffle. On the Model 210D and on, a dual ram air source is provided through the addition of an air filter and an air box at the upper right rear engine baffle. This additional air box is attached to the left air box assembly. An induction air door, located between the air box intake and the fuel air-control unit, may be operated manually, from the cabin to permit the selection of either cold or heated air. When the induction air door is closed, engine suction opens a spring-loaded door through which heated air is drawn from a shroud mounted on the right engine muffler on the Model 210 thru 210C and Model 205 through serial number 205-0033. On the Model 205 series with serial number 205-0034 and on, Model 206 series, and Model 210D and on, heated air is drawn from within the engine compartment. Also, on the 210D and on, the manually operated induction air door closes only the left induction air inlet. The spring-loaded door closes automatically, in the event of engine backfire, to prevent the backfire from discharging into the engine compartment, which would create a fire hazard. On some models the throttle and mixture control brackets are attached to the airbox. From the fuel air control unit, air is supplied to the cylinders through the manifold intake piping. Drains are provided in the left and right intake manifolds and balance tube. The balance tube connects the right and left intake manifold at the front of the engine.

12-15. REMOVAL OF AIR INTAKE BOX. (See figures 12-6 thru 12-10.)

a. Disconnect induction air control at control arm.
b. Disconnect throttle switch(es).
c. Remove induction air filter (right and left filter on Model 210D and on).
d. Loosen clamp and remove flexible heated air tube. (Models 210 thru 210C and Model 205 prior to serial number 205-0034.)
e. Loosen crankcase thru-bolt securing heated air horn support. (Models 210 thru 210C, and 205 prior to serial number 205-0034.)
f. Disconnect engine control rod ends and engine control anchor block. (IO-470-E only.)
g. Remove clamps attaching lines and wires to airbox.
h. Remove bolts securing air box to fuel-air control unit and remove airbox and gasket.

SHOP NOTES:

12-16. CLEANING AND INSPECTION OF AIR INTAKE BOX. Clean all metal parts with a suitable solvent. Inspect for cracks, dents, loose rivets, etc. Minor cracks may be stop drilled. In case of continued or severe cracking, replace air box.

12-17. INSTALLATION OF AIR INTAKE BOX. (See figures 12-6 thru 12-10.)

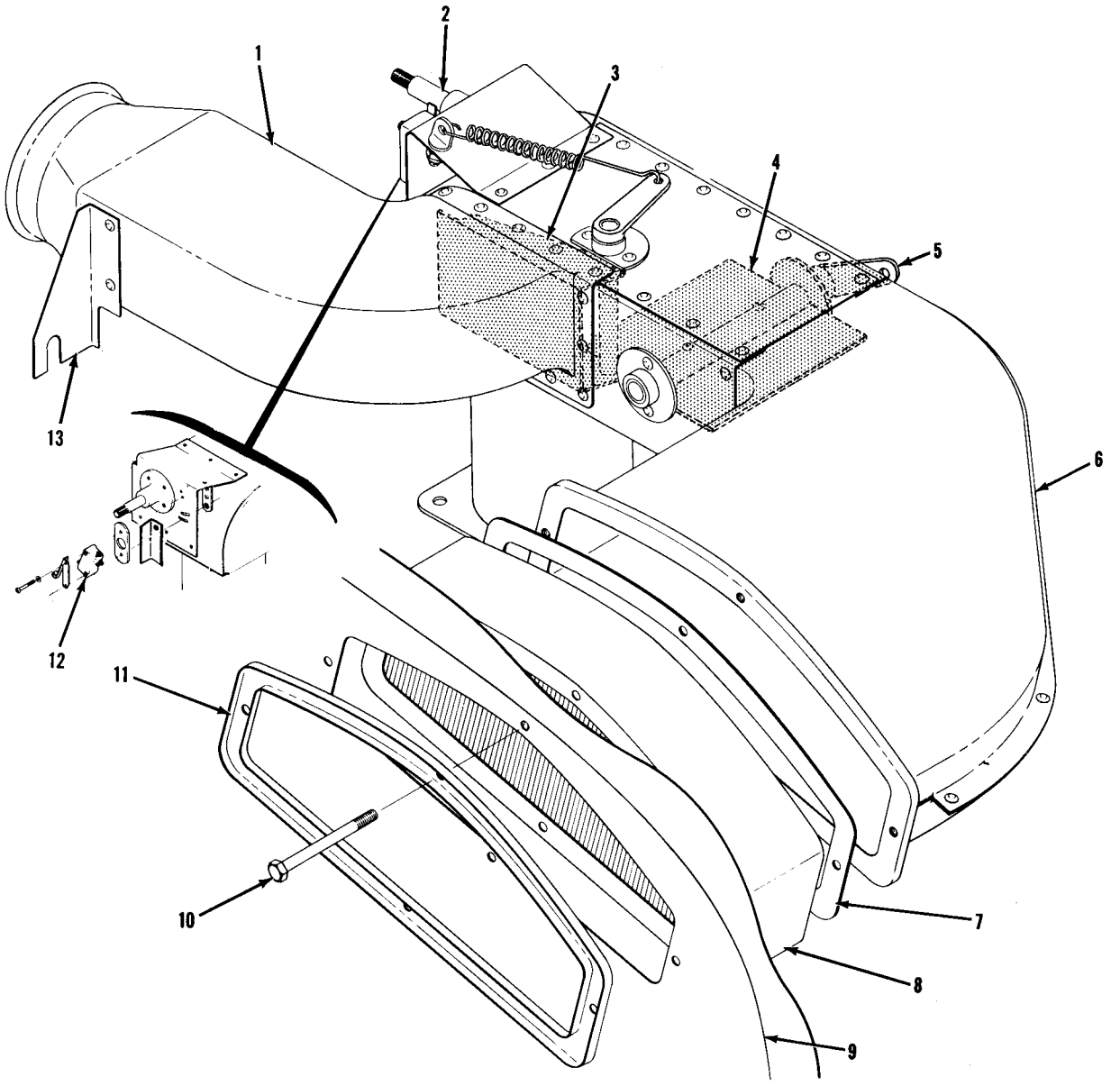
a. Place air box and gasket in place on engine and fuel-air control unit.
b. Install attaching bolts. When installing bolts make certain that fuel-air control support bracket and engine control support bracket are in place (IO-470-E only).
c. Connect engine controls and secure engine control anchor block (IO-470-E only).
d. Tighten crankcase thru-bolt securing the heated air horn support. (Models 210 thru 210C, and Model 205 prior to serial number 205-0034.)
e. Install flexible heated air duct on the heated horn and secure with clamp. (Models 210 thru 210C, and Model 205 prior to Serial number 205-0034.)
f. Install clamps attaching lines and wires to airbox.
g. Install air filter. (Right and left 210D and on.)
h. Rig engine controls in accordance with paragraph 12-53.
i. Rig induction air control in accordance with paragraph 12-54.
j. Connect and adjust throttle switch(es).

12-18. ENGINE AIR FILTER. An air maze filter, mounted at the induction air box intake, removes dust particles from the ram air by collecting them on oil coated filtering units.

12-19. REMOVAL OF ENGINE AIR FILTER. The engine air filter is secured by four bolts which pass through the upper left rear engine baffle, engine air filter, a gasket and retainer, and fasten to the induction air box intake. To remove the engine air filter, remove these four bolts. On the Model 210D and on a second air filter is mounted in the right induction air box intake in the same manner as the left side.

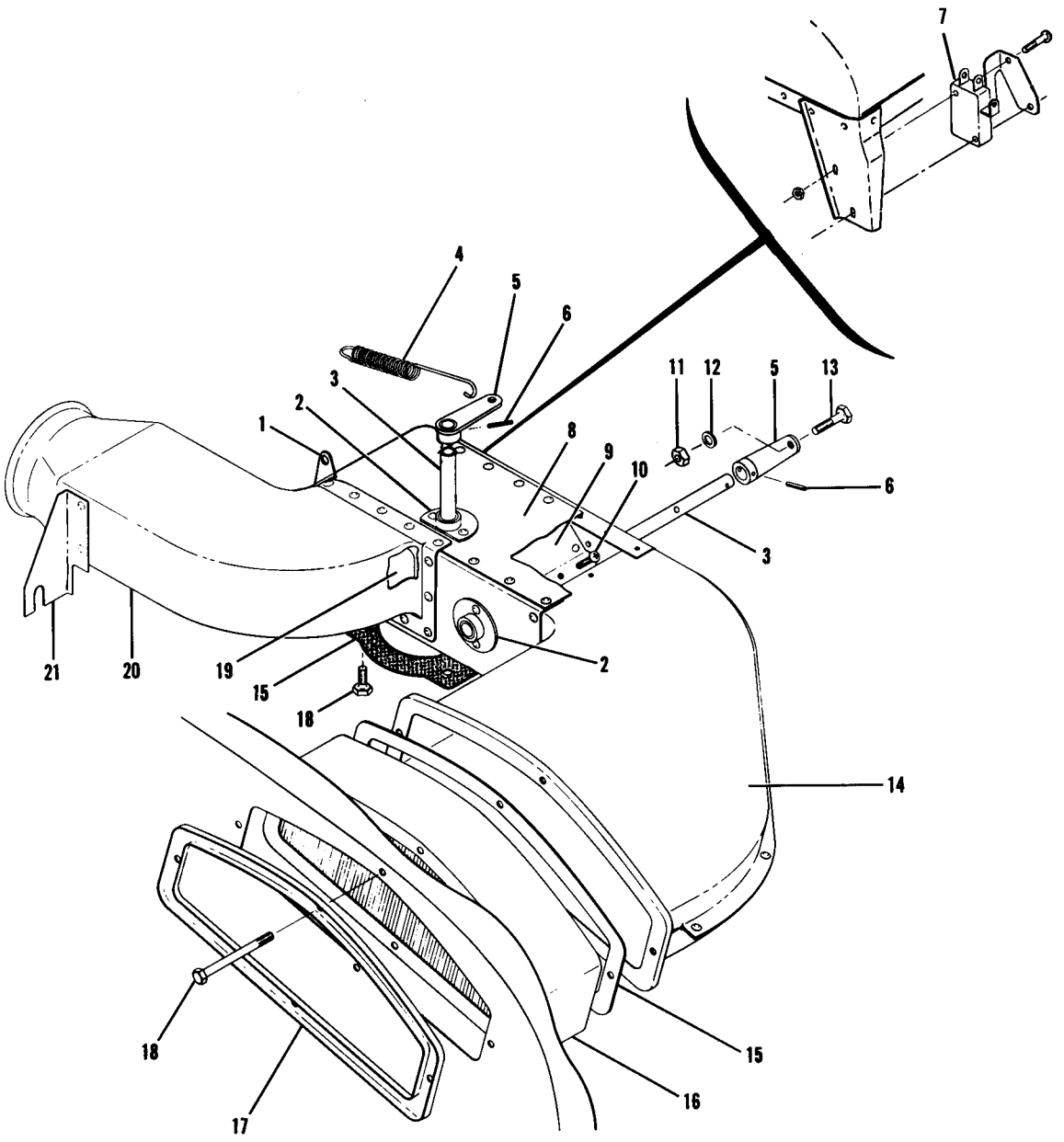
12-20. CLEANING OF ENGINE AIR FILTER. The filter should be serviced in accordance with instructions outlined in Section 2.

12-21. INSTALLATION OF ENGINE AIR FILTERS. Place the engine air filter in position between the upper left rear engine baffle and the induction airbox intake. Make certain the gasket is in place between the filter and the airbox intake. Install the four bolts which secure the assembly. On the Model 210D and on an air filter is installed in the right induction air box in the same manner as the left air filter.



1. Heated Air Horn
2. Engine Control Stud
3. Heated Air Control Door
4. Induction Air Door
5. Induction Air Door Arm
6. Air Intake Box
7. Gasket
8. Air Filter
9. Baffle
10. Bolt
11. Baffle Retainer
12. Throttle Microswitch
13. Heated Air Horn Support

Figure 12-6. Induction Air Box (Models 210 and 210A)



1. Bracket
2. Bushing Assembly
3. Shaft
4. Spring
5. Arm Assembly
6. Roll Pin
7. Throttle Microswitch
8. Inboard Duct Assembly
9. Valve Assembly
10. Screw
11. Nut
12. Washer
13. Clamp
14. Outboard Duct Assembly
15. Gasket
16. Air Filter
17. Retainer
18. Bolt
19. Alternate Air Door
20. Adapter
21. Bracket

Figure 12-7. Induction Air Box (Models 210B and 210C)

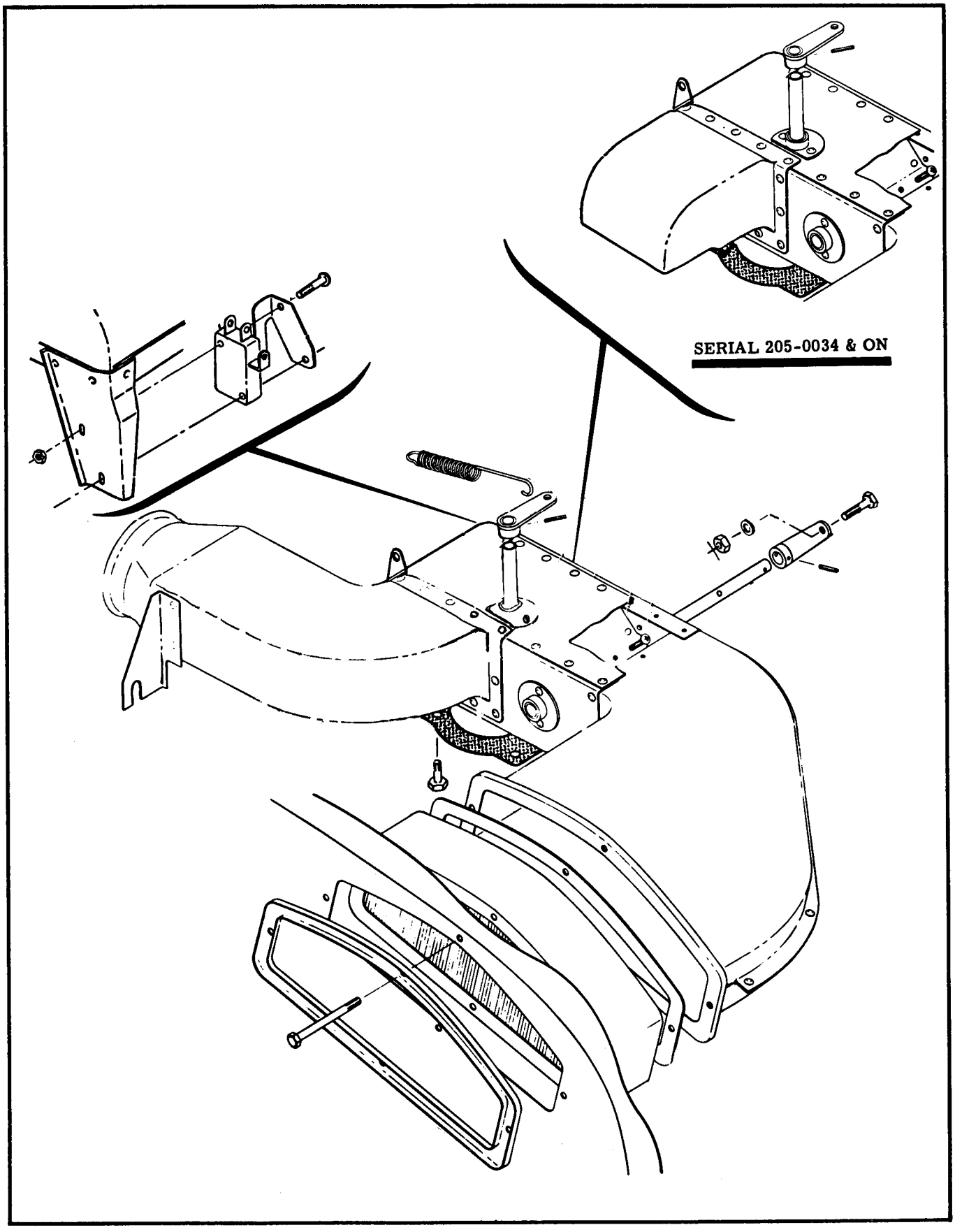


Figure 12-8. Induction Air Box (Model 205 Series)

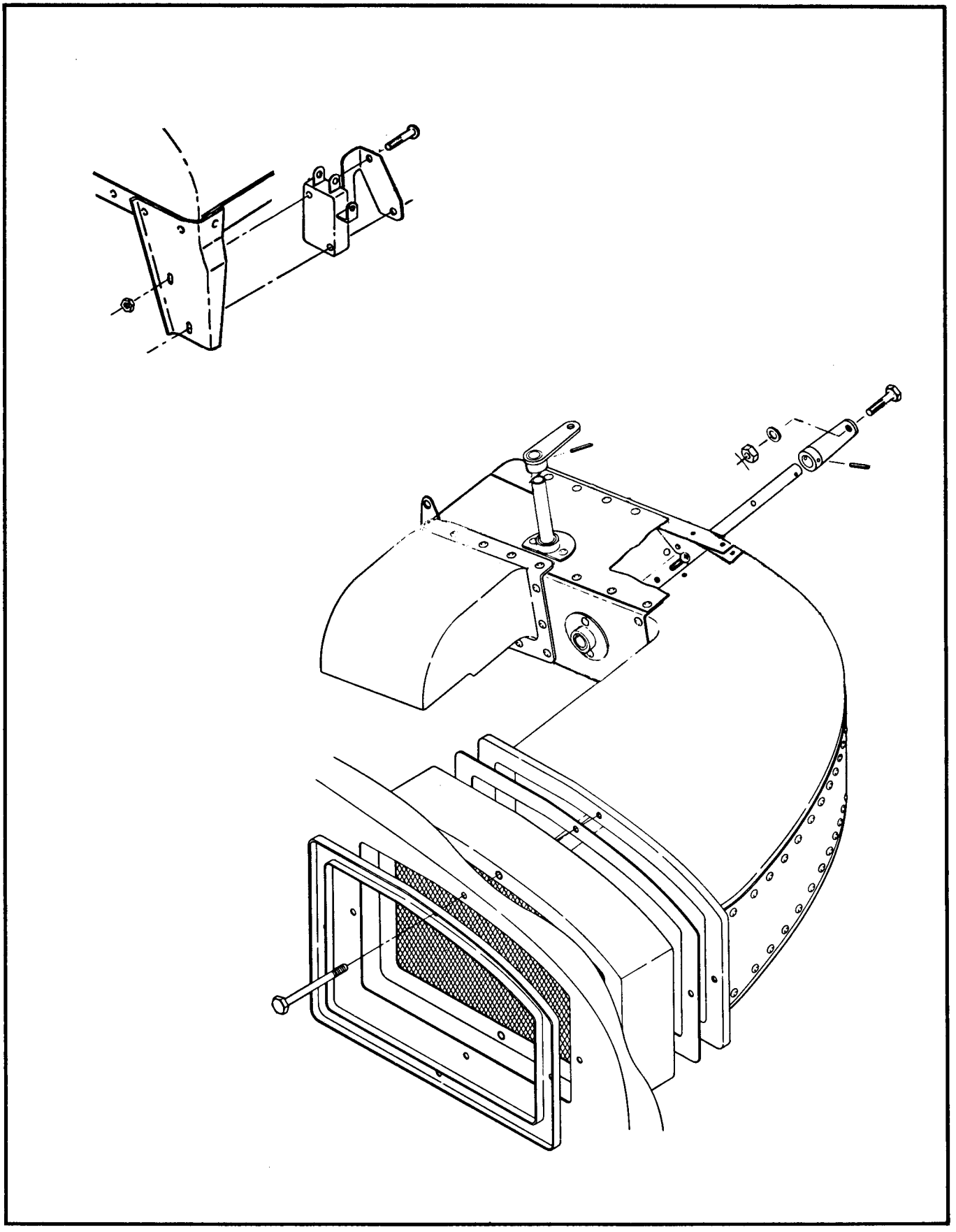


Figure 12-9. Induction Air Box (Model 206 Series)

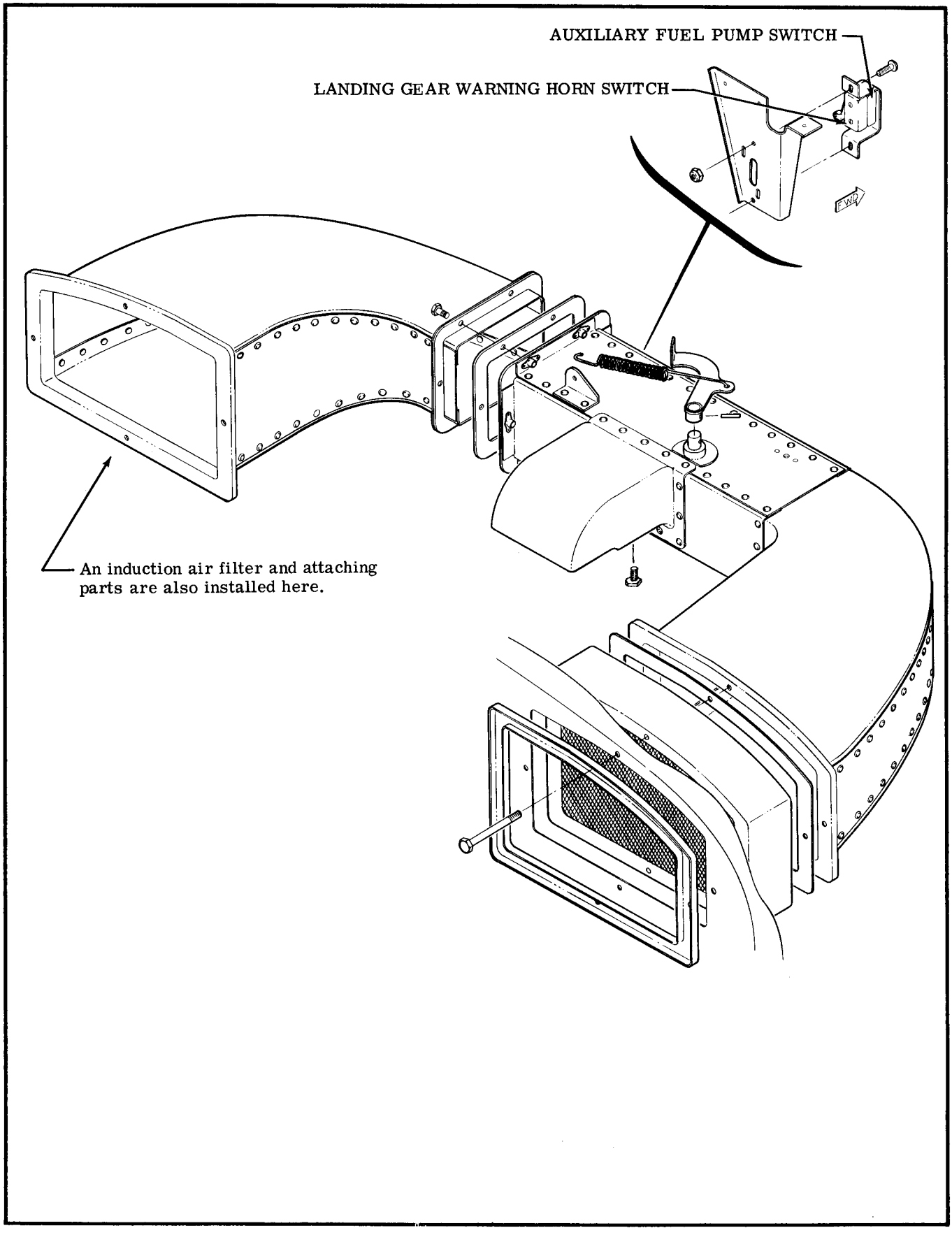
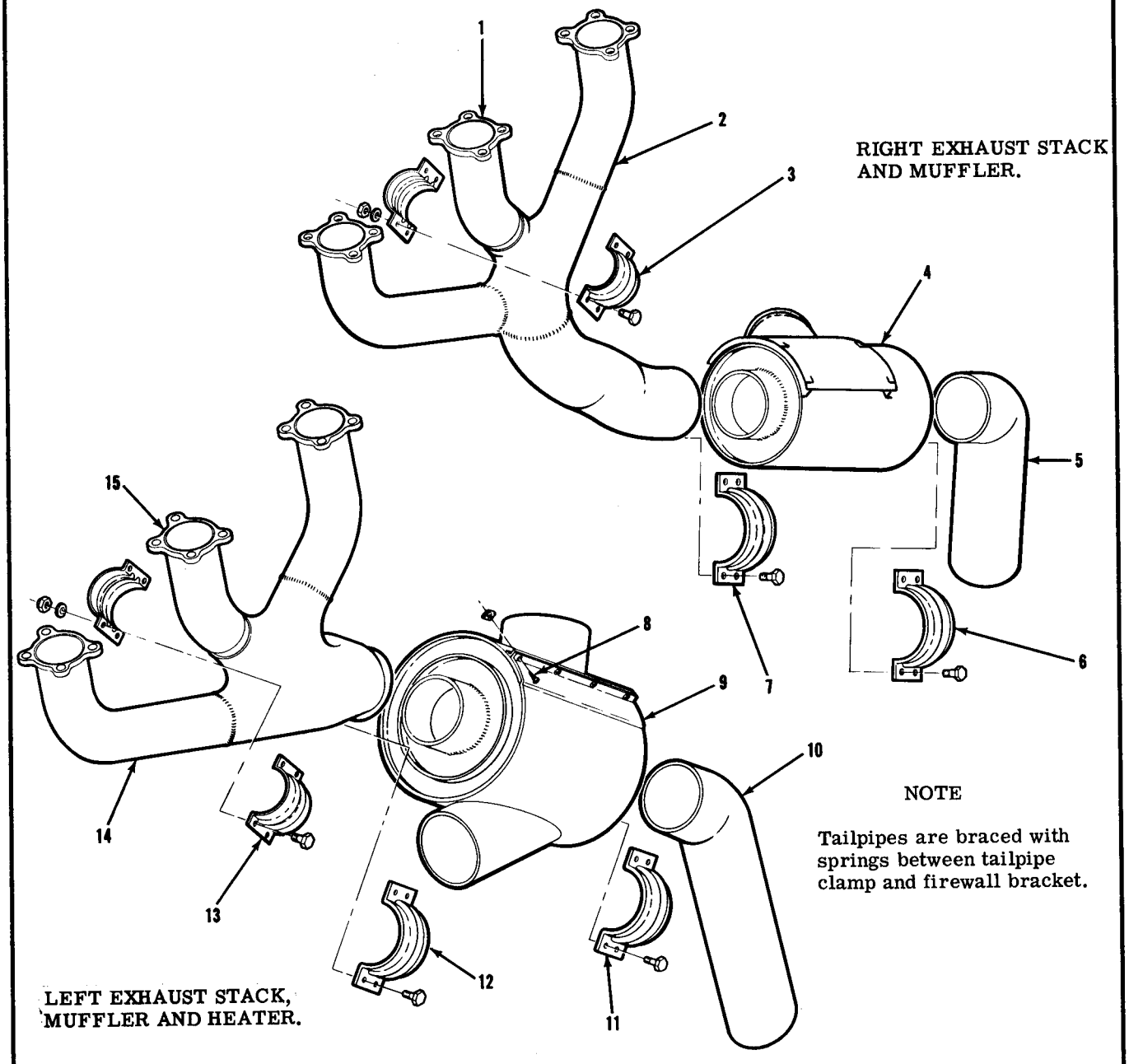
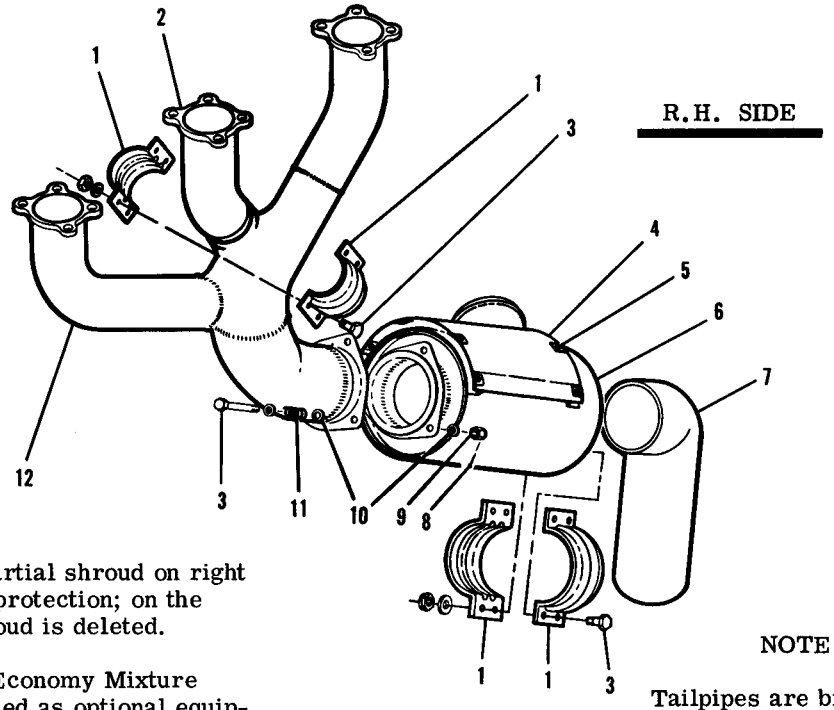


Figure 12-10. Induction Air Box (Model 210D & on)



1. Right Center Riser
2. Right Front and Aft Risers
3. Clamp
4. Right Muffler and Heater Shroud
5. Right Tailpipe
6. Clamp
7. Clamp
8. Screw
9. Left Muffler and Heater Shroud
10. Left Tailpipe
11. Clamp
12. Clamp
13. Clamp
14. Left Front and Aft Risers
15. Left Center Riser

Figure 12-11. Exhaust Stacks and Mufflers (210 and 210A)



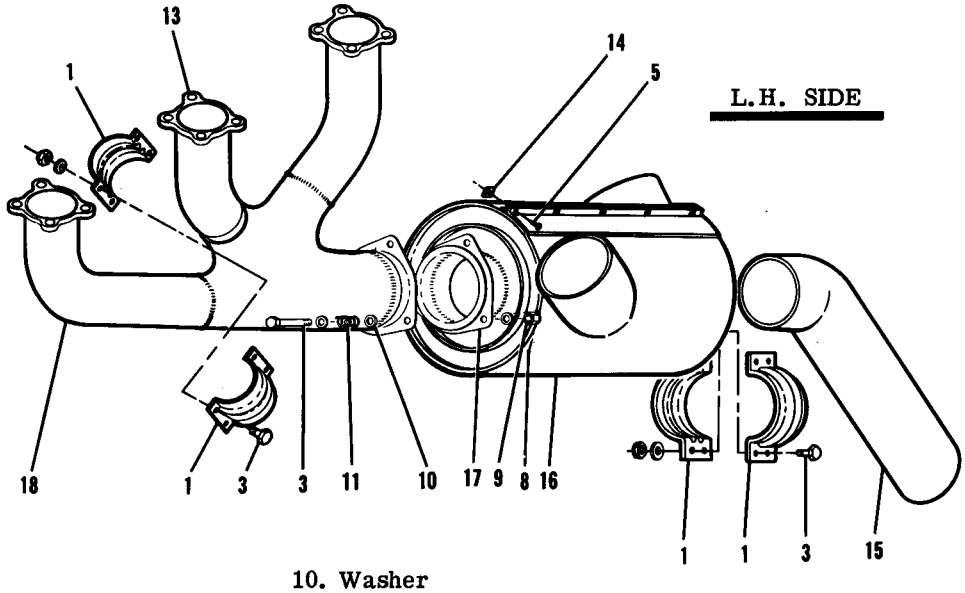
NOTE

On Model 206 series, the partial shroud on right muffler is retained as heat protection; on the Model 210C and on, the shroud is deleted.

Refer to Section 16 for the Economy Mixture Indicating system (EGT), used as optional equipment for 1965 models and on.

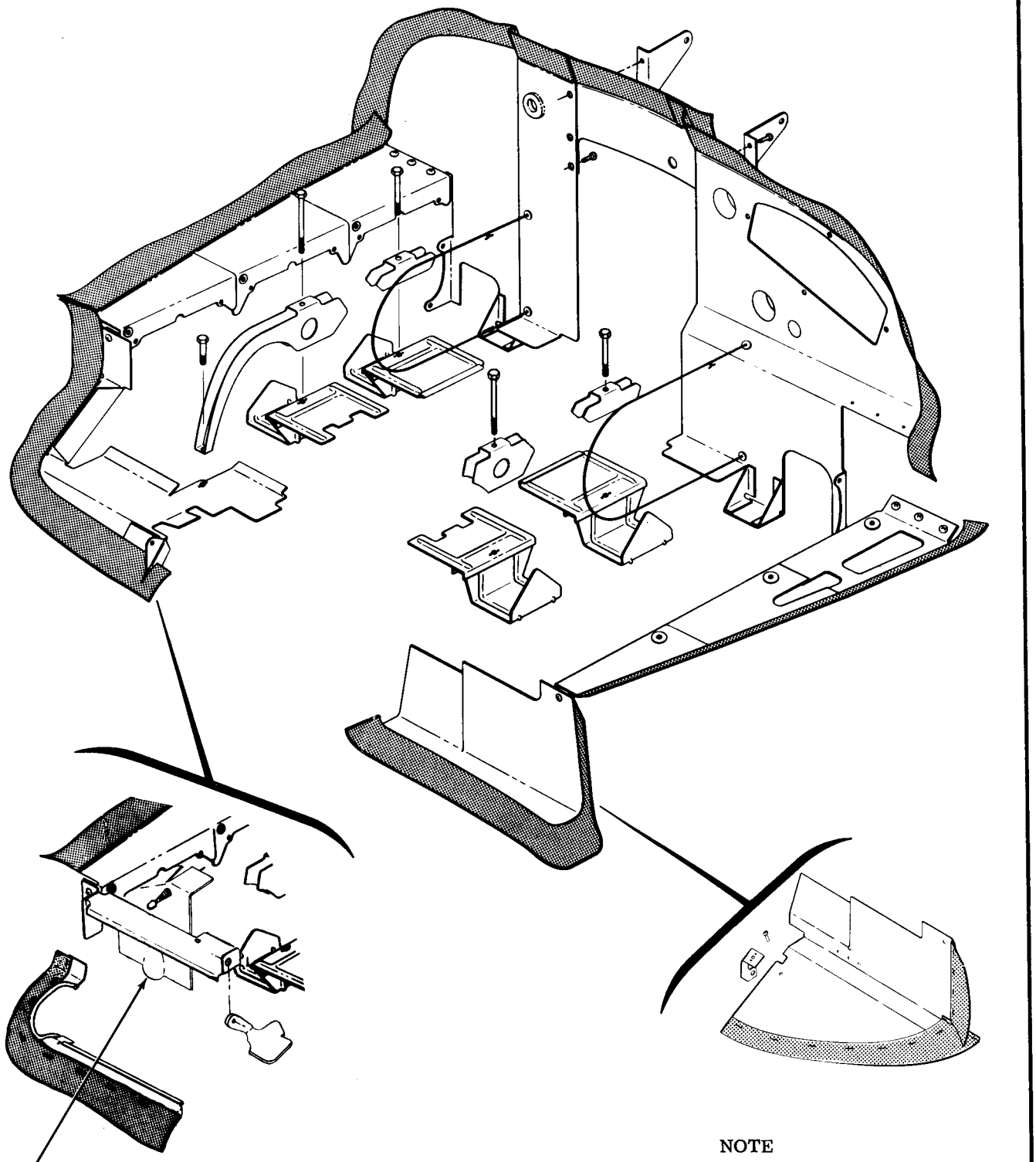
NOTE

Tailpipes are braced with clamps shock-mounted to firewall brackets.



1. Clamp
2. Upper R.H. Center Stack Assembly
3. Bolt
4. R.H. Muffler Shroud
5. Screw
6. R.H. Muffler
7. R.H. Tailpipe
8. Cotter Pin
9. Nut
10. Washer
11. Spring
12. R.H. Collector Assembly
13. Upper L.H. Center Stack Assembly
14. Nut
15. L.H. Tailpipe
16. L.H. Muffler Shroud
17. L.H. Core Assembly
18. L.H. Collector Assembly

Figure 12-12. Exhaust Stacks and Mufflers (205 & 206 Series, and 210B & on)



As noted in Service Letter 64-32, this baffle and fastener should be installed on all 200-series airplanes, prior to 205-0566, 206-0177, and 21058395.

NOTE

This illustration depicts a typical baffle installation. Many variations of baffling have been made according to model and date of manufacture.

Figure 12-13. Typical Engine Baffles

12-22. ENGINE EXHAUST SYSTEM. The exhaust system consists of two exhaust stack assemblies, one for the left and one for the right bank of cylinders. Each cylinder has a riser pipe attached to the exhaust port. The three risers at each bank of cylinders are joined together into a collector pipe which connects to a muffler and a tailpipe, forming an exhaust stack assembly. The center riser on each bank is detachable but the front and aft risers are welded to the collector pipe. The left muffler is enclosed in a shroud which captures exhaust heat which is used to heat the airplane cabin. The right muffler is also shrouded. On Models 210 thru 210C, and Model 205 prior to serial number 205-0034 an outlet on the right muffler provides a source for the heated air to the induction airbox.

12-23. REMOVAL OF ENGINE EXHAUST SYSTEM. The exhaust stack and muffler removal sequence can be clearly seen in figure 12-11 or 12-12. The tailpipes are attached to the lower firewall with one spring each. On later Models the tailpipes are attached to the lower firewall through a clamp which is shock mounted at the firewall.

12-24. INSPECTION of the exhaust system should be thorough because the cabin heating system uses air heated by the heat exchangers of the exhaust system. Since exhaust systems of this type are subject to burning, cracking, and general deterioration from alternate thermal stresses and vibration (comparable to those affecting automotive mufflers), inspection is important and should be accomplished every 100 hours of operation. In addition, an inspection should be performed any time exhaust fumes are detected in the cabin.

a. Remove engine cowling, and loosen or remove heater shrouds so that ALL surfaces of the exhaust stack assembly can be visually inspected. Especially check the areas adjacent to welds. Look for exhaust deposits in surrounding areas, indicating that exhaust gas is escaping through a crack or hole.

b. Where part of the exhaust stack assembly is not accessible for a thorough visual inspection, or is hidden by parts of non-removable shrouds, the following method is recommended.

1. Remove the exhaust stack assembly and heater shrouds.
2. Use rubber expansion plugs to seal openings.
3. Using a manometer or gage, apply approximately 1 1/2 psi (3 inches of mercury) air pressure while the stack assembly is submerged in water. Any leaks will appear as bubbles and can be readily detected.
4. It is recommended that any exhaust stacks found defective be replaced before the next flight.
5. If no defects are found, remove plugs and dry thoroughly with compressed air.

12-25. INSTALLATION OF ENGINE EXHAUST SYSTEM. When installing exhaust stacks be sure there is one copper-asbestos gasket between each riser and its mounting pad on the cylinder. The exhaust system installation sequence can be clearly seen in figure 12-11 or 12-12. The tailpipes are secured at the lower firewall with one spring each. Make certain these springs are installed. On later Models make certain the clamp is tight around the tailpipe. and the shock mounts are in serviceable condition.

12-26. ENGINE BAFFLES. (See figure 12-13.)

12-27. The sheet metal baffles installed on the engine direct the flow of air around the cylinders and other engine components. These baffles incorporate rubber-asbestos composition seal at points of contact with the engine nacelle to help confine and direct the airflow to the desired area. It is very important to engine cooling that the baffles are installed correctly.

12-28. CLEANING AND INSPECTION OF ENGINE BAFFLES. The engine baffles should be cleaned with a suitable solvent to remove oil and dirt.

NOTE

The rubber-asbestos seals are oil and grease resistant but should not be soaked in solvents for long periods.

Inspect for cracks in the metal and for loose and/or torn seals. Replace defective parts.

12-29. FUEL INJECTION SYSTEM.

12-30. Fuel injection is standard equipment on all 200-series aircraft. This fuel injection system is a simple, low pressure system of injecting fuel into the intake valve port in the cylinder head. It is a multi-nozzle, continuous flow type which controls fuel flow to match engine airflow. Any change in throttle position, engine speed, or a combination of both, causes changes in fuel flow in the correct relation to engine airflow. A manual mixture control and either a pressure gage or a fuel flow indicator are provided for leaning at any combination of altitude and power setting. The fuel pressure gage is calibrated in pounds per square inch. The fuel flow meter is calibrated in gallons per hour and indicates approximately the gallons of fuel consumed each hour. The continuous flow system uses a typical rotary vane fuel pump. There are no running parts in this system except for the engine driven fuel pump.

12-31. FUEL-AIR CONTROL UNIT. This unit occupies the position ordinarily used for a carburetor, at the intake manifold inlet. The function of this unit is to control engine air intake and to set the metered fuel pressure for proper fuel-air ratio. There are three control elements in this unit, one for air and two for fuel, one of which is for fuel mixture and the other for fuel metering. Main fuel enters the control unit through a strainer and passes to the metering valve. The position of the metering valve controls this fuel passed to the manifold valve and nozzles. A linkage connecting the metering valve to the air throttle proportions airflow to fuel flow. The position of the mixture valve determines the amount of fuel returned to the fuel pump. The fuel control portion of the fuel-air control unit is enclosed in a shroud and is blast-air cooled to help prevent vapor lock.

12-32. REMOVAL OF FUEL-AIR CONTROL UNIT.

a. Remove the air intake box in accordance with paragraph 12-15 and on IO-470-S installation, disconnect mixture and throttle control rod ends at fuel-air control unit.

NOTE

Cap all disconnected hoes, lines and fittings.

b. The three fuel lines which attach to the fuel control unit are routed inside flexible tubing to help cool the fuel. Loosen the tubing clamps at the fuel control unit and slide the tubing back to gain access to the fuel line fittings.

c. Disconnect the fuel lines at the fuel control unit.

d. Loosen the hose clamps which secure the fuel-air control unit to the right and left intake manifolds.

e. Remove the fuel-air control unit.

f. Cover the open ends of the intake manifold piping to prevent the entry of foreign matter.

12-33. CLEANING AND INSPECTION OF FUEL-AIR CONTROL UNIT.

a. Check control connections, levers, and linkages for security, safetying, and for lost motion due to wear.

b. Remove the fuel screen assembly and clean in fresh cleaning solvent. Reinstall and safety.

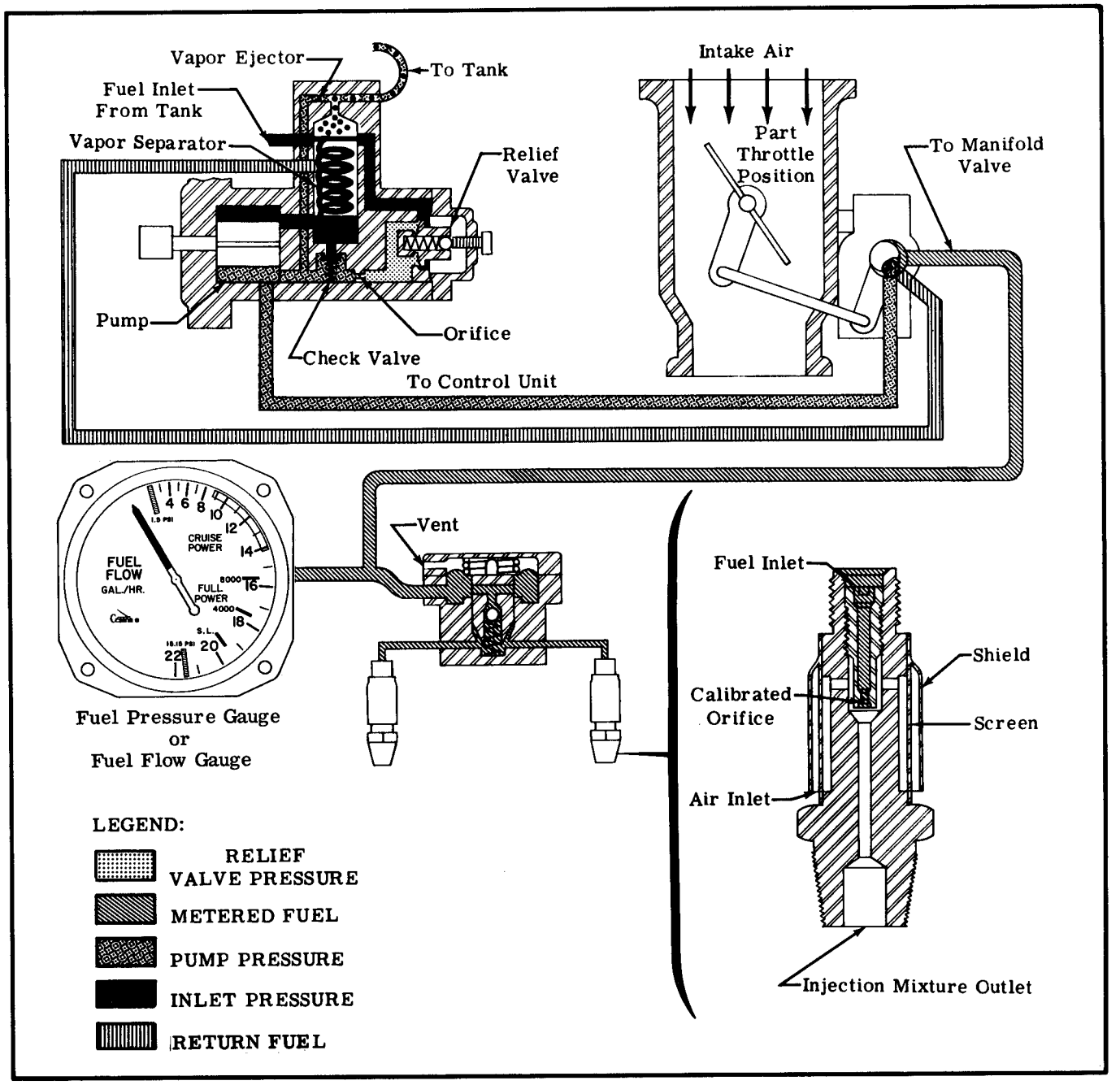


Figure 12-14. Fuel Injection Schematic

c. Check the air control body for cracks and the fuel-air control unit for overall condition.

12-34. INSTALLATION OF FUEL-AIR CONTROL UNIT.

a. Place the fuel-air control unit in position on the engine.

b. Before tightening the hose clamps which secure the fuel-air control unit to the intake manifold, temporarily bolt the fuel-air control unit to the fuel-air control unit support to obtain the correct position.

NOTE

Latest recommendation for lubrication and sealing fuel system fittings is MIL-T-5544 graphite-petrolatum (or equivalent). Apply to male threads only, omitting the first two threads.

c. Connect the fuel lines at the fuel-air unit.

d. Install the air tubes on the fuel control shroud and secure with clamps.

e. Install the induction airbox in accordance with paragraph 12-17.

f. Rig the engine controls in accordance with paragraph 12-53.

12-35. FUEL-AIR CONTROL UNIT ADJUSTMENTS. The idle speed adjustment is a conventional spring-loaded screw located in the air throttle lever. The idle mixture adjustment is the locknut at the metering valve end of the linkage. Tightening the nut to shorten the linkage provides a richer mixture. A leaner mixture is obtained by backing off the nut to lengthen the linkage. Adjust mixture control to obtain a slight and momentary gain of 25 rpm maximum at 1000 rpm engine speed as mixture control is moved slowly from full "RICH" toward idle cut-off. If mixture is set too "LEAN," engine speed will drop immediately, thus requiring enrichment. If mixture is set too "RICH," engine speed will increase above 25 rpm, thus requiring leaning. Idle speed is approximately 600 rpm.

12-36. FUEL MANIFOLD. From the fuel control unit fuel is delivered to the fuel manifold which provides a central point for dividing fuel to the individual cylinders. In the fuel manifold, a diaphragm and plunger valve raises or lowers, by fuel pressure, to open or close the individual cylinder fuel supply ports simultaneously. A ball check valve under the plunger serves to insure that the plunger fully opens the outlet ports before fuel flow starts. Thus, there is no unbalanced restriction to fuel flow in the fuel manifold. A fine mesh screen is included in the fuel manifold as additional protection of the injection nozzles against dirt or foreign matter.

12-37. REMOVAL OF FUEL MANIFOLD.

NOTE

Cap all disconnected lines, hoses, and fittings.

a. Disconnect the fuel lines and the six fuel injection lines at the fuel manifold.

b. Remove the two crankcase bolts which secure the fuel manifold and remove the fuel manifold.

12-38. CLEANING FUEL MANIFOLD VALVE.

a. Remove the fuel manifold valve.

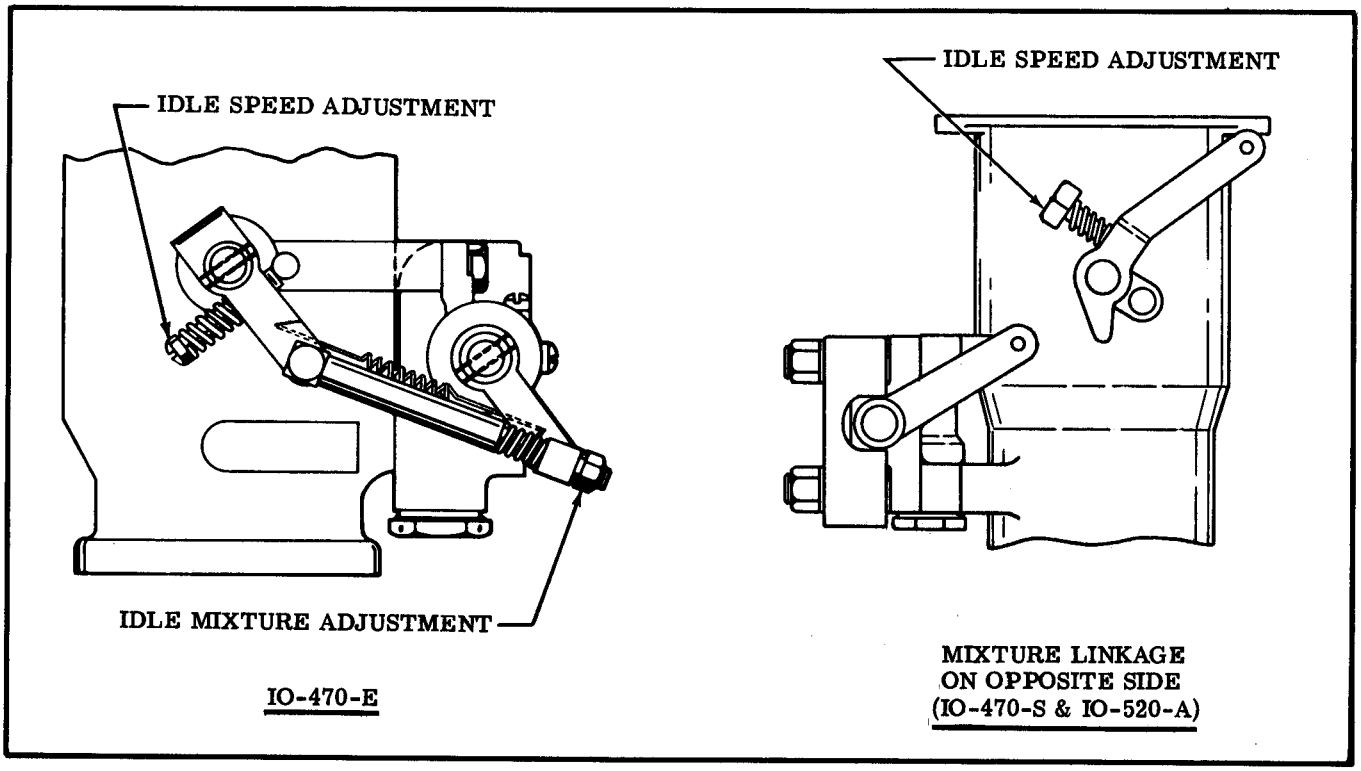


Figure 12-15. Idle Adjustments

b. Hold the top cover down against internal spring until all four attaching screws have been removed, then gently lift off the cover. Use care not to damage the spring-loaded diaphragm below it.
c. Remove the upper spring and lift the diaphragm assembly straight up.

NOTE

If the valve attached to the diaphragm is stuck in the bore of the body, grasp the center nut and rotate and lift at the same time to work gently out of the body.

d. Remove the lower ball and spring.
e. Remove the flushing plug or fitting located opposite the inlet fitting.

CAUTION

The filter screen is a tight fit and may be damaged if removal is attempted. It should be removed only if a new screen is to be installed.

f. Using clean gasoline, flush out the chamber below the screen.
g. Flush above the screen and inside the center bore making sure that outlet passages are open. Use only a gentle stream of compressed air to remove dust and dirt and to dry.
h. Replace flushing plug or fuel line fitting.
i. Clean the diaphragm and valve, top cover, and ball and springs in the same manner.
j. Replace lower spring and ball (ball on TOP of spring).
k. Carefully replace diaphragm and valve, making sure ball and spring feed into hollow end of valve. Check that valve works freely.
l. Place upper spring in position.
m. Align mounting holes in body, diaphragm and top cover, positioning diaphragm so horizontal hole in plunger is NOT in line with inlet port, hold cover down and install. Tighten and safety screws. Cover vent should be 90° to inlet port.
n. Install the fuel manifold valve assembly on the engine and reconnect all lines.

12-39. INSTALLATION OF FUEL MANIFOLD.
a. Secure the fuel manifold to the crankcase with two crankcase bolts.

NOTE

Latest recommendation for lubrication and sealing fuel system fittings is MIL-T-5544 graphite-petrolatum (or equivalent). Apply to male threads only, omitting the first two threads.

b. Connect the fuel lines and the six fuel injection lines. Inspect completed installation.

12-40. FUEL DISCHARGE NOZZLE. From the fuel manifold valve, individual fuel lines carry the metered fuel to the fuel discharge nozzles located in the cylinder heads. The outlet of each nozzle is directed into the intake valve port of each cylinder. The nozzles are calibrated in several ranges. All nozzles furnished for one engine are of the same range and are identified by a number and a suffix letter stamped on the flat portion of the nozzle body. When replacing a fuel discharge nozzle be sure that it is of the same calibrated range as the rest of the nozzles in the engine. When a complete set of nozzles is being replaced, the number must be the same as the one removed, but the suffix letters may be different, as long as they are the same for all nozzles being installed on a particular engine. An air bleed, incorporated into each nozzle, aids in vaporizing the fuel by breaking the high vacuum in the intake manifold at idle rpm and keeps the fuel lines filled.

12-41. REMOVAL OF FUEL DISCHARGE NOZZLES.

NOTE

Plug or cap all disconnected lines and fittings.

a. Disconnect the fuel injection lines at the fuel discharge nozzles. Remove the nozzles with a 1/2 inch deep socket.

12-42. CLEANING AND INSPECTION OF FUEL DISCHARGE NOZZLES. To clean nozzles, immerse in clean solvent. Use compressed air to dry. Do not remove shield to clean air screens in nozzle. Do not use a wire or other object to clean orifices. Remove, clean, and inspect the nozzles every 100 hours.

12-43. INSTALLATION OF FUEL DISCHARGE NOZZLES.
a. Install the fuel discharge nozzles in the cylinders using a 1/2 inch deep socket.

NOTE

Latest recommendation for lubrication and sealing fuel system fittings is MIL-T-5544 graphite-petrolatum (or equivalent). Apply to male threads only, omitting the first two threads.

b. Connect the fuel injection lines at the fuel discharge nozzles.
c. Check installation for crimped lines, loose fittings, etc.

12-44. FUEL INJECTION PUMP. The fuel pump is a positive-displacement, rotating vane type. It has a splined shaft for connection to the accessory drive section of the engine. Fuel enters the pump at the swirl well of the vapor separator. Here, vapor is separated by a swirling motion so that only liquid fuel is fed to the pump. The vapor is drawn from the top center of the swirl well by a small pressure jet of fuel and is fed into the vapor return line and returned to the fuel tank. Since the pump is engine driven, changes in engine speed affect total pump flow proportionally. The pump supplies more fuel than is required by the engine, therefore a relief valve is provided so that auxiliary pump pressure can bypass the engine driven pump for starting, or in the event of engine-driven fuel pump failure in flight.

12-45. REMOVAL OF FUEL INJECTION PUMP. Place the fuel tank selector valve OFF. Place the mixture control in idle cut-off. The fuel pump is enclosed in a shroud and is ram-air cooled to help prevent high fuel temperatures. The ram air is picked up at the upper left engine baffle and directed through a flexible tube to the fuel pump shroud. The fuel supply and return lines from the fuel pump to the fuel control unit are routed inside flexible tubes. Loosen the clamps and slide the flexible tubes free of the horns on the fuel pump shroud to gain access to the fuel lines.

a. Remove the generator or alternator drive belt.

b. Tag and disconnect all lines and fittings attached to the fuel pump.

NOTE

Plug or cap all disconnected lines, hoses, and fittings.

c. Remove the shroud surrounding the fuel pump.

d. Remove the nuts and washers attaching the fuel pump to the engine.

e. Remove fuel pump and gasket.

WARNING

Residual fuel draining from lines and hoses is a fire hazard. Use care to prevent accumulation of such fuel when lines and/or hoses are disconnected.

f. If a replacement pump is not being installed immediately, a temporary cover should be installed on the fuel pump mount pad.

12-46. INSTALLATION OF FUEL INJECTION PUMP.

a. Position a new gasket and fuel pump on the four mounting studs with the fuel pump inlet to the left.

b. Secure pump to engine with four plain washers, four internal tooth lockwashers, and nuts.

NOTE

Latest recommendation for lubrication and sealing fuel system fittings is MIL-T-5544 graphite-petrolatum (or equivalent). Apply to male threads only, omitting the first two threads.

c. Install the cooling shroud on the fuel pump.

d. Install all fittings and connect all lines.

e. Install the flexible ram air tube on the air horn at the top of the fuel pump shroud and clamp.

f. Replace the generator or alternator drive belt and tighten the nut on the adjusting arm so that the belt has proper tension.

g. Inspect completed installation.

12-47. FUEL INJECTION PUMP ADJUSTMENTS. The fuel injection pump pressure adjustment requires special equipment and procedures. Cessna Service Kit No. SK320-2 provides a special indicator, lines, and instructions for performing accurate calibration of the engine-driven fuel pump pressure. With engine at normal operating temperature and mixture control set full rich, the unmetered fuel pressure at 600 rpm should be 9.0 to 11.0 psi. At 2625 rpm, unmetered fuel pressure on IO-470 series engines should be 25.3 to 26.8 psi. At 2700 rpm, unmetered fuel pressure on IO-520 series engines should be 30.0 to 31.5 psi.

12-48. ENGINE COWL FLAPS. Cowl flaps are provided as a means of controlling engine temperature. Two cowl flaps, operated by a single control in the cabin, are located at the lower aft end of the engine nacelle. Engine exhaust stacks extend through cut-outs in the aft portion of the cowl flaps. Prior to the 210B (Serial No. 21057841) the cowl flap control can be placed in any one of four positions: OPEN, HALF, QUARTER, and CLOSED. On all 200-Series airplanes beginning with the 210B, the control can be placed in many positions as shown in figure 12-17A.

12-49. RIGGING ENGINE COWL FLAPS.

a. Disconnect clevis at each cowl flap.

b. Place cowl flap control in CLOSED position. Check that correct hole in position bracket is used, as shown in figure 12-17A, for applicable model and serial number.

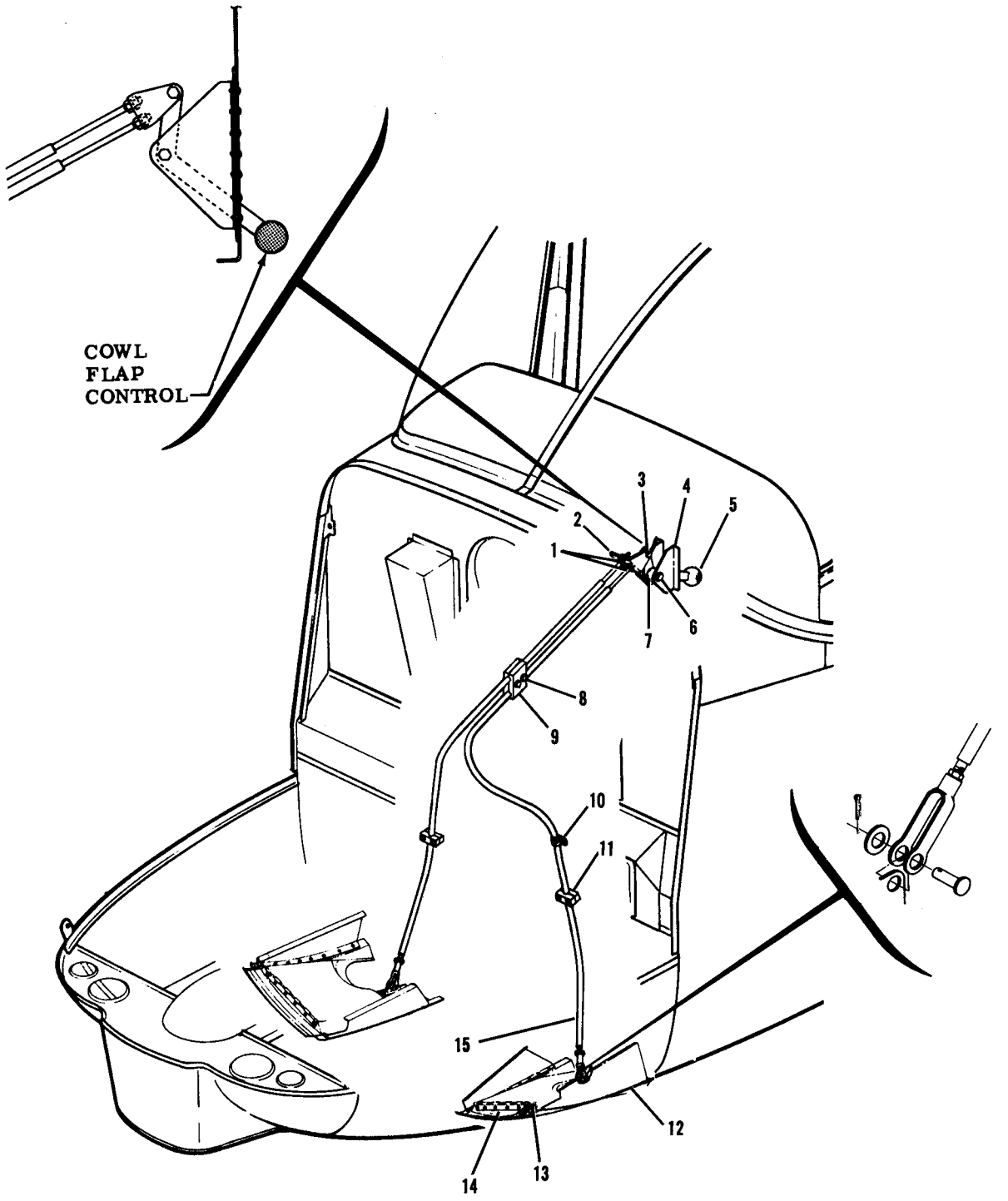
c. Hold one cowl flap closed snugly and adjust clevis at cowl flap until pin can be installed. Repeat for other cowl flap. If either control needs to be lengthened or shortened to obtain sufficient thread engagement, clamps may be loosened and housing slipped in the clamps or opposite end of control may be adjusted at upper end.

d. Check that nuts are tight and all cotter pins installed.

NOTE

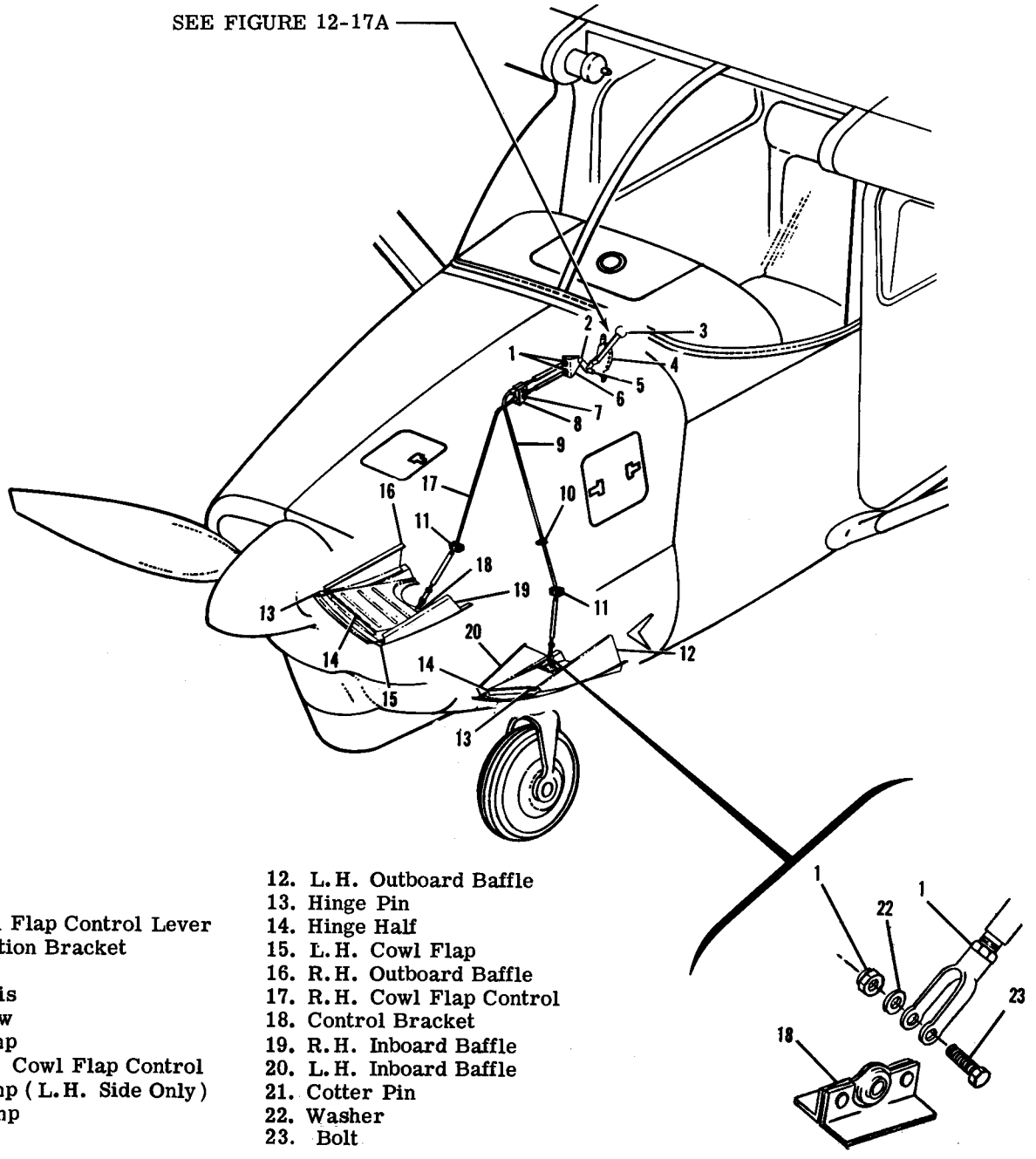
Cowl flaps should close snugly, but not too tightly. Some models have small rubber bumpers against which the cowl flaps close. Some cowl flaps are so shaped that only the aft corners contact the fuselage when closed; the center portion is still open approximately one inch at the aft edge.

12-50. ENGINE CONTROLS. The throttle, propeller control, and mixture control lock in any position desired. To move these controls, the spring-loaded button, one in the end of each control knob, must be depressed. When this button is released the control is locked in position. All three controls also have a vernier adjustment. Turning the control knob in either direction will change the control setting. The vernier control is primarily for precision control setting. The induction air control also has a button in the control knob which must be depressed to change the control setting but it does not have a vernier adjustment. The control will lock in any position desired.



1. Nut
2. Clevis
3. Bolt
4. Position Bracket
5. Lever Assembly
6. Bolt
7. Spacer
8. Bolt
9. Clamp
10. Clamp (L. H. Only)
11. Clamp
12. Cowl Flap
13. Hinge Pin
14. Hinge
15. Control

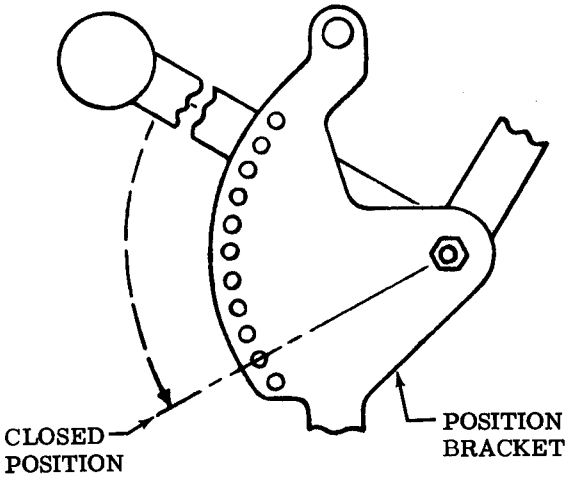
Figure 12-16. Cowl Flaps Control System (210 and 210A)



1. Nut
2. Pin
3. Cowl Flap Control Lever
4. Position Bracket
5. Stud
6. Clevis
7. Screw
8. Clamp
9. L.H. Cowl Flap Control
10. Clamp (L.H. Side Only)
11. Clamp
12. L.H. Outboard Baffle
13. Hinge Pin
14. Hinge Half
15. L.H. Cowl Flap
16. R.H. Outboard Baffle
17. R.H. Cowl Flap Control
18. Control Bracket
19. R.H. Inboard Baffle
20. L.H. Inboard Baffle
21. Cotter Pin
22. Washer
23. Bolt

Figure 12-17. Cowl Flaps Control System (205 & 206 Series, and 210B & on)

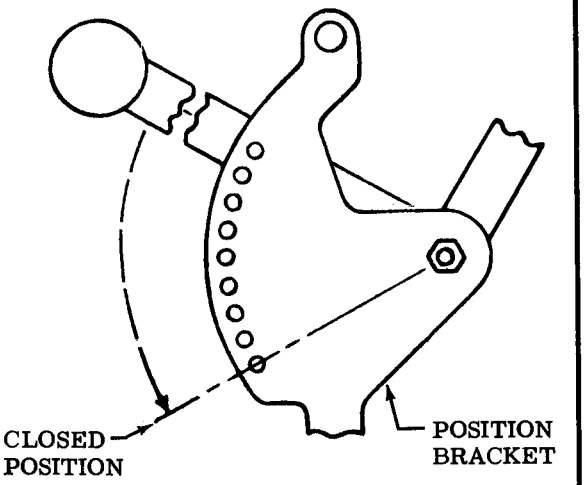
DETAIL A



Position bracket containing 11 holes; second hole from bottom is closed position.

21057841 thru 21058085

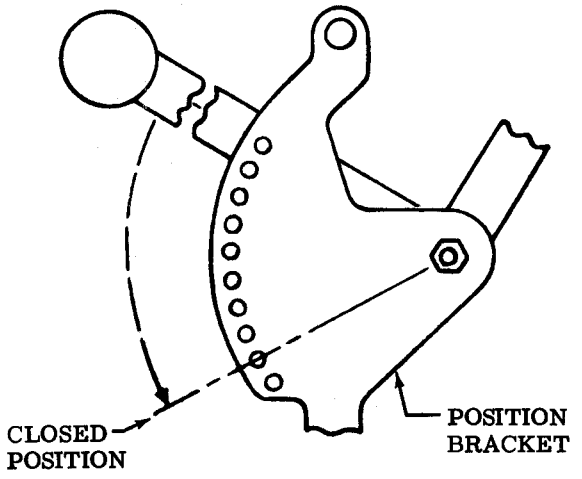
DETAIL B



Position bracket containing 9 holes; hole at bottom is closed position.

21058086 thru 21058306
205 & 206 Series until supply of brackets is exhausted
(Spare part is shown in DETAIL C)

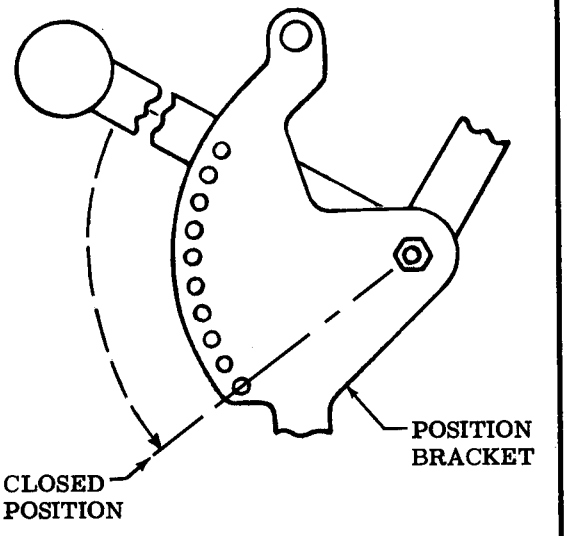
DETAIL C



Position bracket containing 10 holes; second hole from bottom is closed position.

21058086 thru 21058306
205 & 206 Series after supply of brackets shown in DETAIL B is exhausted
(Spare part for bracket shown in DETAIL B)

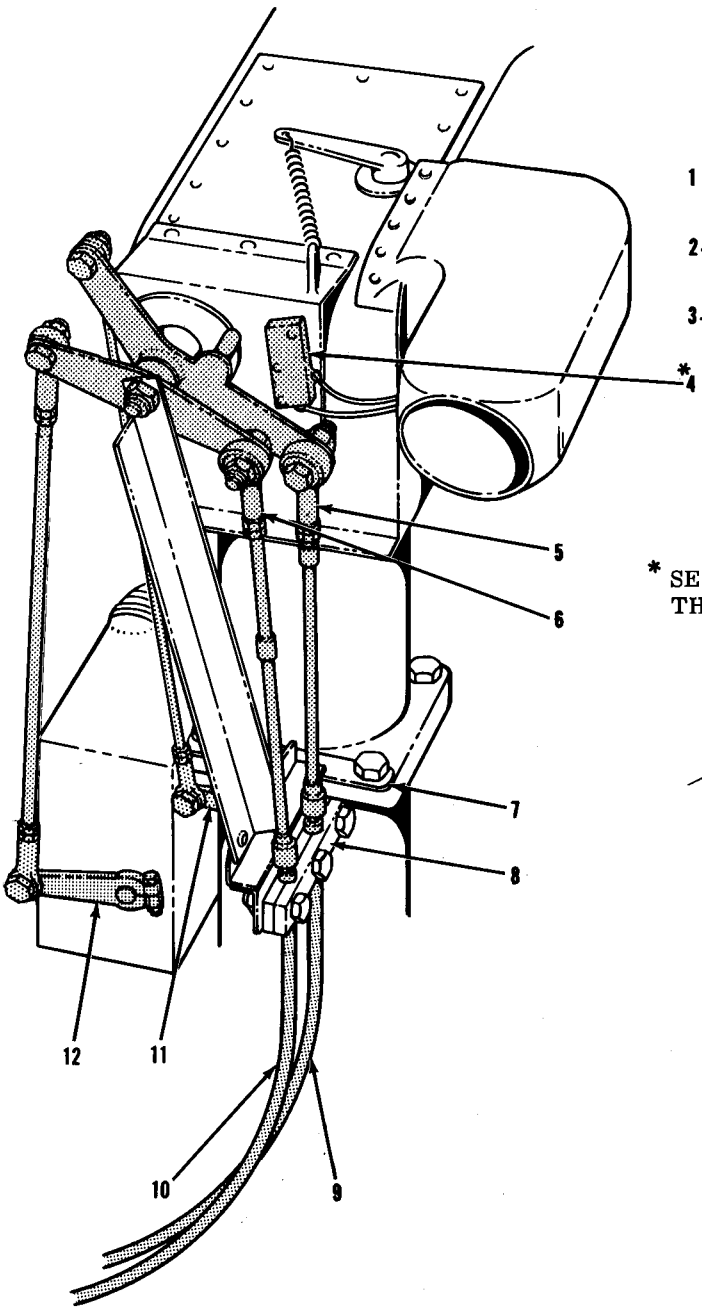
DETAIL D



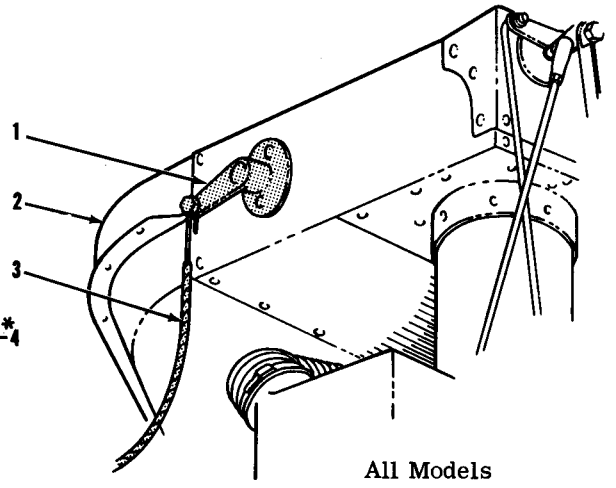
Position bracket containing 10 holes; hole at bottom is closed position.

21058307 and on

Figure 12-17A. Cowl Flap Rigging

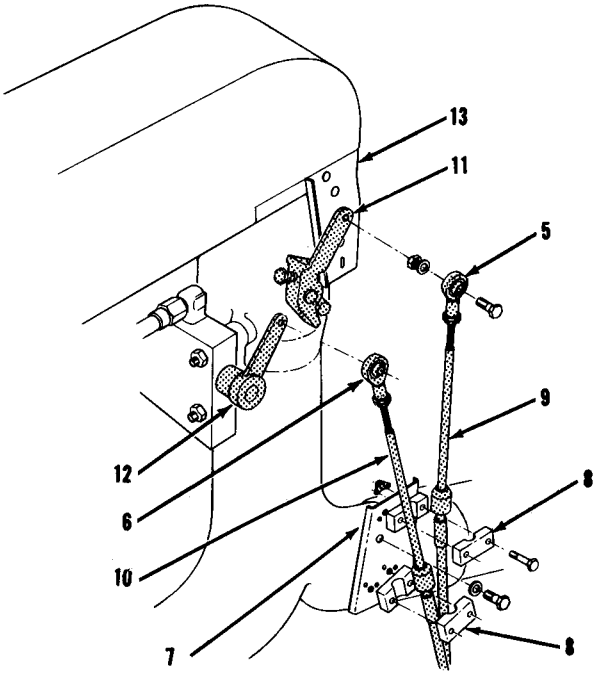


Engine Controls (210 and 210A)



All Models

* SEE FIGURES 12-6 THRU 12-10 FOR THROTTLE MICROSWITCH MOUNTING



Engine Controls (205 and 206 Series, and 210B & on)

1. Induction Air Control Arm
2. Air Intake Box
3. Control Cable
4. Microswitch
5. Throttle Rod End
6. Mixture Rod End
7. Control Bracket Support
8. Control Bracket
9. Throttle Cable
10. Mixture Cable
11. Throttle Arm
12. Mixture Arm
13. Microswitch Bracket

Figure 12-18. Engine Control Rigging

12-51. DISCONNECTING ENGINE CONTROLS. (See figure 12-18.)

a. Disconnect the induction air control as follows:

1. Remove the bolt which secures the control cable to the induction air control arm.

b. Disconnect the governor control as follows:

1. Remove the bolt which attaches end fitting to control bracket.

c. Disconnect the throttle and mixture controls as follows:

1. Remove the bolts which secure control rod ends.

2. Remove the bolts which secure the controls in the control bracket.

12-52. CONNECTING ENGINE CONTROLS. (See figure 12-18.)

a. Connect the induction air control as follows:

1. Connect control cable to induction air control arm with bolt.

2. Rig the induction air control in accordance with paragraph 12-54.

b. Connect the governor control as follows:

1. Connect end fitting to control bracket with bolt.

2. Rig the governor control in accordance with paragraph 14-22.

c. Connect the throttle and mixture controls as follows:

1. Identify each control.

2. Place the control cables in control bracket and secure with bolts.

3. Connect control rod ends with bolts.

4. Rig the throttle control in accordance with paragraph 12-57.

5. Rig the mixture control in accordance with paragraph 12-56.

12-53. RIGGING PROCEDURES – ENGINE CONTROLS.

CAUTION

Some throttle and mixture controls have a small retaining ring brazed (or attached with epoxy resin) in a groove .97 inch from the threaded end of the control. The purpose of these retaining rings is to prevent inadvertent withdrawal and possible damage to the knob end of the controls while jam nuts and rod ends are removed.

12-54. RIGGING INDUCTION AIR CONTROL. (See figure 12-18.)

a. Push control full in, then pull it out approximately 1/8 inch for cushion.

b. Shift the control housing in its clamp as necessary to place the air valve in the full closed position, with valve seating inside the airbox. Tighten clamp in this position.

c. Pull the control out and check that the air valve inside the airbox seats in the opposite direction.

d. Check that the bolt and nut at the air valve lever secure the control wire and that the bolt will swivel in the lever.

e. Bend the wire tip 90° to prevent it from being withdrawn if the attaching nut should become loose.

f. When installing a new control, it may be necessary to shorten the wire and/or control housing.

g. The air valve must seat in both positions and the control should have approximately 1/8 inch cushion at the instrument panel when pushed full in.

12-55. RIGGING PROPELLER GOVERNOR CONTROL. Refer to paragraph 14-22.

12-56. RIGGING MIXTURE CONTROL. (See figure 12-18.)

a. Push control full in, then pull it out approximately 1/8 inch for cushion.

b. Check that mixture control arm is in full rich position. If necessary, loosen locknut and screw rod end in or out until attaching bolt slides in easily.

c. Pull mixture control full out (idle cut-off), remove bolt at rod end, and check that mixture arm is in full idle cut-off. Reinstall bolt.

d. The mixture arm must reach mechanical stops in both positions and control should have approximately 1/8 inch cushion at the instrument panel.

12-57. RIGGING THROTTLE CONTROL. (See figure 12-18.)

a. Push control full in, then pull it out approximately 1/8 inch for cushion.

b. Check that throttle control arm is against the mechanical stop. If necessary, loosen locknut and screw rod end in or out until attaching bolt slides in easily.

c. Pull throttle control full out, remove bolt at rod end, and check that throttle arm contacts idle stop. Reinstall bolt.

d. Throttle arm must reach mechanical stops in both positions and control should have approximately 1/8 inch cushion at the instrument panel.

12-57A. RIGGING THROTTLE MICROSWITCHES. (See figures 12-6 thru 12-10.) All Model 210 series airplanes are equipped with one throttle microswitch which operates the landing gear warning system whenever the throttle is retarded while the gear is not down and locked. In addition, beginning with the Model 210D, another throttle microswitch slows down the electric fuel pump whenever the throttle is retarded while the electric pump is being used. This fuel pump microswitch is also used on 205 and 206 series airplanes. The landing gear warning microswitch should cause the horn to blow as the throttle is retarded to approximately 12 inches of mercury manifold pressure and the electric fuel pump microswitch should slow down the pump as the throttle is retarded to approximately 16 inches of mercury. Slotted holes are provided in switch mounting bracket for adjustment. Proceed as follows:

a. Start engine and set throttle to obtain 16 inches of mercury manifold pressure. Mark throttle position, then shut down engine. On the Model 210, continue to retard throttle to 12 inches of mercury and also mark this position. Shut down engine.

b. Loosen microswitch attaching screws and adjust as required to cause the electric fuel pump microswitch to slow down the pump as throttle is retarded to the marked position. With master switch on, fuel pump switch in high, and mixture control in idle cut-off, listen for the change in sound of the electric

pump as it slows down. Tolerance on switch actuation is ± 1 inch of mercury.

c. On the Model 210, the gear warning microswitch is also mounted with the same screws as the electric fuel pump microswitch. Because the gear is down and locked, it is necessary to depress gear-down (green) indicator light approximately one-half its travel distance before warning horn will sound as throttle is retarded to the 12 inches of mercury manifold pressure marked.

d. Perform flight test to check gear warning system on Model 210 series at 2500 feet pressure altitude as follows:

1. Set propeller control at 2300 rpm.
2. Slowly reduce throttle until warning horn blows, and note manifold pressure at which horn blows. Horn should blow between 11.5 and 12.5 inches of mercury manifold pressure.
3. If horn actuation does not fall within this tolerance, mark throttle at 12 inches of mercury manifold pressure for ground reference.

NOTE

After flight testing, if required results were not obtained, set throttle at the marked position and readjust microswitch to actuate horn at this setting. Recheck electric fuel pump microswitch setting. Repeat flight test until desired results are obtained.

12-58. STARTING SYSTEM.

12-59. The automatically engaged starting system employs an electric starter motor mounted to a 90-degree adapter. A starter solenoid is activated by the push-button or ignition key on the instrument panel. When the solenoid is activated, its contacts close and electrical current energizes the starter motor. Initial rotation of the starter motor engages the starter through an overrunning clutch in the starter adapter, which incorporates worm reduction gears. The starter is located just aft of the right rear cylinder.

12-60. REPLACEMENT OF STARTER.

a. Disconnect electrical leads to the starter solenoid. On later models the solenoid is located on the firewall and only the power cable need be disconnected from the starter. Insulate the disconnected terminals as a safety precaution.

b. Remove the nuts securing the starter and remove the starter.

c. To install the starter, reverse this procedure.

12-61. REPLACEMENT OF STARTER ADAPTER.

a. Remove the starter.

b. Loosen the generator or alternator, and remove drive belt.

c. Remove the generator or alternator support.

d. Remove the thru-bolts securing the adapter to the engine and pull it aft to remove.

e. Reverse the procedure outlined above to install the adapter. Use a new gasket coated with non-hardening gasket compound between the engine pad and the starter adapter.

12-62. STANDARD MAINTENANCE of starters includes replacing brushes and brush springs, cleaning dirty commutators and turning down burned or out-of-round commutators. Starter drive units may be lubricated with engine oil, but never with heavy oil or grease which might prevent normal action of the drive or overrunning clutch mechanism.

CAUTION

Never lubricate the commutator. Do not attempt to lubricate the starter bearings while the starter is being operated. Some starter bearings are sealed and require no lubrication.

Starter brushes should be replaced when worn down to one-half their original length (compare with new ones). Brush spring tension should be sufficient to give brushes a good firm contact with the commutator. Brush leads should be unbroken, with their terminal screws tight. A glazed or dirty commutator can be cleaned by holding a strip of 00 sandpaper or a brush seating stone against it. Move the sandpaper or stone back and forth across the commutator to avoid wearing a groove. Do not use emery paper or carborundum because of their possible shorting action.

CAUTION

Never operate the cranking motor for more than 30 seconds at a time without allowing it to cool. Blow out all dust after the commutator is cleaned.

Roughness, out-of-roundness, or high mica may necessitate turning down the commutator. After the turning operation, the mica should be undercut.

12-63. OVERRUNNING CLUTCH CHECK.

CAUTION

Never clean the overrunning clutch by any degreasing or high temperature method; such cleaning will destroy pre-packed lubricant in the clutch. Brushing with oleum or neutral sprits is satisfactory.

a. Wipe the clutch with a clean cloth.

b. Check that drive pinion will rotate freely in overrunning direction and that it does not slip in the cranking direction.

NOTE

If pinion turns roughly or slips in the cranking direction, replace the overrunning clutch assembly.

12-64. TROUBLE SHOOTING THE STARTER

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
STARTER WILL NOT OPERATE.		
Defective master switch or circuit.	Check master circuit.	Repair circuit.
Defective starter switch or switch circuit.	Check switch circuit continuity.	Replace switch or wires.
Defective starter.	Check through items above. If another cause is not apparent, starter is defective.	Remove and repair or replace starter.
STARTER MOTOR RUNS, BUT DOES NOT TURN CRANKSHAFT.		
Defective overrunning clutch or drive.	Remove starter and check starter drive and overrunning clutch.	Replace defective parts.
Damaged starter pinion gear or crankshaft gear.	Remove starter and check pinion gear and crankshaft gear.	Replace defective parts.
STARTER DRAGS.		
Low battery.	Check battery.	Charge or replace battery.
Starter switch or relay contacts burned or dirty.		Replace with serviceable unit.
Defective starter power cable.	Check cable.	Replace cable.
Defective starter.	Check starter brushes, brush spring tension, thrown solder on brush cover.	Repair or replace starter.
Dirty, worn commutator.	Clean, check visually.	Turn down commutator.
STARTER EXCESSIVELY NOISY.		
Worn starter pinion.	Remove and examine pinion.	Replace starter drive.
Worn or broken teeth on crankshaft gears.	Remove starter and turn over engine by hand to examine crankshaft gear.	Replace crankshaft gear.

SHOP NOTES:

12-65. IGNITION.

NOTE

It is recommended that at each 100-hour inspection the lower spark plugs be installed in the upper holes in the cylinders, and vice versa. Since deterioration of lower spark plugs is usually more rapid than that of upper plugs, rotating them helps prolong spark plug service life.

12-66. Bendix-Scintilla or Slick magnetos are used on the 200-series airplanes. Refer to paragraph 12-6 for the type of magneto used on the different models of engines. The correct magneto-to-engine timing is also given in paragraph 12-6. When timing a magneto, always use a timing light for accuracy.

WARNING

During all magneto maintenance, always take proper precautions to make sure the engine cannot fire or start.

12-67. BENDIX-SCINTILLA MAGNETOS.

12-68. Bendix-Scintilla magnetos, either the Model S-20 Series or the Model S-200 Series, are used on some of the Cessna 210-Series airplanes. These magnetos contain a conventional two-pole rotating magnet (rotor) mounted in ball bearings. Engine-driven at one end, the rotor shaft operates breaker points at the other end. A gear on the rotor shaft drives a distributor gear which transfers high-tension current from the coil to the proper outlet in the distributor block. A breaker compartment is located at the aft end of the magneto. On all except the magnetos used with the starting vibrator system, a condenser is provided in the breaker compartment. A coaxial capacitor which serves as the condenser as well as a radio noise suppressor is provided on magnetos used with the starting vibrator system.

The starting vibrator system employs a combination ignition and starter switch, and a starting vibrator. The left magneto contains an extra set of contact points so positioned that the magneto cam operates them at a retarded position to obtain the proper timing for starting. A starter circuit switch is provided, on some models, to make the starter circuit inoperative for hand-cranking (see paragraph 12-92). When the ignition switch is turned to "START," the right magneto is inoperative and the starting vibrator is energized. On 1961 models only, the starter solenoid is also energized. A push-to-start ignition switch on 1962 models energizes the starter solenoid only when the key is pushed in, eliminating the need for a starter circuit switch. While the starter is cranking the engine, high-tension current is supplied to the spark plugs in the following manner:

a. The vibrator rapidly interrupts the direct current supplied to it by the battery, and this interrupted current flows to both sets of contact points in the left magneto.

b. The interrupted current flows to ground through both sets of points until the main set opens, then it flows to ground through the retard set of points only.

c. When the retard set opens, the interrupted current flows through the magneto primary coil to ground, thus inducing secondary current with a series of high-voltage peaks (a "shower of sparks") which are distributed to the spark plugs at the correct time by the magneto regular distribution system. The condenser operates in parallel with both sets of points.

12-69. REMOVAL. When removal of the complete magneto is desired, remove the high-tension outlet plate, disconnect the primary lead, and remove the nuts securing the magneto to the engine. On magnetos used with a starting vibrator, also disconnect the lead to the retard connection. Condenser or breaker assemblies can be replaced by removing the breaker cover; however, for ease of replacement and internal timing, it is recommended that the magneto be removed. Never remove the screws fastening the two halves of the magneto together - to do so would disengage the distributor gears, causing loss of internal timing and necessitating complete removal and retiming.

12-70. MAGNETO INTERNAL TIMING. The following information gives instructions for adjusting breaker contacts to open at the proper position. It is assumed that the magneto has not been disassembled, and that the distributor gear, rotor gear, and cam have been assembled for correct meshing of gears and direction of rotation. Magneto overhaul, including separating the two major sections of the magneto, is not covered in this manual. Refer to applicable Bendix publications for disassembly and overhaul.

a. Fabricate a timing template as follows:

1. Cut a paper template from figure 12-20.

2. Cement paper template to a thin piece of metal for use as a support plate, then trim the plate to the shape of the paper template.

3. Drill the two mounting holes with a No. 18 drill.

b. Fabricate a timing pointer as shown in figure 12-22.

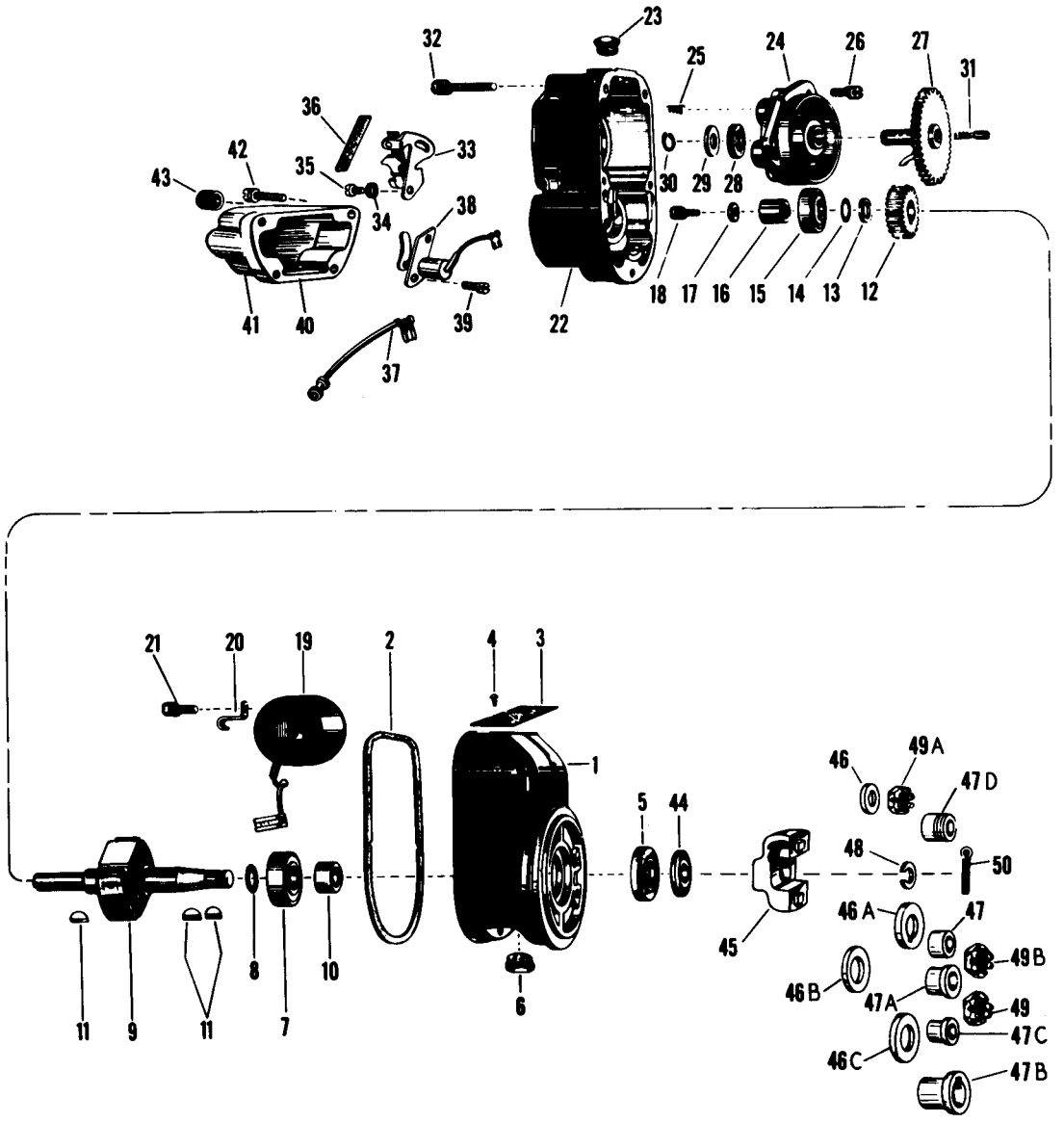
c. Remove magneto from engine, remove breaker compartment cover, and remove timing inspection plug from top of magneto.

d. Attach timing template to breaker compartment as shown in figure 10-23, using 8-32 screws 1/4 inch long.

e. Turn rotating magnet in its direction of rotation until the painted chamfered tooth on distributor gear is approximately in center of inspection window, then turn rotating magnet back until it locates in its magnetic neutral position.

NOTE

Impulse coupling pawls must be depressed to turn rotating magnet in its normal direction of rotation. S-200 series magnetos were not equipped with impulse couplings.



1. Magneto Housing
2. Gasket
3. Plate
4. Drive Screw
5. Oil Seal
6. Ventilator
7. Bearing
8. Shim
9. Rotating Magnet
10. Bearing
11. Key
12. Rotor Gear
13. Washer
14. Shim
15. Bearing
16. Cam
17. Washer
18. Screw and Lockwasher
19. Coil
20. Clamp
21. Screw and Lockwasher
22. Distributor Housing
23. Timing Plug
24. Distributor Block
25. Spring
26. Screw and Washer
27. Distributor Gear
28. Felt Washer
29. Washer
30. Retaining Ring
31. Carbon Brush
32. Screw and Washer
33. Breaker Assembly
34. Washer
35. Screw and Lockwasher
36. Insulation Sheet
37. Retard Lead
38. Capacitor
39. Screw and Lockwasher
40. Gasket
41. Breaker Cover
42. Screw and Lockwasher
43. Nut
44. Oil Deflector
45. Drive Plate
46. Washer
47. Bushing
48. Lockwasher
49. Nut
50. Cotterpin

Figure 12-19. Typical Bendix-Scintilla Magneto

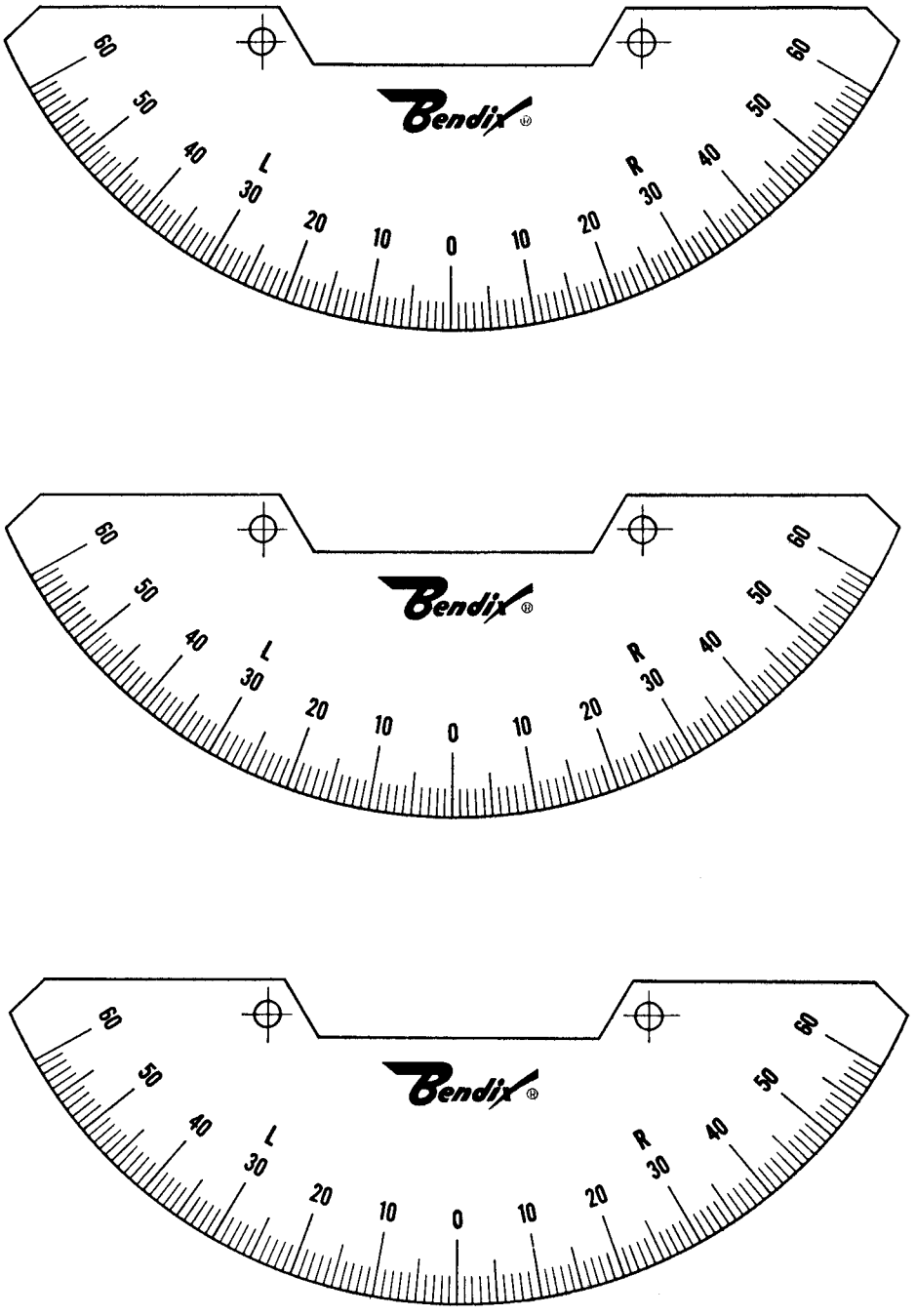


Figure 12-20. Bendix Magneto Timing Template

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f. Remove cam screw, lockwasher, and washer, and use cam screw to install timing pointer so it indexes with 0° mark on template, while rotating magnet is still in its magnetic neutral position.

g. Turn rotating magnet in proper direction of rotation until pointer indexes with 10° mark ("E" gap). Using 11-851 timing light or equivalent, adjust main breaker contacts to open at this point.

h. Turn rotating magnet until cam follower is on high part of cam lobe, and measure clearance between breaker contacts. Clearance must be .018± .006 inch. If clearance is not within these limits, readjust breaker contacts until they are within tolerance, then recheck the 10° ("E" gap) position. Tolerance on the "E" gap position is ± 4°. Replace breaker assembly if "E" gap and contact clearance will not both fall within the specified tolerances.

i. On retard breaker magnetos, the retard breaker is adjusted to open a predetermined number of degrees after the main breaker opens within +2° -0°. The degree of retard for any particular magneto is stamped in the bottom of the breaker compartment for convenience. At the exact point of main breaker opening, note the degree reading. Add the degrees retard to this noted reading to determine retard breaker opening point. Using the Timing Light adjust retard breaker to open at this point +2° -0°. As an example, if main breaker opened at 12° and 30° retard is required, the retard breaker should open between the 42° and 44° degree marks on the timing plate. Continue turning rotating magnet until cam follower is on the high point of the cam lobe. Measure contact clearance. It must be 0.018±0.006. If not, readjust breaker and recheck to be sure that contacts will open within retard degree tolerance. Replace breaker assembly if retard degree tolerance and contact clearance cannot be obtained.

j. Remove timing pointer and timing template, and install cam screw, lockwasher, and washer. Torque to 16-20 lb in.

k. Install magneto and time to engine in accordance with paragraph 12-71.

12-71. INSTALLATION AND TIMING TO THE ENGINE.

a. Turn propeller in normal direction of rotation until No. 1 cylinder is 20° BTC on compression stroke, the correct firing position.

NOTE

Various methods and equipment may be used to arrive at this firing position. An accurate top center indicator which screws into a spark plug mounting hole, and a pendulum pointer mounted on a 360-degree timing disc may be used. The timing disc should be adapted to fit over the end of the propeller spinner dome in such a manner that it may be rotated as necessary.

b. Turn magneto backwards until painted chamfered tooth is approximately in center of timing window. Be sure magneto gasket is in place, then install magneto approximately at the angle noted during removal. Tighten mounting clamps enough to hold magneto in place, but loose enough to permit magneto to be rotated in its clamps.

c. Using a timing light connected across the breaker contacts, rotate magneto case in normal direction of cam rotation until contacts have just closed, then rotate in the opposite direction until timing light indicates position at which contacts break. Secure magneto.

d. Turn propeller back a few degrees (approximately 5°) to close contacts.

NOTE

Do not turn propeller back far enough to engage impulse coupling, or propeller will have to be turned in normal direction of rotation until impulse coupling releases, then again backed up to a few degrees before the firing position. S-200 series magnetos are not equipped with impulse couplings.

e. Slowly advance propeller (tap forward with minute movements as firing position is approached) in normal direction of rotation until timing light indicates position at which contacts break. The contacts should break at the advance firing position of No. 1 cylinder (20° BTC). Rotate magneto case to make contacts break at correct position.

CAUTION

Do not adjust contacts to compensate for incorrect magneto-to-engine timing. Breaker contact adjustment is for internal timing only, and any readjustment after internal timing has been accomplished will result in a weaker spark, with reduced engine performance.

f. After tightening magneto mounting clamps and rechecking magneto-to-engine timing, remove timing equipment. Install and connect any spark plugs that were removed.

g. Install timing inspection plug, breaker compartment cover, any noise filters that were removed, and magneto "P" lead.

h. Connect retard lead on S-200 magnetos.

i. Install high-tension outlet plate.

NOTE

The No. 1 magneto outlet is identified with the number "1." The magneto fires at each successive outlet in direction of rotation. No. 1 magneto outlet routes to No. 1 cylinder, No. 2 magneto outlet to the next cylinder to fire, etc. Cylinder firing order is 1-6-3-2-5-4.

j. Reinstall cowling removed for access.

12-72. MAINTENANCE. At first 25-hour inspection and at each 100-hour inspection thereafter, breaker compartment should be inspected. Magneto-to-engine timing should be checked at each 100-hour inspection. If timing is 20° (plus zero, minus 2°), internal timing need not be checked. If timing is out of tolerance, remove magneto and set internal timing, then reinstall and time to engine.

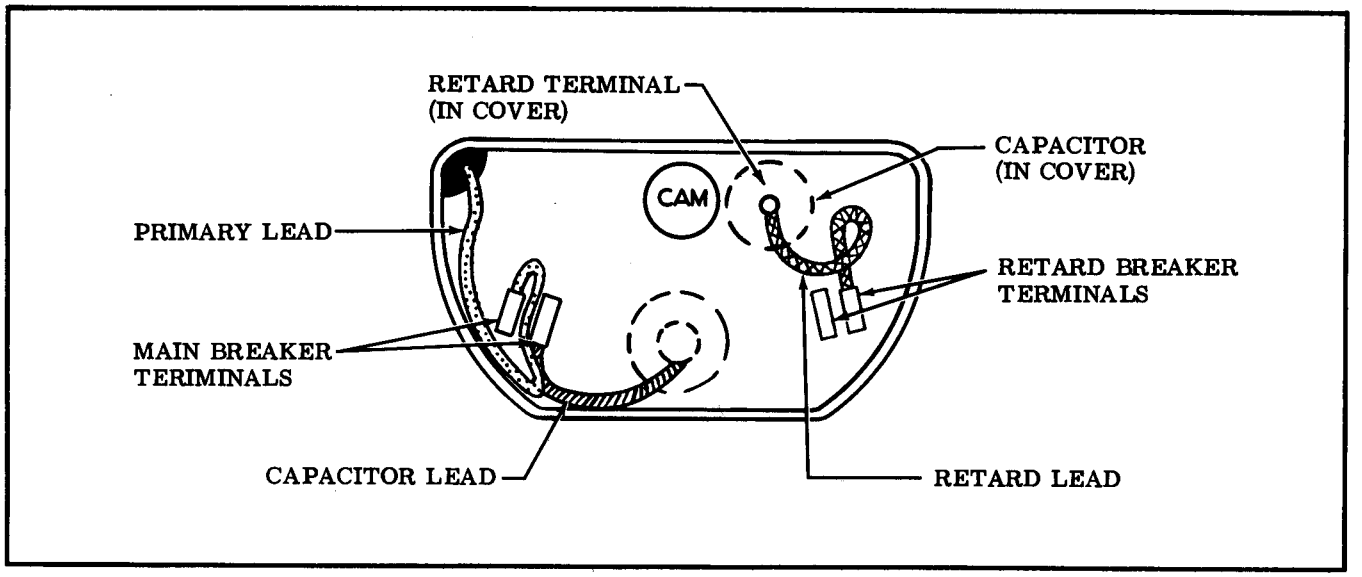


Figure 12-21. Forming Leads in S-200 Breaker Compartment

NOTE

If ignition trouble should develop, spark plugs and ignition wiring should be checked first. If the trouble appears definitely to be associated with a magneto, the following may be used to help disclose the source of trouble without overhauling the magneto.

a. Moisture Check.

1. Remove the high-tension outlet plate, cables, and grommet, and inspect for moisture.
2. Inspect distributor block high-tension outlet side for moisture.
3. If any moisture is evident, lightly wipe with a soft, dry, clean, lint-free cloth.

CAUTION

Do not use gasoline or other solvents, as these will remove the wax coating on some parts and could cause electrical leakage.

b. Breaker Compartment Check.

1. Remove breaker cover.
2. Check all parts of the breaker assembly for security.
3. Check breaker contacts for excessive wear, burning, deep pits, and carbon deposits. Contacts may be cleaned with a hard-finish paper. Replace defective breaker assemblies. Make no attempt to stone or dress contacts. Clean new contacts with clear, unleaded gasoline before installing.
4. Check cam follower oiling felt. If it appears dry, re-oil with 2 or 3 drops of lubricant (Scintilla 10-86527, or equivalent). Allow about 30 minutes for the felt to absorb the oil, then blot off excess with a clean cloth. Too much oil may result in fouling and excessive burning of contacts.
5. Check that the condenser mounting bracket is not cracked or loose. If equipment is available, check condenser for a minimum capacitance of .30 microfarads. If equipment for testing is not available and a defective condenser is suspected, replace with a new one.
6. Form leads in the breaker compartment of S-200 series magnetos as shown in figure **12-21.**

c. If the trouble has not been corrected after accomplishing steps "a" and "b," check magneto-to-engine timing. If timing is not within prescribed tolerance, remove magneto and set internal timing, then reinstall and time to the engine.

d. If the trouble has still not been corrected, magneto overhaul or replacement is indicated.

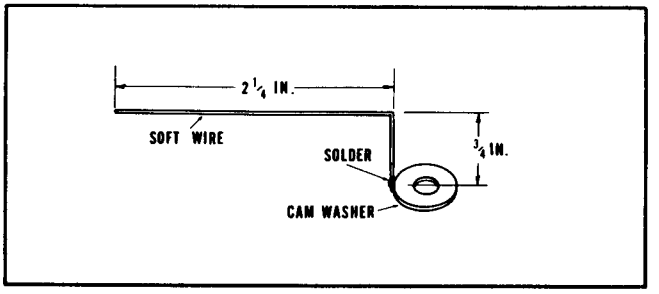


Figure 12-22. Timing Pointer

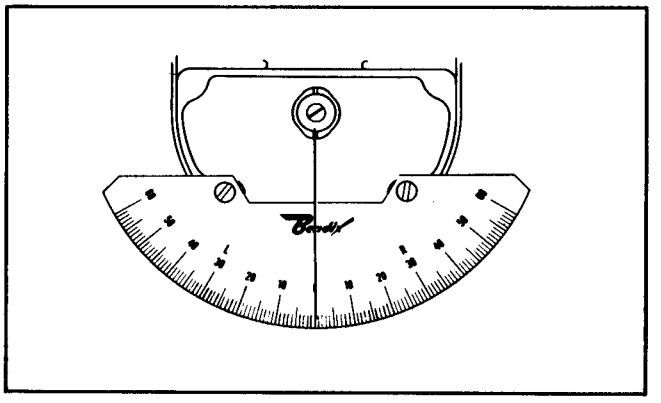
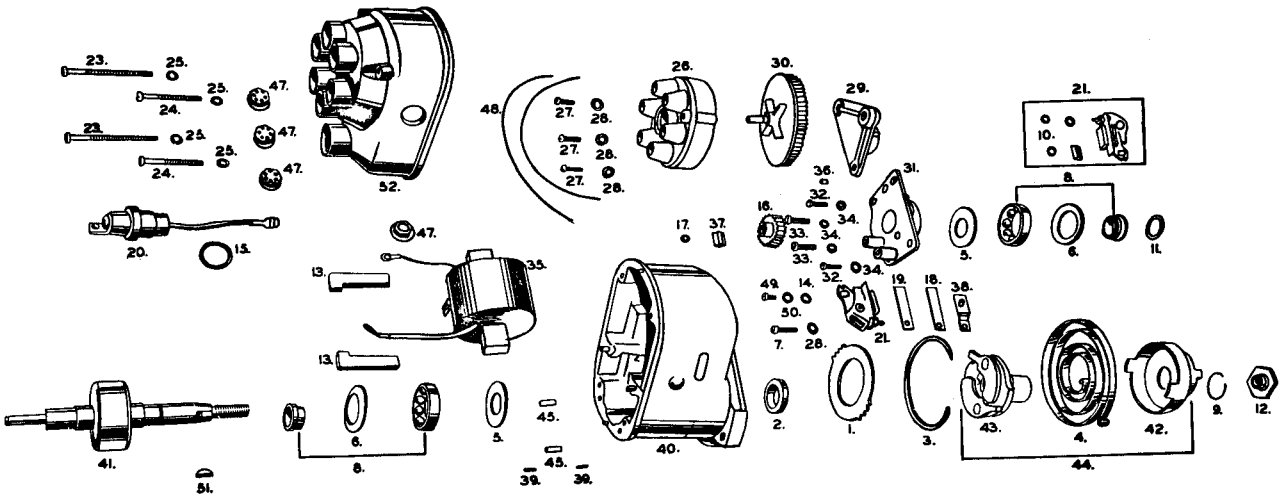


Figure 12-23. Template and Pointer Attached to Breaker Compartment



1. Plate - Stop Pin
2. Oil Seal
3. Snap Ring - Stop Pin Plate
4. Spring - Impulse Coupling
5. Washer - Rotor Shaft Bearing
6. Washer - Expanding Rotor Shaft Bearing
7. Screw - Breaker Bar Support
8. Ball Bearing - Rotor Shaft
9. Snap Ring - Impulse Coupling Hub
10. Nut - Breaker Arm
11. Shim - (.005") Rotor Shaft, End Play
12. Nut - Impulse Coupling
13. Wedge - Coil
14. Washer - Breaker Bar
15. O-ring - Sealing, Condenser
16. Gear - Rotor Shaft
17. Snap Ring - Rotor Shaft Cam
18. Follower - Cam
19. Insulator
20. Condenser
21. Kit - Contact Points
23. Fillister Head Screw
24. Fillister Head Screw
25. Lockwasher
26. Block - Distributor
27. Fillister Head Screw
28. Lockwasher
29. Plate - Bearing
30. Gear - Distributor
31. Plate - Rotor Bearing
32. Fillister Head Screw
33. Fillister Head Screw
34. Lockwasher
35. Coil
36. Brush - Distributor Gear
37. Cam - Breaker
38. Oiler - Breaker Cam
39. Dowel - Distributor Housing
40. Frame
41. Rotor
42. Shell - Impulse Coupling
43. Hub - Impulse Coupling
44. Coupling - Impulse
45. Bushing - Frame Dowel
47. Vent - Air Distributor Housing
48. Gasket - Distributor Housing
49. Fillister Head Screw
50. Lockwasher
51. Woodruff Key - Impulse Coupling Hub
52. Housing - Distributor Block

Figure 12-24. Slick Magneto

12-73. SLICK MAGNETOS.

12-74. Slick magnetos contain a conventional two-pole rotating magnet (rotor), mounted in ball bearings. Driven by the engine through an impulse coupling at one end, the rotor shaft operates the breaker points at the other end. The nylon rotor gear drives a nylon distributor gear which transfers high tension current from the wedge-mounted coil to the proper outlet in the distributor block. A coaxial capacitor is mounted in the distributor block housing to serve as the condenser as well as a radio noise suppressor. Both nylon gears are provided with timing marks for clockwise or counterclockwise rotation, and the distributor gear and distributor block have timing marks, visible through the air vent holes, for timing to the engine. A timing hole is provided in the bottom of the magneto adjacent to the magneto flange. A timing pin or 6-penny nail can be inserted through this timing hole into the mating hole in the rotor shaft to lock the magneto approximately in the proper firing position. The breaker assembly is accessible after removing the screws fastening the magneto halves together and disconnecting capacitor slip terminal.

12-75. REMOVAL. When removal of the complete magneto is desired, remove the spark plug leads at the back of the magneto and tag for identification, disconnect the capacitor lead, and remove the nuts securing the magneto to the engine. For replacement of the breaker assembly or where removal of only the forward (engine) half of the magneto is desired, remove the screws fastening the halves together, pull the rear half aft only enough to disconnect the capacitor slip terminal, and remove the nuts securing the magneto to the engine. As the halves are separated, be sure that the large distributor gear is not dropped.

CAUTION

When removing the distributor block housing from the forward case, do not pull it away far enough to break or damage the capacitor lead or slip terminal.

12-76. INTERNAL TIMING.

a. Whenever the nylon gear on the rotor shaft or the plastic cam (which also serves as the key for the gear) has been removed, be sure that the gear and cam are installed so the timing mark on the gear aligns with the "O" stamped on the rotor shaft.

b. When replacing breaker assembly or adjusting contact points, place a timing pin (or .093" 6-penny nail) through the timing hole in the bottom of the magneto next to the flange and into the mating hole in the rotor shaft. Adjust contact points so they just break in this position, with a maximum point opening of .012" to .015" when the timing pin is removed. Temporarily assemble the two magneto halves and capacitor slip terminal, and use a timing light to check that the timing marks visible through the ventilation plug holes are aligned at the instant the contact points break. Readjust the points if necessary.

NOTE

The side of the magneto with the manufacturer's insignia has a red timing mark and the side opposite the insignia has a black timing mark. The distributor gear also has a red timing mark and a black timing mark. The contact points should break when the two red lines are aligned at the insignia side of the magneto, or, when the two black lines are aligned at the opposite side of the magneto. Do not time with red and black lines together on the same side.

c. Whenever the large distributor gear and the rotor gear have been disengaged, they must be reengaged with their timing marks aligned for the correct rotation. Align the timing mark on the rotor gear with "RH" on the distributor gear. Care must be taken to keep these two gears meshed in this position until the magneto halves are assembled.

SHOP NOTES:

12-77. INSTALLATION AND TIMING TO THE ENGINE. To install and time the magneto to the engine, proceed as follows:

a. Turn the propeller in normal direction of rotation until No. 1 cylinder is in correct firing position on compression stroke (20° BTC).

NOTE

Various methods and equipment may be used to arrive at this firing position. An accurate top center indicator which screws into a spark plug hole, and a pendulum pointer which is mounted on a 360-degree timing disc may be used. The timing disc should be adapted to fit over the end of the propeller spinner dome in such a manner that it may be rotated as necessary. IO-520 series engines and later IO-470 series engines have degrees marked on a bracket attached to the starter adapter, with a timing mark on the generator or alternator drive pulley as the reference point.

b. Turn the magneto shaft until the timing marks visible through the ventilation plug holes are aligned (red-to-red or black-to-black) and insert a timing pin (or .093" 6-penny nail) through the timing hole in the bottom of the magneto next to the flange and into the mating hole in the rotor shaft. This locks the magneto approximately in firing position while installing on the engine.

c. After magneto gasket is in place, position the magneto on the engine and secure, then remove the timing pin from the magneto. Be sure to remove this pin before turning the propeller.

d. Connect a timing light to the capacitor terminal at the rear of the magneto and to a good ground.

e. Turn propeller back a few degrees to close the contact points.

NOTE

Do not turn the propeller back far enough to engage the impulse coupling or the propeller will have to be turned in normal direction of rotation until the impulse coupling releases, then backed up to slightly before the firing position.

f. Slowly advance the propeller in normal direction of rotation until timing light indicates the position of contact point breaking. The magneto mounting flange had elongated slots so that the magneto may be shifted to break the points at the correct engine firing position (20°).

g. Tighten magneto mounting nuts, recheck timing, then remove timing light.

h. Connect spark plug leads to their correct magneto outlets.

NOTE

The No. 1 magneto outlet is the one closest to the ventilation plug on the side of the magneto having the manufacturer's insignia. The magneto fires at each successive outlet in direction of rotation. Connect No. 1 magneto outlet to No. 1 cylinder spark plug lead, No. 2 outlet to the next cylinder to fire, etc. Engine firing order is listed in paragraph 12-6.

i. Connect ignition switch primary lead to the capacitor terminal on the magneto.

12-78. MAINTENANCE. Magneto-to-engine timing should be checked with a timing light every 200 hours. If timing is off more than 1° in either direction, the magneto should be retimed to the engine. The magneto mounting flange has elongated slots for this purpose. If the internal timing marks visible through the ventilation plug holes on the sides of the magneto are misaligned more than 1/16" when the magneto fires, the magneto should be retimed internally. Whenever the magneto halves are separated, the breaker assembly should always be checked. As long as internal timing and magneto-to-engine timing are within the preceding tolerances, it is recommended that the magneto be checked internally only at 500-hour intervals.

NOTE

If ignition trouble should develop, spark plugs and ignition wiring should be checked first. If the trouble appears definitely to be associated with a magneto, the following may be used to help disclose the source of trouble without overhauling the magneto.

a. Moisture Check.

(1) Remove screws securing magneto halves together, disconnect capacitor slip terminal, remove distributor cap, and inspect for moisture.

(2) Check distributor gear finger and carbon brush for moisture.

(3) Check breaker assembly for moisture, especially on contact points.

(4) If any moisture is evident, lightly wipe with a soft, dry, clean, lint-free cloth.

b. Breaker Compartment Check.

(1) Check all parts of the breaker assembly for security.

(2) Check contact points for absence of excessive wear, burning, deep pits, and carbon deposits. Points may be cleaned with a hard-finish paper. Replace defective breaker assemblies. Make no attempt to stone or dress contact points. Clean new points with oleum spirits before installing.

(3) Check cam oiler pad. If dry, apply 2 or 3 drops of SAE 70 oil to the pad. Remove any excessive oil from breaker assembly; too much oil may result in fouling and excessive burning of points. The corner of the cam oiler pad should touch the cam lobe lightly.

(4) Check the capacitor.

(5) Check the carbon brush on the distributor gear for excessive wear. The brush must extend a minimum of 1/32" beyond the end of the gear shaft. The spring which the brush contacts should be bent out approximately 20° from vertical, since spring pressure on the brush holds the distributor gear shaft against the thrust bearing in the distributor cap.

(6) Oil the bearings at each end of the distributor gear shaft with a drop of SAE 20 oil. Wipe off

excess.

(7) Make sure internal timing is correct and reassemble the magneto. If removed from the engine, install and time properly.

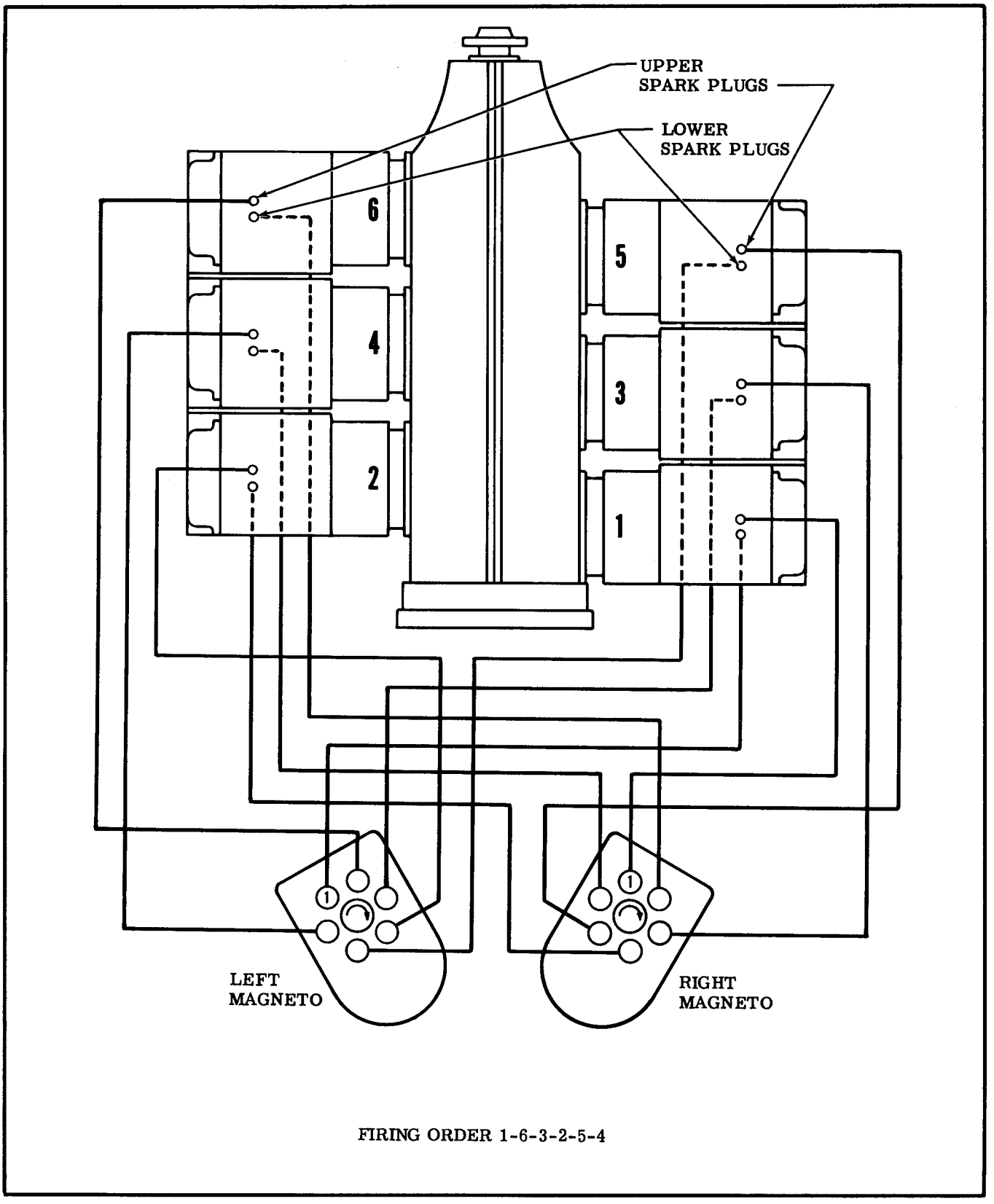


Figure 12-25. Ignition Schematic

12-79. OIL SYSTEM.

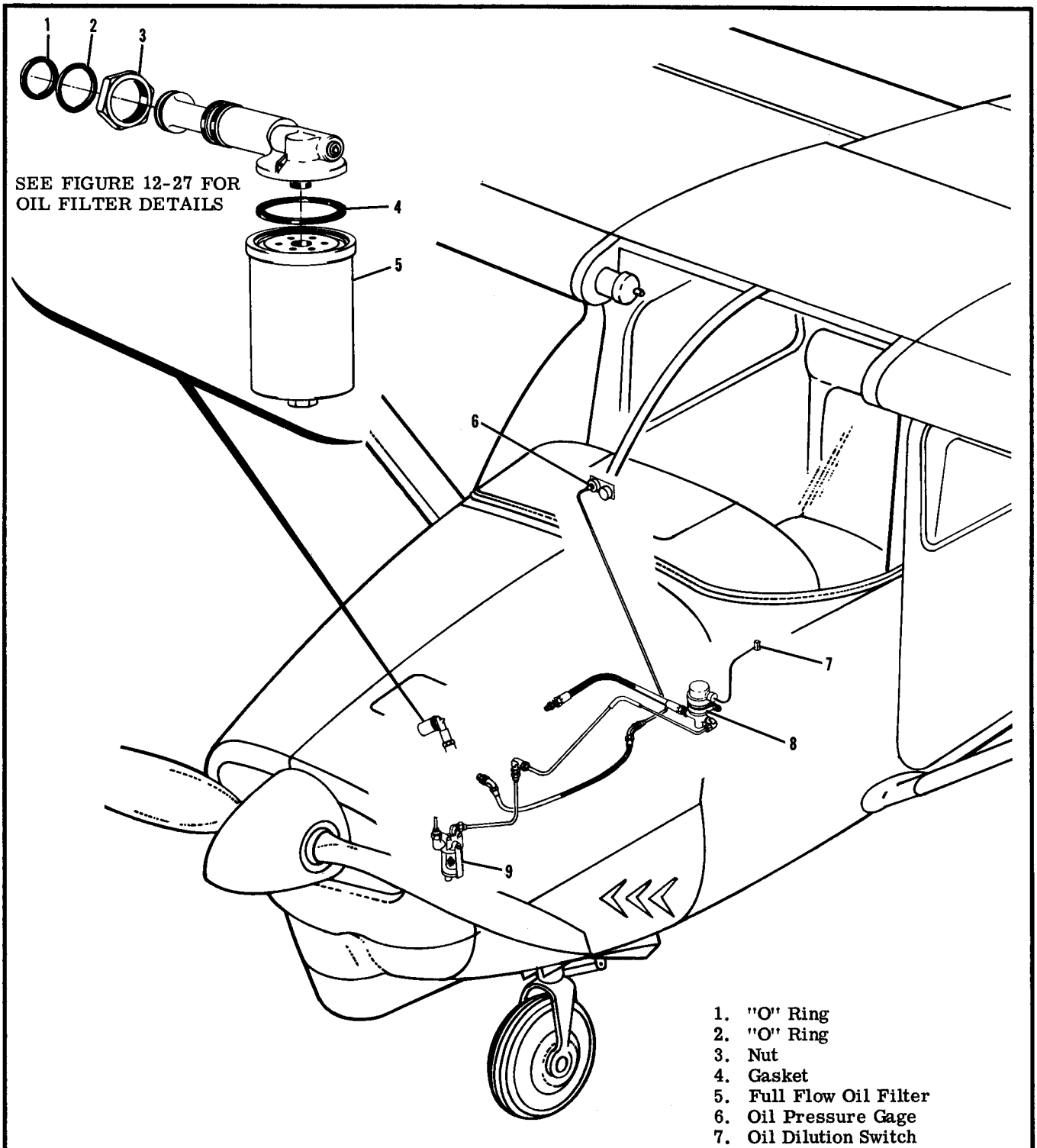
12-80. Wet sump, pressure-lubricating oil systems are employed in the engines used on the 200-series. In these engines, oil under pressure from the oil pump is fed through drilled crankcase passages which supply oil to the crankshaft main bearings and camshaft bearings. Connecting rod bearings are pressure lubricated through internal passages in the crankshaft. Valve mechanisms are lubricated through the hollow push-rods, which are supplied with oil from the crankcase oil passages. Oil is returned by gravity to the engine oil sump. Cylinder walls and piston pins are spray-lubricated by oil escaping from connecting rod bearings. The engines are equipped with an oil cooler and conventional vernatherm-controlled oil temperature regulation. A pressure relief valve is installed to maintain proper oil pressure at higher engine speeds. Removable oil filter screens are provided within oil systems. External, replaceable element oil filters and non-congealing oil coolers are optional equipment.

12-81. TROUBLE SHOOTING.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
NO OIL PRESSURE.		
No oil in sump.	Check with dipstick.	Fill sump with proper grade and amount of oil.
Oil pressure line broken, disconnected, or pinched.	Inspect oil pressure line.	Replace or connect.
Oil pump defective.	Remove and inspect.	Examine engine. Metal particles from damaged pump may have entered engine oil passages.
Defective oil pressure gage.	Check with another gage. If second reading is normal, airplane gage is defective.	Replace gage.
Oil congealed in gage line.	Disconnect line at engine and gage; flush with kerosene.	Pre-fill with kerosene and install.
Relief valve defective.	Remove and check for dirty or defective parts.	Clean and reinstall; replace if defective.
HIGH OIL TEMPERATURE.		
Oil cooler thermo bypass valve defective.	Feel front of cooler core with hand. If core is cold, oil is bypassing cooler.	Replace thermo bypass valve.
Oil cooler air passages clogged.	Inspect cooler core.	Clean air passages.
Oil cooler oil passages clogged.	Attempt to drain cooler. Inspect any drainings for sediment.	Clean oil passages.
Oil congealed in oil cooler.	This condition can only occur in extremely cold temperatures.	If congealing is suspected, use external heater or a heated hangar to thaw the congealed oil.
Secondary effect of low oil pressure.	Observe oil pressure gage for low indication.	Determine and correct reason for low oil pressure.
Defective oil temperature gage.	Check with another gage. If second reading is normal, airplane gage is defective.	Replace gage.
Defective oil temperature bulb.	Check for correct oil pressure, oil level and cylinder head temperature. If they are not correct, check oil temperature gage for being defective; if a similar reading is observed, bulb is defective.	Replace temperature bulb.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
LOW OIL TEMPERATURE.		
Defective oil temperature bulb or gage.	Check with another gage. If reading is normal, airplane gage is defective. If reading is similar, temperature bulb is defective.	Replace defective part.
Oil cooler thermo bypass valve defective or stuck closed.	Remove valve and check for proper operation.	Replace thermo bypass valve.
LOW OIL PRESSURE.		
Low viscosity oil.		Drain oil and refill sump with proper grade of oil.
Low oil level.	Check with dipstick.	Fill sump to proper level with proper grade of oil.
Oil pressure relief valve spring weak or broken.	Remove and check spring.	Replace weak or broken spring.
Defective oil pump.	Check oil temperature and oil level. If temperature is higher than normal and oil level is correct, internal failure is evident.	Examine engine. Metal particles from damaged oil pump may have entered engine oil passages.
Secondary result of high oil temperature.	Observe oil temperature gage for high indication.	Determine and correct reason for high oil temperature.
HIGH OIL PRESSURE.		
High viscosity oil.		Drain oil and refill sump with proper grade and amount of oil.
Relief valve defective.	Remove and check for dirty or defective parts.	Clean and reinstall; replace if defective.
Defective oil pressure gage.	Check oil pressure with another gage. If second gage gives a normal reading, airplane gage is defective.	Replace oil pressure gage.

SHOP NOTES:



1. "O" Ring
2. "O" Ring
3. Nut
4. Gasket
5. Full Flow Oil Filter
6. Oil Pressure Gage
7. Oil Dilution Switch
8. Oil Dilution Valve
9. Fuel Strainer

NOTE

Prior to the Model 210B, a firewall-mounted Winslow full-flow oil filter was available as optional equipment.

Figure 12-26. Optional Oil Filter and Oil Dilution - 210B and on

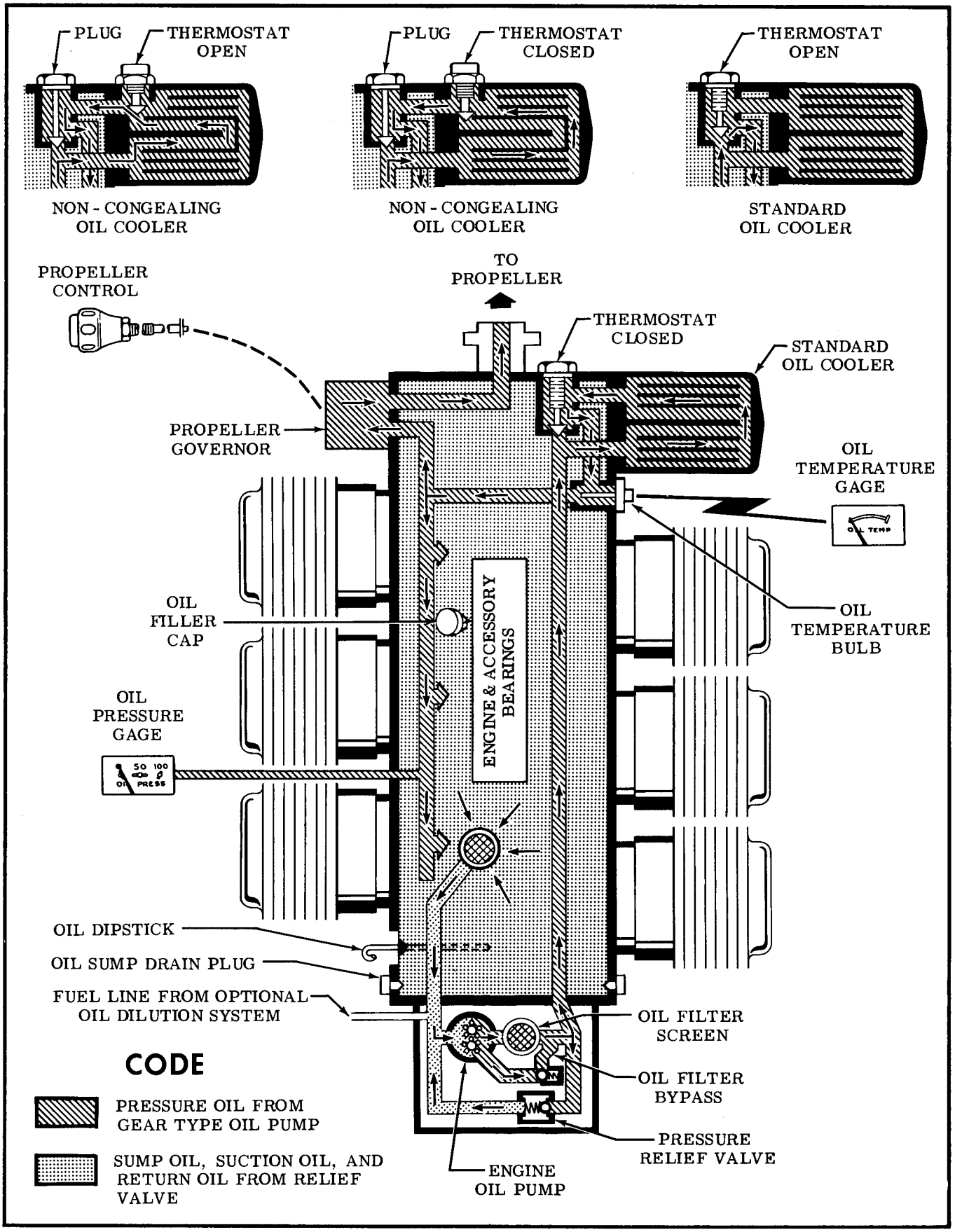
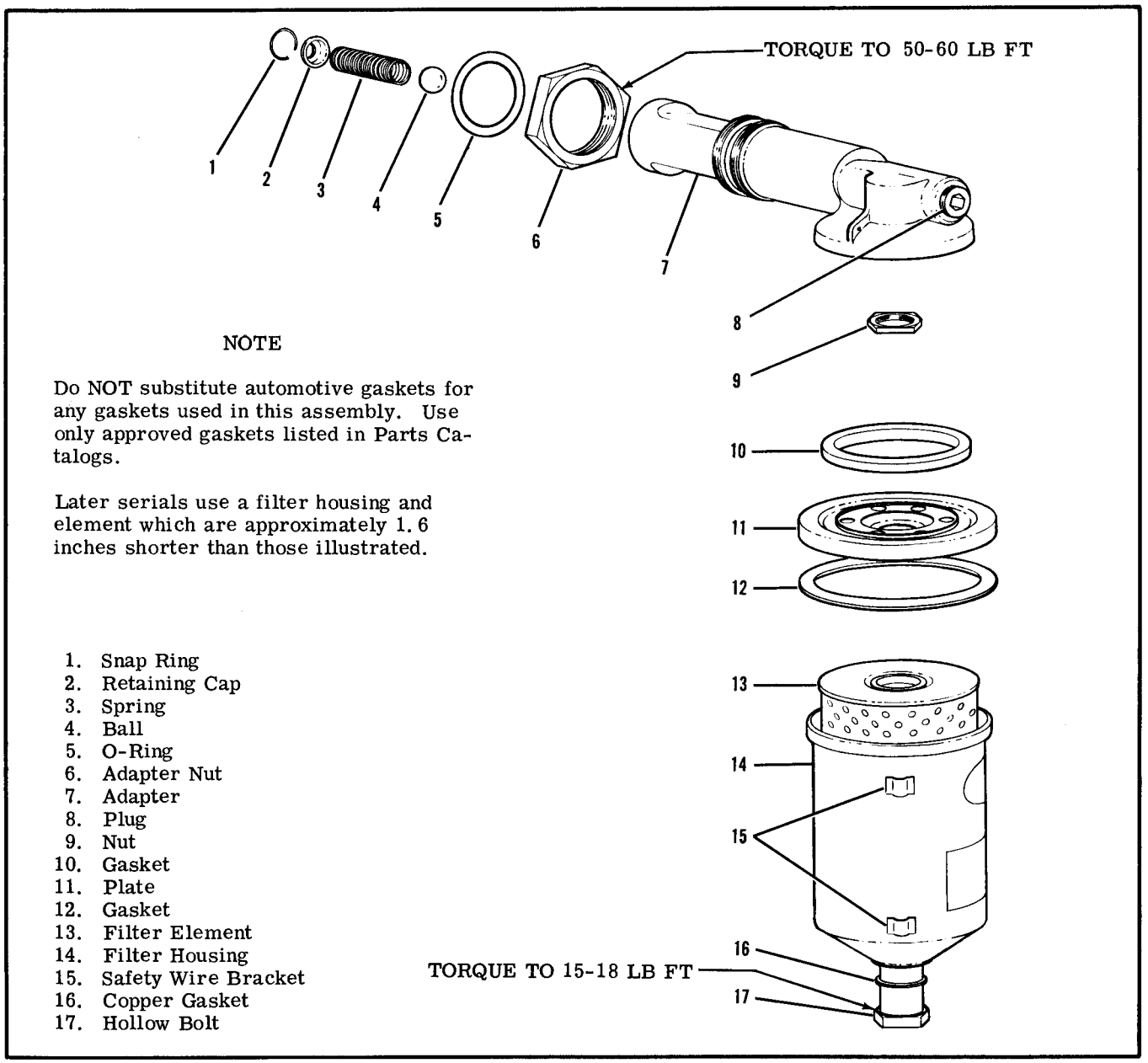


Figure 12-29. Oil System Schematic



NOTE

Do NOT substitute automotive gaskets for any gaskets used in this assembly. Use only approved gaskets listed in Parts Catalogs.

Later serials use a filter housing and element which are approximately 1.6 inches shorter than those illustrated.

1. Snap Ring
2. Retaining Cap
3. Spring
4. Ball
5. O-Ring
6. Adapter Nut
7. Adapter
8. Plug
9. Nut
10. Gasket
11. Plate
12. Gasket
13. Filter Element
14. Filter Housing
15. Safety Wire Bracket
16. Copper Gasket
17. Hollow Bolt

Figure 12-27. Cessna Full-Flow Oil Filter

12-82. CESSNA FULL-FLOW OIL FILTER.

12-83. An optional external oil filter may be installed on all models of the 200-Series airplanes. The filter and filter adapter are illustrated in figure 12-27. The filter adapter replaces the regular engine oil filter. All oil from the engine oil pump is routed through the filter element, then back into the oil system.

12-84. FILTER ELEMENT REPLACEMENT. (See figure 12-27.)

NOTE

Filter element replacement kits are available from the Cessna Spare Parts Department.

a. Remove engine cowling as necessary for access.

b. Remove both safety wires from filter housing and unscrew hollow bolt (17) to detach filter assembly (14) from adapter (7) as a unit. Remove from airplane, discarding gasket (10).

c. Remove nut (9), then press downward on bolt (17) to remove. Retain copper gasket (16).

d. Lift plate (11) off filter housing, discarding gasket (12).

e. Pull filter element out of housing and discard.

f. Wipe parts clean with a soft cloth.

NOTE

When installing a new filter element, it is important that all gaskets are clean, lubricated, and positioned properly, and that the correct amount of torque is applied to the housing attaching bolt. If the bolt is under-

torqued, oil leakage will occur. If the bolt is over-torqued, the filter housing may be deformed, again causing oil leakage.

Lubricate rubber grommets in new filter element, rubber gaskets (10 and 12), and copper gasket (16) with clean engine oil or general purpose grease before installation. Dry gaskets may cause false torque readings, again resulting in oil leakage.

g. Place new element in housing, and insert bolt (17), with copper gasket (16) in place, through the housing and element.
h. Position new gasket (12) inside outer flange of plate (11), and install the plate with nut (9). Screw the nut down snugly, but tighten it only finger tight.
i. Position new gasket (10) around inner flange of plate (11) and screw the filter assembly onto the adapter. Torque bolt (17) to 15-18 lb-ft.

NOTE

Use of a torque wrench is recommended highly. However, if one is not available, bolt (17) may be tightened to cause a light contact of gaskets, then tightened an additional 1-3/4 turns with a suitable wrench.

j. Resafety bolt (17) to lower bracket (15) on filter housing, and resafety adapter to upper bracket (15) on filter housing.
k. Reinstall parts removed for access, and service the engine with proper grade and quantity of oil. One additional quart of oil is required each time the element is replaced.

12-85. FILTER ADAPTER REMOVAL.
a. Remove filter assembly as outlined for element replacement.
b. Remove safety wire and loosen adapter nut (6).

NOTE

A special wrench adapter for adapter nut (6), (Part No. SE-709), is available from the Cessna Spare Parts Department, or one may be made as shown in figure 12-28. Remove any engine accessory that interferes with removal of the adapter.

c. Unscrew adapter and remove from engine.
d. Bypass ball, spring, and retaining cap may be removed from adapter after removing snap ring (1).
e. The Heli-Coil insert in the adapter may be replaced, although special installation tools are required. Follow instructions of the tool manufacturer for their use.

12-86. FILTER ADAPTER INSTALLATION.
a. If bypass ball, spring, and retaining cap were removed, reinstall with snap ring (1).
b. Using a new O-ring lubricated with engine oil, tighten adapter nut until O-ring seats against threads, then back off nut two turns.
c. Screw adapter into engine until O-ring seats against engine without turning adapter nut. Do not tighten nut at this time.
d. Temporarily install filter assembly on adapter, and position so adequate clearance with adjacent parts is attained. Maintaining this position of the adapter, remove the filter assembly, then tighten adapter nut to 50-60 lb ft and safety.

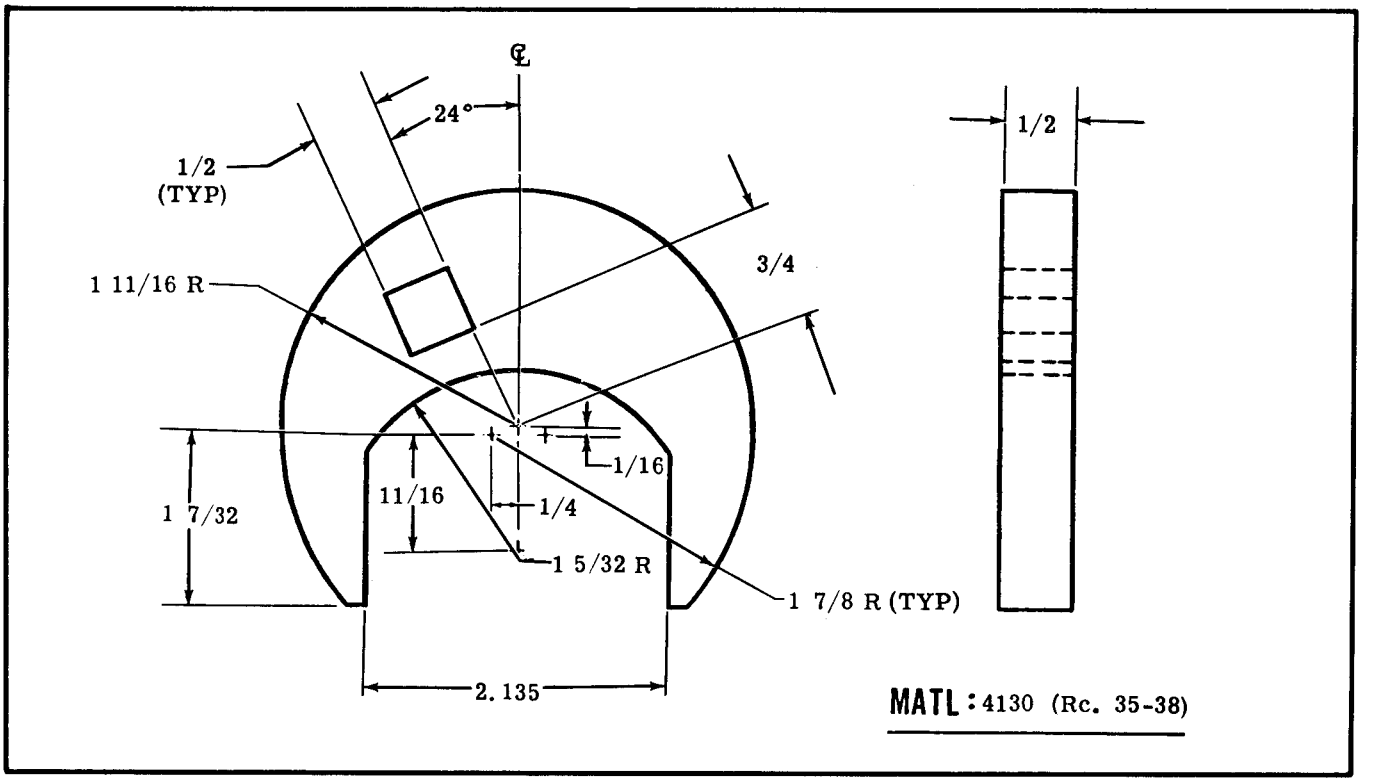


Figure 12-28. Wrench Adapter Fabrication

e. Using a new gasket between the filter assembly and the adapter, install the filter assembly. Torque to 15-18 lb-ft. See the "Note" following paragraph 12-84, step "i."

f. Resafety bolt (17) to lower bracket (15) on filter housing and resafety adapter to upper bracket (15) on filter housing.

g. Reinstall all parts removed for access, and service engine with proper grade and quantity of oil.

12-87. OIL COOLER. An optional non-congealing oil cooler may be installed on the Models 205 and 206 series and Model 210C and on. Oil circulating through the engine is allowed to circulate continuously through the warm-up passages in this cooler to prevent the oil from congealing when operating in low temperatures. A large oil cooler may be installed as optional equipment.

12-88. EXTREME WEATHER MAINTENANCE.

12-89. COLD WEATHER starting will be made easier by the installation of an optional oil dilution system and a ground service receptacle which permits quick connection of an external power source.

After the last flight of the day, drain the engine oil into a clean retainer so the oil can be preheated. Cover the engine to prevent ice or snow from collecting inside the cowling. When preparing the aircraft for flight or engine run-up after these conditions have been followed, preheat the drained oil. After preheating the oil, gasoline may be mixed with the oil in a ratio of 1 part gasoline to 12 parts oil before pouring into the engine oil sump. If the free air temperature is below -29°C (-20°F), the engine compartment should be preheated by a ground heater. After the engine compartment has been preheated, inspect all engine compartment drain and vent lines for presence of ice. After this procedure has been followed, pull the propeller through several revolutions by hand before starting the engine.

WARNING

Do not heat oil above 121°C (250°F). A flash fire may result. Before pulling propeller through, insure that magneto switch is in the OFF position to prevent engine from firing.

CAUTION

Due to the desludging effect of the diluted oil, engine operation should be observed closely during the initial warm-up of the engine. Engines that have a considerable amount of operational hours accumulated since their last dilution period may be seriously affected by the dilution process. This will be caused by the diluted oil dislodging sludge and carbon deposits within the engine. This residue will collect in the oil sump and possibly clog the screened inlet to the oil pump. Small deposits may actually enter the oil pump and be trapped by the main oil filter screen. Partial or, in some cases, complete loss of engine lubrication may result from either condition. If these conditions are anticipated after oil dilution, the engine should be run for several minutes at normal operating temperatures and then stopped and inspected for evidence of sludge and carbon deposits in the oil sump, oil cooler, and oil filter screen. Future occurence of this condition can be prevented by diluting the oil prior to each oil change. This will prevent the built-up accumulation of the sludge and carbon deposits within the engine.

Winterization Kits are available. The kits are essentially devices to restrict the entry of air through the front opening of the cowl, or to restrict the outlet of air at the rear opening of the cowl. All kits are designed for easy installation on the aircraft and should be used in accordance with instructions accompanying the kits.

A new high-output coil has been developed for the Bendix-Scintilla S-200 and S-20 series magnetos. This new coil provides increased voltage output for improved engine starting. Bendix-Scintilla magnetos that have the new high-output coil installed are identified by a red nameplate. The original coil in the earlier model magnetos may be replaced with this new high-output coil to improve engine starting.

An optional manual engine priming system may be installed on Model 205 and 206 series airplanes, and on the Model 210D and on. The manual primer is installed on the pedestal. Fuel to the primer pump is taken from the fuel strainer and is delivered to the aft end of each intake manifold, thus priming the entire length of the intake manifold for each bank of cylinders.

12-90. LOW BATTERY STARTING.

12-91. If a ground service receptacle is installed, the use of an external power source is recommended for low battery starting. Before connecting a generator type external power source, it is important that the master switch be turned on. This will enable the battery to absorb transient voltages which otherwise might damage the semiconductors in the electronic equipment. When using a battery type external power source, the master switch should be turned off to prevent an unnecessary power drain from the power source batteries to the airplane's battery. Starting may also be accomplished by hand-cranking as outlined in the following paragraph.

CAUTION

Be certain that the polarity of any external power source or batteries is correct (positive to positive and negative to negative). A polarity reversal will result in immediate damage to semiconductors in the airplane's electronic equipment.

12-92. HAND-CRANKING. A normal hand-cranking procedure may be used on aircraft with impulse coupling equipped magnetos. Beginning in 1961, ignition for starting is supplied by the battery and a starting vibrator system, rather than the familiar impulse-coupling equipped magnetos. Since a retarded spark for starting can only be obtained in the "START" position of the key-operated ignition switch, 1961 models are provided with a starter circuit "ON-OFF" switch so that the starter can be disconnected before hand-propping is attempted. Beginning in 1962, a push-to-start ignition switch, which eliminates the need for a starter circuit switch, is used on these models. Use the following procedure.

(1961 ONLY):

a. Pull master switch ON momentarily to see if battery power is sufficient to close the battery solenoid. Illumination of the generator warning light or movement of a fuel gage pointer indicates that the solenoid is closed and manual starting is possible. If battery power is not sufficient to close the solenoid, hand starting is impossible, since the starting vibrator requires battery power.

b. Be sure to use wheel chocks if available, and test and set the brakes.

c. Set controls and switches for a normal start, except leave the ignition switch "OFF" and turn the starter circuit switch "OFF."

d. Pull propeller through at least two full revolutions to prime each cylinder (ignition switch still "OFF"). Operate pump as propeller is being pulled through.

NOTE

With the auxiliary fuel pump operating, engine flooding is possible. Avoid prolonged use of the pump.

e. With ignition switch held in the "START" position, hand-crank the engine.

WARNING

Do not hand-crank with the ignition switch on "BOTH," "L," or "R." In these positions, kick-back or reverse rotation may occur, since the magnetos do not have impulse couplings to retard the spark. Also, be sure the starter circuit switch is placed in the "OFF" position before hand-cranking the engine.

f. As soon as the engine fires, immediately release the spring-loaded ignition switch to "BOTH" for better engine acceleration.

g. Return starter circuit switch to "ON" for normal operation.

(1962 & ON):

a. Omitting all references to the starter circuit switch, use the foregoing procedure for handcranking. When the ignition switch is held in the "START" position, do NOT push it in.

12-93. HOT WEATHER. In hot weather, with a hot engine, fuel may vaporize at certain points in the fuel system. Vaporized fuel may be purged by setting the mixture control in "IDLE CUT-OFF" and operating the auxiliary fuel pump on "HIGH" or "EMERGENCY."

Engine mis-starts characterized by weak, intermittent explosions followed by puffs of black smoke from the exhausts are caused by over-priming or flooding. This situation is more apt to develop in hot weather, or when the engine is hot. If it occurs, repeat the starting routine with the throttle approximately one-half "OPEN," the mixture control in "IDLE CUT-OFF," and the auxiliary fuel pump switch "OFF." As the engine fires, move the mixture control to full "RICH" and decrease the throttle to desired idling speed.

Engine mis-starts characterized by sufficient power to disengage the starter but dying after 3 to 5 revolutions are the result of an excessively lean mixture after the start. This can occur in either warm or cold temperatures. Repeat the starting routine but allow additional priming time with the auxiliary fuel pump switch on "LOW (PRIME)" or "START" before cranking is started, or place the auxiliary fuel pump switch on "HIGH" or "EMERGENCY" immediately for a richer mixture while cranking.

If prolonged cranking is necessary, allow the starter motor to cool at frequenct intervals, since excessive heat may damage the starter.

12-94. DUSTY CONDITIONS. Dust inducted into the engine intake system is probably the greatest single cause of early engine wear. Under high dust conditions the induction air filter should be serviced daily as outlined in Section 2.

12-95. SEACOAST AREAS, HUMID AREAS. In salt water areas special care should be given to keep the engine and engine accessories clean to prevent oxidation. Fuel and oil should be checked frequently and drained of condensed moisture in humid areas.

SECTION 13

FUEL SYSTEM

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13-1. FUEL SYSTEM.

NOTE

The fuel system as described in this section does not include the fuel injection system. Refer to Section 12 for that part of the fuel system.

13-2. In the Models 210 and 210A, fuel to the engine-driven pump is fed by gravity-flow from the fuel cell in the wings. The fuel by-passes the electric auxiliary fuel pumps when they are not in operation. The fuel cells are individually vented overboard. Fuel vapor return lines connect to the forward inboard tank fittings to return excess fuel and vapor from the engine-driven fuel pump.

The Models 210B and 210C employ a more involved fuel system which utilizes two fuel feed lines from each tank and fuel reservoir tanks beneath the cabin floor of the airplane. This system allows more usable fuel from each tank although the tanks have no greater capacity that the tanks used in the Models 210 and 210A.

The Models 205 and 205A fuel systems are similar to the Model 210B and 210C except that the Models 205 and 205A fuel systems use one electric auxiliary fuel pump instead of the two pumps used in the Model 210B and 210C system. The solenoid valve in the vapor return line is not necessary for these models; therefore, it has been deleted in the Models 205 and 205A.

In the Model 210D and on and Model 206 series, fuel reservoir tanks are installed forward of the front door post bulkheads, beneath the cabin floor. The fuel vapor return lines from the reservoir tanks to the fuel cells in the wings have been deleted. This also requires the deletion of the vapor return fittings in each main fuel cell. The fuel line from the lower forward corner of each fuel cell to the reservoir tank becomes a combination fuel feed and vapor return line.

WARNING

Fuel draining from fuel tanks and disconnected lines or hoses constitutes a fire hazard. Adequate safety precautions should be taken whenever it is necessary to drain fuel or to disconnect lines or hoses.

NOTE

Latest recommendation for lubricating and sealing fuel system fittings is MIL-T-5544 graphite-petrolatum (or equivalent). Apply to male threads only, omitting the first two threads.

13-3. TROUBLE SHOOTING.

NOTE

Use this trouble shooting chart in conjunction with the engine trouble shooting chart in Section 12.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
NO FUEL FLOW TO ENGINE-DRIVEN FUEL PUMP.		
Fuel selector valve not turned on.	Check position of selector valve.	Turn fuel selector valve on.
Fuel tank empty.	Check fuel quantity.	Service with proper grade and amount of fuel.
Fuel line disconnected or broken.	Inspect fuel lines.	Connect or repair fuel lines.
Fuel cell screen plugged.	Disconnect fuel line from cell outlet. No flow indicates plugged screen.	Remove and clean screen. Flush out fuel cell.
Defective fuel selector valve.	Disconnect inlet and outlet lines from valve. If fuel flows from inlet line but not through valve, it is defective.	Remove and repair or replace selector valve.
Plugged fuel strainer.	Inspect strainer.	Remove and clean strainer and screen.
Defective check valve at electric fuel pumps by-pass.	Disconnect inlet and outlet lines from check valve. If fuel flows from inlet line but not through valve, it is defective.	Repair or replace check valve.
Fuel line plugged.	Disconnect at fuel pump inlet. No flow indicates plugged line.	Disconnect lines as necessary to locate obstructions, then clean.
FUEL STARVATION AFTER STARTING.		
Partial fuel flow from the preceding causes.	Use the preceding isolation procedures, checking for sufficient rate of flow.	Use the preceding remedies.
Malfunction of engine-driven fuel pump or fuel injection system.	Refer to Section 12.	Refer to Section 12.
Fuel vents plugged.	Check per paragraph 13-4.	See paragraph 13-4.
NO FUEL FLOW WHEN ELECTRIC PUMPS OPERATED.		
Defective fuel pump switch.	Check continuity of switch.	Replace defective switch.
Open or defective circuit breaker.	Check visually; if not open, check continuity.	Reset. Replace if defective.
Loose connections or open circuit.	Check connections and wiring.	Tighten connections; repair or replace wiring.
Defective electric fuel pump. Models 210 through 210C.	Listen for clicking noise denoting pump operation. With proper power supply, lack of this indicates defective pump. If clicking noise is present, disconnect outlet line. With proper fuel supply to pump, fuel under pressure should flow from outlet.	Replace defective pump.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
NO FUEL FLOW WHEN ELECTRIC PUMPS OPERATED. (Cont)		
Defective electric fuel pump. (Models 205 & 206 series, and 210D & on.)	Disconnect outlet line. With proper fuel supply to pump, fuel under pressure should flow from pump.	Replace defective pump.
Defective check valve at electric fuel pump by-pass.	Disconnect fuel line from fuel strainer to check valve, at the valve, and plug line. Operate pumps to see that valve closes and no fuel flows from open port.	Repair or replace valve.
Defective engine-driven fuel pump by-pass or defective fuel injection system.	Refer to Section 12.	Refer to Section 12.
	NOTE On the Models 210 through 210C erratic or intermittent operation is usually caused by foreign material on the plunger. Remove the end cover and the three screws securing plunger cup and valve. If cup valve is free, do not remove from cup. Remove plunger and spring from pump. Clean with gasoline, gently dress out any rough spots on plunger with crocus cloth, slosh the pump in gasoline, and reassemble. Cleanliness, good gaskets, and free movement of valves and plungers are essential. Resistance of each pump should be 4.87 to 6.4 ohms. On the Models 205 and 206 series, and 210D and on, a vane-type pump is used. Refer to paragraph 13-23 through 13-35 for maintenance procedures.	
NO FUEL QUANTITY INDICATION.		
Fuel tanks empty.	Check fuel quantity.	Service with proper grade and amount of fuel.
Circuit breaker open or defective.	Check visually; if not open, check continuity.	Reset. Replace if defective.
Loose connections or open circuit.	Check connections and wiring.	Tighten connections; repair or replace wiring.
Defective fuel quantity indicator or sending unit.	Disconnect wire from sending unit at indicator not reading. Install jumper wire from good indicator (corresponding terminal). If indicator does not register, it is defective; if indicator registers, sending unit is defective.	Replace defective indicator or sending unit.

SHOP NOTES:

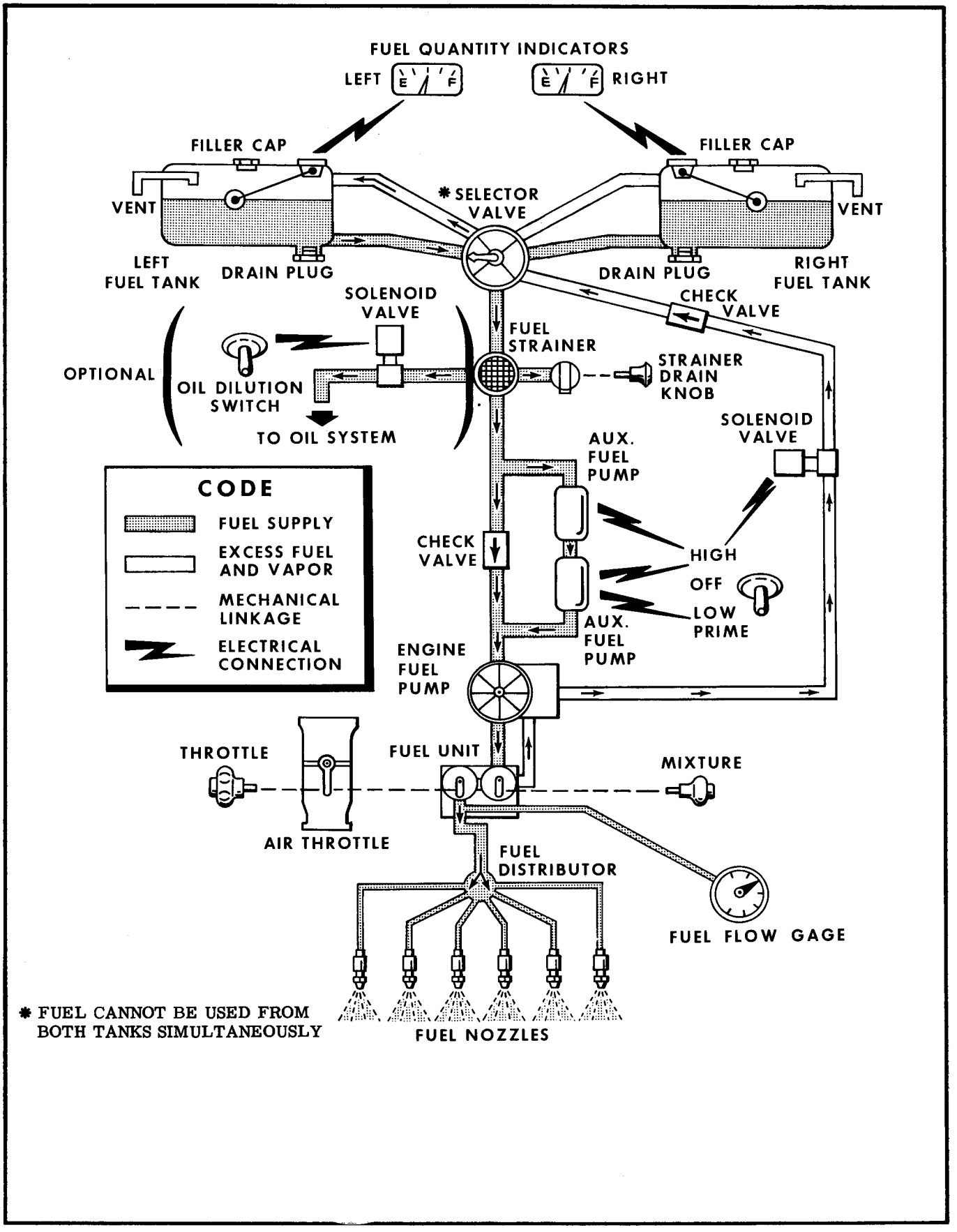
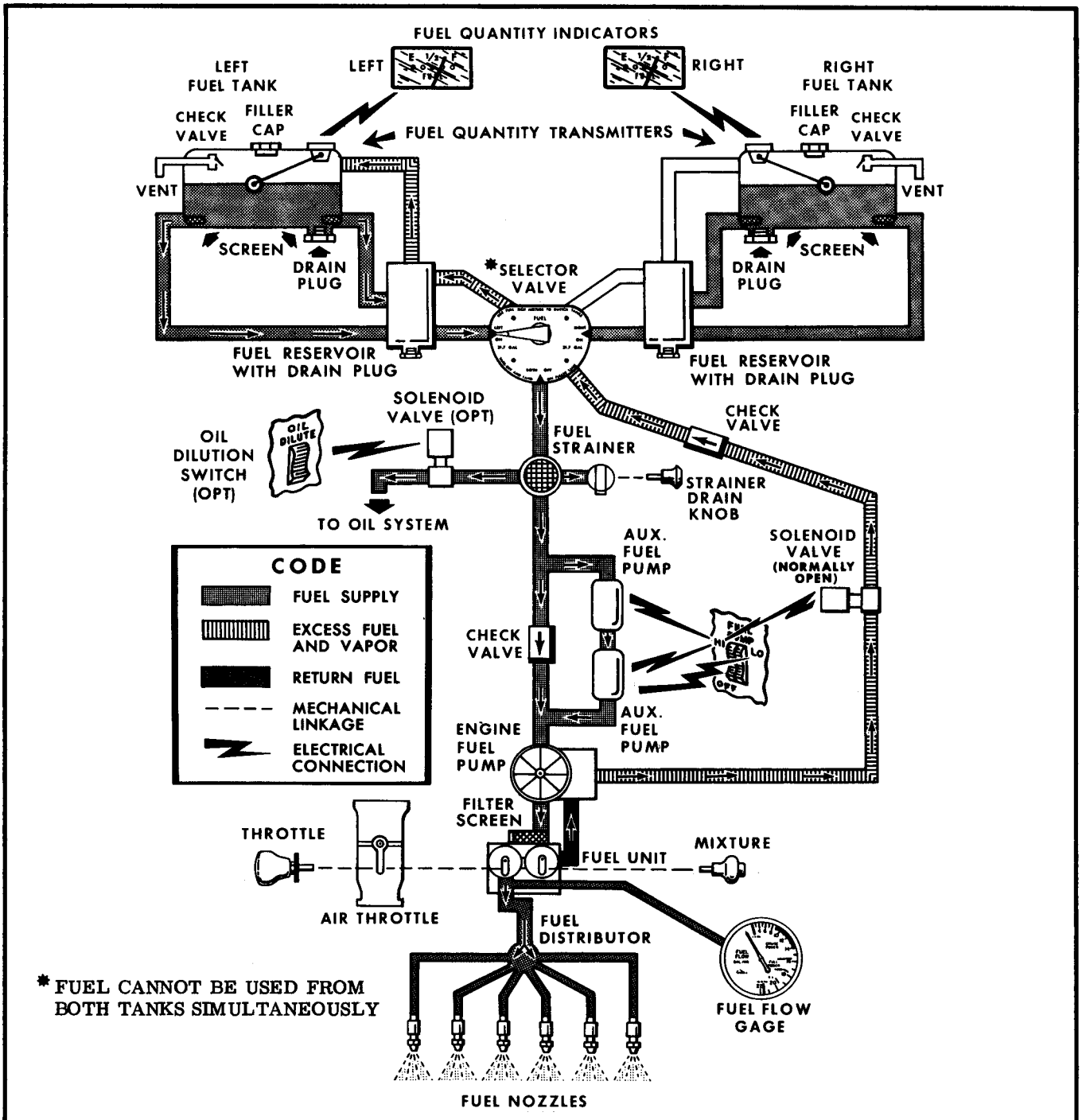


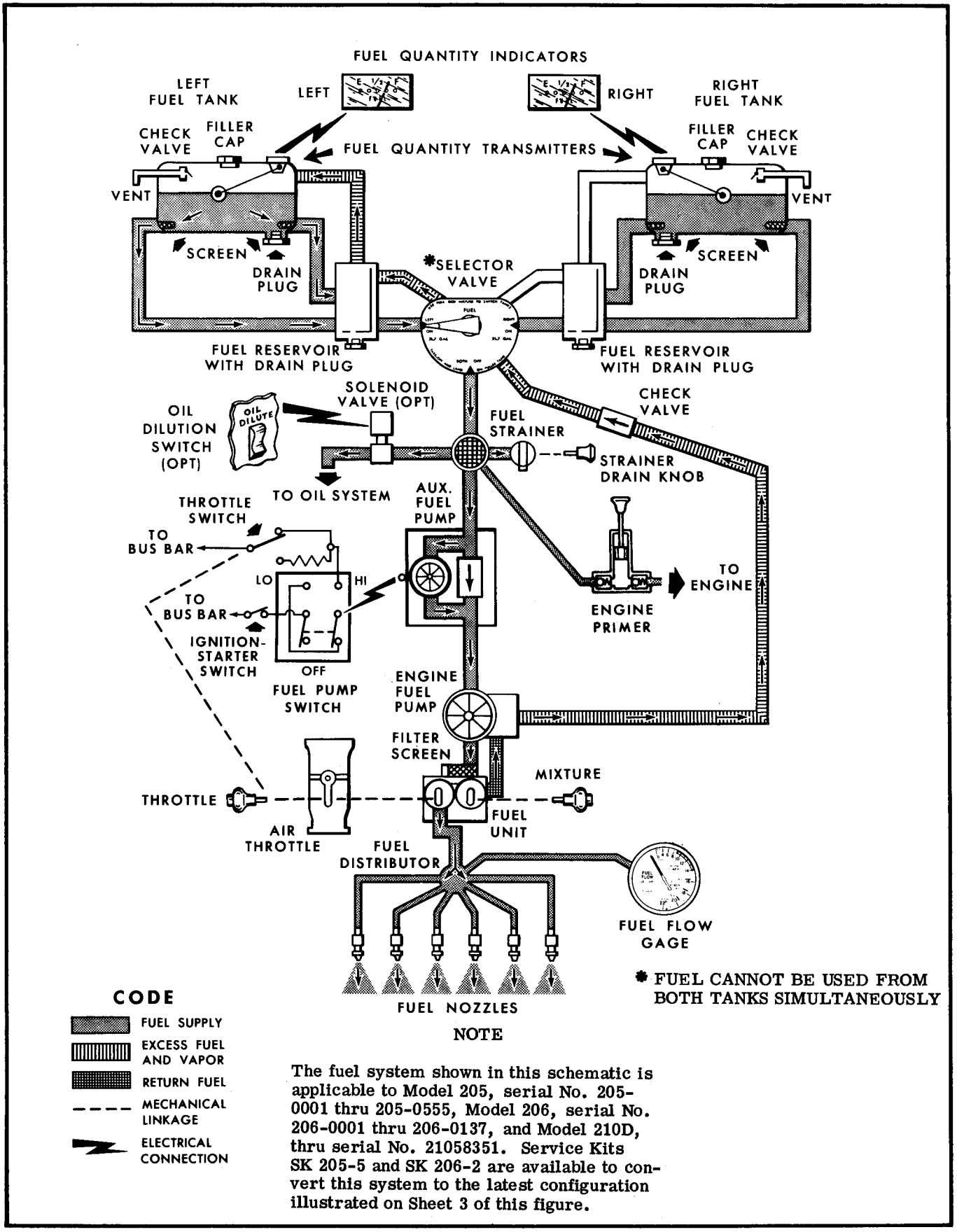
Figure 13-1. Fuel System Schematic - Models 210 and 210A



NOTE

The fuel system shown in this schematic is applicable to Models 210B and 210C. Service Kit SK205-5 is available to convert this system to the latest configuration, illustrated on Sheet 3 of this figure.

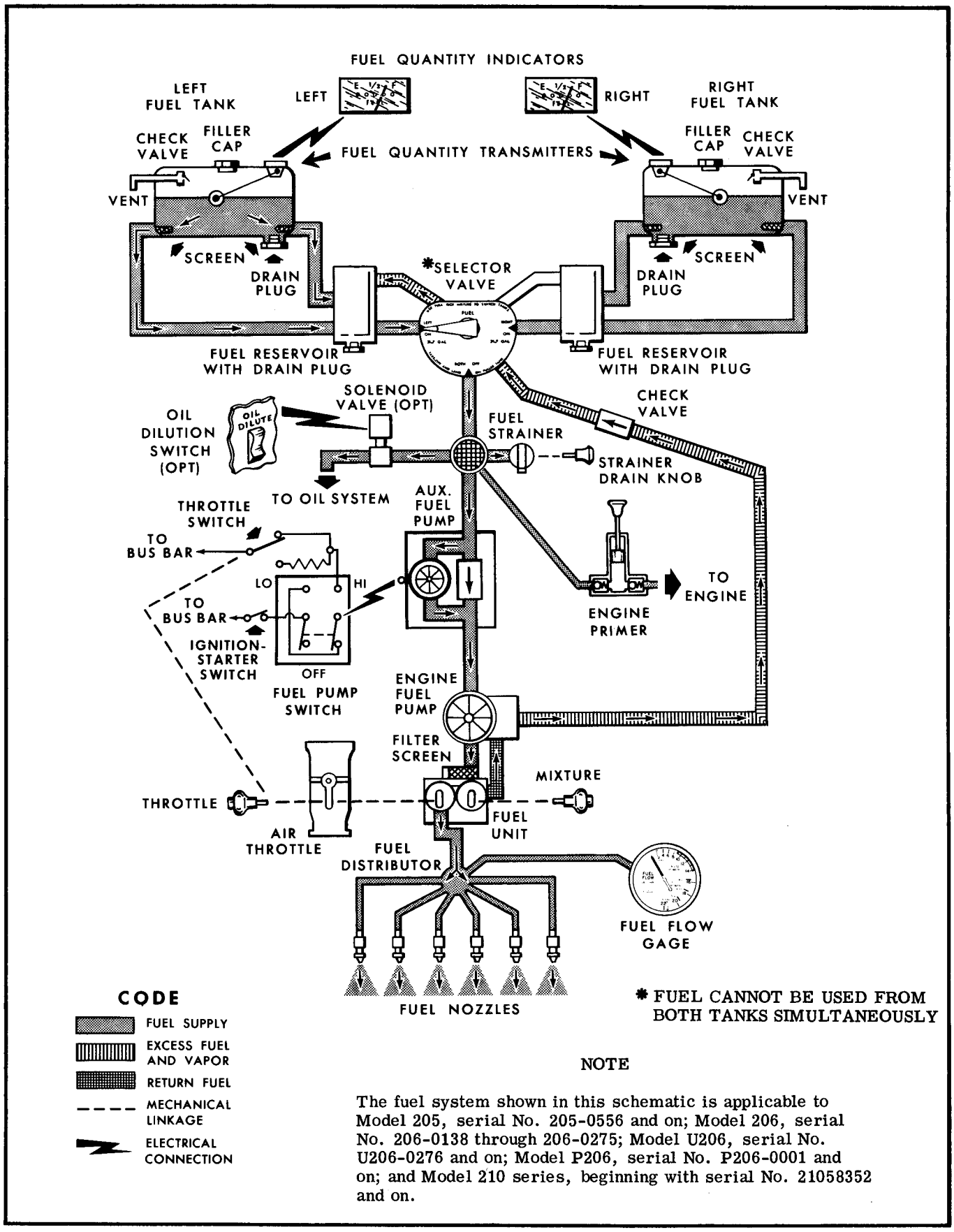
Figure 13-2. Fuel System Schematic (Sheet 1 of 3)



NOTE

The fuel system shown in this schematic is applicable to Model 205, serial No. 205-0001 thru 205-0555, Model 206, serial No. 206-0001 thru 206-0137, and Model 210D, thru serial No. 21058351. Service Kits SK 205-5 and SK 206-2 are available to convert this system to the latest configuration illustrated on Sheet 3 of this figure.

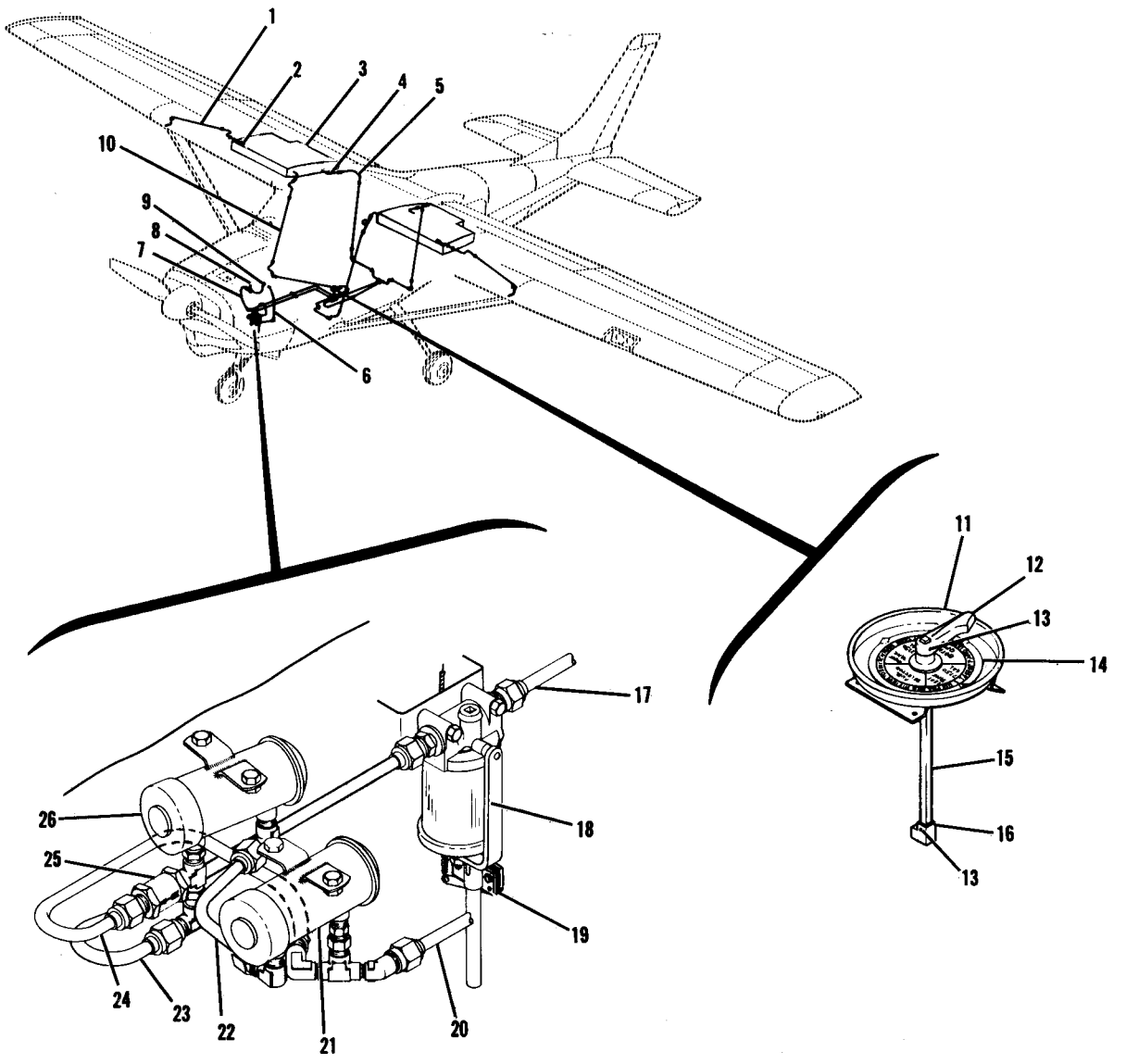
Figure 13-2. Fuel System Schematic (Sheet 2 of 3)



NOTE

The fuel system shown in this schematic is applicable to Model 205, serial No. 205-0556 and on; Model 206, serial No. 206-0138 through 206-0275; Model U206, serial No. U206-0276 and on; Model P206, serial No. P206-0001 and on; and Model 210 series, beginning with serial No. 21058352 and on.

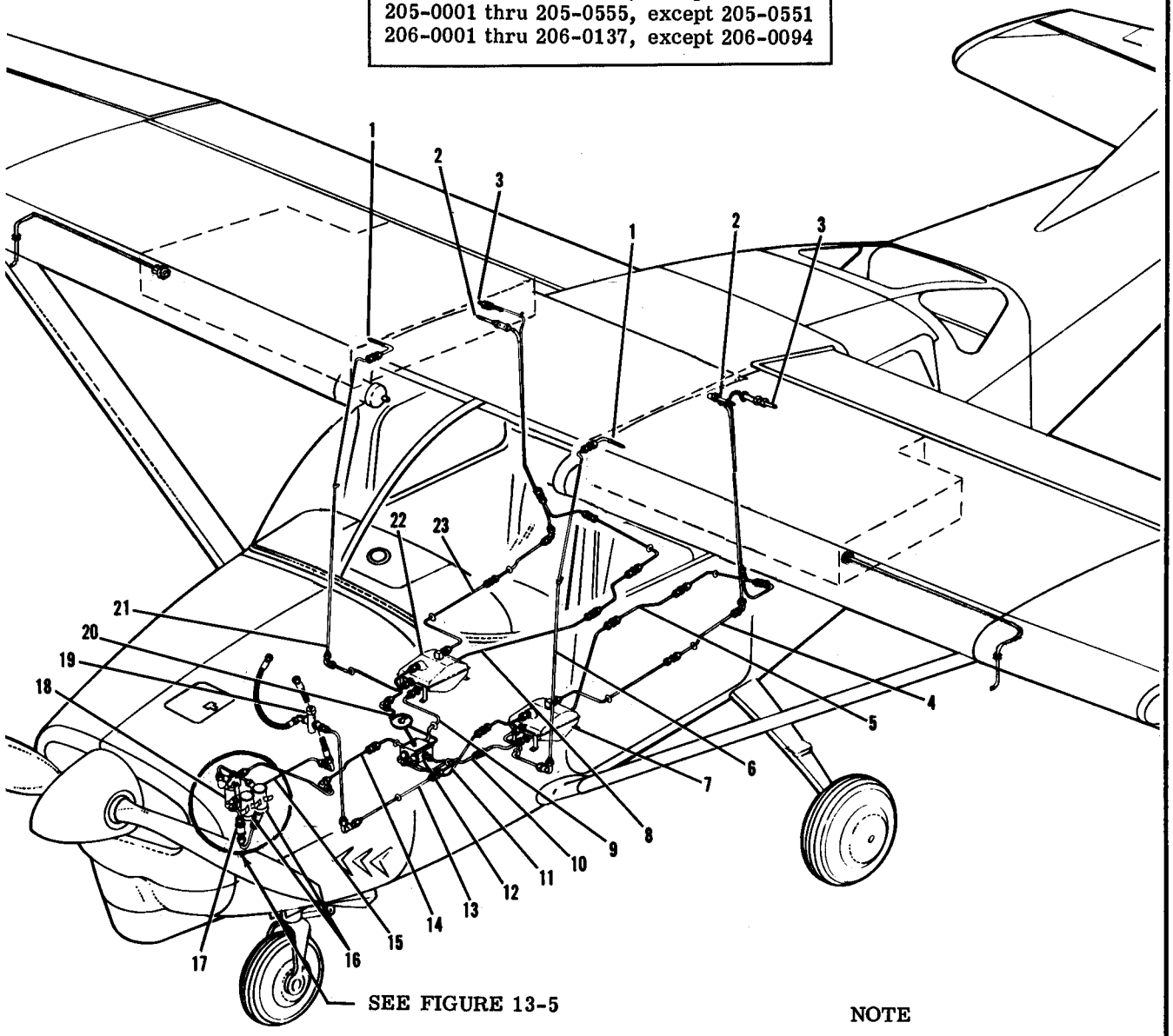
Figure 13-2. Fuel System Schematic (Sheet 3 of 3)



1. Vent Line
2. Check Valve
3. Fuel Tank
4. Strainer (Tank)
5. Fuel Line (Tank to Selector Valve)
6. Fuel Hose (To Engine-Driven Fuel Pump)
7. Vapor Return Line (Check Valve to Selector Valve)
8. Check Valve and Solenoid Valve
9. Vapor Return Hose (Engine-Driven Fuel Pump to Solenoid Valve)
10. Vapor Return Line (Fuel Selector Valve to Tank)
11. Cup
12. Handle
13. Roll Pin
14. Plate
15. Shaft
16. Selector Valve Housing
17. Fuel Line (Selector Valve to Strainer)
18. Fuel Strainer
19. Drain Valve
20. Fuel Line (Electric Fuel Pumps to Hose)
21. Left Electric Fuel Pump
22. Fuel Line (Right Pump Outlet to Left Pump Inlet)
23. Fuel Line (Strainer to Right Pump Inlet and Check Valve)
24. Fuel Line (Check Valve to Left Pump Outlet Tee)
25. Check Valve
26. Right Electric Fuel Pump

Figure 13-3. Fuel System - Models 210 and 210A

21057841 thru 21058351, except 21058326
205-0001 thru 205-0555, except 205-0551
206-0001 thru 206-0137, except 206-0094

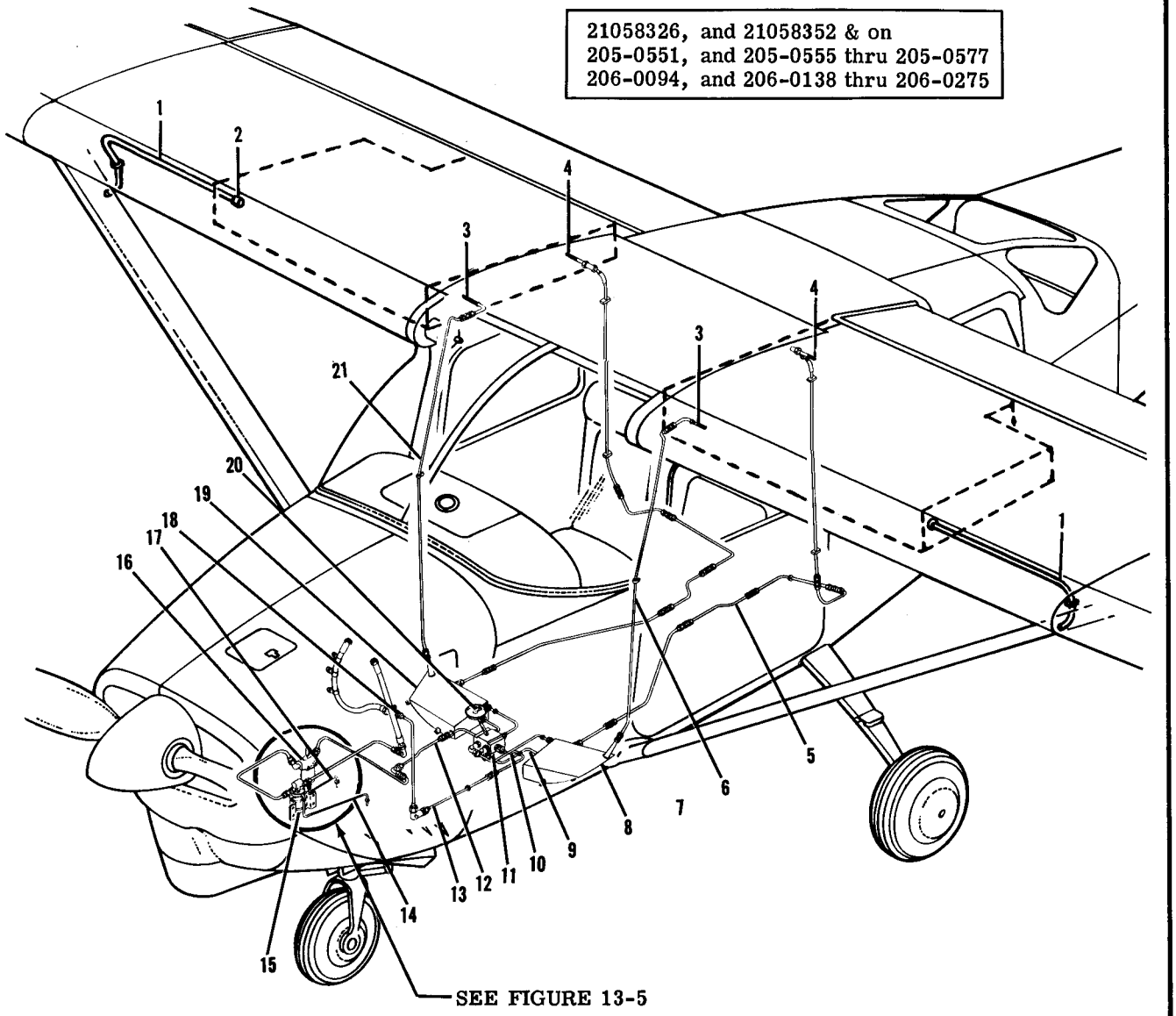


NOTE

There are minor differences in fuel line routing aft of the reservoir tanks for the various models. Service Kits (SK205-5 and SK206-2) are available to convert these systems to the system shown on Sheet 2.

1. Forward Line Screen
2. Aft Line Screen
3. Vapor Return Outlet
4. Vapor Return Line
5. Aft Fuel Line
6. Forward Fuel Line
7. Left Reservoir Tank
8. Aft Fuel Line
9. Reservoir-to-Valve Line RH
10. Reservoir-to-Valve Line LH
11. Vapor Return to Reservoir LH
12. Fuel Selector Valve
13. Vapor Return Line
14. Valve-to-Strainer Line
15. Strainer-to-Engine Pump
16. Electric Fuel Pumps
17. Bypass Check Valve
18. Fuel Strainer
19. Vapor Return Solenoid
20. Selector Valve Handle
21. Forward Fuel Line RH
22. Reservoir Tank RH
23. Vapor Return Line RH

Figure 13-4. Fuel Systems (Sheet 1 of 3)

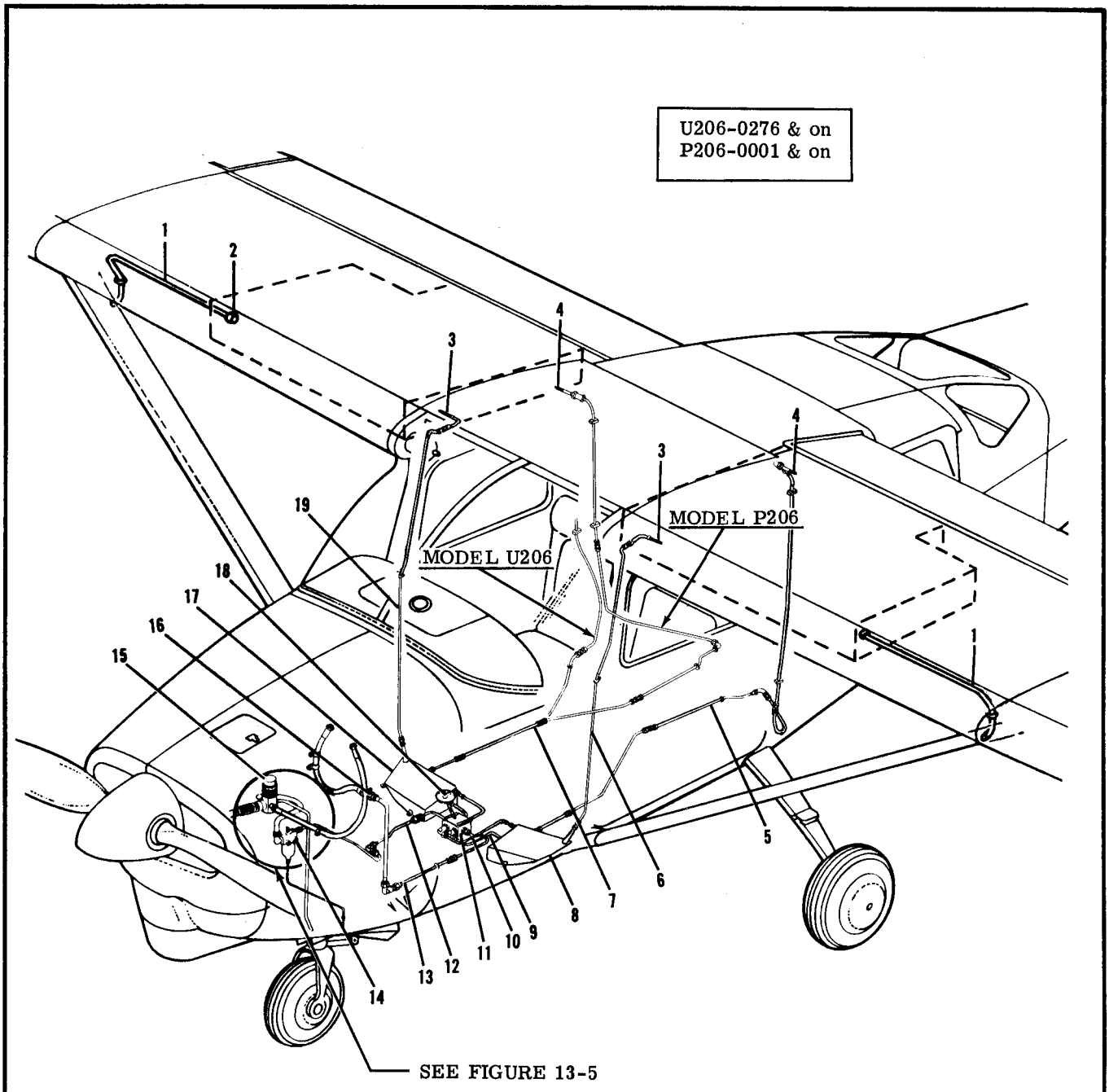


NOTE

There are minor differences in fuel line routing aft of reservoir tanks for the various models.

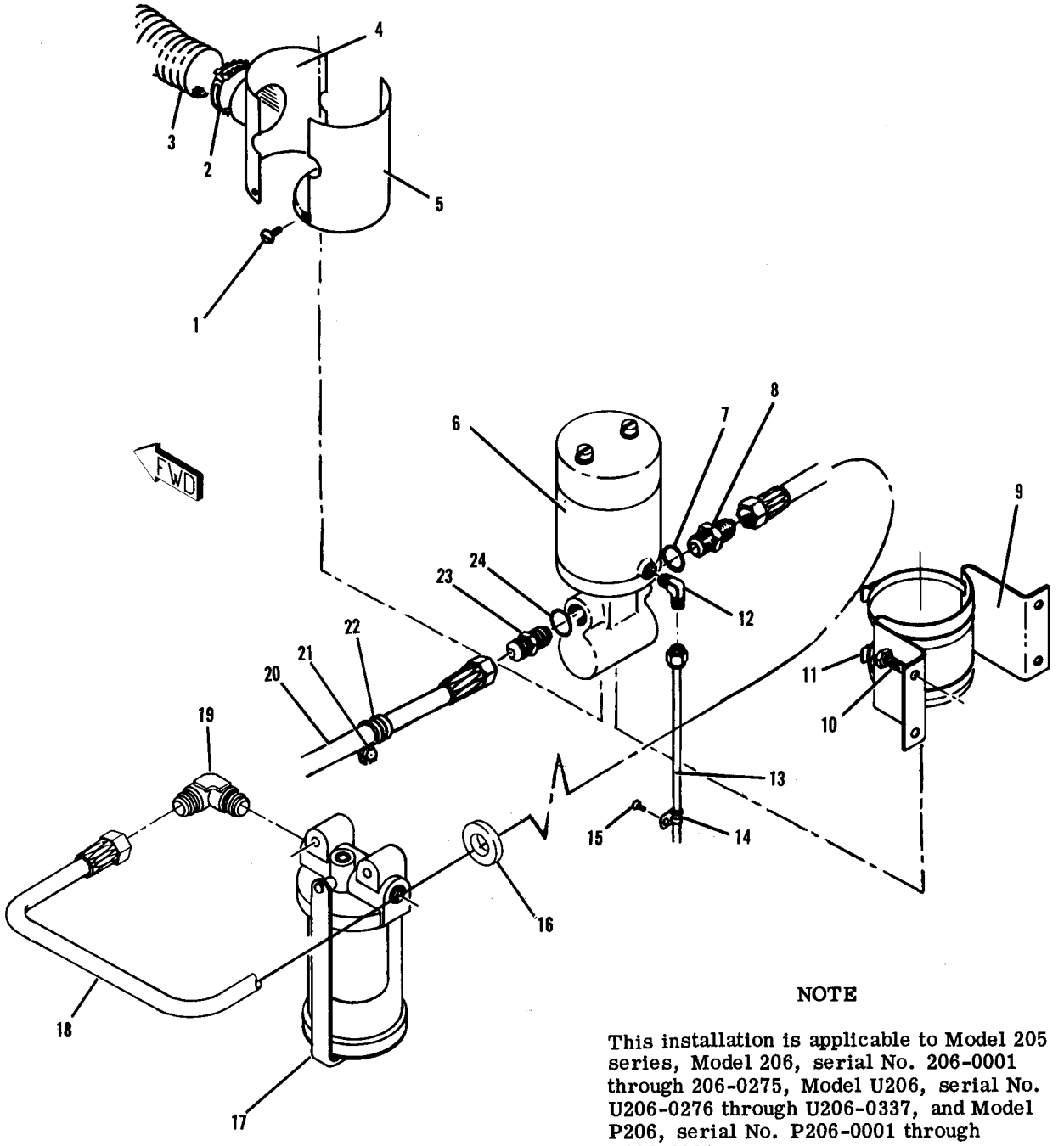
1. Fuel Vent Line
2. Fuel Vent Valve
3. Forward Line Screen
4. Aft Line Screen
5. Aft Fuel Line
6. Forward Fuel Line
7. Aft Fuel Line
8. Left Reservoir
9. Reservoir-to-Selector Valve Line
10. Vapor Return Selector-to-Reservoir Line
11. Selector Valve
12. Selector-to-Strainer Line
13. Vapor Return-to-Selector Line
14. Electric Pump Drain Line
15. Electric Fuel Pump
16. Fuel Strainer
17. Fuel Strainer Drain Line
18. Vapor Return Check Valve
19. Right Reservoir
20. Selector Valve Handle
21. Forward Fuel Line

Figure 13-4. Fuel Systems (Sheet 2 of 3)



1. Fuel Vent Line
2. Fuel Vent Valve
3. Forward Line Screen
4. Aft Line Screen
5. Aft Fuel Line
6. Forward Fuel Line
7. Aft Fuel Line
8. Left Reservoir
9. Reservoir-to-Selector Valve
10. Vapor Return Selector-to-Reservoir
11. Selector Valve
12. Selector-to-Strainer
13. Vapor Return-to-Selector
14. Fuel Strainer
15. Electric Fuel Pump
16. Vapor Return Check Valve
17. Right Reservoir
18. Selector Valve Handle
19. Forward Fuel Line

Figure 13-4. Fuel Systems (Sheet 3 of 3)

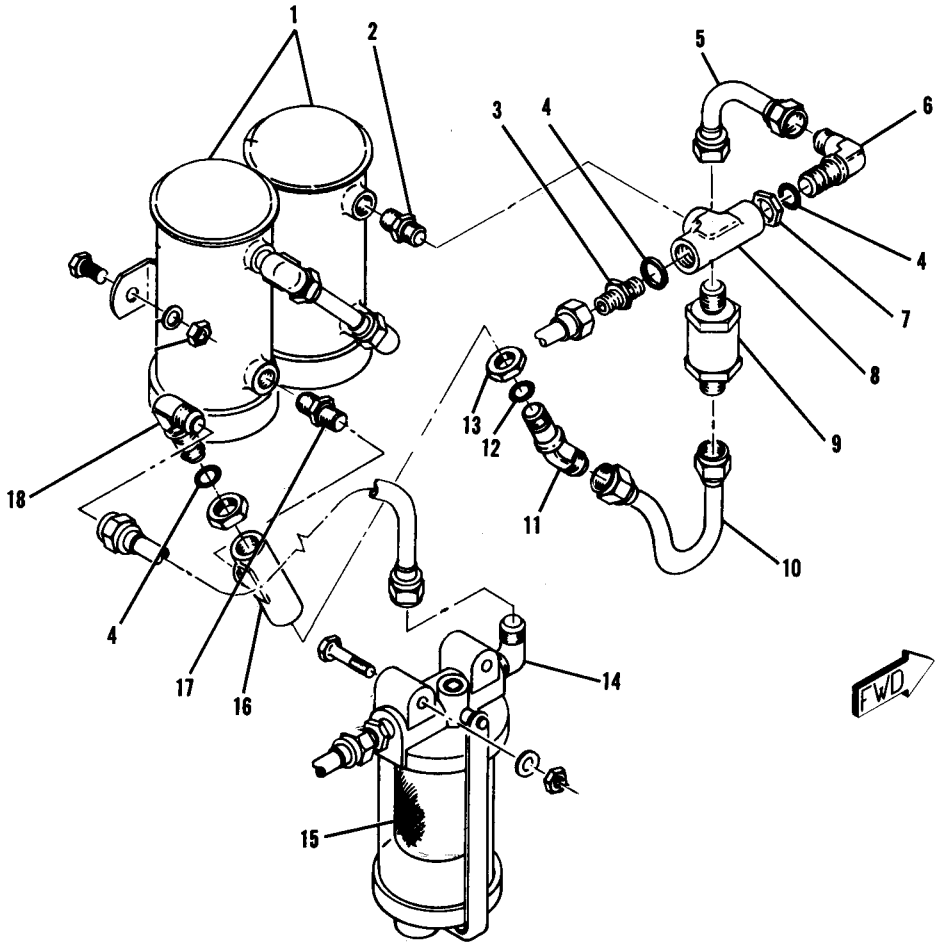


NOTE

This installation is applicable to Model 205 series, Model 206, serial No. 206-0001 through 206-0275, Model U206, serial No. U206-0276 through U206-0337, and Model P206, serial No. P206-0001 through P206-0084.

1. Screw
2. Clamp
3. Duct
4. Aft Half Shroud
5. Forward Half Shroud
6. Auxiliary Fuel Pump
7. Gasket
8. Reducer
9. Pump Bracket
10. Bolt
11. Clamp
12. Elbow
13. Drain Line
14. Clamp
15. Screw
16. Grommet
17. Fuel Strainer
18. Fuel Hose
19. Elbow
20. Fuel Hose
21. Bolt
22. Clamp
23. Reducer
24. Gasket

Figure 13-5. Auxiliary Fuel Pump and Strainer (Sheet 1 of 5)

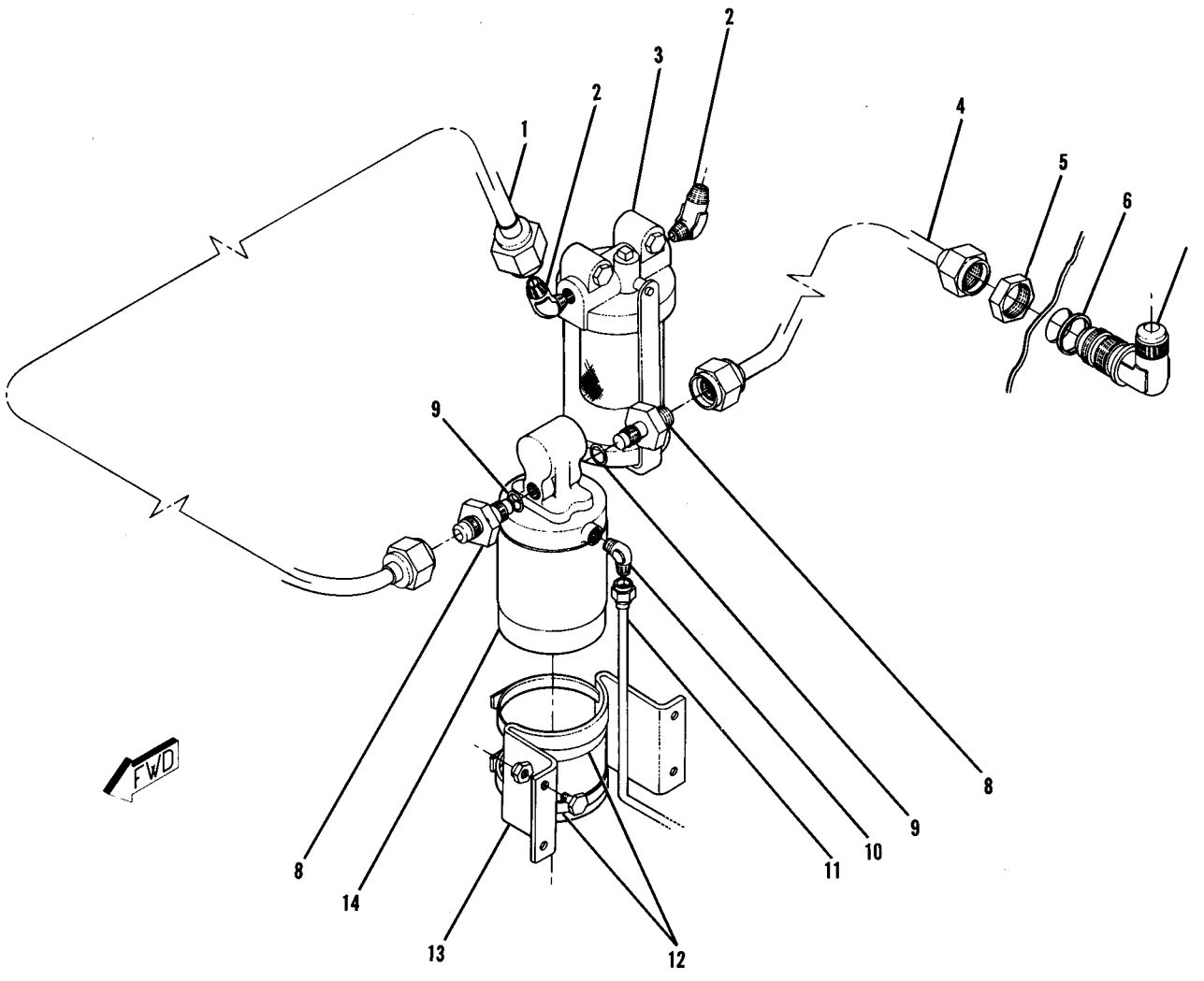


NOTE

This Installation is applicable to Models 210B and 210C.

1. Auxiliary Fuel Pump
2. Nipple
3. Union
4. Gasket
5. Line Assembly
6. Elbow
7. Nut
8. Tee
9. Check Valve
10. Line Assembly
11. Elbow
12. Gasket
13. Nut
14. Elbow
15. Fuel Strainer
16. Tee
17. Nipple
18. Elbow

Figure 13-5. Auxiliary Fuel Pump and Strainer (Sheet 2 of 5)

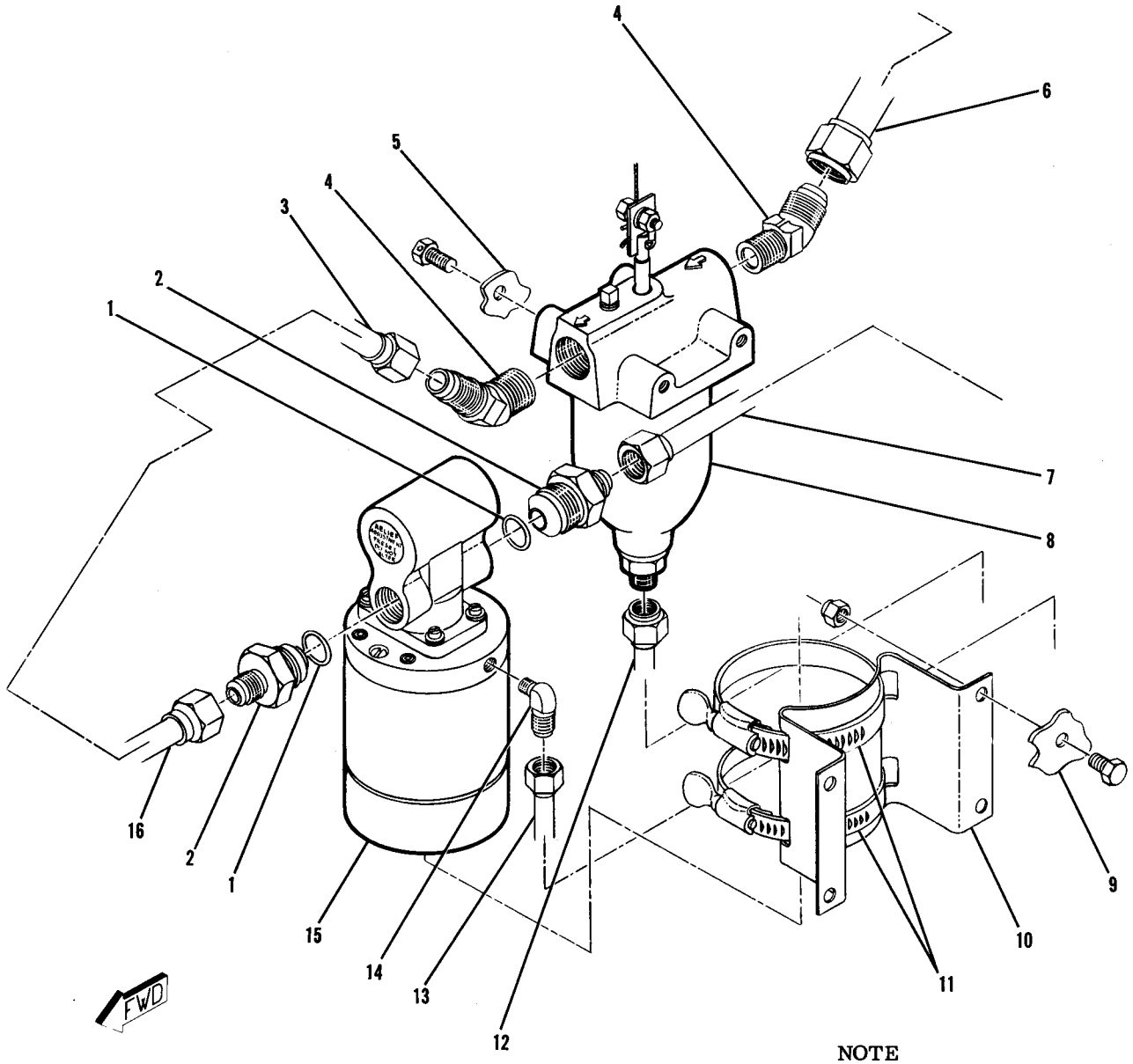


NOTE

This installation is applicable to Model 210D, and Model 210E through serial No. 21058600.

1. Fuel Line
2. Elbow
3. Fuel Strainer
4. Fuel Line
5. Nut
6. Washer
7. Elbow
8. Reducer
9. Gasket
10. Elbow
11. Pump Drain Line
12. Clamp
13. Pump Bracket
14. Auxiliary Fuel Pump

Figure 13-5. Auxiliary Fuel Pump and Strainer (Sheet 3 of 5)

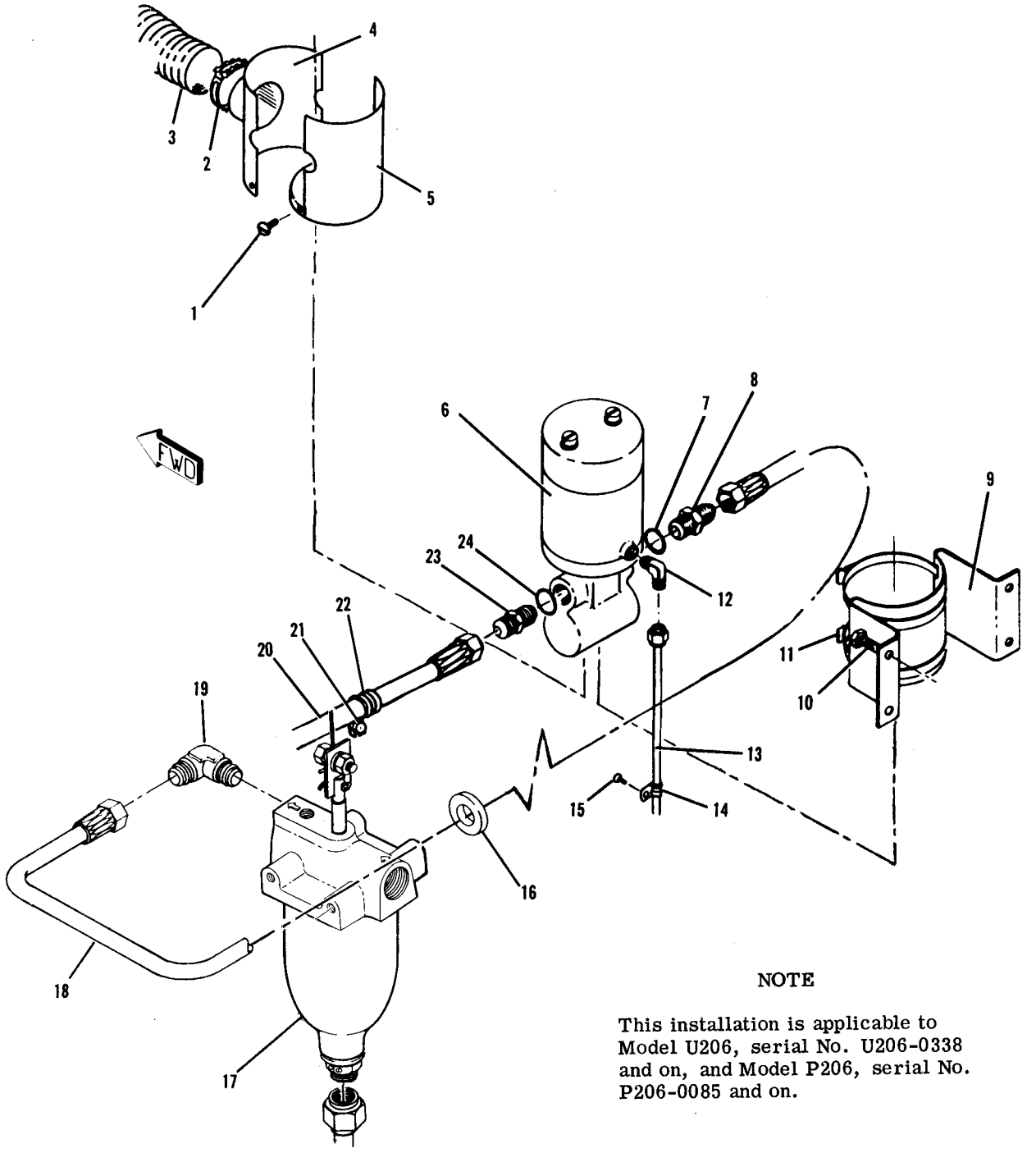


NOTE

This installation is applicable to Model 210E, serial No. 21058601 and on.

1. O-Ring
2. Reducer
3. Fuel Line
4. Elbow
5. R. H. Tunnel Wall
6. Fuel Line
7. Fuel Line
8. Fuel Strainer
9. L. H. Tunnel Wall
10. Pump Bracket
11. Clamp
12. Strainer Drain Line
13. Pump Drain Line
14. Elbow
15. Auxiliary Fuel Pump
16. Fuel Line

Figure 13-5. Auxiliary Fuel Pump and Strainer (Sheet 4 of 5)



1. Screw
2. Clamp
3. Duct
4. Aft Half Shroud
5. Forward Half Shroud
6. Auxiliary Fuel Pump
7. Gasket
8. Reducer
9. Pump Bracket
10. Bolt
11. Clamp
12. Elbow
13. Drain Line
14. Clamp
15. Screw
16. Grommet
17. Fuel Strainer
18. Fuel Hose
19. Elbow
20. Fuel Hose
21. Bolt
22. Clamp
23. Reducer
24. Gasket

Figure 13-5. Auxiliary Fuel Pump and Strainer (Sheet 5 of 5)

13-4. CHECKING FUEL VENTS. Field experience has demonstrated that the fuel vents can become plugged, causing possible fuel starvation of the engine or collapse of the fuel cell. Also the bleed hole in the vent valve assembly could possibly become plugged, allowing pressure from expanding fuel to pressurize the tanks. To check the vent and bleed hole in the vent valve assembly, proceed as follows:

a. Attach a rubber tube to the end of the vent line beneath the wing.

b. Plug or tape opening in vent line beneath opposite wing and check that both fuel filler caps are securely installed.

c. Blow into tube to slightly pressurize the tank. If air can be blown into tank, the vent line is open.

d. After tank is slightly pressurized, insert end of rubber tube into a container full of water and watch for a continuous stream of bubbles, which indicate the bleed hole in valve assembly is open and relieving pressure.

e. Repeat steps "a" through "d" for fuel vent beneath opposite wing.

NOTE

Remember that a plugged vent line or bleed hole can cause either fuel starvation and collapsing of fuel cells or the pressurizing of the tank by fuel expansion.

f. Any fuel vent found plugged or restricted shall be corrected prior to returning the airplane to service.

NOTE

The fuel vent line protruding beneath the wing near the wing strut must be correctly aligned to avoid possible icing of the vent tube. Dimensions are shown in figure 13-7.

13-5. FUEL CELLS.

13-6. These airplanes are equipped with rubberized bladder-type fuel cells, one of which is located in the inboard bay of each wing panel. The cells are secured by snap fasteners to prevent collapse of the flexible cells. The airplane may be equipped with either Goodyear or U.S. Rubber Company fuel cells. Goodyear and U.S. Rubber Company fuel cells are interchangeable; therefore, either type cell may be used. Goodyear fuel cells are BTC-39 type construction and U.S. Rubber Company fuel cells may be either US-907N, US-943, or US-932 type construction. Repair procedures for the fuel cells differ for the type used. Therefore, determine which fuel cell is used before repairs are attempted. To determine this, inspect the top outer surface of the fuel cell. Each fuel cell is marked as to manufacturer and the type of construction.

13-7. GENERAL PRECAUTIONS. When storing, inspecting, or handling U.S. Rubber fuel cells the following precautions should be adhered to:

a. Fuel cells should be stored in their original shipping containers at room temperature and with no more than normal humidity.

b. Remove cells from shipping container only at time of installation.

c. Inspect shipping container and cell for evidence of damage which may have occurred during shipping.

d. When handling fuel cells, do not pick up cell by the fittings or drag cell over any surface.

e. Do not handle cells with any sharp pointed tools or lay cell on any sharp edge or point.

f. Use care when handling fuel cells to protect all projections, such as fittings.

When storing, inspecting or handling Goodyear fuel cells the following should be adhered to:

a. Store cell in a cool dry room away from any electrical motors or direct heat.

b. If for any reason a cell has been in use and is to be stored, clean cell with warm water and soap. Dry and wrap in as small a package as possible and place in a cardboard container.

c. Handle cell carefully to protect all fittings and prevent damage to cell.

13-8. FUEL CELL REMOVAL AND INSTALLATION. When removing a fuel cell, the following procedure is suggested as a guide:

a. Drain applicable fuel cell by removing drain plugs.

NOTE

When removing U.S. Rubber fuel cells, drain fuel and flush the cell with light weight (SAE 10) engine oil 24 hours before cell is removed or deformed in any way.

b. Remove wing root fairings and disconnect fuel lines at wing root.

c. Remove clamps from forward and aft fuel cell boss at wing root and carefully work fuel strainer and line from cell boss.

d. Disconnect electrical lead and ground strap from fuel quantity transmitter. Remove transmitter by removing attaching screws and carefully work it from fuel cell and wing rib.

e. Remove screws attaching drain adapter to lower surface of wing.

f. Remove clamps and work overboard vent line from cell. Remove vent valve from inside of fuel cell.

g. Remove fuel filler adapter and gaskets by removing screws attaching adapter to wing and fuel cell. On airplanes equipped with long range tanks, remove cover plate and gaskets.

h. Working through filler neck opening, loosen snap fasteners. Tilt snap fasteners slightly when pulling cell free, to prevent tearing the rubber.

i. Collapse and carefully fold cell for removal, then work cell out of fuel cell bay through filler opening. Use care when removing and prevent damage to cell.

j. Unfold cell and remove fittings, snap fasteners and fuel sump drain adapter.

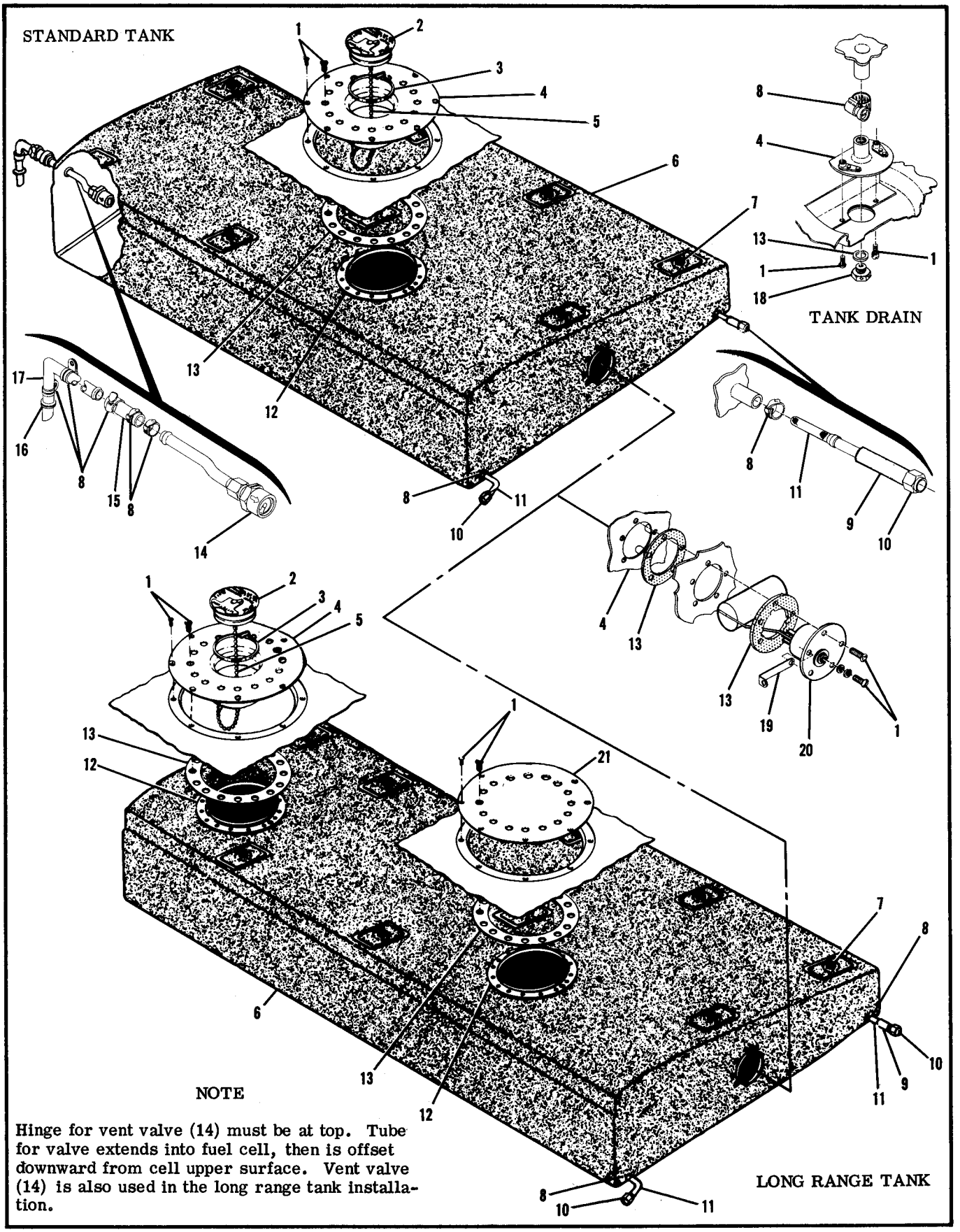


Figure 13-6. Fuel Cell Installation

To install a new or repaired fuel cell proceed as follows:

a. Cell compartment must be thoroughly cleaned of all fittings, trimmings, loose washers, bolts, nuts, etc.

b. All sharp edges of cell compartments must be rounded off and protective tape applied over all sharp edges and protruding rivets.

c. Inspect cell compartment just prior to installation of a cell for the above mentioned conditions.

d. Install fuel drain adapter and snap fasteners.

e. Check to be sure cell is warm enough to be flexible and fold as necessary to fit through fuel cell access opening.

f. Place fuel cell in compartment, develop it out to its fuel size and attach snap fasteners, then reverse the removal procedures for installation. When fastening snap fasteners, tilt the fastener to one side slightly to prevent placing a strain on the rubber.

g. Install all new gaskets when installing fuel cell.

h. When tightening screw-type clamps, apply a maximum of 20 pound-inches of torque to clamp screws. No oil is to be applied to fittings prior to installing.

i. When installing filler adapter, cover plate, and fuel quantity transmitter to the wing and fuel cell, tighten attaching screws evenly. The sealing or compression surfaces must be assembled when absolutely dry (NO SEALING PASTE TO BE USED).

j. After installation has been completed, cell should be inspected for final fit within compartment, making certain that cell is extended out to the structure and no corners are folded in.

k. The final inspection prior to closing the cell should be a close check to be sure cell is free of foreign matter such as lint, dust, oil, or any installation equipment. If cell is not thoroughly clean, it should be cleaned with a lint-free cloth soaked in water, alcohol, or kerosene. NO OTHER SOLVENT SHALL BE USED.

NOTE

Throughout the fuel system use a thread lubricant of graphite-petrolatum (Spec. MIL-T-5544, or equivalent) only if necessary. Anti-seize compound (Spec. JAN-A-669, or equivalent) may be used to seal a leaking connection. Apply sparingly to male fittings only, omitting the first two threads. Always be sure that a compound, the residue from a previously used compound, or any other foreign material cannot enter the system.

13-9. FUEL CELL PRESERVATION. The following is a reprint of U.S. Rubber Company directive:

"When synthetic rubber fuel cells are placed in service, the gasoline has a tendency to extract the plasticizer from the inner liner of the cell. This extraction of plasticizer is not detrimental as long as gasoline remains in the fuel cells, as the gasoline itself will act as a suitable plasticizer. When the gasoline is drained from the fuel cell, the plasticizing effect of the gasoline is lost and the inner liner of the cell begins to dry out and subsequent cracking or checking will occur. This cracking or checking may penetrate through the inner liner permitting gasoline to diffuse through walls of the cell after the cell has been re-fueled. To prevent this failure, a thin coating of light engine oil should be applied to the inner liner of all serviceable fuel cells, which have contained gasoline, when it is evident that the cells will remain without fuel for more than ten days, whether installed in airplanes or in storage. The oil will act as a temporary plasticizer and will prevent the inner liner from drying and cracking. If it becomes necessary to return the cell to the contractor or the vendor for testing or repair, do not allow quantities of oil to be puddled in the cell as it will make handling and repair much more difficult. Cells should be repacked as similar to the original factory pack as possible."

13-10. FUEL CELL REPAIRS.

13-11. U.S.RUBBER - US-907N AND US-943 CELLS.

WARNING

No repairs are to be made on the radius of a cell or in the fitting area of a cell. No damaged areas such as cuts and tears larger than one inch are to be repaired in the field. Cells with such damage should be replaced, or repaired by the manufacturer. Arrangements for manufacturer to repair a fuel cell should be made through Cessna.

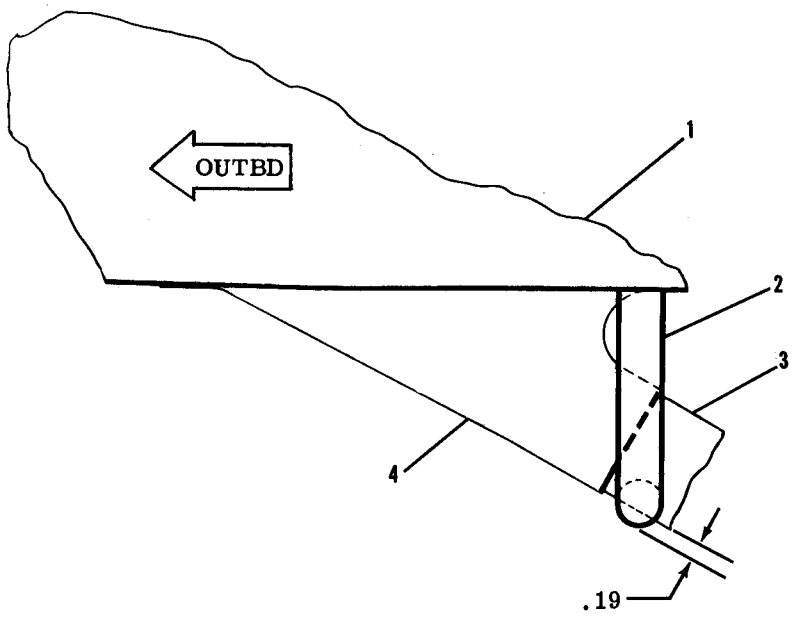
OUTSIDE OF CELL:

a. Use a piece of synthetic rubber coated fabric (U. S. Rubber 5200 outside repair material) large enough to cover damage at least 2" from cut in any direction. Buff this material lightly and thoroughly with garnet paper and wash with Methyl Ethyl Ketone (U.S. Rubber Co. 3339 solution) to remove buffing dust.

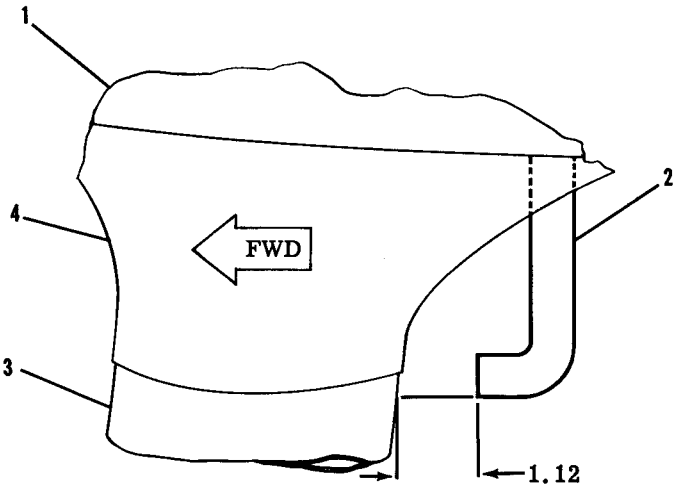
b. Cement buffed side of patch with two coats of U.S. Rubber Co. 3230 cement or Minnesota Mining

References for Figure 13-6

1. Screw
2. Cap
3. O-Ring
4. Adapter
5. Chain
6. Tank
7. Hanger
8. Clamp
9. Protector
10. Nut
11. Strainer
12. Fitting
13. Gasket
14. Valve
15. Hose
16. Grommet
17. Line
18. Plug
19. Ground Strap
20. Fuel Transmitter
21. Cover Plate



VIEW LOOKING FORWARD



VIEW LOOKING INBOARD

NOTE

DIMENSIONS ARE CRITICAL AND MUST BE WITHIN ±.03 INCH TOLERANCE.

1. Wing
2. Vent
3. Strut
4. Fairing

LEFT WING SHOWN (TYPICAL FOR RIGHT WING.)

Figure 13-7. Fuel Vent Location

Co. EC-678. Allow each coat to dry 10-15 minutes.

c. Buff cell area to be patched lightly and thoroughly with garnet paper and wash with 3339 solution to remove buffing dust.

d. Cement buffed area with two coats of U.S. Rubber 3230 or Minnesota Mining Co. EC-678 cement. Allow each coat to dry 10-15 minutes.

e. Freshen cemented area of patch and cemented area of cell with 3339 solution.

f. While still tacky, apply edge of patch to edge of cemented area on the cell. With a roller or blunt instrument, roll or press the patch to the cemented area and roll or press it down a half-inch to an inch across at a time so as not to trap air between patch and cell. Lay 50 lb shot bag over patch which is protected by piece of Holland Cloth to prevent sticking. Weight should not be removed for 6 hours.

g. Seal coat edge of patch 1/2" with one coat of U.S. Rubber 3230 or Minnesota Mining Co. EC-678 cement and allow the cement to dry thoroughly.

INSIDE OF CELL:

a. After the damaged area has been patched on the outside of the cell and the repair allowed to stand a minimum of 6 hours, the cell is then ready to have the patch applied on the inside of the cell.

b. Lightly and thoroughly buff a piece of cured U.S. Rubber 5200/5187 nylon sandwich material large enough to cover damage at least 2" from cut in any direction. Wash buffing dust off patch with Methyl Ethyl Ketone solution (U.S. Rubber 3339).

c. Cement buffed side of patch with two coats of black rubber cement, U.S. Rubber 3230 or Minnesota Mining Co. EC-678, and allow each coat to dry 10-15 minutes.

d. Buff cell area to be patched lightly and thoroughly with fine sandpaper (#"0") and then wash off buffing dust with Methyl Ethyl Ketone solution (U.S. Rubber 3339).

e. Coat buffed area with two coats of black rubber cement, U.S. Rubber 3230 or Minnesota Mining Co. EC-678, and allow each coat to dry 10-15 minutes.

f. Freshen cemented area of patch and cemented area of cell with Methyl Ethyl Ketone (U.S. Rubber 3339) solution.

g. While still tacky, apply edge of patch to edge of cemented area, centering patch over cut in cell. With a roller or blunt instrument, roll or press the patch to the cemented area on the cell. Hold part of patch off the cemented area and roll or press it down a half-inch to an inch across at a time so as not to trap air between patch and cell. Apply 50 lb shot bag to repaired area and do not disturb for 6 hours.

h. Seal coat patch and 1/2" from edge of patch with two coats of U.S. Rubber 3230 or Minnesota Mining Co. EC-678 cement. Allow the first coat to dry one hour or more. Wipe patch and cemented area lightly with #10 oil, so that when the cell is in its original position the patch area will not stick to other areas of the cell.

SCUFFED FABRIC:

a. Buff area surrounding scuffed fabric.

b. Wash buffing dust from area with 3339 solution.

c. Apply two coats of U.S. Rubber 3230 or Minnesota Mining Co. EC-678 cement to the buffed area, allowing 10 minutes drying time between coats.

NOTE

A fuel cell repair kit, U.S. Rubber Kit No. RK-30S, contains all the necessary materials to repair a US-907N or a US-943 fuel cell. This kit is available from the Cessna Spare Parts Department.

13-12. U.S. RUBBER - US-932 CELLS.

REPAIRS. All field repairs are to be made by FAA certificated repair stations using the Repair Kit RK-932 which is available from the Cessna Spare Parts Department. Fuel cells should be pressure tested before repair and 24 hours after repair using the procedure outlined in paragraph 13-13.

WARNING

No repairs are to be made on the radius of a cell or in the fitting area of a cell. No damaged areas such as cuts and tears larger than one inch are to be repaired in the field. Cells with such damage should be replaced, or repaired by the manufacturer. Arrangements for manufacturer to repair a fuel cell should be made through Cessna.

KIT CONTENTS. Following is a list of materials contained in the kit:

DESCRIPTION	QUANTITY
3413 Patching Material	(one) Piece Urethane Film 8" x 8"
5356 Patching Material	(one) Piece Urethane Nylon Fabric 8" x 8"
Paint Brushes	(five) 1/2" Commercial
3339 Solvent	(one) 1/2 Pint Can
Emery Cloth	(five) Pieces 4 1/2" x 5 1/2" # 180 Grit
Cheese Cloth	(one) Piece 18" x 36"
3420-A Adhesive	(five) 1/2 Pint Cans, 32 Grams Each
3420-B Adhesive	(five) Plastic Containers 2 Grams Each
Spatula	(five) Wooden

TYPES OF REPAIRS:
a. Use patches of Urethane film for small pin hole type leaks.
b. Use fabric patches for tears or cuts up to 1" long.
c. Patches may be applied to either the inside or the outside surface of the fuel container, whichever is more convenient.
d. Use a patch that will extend a minimum of 1" in every direction beyond the area to be repaired.

MIXING INSTRUCTIONS FOR ADHESIVES.
a. Cut a small hole in the plastic container and pour contents (3420-B) into the can containing the 3420-A.
b. Mix well with wood spatula (tongue depressor).
c. Allow mixture to stand for 10 minutes.
d. Mix again.
e. The mixed adhesive (3420)must be kept in a closed container until used. Once this adhesive has been mixed, it must be used within 12 hours.

PREPARATION FOR REPAIR.
a. Wash damaged area on fuel container with 3339 solvent. Surface must be clean and dry.
b. Buff area to be repaired with emery cloth and wipe clean with a cheesecloth swab dampened in 3339 solvent. Buffed area should be larger than repair patch.
c. Buff and clean one side of repair patch as outlined in step b above.
d. Cement buffed surfaces of patch and article to be repaired with two coats of mixed adhesive, allowing each coat to dry 10 minutes. Between adhesive coat applications, brush may be kept in 3339 solvent.

PATCH APPLICATION.
a. Allow cemented surfaces to dry until tacky.
b. Center patch over damaged area and apply slowly, 1/2" to 1" at a time, making sure no air is trapped under the patch.
c. Apply pressure by rubbing a well rounded screwdriver handle (or similar tool) across the patch.
d. Weight or clamp repaired area between two pieces of wood (or metal) for a minimum of 8 hours with waxed paper (or similar material) between the repair and clamping blocks to prevent sticking. Avoid sharp edges on clamping blocks or plates.

CAUTION

Do not disturb repair for 24 hours and repaired container should be aged for 5 days at temperatures of 60°F to 80°F before returning to service.

13-13. FUEL CELL TESTING - U.S. RUBBER.

PROCEDURE FOR PHENOLPHTHALEIN - AMMONIA TESTING. When cells are removed from the airplane for suspected leakage, the following method for locating leaks may be used. This method may also be employed after local repairs have been made to check both the efficiency of the repair and presence of other leaks not originally found.

MATERIALS NEEDED:
a. Commercial or household ammonia (28-29% concentration).
b. Indicator solution -- contents per gallon as follows:
1. 1/2 gallon of distilled water.
2. 1/2 gallon of denatured alcohol.
3. 15 grams of phenolphthalein crystals or powder.
c. Approximately three yards of balloon cloth or airplane cloth.

PROCEDURE:
a. Pour ammonia on an absorbent cloth at the rate of 3cc per cubic foot of cell capacity with a minimum of 10cc. Place saturated cloth inside cell.
b. Close all openings and apply positive test air pressure of 1/4 psi (4 ounces).

CAUTION

Never inflate an unsupported cell above a pressure of 1/4 psi (4 ounces). Pressures in excess of four ounces may damage the cell.

c. Soak cloth in phenolphthalein indicator solution.
d. Wring out cloth and spread evenly and smoothly over area of cell being checked.
e. Check all surfaces of cell. Leaks will be indicated by the appearance of pink spots on the cloth.

PRECAUTIONS:
a. Extreme caution must be maintained to prevent cover plates from damaging or cutting the cell during installation, phenol test, deflation and removal.
b. Unsupported test must be conducted on a flat, dirt free surface having no sharp projections or anything which could damage the inflated cell. An unsupported bladder cell can be inflated only to a pressure of 1/4 psi (4 ounces) maximum. Any pressure in excess of this will cause damage or rupture of cell.
c. If phenolphthalein-ammonia solution is used more than 8 hours a new solution should be prepared.

13-14. GOODYEAR - BTC 39 CELLS. The following is the recommended repair procedure for Goodyear fuel cells.

REPAIRS. All field repairs should be made on a suitable size table or bench having a flat, smooth, clean surface using Repair Kit No. 2F1-2-31853, which is available from the Cessna Spare Parts Department. Fuel cells should be tested before and after repair using the procedure outlined in paragraph 13-15.

WARNING

No repairs are to be made on the radius of a cell or in the fitting area of a cell. No damaged areas such as cuts and tears larger than three inches are to be repaired in the field. Cells with such damage should be replaced, or repaired by the manufacturer. Arrangements for manufacturer to repair a fuel cell should be made through Cessna.

KIT CONTENTS. The following is a list of materials contained in the repair kit:

DESCRIPTION	QUANTITY	
*2342C Adhesive	(two)	Quart Cans 272-Grams Each
*2333C Adhesive	(two)	1/2 Pint Cans 185CC Each
*2315C Adhesive	(two)	Bottles 59CC Each
Methol Ethyl Ketone	(two)	Pint Cans
BTC 39 Repair Material	(one)	Sheet 12" x 12"
Cellophane	(one)	Sheet 12" x 24"
Foam Rubber Cloth Back	(one)	Sheet 12" x 12"

*At room temperature, the shelf life of adhesives is one year from date of packaging. If packaging date is not on containers use code date marked on kit package. Code date consists of a letter designating the month and a numeral designating the year. Example: A-3 is January, 1963. C-4 is March, 1964.

MIXING INSTRUCTIONS FOR ADHESIVES. The repair kit contains enough unmixed cements to make two separate repairs. The adhesive is a three part cement and should be mixed as follows:

a. Open one can of 2342C adhesive. If contents of can are not in liquid form, heat until contents become liquid.

b. Open one can of 2333C adhesive and mix into can containing 2342C adhesive. Stir mixture until smooth. Continue to stir mixture for a minimum of five minutes.

c. Open one bottle of 2315C adhesive and mix into mixture of 2342C and 2333C adhesives. Stir mixture for a minimum of ten minutes.

NOTE

It is of utmost importance that the time limits are followed for stirring the mixture as an improper mixed cement will not cure properly resulting in an unsatisfactory repair. Once this cement has been mixed, it must be used within two hours.

PREPARATION FOR REPAIR.

a. Wash damaged area on fuel cell with Methol Ethyl Ketone.

NOTE

When cleaning fuel cell, use a lint free cloth dampened with Methol Ethyl Ketone and clean an area of approximately one square foot surrounding the damaged area. Three separate washings are recommended to assure cleanliness.

b. Cut a patch from repair material large enough to cover damaged area by at least two inches in any direction from cut.

c. Taper edges and round corners of patch so as to present a feather edge to the cell when patch is applied.

d. Using Methol Ethyl Ketone thoroughly wash the dull or gum stock side of patch. This side of patch shall be placed next to the cell.

e. Apply two evenly brushed coats of cement to the cell and patch surface. Allow 30 minutes drying time between first and second coats of cement.

NOTE

Once this cement has been mixed, it must be used within two hours.

PATCH APPLICATION.

a. Apply two evenly brushed coats of cement to the cell and patch surface. Allow 30 minutes drying time between first and second coats of cement.

NOTE

Once this cement has been mixed, it must be used within two hours.

b. After the second coat of cement has been applied and 15 minutes of drying time allowed, apply patch to cemented area of cell. With a roller, roll or press patch to cemented area of cell starting at center of patch and working to outside edge to prevent air from being trapped between patch and cell.

c. Place a piece of cellophane on inside of cell over repair area. This is to prevent the inside surfaces of the cell being cemented together when clamp is placed on patch.

d. Place a piece of cellophane over patch on outside surface of cell. Then place cloth backed foam rubber, cloth side up, over cellophane and patch.

e. Place a metal plate over cloth backed foam rubber and place "C" clamp (8 inch minimum clamp) over metal plate and underneath table top.

NOTE

Make certain the patch, cellophane, cloth back foam rubber, and metal plate is centered over repair and remains centered over the repair area while tightening "C" clamp.

f. Tighten "C" clamp until cement is forced out under edges of repair.

g. Leave cell clamped to air cure for 72 hours.

NOTE

Air cure repairs to be made at room temperature of approximately 75°F. For each 10° drop in temperature add 25 per cent cure time. Example: room temperature is 64°, air cure for 90 hours instead of 72 hours.

h. After cure time has expired, remove clamp, metal plate, foam rubber, and cellophane. To remove cellophane use a wet cloth or sponge to dampen cellophane and remove by peeling off.

i. Inspect repair for any loose edges or unsatisfactory conditions. If a loose edge is found and it is not more than 1/4 inch it is permissible to trim and buff loose edge.

13-15. FUEL CELL TESTING – GOODYEAR. Fuel cells should be tested after repair and before installation. Either of the following test procedures may be used; however, the chemical test is the more sensitive and preferred test.

SOAP SUDS TEST.

a. Install test plates on all fitting openings.

b. Inflate the cell with air to a pressure of 1/4 psi (4 ounces) maximum.

CAUTION

Never inflate an unsupported cell above a pressure of 1/4 psi (4 ounces). Pressures in excess of four ounces may damage the cell.

c. Apply a soap and water solution to all repaired areas and all areas which are suspected of leakage. Bubbles indicate leakage in the cell.

d. After completion of test, clean exterior of cell and remove test plates.

CHEMICAL TEST.

a. Install test plate on all but one fitting opening.

b. Pour ammonia on an absorbent cloth in the ratio of 3 cc per cubic foot of cell capacity.

c. Place the ammonia saturated cloth inside cell and install test plate on opening.

d. Make a phenolphthalein solution as follows: Mix 40 grams of phenolphthalein crystals in 1/2 gallon of ethyl alcohol. To this solution add 1/2 gallon of water.

e. Inflate the cell with air to a pressure of 1/4 psi (4 ounces) maximum.

f. Soak a large white cloth in the phenolphthalein solution.

g. Wring cloth out thoroughly and spread evenly and smoothly over outer surface of cell.

h. Check all surfaces of cell. Leaks will be indicated by the appearance of red spots on the cloth. If red spots appear on the cloth, they may be removed by soaking the cloth in the phenolphthalein solution.

NOTE

The phenolphthatein solution and test cloth are satisfactory only as long as they remain clean. Indicator solution that is not in immediate use should be stored in a closed container to prevent evaporation and deterioration.

i. After completion of test, remove all test plates and test equipment. Allow cell to air out.

13-16. REPLACEMENT OF FUEL GAGE TRANSMITTER.

a. Drain fuel from cell.

b. Remove wing root fairing to gain access to transmitter.

c. Disconnect electrical leads at transmitter.

d. Remove screws through unit and root rib.

e. Replace the unit by reversing the steps listed above. Use no gasket paste on rubberized cells.

f. Fill cell with fuel to check for leaks and correct gage indication (see paragraph 16-45).

13-17. REPLACEMENT OF FUEL RESERVOIR TANKS.

a. Remove front seats, carpeting, and access plates as necessary for access to tank to be removed.

b. Disconnect fuel and vapor return lines at the tank to be removed.

c. Remove four screws securing tank mounting legs to fuselage structure.

d. Lift out the tank.

e. Reverse the steps listed above to install a reservoir tank.

13-18. FUEL SELECTOR VALVE REPLACEMENT.

a. Drain all fuel from wing tanks at fuel tank sump drain plugs. With valve turned to LEFT TANK, drain left fuel lines at selector valve; with valve turned to RIGHT TANK, drain right fuel lines.

b. On all models except 210 and 210A, remove control pedestal cover. (Refer to paragraph 11-4A for procedure.)

c. Remove access hole covers in floorboard and fuselage skin in area of fuel selector valve.

d. Disconnect all fuel and vapor return lines from selector valve.

e. Disconnect square shaft from valve by removing attached roll pin.

f. Remove bolts or screws attaching valve to support bracket and remove valve.

g. Install valve by reversing this procedure.

13-19. FUEL SELECTOR VALVE REPAIR – MODEL 210 AND 210A. Fuel selector valve repair may be accomplished using figure 13-8 as a guide.

13-20. FUEL SELECTOR VALVE REPAIR – ALL MODELS, EXCEPT MODELS 210 AND 210A. (See figure 13-9.) The fuel selector valve may be repaired by disassembly, replacement of defective parts, and reassembly as follows:

a. Mark sump plate (23) and body (1) to ensure correct reassembly, then remove sump plate (23) and O-ring (22) after removing four screws.

b. Drive out roll pin (5) securing yoke (6) to shaft. As yoke is lifted off, balls (8) and springs (7) are free. Retain them.

c. Lift off washer (9).

d. Mark cap (4) and body to assure later alignment of parts and remove screws (3).

e. With fine emery paper, sand off any burrs or sharp edges on shaft (21). Apply petrolatum to shaft as a lubricant, then work cap off shaft.

f. Drive back roll pin (13) and remove rotor (12). Teflon seal (14), O-rings (15), washers (16), and springs (17) are now free to be removed. Check all parts carefully to locate defect.

g. Remove burrs or sharp edges on shaft, lubricate and slide it down, out of body (1). Remove teflon seals (20) and O-rings (19).

h. Remove O-ring (18) within body and (10) within cap.

i. Replace all O-rings, lap or replace teflon seals, and lubricate O-rings before installation.

CAUTION

Install all parts in the relative position depicted in figure 13-9, otherwise the valve will not operate correctly.

j. Install O-ring (18) in body shaft hole. Install O-rings (19) and teflon seals (20), then slide shaft and rotor into place. Position rotor in exact relative position shown in figure 13-9, then install O-ring (22) and sump plate (23).

k. Install .169" diameter pins in body ports, then slide springs (17), washers (16), O-rings (15) and teflon seals over pins. Slide rotor (12) over shaft. Remove .169" dia. pins and, readjusting rotor vs. shaft position as necessary, tap roll pin (13) into place, letting it protrude on the side depicted.

NOTE

This roll pin serves also as a stop, limiting valve shaft travel.

l. Install O-ring (10) in cap, lubricate shaft (21) with petrolatum, install large O-ring (11), and slide cap down into place.

CAUTION

Make sure cap is installed in relative position illustrated. A lug on the cap protrudes to serve as a stop detent and if the cap is not installed correctly, the valve will not operate correctly.

1. Screw
2. Roll Pin
3. Housing
4. Spring
5. Ball
6. Cover
7. O-Ring
8. Washer
9. Cam
10. O-Ring
11. Gasket
12. Bearing
13. Body
14. Ball
15. Retainer
16. O-Ring
17. Ball
18. Spring
19. O-Ring
20. Nipple
21. Bolt
22. Stat-O-Seal
23. Nipple
24. Reducer
25. O-Ring
26. Stop

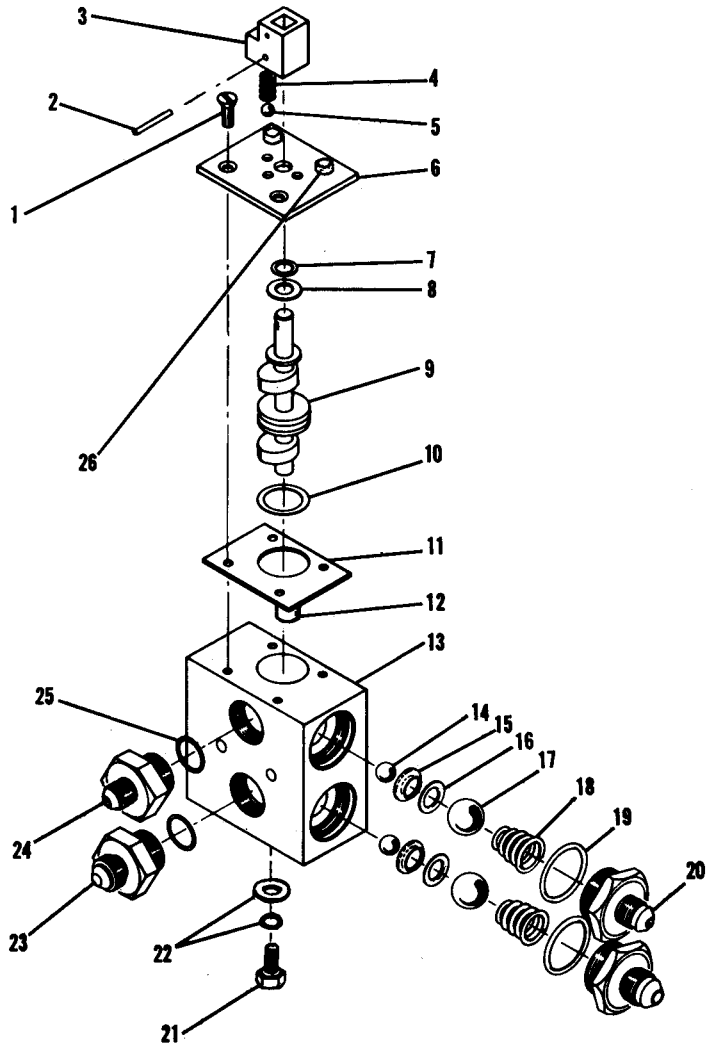
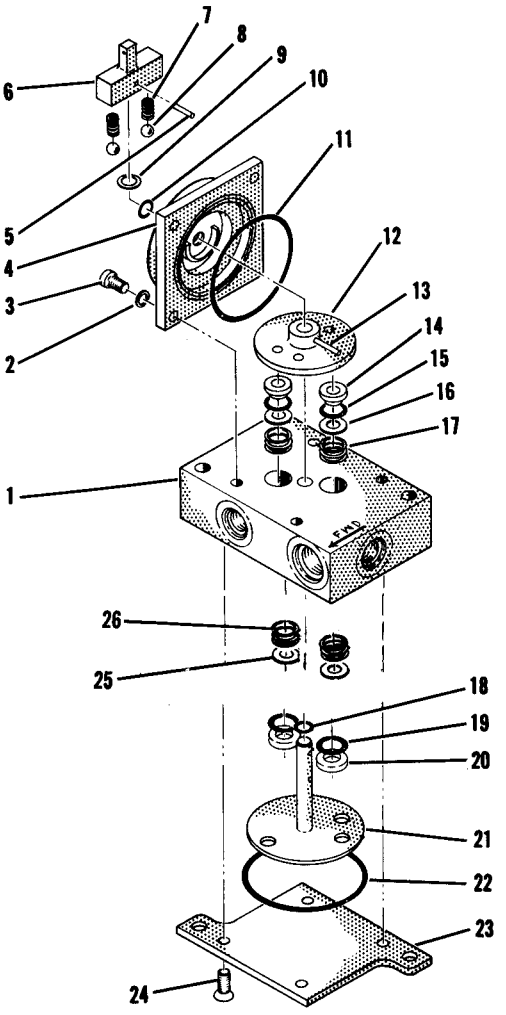


Figure 13-8. Fuel Selector Valve - Models 210 & 210A

m. Install brass washer (9) and yoke (6). Note the position of the small hole in the squared, upper portion of the yoke. If this is reversed, the valve linkage will not attach properly.



NOTE

Springs (26) and washers (25), and a different sump plate (23), are used on the latest valve configuration.

1. Valve Body
2. Lockwasher
3. Screw
4. Cover
5. Roll Pin
6. Yoke
7. Spring
8. Ball
9. Brass Washer
10. O-Ring
11. O-Ring
12. Rotor
13. Roll Pin
14. Seal
15. O-Ring
16. Washer
17. Spring
18. O-Ring
19. O-Ring
20. Seal
21. Rotor
22. O-Ring
23. Sump Plate
24. Screw
25. Washer
26. Spring

Figure 13-9. Fuel Selector Valve - All Models Except Models 210 and 210A

13-21. ELECTRIC FUEL PUMPS – MODELS 210 THRU 210C. Two electric fuel pumps, connected in series, are located in the nose gear well. Placing the auxiliary fuel pump switch in "LOW PRIME" operates only one pump, providing sufficient fuel for priming and starting. The "HIGH" position, used for vapor purging and maintaining flight in the event of engine-driven fuel pump failure, operates both pumps and closes the vapor return line solenoid valve. Replacement of the electric pumps is accomplished by disconnecting fuel lines and electrical wiring, then removing the attaching bolts. Disassembly, other than minor disassembly to clean filter screens, is not recommended for the pumps. They are illustrated in figure 13-10.

13-22. ELECTRIC FUEL PUMP FILTER SCREENS -- MODELS 210 THRU 210C. Electric fuel pump filter screens may be cleaned as follows:

a. Open nose wheel doors.

b. Use a 5/8" box end wrench or socket to unlock the pump cover at the top of the pump. Lift the cover straight up and remove the screen. Examine the screen carefully, wash in solvent to dislodge foreign particles and reinstall. Using a new cover gasket, reinstall the cover.

c. Test operate to check for proper operation.

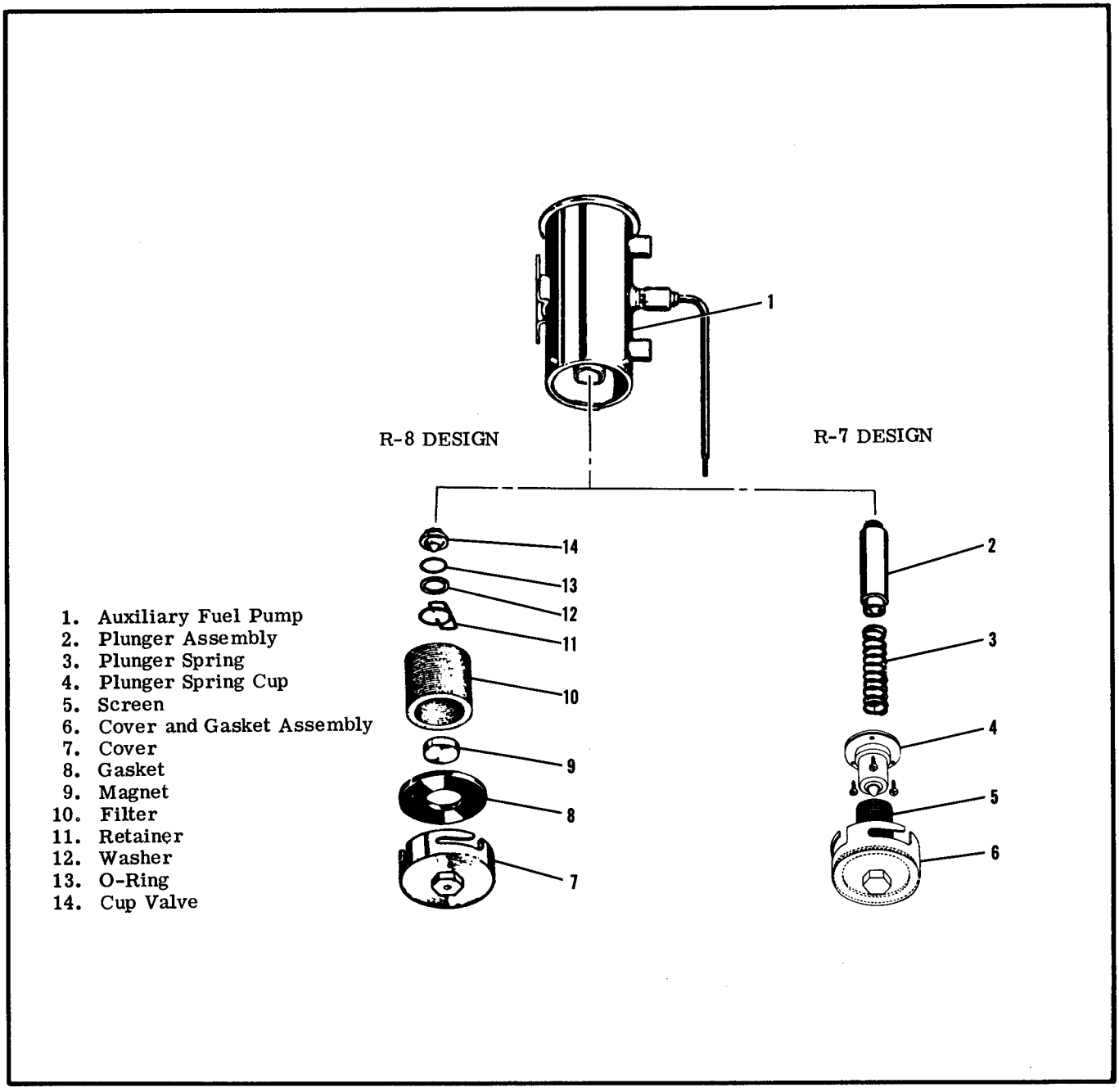


Figure 13-10. Electric Fuel Pump - Models 210 thru 210C

13-23. ELECTRIC FUEL PUMP -- MODELS 205 AND 206 SERIES, AND 210D & ON. The electric fuel pump on the Models 205 and 206 series is located on the firewall. On the Model 210, the pump is mounted in the nose gear wheel well. An integral bypass and check valve permits fuel flow through the pump even when the pump is inoperative, but prevents reverse flow. A separate overboard drain line from the pump prevents entry of fuel into the electric motor, in the event of pump internal leakage.

13-24. DISASSEMBLY. (See figure 13-11.)
a. Remove screws (29) and washers (13), and separate motor from pump.

CAUTION

Use care when removing screws (29) as spring (20) is under compression.

13-25. DISASSEMBLY OF MOTOR.
a. Loosen screws (19) but do not remove.
b. Remove cover (3) by removing screws (1) and washers (2).
c. Remove brush holders (6) and brush assemblies (7) by removing screws (5).
d. Loosen screws (19) and remove end bell (8), but do not remove screws (19) from shaft end bell (18).
e. Remove bearing (9) from end bell (8).
f. Remove armature (11).
g. Remove springs (12), washers (13), field (14), shell (15), spacers (17), screws (19), and washers (2) from shaft bell end (18).
h. Remove bearing (9) from shaft bell end (18).
i. Do not remove spacer (22), truarc rings (10), or motor shaft pin (12) unless replacement is necessary.

13-26. INSPECTION OF MOTOR COMPONENTS.
a. Thoroughly wash all parts of motor, except brushes (7), bearings (9), armature (11), and field (14), in cleaning solvent (Federal Specification P-S-661, or equivalent) and dry with filtered compressed air.
b. Wipe parts not washed in solvent with a clean cloth.
c. Inspect all parts for damage and evidence of excessive wear.
d. Inspect all parts for breakage or distortion.
e. Replace any worn or damaged parts.

13-27. REASSEMBLY OF MOTOR. The assembly procedure for the motor is the reverse of the disassembly procedure. When reassembling, pay special attention to the following items:
a. Spacers (17), springs (12), and washers (13) must be held in place by screws (19) when assembling end bell (8).
b. Compress end bell (8) until screws (19) are engaged, then tighten screws (19) evenly to a torque value of 10 pound-inches.
c. Brushes (7) are contoured, therefore the contour of the brush must match the armature commutator when being installed.

13-28. DISASSEMBLY OF PUMP.
a. Remove pin (23) and remove slinger ring (41).
b. Remove bearing and seal assembly (40) and rotor and shaft assembly (39) from pump body (30).

NOTE

Vanes (25) and pins (26) are attached to rotor (39) and are removed with rotor and shaft assembly.

c. Remove spacer (38), bearing plate (37), O-ring (27), and body bearing (28) from pump body (30).

13-29. INSPECTION OF PUMP COMPONENTS.
a. Thoroughly wash all parts in cleaning solvent (Federal Specification P-S-661, or equivalent) and dry with filtered compressed air.
b. Inspect all parts for damage and evidence of excessive wear.
c. Replace all O-rings, and bearing and seal assembly.
d. Replace any damaged or worn parts.

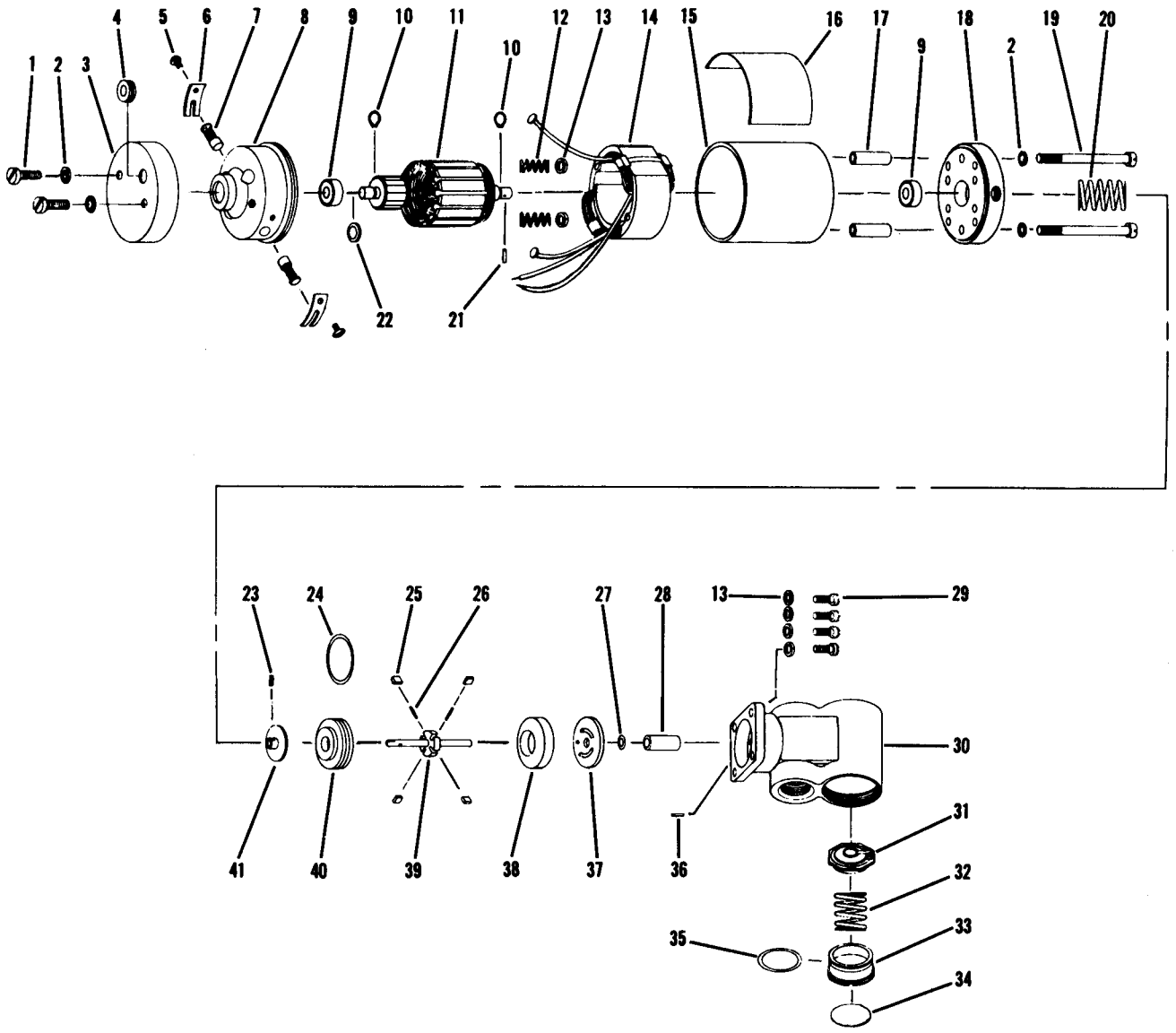
13-30. REASSEMBLY OF PUMP. The assembly procedure for the pump is the reverse of the disassembly procedure. When reassembling, pay special attention to the following items:
a. Pin (36) must be correctly located in pump body (30) in order to properly position bearing plate (37) and spacer (38). Location holes in bearing plate and spacer must align with pin.
b. Vanes (25) and pins (26) must be assembled to the rotor and shaft assembly (39), and held in place while installing in pump body (30).
c. Use a suitable lubricant on O-rings to prevent damage when installing. A recommended lubricant for O-rings is Dow Corning Silicone No. 4.

13-31. DISASSEMBLY OF BYPASS AND PRESSURE RELIEF.
a. Remove nameplate (34), plug assembly (33), spring (32), and swing check assembly (31) from pump body (30).

13-32. INSPECTION OF BYPASS AND PRESSURE RELIEF.
a. Thoroughly wash all parts in cleaning solvent (Federal Specification P-S-661, or equivalent) and dry with filtered compressed air.
b. Inspect all parts for damage and evidence of excessive wear.
c. Inspect swing check assembly seat for damage.
d. Replace O-rings and all other damaged parts.

13-33. REASSEMBLY OF BYPASS AND PRESSURE RELIEF. The assembly procedure for the bypass and pressure relief is the reverse of the disassembly procedure. When reassembling, pay special attention to the following:
a. Install swing check assembly (31) so it is seated on seat in pump body (30). The valve must open inwardly.

13-34. ADJUSTING PRESSURE RELIEF.
a. Install pump assembly in appropriate test stand. (See figure 13-12.)
b. While maintaining a no flow condition, adjust plug (33) until a relief pressure of 23 to 24 psi is obtained.



1. Screw
2. Lockwasher
3. Cover
4. Grommet
5. Screw
6. Brush Retainer
7. Brush Assembly
8. End Bell
9. Bearing
10. Truarc Ring
11. Armature
12. Spring
13. Lockwasher
14. Field Assembly
15. Shell
16. Nameplate
17. Spacer
18. Shaft End Bell
19. Screw
20. Retention Spring
21. Motor Shaft Pin
22. Spacer
23. Slinger Pin
24. Bearing O-Ring
25. Vane
26. Vane Pin
27. Bearing O-Ring
28. Body Bearing
29. Screw
30. Pump Body
31. Swing Check Assembly
32. Spring
33. Adjusting Plug
34. Nameplate
35. O-Ring
36. Housing Pin
37. Bearing Plate
38. Spacer
39. Rotor and Shaft Assembly
40. Bearing and Seal Assembly
41. Slinger Ring

Figure 13-11. Electric Fuel Pump - Model 205 &206 Series, and 210D & On

c. After correct pressure is obtained, seal plug (33) at threads with Epocast Epoxy No. 212-10 mixed with hardener No. 9816. (Reference: Furane Plastics.)
d. Allow Epoxy to dry and install nameplate (34).

13-35. FUNCTIONAL TEST PROCEDURE. Each unit shall be set up in test stand as shown in figure 13-12 and functionally tested as follows:
a. Flow Tests.
1. Apply 14 vdc to test unit.
2. With valves "A" and "B" closed, adjust valve "C" to outlet pressures of 5.0 psi increments until maximum relief is reached at no flow.

NOTE

No flow pressure shall be 27.5 psig maximum.

b. Bypass Pressure Drop.
1. With test unit shut off, open valves "A" and "B."
2. Close valve "C" and energize bypass pump.
3. Adjust valve "B" until flowmeter reads 40 gph and record inches of mercury as read on Hg manometer.

NOTE

Pressure drop shall not exceed 0.60 inches of mercury. Bypass pressure drop is 0.35 psi maximum at 40 gph.

c. Insulation Resistance Test.
1. Apply 50 volts dc across both leads and pump case. Insulation resitance shall be 50 megohms minimum.

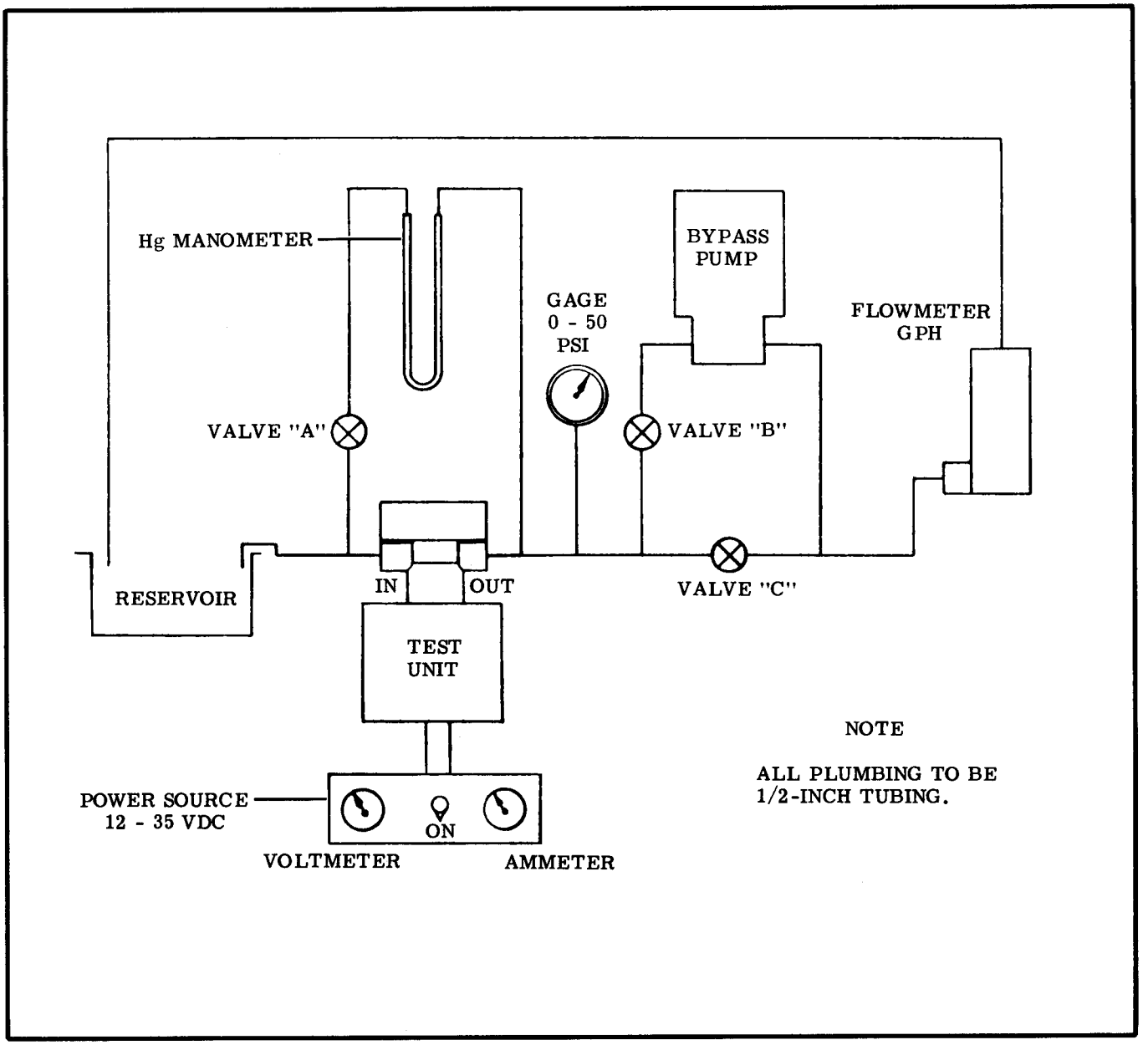


Figure 13-12. Test Stand Schematic

13-36. ELECTRIC FUEL PUMP CIRCUITS. Prior to the Model 210B, the electric fuel pumps circuit is operated by a toggle switch. The low position of the switch operates one fuel pump, and the high position operates both pumps and closes the vapor return line solenoid valve. On the Model 210B and 210C, the circuit is the same, except that a split rocker-type switch is used.

On the Model 205 and 206 series, and the Model 210D and on, a split rocker-type switch is used, but the circuit is different. The low side of the switch is connected through the "START" position of the ignition switch so that the fuel pump will operate only while the ignition switch is in the "START" position and the low side of the fuel pump switch is turned on. When the ignition key is released, the pump will stop. The high side of the fuel pump switch will operate the pump regardless of ignition switch position. Beginning with the Model 210D, and all Model 205 and 206 series airplanes, a throttle shaft operated microswitch adds a resistance to the high circuit to slow down the pump when the throttle is retarded to approximately 16 inches of mercury manifold pressure. This prevents an excessively rich mixture as throttle is retarded while the electric pump is operating in the high position.

NOTE

On Model 210 series airplanes, a landing gear warning system microswitch is also located at the throttle shaft. Refer to Section 12 for rigging of the microswitches.

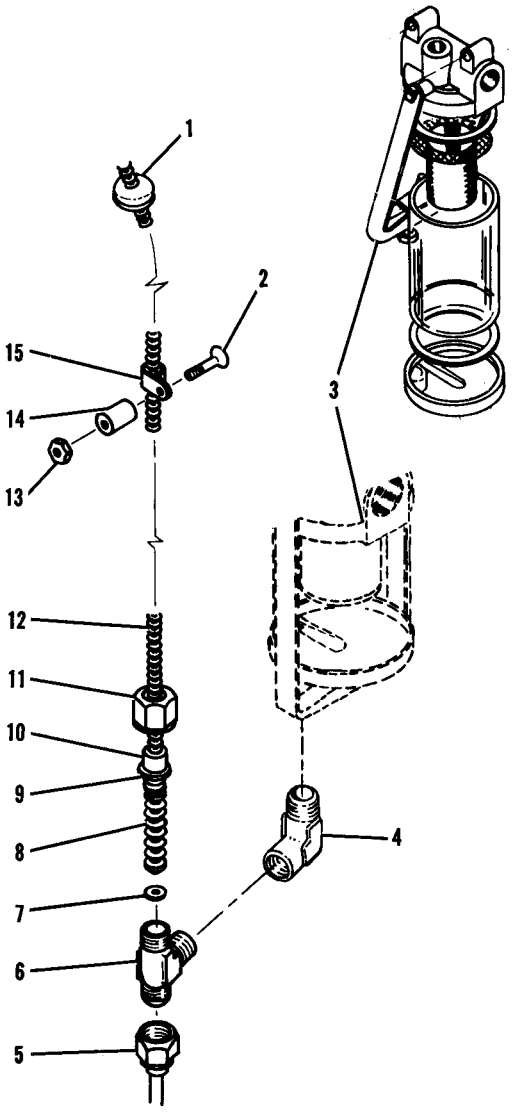
13-37. FUEL STRAINER. The fuel strainer is located in the nose wheel well in the Model 210 series and in the forward tunnel area in the Model 205 and 206 series airplanes. In the Model 210 series, the strainer is readily accessible with the nose gear doors open. In the Model 205 and 206 series, the engine cowling must be removed for access to the fuel strainer. The strainer is equipped with a drain valve control operated from the cabin.

13-38. FUEL STRAINER DRAIN CONTROL. (See figure 13-13.) On the type control and drain which resembles a tee fitting, disassembly and assembly procedures are not obvious. Use the following procedure, being careful not to bend the control or damage parts.

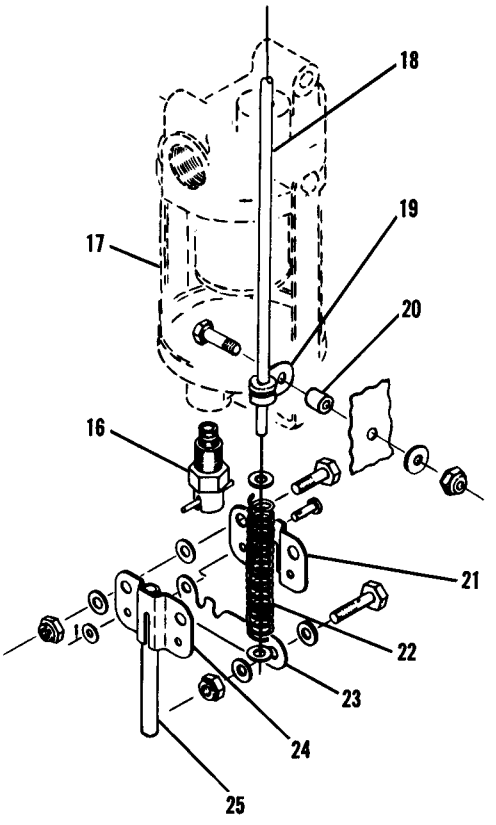
a. Remove clamp (15).
b. Unscrew nut (11) connecting the control to valve body (6) and pull the control out of the body.
c. To replace valve seat (7), remove the old seat with a hook and tap the new seat into position.
d. To replace O-ring (9), remove the old one and discard it. Place a smooth, thin-walled, well greased tube over the spring and small washer on the end of the control (greased tape may be used) and carefully slide the O-ring in position past the washer. Remove the tube or tape.
e. From the cabin, pull the control knob out only far enough to remove all slack between the parts at the lower end of the control. Maintaining this position of the control, align the O-ring with washer and sleeve (10).
f. Insert the control into the valve body until it bottoms. Pull the control knob out until the lower end of the control can be pushed into the valve body far enough for the O-ring to slip past the chamfer on top of the valve body. After the O-ring is inside the valve body, pull the control knob all the way out and keep it out until nut (11) has been tightened. After tightening the nut, release the control knob.
g. Reinstall clamp (15).

13-39. CESSNA FUEL STRAINER. Figure 13-14 shows the fuel strainer currently being used. To disassemble and assemble the strainer, proceed as follows:
a. Turn off fuel selector valve.
b. Disconnect strainer drain tube and remove safety wire, nut, and washer at bottom of filter bowl and remove bowl.
c. Carefully unscrew standpipe and remove.
d. Remove filter screen and gasket. Wash filter screen and bowl in solvent (Federal Specification P-S-661, or equivalent) and dry with compressed air.
e. Using a new gasket between filter screen and top assembly, install screen and standpipe. Tighten standpipe only finger tight.
f. Using all new O-rings, install bowl. Note that step-washer at bottom of bowl is installed so that step seats against O-ring. Connect strainer drain tube.
g. Turn on fuel selector valve, close strainer drain, and check for leaks. Check for proper operation.
h. Safety wire bottom nut to top assembly. Wire must have right hand wrap, at least 45 degrees.

SHOP NOTES:



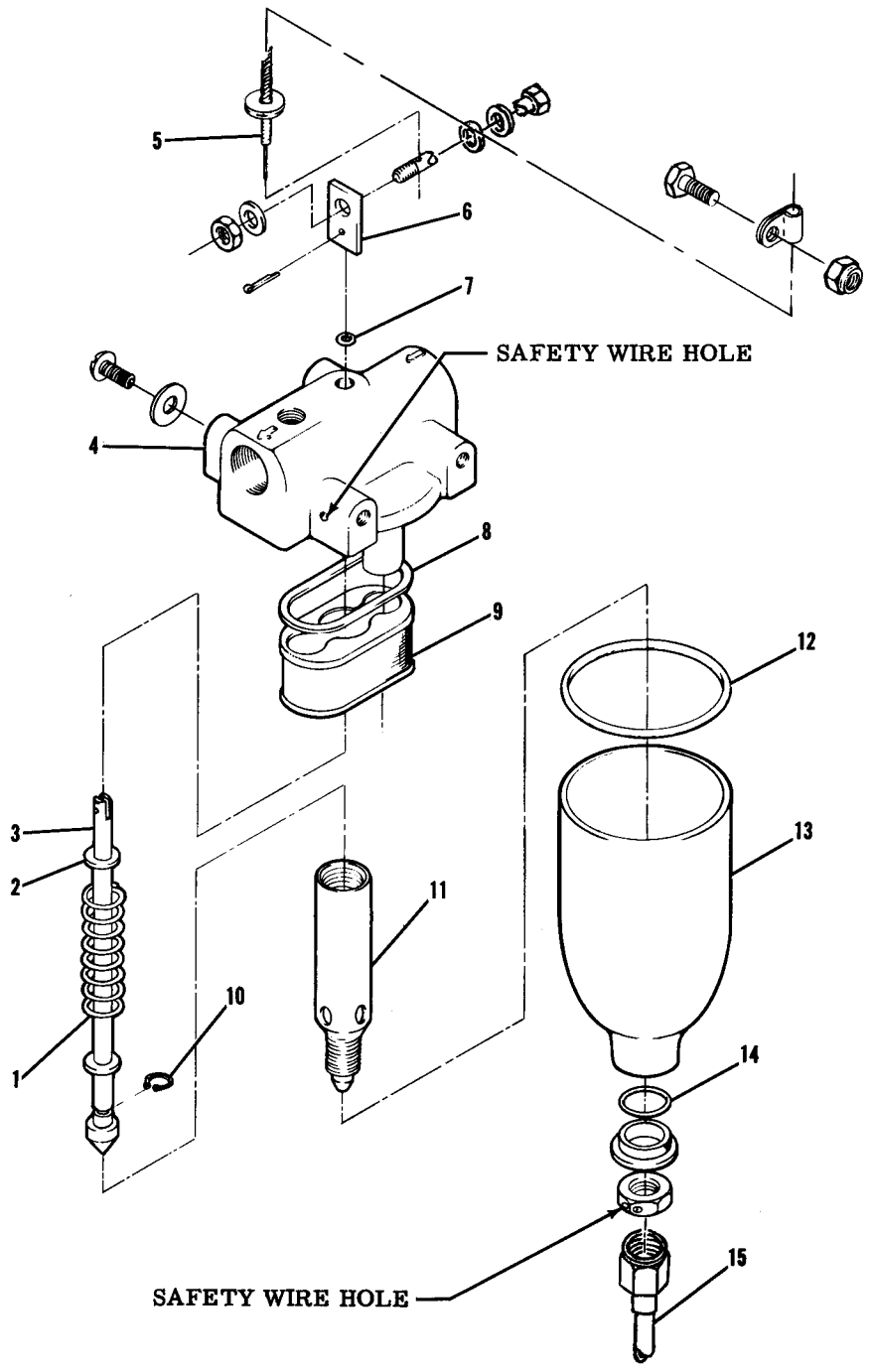
210B THRU 210E SERIAL 21058600
205 & 206
U206-0276 THRU SERIAL U206-0337
P206-0001 THRU SERIAL P206-0084



210 & 210A

1. Grommet
2. Screw
3. Fuel Strainer
4. Elbow
5. Drain Line
6. Valve Body
7. Seal (Valve Seat)
8. Spring
9. O-Ring
10. Sleeve
11. Nut
12. Control
13. Nut
14. Spacer
15. Clamp
16. Drain Valve
17. Fuel Strainer
18. Control
19. Clamp
20. Spacer
21. Clamp Half
22. Spring
23. Pawl
24. Clamp Half
25. Drain Tube

Figure 13-13. Strainer and Drain Valve



210E SERIAL 21058601 & ON
U206 SERIAL U206-0338 & ON
P206 SERIAL P206-0085 & ON

1. Spring
2. Washer
3. Plunger
4. Top
5. Drain Control
6. Plate
7. O-Ring
8. Gasket
9. Filter
10. Retainer Ring
11. Standpipe
12. O-Ring
13. Bowl
14. O-Ring
15. Drain Line

Figure 13-14. Cessna Fuel Strainer

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SECTION 14

PROPELLERS

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NOTE

Federal Aviation Regulations define major and minor repairs and alterations and who may accomplish them. This section may be used as a guide, but the Federal Aviation Regulations and the propeller manufacturer's instructions must be observed.

14-1. PROPELLERS.

14-2. All 200-series aircraft are equipped with Hartzell or McCauley all-metal constant-speed, governor-regulated propellers. Hartzell propellers were discontinued after 1961 on 200-series aircraft. The Model 206 Series and 210D and on are equipped with a McCauley propeller with blades having a built-in tilt of approximately 5/8 degree beginning about the 16-inch station. This tilt provides the blades with a greater centrifugal restoring moment. The propeller is similar but not interchangeable with earlier McCauley propellers. The propeller used on the Model 210E and on, and Model P206 Super Skylane is similar to the other McCauley propellers, except the propeller hub extends the blades approximately 4-1/2 inches farther forward.

14-3. REPAIR of metal propellers first involves evaluating the damage and determining whether the repair will be a major or minor one and, in accordance with Federal Aviation Regulations, who is permitted to accomplish the repair.

a. General Repair Considerations:

Under no circumstances are the raised edges of defects to be corrected by peening. No welding, soldering or compounds of any nature are to be used to fill or correct defects. All repair is to be in accordance with standard approved and accepted practice.

More than one defect on blade is not cause for considering blade not airworthy if repair is within indicated limits. A reasonable number of repairs per blade is permissible if their location with respect to each other is not such as to form a continuous line that may materially weaken blade. Any transverse crack shall be cause for considering blade not airworthy. Repair necessitating the removal of an appreciable amount of metal shall be reason to check horizontal and vertical balance.

The repair of defects is permissible providing the treatment does not materially weaken the blade, reduce its weight, or impair its performance.

b. Defects on Thrust Face or Camber Side:

Repair by removal of metal to form shallow, large radius, round bottomed depressions. Periodic inspection during repair should be made to avoid removal of excessive amounts of metal. All raised edges should be carefully smoothed out to reduce the area of the defect and the amount of metal to be removed. Repair with suitable fine cut files and coarse grain emery cloth and smooth all edges and surfaces with fine grain emery cloth. Any blade repair on these surfaces which necessitates a depression that exceeds the manufacturer's tolerances or those listed in CAM 18 shall be cause for considering blade not airworthy.

c. Defects on Leading and Trailing Edge:

Repair defects as outlined in "b" above with suitable half round file and emery cloth. Carefully smooth all edges of repaired defect. Any blade repair on leading and trailing edges which necessitates metal removal that exceeds

the manufacturer's tolerances or those listed in CAM 18 shall be cause for considering blade not airworthy.

Blades that have leading or trailing edges pitted from normal wear may be reworked by removing sufficient metal to eliminate the pitting. Start well back from the edge and work over the edge in such a manner that the contour of the blade remains substantially the same. Avoid abrupt section changes and blunt edges. Permissible reductions in blade thickness and width, listed in the manufacturer's publications or CAM 18, must be observed.

d. Tip Damage:

Damage on blade tips may be removed in accordance with "b" and "c" listed above, as long as metal removal is within the tolerances specified. Damage which cannot be repaired by local removing of metal may be repaired by removing metal so as to shorten blades, although shortening blades is a propeller major repair. Any shortening of one blade requires an identical shortening of the other one, and any change in tip plan form or contour of one blade requires an identical change on the other one. Limitations concerning shortening of blades are specified in the manufacturer's publications or CAM 18.

e. Refinishing:

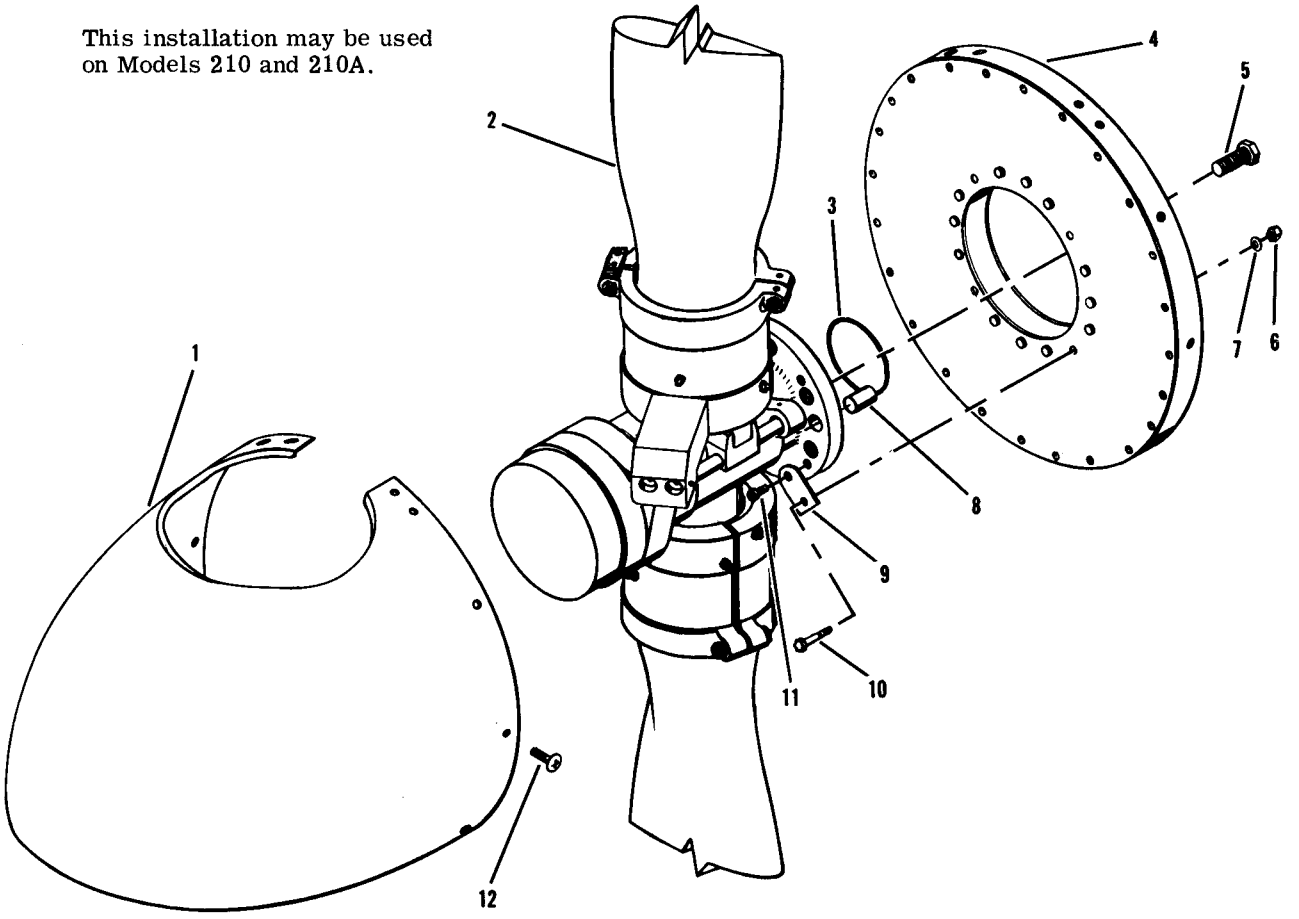
Prior to corrosion protection treatments, all repair areas should be smoothly polished out and blended in to finish repair and improve appearance. Wherever possible, all repaired blades should be anodized in a sulfuric acid anodize bath. The blades must be anodized with loose blade retention hardware on shank end; therefore, the blade must be supported vertically with steel hardware out of the solution and suitably protected to be unaffected by fumes. The same holds true for caustic baths.

Where anodizing is not readily available, local repaired or inspected areas may be treated by other approved methods for corrosion protection; so-called chromodizing, alodine solution, painting, etc. It is doubtful that the finish of these treatments, other than sulfuric acid anodize, will blend in with regard to appearance. If desired, both camber and thrust face sides may be painted with zinc chromate primer and black lacquer to improve appearance. The thrust face side should always be painted.

SHOP NOTES:

NOTE

This installation may be used on Models 210 and 210A.



LIST OF APPROVED GREASES

1. MIL-G-3278
2. Stroma HT-1 (Z-801 Grease). Union Oil Co. of California.
3. Gulflex Moly for blade bushings.
4. Gulflex A. This grease is recommended for the blade ball bearings as it will not bleed oil in hot weather.
5. RPM Aviation Grease No. 2 (Standard Oil Co. of California).
6. Stroma LT-1 (Z-815 Grease). Union Oil Co. of California.
7. Lubricate 630 AA (Fiske Brothers, Toledo, Ohio). This grease will bleed oil in hot weather. It is recommended only for lubrication of the blade pilot tubes, but not the blade bearings.
8. RPM Aviation Grease No. 1 (Standard Oil Co. of California).
9. Lubriplate 707 (Fiske Brothers, Toledo, Ohio).
10. Mobilgrease Aero Lo-Hi PD-535-K (Socony Vacuum Oil Co.).
11. No. 84 Medium Grease (Keystone Lubricating Co.).
12. Texaco Regal Starfax Special.
13. Molub-Alloy No. 2 Grease - 10°F.
    No. 1 Grease - 25° F. (Imperial Oil & Grease Co., Los Angeles, California).
14. Germany - Calypsol H729 (German Calypsol Company, Dusseldorf).

1. Propeller Spinner
2. Propeller
3. O-Ring
4. Spinner Bulkhead
5. Bolt
6. Nut
7. Washer
8. Dowel Pin
9. Lug
10. Bolt
11. Bolt
12. Screw

Figure 14-1. Hartzell Propeller

14-4. HARTZELL PROPELLER.

14-5. The Hartzell constant-speed propeller is a single-acting propeller in which oil pressure from the engine, boosted and regulated by a governor, is used to decrease blade pitch, and centrifugal force acting on counterweights is used to increase blade pitch. The propeller is illustrated in figure 14-1.

14-6. TROUBLE SHOOTING.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
FAILURE TO CHANGE PITCH.		
Control disconnected or broken.	Check visually.	Connect or replace control.
Governor not correct for propeller. "Sensing" wrong.	Check that governor is correctly set. See figure 14-4.	Install correct governor.
Defective governor.	See paragraph 14-17.	See paragraph 14-17.
Defective pitch changing mechanism or excessive blade friction.	Lubricate propeller and check manually.	Propeller repair or replacement is required.
FAILURE TO CHANGE PITCH FULLY.		
Improper rigging of governor control.	Check that arm on governor has full travel.	Rig correctly.
Defective governor.	See paragraph 14-17.	See paragraph 14-17.
SLUGGISH RESPONSE TO PROPELLER CONTROL.		
Excessive friction in pitch changing mechanism or excessive blade friction.	Lubricate propeller and check manually.	Propeller repair or replacement is required.
STATIC RPM TOO HIGH.		
Governor high rpm stop set too high.	See "Note" at end of this chart.	Rig correctly.
Defective governor.	See paragraph 14-17.	See paragraph 14-17.
Incorrect propeller or incorrect low pitch blade angle.	Check aircraft specifications.	Install correct propeller, with correct blade angle.
STATIC RPM TOO LOW.		
Governor high rpm stop set too low.	See "Note" at end of this chart.	Rig correctly.
Defective governor.	See paragraph 14-17.	See paragraph 14-17.
Incorrect propeller or incorrect low pitch blade angle.	Check aircraft specifications.	Install correct propeller, with correct blade angle.
ENGINE SPEED WILL NOT STABILIZE.		
Sludge in governor.	See paragraph 14-17.	See paragraph 14-17.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
ENGINE SPEED WILL NOT STABILIZE (Cont).		
Air trapped in propeller actuating cylinder.	This condition may occur after the propeller has been reinstalled or has been idle for an extended period.	Trapped air should be purged by exercising the propeller several times prior to take-off after the propeller has been reinstalled or has been idle for an extended period.
Excessive friction in pitch changing mechanism or excessive blade friction.	Lubricate propeller and check manually.	Propeller repair or replacement is required.
Defective governor.	See paragraph 14-17.	See paragraph 14-17.
OIL LEAKAGE AT MOUNTING FLANGE.		
Damaged O-ring seal between engine and propeller.	Check visually for oil leakage.	Replace O-ring seal.
Foreign material between engine and propeller mounting flange or bolts not tight.	Check visually for oil leakage.	Clean propeller and engine flanges and tighten bolts properly.
GREASE LEAKAGE AT GREASE FITTING.		
Loose or defective grease fitting.	Check visually for grease leakage.	Tighten loose grease fitting; replace, if defective.
OIL OR GREASE LEAKAGE AT ANY OTHER PLACE.		
Defective seals, gaskets, threads, etc. or incorrect assembly.	Check visually for oil or grease leakage.	Propeller repair or replacement is required.

NOTE

It is possible for either the propeller low pitch (high rpm) stop or the governor high rpm stop to be the high rpm limiting factor. It is desirable for the governor stop to limit the high rpm at the maximum rated rpm for a particular airplane. Due to climatic conditions, field elevation, low pitch blade angle, and other considerations, an engine may not reach rated rpm on the ground. It may be necessary to readjust the governor stop after test flying to obtain maximum rated rpm when airborne.

14-7. REMOVAL.

a. Remove screws securing spinner to spinner bulkhead and remove spinner.

b. Remove propeller mounting bolts and pull propeller forward to remove from engine.

NOTE

As the propeller is separated from the engine, oil will drain from the propeller and engine cavities.

c. If desired, the spinner bulkhead can be removed from the propeller.

14-8. INSTALLATION.

a. Clean propeller and engine flanges. Remove any nicks, burrs, or sharp edges.

b. Assemble spinner bulkhead to propeller, positioning the bulkhead so propeller blades will emerge from the spinner with ample clearance. Safety the support lug screws.

c. Lightly lubricate a new O-ring and the crankshaft pilot and install the O-ring on the crankshaft pilot.

d. Check that the two dowel pins are installed in the aft side of propeller flange, align mounting holes and dowel pins with proper holes in crankshaft, and slide propeller carefully over the crankshaft pilot.

CAUTION

Avoid scraping metal from bore of spinner bulkhead and wedging scrapings between engine flange and propeller. Trim the inside diameter of the bulkhead as necessary when installing a new spinner bulkhead.

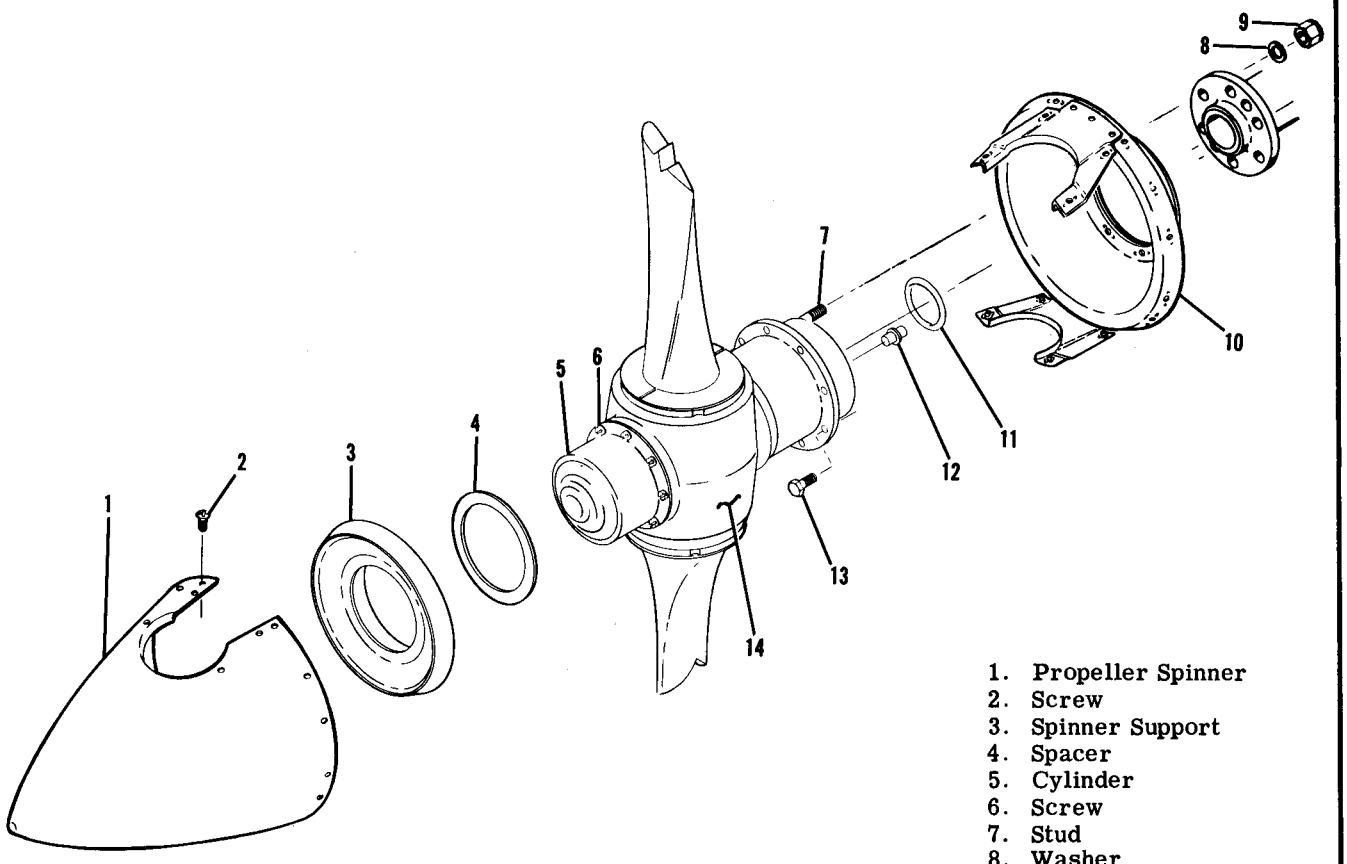
e. Install propeller bolts through engine flange into tapped holes in propeller flange. Tighten bolts evenly, torque to 75 lb ft, and safety in pairs.

f. Check all safeties, then install the spinner.

NOTE

If clearance between propeller blades and spinner is inadequate, the spinner may be shifted slightly by loosening the spinner bulkhead mounting lug screws, rotating the bulkhead, tightening the attaching screws, and re-safetying.

210E & ON
P206 SUPER SKYLANE



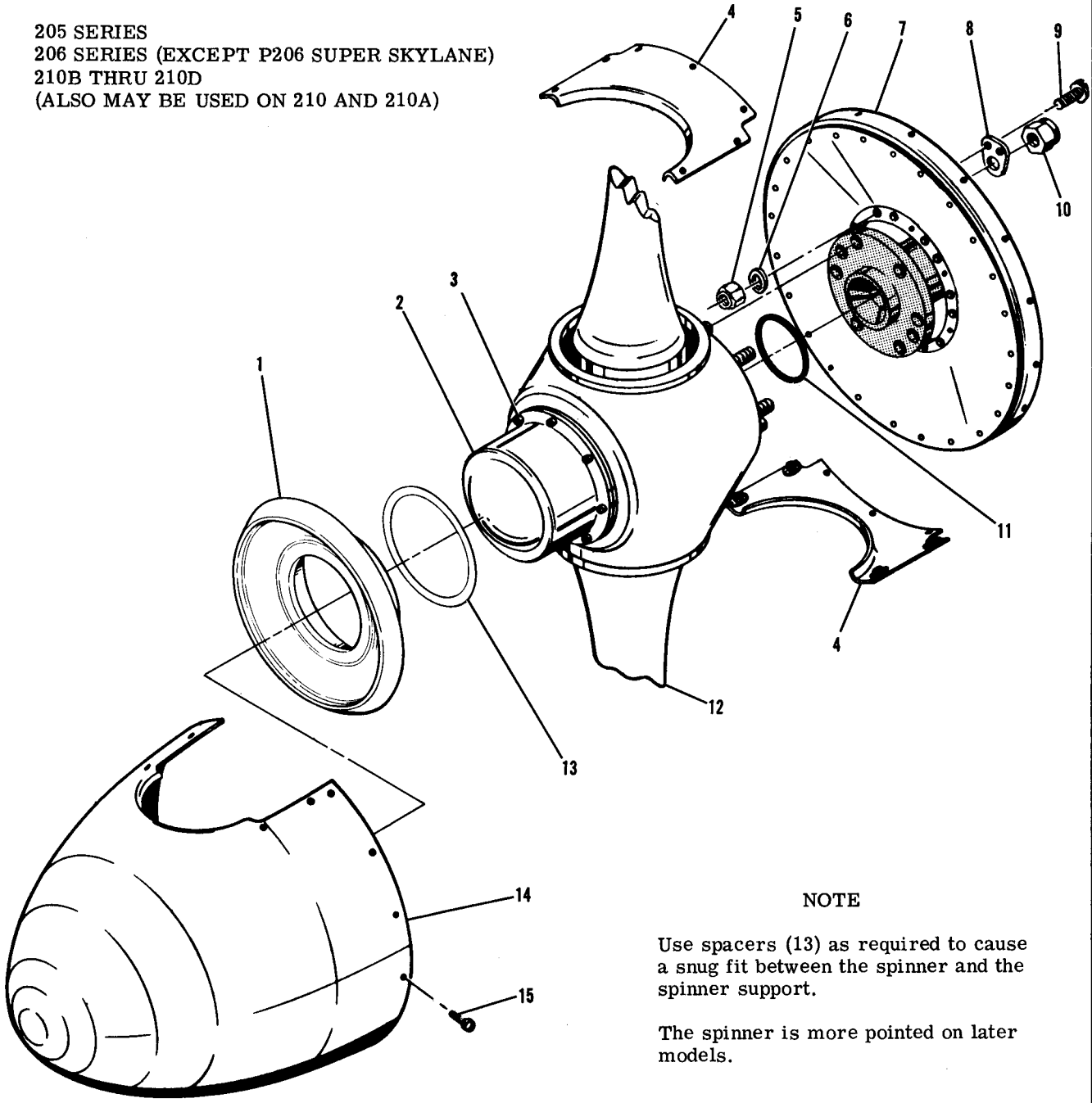
NOTE

Use spacers (4) as required to cause a snug fit between the spinner and the spinner support.

1. Propeller Spinner
2. Screw
3. Spinner Support
4. Spacer
5. Cylinder
6. Screw
7. Stud
8. Washer
9. Nut
10. Spinner Bulkhead
11. O-Ring
12. Dowel Pin
13. Bolt
14. Propeller

Figure 14-2. McCauley Propeller (Extended Hub)

205 SERIES
206 SERIES (EXCEPT P206 SUPER SKYLANE)
210B THRU 210D
(ALSO MAY BE USED ON 210 AND 210A)



NOTE

Use spacers (13) as required to cause a snug fit between the spinner and the spinner support.

The spinner is more pointed on later models.

1. Spinner Support
2. Cylinder
3. Screw
4. Fillet
5. Nut
6. Washer
7. Spinner Bulkhead
8. Lug
9. Screw
10. Nut
11. O-Ring
12. Propeller
13. Spacer
14. Propeller Spinner
15. Screw

Figure 14-3. McCauley Propeller

14-9. McCAULEY PROPELLER.

14-10. The McCauley constant-speed propeller used on the 200-series is a single-acting propeller in which oil pressure from the engine, boosted and regulated by a governor, is used to increase blade pitch, and the natural, centrifugal twisting moment of the rotating blades and the force of a spring are used to decrease blade pitch. The propeller is illustrated in figures 14-2 and 14-3.

14-11. TROUBLE SHOOTING.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
FAILURE TO CHANGE PITCH.		
Control disconnected or broken.	Check visually.	Connect or replace control.
Governor not correct for propeller. "Sensing" wrong.	Check that governor is correctly set. See figure 14-4.	Install correct governor.
Defective governor.	See paragraph 14-17.	See paragraph 14-17.
Defective pitch changing mechanism inside propeller or excessive blade friction.	Check manually.	Propeller repair or replacement is required.
FAILURE TO CHANGE PITCH FULLY.		
Improper rigging of governor control.	Check that arm on governor has full travel.	Rig correctly.
Defective governor.	See paragraph 14-17.	See paragraph 14-17.
SLUGGISH RESPONSE TO PROPELLER CONTROL.		
Excessive friction in pitch changing mechanism inside propeller or excessive blade friction.	Check manually.	Propeller repair or replacement is required.
STATIC RPM TOO HIGH.		
Governor high rpm stop set too high.	See "Note" at end of this chart.	Rig correctly.
Defective governor.	See paragraph 14-17.	See paragraph 14-17.
Incorrect propeller or incorrect low pitch blade angle.	Check aircraft specifications.	Install correct propeller, with correct blade angle.
STATIC RPM TOO LOW.		
Governor high rpm stop set too low.	See "Note" at end of this chart.	Rig correctly.
Defective governor.	See paragraph 14-17.	See paragraph 14-17.
Incorrect propeller or incorrect low pitch blade angle.	Check aircraft specifications.	Install correct propeller, with correct blade angle.
ENGINE SPEED WILL NOT STABILIZE.		
Sludge in governor	See paragraph 14-17.	See paragraph 14-17.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
ENGINE SPEED WILL NOT STABILIZE (Cont).		
Air trapped in propeller actuating cylinder.	This condition may occur after the propeller has been reinstalled, or has been idle for an extended period.	Trapped air should be purged by exercising the propeller several times prior to take-off after the propeller has been reinstalled or has been idle for an extended period.
Excessive friction in pitch changing mechanism inside propeller or excessive blade friction.	Check manually.	Propeller repair or replacement is required.
Defective governor.	See paragraph 14-17.	See paragraph 14-17.
OIL LEAKAGE AT MOUNTING FLANGE.		
Damaged O-ring seal between engine and propeller.	Check visually for oil leakage.	Replace O-ring seal.
Foreign material between engine and propeller mating surfaces or nuts not tight.	Check visually for oil leakage.	Clean propeller and engine mating surfaces and tighten nuts properly.
OIL LEAKAGE BETWEEN HUB AND CYLINDER.		
Defective gasket or screws not tight (on models where screws are external).	Check visually for oil leakage.	Replace gasket and tighten screws properly.
OIL LEAKAGE AT ANY OTHER PLACE.		
Defective seals, gaskets, threads, etc., or incorrect assembly.	Check visually for oil leakage.	Propeller repair or replacement is required.

NOTE

It is possible for either the propeller low pitch (high rpm) stop or the governor high rpm stop to be the high rpm limiting factor. It is desirable for the governor stop to limit the high rpm at the maximum rated rpm for a particular airplane. Due to climatic conditions, field elevation, low pitch blade angle, and other considerations, an engine may not reach rated rpm on the ground. It may be necessary to readjust the governor stop after test flying to obtain maximum rated rpm when airborne.

14-12. REMOVAL. (See figures 14-2 and 14-3.) On Models with the type propeller shown in figure 14-3, the propeller spinner must be removed for propeller removal. On models with the type shown in figure 14-2, the propeller and propeller spinner may be removed as a complete unit. To remove propeller, proceed as follows:

a. If spinner is to be removed, remove attaching screws and remove spinner, spinner support, and spacers. Retain any spacers behind spinner support.

b. On models with the type propeller shown in figure 14-2, remove cowling to gain access to propeller attaching nuts.

c. Loosen nuts attaching propeller about 1/4" and pull propeller forward until halted by nuts.

NOTE

As the propeller is separated from the engine, oil will drain from the propeller and engine cavities.

d. Remove attaching nuts and pull propeller forward to remove from engine.
e. If desired, the spinner bulkhead can be removed by removing attaching lugs (figure 14-3) or bolts (figure 14-2).

14-13. CLEANING OF PROPELLER HUB.
a. Remove propeller spinner. Remove spinner support from front of propeller. Remove any spacers used behind the spinner support.
b. Remove screws securing cylinder to hub and remove cylinder.
c. Use a solution of one part light engine oil and two parts solvent to clean exposed parts and interior of cylinders. Dry gently with compressed air, then use clean engine oil to lubricate parts lightly before assembly.
c. Install new O-rings and gaskets at each cleaning of propeller hub.
e. Reassemble cylinder to hub.
f. Install any spacers used between the spinner support and cylinder, then install the spinner support and spinner. Spacers are used as required to cause a snug fit between the spinner and the spinner support.

14-14. INSTALLATION.
a. If spinner bulkhead was removed, position it so the propeller blades will emerge from the spinner with ample clearance and install spinner bulkhead attaching lugs (figure 14-3) or bolts (figure 14-2).

CAUTION

Avoid acraping metal from bore of spinner bulkhead and wedging scrapings between engine flange and propeller. Trim the inside diameter of the bulkhead as necessary when installing a new spinner bulkhead.

b. Clean propeller hub cavity, mating surfaces, and crankshaft.
c. Lightly lubricate a new O-ring and the crankshaft pilot with clean engine oil, and install the O-ring in the propeller hub.
d. Align propeller mounting studs and dowel pins with proper holes in engine crankshaft flange and slide propeller carefully over crankshaft pilot until mating surface is approximately 1/4 inch from crankshaft flange.
e. Install propeller attaching washers and nuts and work propeller aft as far as possible, then tighten nuts evenly and torque to 55-65 pound-feet.
f. Install any spacers used between spinner support bulkhead and propeller cylinder, then install spinner support and spinner. The spacers are used as required to cause a snug fit between the spinner and the spinner support.

14-15. PROPELLER GOVERNOR.

14-16. The propeller governor is a single-acting, centrifugal type, which boosts oil pressure from the engine and directs it to the propeller where the oil is used to increase blade pitch of some propellers and to decrease blade pitch of others. A single-acting governor uses oil pressure to effect a pitch change in one direction only; a pitch change in the opposite direction results from propeller counterweights, centrifugal twisting moment of rotating blades, compressed springs, or a combination of some of these forces. Oil pressure is boosted in the governor by a gear type oil pump. A pilot valve, flyweights, and a speeder spring act together to open and close governor oil passages as required to maintain a constant engine speed.

NOTE

Outward physical appearance of specific governors is the same, but internal parts determine whether it uses oil pressure to increase or decrease blade pitch. Always be sure the correct governor is used.

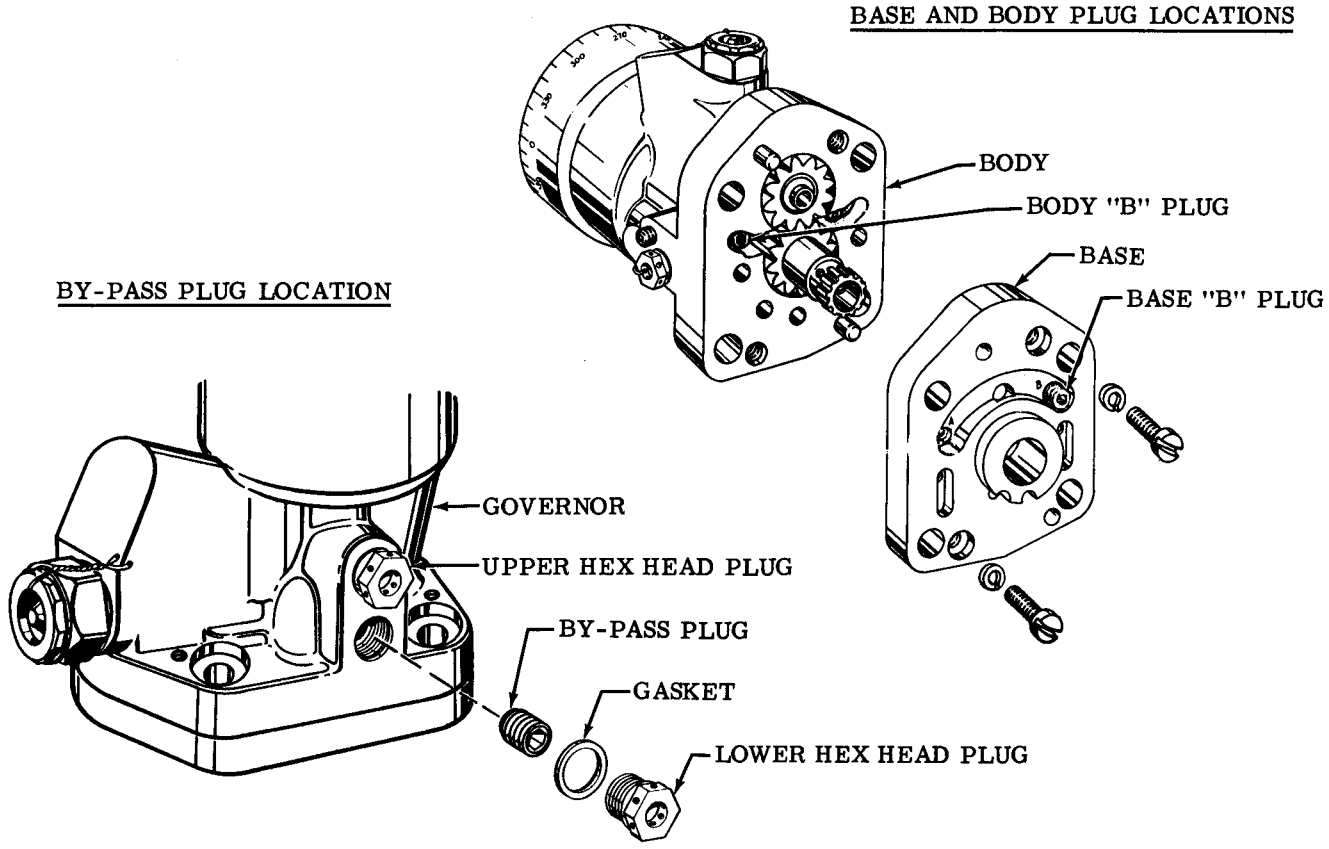
CAUTION

Hartzell propellers and McCauley propellers used on the 200-series require governors which "sense" in the opposite manner. On early Woodward governors, "sensing" is determined by the location of a by-pass plug. On later Woodward governors, as well as early ones which have been reworked, "sensing" is determined by the type pilot valve installed inside the governor. Since the same basic governor may be set to "sense" either way, it is important to ascertain that the governor is correct for the propeller being used. Refer to figure 14-4 for proper location of plugs.

14-17. TROUBLE SHOOTING. When trouble shooting the propeller-governor combination, it is recommended that a governor known to be in good condition be installed to check whether the propeller or the governor is at fault. Removal and replacement, rigging, high-speed stop adjustment, desludging, and replacement of the governor mounting gasket are not major repairs and may be accomplished in the field. Repairs to propeller governors are classed as propeller major repairs in Federal Aviation Regulations, which also define who may accomplish such repairs.

14-18. REMOVAL.
a. Remove cowling, engine baffles, or nose cap as required for access.
b. Disconnect governor control from governor.
c. Remove nuts and washers securing governor to engine, and pull governor from mounting studs.
d. Remove gasket between governor and engine mounting pad.

14-19. INSTALLATION.
a. Wipe governor and engine mounting pad clean.
b. Install a new gasket with the raised surface of the screen away from the engine pad.
c. Position governor on mounting studs, aligning governor splines with splines in engine, and install mounting nuts and washers. Do not force spline engagement. Rotate engine crankshaft slightly and splines will engage smoothly when properly aligned.
d. Connect governor control to governor and rig.



NOTES

1. Location of base and body plugs determines the direction of rotation for the governor. On all Cessna aircraft, the body plug should be located in hole "B" and the base plug in hole "B". Notice that these holes are on opposite sides of the governor.

2. Governor "sensing" (whether oil from the governor is used to increase or decrease propeller pitch) is determined either by location of the by-pass plug or by the type of pilot valve installed inside the governor.

3. On early model Woodward governors, the by-pass plug should be located in the lower passage for use with all McCauley propellers. It should be located in the upper passage for use with all Hartzell propellers used on the 200-series.

4. On later model Woodward governors, "sensing" is determined by the type of pilot valve installed inside the governor instead of by location of a by-pass plug.

5. Some early model Woodward governors have been converted from "sensing" by location of the by-pass plug to "sensing" by the type pilot valve installed inside the governor. These converted governors retain the by-pass plug, but it must be installed in the UPPER passage, regardless of the propeller with which it is used.

6. There are two types of by-pass plugs used on governors. One is a pin type and the other is a threaded, internal-wrenching type.

7. Do not use thread seal on any of the governor plugs.

Figure 14-4. Governor Plug Locations

e. Reinstall parts removed for access.

14-20. CHECKING GOVERNOR PLUG LOCATIONS. Figure 14-4 illustrates the positions of base and body plugs for clockwise rotation. On Cessna aircraft, both base and body plugs should be in holes marked "B." Notice that the "B" holes are opposite each other in the body and base. The governor must be removed to check body and base plug locations.

By-pass plug location is also illustrated in figure 14-4. Pin-type by-pass plugs are used in some governors, and threaded, internal-wrenching plugs are used in others. To check location of the by-pass plug, remove the two external hex-head plugs illustrated. Governor removal is not required for this check.

CAUTION

Do not use thread seal on any governor plugs.

14-21. HIGH RPM STOP ADJUSTMENT.

a. Remove engine cowling and baffles or nose cap as necessary for access.

b. Remove safety wire (not used on some governors) from the high-speed stop screw and loosen the jam nut.

c. Turn the stop screw in to decrease maximum rpm and out to increase maximum rpm. One full turn of the stop screw causes a change of approximately 25 rpm.

d. Make propeller control linkage adjustments as necessary for full travel.

e. Tighten jam nut, safety stop screw, where used, and test operate propeller and governor.

f. Reinstall cowling and baffles or nose cap removed for access.

NOTE

It is possible for either the propeller low pitch (high rpm) stop or the governor high rpm stop to be the high rpm limiting factor. It is desirable for the governor stop to limit the high rpm at the maximum rated rpm for a particular airplane. Due to climatic conditions, field elevation, low pitch blade angle, and other considerations, an engine may not reach rated rpm on the ground. It may be necessary to readjust the governor stop after test flying to obtain maximum rated rpm when airborne.

14-22. RIGGING THE PROPELLER GOVERNOR CONTROL.

a. Disconnect control end from governor arm.

b. Place propeller control in cabin full forward, then pull back approximately 1/8" and lock in this position. This will allow "cushion" to assure full contact with governor high rpm stop screw.

c. Place governor arm against high rpm stop screw.

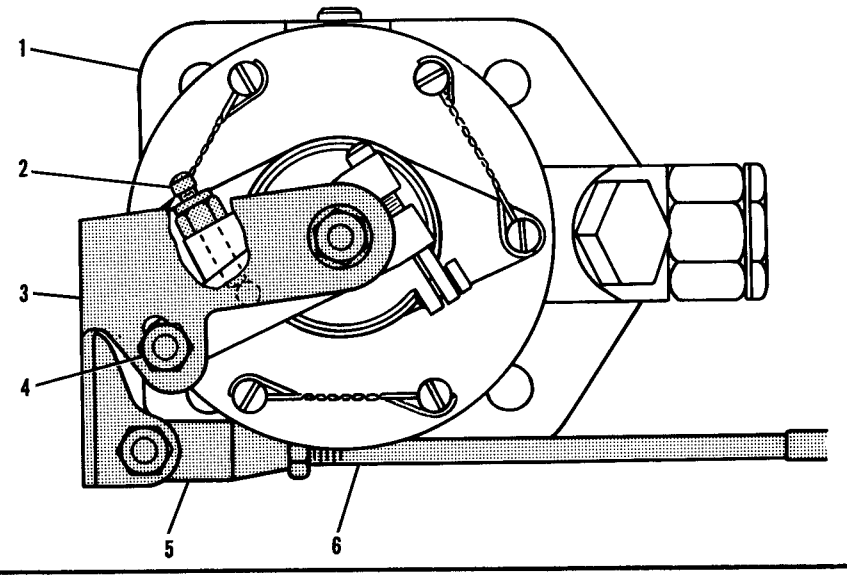
d. Loosen jam nut and adjust control rod until attaching holes align while governor arm is against high rpm stop screw. Be sure to maintain sufficient thread engagement of the control and the rod end. If necessary, shift the control in its clamps to achieve this.

e. Attach control rod end to the governor arm, tighten jam nut, and install all safeties.

f. Operate the propeller control to see that the governor arm attains full travel in both directions.

NOTE

Some models are equipped with an offset extension to the governor arm. The offset extension has an elongated slot to permit further adjustment. The preceding steps may still be used as an outline of the rigging procedure. The result of rigging, in all cases, is full travel of the governor arm, with some "cushion" at the full-in position.



1. Propeller Governor
2. High Speed Stop Screw
3. Governor Arm Extension
4. Nut
5. Control Rod End
6. Governor Control

Figure 14-5. Propeller Governor Control

SECTION 15

UTILITY SYSTEMS

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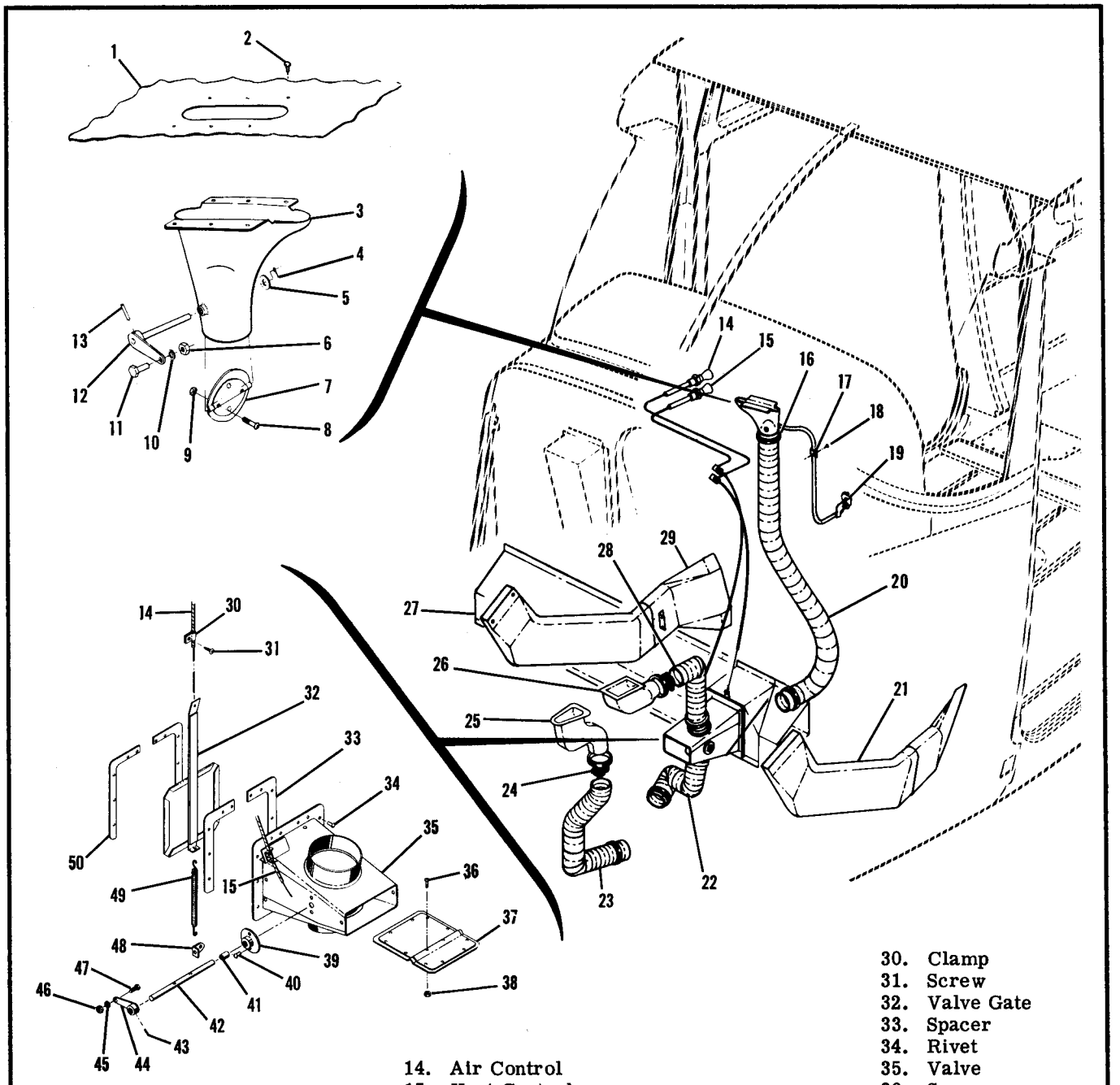
15-1. HEATING AND DEFROSTING SYSTEM.

15-2. Cabin heating and defrosting are provided by an exhaust manifold heat exchanger, air ducts and valves, controls, and outlets. The only moving parts of the system are the valves and their controls, hence there is little mechanical wear involved. Normally, the only maintenance check required on the heating and defrosting system is careful examination to make sure that the exhaust manifold and heat exchanger have no burned spots or cracks which could allow exhaust fumes to enter the system, and a check of hoses and ducting to make sure that air passage is unobstructed. Heater and defroster controls and valves should be checked periodically to insure proper operation.

15-3. HEATER OPERATION (Model 210). Ram air is ducted through an engine baffle to the heat-exchange section of the left exhaust muffler. The heated air flows from the muffler to a mixing valve on the forward side of the firewall, then into a duct across the aft side of the firewall where it is distributed into the cabin. This system has an alternate supply of fresh air which is heated only by flowing across the engine to the firewall mixing valve. The "CABIN HEAT" control is used to select either source of heated air, or to blend them in any desired ratio. Pulling the control full out selects heated air from the exhaust heat exchanger and pushing it full in selects the alternate heated air source. A shut-off valve on the firewall, operated by a control marked "CABIN AIR," regulates the volume of heated air entering the cabin. Pushing this control full in provides maximum flow and pulling it out gradually decreases flow, shutting it off completely when pulled full out.

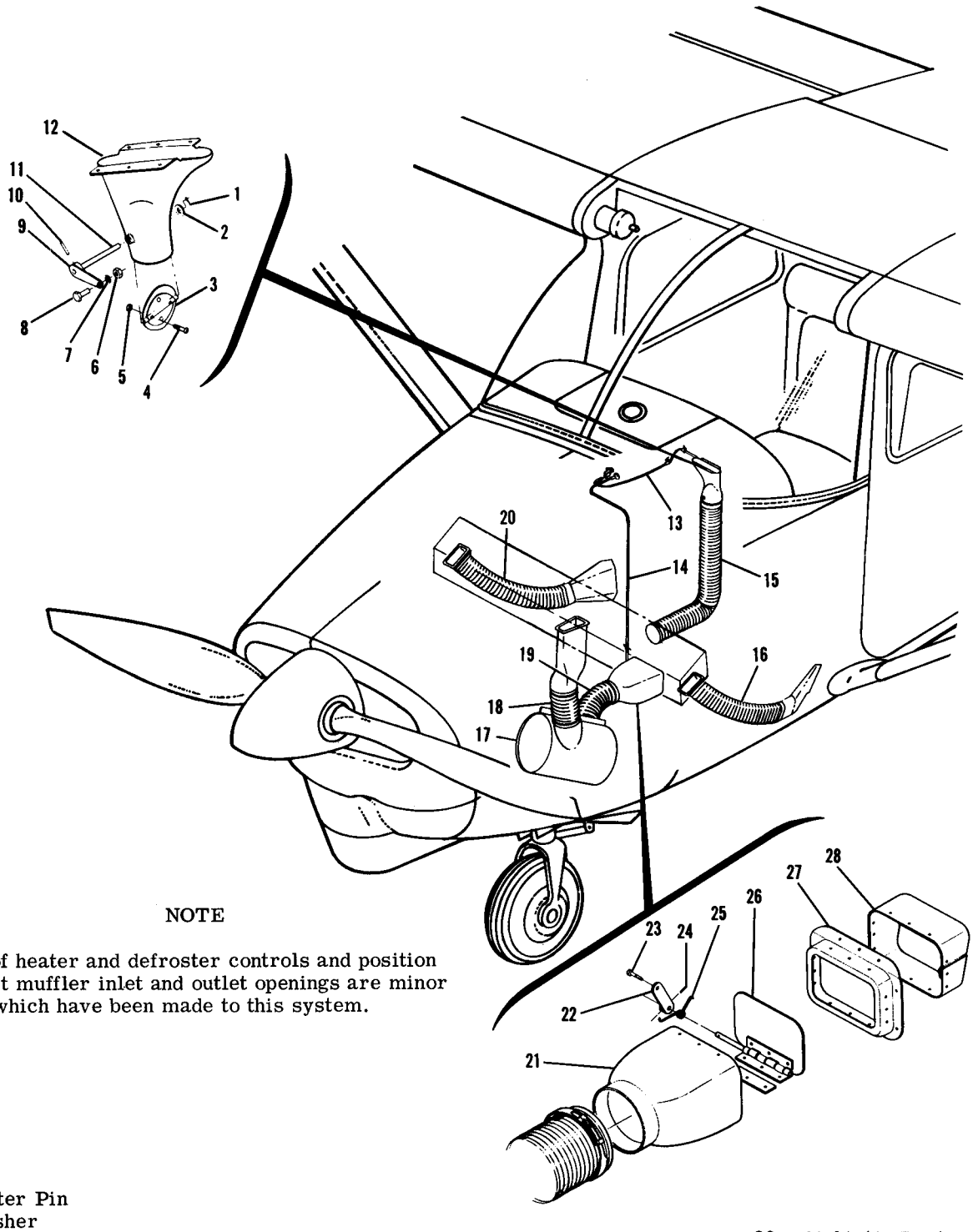
NOTE

Always push the "CABIN HEAT" control full in before pulling the "CABIN AIR" control full out, since overheating of the heater duct may occur because there is no outlet for the heated air when the shut-off valve is closed.



1. Cowl Deck
2. Rivet
3. Defroster Outlet
4. Cotter Pin
5. Washer
6. Nut
7. Valve
8. Screw
9. Nut
10. Washer
11. Bolt
12. Lever Assembly
13. Roll Pin
14. Air Control
15. Heat Control
16. Clamp
17. Clamp
18. Screw
19. Defroster Control
20. Defroster Hose
21. Left Duct
22. Hose (Heater Shroud to Valve)
23. Hose (Inlet to Heater Shroud)
24. Filter
25. Forward Air Inlet
26. Aft Air Inlet
27. Firewall Duct
28. Hose (Inlet to Valve)
29. Right Duct
30. Clamp
31. Screw
32. Valve Gate
33. Spacer
34. Rivet
35. Valve
36. Screw
37. Valve Plate
38. Nut
39. Bushing
40. Rivet
41. Bearing
42. Shaft
43. Roll Pin
44. Arm
45. Washer
46. Nut
47. Bolt
48. Bracket
49. Spring
50. Spacer

Figure 15-1. Heating and Defrosting System (Model 210)



NOTE

Routing of heater and defroster controls and position of exhaust muffler inlet and outlet openings are minor changes which have been made to this system.

1. Cotter Pin
2. Washer
3. Defroster Valve
4. Screw
5. Nut
6. Nut
7. Washer
8. Clamp Bolt
9. Arm
10. Roll Pin
11. Shaft
12. Defroster Nozzle
13. Defroster Control
14. Cabin Heat Control
15. Defroster Hose
16. Left Air Duct
17. Exhaust Manifold Muffler
18. Muffler Inlet Hose
19. Muffler Outlet Hose
20. Right Air Duct
21. Valve Body
22. Arm
23. Clamp Bolt
24. Roll Pin
25. Spring
26. Valve Plate
27. Valve Seat
28. Valve Extension

Figure 15-2. Heating and Defrosting System (205, 206, & 210A &on)

15-4. HEATER OPERATION (MODELS 205, 206, AND 210A AND ON). Ram air is ducted through an engine baffle to the heat-exchange section of the left exhaust muffler. The heated air flows from the muffler, through a firewall shut-off valve, into a duct across the aft side of the firewall where it is distributed into the cabin. The shut-off valve, operated by a control marked "CABIN HEAT," regulates the volume of heated air entering the cabin. Pulling the heater control full out supplies maximum flow and pushing it in gradually decreases flow, shutting it off completely when pushed full in. Refer to paragraph 15-8 for operation of fresh air scoop doors, which permit unheated air also to enter the firewall duct for distribution into the cabin.

15-5. DEFROSTER OPERATION. Air from the duct across the aft side of the firewall flows through a flexible duct to the defroster outlet. The defroster control operates a damper in the outlet to regulate the amount of air deflected across the inside surface of the windshield. The temperature and volume of this air are controlled by the settings of the cabin heating system controls.

15-6. VENTILATING SYSTEM.

15-7. OVERHEAD CABIN VENTILATION is provided by manually adjustable ventilators installed on each side of the cabin near the upper corners of the windshield. Air is received from scoops mounted in the inboard leading edges of the wings. Formed elbows and ducts deliver ram air to the ventilators, which are adjustable to regulate the amount and direction of air emitted into the cabin. Rear seat overhead ventilators receive air from scoops mounted in the leading edges of the wing root fairings and/or inboard wing leading edges. The ram air is ducted to the rear seat ventilator outlets, which are adjustable to regulate the amount and direction of air emitted into the rear cabin area.

NOTE

The filters at the air inlets are primarily noise reduction filters. They may be removed and cleaned or replaced. Since air passing through the filters is emitted into the cabin, do not use a cleaning solution which would contaminate cabin air. The filters may be removed to increase air flow. However, their removal will cause a slight increase in noise level. Some models do not use these filters.

15-8. FORWARD CABIN VENTILATION is provided by two fresh air scoops, one on each side of the fuselage, just forward of the front seats. On the Model 210 these scoops transmit air directly into the cabin through outlets which are adjustable to regulate the amount and direction of air emitted into the cabin. On the Model 210A, the scoops are small doors, operated by separate controls at the lower outboard corners of the instrument panel. The left scoop door on Models 205, 206, and 210B and on, is operated by a control in the instrument panel marked "CABIN AIR," and the right scoop door is operated by a control at the lower outboard corner of the instrument panel marked "AUX. CABIN AIR." On all except Model 210, fresh air from the scoop doors is routed to the duct across the aft side of the firewall, where it is distributed into the cabin. As long as the "CABIN HEAT" control is pushed full in, no heated air can enter the firewall duct; therefore, when the "CABIN AIR" or "AUX. CABIN AIR" controls are pulled out, only fresh air from the scoops will flow through the duct into the cabin. As the "CABIN HEAT" control is gradually pulled out, more and more heated air will blend with the fresh air from the scoops and be distributed into the cabin. All of the controls may be set at any position from full open to full closed.

15-9. TROUBLE SHOOTING.

15-10. Most of the operational troubles in the heating, defrosting, and ventilating systems are caused by sticking or binding air valves and their controls, damaged air ducting, or defects in the exhaust muffler. In most cases, air valves or controls can be freed by proper lubrication. Damaged or broken parts should be repaired or replaced. When checking rigging of controls, be sure valves respond freely to control movement, that they move in the correct direction, and that they move through their full range of travel and seal properly. Check that heater hoses are properly secured and replace hoses that are burned, frayed, or crushed. If fumes are detected in the cabin, a very thorough inspection of the exhaust muffler should be accomplished. Refer to paragraph 12-24 for this inspection. Since any holes or cracks may permit exhaust fumes to enter the cabin, replacement of defective parts is imperative because the fumes constitute an extreme danger.

15-11. REPLACEMENT AND REPAIR.

15-12. Figures 15-1 through 15-4 show the various heating, defrosting, and ventilating systems, and they may be used as a guide during replacement of components. Burned, frayed, or crushed hose should be replaced with new hose. Cut to length and install in the original routing. Trim the hose winding shorter than the hose to allow hose clamps to be fitted. Air valves that are defective should be repaired or replaced. Check for proper operation and correct rigging of the valves after repair or replacement.

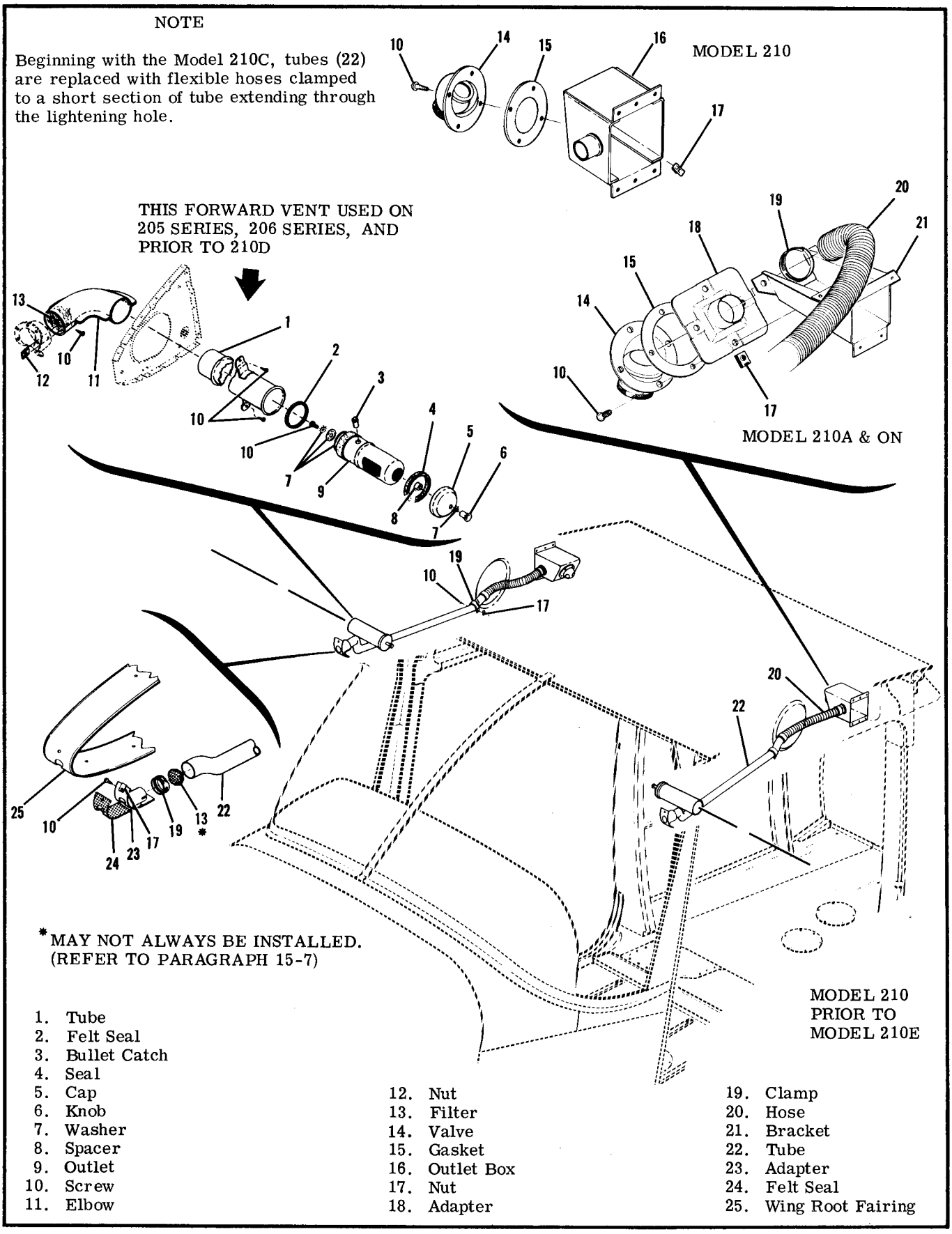
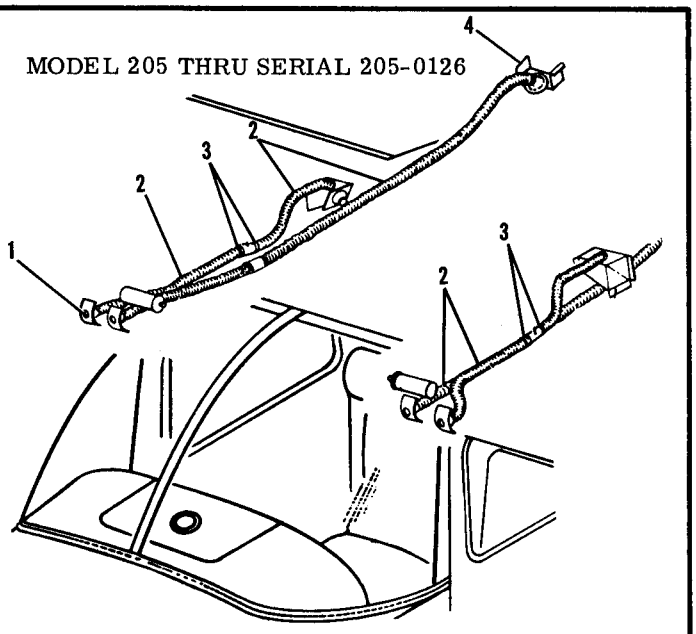
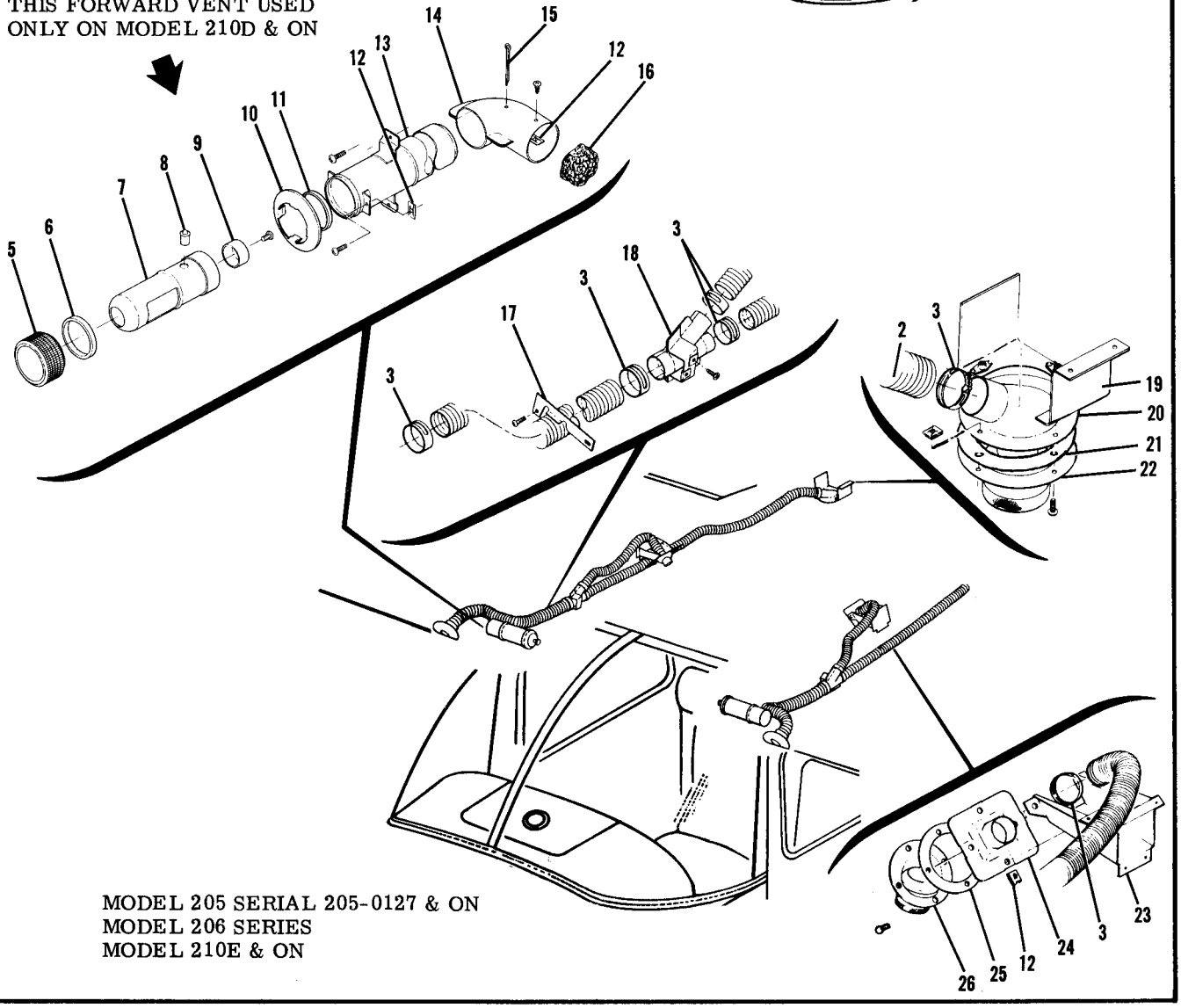


Figure 15-3. Overhead Ventilation System (Sheet 1 of 2)

1. Ram Air Inlet
2. Flexible Hose
3. Clamp
4. Rear Outlet
5. Outlet Cap
6. Seal
7. Barrel Assembly
8. Bullet Catch
9. Retainer
10. Air Vent Trim
11. Seal
12. Nut
13. Tube Assembly
14. Elbow
15. Cotter Pin
16. Filter
17. Retainer
18. "Y" Fitting
19. Bracket
20. Adapter
21. Gasket
22. Valve
23. Support
24. Adapter
25. Gasket
26. Valve

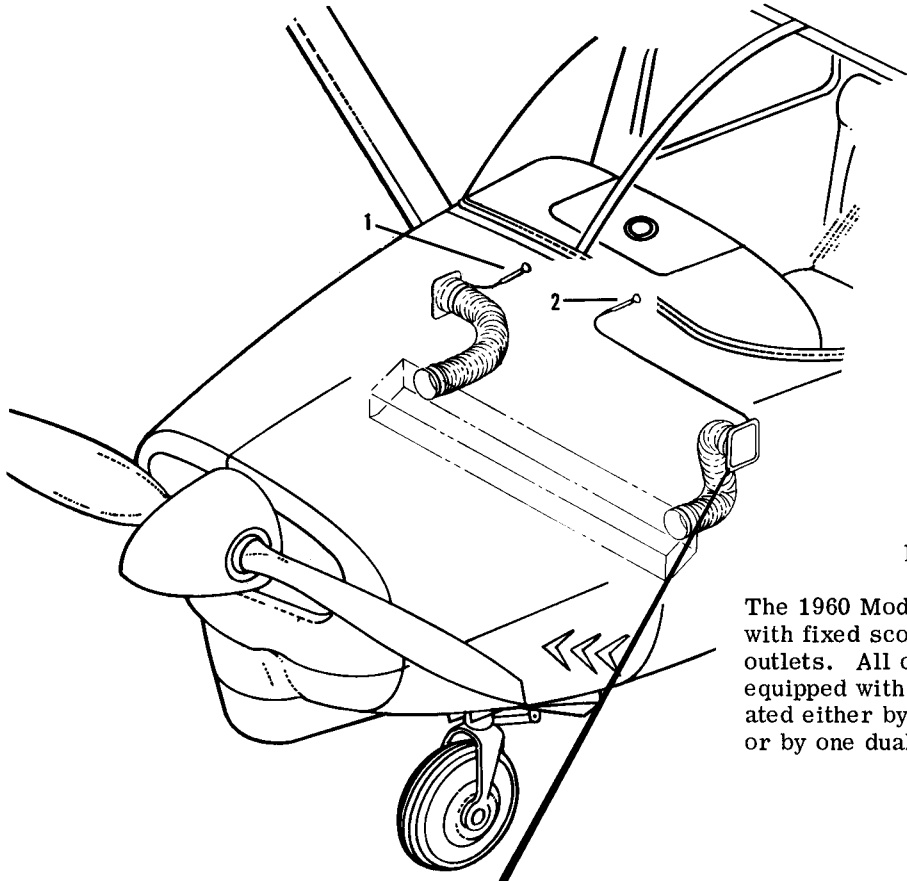


THIS FORWARD VENT USED ONLY ON MODEL 210D & ON



MODEL 205 SERIAL 205-0127 & ON
MODEL 206 SERIES
MODEL 210E & ON

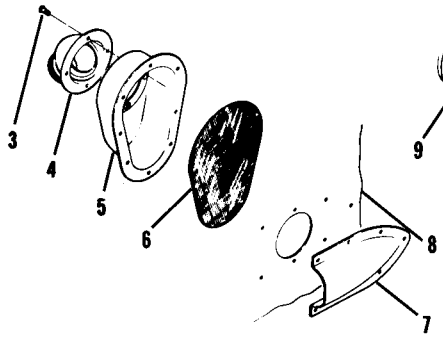
Figure 15-3. Overhead Ventilating System (Sheet 2 of 2)



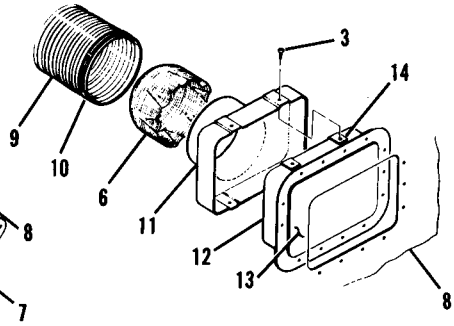
NOTE

The 1960 Model 210 is equipped with fixed scoops and adjustable outlets. All other models are equipped with scoop doors operated either by separate controls or by one dual control.

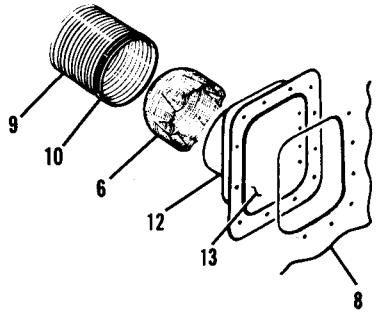
210



210A



205 & 206 SERIES, 210B & ON



1. Auxiliary Cabin Air Control
2. Cabin Air Control
3. Screw
4. Outlet
5. Adapter
6. Screen
7. Scoop
8. Fuselage Skin
9. Hose
10. Clamp
11. Cover
12. Air Valve Assembly
13. Scoop Door
14. Nut

Figure 15-4. Forward Ventilating System

15-13. OXYGEN SYSTEM.

15-14. All 200-Series aircraft may be equipped with four, five, or six-port oxygen systems depending on year and model.

NOTE

Models 210D, 206, and 205 series oxygen systems have an additional two-port, aft-mounted manifold, and a total of seven ports. Six disposable, continuous flow oxygen masks are supplied with this system.

All systems are equipped with a single cylinder, automatic constant flow regulator, pressure lines and outlets. Prior to 1965, the pilot's oxygen outlet is designed to provide a double supply of oxygen. The outlets are identical in 1965 and on, but the pilot's oxygen mask has a larger orifice providing the extra oxygen. The cylinder is filled through a filler valve mounted in the aft baggage compartment.

WARNING

Oil, grease, or other lubricants in contact with oxygen create a serious fire hazard, and such contact must be avoided. Do not permit smoking or open flame in or near airplane while work is performed on oxygen system, or when the system is in operation. Guard against inadvertently turning the master switch on.

15-15. MAINTENANCE. Before and during maintenance on oxygen systems, the following general rules must be followed:

a. Clean hands, tools, and working area.

b. Keep grease, oil, water, and all foreign matter from system.

c. Keep all lines dry and capped until installed.

d. All compounds used on fittings must conform to MIL-C-5542. No compound shall be used on aluminum alloy flared fittings. Compounds are used only on the first three threads of male fittings. No compound is used on coupling sleeves, or outside of tube flares.

e. Inspection of the cylinder is required before charging. Do not attempt to charge the cylinder if any of the following conditions exist:

1. Contaminated or corroded fitting on cascade, cylinder or filler valve.
2. Cylinder out of hydrostatic test date.
3. Cylinder bears no I.C.C. designation.
4. Cylinder completely empty. Must be completely disassembled and inspected in an FAA approved facility before charging.

f. Fabrication of pressure lines is not recommended. Lines should be replaced from factory by part number.

g. Lines and fittings shall be clean and dry. One of the following methods may be used to clean lines.

1. A vapor degreasing solution of stabilized trichlorethylene conforming to Specification MIL-T-7003 followed by blowing tubing clean and dry with a stream of clean, dry, filtered air.

CAUTION

Most air compressors are oil lubricated, and a minute amount of oil may be carried by the air stream. A water lubricated compressor should be used to blow tubing clean.

2. Flush with naptha conforming with Specification TT-N-95, then blow clean and dry with clean, dry, filtered air. Flush with anti-icing fluid conforming to MIL-F-5566 or anhydrous ethyl alcohol. Rinse thoroughly with fresh water and dry with clean, dry, filtered air.
3. Flush with hot inhibited alkaline cleaner until free from oil and grease. Rinse with fresh water and dry with clean, dry, filtered air.

NOTE

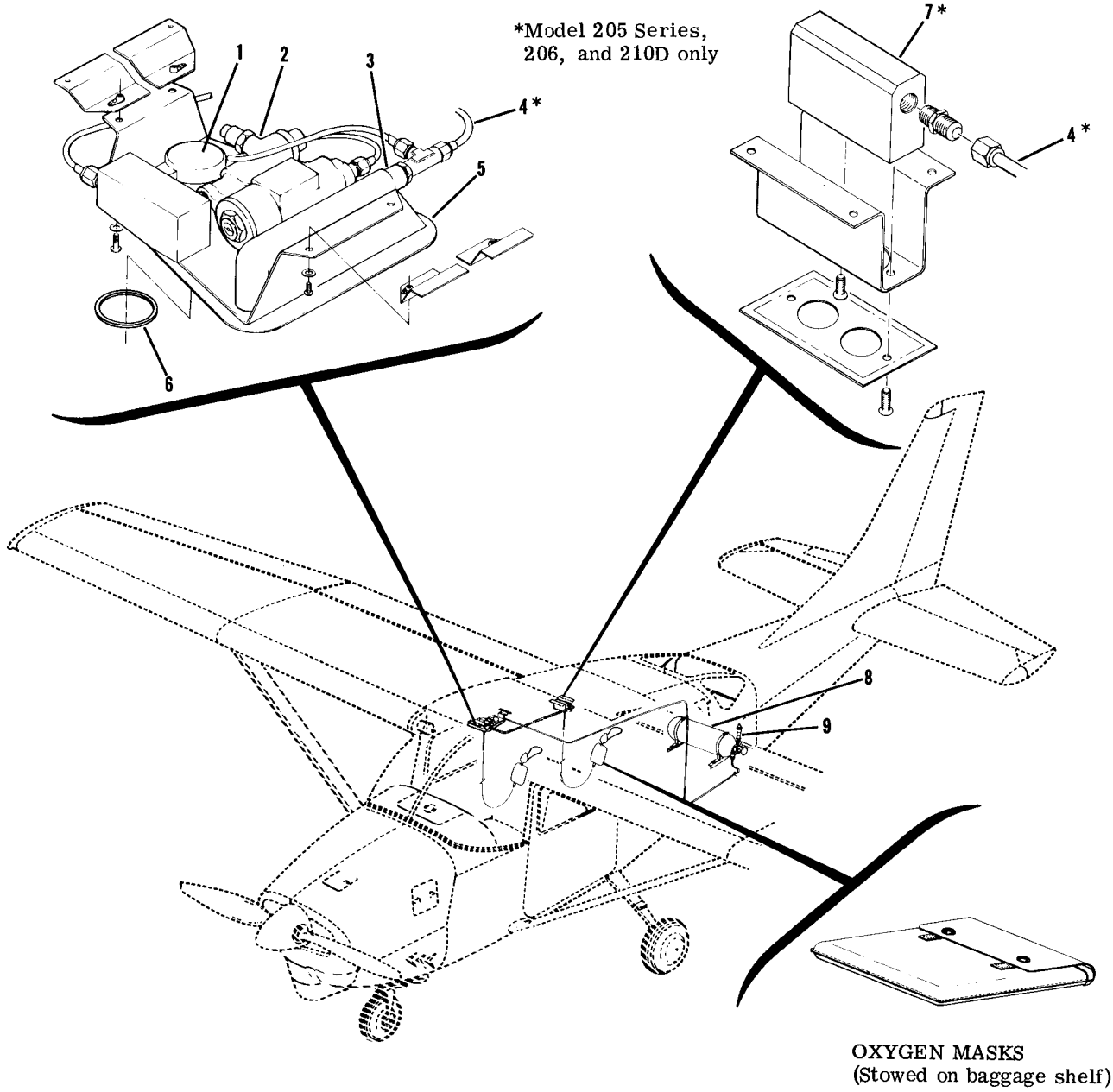
Cap lines at both ends immediately after drying to prevent moisture from entering.

15-16. REMOVAL AND INSTALLATION OF OXYGEN SYSTEM may be accomplished using figure 15-5 as a guide. On systems prior to 1965, it is necessary to close the cylinder shut-off valve by hand before removing the cylinder. The handle is accessible through a placarded cover on the aft baggage compartment wall. On 1965 and on aircraft (sheet 2), move knob (9) at the pilot's oxygen outlet to "OFF" position, then with the baggage compartment wall removed, disconnect control cable (4) at the push-pull valve on the cylinder.

NOTE

To facilitate removal of a charged cylinder, a check valve is located in the union on the filler valve connection at the regulator. The pressure gage and line must remain attached to the cylinder upon removal to retain charge.

If the cylinder is to be filled by a commercial oxygen supplier, remove cylinder and fill with aviator's breathing oxygen (MIL-O-27210). If the entire system is to be removed, the headliner must be lowered and the soundproofing removed to expose lines. Refer to Section 3 for headliner removal.



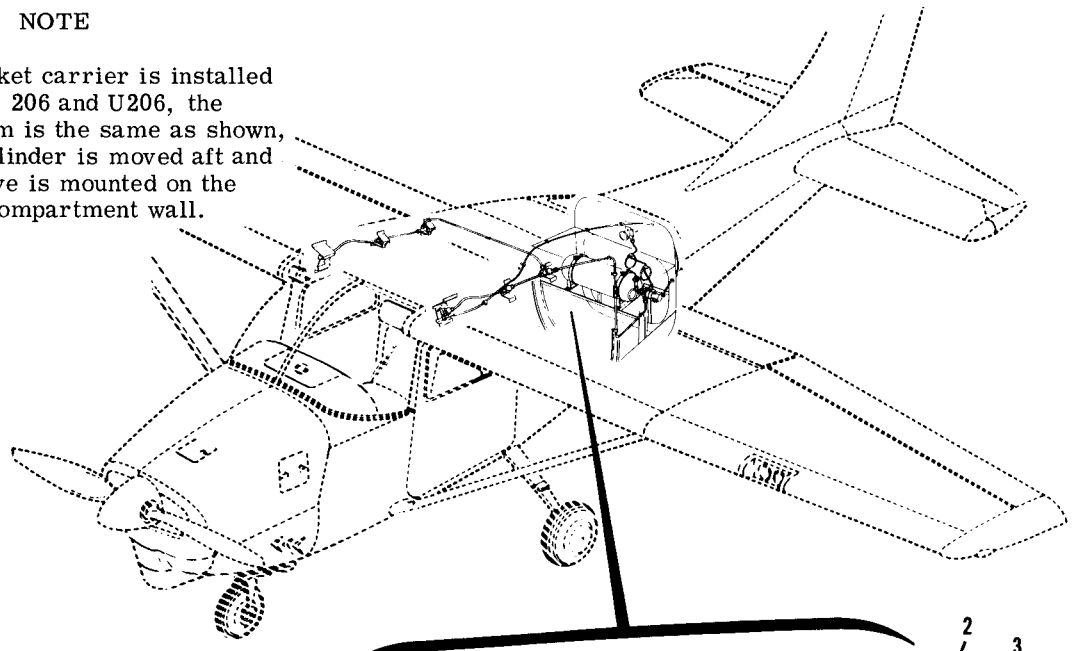
200-Series Prior to 1965

1. Pressure Gage
2. Regulator
3. Manifold (5-Port)
4. Line
5. Cover
6. Retainer Ring (Gage)
7. Manifold (2-Port)
8. Oxygen Cylinder
9. Filler Valve

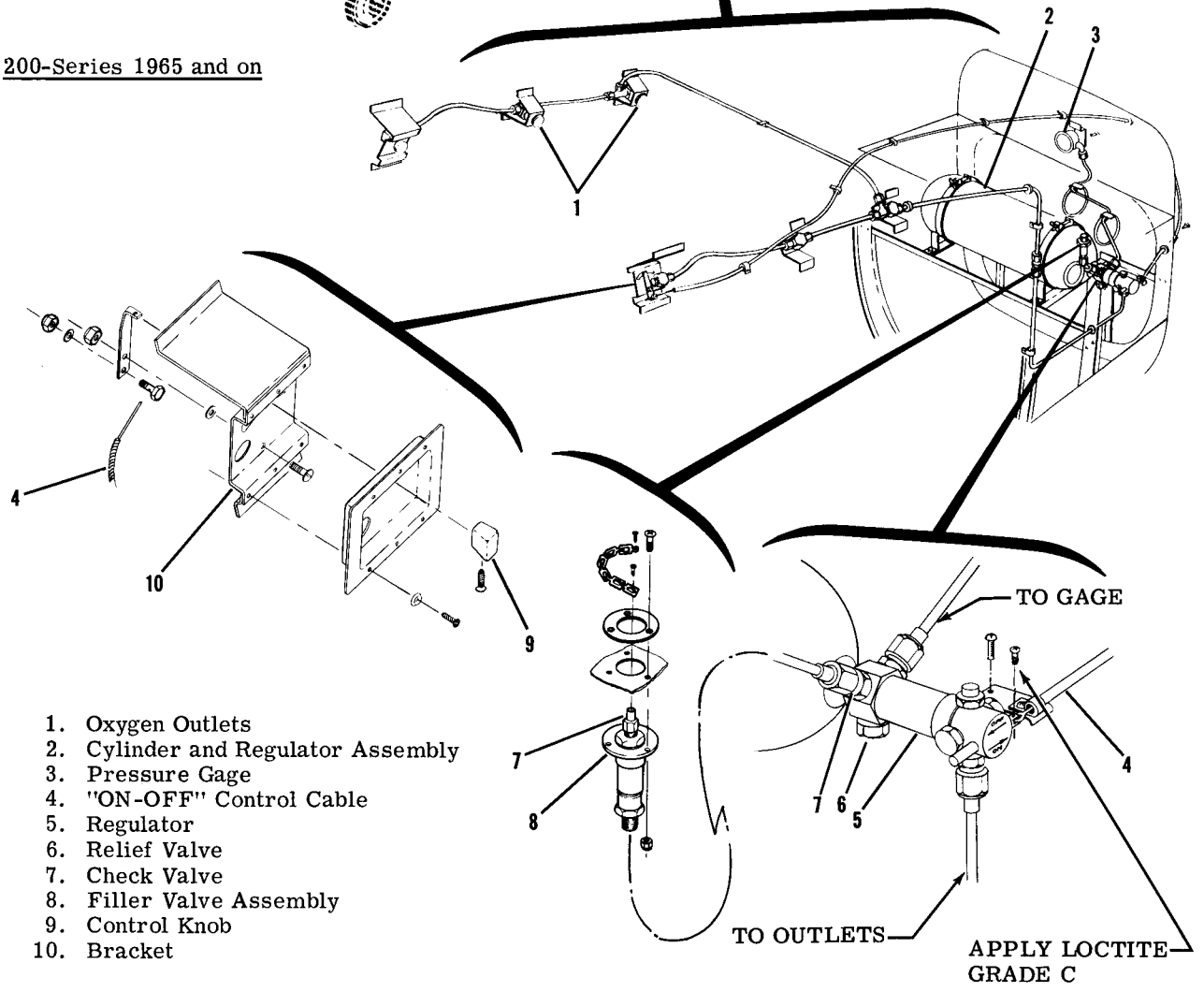
Figure 15-5. Oxygen System (Sheet 1 of 2)

NOTE

When the casket carrier is installed in the Models 206 and U206, the oxygen system is the same as shown, except the cylinder is moved aft and the filler valve is mounted on the aft baggage compartment wall.



200-Series 1965 and on



1. Oxygen Outlets
2. Cylinder and Regulator Assembly
3. Pressure Gage
4. "ON-OFF" Control Cable
5. Regulator
6. Relief Valve
7. Check Valve
8. Filler Valve Assembly
9. Control Knob
10. Bracket

Figure 15-5. Oxygen System (Sheet 2 of 2)

15-17. CHARGING. The following procedure may be used in conjunction with the table of pressure/temperature values for charging the cylinder.

TABLE OF FILLING PRESSURES

Initial temperature refers to ambient temperature in filling room. A rise of approximately 25°F. may be expected as a result of compression. The cylinder should be filled as quickly as possible and allowed to cool by ambient air only.

Initial Temp. °F	Filling Pressure psig	Initial Temp. °F	Filling Pressure psig
0	1,600	70	1,925
10	1,650	80	1,975
20	1,700	90	2,000
30	1,725	100	2,050
40	1,775	110	2,100
50	1,825	120	2,150
60	1,875	130	2,200

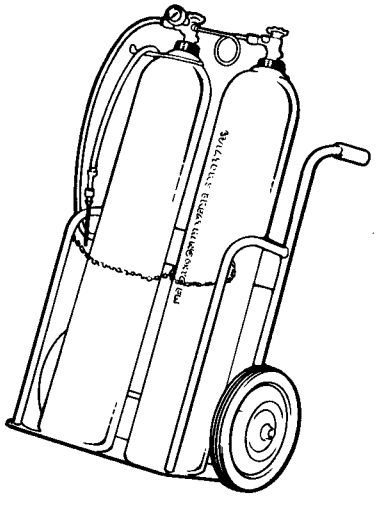
a. Connect the cascade connection to filler valve.
b. Slowly open valve of cylinder to be charged and observe pressure on cascade system.
c. Slowly open valve on cascade cylinders having lowest pressure and allow pressure to equalize.
d. Close cylinder valve on cascade cylinders, and slowly open valve on cylinder with next highest pressure until cylinder has been charged in accordance with chart.

15-18. TOP-OFF. Close all valves on the cascade, and on cylinder, then remove connections. Using a commercial leak detector or a mild castile soap and water, check all connections for leaks. Allow system to stabilize for one hour, then re-check the gage.

15-19. SERVICING & INSPECTION of oxygen system components shall be accomplished as follows:
a. Oxygen Cylinder - The 1800 psi, 48.3 cu. in., ICC 3AA 1800 cylinder shall be hydrostatically tested to 5/3 working pressure every five years. The month and year of last test is stamped on the cylinder beneath the I. C. C. identification.
b. Regulator- Inspected every 2 years or 1000 hours whichever occurs first.
c. Pressure Gage- Inspected every 2 years or during major aircraft overhaul.
d. High Pressure Lines- None required unless trouble is indicated. Lines should be tested to not less than 3000 psi if trouble is indicated.

NOTE

Each interconnected series of oxygen cylinders is equipped with a single gage. The trailer type cascade may also be equipped with a nitrogen cylinder (shown reversed) for filling landing gear struts, accumulators, etc. Cylinders are not available for direct purchase, but are usually leased and refilled by a local compressed gas supplier.



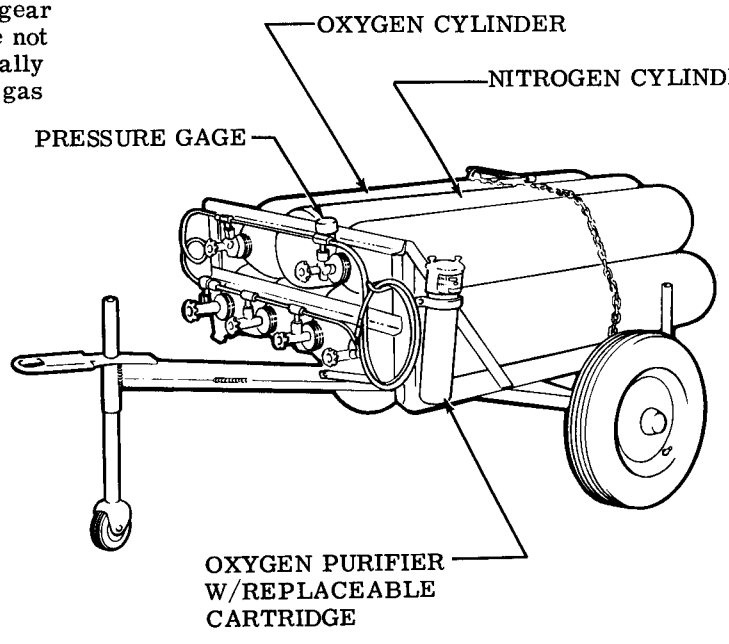


Figure 15-6. Typical Portable Oxygen Cascades

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SECTION 16

INSTRUMENTS AND INSTRUMENT SYSTEMS

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16-1. GENERAL.

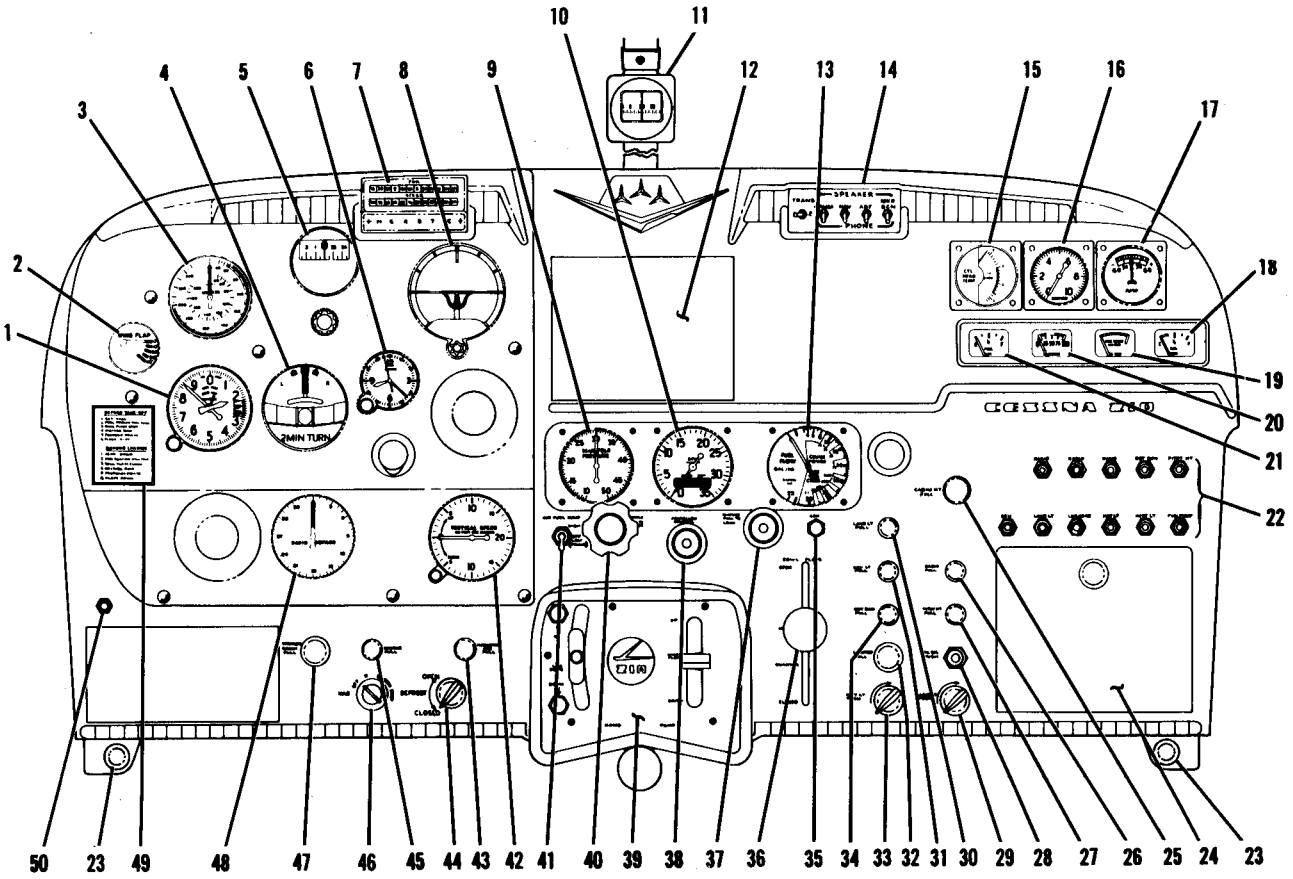
16-2. This section describes typical instrument installations and the systems operating them, with emphasis on trouble shooting and corrective measures for the systems themselves. It does not deal with specific instrument repairs since this usually requires special equipment and data and should be handled by instrument specialists. Federal Aviation Regulations require that malfunctioning instruments be sent to an approved instrument overhaul and repair station or returned to the manufacturer for servicing. Our concern here is with preventive maintenance on the various instrument systems and correction of system faults which result in instrument malfunctions.

The descriptive material, maintenance and trouble shooting information in this section is intended to help the mechanic determine malfunctions, and correct them, up to the defective instrument itself; at which point the instrument technician should be called in.

Some instruments, such as fuel quantity and oil pressure gages, are so simple and inexpensive that repairs usually will be more costly than a new instrument; on the other hand, aneroid and gyro instruments usually are well worth repairing. The words, "replace instrument" in the text, therefore, should be taken only in the sense of physical replacement in the airplane. Whether the replacement is to be with a new instrument, an exchange one or the original instrument is to be repaired must be decided on the basis of individual circumstances.

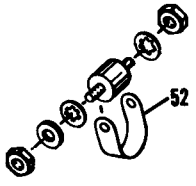
16-3. INSTRUMENT PANELS.

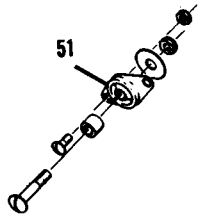
16-4. Instrument panels in 200-series aircraft are made in two main sections: the stationary panel carries switches and controls and contains instruments, such as the tachometer, manifold pressure gage, and fuel and oil gages, which are not sensitive to vibration; the shock-mounted panel carries the major flight instruments. Most of the instruments are screw-mounted on the backs of the stationary



NOTE

If shockmount has unequal thread length, install shorter threads through stationary panel.





NOTE

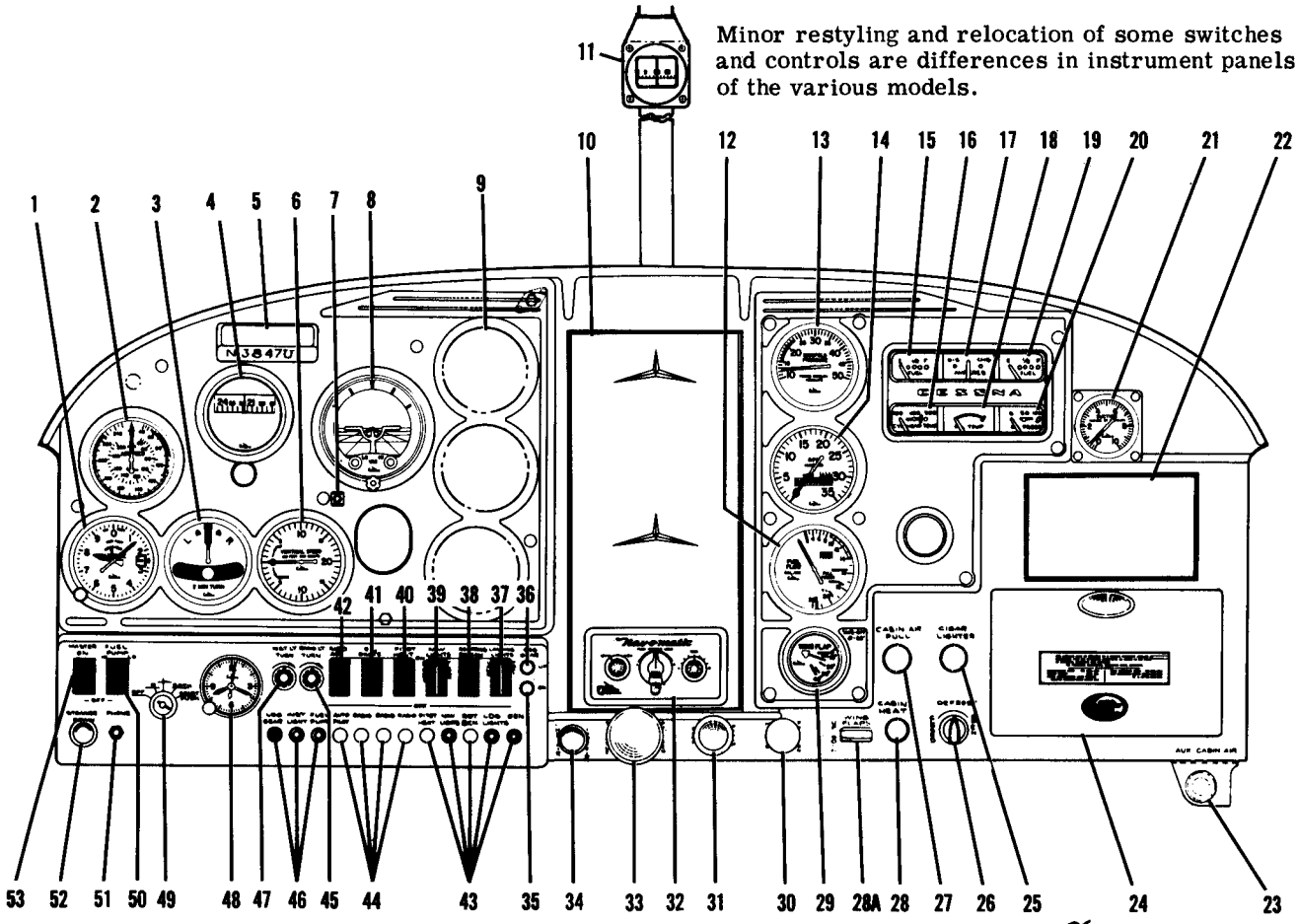
The 210 and 210A instrument panels are identical except for minor styling changes and switch relocations.

1. Altimeter
2. Wing Flap Position Indicator
3. Airspeed Indicator
4. Turn-and-Bank Indicator
5. Directional Gyro
6. Clock
7. Compass Correction Card
8. Gyro Horizon
9. Manifold Pressure Gage
10. Tachometer
11. Magnetic Compass
12. Radio Space
13. Fuel Flow Indicator
14. Radio Selector Switches
15. Cylinder Head Temp. Gage
16. Suction Gage
17. Ammeter
18. Fuel Quantity Indicator
19. Oil Temperature Gage
20. Oil Pressure Gage
21. Fuel Quantity Indicator
22. Circuit Breakers
23. Cabin Air Knob
24. Map Compartment
25. Cabin Heat Knob
26. Radio Switch
27. Pitot Heater Switch
28. Oil Dilution Switch
29. Radio Light Rheostat
30. Landing Light Switch
31. Navigation Light Switch
32. Cigar Lighter
33. Instrument Light Rheostat
35. Generator Warning Light
36. Cowl Flap Lever
37. Mixture Control
38. Propeller Control
39. Power Pack (See Section 5)
40. Throttle
41. Auxiliary Fuel Pump Switch
42. Vertical Speed Indicator
43. Induction Hot Air Knob
44. Defrost Knob
45. Master Switch
46. Ignition - Start Switch
47. Fuel Strainer Drain Knob
48. Radio Compass
49. Check List
50. Microphone Jack
51. Shock Mount
52. Ground Strap

Figure 16-1. Instrument Panel (Prior to Model 210B)

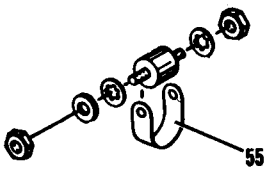
NOTE

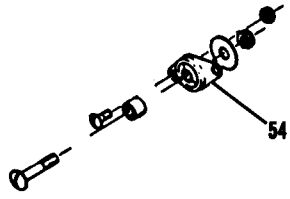
Minor restyling and relocation of some switches and controls are differences in instrument panels of the various models.



NOTE

If shockmount has unequal thread length, install shorter threads through stationary panel.





1. Altimeter
2. Airspeed Indicator
3. Turn-and-Bank Indicator
4. Directional Gyro
5. Compass Correction Card
6. Vertical Speed Indicator
7. Vacuum Lights Test Switch
8. Gyro Horizon
9. Optional Instrument Space
10. Radio Space
11. Magnetic Compass
12. Fuel Flow Indicator
13. Manifold Pressure Gage
14. Tachometer
15. Fuel Quantity Indicator
16. Cylinder Head Temperature Gage
17. Ammeter
18. Oil Temperature Gage
19. Fuel Quantity Indicator
20. Oil Pressure Gage
21. Suction Gage
22. Radio Space
23. Cabin Air Knob
24. Map Compartment
25. Cigar Lighter
26. Defrost Knob
27. Cabin Air Knob
28. Cabin Heat Knob

28A. Flap Switch(except 210B & C)

29. Wing Flap Position Indicator
30. Mixture Control
31. Propeller Control
32. Optional Nav-O-Matic Control Unit
33. Throttle
34. Induction Hot Air Knob
35. Gear Down Indicator Light
36. Gear Up Indicator Light
37. Landing Lights Switch
38. Rotating Beacon Switch
39. Navigation Light Switch
40. Pitot Heater Switch
41. Oil Dilution Switch
42. Radio Switch
43. Circuit Breakers
44. Circuit Breakers
45. Radio Light Rheostat
46. Circuit Breakers
47. Instrument Light Rheostat
48. Clock
49. Ignition - Start Switch
50. Auxiliary Fuel Pump Switch
51. Microphone Jack
52. Fuel Strainer Drain Knob
53. Master Switch
54. Shock Mount
55. Ground Strap

Figure 16-2. Instrument Panel (205 & 206 Series, and 210B & On)

and shock-mounted panels, which in turn are covered with decorative panels.

16-5. REMOVAL. The stationary instrument panel is secured to engine mount stringers and a forward fuselage bulkhead and ordinarily is not considered removable. The shock-mounted panel is secured to the stationary panel by rubber shock mount assemblies.

a. To remove the shock-mounted panel, release the clips securing the decorative panel by carefully prying under the buttons on the clips. Remove any control knobs or switches on the panel which would interfere, and pull off the cover. Remove the nuts from the shock mount screws, tag and disconnect the instrument plumbing and wiring, and pull the panel straight back. If it should become necessary to remove the shock-mounted panel and its decorative cover from the airplane, on models prior to 1962 the control wheel shaft and wheel must be removed first. This is done by removing the nuts and bolts securing the shaft to the control wheel universal on the control tee. On aircraft (1962 and on), the control wheel can be removed from the control shaft by removing securing screws, thereby permitting the shock panel to be taken off with the control shaft installed.

b. Where Lord shock mount assemblies are used, the bolts securing the panel to the shock mounts must be removed. Note the combination of bolts, washers, ground straps and spacers used on each mount for correct replacement when the panel is reinstalled.

16-6. ADDING EXTRA SHOCK MOUNTS. Service life of instruments is directly related to adequate shock-mounting of the panel. In some cases, particularly when additional instruments have been added in the field, the original shock-mounts are inadequate to support the increased weight of the panel. Installing additional shock mounts, when the instrument complement is increased, is a practical fix to prevent rapid deterioration of the mounts at the original locations.

16-7. INSTALLATION.

a. To install the shock-mounted panel, set it in place in the stationary panel, aligning the shock mounts with the holes in the panel, and install the nuts on the shock mount screws.

b. To install the shock-mounted panel where Lord shock mount assemblies are used, place the panel mounting screws and spacers in their proper positions, then position the panel, insert the screws in the mounts and install the nuts.

c. Replace the instruments and connect the wiring and plumbing. Position the decorative cover and press the retainer clips through the holes in the panel. A light coat of paraffin, beeswax or soap on the prongs of the retainer clips will make their insertion easier.

d. Install any previously removed control knobs and switches. If the control wheel and control shaft were previously removed for complete removal of the shock panel and decorative cover, insert the control wheel and shaft through the shock-mounted panel and connect it to the universal on the control tee. Reinstall the control wheel on the control shaft on aircraft (1962 and on).

16-8. INSTRUMENT REMOVAL. Most instruments are secured to the panel with screws inserted through the panel face, under the decorative cover. To remove an instrument, remove the decorative cover (if necessary), disconnect the plumbing or wiring to the instrument concerned, remove the retainer screws and take the instrument out from behind. Some instruments installed on the stationary panel can be removed if desired without removing the decorative cover; the mounting screws for these instruments have jam nuts so that the instrument retainer nuts may be removed and replaced without holding the screw heads. Other instruments on the stationary panel are circumscribed with escutcheons. Instrument mounting screws in the corners of the escutcheons are accessible on the face of the panel; the retainer nuts are accessible from behind the instrument panel. The decorative cover need not be removed to take out these instruments. The instrument cluster, containing fuel and oil gages, is installed as a unit, secured by a screw on each end of the cluster. The cluster must be removed from the panel to replace an individual gage.

NOTE

Beginning in 1965, 200-series aircraft are equipped with a zipper across the cowl deck pad to provide access to the back of the instrument panel.

In all cases when an instrument is removed, the lines or wires disconnected from it should be protected. Cap open lines and cover pressure connections on the instrument, to prevent thread damage and the entrance of foreign matter. Wire terminals should be insulated or tied up so they will not ground accidentally, or short-circuit on another terminal.

16-9. INSTRUMENT INSTALLATION. Generally, installation procedure is the reverse of the removal procedure. Make sure mounting screw nuts are tightened firmly, but do not overtighten them, particularly on instruments having plastic cases. The same rule generally applies to connecting plumbing and wiring. If thread lubricant or sealer is used on plumbing, it should be applied sparingly and only on the male threads. When replacing an electrical gage in an instrument cluster assembly avoid bending the pointer or dial plate. Distortion of the dial or back plate could change calibration of the gages.

16-10. PITOT AND STATIC SYSTEMS.

16-11. The pitot and static systems are systems of plastic tubing which convey ram air pressure and atmospheric pressure to the airspeed and vertical speed indicators and the altimeter.

NOTE

Some pitot and static lines in models prior to the Model 210A were of metal tubing.

Ram pressure is picked up by the pitot tube, and transferred through tubing to the airspeed indicator. Atmospheric pressure for the airspeed and vertical speed indicators and altimeter is furnished by static pressure ports (see figure 16-15). An alternate static source (1965 and on), may be installed as optional equipment to be used in emergencies. When used as a static source, cabin pressure is substituted for atmospheric pressure, causing instrument readings to vary from normal. Refer to Owner's Manual for flight operation using alternate static source pressure. A pitot tube heater and stall warning heater may be installed as optional equipment. The heating element is controlled by a switch at the instrument panel and powered by the electrical system. Several variations of pitot and static line plumbing have been used in factory installation to accommodate optional instrumentations and other variations have been made in the field while making custom installations. The servicing and maintenance procedures given here will apply in general to all of these variations.

16-12. TROUBLE SHOOTING -- PITOT-STATIC SYSTEM.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
LOW OR SLUGGISH AIRSPEED INDICATION.		
Normal altimeter and vertical speed - Pitot tube obstructed, leak or obstruction in pitot line.	Test pitot tube and line for leaks or obstructions.	Blow out tube and line, repair or replace damaged line.
INCORRECT OR SLUGGISH RESPONSE.		
All three instruments - leaks or obstruction in static line.	Test line for leaks and obstructions.	Repair or replace line, blow out obstructed line.
Alternate static source valve open.	Check visually.	Close for normal operation.

16-13. TROUBLE SHOOTING -- AIRSPEED INDICATOR.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
HAND FAILS TO RESPOND.		
Pitot pressure line not properly connected to airspeed indicator connection.	Test line and connection for leaks.	Repair or replace damaged line, tighten connections.
Pitot or static lines clogged.	Check lines for obstructions.	Blow out lines.
INCORRECT INDICATION OR HAND OSCILLATES.		
Leak in pitot or static lines.	Test lines and connections for leaks.	Repair or replace damaged lines, tighten connections.
Defective mechanism.	Substitute known-good indicator and check reading.	Replace instrument.
Leaking diaphragm.	Substitute known-good indicator and check reading.	Replace instrument.
Alternate static source valve open.	Check visually.	Close for normal operation.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
HAND VIBRATES.		
Excessive vibration.	Check panel shock mounts.	Replace defective shock mounts.
Excessive tubing vibration.	Check clamps and line connections for security.	Tighten clamps and connections, replace tubing with flexible hose.

16-14. TROUBLE SHOOTING -- ALTIMETER.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
INSTRUMENT FAILS TO OPERATE.		
Static line plugged.	Check line for obstructions.	Blow out line.
Defective mechanism.	Substitute known-good altimeter and check reading.	Replace instrument.
INCORRECT INDICATION.		
Hands not carefully set.	Reset hands with knob.	
Leaking diaphragm.	Substitute known-good altimeter and check reading.	Replace instrument.
Pointers out of calibration.	Compare reading with known-good altimeter.	Recalibrate.
HAND OSCILLATES.		
Static pressure irregular.	Check line for obstructions or leaks.	Blow out line, tighten connections.
Leak in Airspeed or Vertical Speed Indicator installations.	Check other instruments and system plumbing for leaks and obstructions.	Blow out lines, tighten connections.

16-15. TROUBLE SHOOTING -- VERTICAL SPEED INDICATOR.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
INSTRUMENT FAILS TO OPERATE.		
Static line plugged.	Check line for obstructions.	Blow out line.
Static line broken.	Check line for damage, connections for security.	Repair or replace damaged line, tighten connections.
INCORRECT INDICATION.		
Partially plugged static line.	Check line for obstructions.	Blow out line.
Ruptured diaphragm.	Substitute known-good indicator and check reading.	Replace instrument.
Pointer off zero.	Reset pointer to zero.	

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
HAND VIBRATES.		
Excessive vibration.	Check panel shock mounts.	Replace defective shock mounts.
Defective diaphragm.	Substitute known-good indicator and check for vibration.	Replace instrument.
POINTER OSCILLATES.		
Partially plugged static line.	Check line for obstructions.	Blow out line.
Leak in static line.	Test line and connections for leaks.	Repair or replace damaged line, tighten connections.
Leak in instrument case.	Substitute known-good indicator and check reading.	Replace instrument.

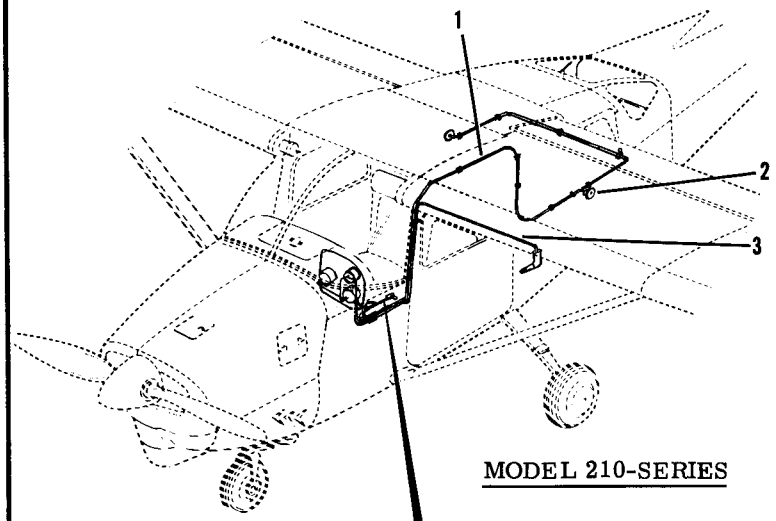
16-16. TROUBLE SHOOTING -- PITOT TUBE HEATER.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
TUBE DOES NOT HEAT OR CLEAR ICE.		
Switch turned "OFF."	Turn switch "ON."	
Circuit breaker out.	Check circuit breaker.	Reset circuit breaker.
Break in wiring.	Test for open circuit.	Repair wiring.
Heating element burned out.	Check resistance of heating element.	Replace element.

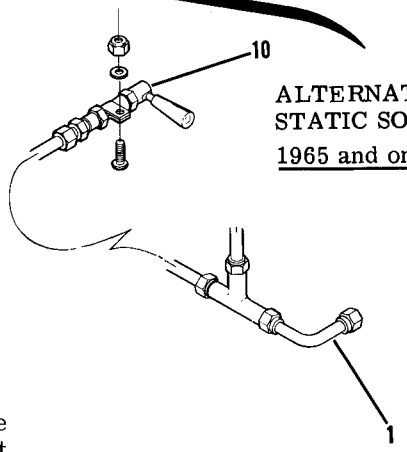
SHOP NOTES:

NOTE

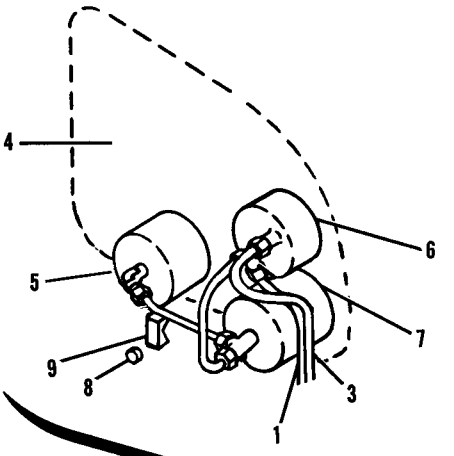
The pitot-static systems shown are similar in that the static ports are mounted aft, although plumbing and exact locations of the static ports vary with the model and the date of manufacture. Components at the shock-mounted instrument panel (with minor variations) generally apply to all 200-series aircraft.



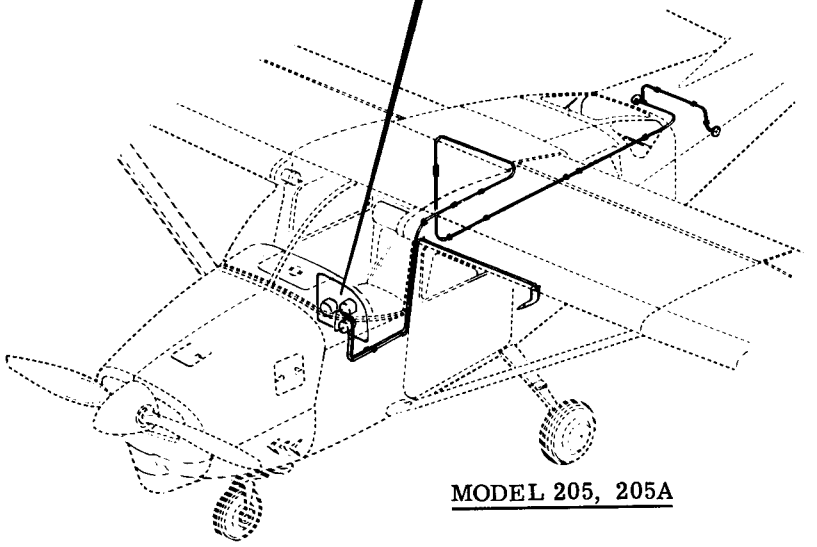
MODEL 210-SERIES



ALTERNATE
STATIC SOURCE
1965 and on

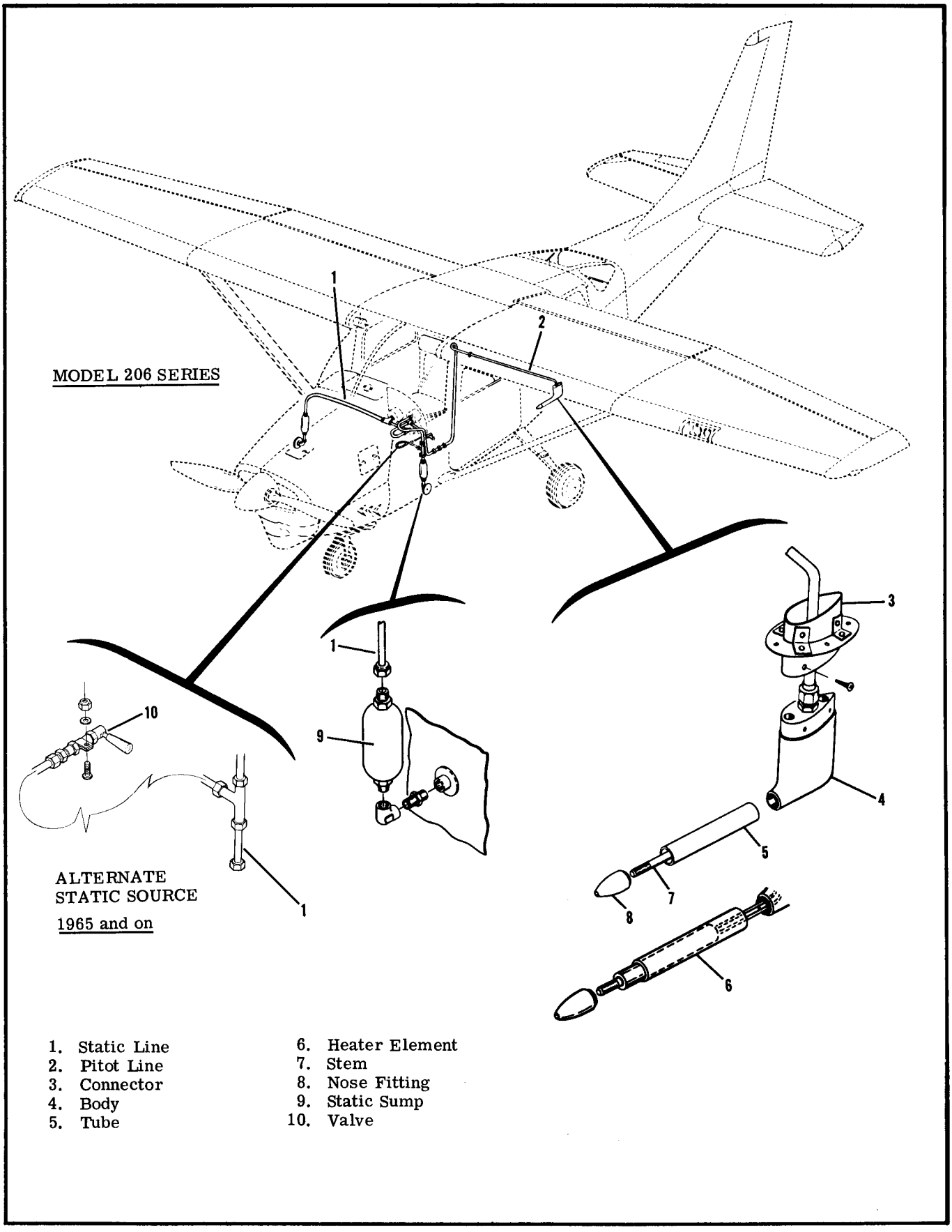


1. Static Line
2. Static Port
3. Pitot Line
4. Shock-Mounted Instrument Panel
5. Vertical Speed Indicator
6. Airspeed Indicator
7. Altimeter
8. Circuit Breaker (Pitot Heat)
9. Switch (Pitot Heat)
10. Valve



MODEL 205, 205A

Figure 16-3. Pitot-Static Systems (Sheet 1 of 2)



1. Static Line
2. Pitot Line
3. Connector
4. Body
5. Tube
6. Heater Element
7. Stem
8. Nose Fitting
9. Static Sump
10. Valve

Figure 16-3. Pitot-Static Systems (Sheet 2 of 2)

16-17. PITOT AND STATIC SYSTEM MAINTENANCE. Proper maintenance of the pitot and static system is essential for the proper operation of the altimeter, and vertical speed and airspeed indicators. Leaks, moisture and obstructions in the pitot system will result in false airspeed indications, while static system malfunctions will affect the readings of all three instruments. Under instrument flight conditions, these instrument errors could be hazardous. Cleanliness and security are the principal rules for pitot and static pressure system maintenance. Both the pitot tube and the static ports must be kept clean and unobstructed.

16-18. CHECKING FOR LEAKS. To check the pitot system for leaks, fasten a piece of rubber or plastic tubing over the pitot tube, close the opposite end of the tubing and slowly roll up the tube until the airspeed indicator registers in the cruise range. Secure the tube and after a few minutes recheck the airspeed indicator. Any leakage will have reduced the pressure in the system, resulting in a lower airspeed indication. Slowly unroll the tubing before removing it, so the pressure is reduced gradually. Otherwise the instrument may be damaged. If the test reveals a leak in the system, check all connections for tightness.

16-19. BLOWING OUT PITOT AND STATIC LINES. Although the pitot system is designed to drain down to the pitot tube opening, condensation may collect at other points in the system and produce a partial obstruction. To clear the line, disconnect it at the airspeed indicator and, using low pressure air, blow from the indicator end of the line toward the pitot tube.

CAUTION

Never blow through pitot or static lines toward the instruments. Doing so may damage them.

Like the pitot lines, the static pressure lines must be kept clear and the connections tight. When necessary, disconnect the static line at the first instrument to which it is connected, then blow the line clear with low-pressure air.

NOTE

On aircraft equipped with alternate static source (1965 and on), use the same procedure, opening alternate static source valve momentarily to clear its line, then close valve and clear remainder of the system.

16-20. REMOVAL OF PITOT AND STATIC PRESSURE SYSTEM. To remove the pitot mast, remove the four mounting screws on the side of the attaching connector and pull the mast out of the connector far enough to disconnect the pitot line. Electrical connections to the heater assembly (if installed) may be disconnected through the wing access opening just inboard of the mast. The pitot and static lines are removed in the usual manner, after removing the wing access openings, decorative cover over the left doorpost and left forward upholstery panel. If it is necessary to remove all static system plumbing, the cabin left sidewall upholstery and left side of headliner must be loosened for access to the static line in these areas. The static pressure port connections are accessible through the main gear wheel wells (Model 210-series only). Reinstallation of the pitot line in the wing will be simpler if a guide wire is drawn in as the line is removed from the wing.

16-21. REPLACEMENT OF PITOT AND STATIC PRESSURE SYSTEM. When replacing components of the pitot and static pressure systems, use antiseize compound sparingly on the male threads on both metal and plastic connections. Avoid excess compound which might enter the lines. Tighten connections firmly, but avoid overtightening and distorting the fittings. If twisting of plastic tubing is encountered when tightening the fittings, VV-P-236 or USP Petrolatum may be applied sparingly between the tubing and fittings.

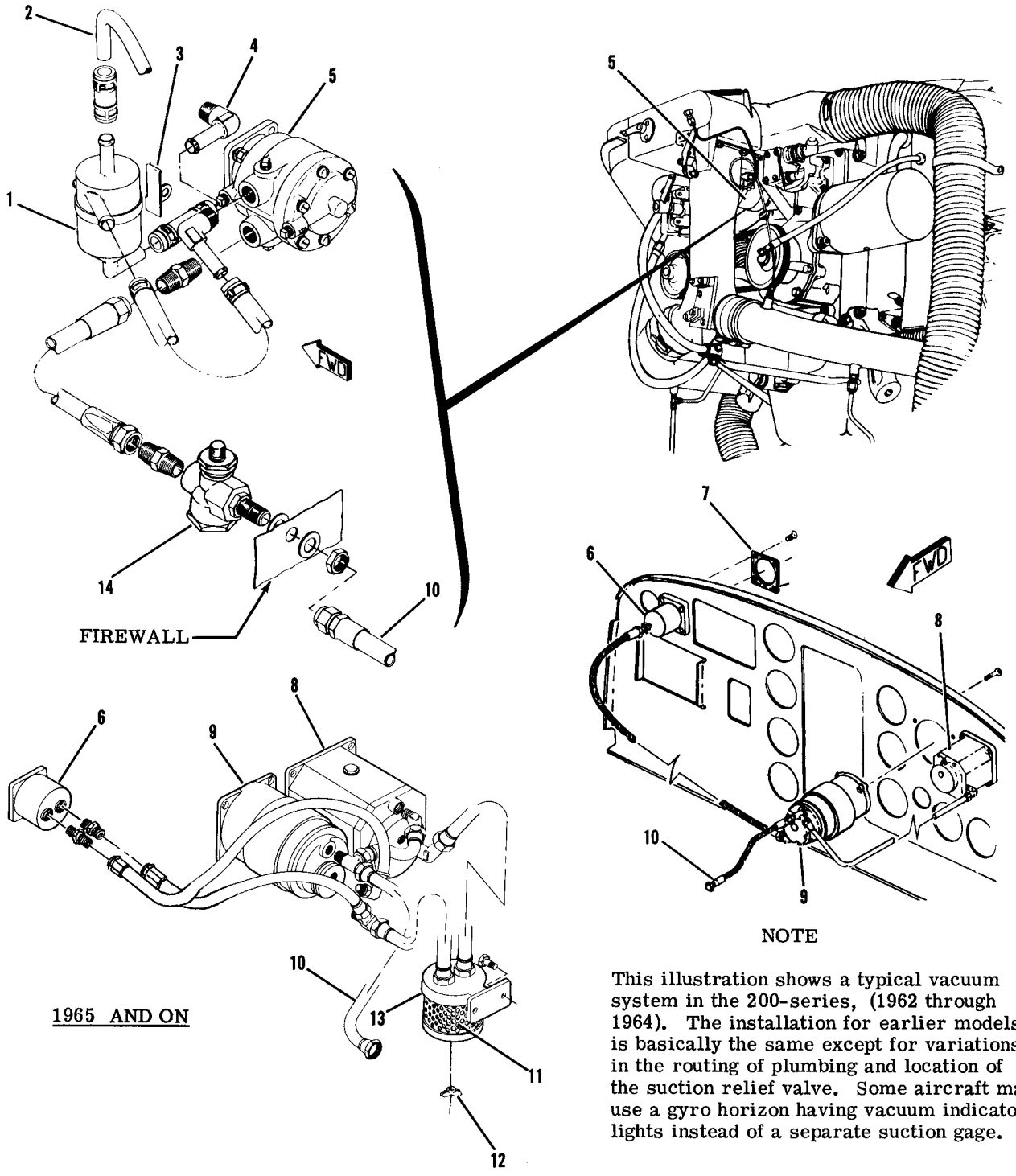
16-22. VACUUM SYSTEM.

16-23. Suction to operate the directional gyro and gyro horizon instruments is provided by an engine-driven vacuum pump mounted on the engine accessory section. The pump is gear-driven through a spline-type coupling. The vacuum pump discharge is through an oil separator, where the oil, which passes through the pump and lubricates it, is returned to the engine sump and the air is expelled overboard. A suction relief valve, to control system pressure, is connected between the pump inlet and the firewall fitting.

NOTE

Prior to the 210B the suction valve was coupled, by means of a nipple, directly to the vacuum pump; on the 200-series (1962 and on) the relief valve is mounted adjacent to the firewall.

In the cabin, the vacuum line runs from the gyro instruments to a relief valve at the firewall. A suction gage indicates suction at the gyro instruments. A central air filtering system is utilized in all vacuum systems beginning in 1965. The reading of the suction gage in the central filter system indicates net difference in suction before and after air passes through a gyro. This differential pressure will gradually decrease as the central filter becomes dirty, causing a lower reading on the suction gage. Prior to 1965 the pictorial gyros are equipped with warning lights to indicate abnormal suction, and do not utilize a suction gage. A test switch provides a means of checking the lights.



NOTE

This illustration shows a typical vacuum system in the 200-series, (1962 through 1964). The installation for earlier models is basically the same except for variations in the routing of plumbing and location of the suction relief valve. Some aircraft may use a gyro horizon having vacuum indicator lights instead of a separate suction gage.

1. Oil Separator
2. Vent
3. Bracket
4. Oil Return (To Engine)
5. Vacuum Pump
6. Suction Gage
7. Escutcheon
8. Directional Gyro
9. Gyro Horizon
10. Hose
11. Filter Element
12. Wing Nut
13. Bracket
14. Relief Valve

Figure 16-4. Typical Vacuum System

16-24. TROUBLE SHOOTING -- VACUUM SYSTEM.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
HIGH SUCTION GAGE READINGS.		
Gyros function normally - Relief valve screen clogged, relief valve malfunction.	Check screen, then valve. Compare gage readings with new gage.	Clean screen, reset valve. Replace gage.
NORMAL SUCTION GAGE READING, SLUGGISH OR ERRATIC GYRO RESPONSE.		
Instrument air filters clogged. (Prior to 1965)	Check operation with filters removed.	Replace filters.
LOW SUCTION GAGE READINGS.		
Leaks or restriction between instruments and relief valve, relief valve out of adjustment, defective pump, restriction in oil separator or pump discharge line.	Check lines for leaks, check pump discharge volume, disconnect and test pump.	Repair or replace lines, adjust or replace relief valve, repair or replace pump, clean oil separator.
Central air filter dirty (1965 and on).	Check operation with filter removed.	Clean or replace filter.
SUCTION GAGE FLUCTUATES.		
Defective gage or sticking relief valve.	Check suction with test gage.	Replace gage. Clean sticking valve with Stoddard solvent. Blow dry and test. If valve sticks after cleaning, replace it.
OIL COMES OVER IN PUMP DISCHARGE LINE.		
Oil separator clogged, oil return line obstructed, excessive oil flow through pump.	Check oil separator, return line. Check that pump oil return rate does not exceed 120 cc/hour (approx. 8 drops/minute), at 50 psi oil pressure.	Clean oil separator in Stoddard solvent, blow dry. Blow out lines. If pump oil consumption is excessive, replace oil metering collar and pin in pump.

16-25. TROUBLE SHOOTING -- GYROS.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
HORIZON BAR FAILS TO RESPOND.		
Central or instrument air filters dirty.	Check filters.	Clean or replace filters.
Suction relief valve improperly adjusted.		Adjust or replace relief valve.
Faulty suction gage.	Substitute known-good suction gage and check gyro response.	Replace suction gage.
Vacuum pump failure.	Check pump.	Replace pump.
Vacuum line kinked or leaking.	Check lines for damage and leaks.	Repair or replace damaged lines, tighten connections.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
HORIZON BAR DOES NOT SETTLE.		
Defective mechanism.	Substitute known-good gyro and check indication.	Replace instrument.
Insufficient vacuum.		Adjust or replace relief valve.
Excessive vibration.	Check panel shock mounts.	Replace defective shock mounts.
HORIZON BAR OSCILLATES OR VIBRATES EXCESSIVELY.		
Central or instrument air filter dirty.	Check filters.	Clean or replace filters.
Suction relief valve improperly adjusted.		Adjust or replace relief valve.
Faulty suction gage.	Substitute known-good suction gage and check gyro indication.	Replace suction gage.
Defective mechanism.	Substitute known-good gyro and check indication.	Replace instrument.
Excessive vibration.	Check panel shock mounts.	Replace defective shock mounts.
EXCESSIVE DRIFT IN EITHER DIRECTION.		
Central or instrument air filter dirty.	Check filters.	Clean or replace filters.
Low vacuum, relief valve improperly adjusted.		Adjust or replace relief valve.
Faulty suction gage.	Substitute known-good suction gage and check gyro indication.	Replace suction gage.
Vacuum pump failure.	Check pump.	Replace pump.
Vacuum line kinked or leaking.	Check lines for damage and leaks.	Repair or replace damaged lines, tighten connections.
DIAL SPINS IN ONE DIRECTION CONTINUOUSLY.		
Operating limits have been exceeded.		Cage and reset when airplane is level.
Defective mechanism.	Substitute known-good gyro and check indication.	Replace instrument.

SHOP NOTES:

16-26. TROUBLE SHOOTING -- VACUUM PUMP.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
EXCESSIVE OIL IN DISCHARGE.		
Excessive flow to pump.	Check pump vent plugs.	Clean vent plugs.
Clogged oil separator.	Check separator for obstructions.	Clean separator.
Damaged engine drive seal.		Replace gasket.
HIGH SUCTION.		
Suction relief valve screen clogged.	Check screen for obstructions.	Clean or replace screen.
LOW SUCTION.		
Relief valve leaking.		Replace relief valve.
Vacuum pump failure.	Substitute known-good pump and check pump suction.	Replace vacuum pump.
LOW PRESSURE.		
Safety valve leaking.		Replace safety valve.
Vacuum pump failure.	Substitute known-good pump and check pump pressure.	Replace vacuum pump.

16-27. TROUBLE SHOOTING -- VACUUM SWITCH (TYPE 34B GYRO HORIZON).

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
FALSE INDICATION FROM "HI" AND "LO" VACUUM INDICATOR LIGHTS.		
Leakage of pressure through switch connection.	Check connection for security.	Tighten loose connection.
Leaking switch diaphragm.		Replace switch.
Bent or loose contacts.		Replace switch.
INDICATOR LIGHT FAILURE.		
Diaphragm does not return to normal position.		Replace switch.
Loose electrical connections.	Check all connections for security.	Tighten all connections.
Worn or corroded switch contact points.		Replace switch.
Bulb burned out.	Test lights with vacuum lights test switch.	Install new bulb.

16-28. REMOVAL OF VACUUM SYSTEM. The various components of the vacuum system are secured by conventional clamps, mounting screws and nuts. To remove a component, remove the mounting screws, nuts, or clamps and disconnect lines.

16-29. REPLACEMENT OF VACUUM SYSTEM. When replacing a vacuum system component, make sure connections are made correctly. Use thread lubricant sparingly and only on male threads. Avoid overtightening connections. Before reinstalling a vacuum pump, probe the oil passages in the pump and engine, to make sure they are open. Place the mounting pad gasket in position over the studs and make sure it does not block the oil passages. Coat the pump drive splines lightly with a high-temperature grease such as Dow Silicone # 30 (Dow-Corning Co., Midland, Mich.). After installing the pump, before connecting the plumbing, start the engine and hold a piece of paper over the pump discharge to check for proper lubrication. Proper oil flow thru the pump is one to four fluid ounces per hour.

16-30. CLEANING OF VACUUM SYSTEM. In general, low-pressure, dry compressed air should be used in cleaning vacuum system components removed from the airplane.

CAUTION

Never apply compressed air to lines or components installed in the airplane. The excessive pressures will damage the gyro instruments. If an obstructed line is to be blown out, disconnect it at both ends and blow from the instrument panel out.

Components such as the oil separator and suction relief valve which are exposed to engine oil and dirt should be washed with Stoddard solvent, then dried with a low-pressure air blast. Check hoses for collapsed inner liners as well as external damage.

16-31. SUCTION GAGE READINGS. A suction of 5.3 inches of mercury is desirable for gyro instruments. However, a range of 5.2 to 5.4 inches of mercury in normal cruising flight is considered acceptable. Run engine to 1900 rpm on ground, and set relief valve to obtain 5.2 inches of mercury on the suction gage. Readjust after flight test if acceptable range is exceeded. If no suction gage is used, adjust the relief valve until the "LO VAC" indicator light goes out, count the number of turns required to make the "HI VAC" indicator light illuminate, then adjust the relief valve back one half the number of turns noted. The indicator lights warn of high or low vacuum when illuminated; both are out when vacuum is within permissible limits.

NOTE

On aircraft equipped with a central air filter (1965 and on), remove filter element and make adjustments. Be sure filter element is clean before installing. If reading drops noticeably, install new filter element.

16-32. ENGINE INDICATORS.

16-33. TACHOMETER. The tachometers used on 200-series aircraft are mechanical indicators driven at half crankshaft speed by flexible shafts. Most tachometer difficulties will be found in the driveshaft. To function properly, the shaft housing must be free of kinks, dents and sharp bends. There should be no bend on a radius shorter than six inches, and no bend within three inches of either terminal. If a tachometer is noisy or the pointer oscillates, check the cable housing for kinks, sharp bends and damage. Disconnect the cable at the tachometer and pull it out of the housing. Check the cable for worn spots, breaks and kinks.

NOTE

A kink may be detected by holding the cable vertically by one end and slowly rotating it between the fingers to feel for binding and jumpy motion.

Before replacing a tachometer cable in the housing, coat the lower two thirds with AC Type ST-640 Speedometer cable grease or Lubriplate No. 110. Insert the cable in the housing as far as possible, then slowly rotate it to make sure it is seated in the engine fitting. Insert the cable in the tachometer, making sure it is seated in the drive shaft, and reconnect the housing.

16-34. MANIFOLD PRESSURE GAGE. The manifold pressure gage is a barometric instrument which indicates the absolute pressure in the intake manifold in inches of mercury; thus, with the engine stopped or at sudden full throttle and maximum rpm, it will register approximately the ambient barometric pressure.

SHOP NOTES:

16-35. TROUBLE SHOOTING -- MANIFOLD PRESSURE GAGE.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
EXCESSIVE ERROR AT EXISTING BAROMETRIC PRESSURE.		
Pointer shifted.		Replace instrument.
Leak in vacuum bellows.		Replace instrument.
Loose pointer.		Replace instrument.
Leak in pressure line.	Test line and connections for leaks.	Repair or replace damaged line, tighten connections.
Condensate or fuel in line.	Check line for obstructions.	Blow out line.
JERKY MOVEMENT OF POINTER.		
Excessive internal friction.		Replace instrument.
Rocker shaft screws tight.		Replace instrument.
Link springs too tight.		Replace instrument.
Dirty pivot bearings.		Replace instrument.
Defective mechanism.		Replace instrument.
Leak in pressure line.	Test line and connections for leaks.	Repair or replace damaged line, tighten connections.
SLUGGISH OPERATION OF POINTER.		
Foreign matter in line.	Check line for obstructions.	Blow out line.
Damping needle dirty.		Replace instrument.
Leak in pressure line.	Test line and connections for leaks.	Repair or replace damaged line, tighten connections.
EXCESSIVE POINTER VIBRATION.		
Tight rocker pivot bearings.		Replace instrument.
Excessive panel vibration.	Check panel shock mounts.	Replace defective shock mounts.
IMPROPER CALIBRATION.		
Faulty mechanism.		Replace instrument.
NO POINTER MOVEMENT.		
Faulty mechanism.		Replace instrument.
Broken pressure line.	Check line and connections for breaks.	Repair or replace damaged line.

16-36. FUEL PRESSURE GAGE/FLOW INDICATOR. A fuel pressure gage or fuel flow indicator is used with the Continental fuel injection system. On the Model 210, the gage is labeled "FUEL PRESSURE" and on the 205 and 206 series, and the 210A and on, the gage is labeled "FUEL FLOW." The fuel pressure gage indicates, in pounds per square inch, the pressure at which fuel is delivered to the injection nozzles. The fuel flow indicator is also a pressure gage, but is calibrated in gallons per hour. It indicates the approximate gallons per hour of fuel being metered to the engine. The pressure for operating the gage or indicator is obtained through a hose or line connected either to the fuel/air control unit or the fuel manifold valve. Beginning in 1965, 200-series aircraft have the fuel flow and manifold pressure gages combined in one instrument case; however, each instrument is serviced individually.

16-37. TROUBLE SHOOTING -- FUEL PRESSURE GAGE/FLOW INDICATOR.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
DOES NOT REGISTER.		
Pressure line clogged.	Check line for obstructions.	Blow out line.
Pressure line broken.	Check line for leaks and damage.	Repair or replace damaged line.
Fractured bellows or damaged mechanism.		Replace instrument.
Clogged snubber orifice.		Replace instrument.
Pointer loose on staff.		Replace instrument.
POINTER FAILS TO RETURN TO ZERO.		
Foreign matter in line.	Check line for obstructions.	Blow out line.
Clogged snubber orifice.		Replace instrument.
Damaged bellows or mechanism.		Replace instrument.
INCORRECT OR ERRATIC READING.		
Damaged or dirty mechanism.		Replace instrument.
Pointer bent, rubbing on dial or glass.		Replace instrument.
Leak or partial obstruction in pressure line.	Check line for obstructions or leaks.	Blow out dirty line, repair or tighten loose connections.

SHOP NOTES:

16-38. CYLINDER HEAD TEMPERATURE GAGE. On the 200-series, a temperature bulb regulates power to the electrical system powered cylinder head temperature gage. The gage and bulb require little or no maintenance other than cleaning, making sure the lead is properly supported, and all connections are clean, tight and properly insulated.

16-39. TROUBLE SHOOTING -- CYLINDER HEAD TEMPERATURE GAGE.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
GAGE INOPERATIVE.		
No current to circuit.	Check circuit breaker, electrical circuit to gage.	Repair electrical circuit.
Defective gage, bulb or circuit.	Isolate with ohmmeter check of circuits.	Repair or replace defective item.
GAGE FLUCTUATES RAPIDLY.		
Loose or broken wire permitting alternate make and break of gage current.	Inspect circuit wiring.	Repair or replace defective wire.
GAGE READS TOO HIGH ON SCALE.		
High voltage.		Check "A" terminal.
Gage off calibration.		Replace instrument.
GAGE READS TOO LOW ON SCALE.		
Low voltage.		Check voltage supply and "D" terminal.
Gage off calibration.		Replace instrument.
GAGE READS OFF SCALE AT HIGH END.		
Break in bulb.		Replace instrument.
Break in bulb leads.		Replace instrument.
Internal break in gage.		Replace instrument.
OBVIOUSLY INCORRECT READING.		
Defective gage mechanism.		Replace instrument.
Incorrect calibration.		Replace instrument.

SHOP NOTES:

16-40. OIL PRESSURE GAGE. The Bourdon-type oil pressure gage on the 200-series is a direct-reading gage, operated by a pressure pickup line connected to the engine main oil gallery.

16-41. TROUBLE SHOOTING -- OIL PRESSURE GAGE.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
GAGE DOES NOT REGISTER.		
Pressure line clogged.	Check line for obstructions.	Clean line.
Pressure line broken.	Check line for leaks and damage.	Repair or replace damaged line.
Fractured Bourdon tube.		Replace instrument.
Gage pointer loose on staff.		Replace instrument.
Damaged gage movement.		Replace instrument.
GAGE POINTER FAILS TO RETURN TO ZERO.		
Foreign matter in line.	Check line for obstructions.	Clean line.
Foreign matter in Bourdon tube.		Replace instrument.
Bourdon tube stretched.		Replace instrument.
GAGE DOES NOT REGISTER PROPERLY.		
Faulty mechanism.		Replace instrument.
GAGE HAS ERRATIC OPERATION.		
Worn or bent movement.		Replace instrument.
Foreign matter in Bourdon tube.		Replace instrument.
Dirty or corroded movement.		Replace instrument.
Pointer bent and rubbing on dial, dial screw or glass.		Replace instrument.
Leak in pressure line.	Check line for leaks and damage.	Repair or replace damaged line.

16-42. OIL TEMPERATURE GAGE. The oil temperature gage is a Bourdon-type pressure instrument connected by armored capillary tubing to a temperature bulb in the engine. The temperature bulb, capillary tube, and gage are filled with fluid and sealed. Expansion and contraction of the fluid in the bulb with temperature changes operates the gage. Checking the capillary tube for damage and fittings for security is the only maintenance required. Since the tube's inside diameter is quite small, small dents and kinks which would be quite acceptable in larger tubing may partially or completely close off the capillary, making the gage inoperative.

16-43. FUEL QUANTITY INDICATORS. Two types of electric fuel quantity indicators have been used in Model 210 aircraft, the thermal type (210 and 210A) and the magnetic type (200-series 1962 and on).

NOTE

In the thermal type indicator, operation depends upon heating and cooling of a bimetal

strip. Therefore, after the master switch is turned on, a warming period is required before the indicator needle will arrive at the fuel level reading. Also, the needle will require several seconds to readjust itself to the reading after any abrupt change in flight attitude of the airplane. In the magnetic type indicator, fuel level indication is instantaneous.

The fuel quantity indicators are used in conjunction with float-operated variable-resistance transmitters in the fuel tanks. The tank-full position of the transmitter float produces a minimum resistance through the transmitter, permitting maximum current flow through the fuel quantity indicator and maximum pointer deflection. As the fuel level of the tank is lowered, resistance in the transmitter is increased, producing a decreased current flow through the fuel quantity indicator and a smaller pointer deflection.

16-44. TROUBLE SHOOTING -- FUEL QUANTITY INDICATORS.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
FAILURE TO INDICATE.		
No power to indicator or transmitter. (Pointer stays below E)	Check circuit breaker, inspect for open circuit.	Reset breaker, repair or replace defective wire.
Grounded wire. (Pointer stays above F)	Check for partial ground between transmitter and gage.	Repair or replace defective wire.
Low voltage.	Check voltage at indicator.	Correct voltage.
Defective indicator.	Substitute known-good indicator.	Replace indicator.
OFF CALIBRATION.		
Defective indicator.	Substitute known-good indicator.	Replace indicator.
Defective transmitter.	Check internal resistance of transmitter.	Recalibrate or replace.
Low or high voltage.	Check voltage at indicator.	Correct voltage.
STICKY OR SLUGGISH INDICATOR OPERATION.		
Defective indicator.	Substitute known-good indicator.	Replace indicator.
Low voltage.	Check voltage at indicator.	Correct voltage.
ERRATIC READINGS.		
Loose or broken wiring on indicator or transmitter.	Inspect circuit wiring.	Repair or replace defective wire.
Defective indicator or transmitter.	Substitute known-good indicator or transmitter.	Replace indicator or transmitter.
Defective master switch.		Replace switch.

16-45. FUEL QUANTITY TRANSMITTER CALIBRATION. While the chance of transmitter calibration change during normal service is remote, it is possible to bend the float arm or stops while the transmitter is out of the tank, changing its calibration. A calibration check, therefore, is advis-

able before the transmitter is installed. Float travel is limited by the float arm stops. Before installing a transmitter in a tank, attach the electrical wires to transmitter and place master switch in the ON position. Allow float arm to rest against the lower float arm stop and read fuel quantity indicator. The pointer should be on E (empty) position. Adjust lower float arm stop with float arm against stop so that pointer indicator is on E (empty). Raise float until float arm is against the upper stop and adjust stop to permit fuel quantity indicator pointer to be on F (full).

16-46. WING FLAP POSITION INDICATOR.

16-47. The wing flap position indicator used on 200-series aircraft is an electrical instrument, and indicates flap position, in 10-degree increments, from zero to 40 degrees. For trouble shooting of the flap position indicating system, refer to Section 7.

16-48. WING FLAP POSITION TRANSMITTER. The wing flap position transmitter is located in the left wing (210-series prior to 1964), in the right wing in the 200-series, (1964 and on). It is controlled by mechanical linkage and delivers an electrical signal to the flap position indicator.

16-49. MAGNETIC COMPASS.

16-50. The magnetic compass used in 200-series aircraft is liquid-filled, with expansion provisions to compensate for temperature changes. It is equipped with compensating magnets adjustable from the front of the case. The compass is individually lighted by a GE No. 330 lamp inside the compass case, controlled by the instrument lights rheostat switch. No maintenance is required on the compass except an occasional check on a compass rose with adjustment of the compensation, if necessary, and replacement of the lamp.

16-51. STALL WARNING HORN AND TRANSMITTER.

16-52. The stall warning horn is mounted on the map compartment. It is electrically operated, and is controlled by a stall warning transmitter mounted on the leading edge of the left wing. For further discussion of the warning horn and transmitter, refer to Section 17.

16-53. ELECTRIC CLOCK.

16-54. Most 200-series aircraft are equipped with an electric clock which operates on 12 volts and requires a one amp fuse. The fuse holder is located adjacent to the battery box. The clock's electrical circuit is separate from the aircraft's electrical system, and will operate when the master switch is "OFF."

NOTE

Some early electric clocks are equipped with a two amp fuse. A one amp fuse is recommended for replacement and adequate protection.

16-55. TURN-AND-BANK INDICATOR.

16-56. The turn-and-bank indicator used in 200-series aircraft is an electrically operated instrument. It is powered by the aircraft electrical system, and therefore, operates only when the master switch is on. Its electrical circuit is protected by an automatically resetting circuit breaker.

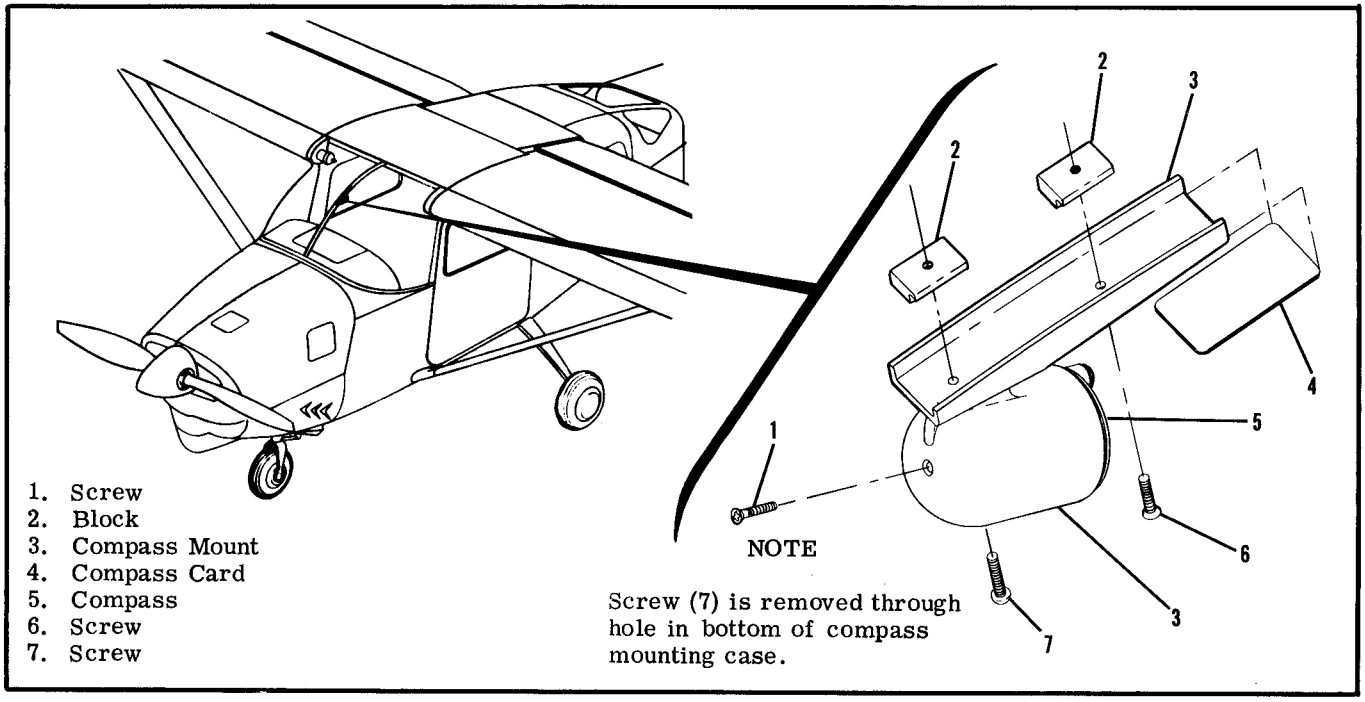


Figure 16-5. Magnetic Compass

16-57. TROUBLE SHOOTING -- TURN-AND-BANK INDICATOR.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
INDICATOR POINTER FAILS TO RESPOND.		
Automatic resetting circuit breaker defective.	Check circuit breaker.	Replace circuit breaker.
Master switch "OFF" or switch defective.	Check switch "ON."	Replace defective switch.
Broken or grounded lead to indicator.	Check circuit wiring.	Repair or replace defective wiring.
Indicator not grounded.	Check ground wire.	Repair or replace defective wire.
Defective mechanism.		Replace instrument.
HAND SLUGGISH IN RETURNING TO ZERO.		
Defective mechanism.		Replace instrument.
Low voltage.	Check voltage at indicator.	Correct voltage.
POINTER DOES NOT INDICATE PROPER TURN.		
Defective mechanism.		Replace instrument.
HAND DOES NOT SIT ON ZERO.		
Gimbal and rotor out of balance.		Replace instrument.
Hand incorrectly sits on rod.		Replace instrument.
Sensitivity spring adjustment pulls hand off zero.		Replace instrument.
IN COLD TEMPERATURES, HAND FAILS TO RESPOND OR IS SLUGGISH.		
Oil in indicator becomes too thick.		Replace instrument.
Insufficient bearing end play.		Replace instrument.
Low voltage.	Check voltage at indicator.	Correct voltage.
NOISY GYRO.		
High voltage.	Check voltage at indicator.	Correct voltage.
Loose or defective rotor bearings.		Replace instrument.

16-58. CESSNA ECONOMY POWER INDICATOR (optional) is an exhaust gas temperature (EGT) sensing device which is used to aid the pilot in selecting the most desirable fuel-air mixture for cruising flight at less than 75% power. Exhaust gas temperature (EGT) varies with the ratio of fuel-to-air mixture entering the engine cylinders. See appropriate airplane Owner's Manual for operating procedures of system.

16-59. TROUBLE SHOOTING.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
GAGE INOPERATIVE.		
Defective gage, probe or circuit.	Isolate with ohmmeter check of circuit.	Repair or replace defective part.
INCORRECT READING.		
Indicator needs calibrating.	See paragraph 16-60.	See paragraph 16-60.
FLUCTUATING READING.		
Loose, frayed, or broken lead, permitting alternate make and break of current.	Check for defective circuit.	Tighten connections, and repair or replace defective leads.

16-60. CALIBRATION. The adjustment knob located on the face of the instrument is used to position the pointer over the reference increment line (4/5 of scale) at peak EGT with 65% cruise power.

NOTE

This setting will provide relative temperature indications for normal cruise power settings within the range of the instrument.

Rotation of the knob will adjust the pointer three small divisions up or down (±75°F). The knob operates a cam and may be rotated either direction through 360°, without damage to the instrument. If further calibration is required to place the pointer over the reference line at peak EGT with 65% power, remove the instrument from the panel and use the small adjustment screw located in the hole at the one o'clock position on the back of the case. Turning the screw one complete turn counterclockwise increases the meter reading one small increment (25° F). Clockwise rotation of the screw decreases the meter reading. Rarely will adjustment of this nature be required after initial installation. The meter reading will change slightly with time because of lead deposit build-up on the probe. These deposits, however, will reach an equilibrium level and will result in a small drop in EGT indication, so that a small recalibration will be desirable. These lead deposits do not in any way affect the use of the indicator for mixture control or trouble detection.

16-61. REMOVAL AND INSTALLATION. Removal of the indicator is accomplished by removing the mounting screws and disconnecting leads. Tag the leads to facilitate installation. The thermocouple probe is secured to the exhaust stack with a clamp. The clamp should be tightened to 45 in-lb., and safetied as required.

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SECTION 17

ELECTRICAL SYSTEMS

NOTE

The electrical equipment for the 205 and 206 Series is identical to the Model 210 except where specifically noted.

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17-1. ELECTRICAL POWER SUPPLY SYSTEM.

17-2. Electrical energy for the aircraft is supplied by a 12-volt, direct-current, single-wire, negative ground electrical system. A single 12-volt battery supplies power for starting and furnishes a reserve source of power in the event of generator or alternator failure. An engine-driven generator or alternator is the normal source of power during flight and maintains a battery charge controlled by a voltage regulator. An external power source receptacle is offered as optional equipment to supplement the battery generator system for starting and ground operation.

17-3. BATTERY AND EXTERNAL POWER SYSTEM.

17-4. The battery and external power system consists of a battery, a battery solenoid, a master switch and an external power receptacle (optional equipment).

17-5. BATTERY. Three types of batteries have been used in the 210. All are 12-volt, and approximately 33 ampere-hour capacity. Some aircraft have the battery mounted under the floor of the baggage compartment. Other aircraft have the battery mounted under the floorboards below the pilot's seat. Current production models have the battery mounted on the right side of the firewall. The batteries differ in size, and require different boxes. All batteries are equipped with non-spill type filler caps.

17-6. BATTERY BOX. The battery is completely enclosed in a box which is painted with acid proof paint. The box has a vent tube which protrudes through the bottom of the aircraft allowing battery gases and spilled electrolyte to escape. The battery box is riveted to the airframe.

17-7. BATTERY SOLENOID. The battery solenoid is bolted to the battery box or to the firewall below the battery box. The solenoid is a plunger type contactor which is actuated by turning the master switch on. When the master switch is off, the battery is disconnected from the electrical system. A silicon diode has been added to all the late model aircraft to eliminate spiking of transistorized radio equipment. The large terminal of the diode connects to the battery terminal of the battery solenoid. The small terminal of the diode and the master switch wire connect to the minus terminal of the solenoid coil. See figure 17-1 for pictorial installation of the battery solenoid and diode.

17-8. MASTER SWITCH. The operation of the battery and generator systems is controlled by a master switch. The switch is either a push-pull or rocker type with double-pole, double-throw contacts. The switch, when operated, connects the battery solenoid coil and the generator field coil to ground, activating the power systems. The master switch is located on the stationary instrument panel.

17-9. GROUND SERVICE RECEPTACLE. The ground service receptacle has been installed in two locations on the left side of the cowl. A 12-volt battery cart or ground service generator may be used for starting or ground operation of the electrical systems for extended periods. Refer to figure 17-2 for exploded views of the receptacles.

17-10. TROUBLE SHOOTING THE BATTERY SYSTEM.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
BATTERY DOES NOT SUPPLY POWER TO BUS WHEN MASTER SWITCH IS ON.		
Dead battery.	Check specific gravity of electrolyte. Gravity reading should be at least 1.256 which indicates a 75% charge at normal temperature.	Replace or charge battery. Check charging rate of generator.
Defective master switch, battery solenoid or wiring.	Short the battery solenoid terminal that is wired to the master switch to ground. If the solenoid does not operate, check the jumper wire connecting the solenoid coil to the "hot" solenoid terminal.	Repair wiring. Check master switch. Replace solenoid.
Faulty battery cable.	Inspect the battery cables for good connection.	Replace cable. Clean and reconnect.
BATTERY SUPPLIES POWER TO BUS BUT WILL NOT CRANK ENGINE.		
Low battery.	Check specific gravity.	Charge battery.
Faulty battery cables.	Inspect for corrosion and poor connection.	Clean and reconnect.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
BATTERY SUPPLIES POWER TO BUS BUT WILL NOT CRANK ENGINE. (Cont)		
Battery cell shorting under load.	Test battery with a load tester.	Replace battery.
Defective starter contactor or solenoid.	Check operation of starter switch and solenoid.	Repair wiring. Replace switch. Replace Solenoid.
BATTERY USES EXCESSIVE AMOUNT OF WATER.		
Charging rate too high.	Test voltage regulator or try a new unit.	Adjust or replace regulator.
NOTE Voltage regulators are adjustable, however adjustment should not be attempted unless proper equipment is available. Refer to Delco-Remy service bulletins for instructions.		

17-11. REMOVAL AND REPLACEMENT OF BATTERY. (See figure 17-1.)

a. On models prior to 1961, the battery is located under the baggage compartment floorboard. To gain access to the battery, remove the baggage door scuff plate and loosen the baggage compartment carpet. On 1961 models, the battery is located beneath the floorboards under the pilot's seat. Remove the seat and loosen the carpet to gain access to the battery box. On 1962 models and on, the battery is located on the right side of the firewall. To gain access to the battery, remove the upper right half of the cowling.

b. Remove the battery box lid and disconnect the battery ground cable.

CAUTION

Always remove the ground cable first and connect it last to prevent accidentally shorting the battery to the airframe with tools.

c. Disconnect the positive cable from the battery and remove the battery from the aircraft.

d. To install a battery, reverse this procedure.

17-12. CLEANING THE BATTERY. For maximum efficiency, the battery and connections should be kept clean at all times.

a. Remove the battery in accordance with preceding paragraph.

b. Tighten battery cell filler caps to prevent the cleaning solution from entering the cells.

c. Wipe battery cable ends, battery terminals and entire surface of the battery with a clean cloth moistened with a solution of bicarbonate of soda (baking soda) and water.

d. Rinse with clear water, wipe off excess water and allow battery to dry.

e. Brighten up cable ends and battery terminals with emery cloth or a wire brush.

f. Coat the battery terminals and the cable ends with petroleum jelly.

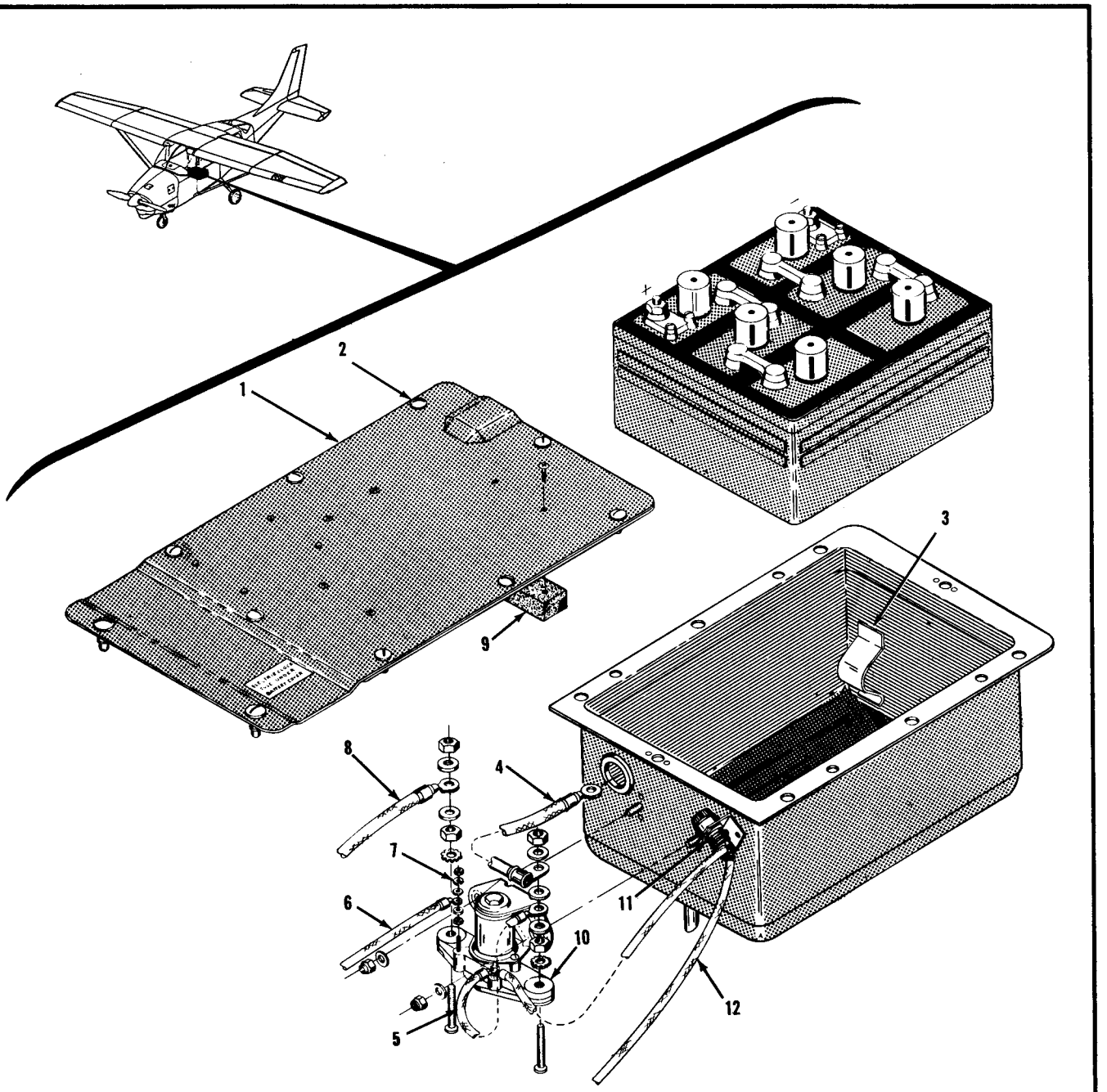
g. Install the battery according to the preceding paragraph.

17-13. ADDING ELECTROLYTE OR WATER TO THE BATTERY. A battery being charged and discharged with use will decompose the water from the electrolyte by electrolysis. When the water is decomposed, hydrogen and oxygen gases are formed which escape into the atmosphere through the battery vent system. The acid in the solution chemically combines with the plates of the battery during discharge or is suspended in the electrolyte solution during charge. Unless the electrolyte has been spilled from a battery, acid should not be added to the solution. The water will decompose into gases and should be replaced regularly. Add distilled water as necessary to maintain the electrolyte level even with the horizontal baffle plate inside the battery. When "dry charged" batteries are put into service, fill as directed with electrolyte. However, as the electrolyte level falls below normal with use add only distilled water to maintain the proper level. The battery electrolyte contains approximately 25% sulphuric acid by volume. Any change in this volume will hamper the proper operation of the battery.

CAUTION

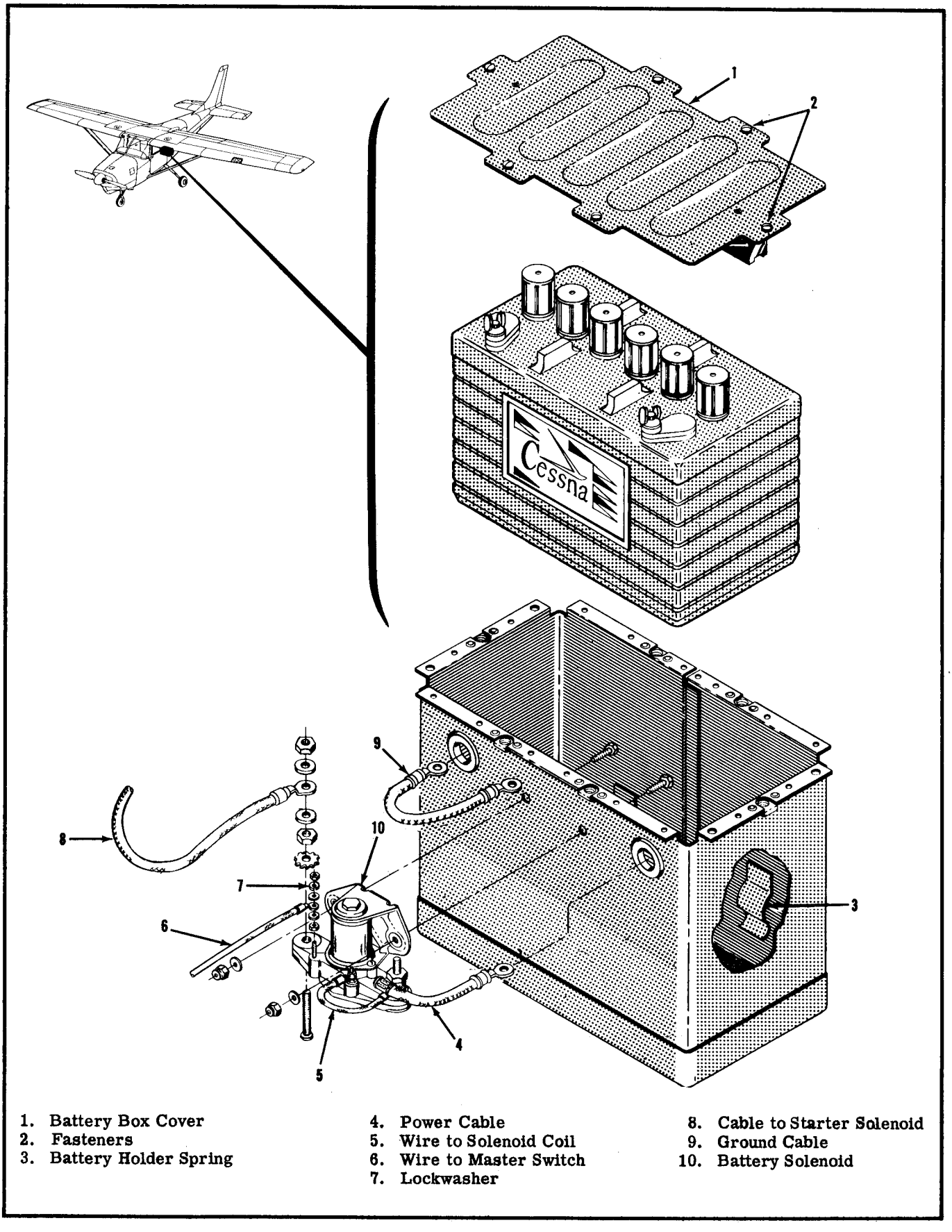
Do not add any type of "battery rejuvenator" to the electrolyte. When acid has been spilled from a battery, the acid balance may be adjusted by following instructions published by the Association of American Battery Manufacturers.

17-14. TESTING THE BATTERY. The specific gravity of the battery may be measured with a hydrometer to determine the state of battery charge. If the hydrometer reading is low, slow-charge the battery and retest. Hydrometer readings of the electrolyte must be compensated for the temperature of the electrolyte. Below is a chart showing percent of charge based on an electrolyte temperature of 80° Fahrenheit. Some battery hydrometers



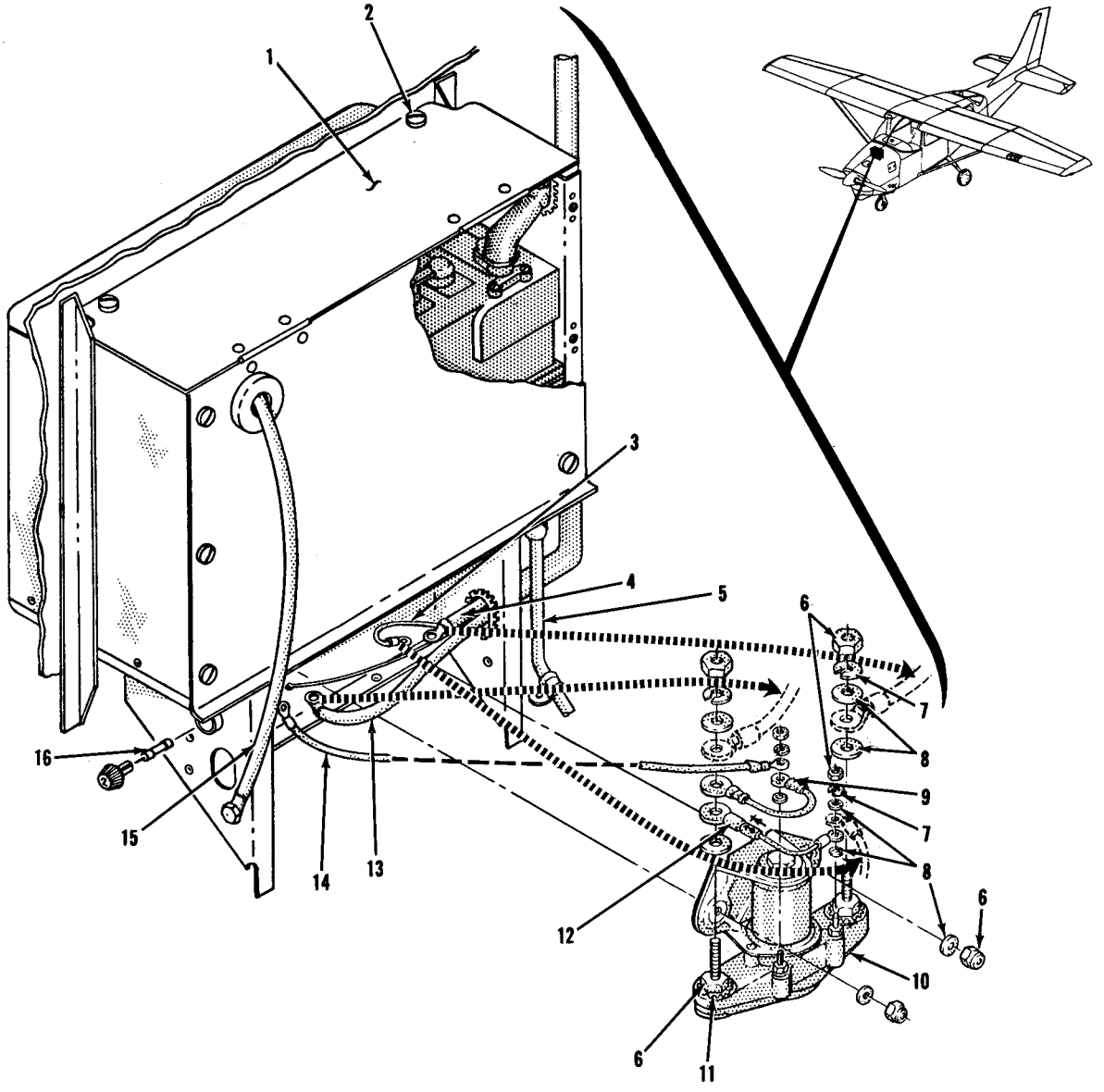
1. Battery Box Cover
2. Fasteners
3. Battery Holder Spring
4. Power Cable
5. Wire To Solenoid Coil
6. Wire to Master Switch
7. Lockwasher
8. Cable To Starter Solenoid
9. Spacer
10. Battery Solenoid
11. Clock Fuse
12. Wire To Clock

Figure 17-1. Battery Installation 1961 Only. (Sheet 1 of 3)



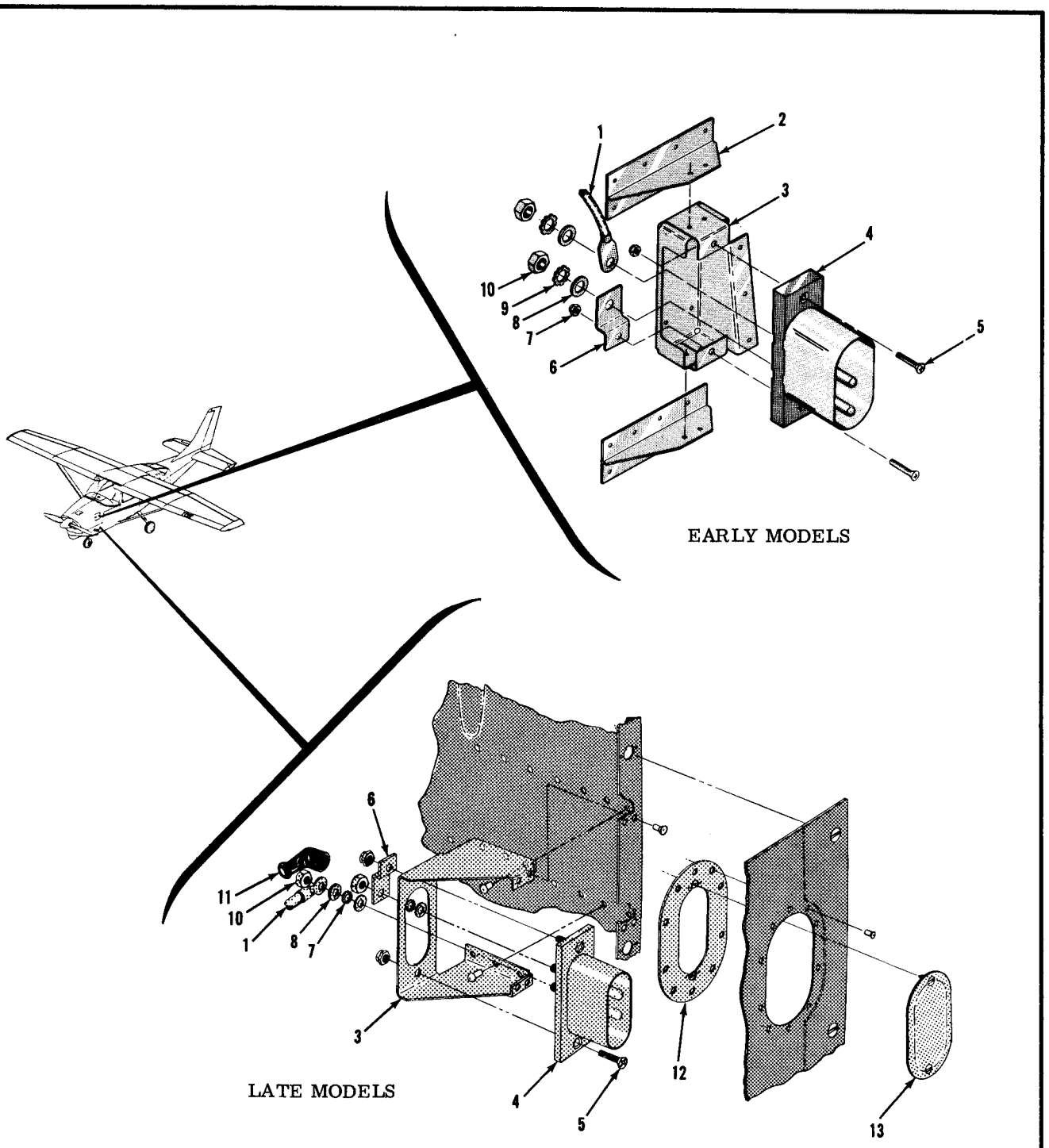
1. Battery Box Cover
2. Fasteners
3. Battery Holder Spring
4. Power Cable
5. Wire to Solenoid Coil
6. Wire to Master Switch
7. Lockwasher
8. Cable to Starter Solenoid
9. Ground Cable
10. Battery Solenoid

Figure 17-1. Battery Installation prior to 1961. (Sheet 2 of 3)



1. Battery Box Cover
2. Fasteners
3. Master Switch Wire
4. Cable to Starter Solenoid
5. Drain
6. Nut
7. Lockwasher
8. Washer
9. Jumper
10. Battery Solenoid
11. Star Washer
12. Diode Assy
13. Power Cable
14. Clock Fuse Wire
15. Ground Wire
16. Clock Fuse

Figure 17-1. Battery Installation 1962 and on. (Sheet 3 of 3)



1. Power Cable
2. Stiffener
3. Mounting Bracket
4. External Power Receptacle
5. Screw
6. Ground Strap
7. Locknut
8. Washer
9. Star Washer
10. Nut
11. Nipple
12. Doubler
13. Cover Plate

Figure 17-2. External Power Receptacle Installations

have a built in thermometer and conversion chart.

BATTERY HYDROMETER READINGS

1.280 Specific Gravity	100% Charged
1.250 Specific Gravity	75% Charged
1.220 Specific Gravity	50% Charged
1.190 Specific Gravity	25% Charged
1.160 Specific Gravity	Practically Dead

NOTE

All readings shown are for an electrolyte temperature of 80° Fahrenheit. For higher temperatures the readings will be slightly lower. For cooler temperatures the readings will be slightly higher.

17-15. CHARGING THE BATTERY. When the battery is to be charged, the level of electrolyte should be checked and adjusted by adding distilled water to cover the tops of the internal battery plates. The battery cables and connections should be clean.

CAUTION

When a battery is charging, hydrogen and oxygen gases are generated. Accumulation of these gases can create a hazardous explosive condition. Always keep sparks and open flame away from the battery. Allow unrestricted ventilation of the battery area during charging.

The main points of consideration during a battery charge are excessive battery temperature and violent gassing. Test the battery with a hydrometer to determine the amount of charge. Decrease or stop the battery charging temporarily if the battery temperature exceeds 125°F.

17-16. REMOVAL AND REPLACEMENT OF BATTERY BOX. (See figure 17-1.) The battery box is either riveted to the airframe or to the firewall. The rivets must be drilled out to remove the box. When a battery box is installed and riveted into place, all rivets and scratches inside the box should be painted with acid-proof lacquer such as Enmar Type TT-L-54.

17-17. MAINTENANCE OF BATTERY BOX. The battery box should be inspected and cleaned periodically. The box and cover should be cleaned with a strong solution of bicarbonate of soda (baking soda) and water. Hard deposits may be removed with a wire brush. When all corrosive deposits have been removed from the box, flush it thoroughly with clean water.

CAUTION

Do not allow acid deposits to come in contact with skin or clothing. Serious acid burns may result unless the affected area is washed immediately with soap and water. Clothing will be ruined upon contact with battery acid.

Inspect the cleaned box and cover for physical damage and for areas lacking proper acid proofing. A badly damaged or corroded box should be replaced. If the box or lid require acid proofing, paint the area with acid-proof black lacquer such as Enmar type TT-L-54.

17-18. REMOVAL AND REPLACEMENT OF BATTERY SOLENOID. (See figure 17-1.)

a. Open battery box and disconnect ground cable from negative battery terminal. Pull cable clear of battery box.

b. Remove the nut, lockwasher and the two plain washers securing the battery cables to the battery solenoid.

c. Remove the nut, lockwasher and the two plain washers securing the wire which is routed to the master switch.

d. Remove the bolt, washer and nut securing each side of the battery solenoid to either the battery case or the firewall. The solenoid will now be free for removal.

e. To replace solenoid, reverse this procedure.

17-19. REMOVAL AND REPLACEMENT OF GROUND SERVICE RECEPTACLE. (See figure 17-2.)

a. Open battery box and disconnect the ground cable from the negative terminal of the battery and pull the cable from the battery box.

b. Remove the nuts and washers from the studs of the receptacle and remove the battery cable.

c. Remove the screws and nuts holding the receptacle; ground strap will then be free from the bracket.

d. To install a ground service receptacle, reverse this procedure. Be sure to place the ground strap on the negative stud.

17-20. GENERATOR POWER SYSTEM.

17-21. The generator power system consists of the generator voltage regulator and circuit breaker. Operation of the generator system is controlled by the master switch which completes the generator field circuit and connects the battery to the aircraft bus. A 50-ampere system is now standard equipment. Some early aircraft were equipped with 35-ampere systems as standard.

17-22. GENERATOR. The generator is a two-brush, shunt wound type with negative ground. The generator output is controlled by the current passing thru the field winding of the generator. The field winding is connected to the armature circuit of the generator internally and must be grounded externally (by the regulator) for the generator to operate. The generator is driven by a V-belt from the engine and is blast-cooled through a tube extending to the rear engine baffle. The output is 14 volts at 35 or 50 amperes, depending upon the particular unit. Three electrical connections are required for the generator. Ground is provided thru the generator case and mounting brackets. The field terminal is connected through the master switch to the voltage regulator and the

armature terminal connects directly to the voltage regulator. On some aircraft a capacitor is attached to the armature terminal of the generator. The capacitor suppresses any radio interference which might be created by the generator.

17-23. VOLTAGE REGULATORS. The voltage regulator is a vibrating contact type containing three relays. The voltage and current limiting relays control the output of the generator according to the demand of the battery. This control of the generator is accomplished by changing the amount of field current flowing through the generator. The maximum current output of the generator is controlled by the current limiting relay. If the current output of the generator exceeds a preset amount the current limiting relay interrupts the generator field circuit, reducing the output by inserting a resistance into the field circuit. Similar conditions apply for generator output voltage control. When the generator is not producing, such as in an idle condition, it is necessary to disconnect the battery from the generator. If the generator is not disconnected during no output conditions the armature appears as a path to ground for the battery voltage. To prevent this loss of battery potential the cutout relay portion of the regulator disconnects the battery from the armature circuit when the charging voltage drops below a specified level and current begins to flow in a reverse direction. The operation of the voltage regulator controls the output of the generator with respect to certain preset maximum levels, however the regulator must be informed of the battery's condition to taper the charge and prevent overcharging. This information is supplied to the regulator by the battery counter-electromotive force on the regulator. The rate of charge is determined by the voltage limiting relay. The higher the battery's charge the higher the charging voltage must be and the more effect the voltage limiter will have on the charging rate. This reduces the charging rate as the battery comes up to charge.

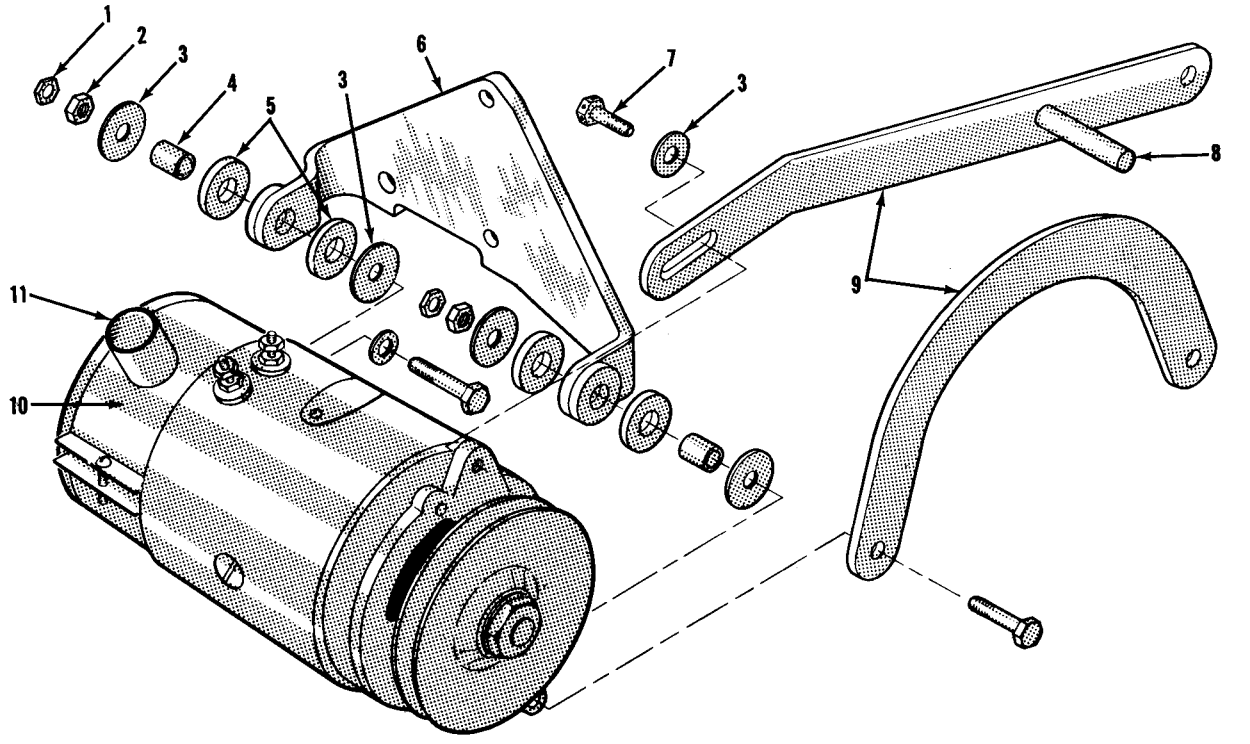
17-24. GENERATOR WARNING LIGHT. The generator warning light is provided to indicate when the generator is not charging the battery. The light is electrically connected across the cutout relay contacts of the voltage regulator. Whenever the cutout contacts are open the light will measure the potential difference between the battery and the generator armature. When the battery voltage is in excess of the generator output (such as an idling condition) the light will come on. As the generator speed (output) is increased, the potential difference across the light will diminish and the light will grow dimmer. When the cutout relay connects the generator output to the battery, the light circuit is bypassed through the voltage regulator and the light will go out.

17-25. AMMETER. The ammeter is connected between the battery and the aircraft bus. The meter indicates the amount of current flowing either to or from the battery. With a low battery and the engine operating at cruise speed the ammeter will show the full generator output when all electrical equipment is turned off. When the battery is fully charged and cruise RPM is maintained with all electrical equipment off, the ammeter will show a minimum charging rate.

17-26. TROUBLE SHOOTING THE GENERATOR POWER SYSTEM.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
WARNING LIGHT OPERATES CORRECTLY — BATTERY DOES NOT COME UP TO FULL CHARGE.		
Blown circuit breaker.	Inspect.	Reset or replace.
Loose drive belt on generator.	Inspect.	Tighten to 1/2" deflection.
Poor wiring connections.	Inspect.	Clean and tighten connectors.
Faulty battery.	Test.	Replace.
Faulty regulator.	Test or substitute.	Adjust or replace.
Generator output low.	Test or substitute.	Repair.
Excessive power consumption.	Calculate electrical loading.	Install larger generator system.
WARNING LIGHT DOES NOT COME ON WHEN MASTER SWITCH IS TURNED ON.		
Battery down.	Battery solenoid not closing.	Charge battery.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
WARNING LIGHT DOES NOT COME ON WHEN MASTER SWITCH IS TURNED ON. (Cont)		
Burned out lamp.	Try new lamp.	Replace.
Circuit breaker out.	Inspect.	Replace.
Faulty wiring or battery solenoid.	Test wiring and solenoid.	Repair or replace.
WARNING LIGHT DOES NOT GO OUT WHEN ENGINE SPEED IS INCREASED.		
Loose or broken generator belt.	Inspect.	Replace or tighten.
Loss of generator polarity.	Generator does not charge.	Polarize generator.
Faulty voltage regulator.	Test or substitute.	Adjust or replace. Polarize generator.
Faulty generator.	Test or substitute.	Repair or replace. Polarize generator.
Faulty circuit wiring.	Check.	Repair wiring.



1. Palnut
2. Nut
3. Washer
4. Spacer
5. Rubber Washers
6. Mounting Bracket
7. Belt Tension Adjusting Bolt
8. Drive Belt Guard
9. Braces
10. Brush Cover Band
11. Blast Tube

Figure 17-3. Generator Installation

17-27. REMOVAL AND REPLACEMENT OF GENERATOR. (See figure 17-3.)

a. The generator may be removed through the cowl door. However, the job will be easier if the top portion of the cowl is removed.

b. Release the clamp securing the generator blast tube and remove the tube.

c. Tag and remove the wiring from the generator.

d. Cut the safety wire securing the generator adjustment bolt and remove the bolt and washer. Leave the generator belt in place to support the generator.

e. Remove the bolts, washers and nuts from the lower generator bracket and remove the generator and drive belt.

f. To install the generator, reverse this procedure. Adjust the drive belt for 3/8" deflection with a force of 12 pounds applied.

CAUTION

If the generator has a filter capacitor connected for suppression of radio noise, be sure that it is connected to the armature terminal of the generator. If the capacitor is accidentally connected to the field terminal, it will cause arcing and burning of the voltage regulator contacts.

17-28. POLARIZING THE GENERATOR. A generator of the type used on aircraft must maintain a residual magnetism in the pole shoes in order to produce a charge. Whenever any work is performed on the basic electrical system the generator should be polarized to make sure a charge will be produced. To polarize a generator connect a jumper momentarily between the ARMATURE and BATTERY terminals of the regulator before starting the engine. A momentary surge through the generator is enough to correctly polarize it.

CAUTION

If a generator is not correctly polarized the regulator and generator may be damaged.

17-29. REMOVAL AND REPLACEMENT OF VOLTAGE REGULATOR.

a. Disconnect the wiring from the voltage regulator terminals.

CAUTION

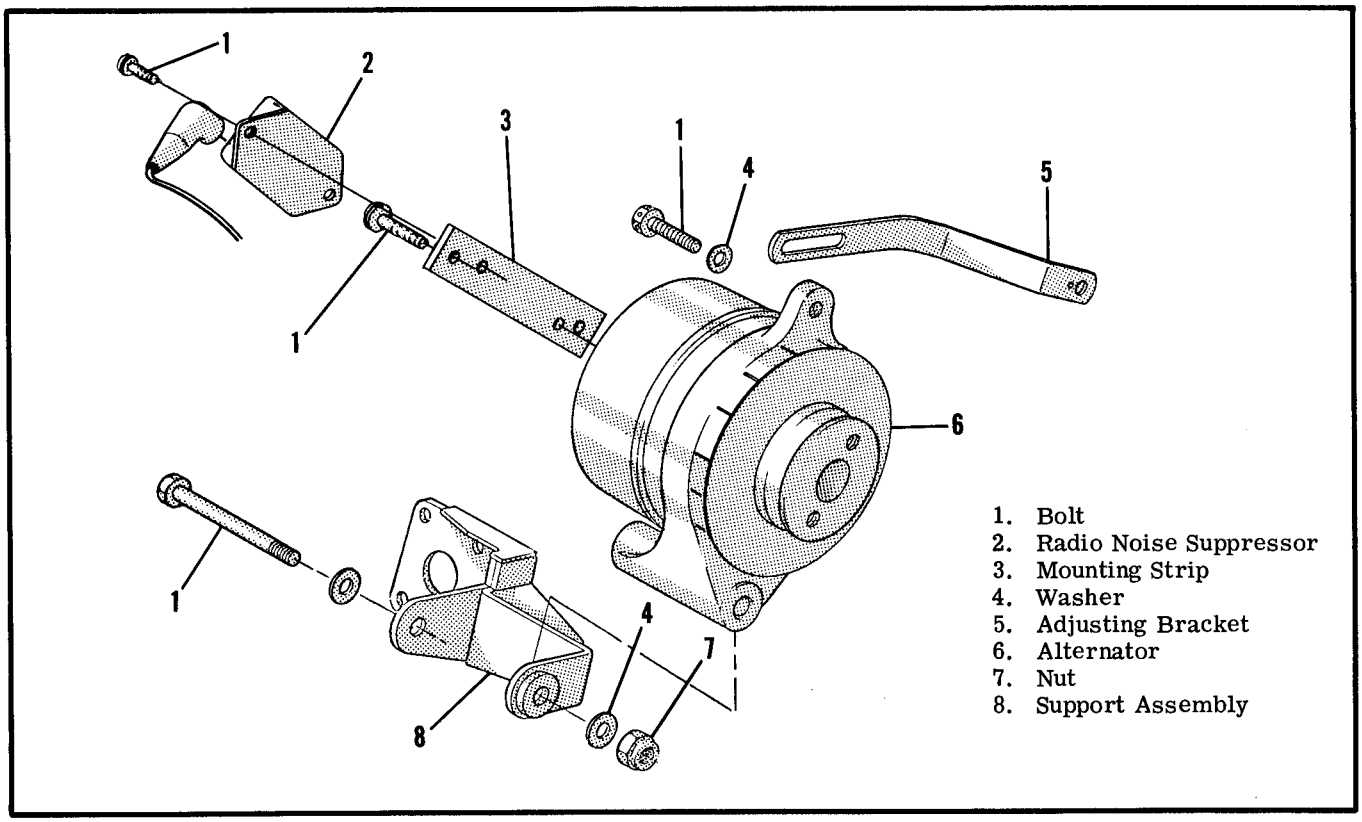
When removing the battery lead from the voltage regulator, tape the terminal on the end of the wire to prevent accidental short circuits.

b. Remove the three bolts securing the regulator to the firewall and remove the regulator.

c. To replace the regulator, reverse this procedure and flash the generator field when completed.

NOTE

When replacing the generator or regulator, it is necessary to flash the generator field to establish proper polarity. Connect a wire between the battery and armature terminals of the voltage regulator for about five seconds.



17-4. Alternator Installation

17-30. REMOVAL AND REPLACEMENT OF GENERATOR WARNING LIGHT.

a. Unsolder the wires attached to the light receptacle.

b. Remove the nut and lockwasher from the rear of the instrument panel and withdraw the receptacle.

c. To replace the receptacle, reverse this procedure.

17-31. ALTERNATOR POWER SYSTEM. The introduction of the high current silicon diode resulted in a reduction of mass making the alternator suitable for light aircraft use. The alternator power system provides a high power output with a low engine speed and a reduction in weight. The alternator, like the generator, produces an ac voltage by electromagnetic induction. Rectification of the ac is accomplished by the silicon diodes. The alternator system does not require external current regulation. The current regulation of the alternator is inherent and overloading results in a power drop off due to magnetic saturation. The alternator system requires an external exciting voltage to create a magnetic field around the rotor poles before power may be derived.

17-32. ALTERNATOR. Alternators used on Cessna single engine aircraft are three phase wye connected with integral silicon diode rectifiers. The alternator is rated at 14 volts at 52 amperes continuous output. The moving center part of the alternator (rotor) consists of a radial winding and interlocking poles which surround the winding. With excitation applied to the winding through slip rings the pole pieces assume magnetic polarity. The rotor is mounted in bearings and rotates inside the stator which is the stationary part of the alternator. The stator contains three wye connected phase windings and six silicon diodes. As the magnetic lines (created by exciting the rotor with a dc voltage) cut the stator windings an alternating voltage is produced. The alternating voltage from the three phase windings of the stator is fed into six diode rectifiers which are arranged electrically to provide full wave rectification. The diode output is dc and is combined and applied to the aircraft bus bar and also to the voltage regulator for sensing. The alternator is mounted in approximately the same location as the generator, although a different mounting bracket is used. The alternator is also V-belt driven. For maintenance of the alternator, refer to the "Cessna 12-Volt Alternator Charging System Service/Parts Manual."

17-33. ALTERNATOR REVERSE VOLTAGE DAMAGE. The alternator is very susceptible to reverse polarity current because of the silicon diodes. The diodes, having a very high resistance to reverse current flow are used without any cutout relay such as used on a generator system. The alternator diodes are arranged with their cathodes connected to the aircraft bus bar which is positive and no back current will flow. If the polarity of the battery is reversed the diodes will offer no resistance to the current flow. The current rating of the diodes is exceeded and diode failure will result.

17-34. ALTERNATOR VOLTAGE REGULATOR. The alternator voltage regulator contains two relays. One relay is actuated by the aircraft master switch and connects the regulator to the battery. The second relay is a two-stage voltage regulator which controls the field current to the alternator. The voltage limiter relay vibrates to provide a variable control of the field current depending upon the load. The limiter relay is compensated for temperature variation to provide increased charging during cold weather operation.

17-35. REMOVAL AND REPLACEMENT OF ALTERNATOR. (See figure 17-4.)

a. Make sure the master switch remains in the off position or disconnect the negative lead from the battery.

b. Disconnect the wiring from the alternator.

c. Remove the safety wire from the upper adjusting bolt and remove the bolt from the alternator.

d. Remove the nut and washer from the lower mounting bolt to remove alternator.

e. Remove the alternator drive belt and lower mounting bolt to remove alternator.

f. To replace alternator reverse this procedure.

CAUTION

When tightening the alternator belt, apply pry bar pressure only to the end of the alternator nearest to the belt pulley.

17-36. TROUBLE SHOOTING THE ALTERNATOR POWER SYSTEM.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
ALTERNATOR OPERATES CORRECTLY - BATTERY DOES NOT COME UP TO FULL CHARGE.		
Faulty battery.	Slow charge battery and load test.	Replace.
Faulty wiring.	Carefully inspect for dirty or loose connections.	Clean and tighten all connections to battery, regulator and alternator.
Regulator voltage set too low.	Measure bus voltage. Should be 14 vdc with alternator operating.	Replace.

17-36. TROUBLE SHOOTING THE ALTERNATOR POWER SYSTEM (Cont).

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
ALTERNATOR OUTPUT CONTINUOUSLY HIGH.		
Faulty wiring.	Inspect for loose or dirty connections.	Clean and tighten.
Regulator set too high.	Measure voltage output of alternator.	Adjust or replace regulator.
Regulator faulty.	Substitute.	Adjust or replace.
ALTERNATOR CIRCUIT BREAKER OPENS WHEN MASTER SWITCH IS TURNED ON - ENGINE NOT RUNNING.		
Shorted diode inside alternator.	Test diodes.	Replace diode assembly.
Short in wiring between bus bar and alternator.	Test wiring for shorts.	Repair.
ALTERNATOR DOES NOT PRODUCE CURRENT.		
Circuit breaker out.	Inspect.	Reset.
Faulty wiring.	Inspect for dirty or loose connections.	Clean and tighten.
Faulty switch.	Test for continuity.	Replace.
ALTERNATOR OUTPUT CONTINUOUSLY LOW.		
Faulty wiring.	Inspect for loose or dirty connections.	Clean and tighten.
Faulty diode in alternator.	Test diodes.	Replace.
Faulty alternator winding.	Test.	Replace.
BATTERY CONSUMES WATER RAPIDLY.		
Faulty battery.	Slow charge battery and load test.	Replace.
Regulator set too high.	Measure alternator voltage output.	Adjust voltage to 14 vdc.
Shorted diode in alternator causing battery to cycle.	Test diodes.	Replace diode and test regulator.

17-37. AIRCRAFT LIGHTING SYSTEM.

17-38. Lighting equipment consists of landing and taxi lights, navigation lights, interior and instrument panel lights, courtesy lights and a rotating beacon.

17-39. LANDING AND TAXI LIGHTS. The landing and taxi lights are mounted in the leading edge of the left wing. A clear plastic cover provides weather protection for the lamps and is shaped to maintain the leading edge curvature of the wing. The landing lamp is mounted on the inboard side and adjusted to throw its beam further forward than the taxi light. Both lights are controlled by a single switch.

17-40. NAVIGATION LIGHTS. The navigation lights are located on each wing tip and the stinger. A flasher is provided which blinks the lights at regular intervals. Operation of the lights is controlled by a single three position switch. A plastic light detector on each wing tip allows the pilot to determine if the lamps are working properly during flight.

17-41. NAVIGATION LIGHTS FLASHER. The navigation lights flasher is mounted atop the map compartment on early aircraft and is mounted on the bottom of the map compartment on late aircraft. The flasher is completely electronic in operation. It contains two transistors and is non-adjustable. The flasher is designed so that if one navigation light or the circuit to one light fails, the other lights will continue to operate.

17-42. ROTATING BEACON. Two types of rotating beacon lights have been used on 210 aircraft. Both beacons contain a small motor which rotates either two lamps or a shutter containing three lens openings around a single bulb to give a flashing warning of the aircraft's position. The beacon is installed in a fiberglas mounting atop the vertical fin.

17-43. INTERIOR LIGHTS CONSOLE, MAP LIGHT AND DOME LIGHT. Two interior light consoles have been used on 210 aircraft. Prior to 1962, the console incorporated a dome light. The 1962 and on, console does not incorporate a dome light, but does incorporate a map light. Both consoles contain lighting for the instrument panel. The instrument light portion of the console has a red lens which provides non-glare instrument lighting. The intensity of the instrument lighting is controlled by a rheostat mounted on the instrument panel. The dome light has a frosted lens and is controlled by a slide switch located in the center of the console. The 1962 and on, console incorporates two map light opening holes with slide covers to provide map lighting. The map light can be exposed by merely moving the slide cover. The map light on models prior to 1962, is an adjustable light mounted on the forward post of the left door post with the switch mounted below the light. The light beam is adjusted by rotating a small knob on the end of the light. The 1962 and on models are equipped with two dome lights. One is located on each side of the aft cabin section and is controlled by a single-slide switch labeled "Utility Lights." The utility lights switch also operates the courtesy lights.

17-44. COURTESY LIGHTS. Courtesy lights are installed as standard equipment on 1962 models. The lights consist of one light located on the underside of each wing to provide ground lighting for the cabin area. The courtesy lights have a clear lens and are controlled by a single slide switch labeled, "Utility Lights," located on the left rear door post. The switch also operates the dome lights.

17-45. COMPASS LIGHT. The compass lamp may be removed by sliding up the cover plate located just above the compass window.

17-46. RADIO LIGHTS. To replace a dial light in most radios remove the dust cover and slide the bulb out the back of the control head. On some radios, the front panel must be removed from the control panel to replace the dial light bulb. On other radios, the dial light may be replaced by unscrewing the plug, or plugs, on the face of the control head.

17-47. TROUBLE SHOOTING AIRCRAFT LIGHTING SYSTEM.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
LANDING OR TAXI LIGHT OUT.		
Lamp burned out.	Inspect.	Replace lamp.
Defective wiring.	Check continuity.	Repair wiring.
BOTH LANDING AND TAXI LIGHT OUT.		
Circuit breaker open.	Inspect.	Reset breaker.
Defective wiring.	Check continuity.	Repair wiring.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
BOTH LANDING AND TAXI LIGHT OUT. (Cont)		
Defective switch.	Check continuity through switch.	Replace switch.
ONE NAVIGATION LIGHT OUT.		
Lamp burned out.	Inspect.	Replace lamp.
Defective wiring.	Check continuity.	Replace wiring.
Defective flasher unit.		Replace flasher unit.
NAVIGATION LIGHTS WILL NOT TURN ON.		
Circuit breaker open.	Inspect.	Reset breaker.
Defective wiring.	Check continuity between switch and aircraft bus.	Repair wiring.
Defective switch.	Check continuity through switch.	Replace switch.
NAVIGATION LIGHTS ON – WILL NOT BLINK.		
Defective flasher unit.	Test by replacing unit.	Repair or replace flasher.
Defective switch.	Check continuity through switch.	Replace switch.
ROTATING BEACON WILL NOT OPERATE.		
Circuit breaker open.	Inspect.	Reset breaker.
Defective wiring.	Check continuity of wiring from aircraft bus to rotating beacon plug.	Repair wiring.
Defective beacon.		Repair or replace beacon.
MAP LIGHT, DOME LIGHT OR COURTESY LIGHT TROUBLE.		
Circuit breaker open.	Inspect.	Reset breaker.
Burned out lamp.	Inspect.	Replace.
Defective switch.	Check continuity.	Replace.
Defective wiring.	Check continuity from light to aircraft bus.	Repair wiring.
INSTRUMENT LIGHTS WILL NOT LIGHT.		
Rheostat turned down.		Adjust.
Circuit breaker open.	Inspect.	Reset breaker.
Burned out lamp.	Inspect.	Replace.
Defective rheostat.	Check continuity.	Replace.
Defective wiring.	Check continuity of wiring from light to bus.	Repair wiring.

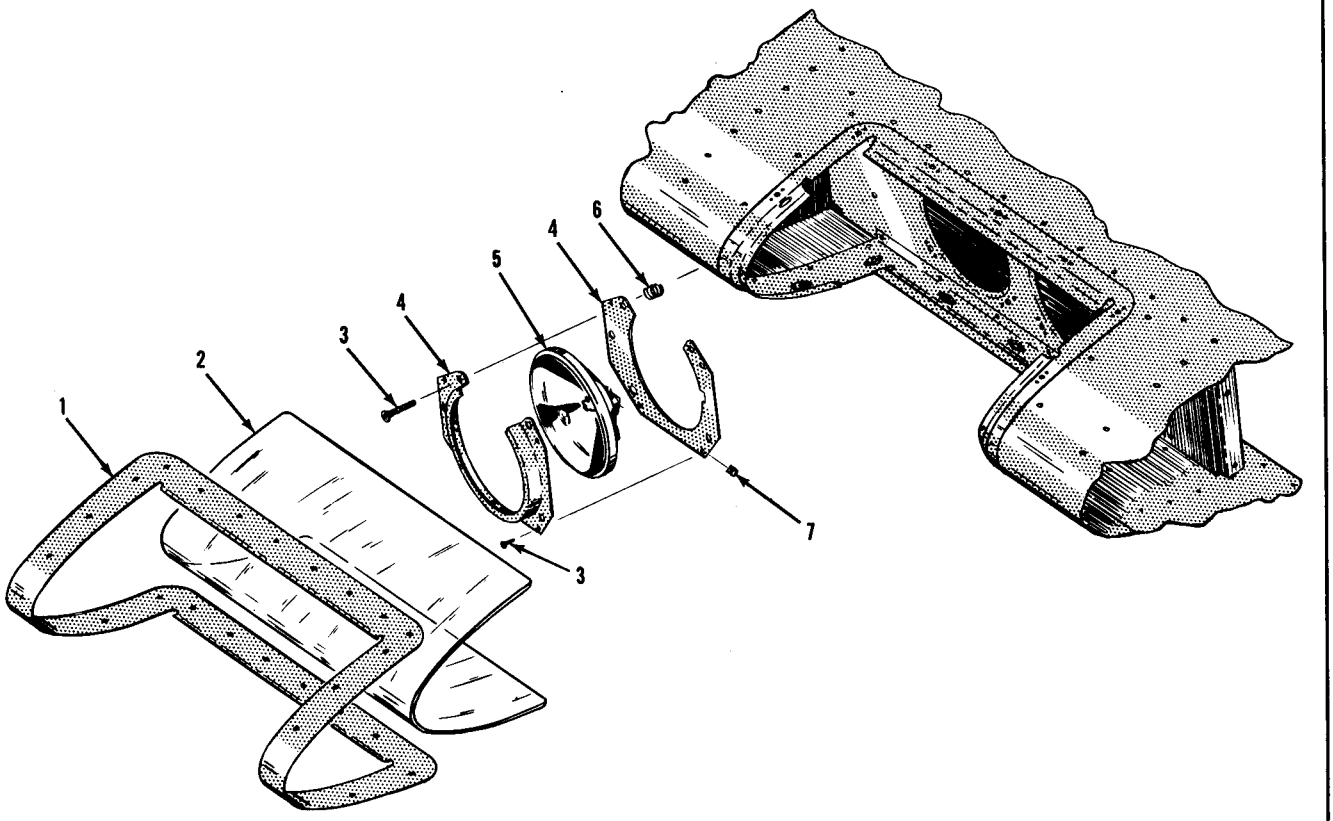
17-48. REMOVAL AND REPLACEMENT OF LANDING OR TAXI LIGHT. (See figure 17-5.)

a. Remove the screws securing the landing light window retainer and remove the window.

b. For landing lights having four screws holding each bracket to the wing it is necessary to remove the adjusting screws and springs to replace a lamp. On aircraft with three adjusting screws for each bracket, the screws holding the bracket together may be removed and the lamp may be changed without disturbing the adjustment.

NOTE

To remove the lamp from the formed bracket which is riveted together, place both thumbs against the upper right hand corner of the bracket while applying pressure against the back of the lamp with the fingers. The bracket may be twisted in this manner and slipped off the lamp. When replacing the lamp in the bracket, start by aligning the boss on the lamp with the keyway in the bracket. Apply pressure to the lamp with the thumbs and work the bracket around the lamp with the fingers.



1. Window Retainer
2. Window
3. Screw
4. Lamp Bracket
5. Lamp
6. Spring
7. Tinnerman Nut

Figure 17-5. Landing and Taxi Light Installation

POSITION	1	2	3	4	5	6	7	8	9	10
"D"	.50	.60	.85	.95	.50	.90	.85	1.25		
"D"		.60		.95	.50		.85		.68	1.08

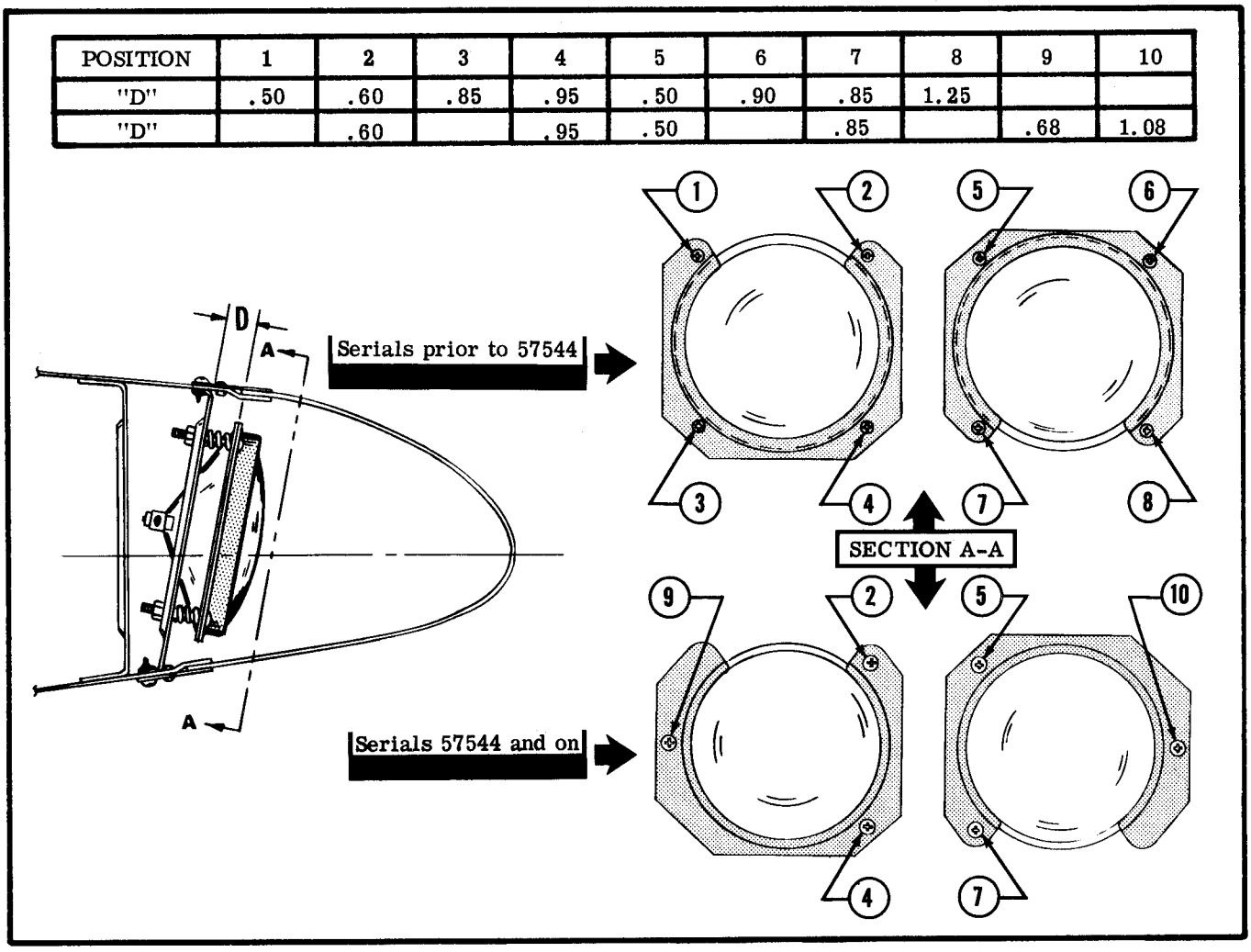
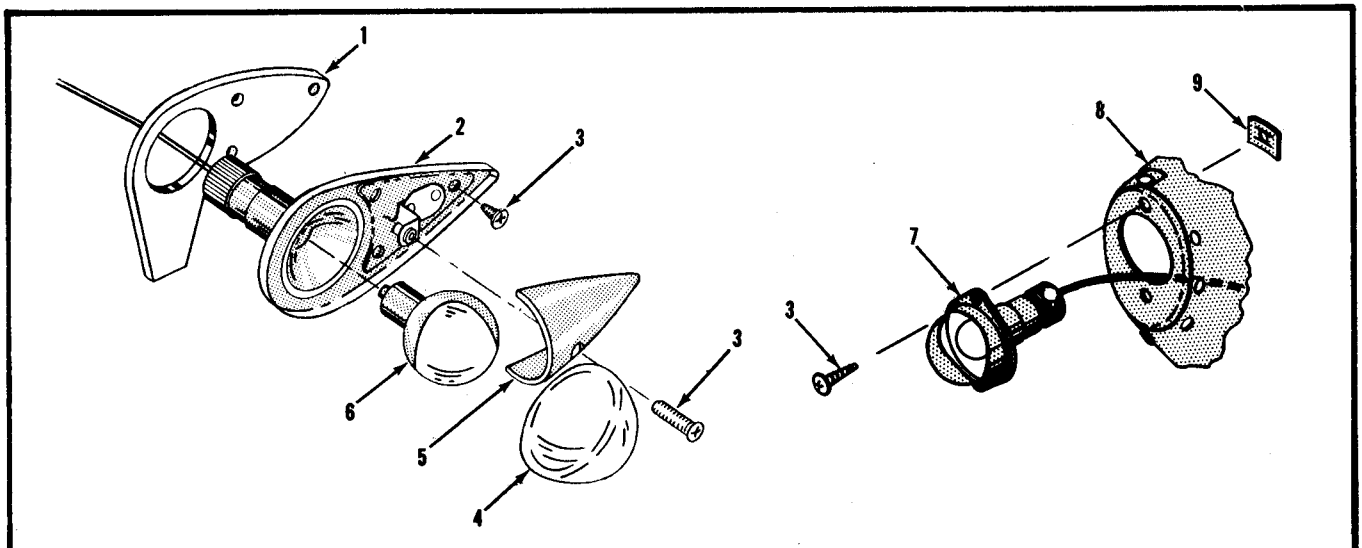


Figure 17-6. Landing and Taxi Lights Adjustment Chart



1. Detector
2. Wing Navigation Light
3. Screw
4. Lens
5. Retainer
6. Lamp
7. Tail Light
8. Stinger
9. Tinnerman Nut

Figure 17-7. Navigation Lights Installation

17-49. REMOVAL AND REPLACEMENT OF NAVIGATION LIGHTS. Figure 17-7 shows in detail all components of the navigation lights. Use this figure as a guide for removal and replacement.

17-50. REMOVAL AND REPLACEMENT OF NAVIGATION LIGHTS FLASHER. Figure 17-10 shows in detail the installation of the navigation lights flasher. Use this figure as a guide for removal and replacement.

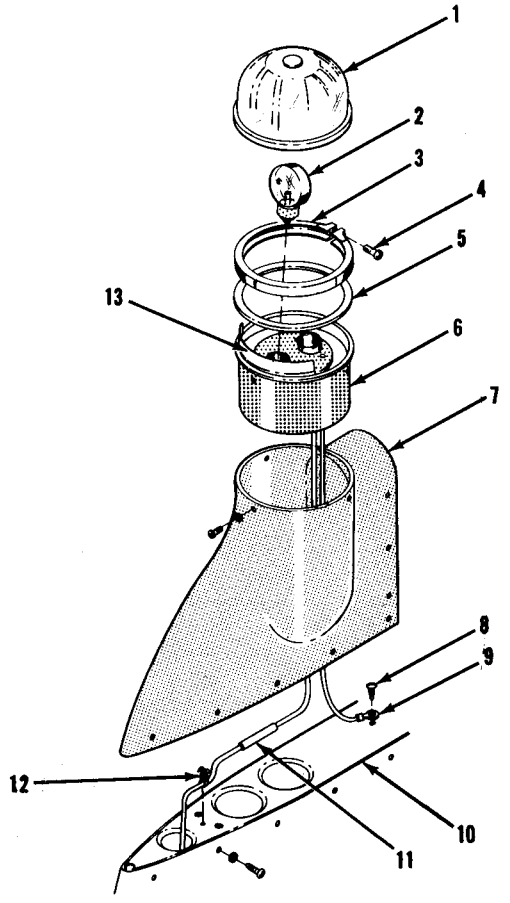
17-51. REMOVAL AND REPLACEMENT OF ROTATING BEACON. (See figure 17-8.)

a. Remove the three screws holding the beacon to the fiberglas mounting.

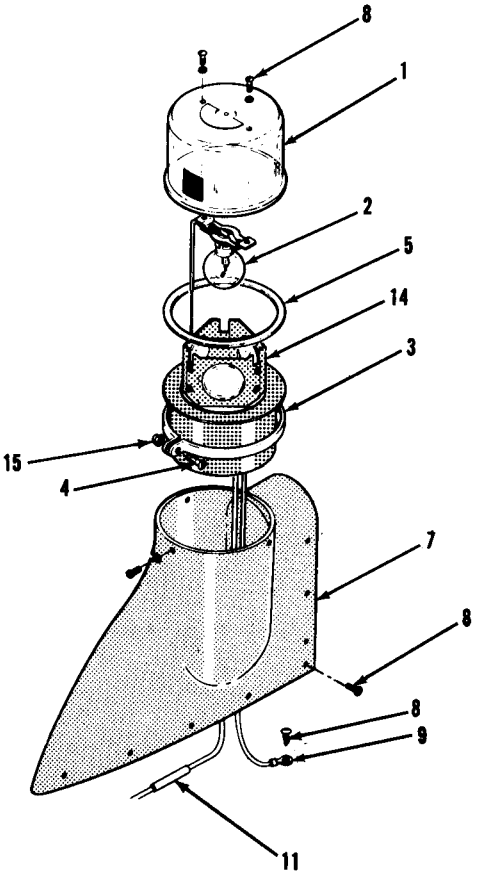
b. Withdraw the beacon from the mounting and remove the screw attaching the ground wire to the fin structure.

c. Disconnect the other electrical lead and remove beacon.

EARLY



LATE



1. Lens
2. Lamp
3. Lens Retaining Ring
4. Bolt
5. Gasket
6. Rotating Beacon
7. Mount
8. Screw
9. Ground Wire
10. Fin
11. Connector
12. Tinnerman Clip
13. Baffle
14. Lens Assembly
15. Nut

Figure 17-8. Courtesy Lights Installation

d. To replace the beacon, reverse this procedure. Mount the beacon with the light baffle forward.

17-52. REMOVAL AND REPLACEMENT OF DOME AND INSTRUMENT LIGHTS. Figure 17-11 shows in detail all components of the dome and instrument lights installation. Use this figure as a guide for removal and replacement.

17-53. ADJUSTMENT OF OVERHEAD LIGHT CONSOLE FOR LATE MODEL 210'S. The overhead light console on late 210 models may be adjusted to allow the light to illuminate the instrument panel without striking the windshield and causing glare. Adjust the angle of light by turning the rear outboard screws (see figure 17-11), until the light beams are properly directed.

17-54. REMOVAL AND REPLACEMENT OF COURTESY LIGHTS. Figure 17-9 shows in detail all components of the courtesy lights installation. Use this figure as a guide for removal and replacement.

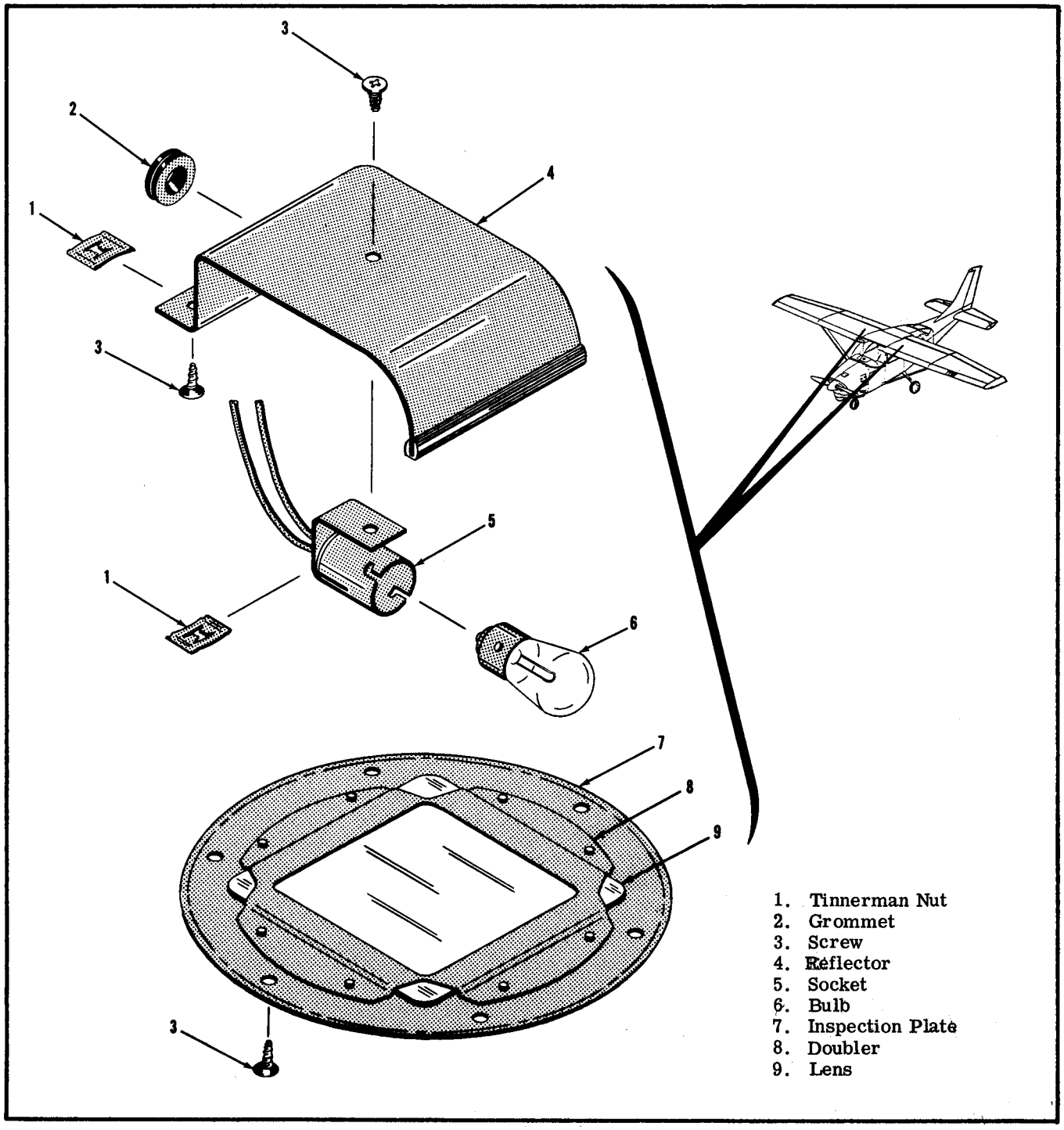
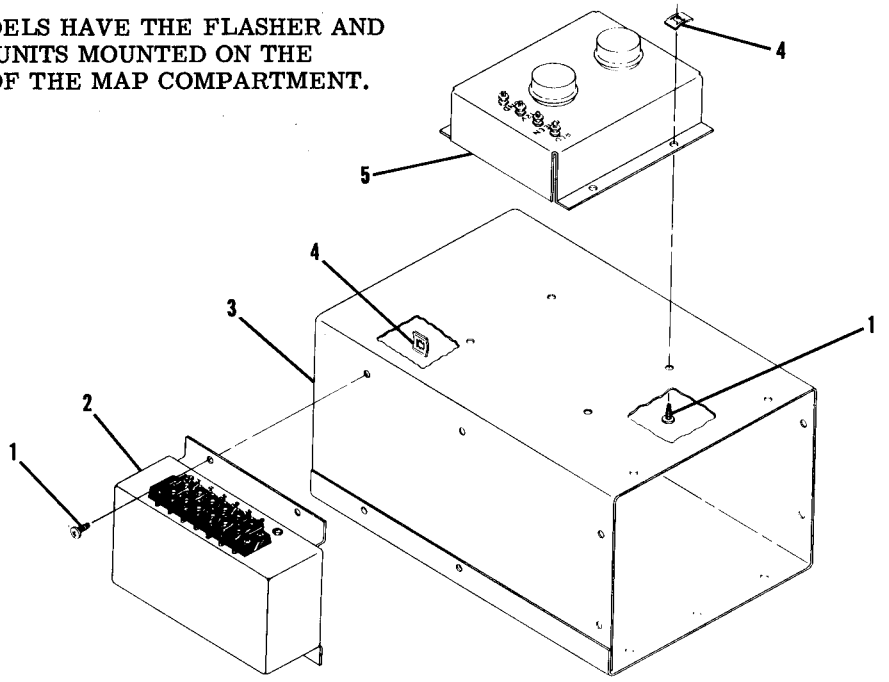


Figure 17-9. Courtesy Lights Installation

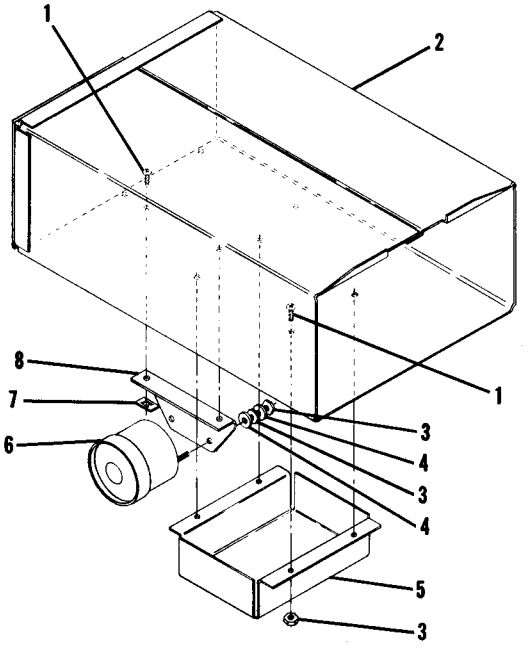
210 MODELS ONLY

NOTE: LATE MODELS HAVE THE FLASHER AND WARNING UNITS MOUNTED ON THE BOTTOM OF THE MAP COMPARTMENT.



1. Screw
2. Stall and Gear Warning Unit
3. Map Compartment
4. Tinnerman Nut
5. Navigation Lights Flasher

205 & 206 MODELS ONLY



1. Screw
2. Map Compartment
3. Nut
4. Washer
5. Navigation Lights Flasher
6. Stall Warning Horn
7. Tinnerman Nut
8. Bracket

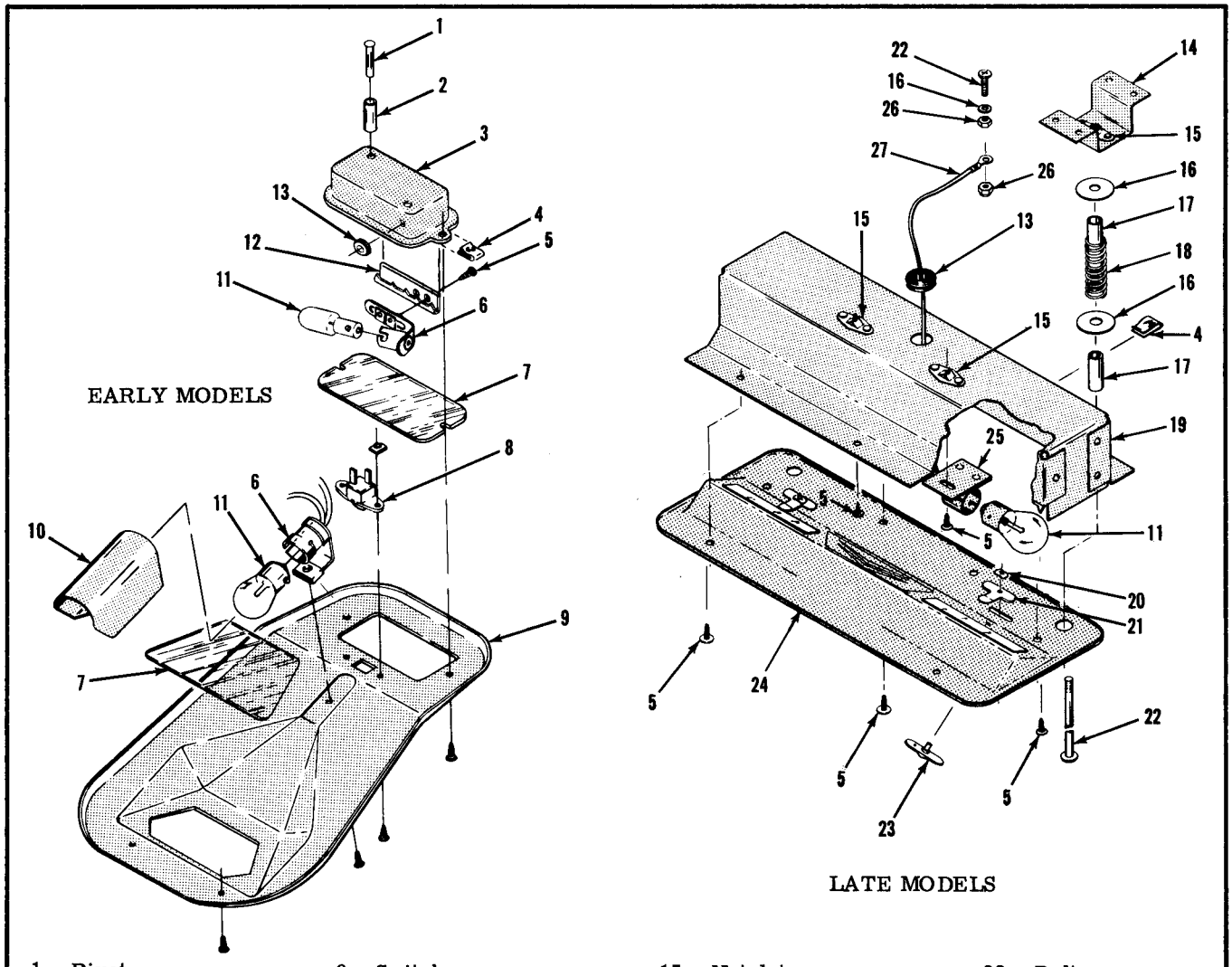
Figure 17-10. Stall and Gear Warning Units and Navigation Lights Flasher Installations

17-55. STALL AND GEAR WARNING UNITS.

17-56. The stall and gear warning unit used on early 210 aircraft is mounted on the inboard side of the map compartment on early models and the bottom of the map compartment on later models. The early 210 unit contains transistor oscillators which produce a high-pitched stall warning signal and an interrupted lower-pitched gear warning signal. These signals are transmitted by a speaker which is either mounted in the cabin ceiling on early models or mounted in the right wing root on late models. Current production 210 models have incorporated a stall and gear warning unit which has two horns built into the unit, thereby eliminating the need of a speaker. The new unit is completely interchangeable with the older unit and also emits the same type high-pitched stall warning signal and an interrupted lower-pitched gear warning signal. The 205 and 206 aircraft incorporate a different stall warning horn which emits a high-pitched signal directly from the horn. The warning horn for the 205 and 206 is mounted on the inboard side of the map compartment as shown in figure 17-10.

17-57. STALL WARNING SWITCH.

17-58. The stall warning switch is installed in the leading edge of the left wing and is actuated by airflow over the surface of the wing. The switch will close as a stall condition is approached, actuating the stall and gear down warning unit. The warning unit should transmit a warning signal at approximately five to ten miles per hour above airplane stall speed. Install the lip of the warning unit ap-



1. Rivet
2. Spacer
3. Reflector
4. Tinnerman Nut
5. Screw
6. Socket
7. Lens
8. Switch
9. Cover Plate
10. Shield
11. Lamp
12. Retainer
13. Grommet
14. Bracket Assembly
15. Nutplate
16. Washer
17. Spacer
18. Spring
19. Housing Assembly
20. Clip
21. Slide
22. Bolt
23. Slide Cover
24. Cover Assembly
25. Socket Support
26. Nut
27. Ground Wire

Figure 17-11. Dome and Instrument Lights Installation

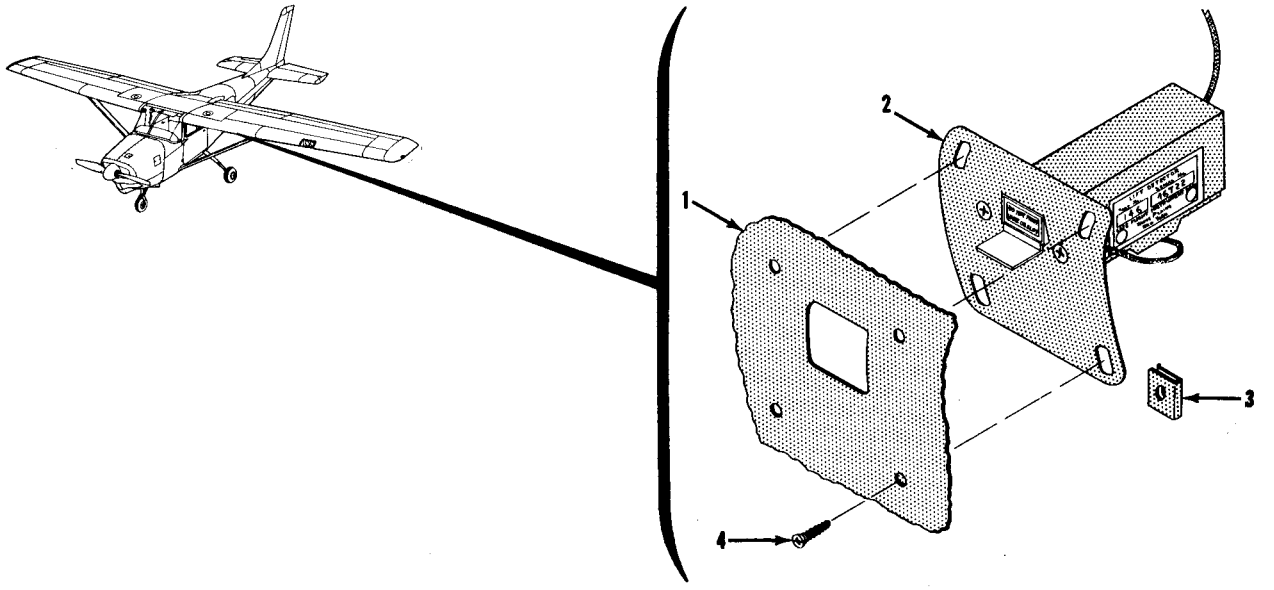
proximately one sixteenth of an inch below the center line of the wing skin cutout. Test fly the aircraft to determine if the unit actuates the horn at the desired speed. If the unit actuates the horn at a speed in excess of ten miles per hour, loosen the mounting screws and move the unit down. If the unit actuates the horn at a speed less than five miles per hour, loosen the mounting screws and move the unit up.

17-59. PITOT AND STALL WARNING HEATER CIRCUITS.

17-60. Electrical heater units are incorporated in some pitot tubes and stall warning switch units. The heaters offset the possibility of ice formations on the pitot tube and stall warning actuator switch. The heaters are integrally mounted in the pitot tube and stall warning actuator switch. Both heaters are controlled by the pitot heat switch.

17-61. REMOVAL AND REPLACEMENT OF STALL AND GEAR WARNING UNITS. Figure 17-10 shows in detail the installation of the 210 stall and gear warning unit and the 205 and 206 stall warning horn. Use this figure as a guide for removal and replacement.

17-62. REMOVAL AND REPLACEMENT OF STALL WARNING SWITCH. Figure 17-12 shows in detail the installation of the stall warning switch. Use this figure as a guide for removal and replacement.



1. Wing Skin
2. Actuator
3. Tinnerman Nut
4. Screw

Figure 17-12. Stall Warning Actuator Installation

17-63. REMOVAL AND REPLACEMENT OF PITOT HEATER. Figure 17-13 shows in detail all components of the pitot heater installation. Use this figure as a guide for removal and replacement.

17-64. LANDING GEAR INDICATOR LIGHTS. The position of the landing gear is indicated by two press-to-test lights mounted on the left side of the landing gear power pack on early 210 aircraft. On later aircraft they are mounted on the right side of the switch panel. The green light is on when both of the main gears and the nose gear are down and locked. The red light is on when both of the main gears and the nose gear are up and locked. If one or more of the gears is not down and locked or up and locked, neither light will operate. The hood of each light is removable for bulb replacement, and has a dimming shutter.

17-65. REMOVAL AND REPLACEMENT OF LANDING GEAR INDICATOR LIGHTS.

a. On early 210 aircraft remove the five screws securing the power pack cover and pull the cover out to gain access to the light wiring. On other aircraft it is not necessary to remove the switch panel cover.

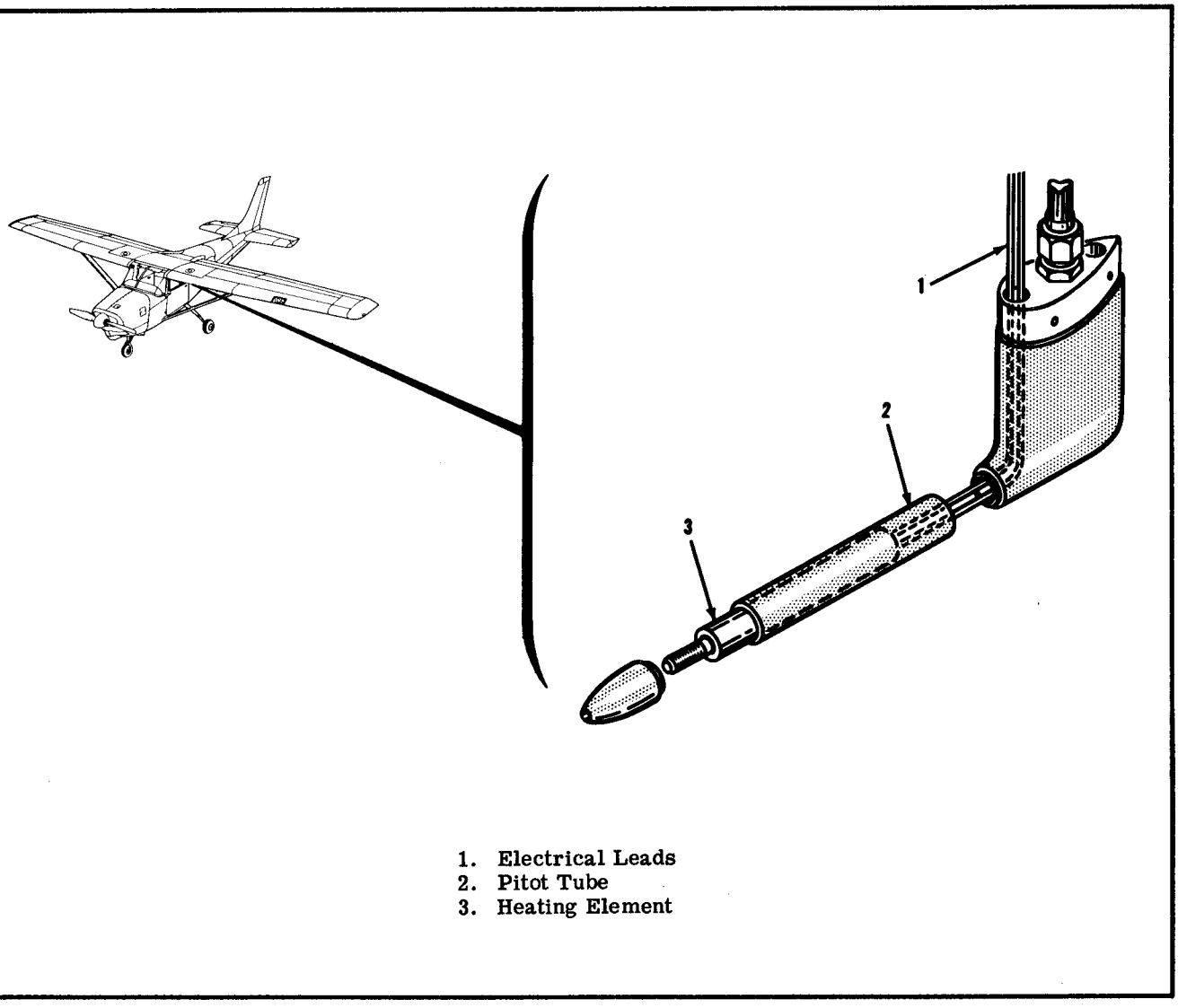
b. Remove the hood on each light by turning counter clockwise.

c. Remove the nut securing the light and remove the light.

d. Tag and unsolder the wires from the light.

e. To install a landing gear indicator light, reverse this procedure.

17-66. CIGARETTE LIGHTER. A special circuit breaker has been installed on late models. The circuit breaker is contained in a small cylinder and is screwed directly onto the rear of the cigarette lighter receptacle. The circuit breaker is a bi-metallic type and is resettable. To set the breaker, insert a small diameter pin through the hole in the phenolic backplate of the breaker and spring the bimetallic disc by pressing on the pin.



1. Electrical Leads
2. Pitot Tube
3. Heating Element

Figure 17-13. Heated Pitot Installation

ELECTRICAL LOAD ANALYSIS CHART

FOR ALL 1965 MODELS

ELECTRICAL EQUIPMENT	AMPS. REQD		
	P206	U206	210
Battery Contactor	0.8	0.8	0.8
Carburetor Air Temperature Indicator	0.03	0.03	0.03
Cigarette Lighter	10.0	10.0	10.0
Clock		Negligible	
Courtesy Lights and Cabin Lights	3.3	3.3	3.3
Cylinder Head Temperature Indicator	0.18	0.18	0.18
Flap Motor	15.00	15.00	15.00
Flap Position Indicator	0.26	0.26	0.26
Fuel Quantity Indicators	0.36	0.36	0.36
Fuel Pump - Auxiliary	3.0	3.0	3.0
Gear Warning Horn	---	---	0.25
Heaters, Stall Warning & Pitot	8.6	8.6	8.6
H.F. Antenna Reel Motor	14.0	14.0	14.0
Instrument Lights:			
Cluster	0.3	0.3	0.3
*Console	2.0	2.0	2.0
Compass	0.08	0.08	0.08
Lamp - Gear Up or Gear Down	---	---	0.08
Landing Lights	15.6	15.6	15.6
Map Light	0.33	0.33	0.33
Navigation Light	5.6	5.6	5.6
Oil Dilution System	1.0	1.0	1.0
*Post Lighted Panel Installation	1.6	1.6	1.6
Rotating Beacon	4.8	4.8	4.8
Solenoid Valve - Door Opening	---	---	2.7
†Solenoid Valve - Gear Handle Lock	---	---	0.6
Stall Warning Horn	.25	.25	.25
Turn & Bank Indicator	0.18	0.18	0.18
Vertical Adjusting Seats	20.0	20.0	20.0
Cessna ADF 300 (Type R-521)	1.6	1.6	1.6
Cessna ADF 500 (Type R-318)	4.3	4.3	4.3
Cessna Marker Beacon 300 (Type R-521)	0.17	0.17	0.17
Cessna 1 1/2 Nav/Com 300 & 300R (Types RT-514A & RT-514R)	4.5	4.5	4.5
Cessna Nav/Com 500 (Type RT-317)	5.2	5.2	5.2
Cessna Nav/Omni 500 (Type R-319)	7.0	7.0	7.0
Cessna Nav-O-Matic 200 Autopilot	2.0	2.0	2.0
Cessna Nav-O-Matic 300 Autopilot	2.0	2.0	2.0
Cessna Transceiver 500 (Type RT-302)	6.5	6.5	6.5
King KA-10 Isolation Amplifier	0.5	0.5	0.5
King KN-60 DME	5.0	5.0	5.0
King KX-120 with KI-200 Indicator	6.4	6.4	6.4
King KX-150 AE	6.0	6.0	6.0
King KY-95	4.0	4.0	4.0
Narco Mark IV Superhomer	4.0	4.0	4.0
Narco Mark XII with VOA-4, VOA-5, or VOA-6 Indicator	5.2	5.2	5.2
Narco UGR-1A Glideslope Receiver	2.5	2.5	2.5
Pantronics DX10-D	5.8	5.8	5.8

*A switching arrangement prevents the console lights from being operated at the same time the post lights are operated.

†Applicable to the flight running load only.

SECTION 18

ELECTRONIC SYSTEMS

This section has been deleted from this book. The information formerly contained in this section may now be found in one of the individual Cessna Electronic Manuals. For installation, refer to the "Cessna Electronic Installations and Service/Parts Manual." For repair, refer to the appropriate Cessna Service/Parts Manual.

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SECTION 19

STRUCTURAL REPAIR

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19-1. REPAIR CRITERIA.

19-2. Although this section outlines repair permissible on structure of the aircraft, the decision of whether to repair or replace a major unit of structure will be influenced by such factors as time and labor available, and by a comparison of labor costs with the price of replacement assemblies. Past experience indicates that replacement, in many cases, is less costly than major repair. Certainly, when the aircraft must be restored to its airworthy condition in a limited length of time, replacement is preferable.

19-3. Restoration of a damaged aircraft to its original design strength, shape and alignment involves careful evaluation of the damage, followed by exacting workmanship in performing the repairs. This section suggests the extend of structural repair practical on the aircraft and supplements C.A.M. 18. Consult the factory when in doubt about a repair not specifically mentioned here.

19-4. EQUIPMENT AND TOOLS.

19-5. Equipment and tools for repair of structure may be fabricated locally for all but major repair jobs. For major repair of wings and fuselage, special jigs, available from the factory, are recommended. These jigs are precision equipment designed to ensure accurate alignment of these airframe components.

19-6. CONTROL BALANCING requires the use of a fixture to determine the static balance moment of the control surface assembly. Plans for, and the use of such a fixture are shown in figure 19-9.

19-7. SUPPORT STANDS shown in figure 19-1 are used to hold a fuselage or wing when it is removed. The stands may be manufactured locally of any suitable wood.

19-8. FUSELAGE REPAIR JIG. The fuselage jig which may be obtained from the factory is a sturdy, versatile fixture used to hold an entire fuselage and locate the firewall, wing and landing gear attachment points. The jig is ideal for assembling new parts in repair of a badly damaged fuselage.

19-9. WING JIG. The wing jig, which may also be obtained from the factory, serves as a holding fixture during extensive repair of a damaged wing. The jig locates the root-rib, leading edge, and tip rib of the wing.

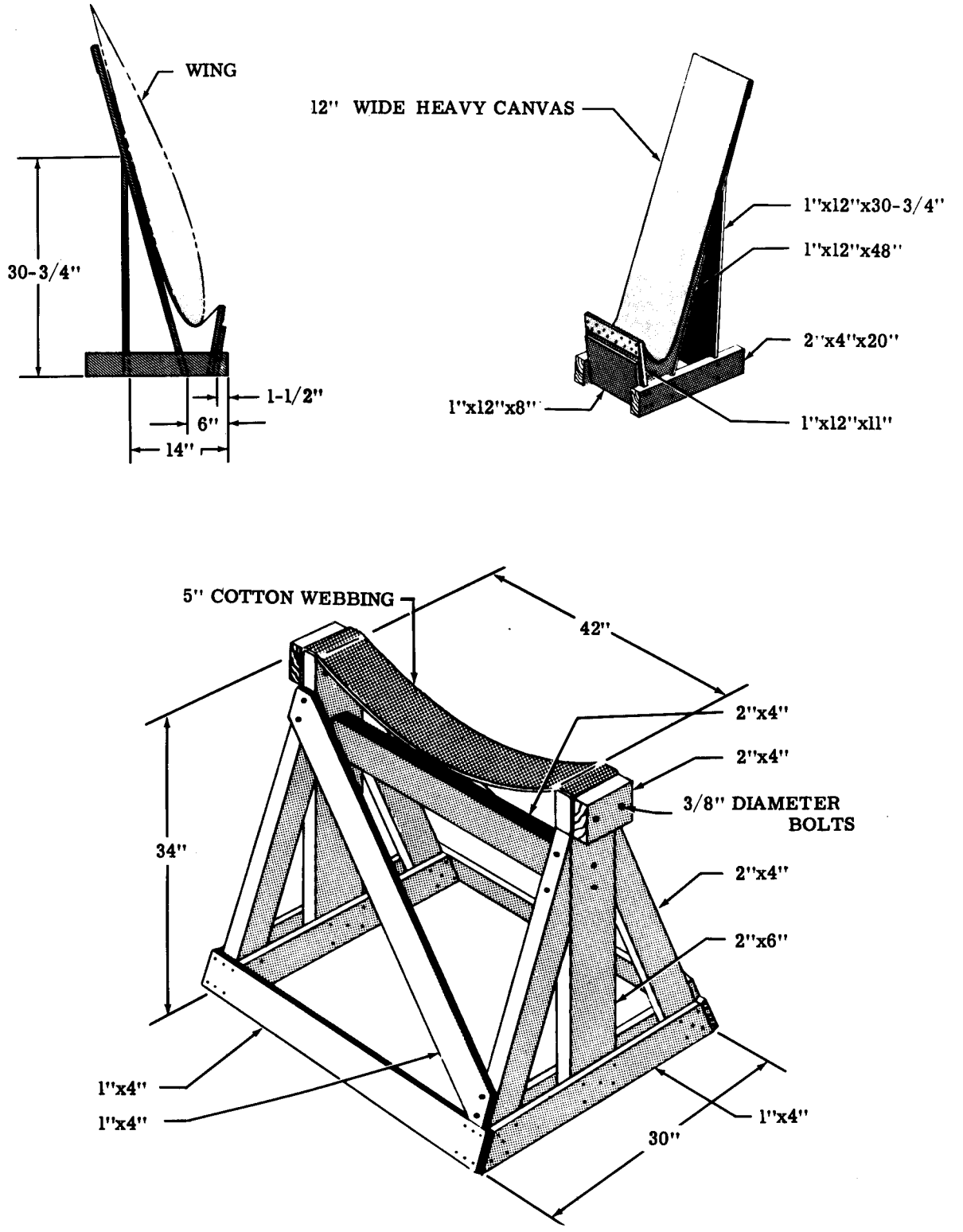
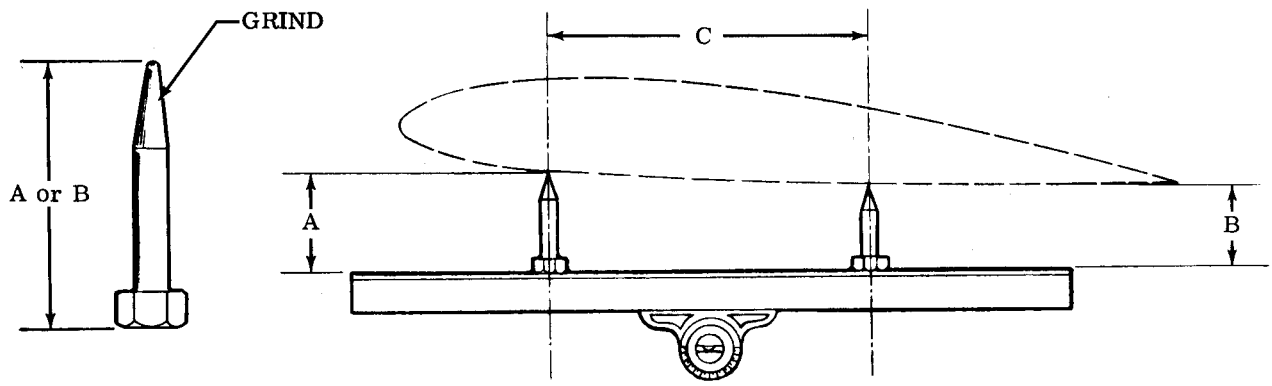


Figure 19-1. Wing and Fuselage Support Stands



A	B	C	WING STATION
2.09	1.00	28.75	39.00
1.55	1.00	24.50	207.00

MEASURING WING TWIST

If damage has occurred to a wing, it is advisable to check the twist. The following method can be used with a minimum of equipment, which includes a straightedge (32" minimum length of angle, or equivalent), three modified bolts for a specific wing, and a protractor head with level.

1. Check chart for applicable dimension for bolt length (A or B).
2. Grind bolt shanks to a rounded point as illustrated, checking length periodically.
3. Tape two bolts to straightedge according to dimension C.
4. Locate inboard wing station to be checked and make a pencil mark on rivet line approximately one inch aft of leading edge skin.
5. Holding straightedge parallel to wing station, (staying as clear as possible from "cans"), place longer bolt on pencil mark and set protractor head against lower edge of straightedge.
6. Set bubble in level to center and lock protractor to hold this reading.
7. Omitting step 6, repeat procedure for outboard wing station, using dimensions specified in chart. Check to see that protractor bubble is still centered.
8. Proper twist is present in wing if protractor readings are the same (parallel).

Figure 19-1A. Structural Alignment

19-10. WING AND STABILIZER ANGLE-OF-INCIDENCE. Angle-of-incidence and wing twist is listed in the following chart. Stabilizers do not have twist. Wings have a constant angle from the wing root to the strut fitting station. All twist in the panel is between this station and the tip rib. The amount of twist between these points is the difference between the angle-of-incidence at the root and the angle-of-incidence at the tip. Refer to figure 19-1A to check wing twist.

WING	
Angle-of-incidence, Root	+1°30'
Angle-of-incidence, Tip	-1°30'
Twist	3°
STABILIZER	
Angle-of-incidence	-3°±15'

19-11. SKIN REPAIR MATERIALS.

19-12. Thickness of a skin on which a repair is to be made can easily be determined by measuring with a micrometer. In general, skins used on Cessna aircraft covered in this manual are made from 2024 aluminum alloy, heat treated to a -T3, -T4, or -T42 condition.

If the material of a skin cannot be readily determined, 2024-T3 may be used in making repairs, since the strength of -T3 is greater than -T4 or -T42 (-T4 and -T42 may be used interchangeably, but they may not be substituted for -T3).

A few components (some empennage tips, for example) have been fabricated from an easily formed and/or readily weldable material, such as 5052-O and 6061-O. These can be recognized by their relative softness. Royalite or Fiberglas is also used for some of these components.

SHOP NOTES:

19-13. WING.

19-14. The wing assemblies are of the semi-cantilever type employing semi-monocoque type of structure. Basically, the internal structure consists of built-up front and rear spar assemblies, a formed auxiliary spar assembly and formed sheet metal nose, intermediate, and trailing edge ribs. Stressed skin, riveted to the rib and spar structures, completes the rigid structure.

19-15. ACCESS openings (hand holes with removable cover plates) are located in the underside of the wing between the wing root and tip section. These openings afford access to the aileron bellcranks, flap bellcranks, electrical wiring, strut attaching fittings, aileron control cable pulley and control cable disconnect points.

19-16. WING SKIN.

19-17. NEGLIGIBLE DAMAGE. Any smooth dents in the wing skin that are free from cracks, abrasions and sharp corners, which are not stress wrinkles and do not interfere with any internal structure or mechanism, may be considered as negligible damage. In areas of low stress intensity, cracks, deep scratches or deep, sharp dents, which after trimming or stop drilling can be enclosed by a two-inch circle, can be considered negligible if the damaged area is at least one diameter of the enclosing circle away from all existing rivet lines and material edges. Stop drilling is considered a temporary repair and a permanent repair should be made as soon as practicable.

19-18. REPAIRABLE DAMAGE. Figure 19-2 outlines typical repairs to be employed in patching skin. Before installing a patch, trim the damaged area to form a rectangular pattern, leaving at least a one-half inch radius at each corner, and de-burr. The sides of the hole should lie span-wise or chord-wise. A circular patch may also be used. If the patch is in an area where flush rivets are used, make a flush patch type of repair; if in an area where flush rivets are not used, make an overlapping type of repair. Where optimum appearance and airflow are desired, the flush patch may be used. Careful workmanship will eliminate gaps at butt-joints; however, an epoxy type filler may be used at such joints.

19-19. DAMAGE NECESSITATING REPLACEMENT OF PARTS. If a skin is badly damaged, repair should be made by replacing an entire skin panel, from one structural member to the next. Repair, seams should be made to lie along existing structural members and each seam should be made exactly the same in regard to rivet size, spacing, and pattern as the manufactured seams at the edges of the original sheet. If the manufactured seams are different, the stronger should be copied. If the repair ends at a structural member where no seam is used, enough repair panel should be used to allow an extra row of staggered rivets, with sufficient edge margin, to be installed.

19-20. WING STRINGERS.

19-21. NEGLIGIBLE DAMAGE. Refer to paragraph 19-17.

19-22. REPAIRABLE DAMAGE. Figure 19-3 outlines a typical wing stringer repair. Two such repairs may be used to splice a new section of stringer material in position, without the filler material.

19-23. DAMAGE NECESSITATING REPLACEMENT OF PARTS. If a stringer is so badly damaged that more than one section must be spliced into it, replace the entire stringer.

19-24. WING AUXILIARY SPARS.

19-25. NEGLIGIBLE DAMAGE. Refer to paragraph 19-17.

19-26. REPAIRABLE DAMAGE. Figure 19-4 outlines a typical auxiliary spar repair.

19-27. DAMAGE NECESSITATING REPLACEMENT OF PARTS. If damage to an auxiliary spar would require a repair which could not be made between adjacent ribs, replace the auxiliary spar.

19-28. WING RIBS.

19-29. NEGLIGIBLE DAMAGE. Refer to paragraph 19-17.

19-30. REPAIRABLE DAMAGE. Figure 19-5 outlines typical wing rib repairs.

19-31. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Leading edge and trailing edge ribs that are extensively damaged should be replaced. However, due to the necessity of unfastening so much skin in order to replace ribs, they should be repaired if practicable. Center ribs, between the front and rear spars should always be repaired if practicable.

19-32. WING SPARS.

19-33. NEGLIGIBLE DAMAGE. Due to the stresses which wing spars encounter, very little damage can be considered negligible. All cracks, stress wrinkles, deep scratches, and sharp dents must be repaired. Smooth dents, light scratches, and abrasions may be considered negligible.

19-34. REPAIRABLE DAMAGE. Figure 19-6 outlines typical spar repairs. It is often practical to cut repair pieces from spare parts listed in Parts Catalogs. Service Kits are available for certain types of spar repairs.

19-35. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Damage so extensive that repair is not feasible requires replacement of a complete wing spar. Also refer to paragraph 19-2.

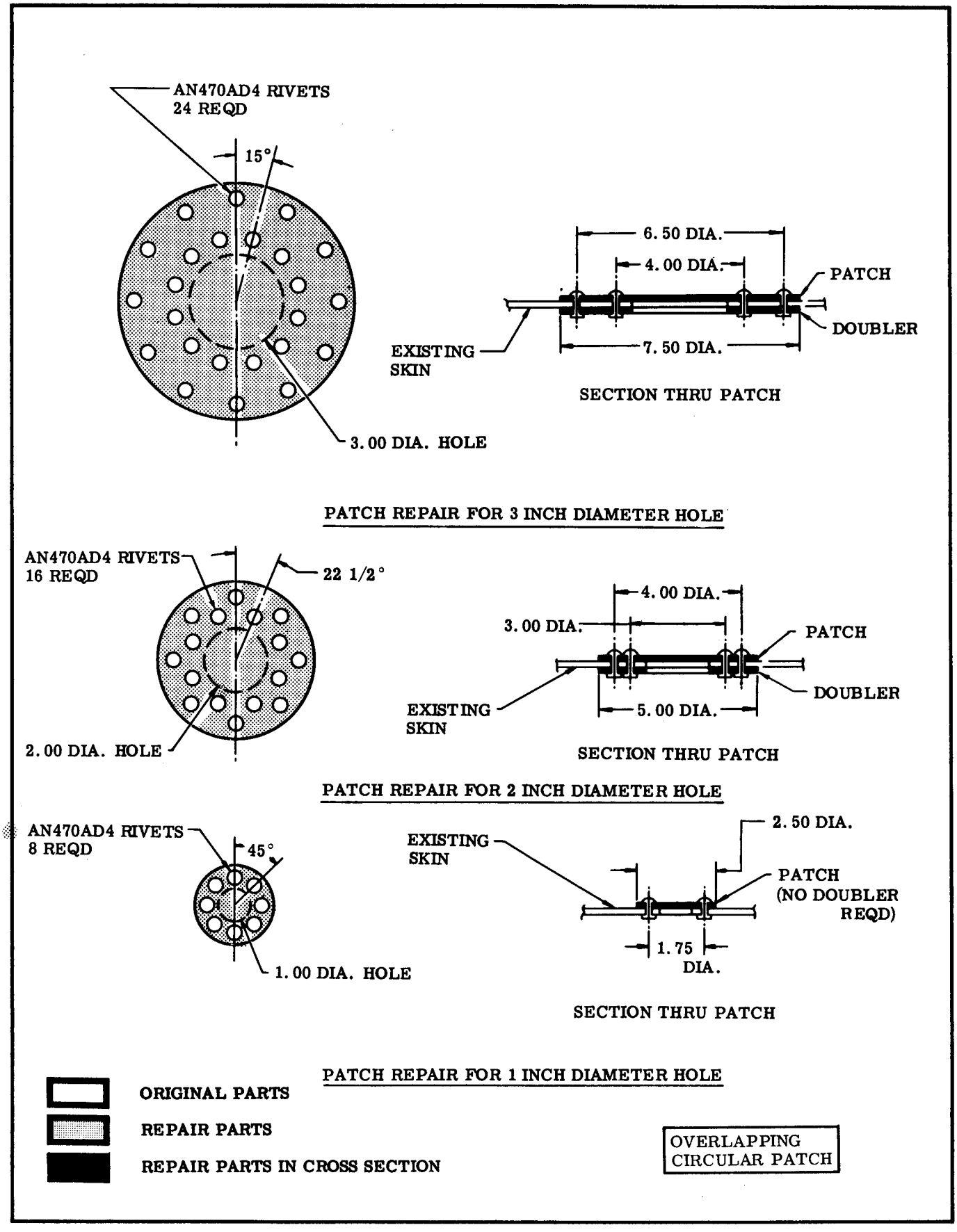
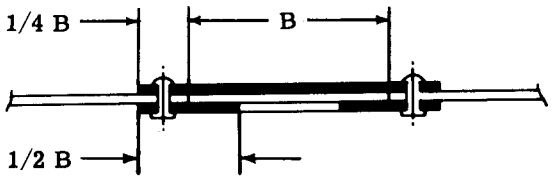
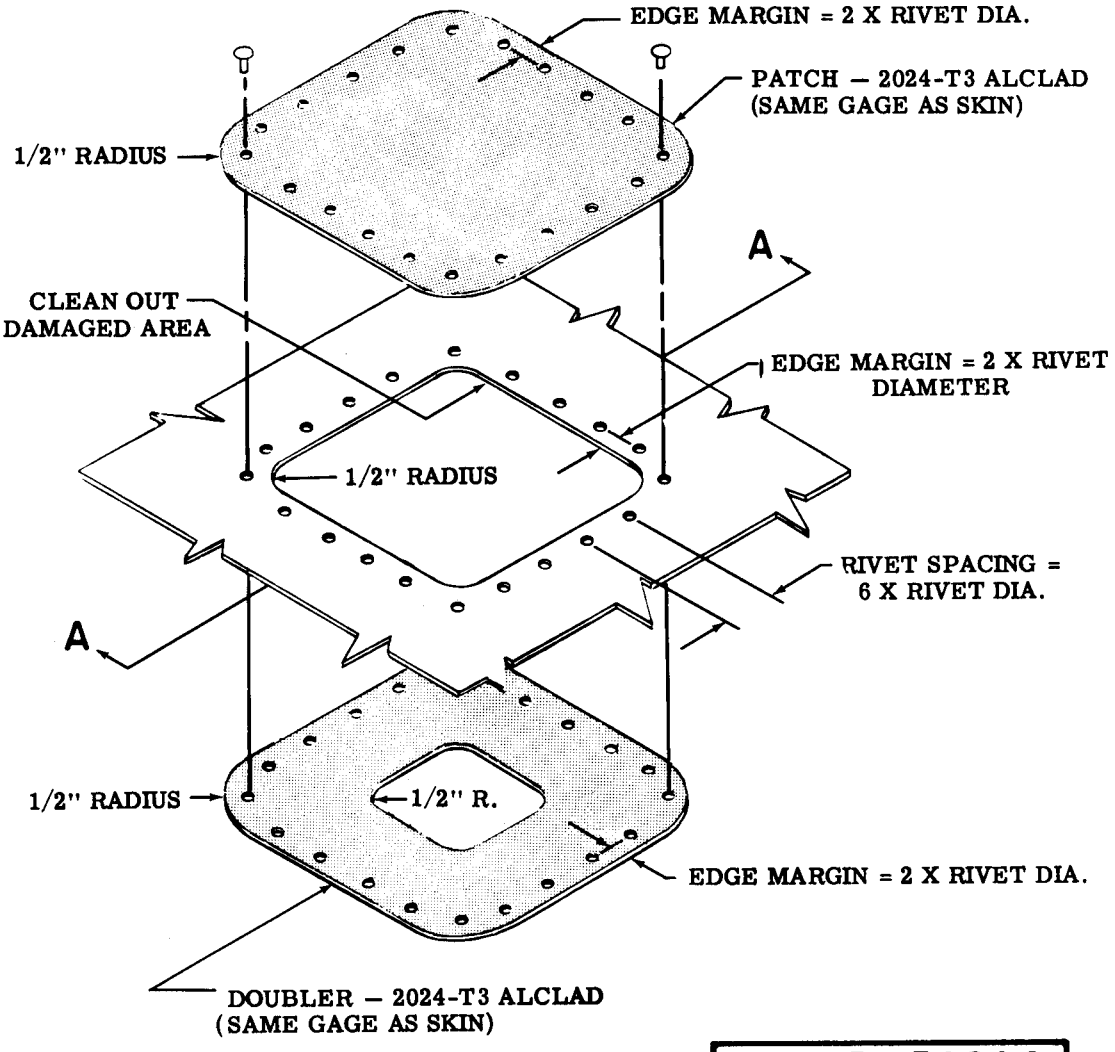


Figure 19-2. Skin Repair - Sheet 1 of 6



SECTION THRU ASSEMBLED PATCH

A–A



ORIGINAL PARTS

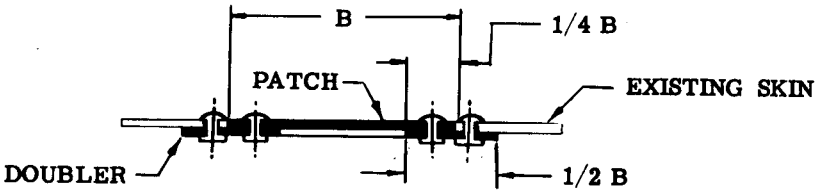
REPAIR PARTS

REPAIR PARTS IN CROSS SECTION

OVERLAPPING RECTANGULAR PATCH

RIVET TABLE	
SKIN GAGE	RIVET DIA.
.020	1/8
.025	1/8
.032	1/8
.040	1/8
.051	5/32

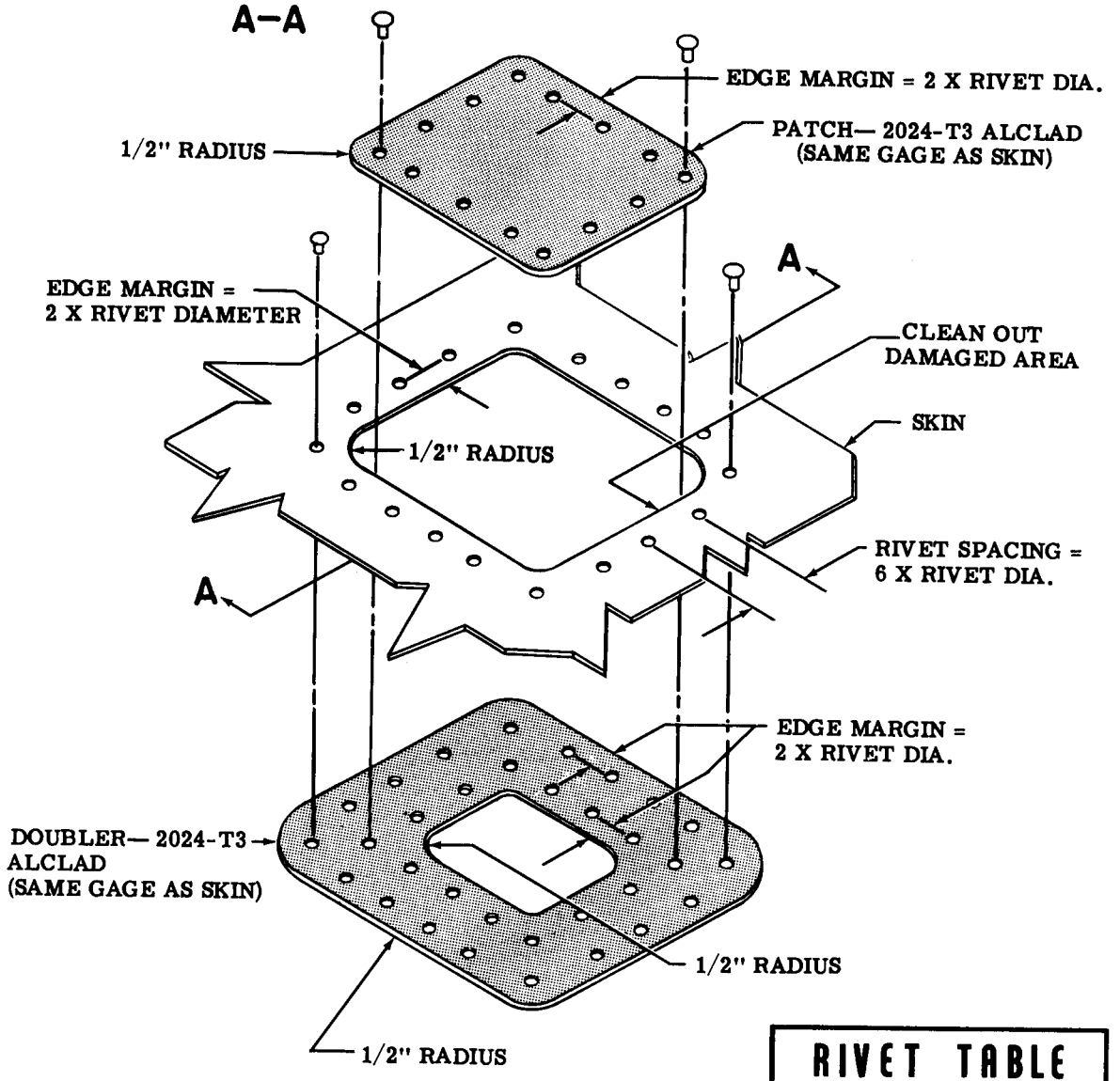
Figure 19-2. Skin Repair - Sheet 2 of 6



SECTION THRU ASSEMBLED PATCH

NOTE

For optimum appearance and airflow, use flush rivets, dimpled skin and patch, and countersunk doubler.



ORIGINAL PARTS

REPAIR PARTS

REPAIR PARTS IN CROSS SECTION

FLUSH RECTANGULAR PATCH (CIRCULAR FLUSH PATCH IS SIMILIAR)

RIVET TABLE

SKIN GAGE	RIVET DIA.
.020	1/8
.025	1/8
.032	1/8
.040	1/8
.051	5/32

Figure 19-2. Skin Repair - Sheet 3 of 6

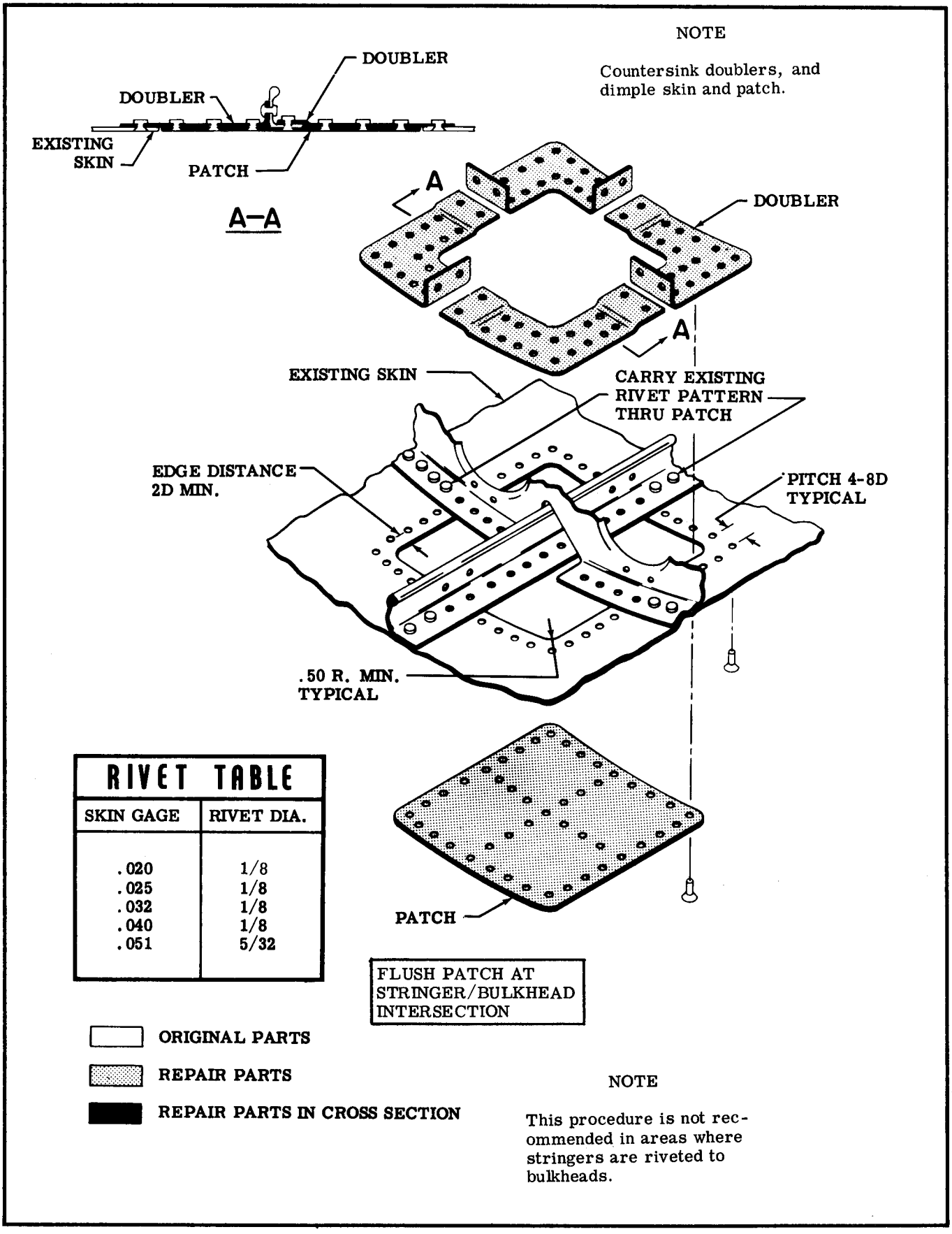


Figure 19-2. Skin Repair - Sheet 4 of 6

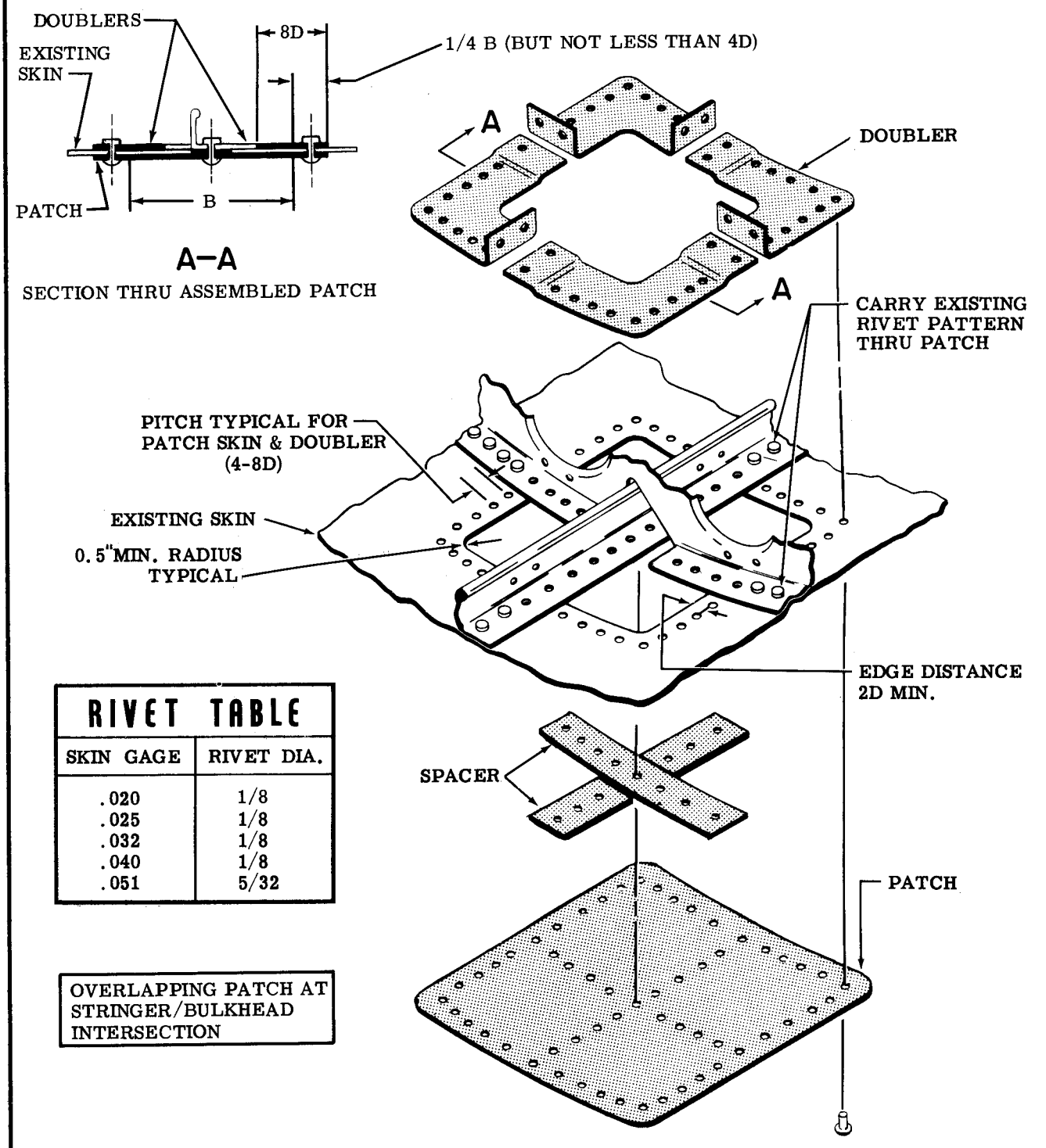


Figure 19-2. Skin Repair - Sheet 5 of 6

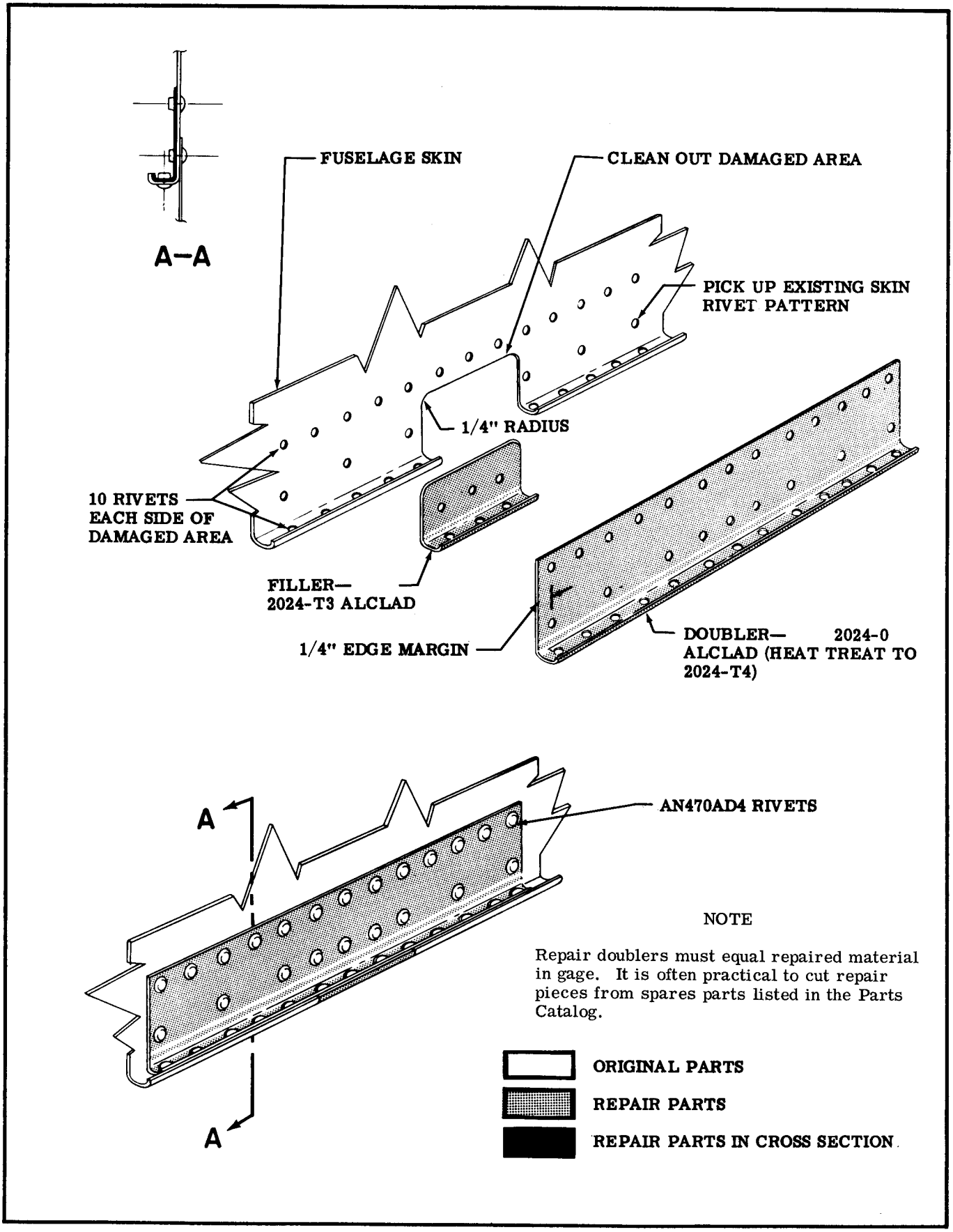


Figure 19-2. Skin Repair - Sheet 6 of 6

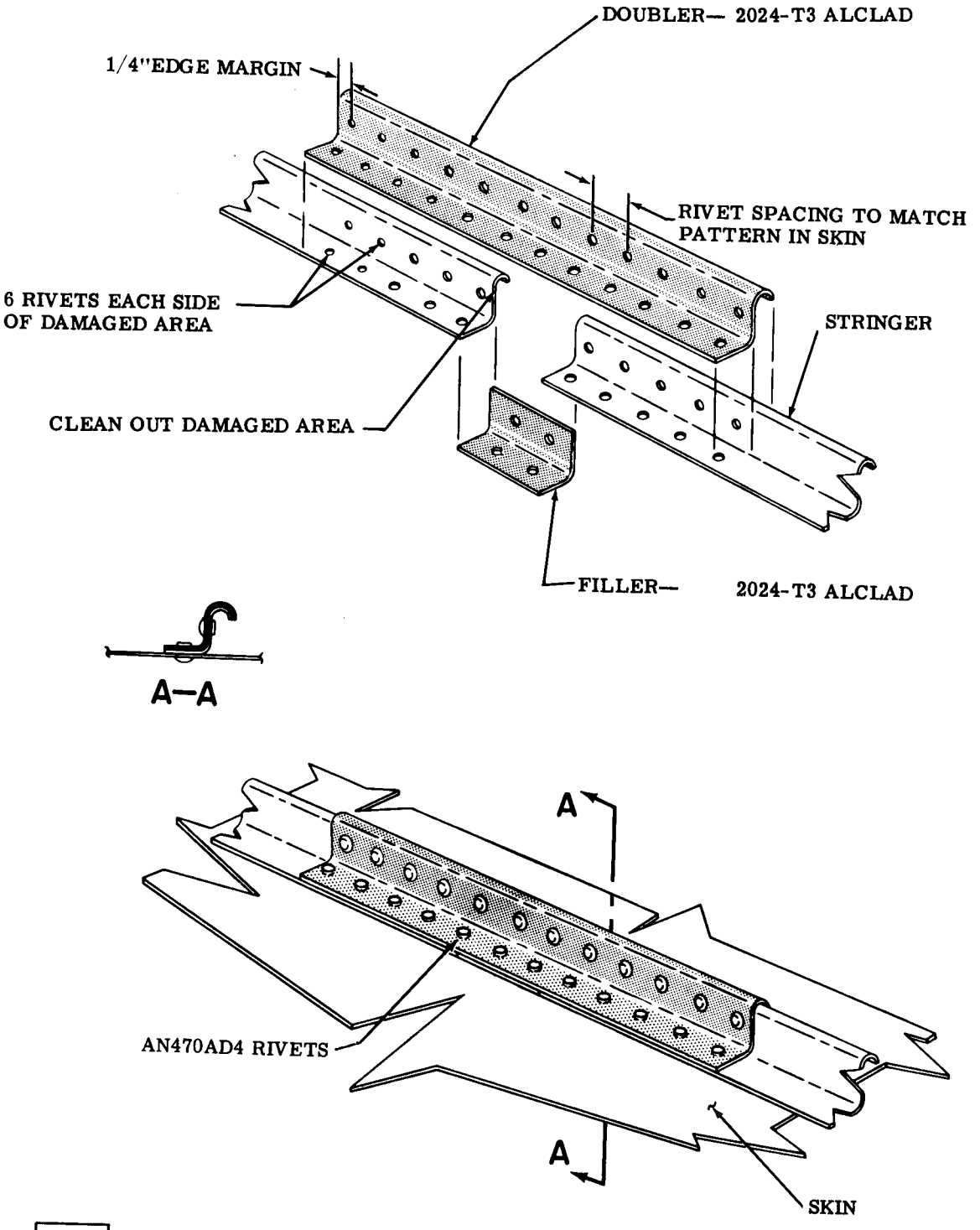


Figure 19-3. Stringer and Channel Repair - Sheet 1 of 4

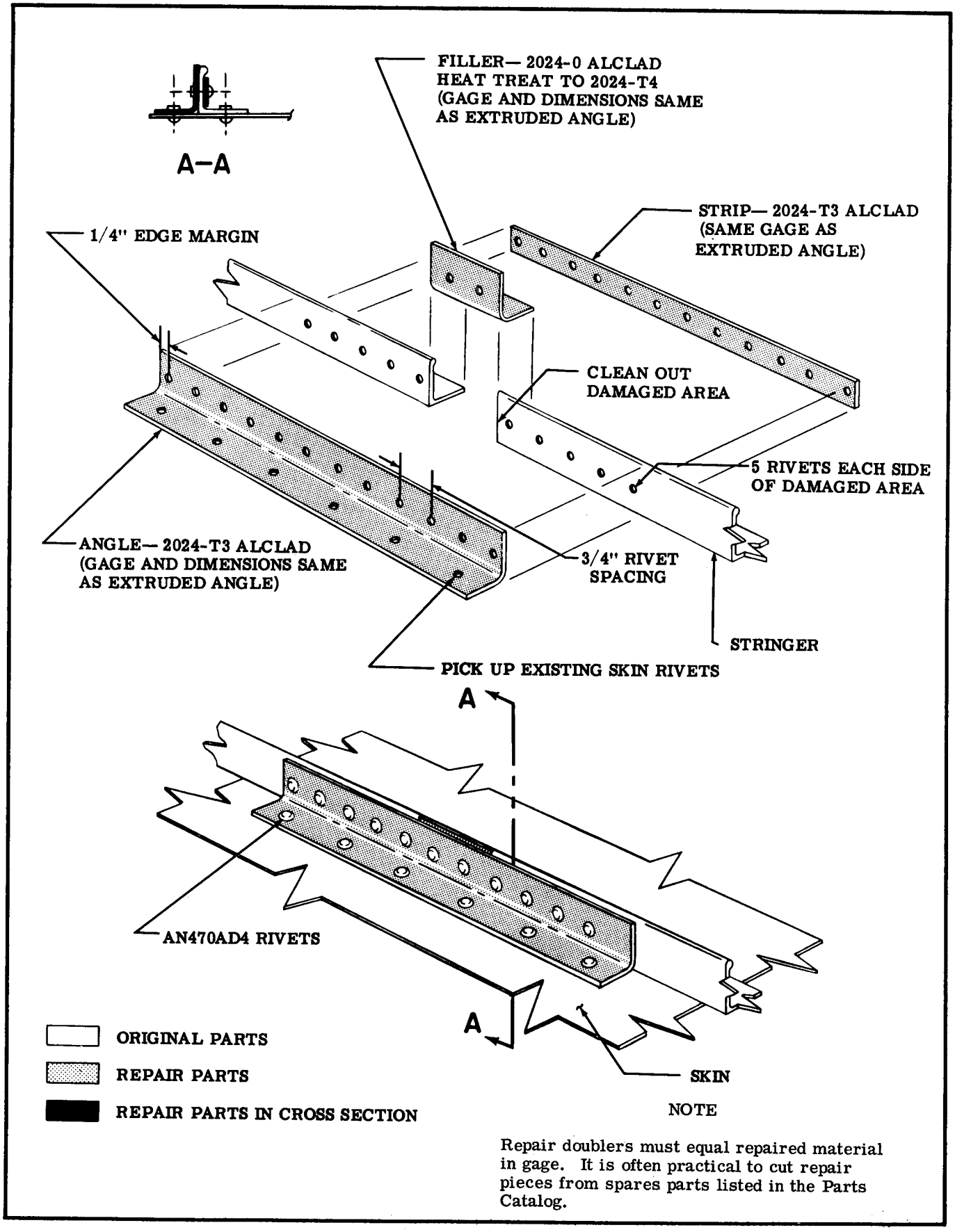


Figure 19-3. Stringer and Channel Repair - Sheet 2 of 4

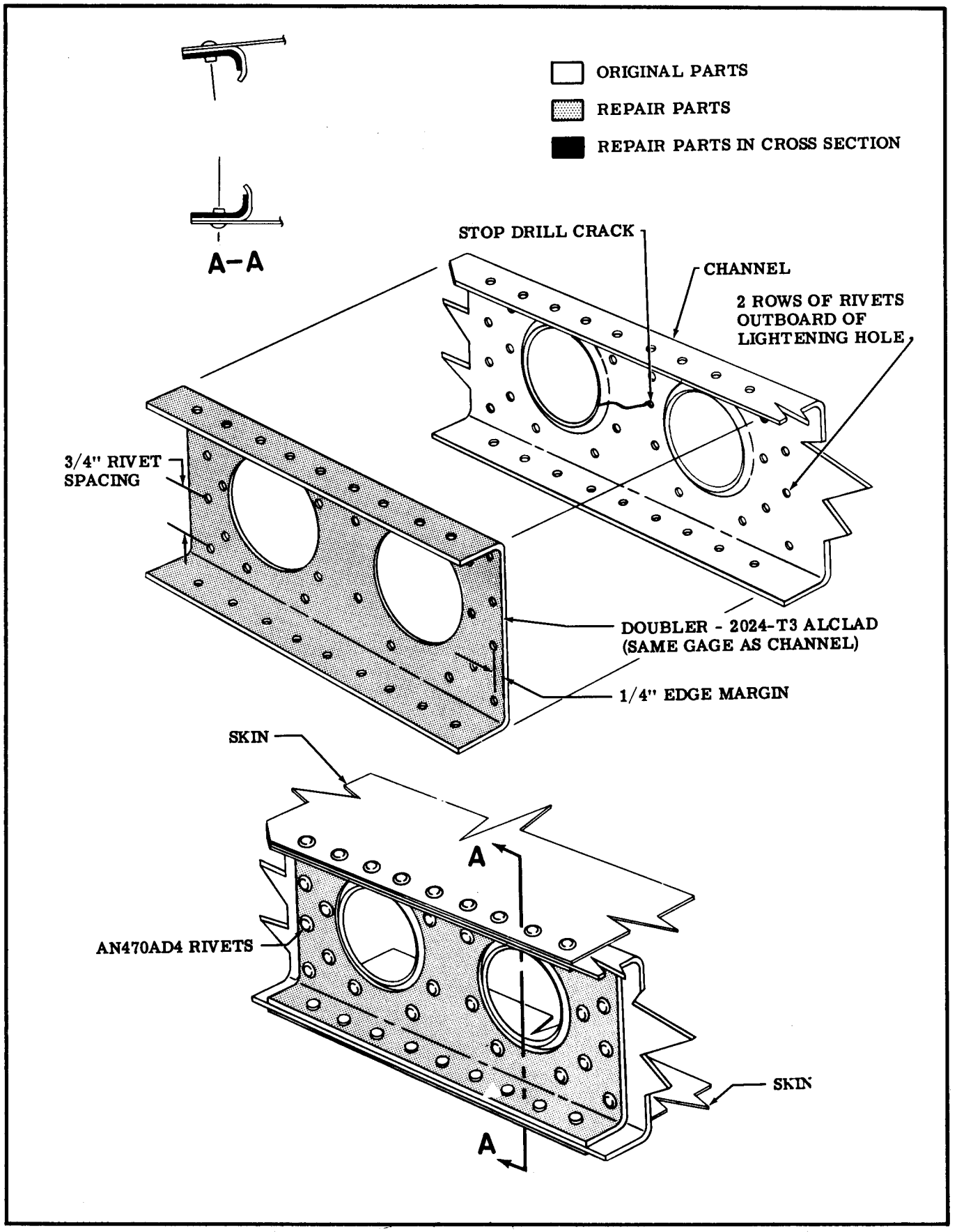


Figure 19-3. Stringer and Channel Repair - Sheet 3 of 4

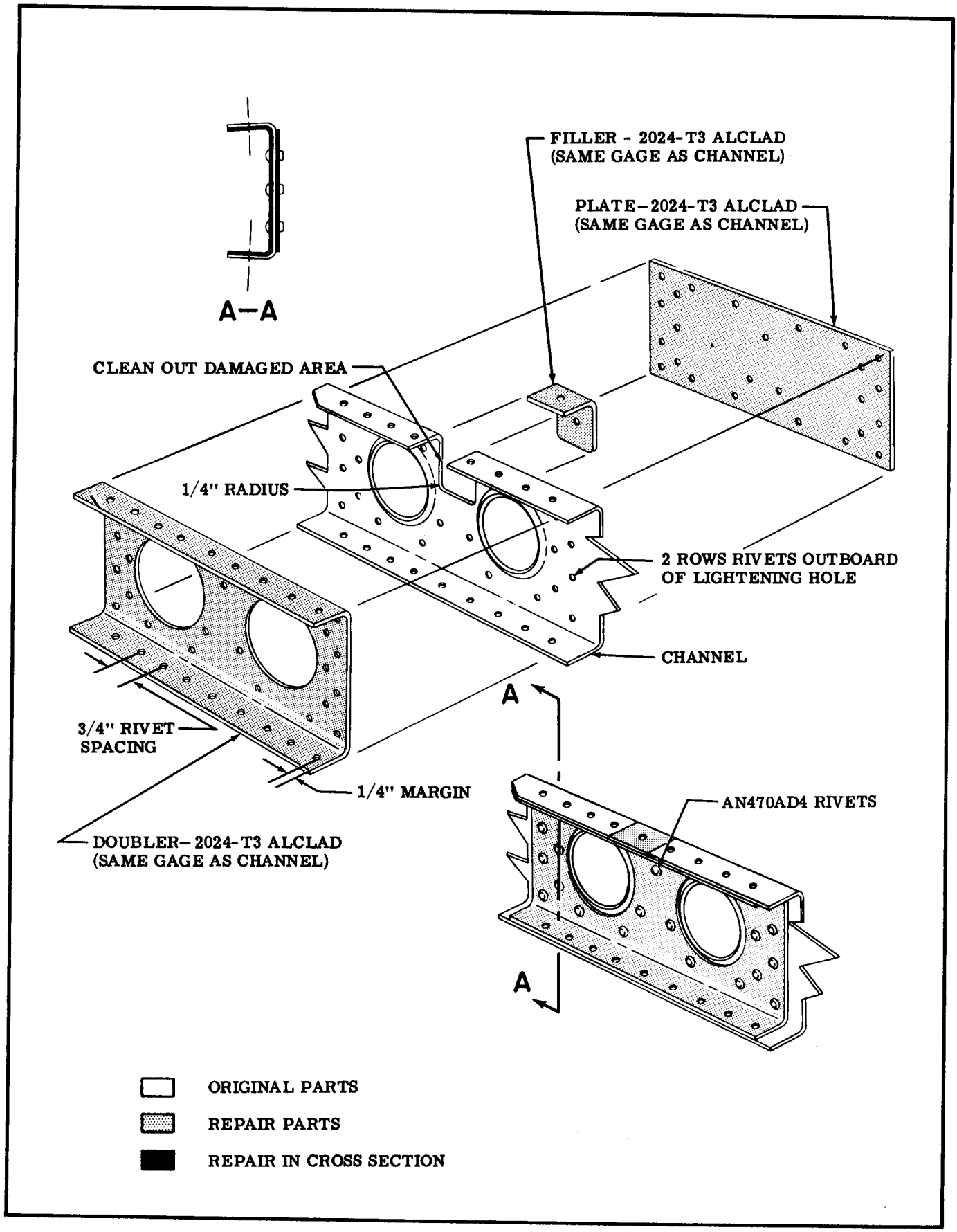


Figure 19-3. Stringer and Channel Repair - Sheet 4 of 4

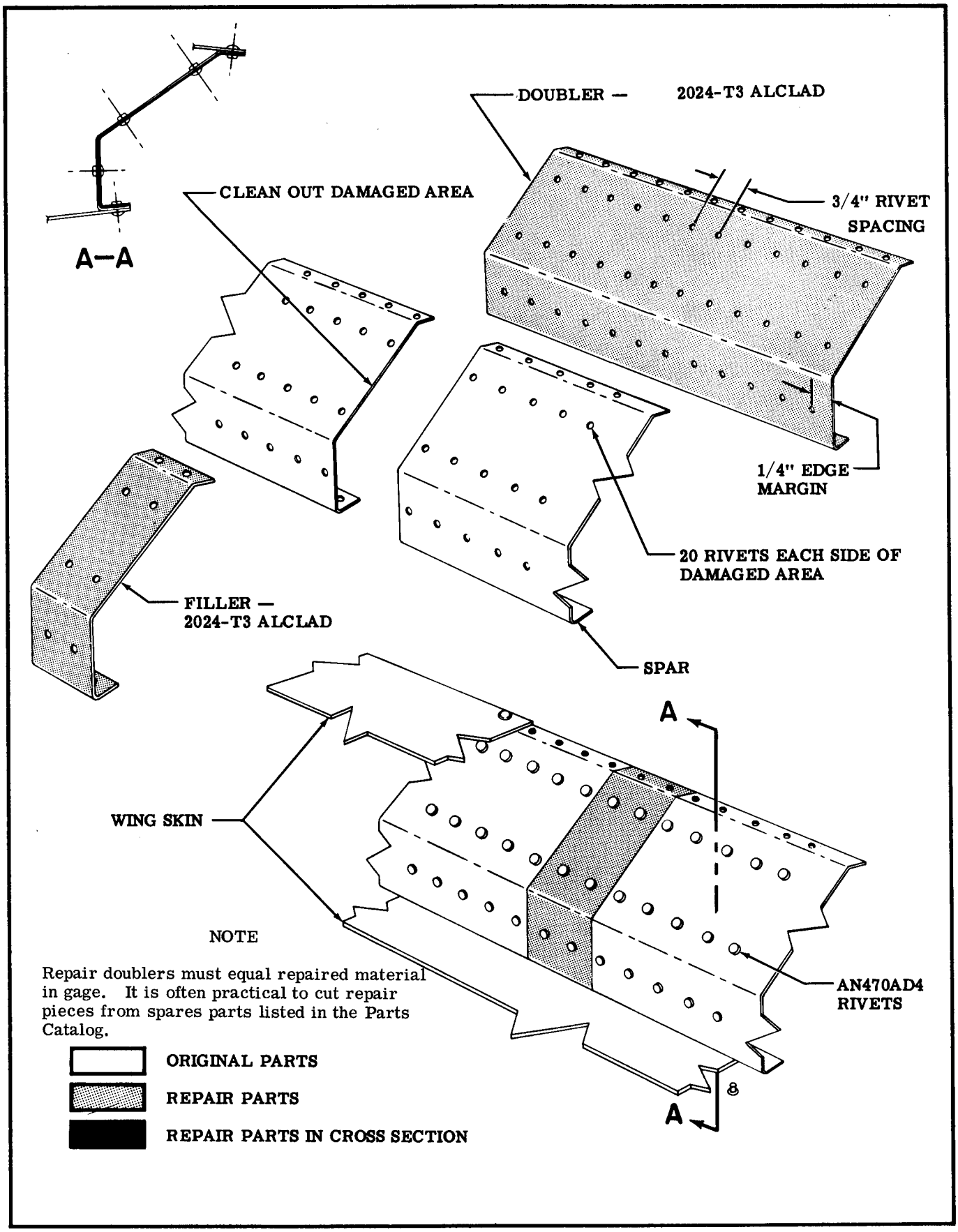


Figure 19-4. Wing Auxiliary Spar Repair

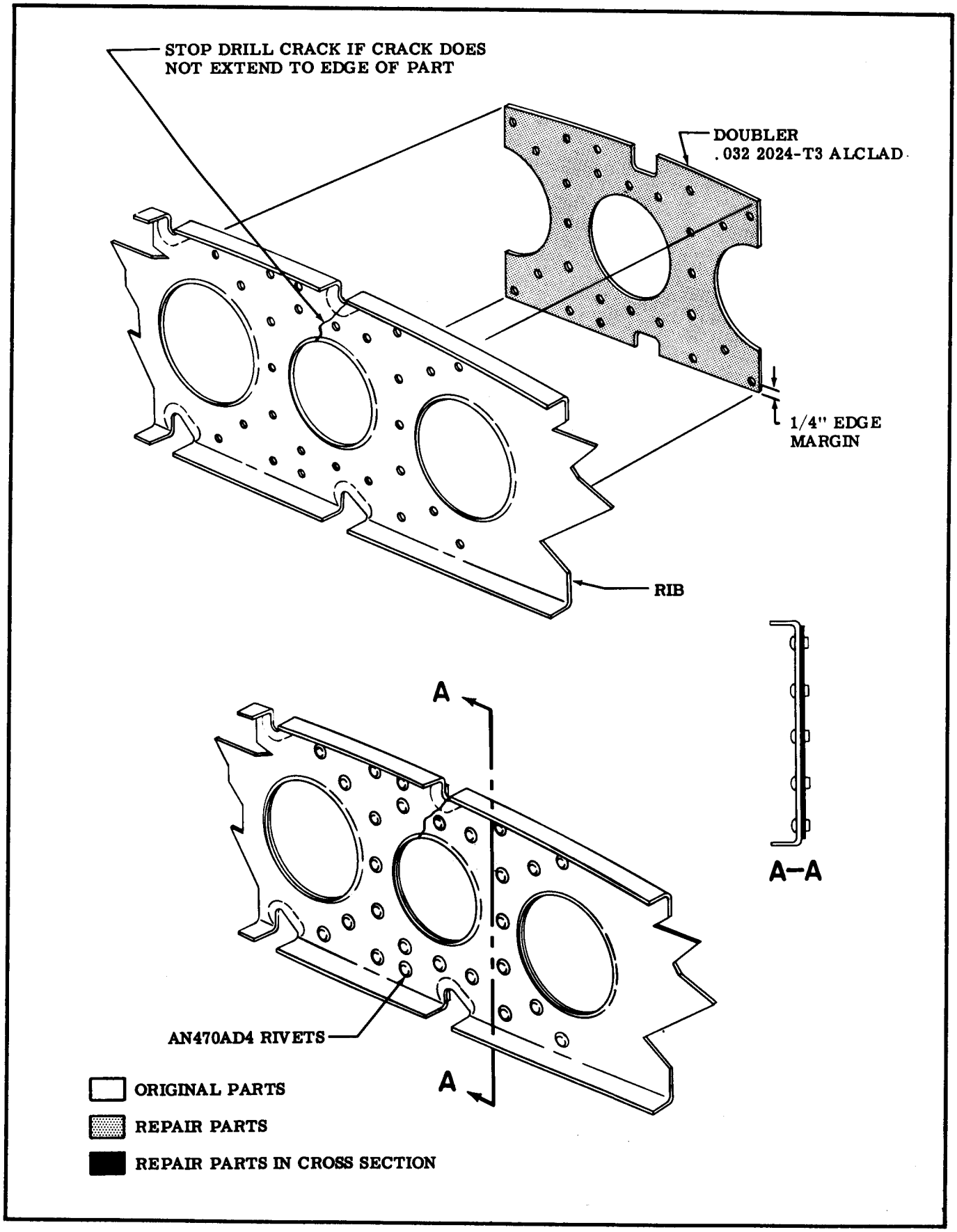


Figure 19-5. Rib Repair - Sheet 1 of 2

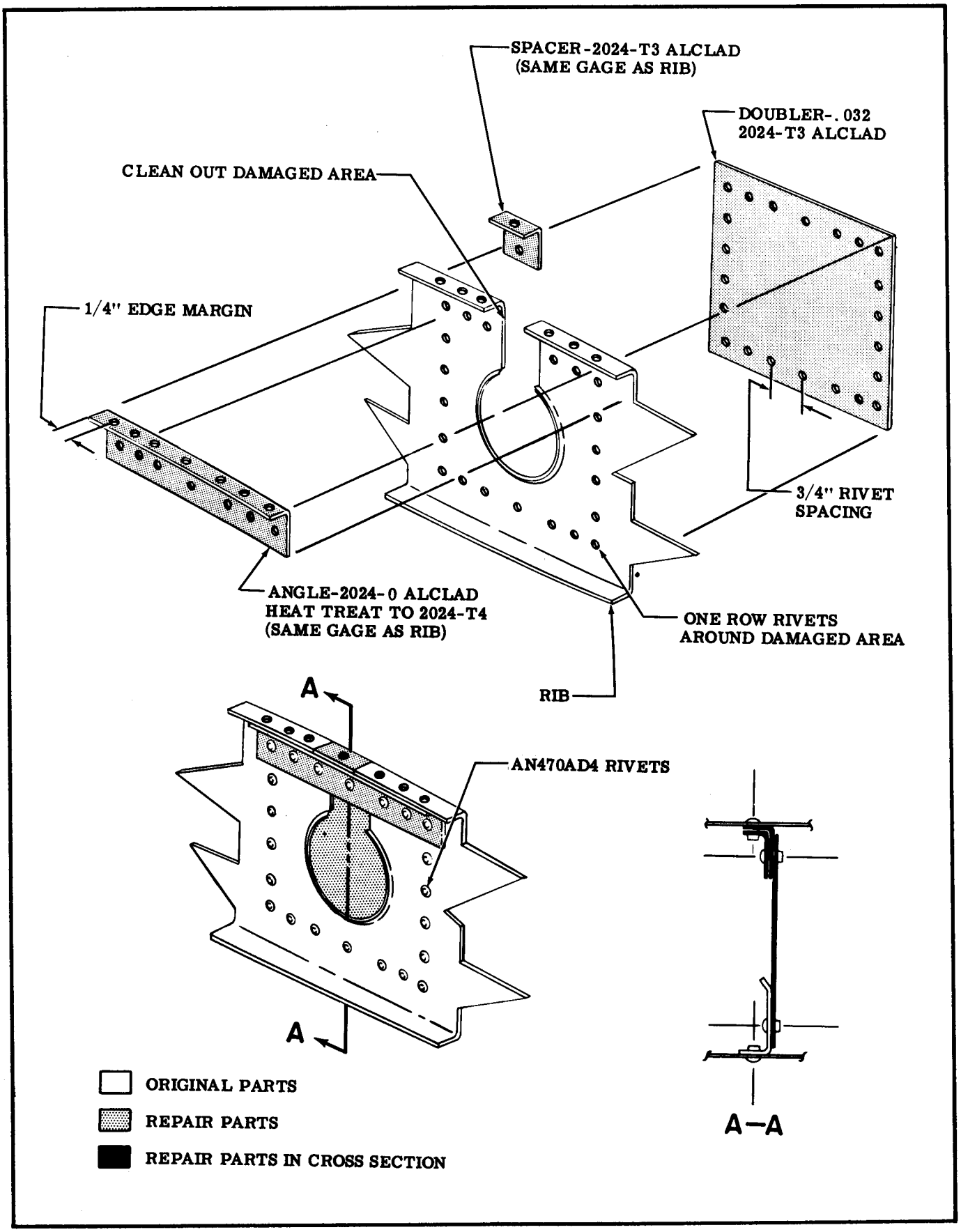


Figure 19-5. Rib Repair - Sheet 2 of 2

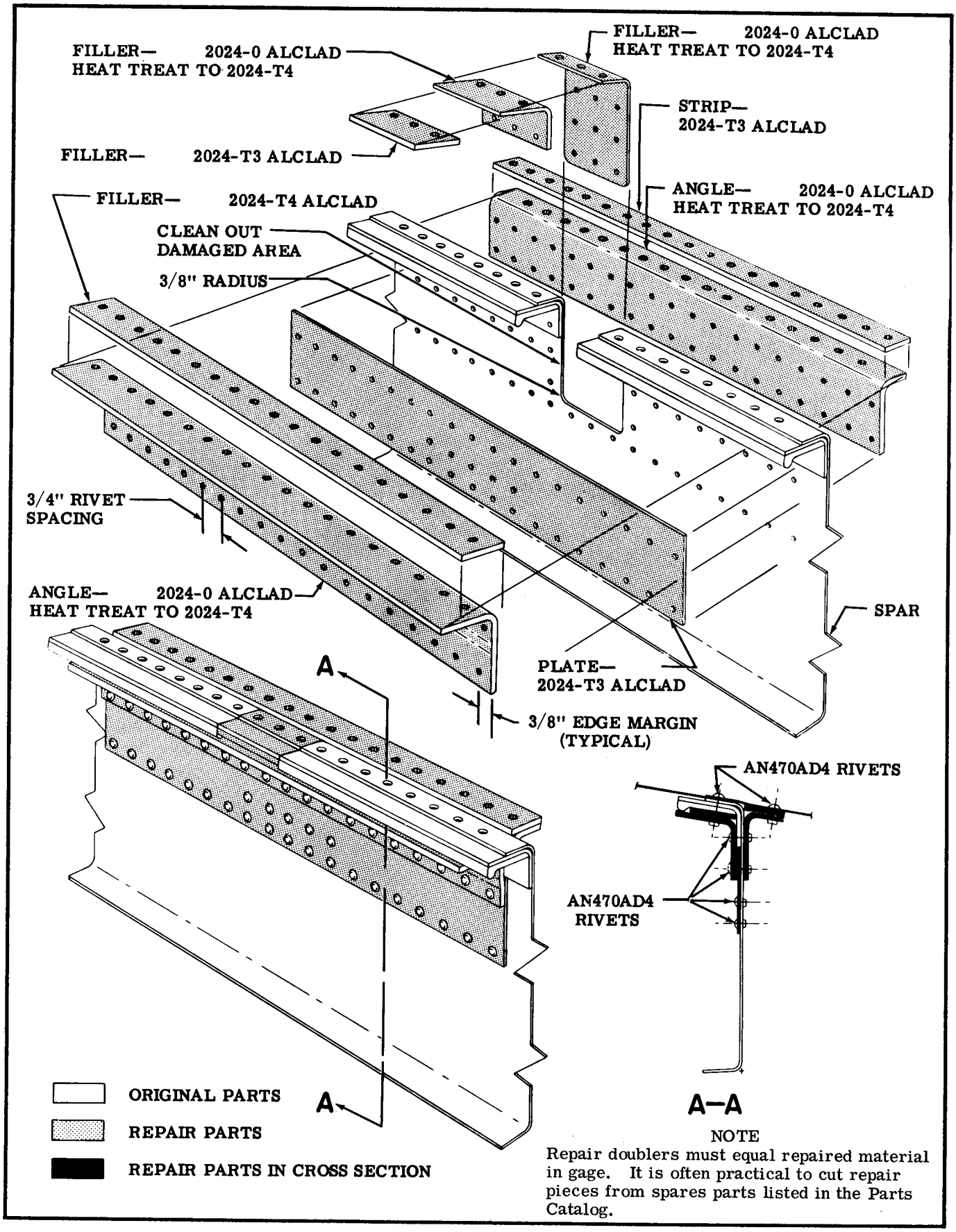


Figure 19-6. Wing Spar Repair - Sheet 1 of 4

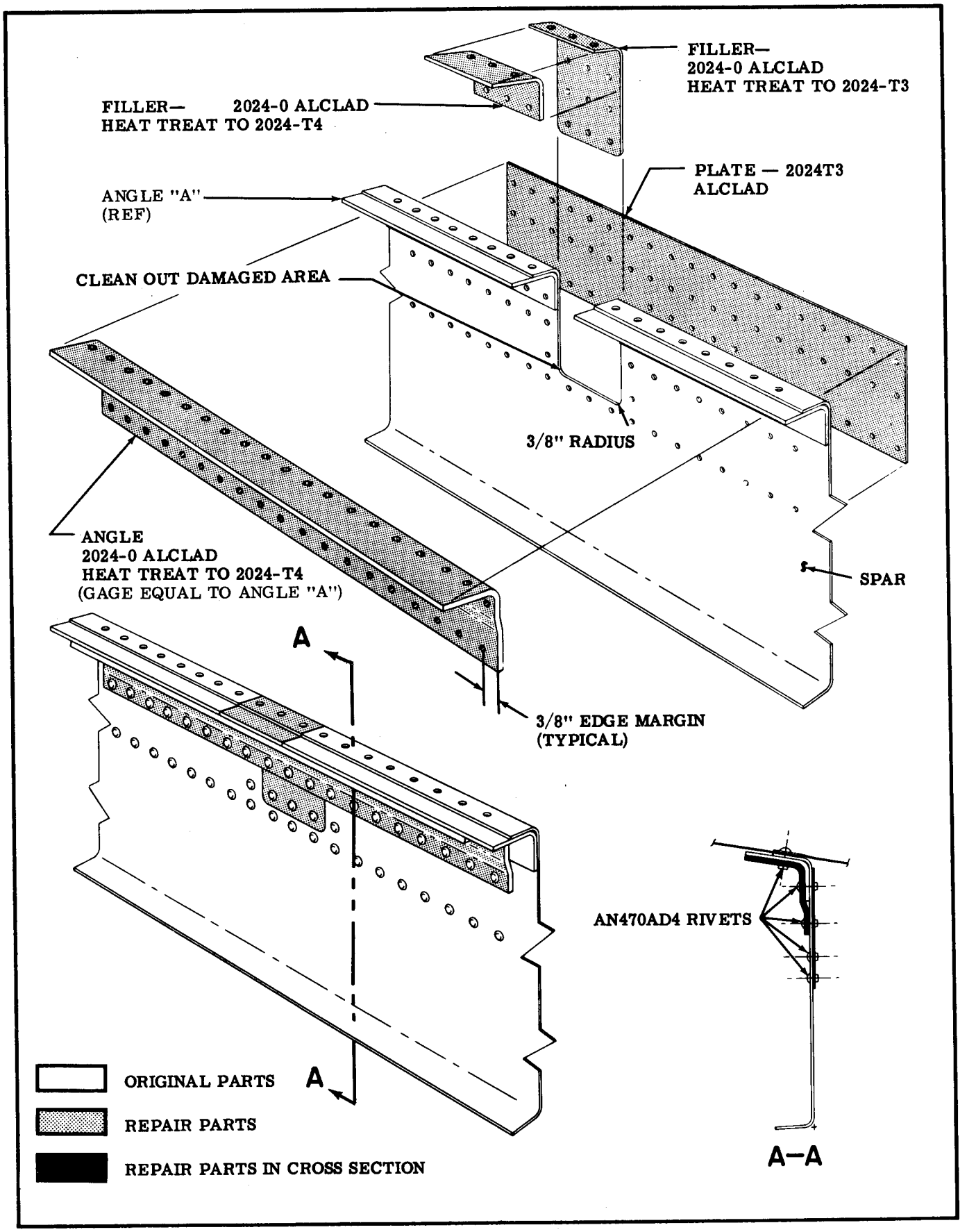


Figure 19-6. Wing Spar Repair - Sheet 2 of 4

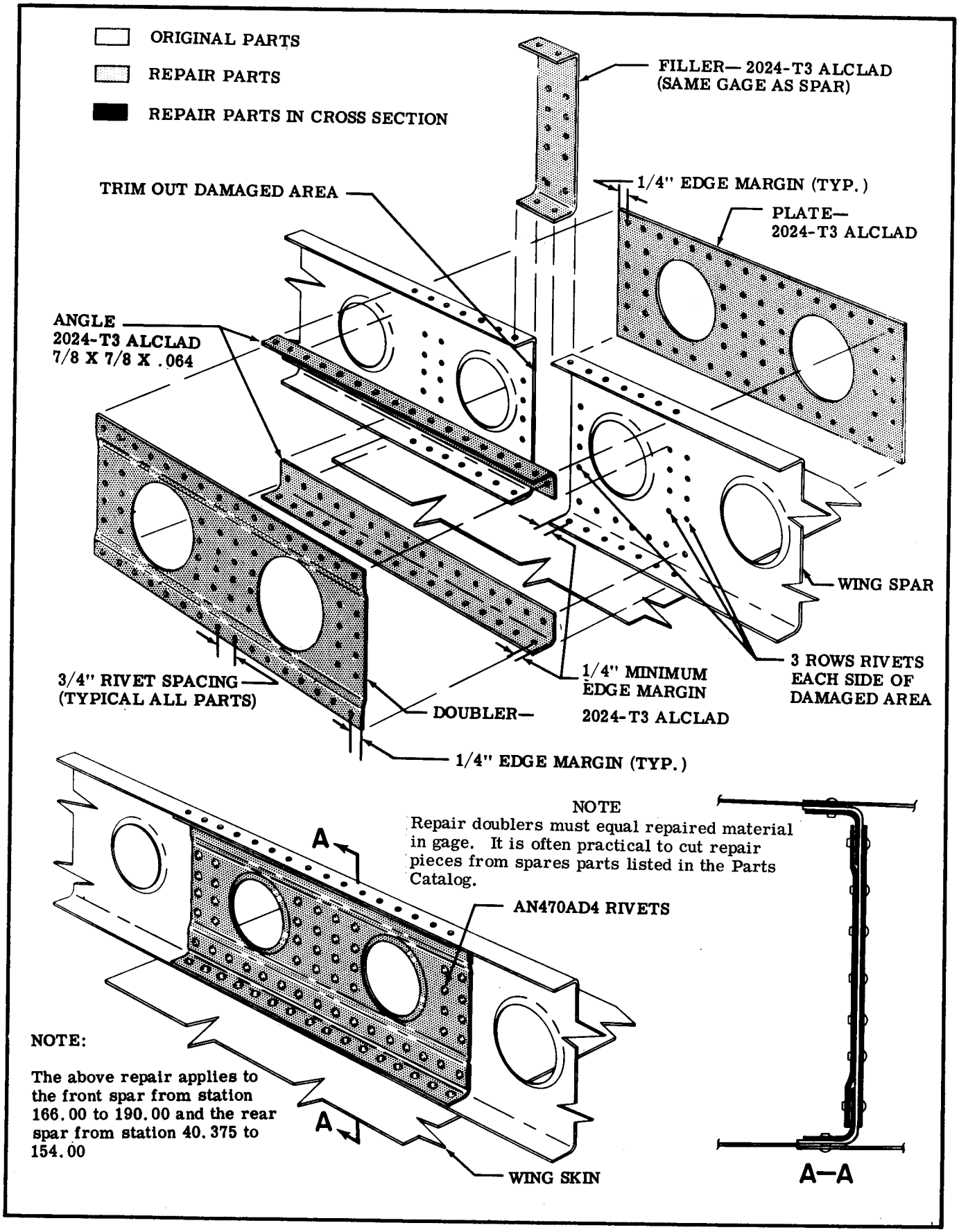


Figure 19-6. Wing Spar Repair - Sheet 3 of 4

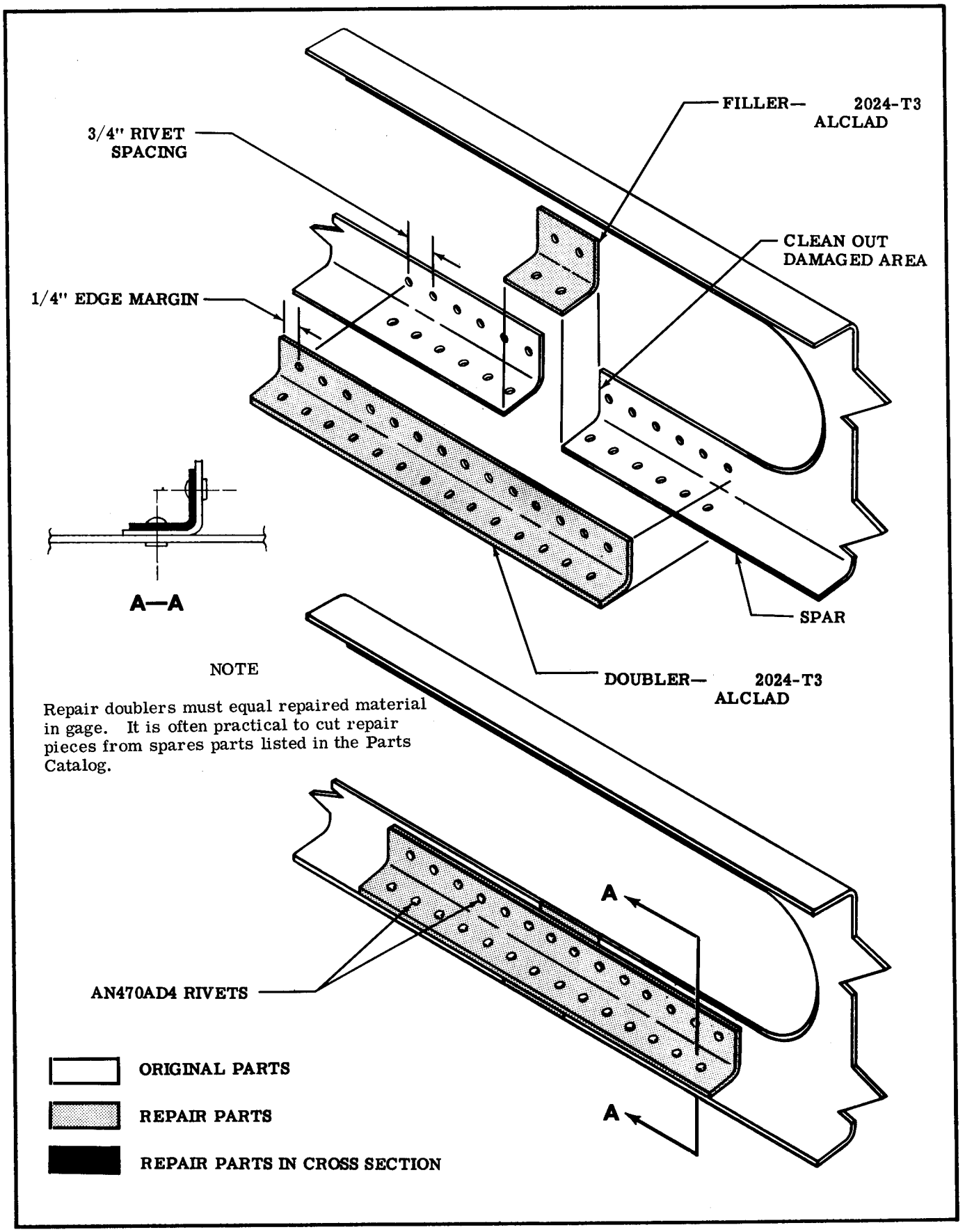


Figure 19-6. Wing Spar Repair - Sheet 4 of 4

19-36. WING LEADING EDGE.

19-37. NEGLIGIBLE DAMAGE. Refer to paragraph 19-17.

19-38. REPAIRABLE DAMAGE. The wing skin repairs outlined in paragraph 19-18 may be used to repair leading edge skins, although the flush-type patches should be used. To facilitate repair, extra access holes may be installed in the locations noted in figure 19-7. If the damage would require a repair which could not be made between adjacent ribs, refer to the following paragraph.

19-39. DAMAGE NECESSITATING REPLACEMENT OF PARTS. For extensive damage, complete leading edge skin panels should be replaced. To facilitate replacement, extra access holes may be installed in the locations noted in figure 19-7.

19-40. AILERONS.

19-41. NEGLIGIBLE DAMAGE. Refer to paragraph 19-17.

19-42. REPAIRABLE DAMAGE. The flush-type skin patches shown in figure 19-2 should be used to repair damage to an aileron skin. Filler material for corrugated areas must match existing corrugations. Doubler material may be flat. If damage would require a repair which could not be made between adjacent ribs, see the following paragraph.

19-43. DAMAGE NECESSITATING REPLACEMENT OF PARTS. If the damage would require a repair which could not be made between adjacent ribs, complete skin panels should be replaced. Ribs and spars may be repaired, but replacement is generally preferable. Where extensive damage has occurred, replacement of the aileron assembly is recommended. After repair and/or repainting, balance in accordance with figure 19-9.

19-44. WING FLAPS.

19-45. NEGLIGIBLE DAMAGE. Refer to paragraph 19-17.

19-46. REPAIRABLE DAMAGE. Flap repairs should be similar to aileron repairs discussed in paragraph 19-42, although patches may be overlapping instead of flush if desired. A flap leading edge repair is shown in figure 19-8. If an overlapping patch is to be used, be sure it will not interfere with the wing during flap operation.

19-47. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Flap repairs which require replacement of parts should be similar to aileron repairs discussed in paragraph 19-43.

19-48. ELEVATORS AND RUDDERS.

19-49. NEGLIGIBLE DAMAGE. Refer to paragraph 19-17. The exception to negligible damage on the elevator surfaces is the front spar, where a crack appearing in the web at the hinge fittings or in the tip rib which supports the overhanging balance weight is not considered negligible. Cracks in the overhanging tip rib, in the area at the front spar intersection with the web of the rib, also cannot be considered negligible.

19-50. REPAIRABLE DAMAGE. Skin patches shown in figure 19-2 may be used to repair skin damage. If the damaged area would require a repair which could not be made between adjacent ribs, see the following paragraph.

19-51. DAMAGE NECESSITATING REPLACEMENT OF PARTS. If the damaged area would require a repair which could not be made between adjacent ribs, complete skin panels should be replaced. Ribs and spars may be repaired, but replacement is generally preferable. Where extensive damage has occurred, replacement of the entire assembly is recommended. After repair and/or repainting, balance in accordance with figure 19-9.

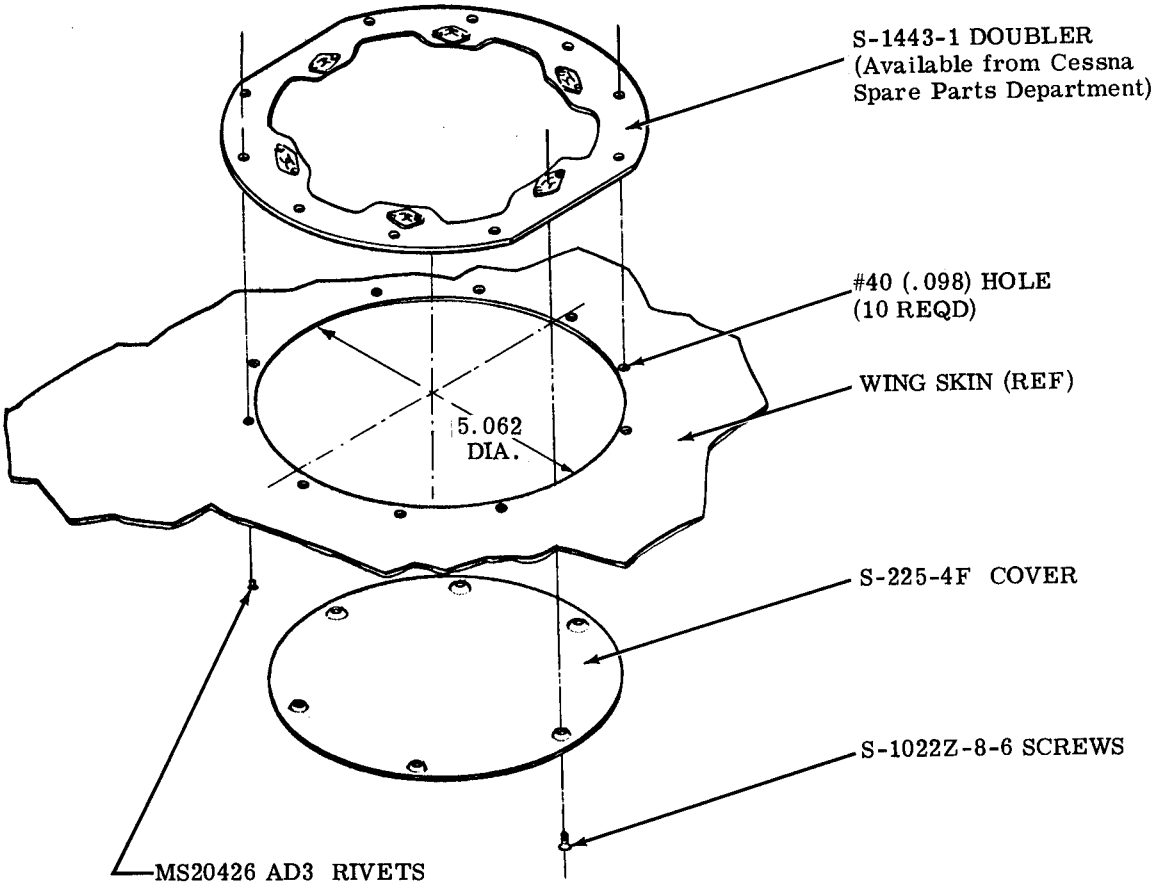
19-52. FOAM-FILLED ELEVATOR TRAILING EDGES AND ELEVATOR TRIM TABS. Skin replacement and/or rebonding the filler material may be accomplished on the foam filled elevator trailing edges and elevator trim tabs. Rebonding may be accomplished by use of an epoxy resin adhesive. Any damage to the filler materials, such as crushing or broken pieces should be repaired by replacing the trailing edge or trim tab as a bonded unit. Standard repairs may be accomplished on the elevator.

19-53. FIN AND STABILIZER.

19-54. NEGLIGIBLE DAMAGE. Refer to paragraph 19-17.

19-55. REPAIRABLE DAMAGE. Skin patches shown in figure 19-2 may be used to repair skin damage. Access to the dorsal area of the fin may be gained by removing the horizontal closing rib at the bottom of the fin. Access to the internal fin structure is best gained by removing skin attaching rivets on one side of the rear spar and ribs, and springing back the skin. Access to the stabilizer structure may be gained by removing skin attaching rivets on one side of the rear spar and ribs, and springing back the skin. If the damaged area would require a repair which could not be made between adjacent ribs, or a repair would be located in an area with compound curves, see the following paragraph.

19-56. DAMAGE NECESSITATING REPLACEMENT OF PARTS. If the damaged area would require a patch which would not be made between adjacent ribs, or the repair would be located in an area with compound curves, complete skin panels should be replaced. Ribs and spars may be repaired, but replacement is generally preferable. Where damage is extensive, replacement of the entire assembly is recommended.



PRECAUTIONS:

1. Add the minimum number of access holes necessary.
2. Any circular or rectangular access hole which is used with approved optional equipment installations may be added in lieu of the access hole illustrated.
3. Use landing light installations instead of adding access holes where possible. Do not add access holes at outboard end of wing; remove wing tip instead.
4. Do not add an access hole in the same bay where one is already located.
5. Locate new access holes near the center of a bay (spanwise).
6. Locate new access holes forward of the front spar as close to the front spar as practicable.
7. Locate new access holes aft of the front spar between the first and second stringers aft of the spar. When installing the doubler, rotate it so the two straight edges are closest to the stringers.
8. Alternate bays, with new access holes staggered forward and aft of the front spar, are preferable.
9. A maximum of five new access holes in each wing is permissible; if more are required, contact the Cessna Service Department.
10. When a complete leading edge skin is being replaced, the wing should be supported in such a manner that wing alignment is maintained.

a. Establish exact location for inspection cover and inscribe center lines.

b. Determine position of doubler on wing skin and center over center lines. Mark the ten rivet hole locations and drill to size shown.

c. Cut out access hole using dimension shown.

d. Flex doubler and insert through access hole, and rivet in place.

e. Position cover and secure using screws as shown.

Figure 19-7. Access Hole Installation

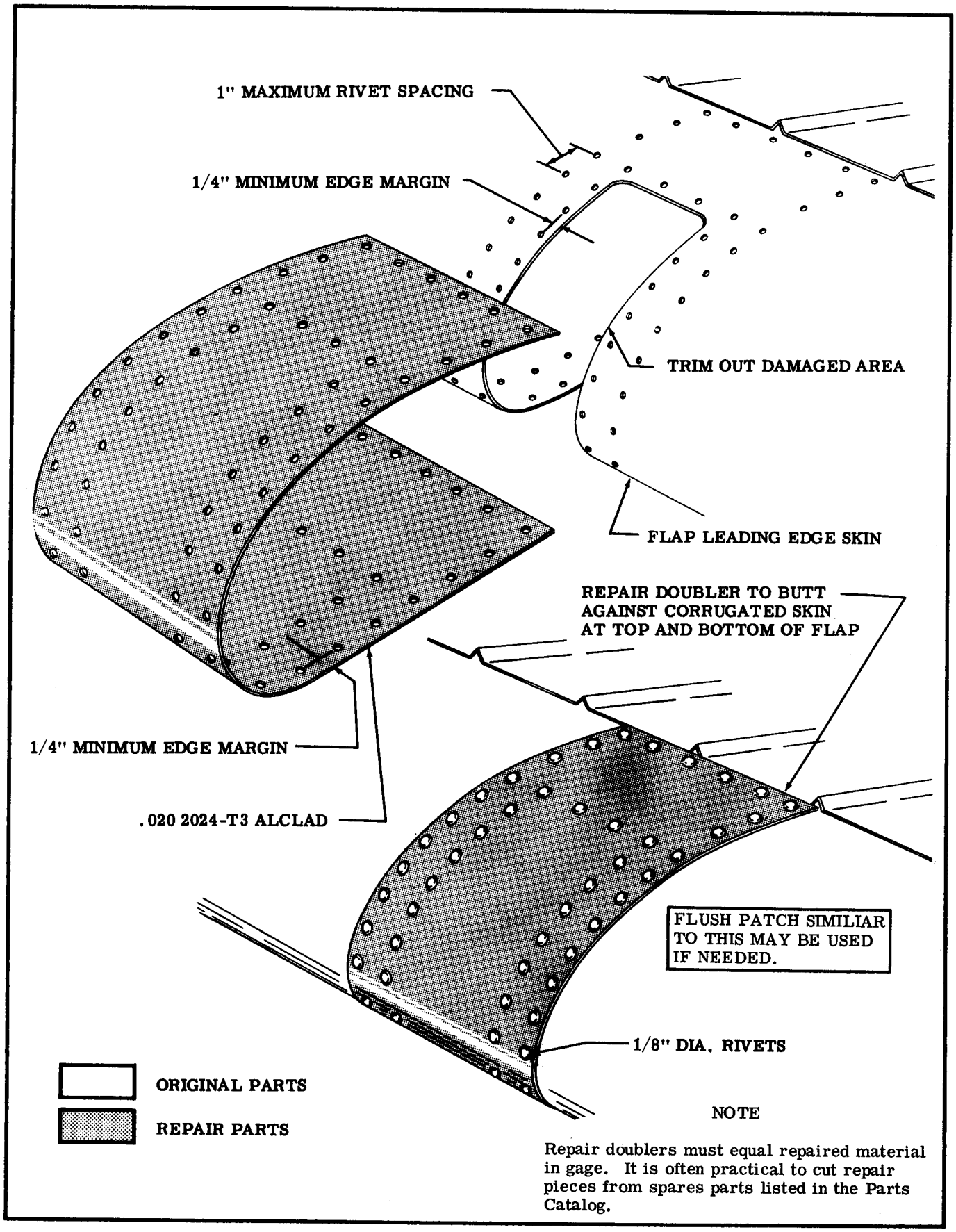
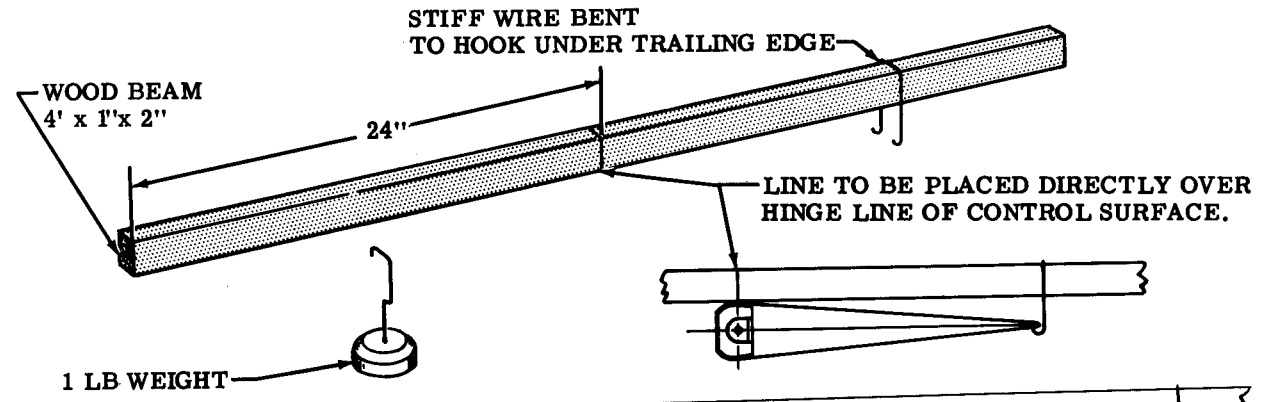
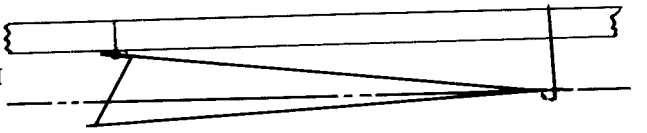


Figure 19-8. Flap Leading Edge Repair

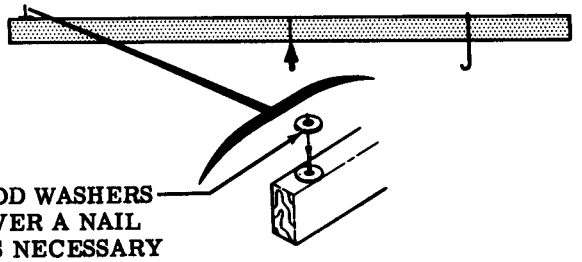
(1) CUT A 4' LENGTH OF 1 x 2 AND MARK ITS MIDPOINT. BEND A WIRE TO HOOK UNDER THE TRAILING EDGE OF THE SURFACE.



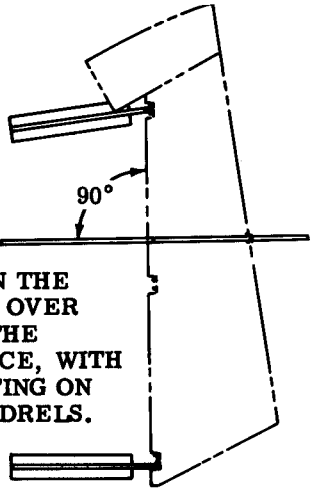
BEAM SHOULD BE PARALLEL TO CHORD OF CONTROL SURFACE. AILERON CHORD PASSES THROUGH A POINT APPROXIMATELY 1/3 UP AT CENTER SPAN OF AILERON FRONT SPAR. FRISE AILERON SHOWN ON SHEET 2.



(2) BALANCE THE BEAM OVER THE HINGE LINE MARK



ADD WASHERS OVER A NAIL AS NECESSARY TO COUNTERBALANCE THE WEIGHT OF THE WIRE HOOK.



(3) SET THE LINE ON THE BEAM DIRECTLY OVER HINGE LINE OF THE CONTROL SURFACE, WITH HINGE PINS RESTING ON BALANCING MANDRELS.

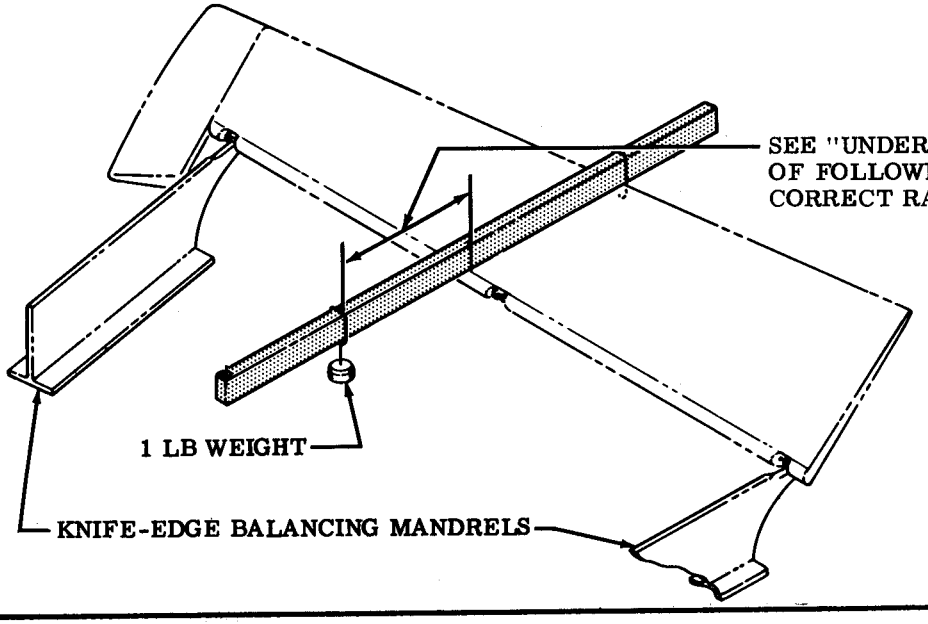
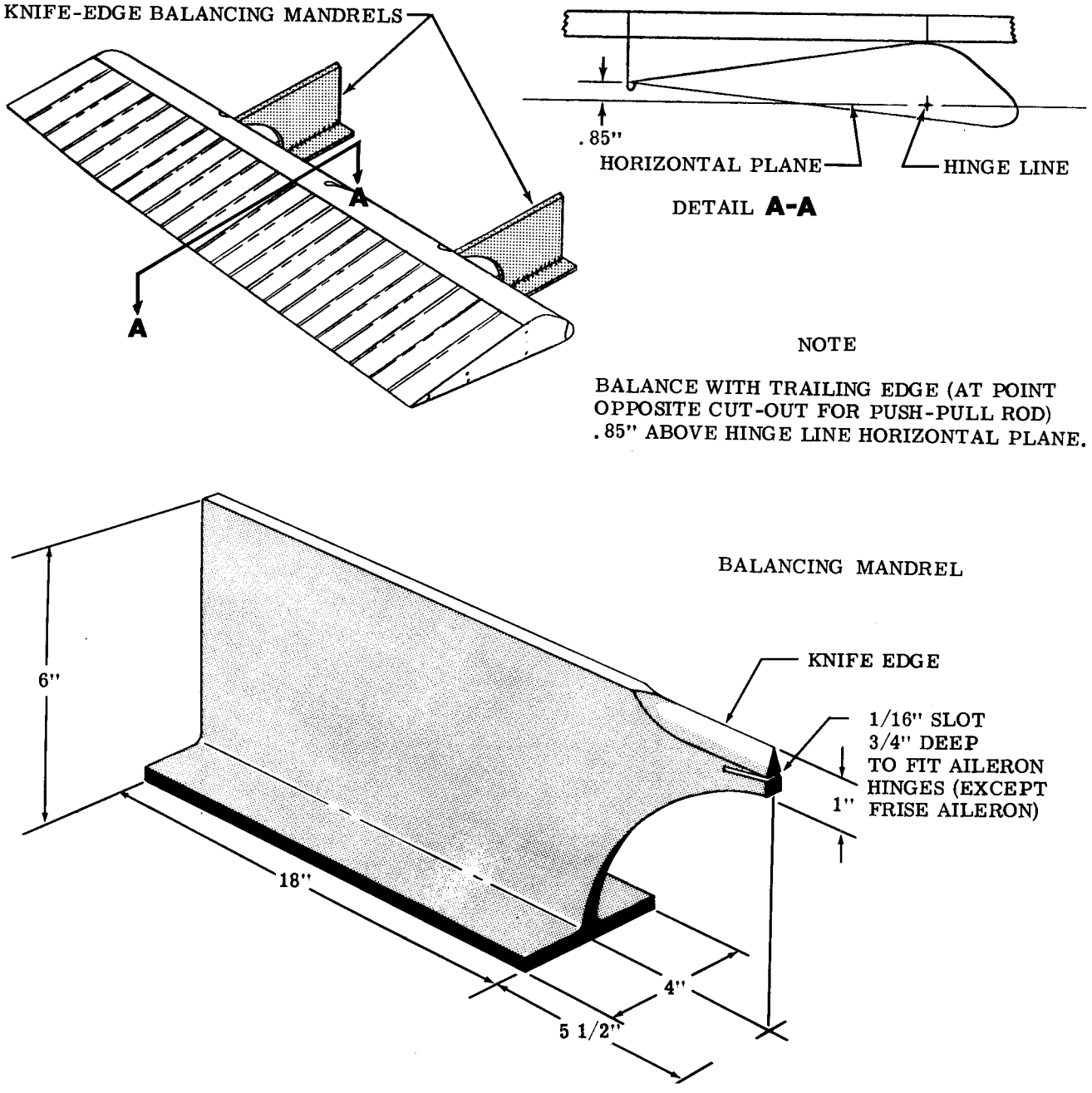


Figure 19-9. Control Surface Balance Details - Sheet 1 of 3



a. Place pins through control surface hinges and position on knife edge of balancing mandrels; secure ailerons by inserting hinges into the slots in the mandrels (except Frise type).
b. Balance in still air.
c. Hinge lines must be horizontal.
d. All control surfaces are neutral to underbalanced. This means the control surfaces should be horizontal or hang down from the hinge line; they should never swing up from horizontal.

Figure 19-9. Control Surface Balance Details - Sheet 2 of 3

Model	Serials	AILERONS Underbalance	RUDDER Underbalance	RIGHT ELEVATOR Underbalance	LEFT ELEVATOR Underbalance
210 & 210A		0.0 to +9.64 in-lbs	0.0 to +3.9 in-lbs	0.0 to +7.58 in-lbs	0.0 to +7.04 in-lbs
210B	57841 to 57957	0.0 to +3.0 in-lbs	Same as above.	Same as above.	Same as above.
210B	57957 and on	Same as above.	Same as above.	0.0 to +6.4 in-lbs	0.0 to +5.2 in-lbs
210C		Same as above.	0.0 to +6.0 in-lbs	Same as above.	Same as above.
210D & 210E		Same as above.	Same as above.	0.0 to +5.4 in-lbs	0.0 to +5.4 in-lbs
205 & 205A		Same as above.	Same as above.	0.0 to +20.2 in-lbs	0.0 to +17.2 in-lbs
206 Series		Same as above.	Same as above.	0.0 to +20.47 in-lbs	0.0 to +20.47 in-lbs

NOTE

The "Underbalance" columns list the moment tolerances within which the control surface must balance. These tolerances must never be exceeded in the final flight configuration, regardless of whether the control surface is painted or unpainted. Note that specific weights and their tolerances have been deleted from the chart. It is now recommended that balance weight be used as necessary to achieve the unbalance specified. Good workmanship and standard repair practices will not result in unreasonable balance weights.

Figure 19-9. Control Surface Balance Details - Sheet 3 of 3

19-57. FUSELAGE.

19-58. The fuselage is of semi-monocoque construction consisting of formed bulkheads, longitudinal stringers, reinforcing channels and skin platings.

19-59. NEGLIGIBLE DAMAGE. Refer to paragraph 19-17. Mild corrosion appearing upon alclad surfaces does not necessarily indicate incipient failure of the base metal. However, corrosion of all types should be carefully considered, and approved remedial action taken. Small cans appear in the skin structure of all metal airplanes. It is strongely recommended however, than wrinkles which appear to have originated from other sources, or which do not follow the general appearance of the remainder of the skin panels, be thoroughly investigated. Except in the landing gear bulkhead areas, wrinkles occurring over stringers which disappear when the rivet pattern is removed may be considered negligible. However, the stringer rivet holes may not align perfectly with the skin holes because of a permanent "set" in the stringer. If this is apparent, replacement of the stringer will usually restore the original strength characteristics of the area.

NOTE

Wrinkles occurring in the skin of the main landing gear bulkhead areas should not be considered negligible. The skin panel should be opened sufficiently to permit a thorough examination of the lower portion of the landing gear bulkhead and its tie-in structure.

Wrinkles occurring on open areas which disappear when the rivets at the edge of the sheet are removed, or a wrinkle which is hand removable, may often be repaired by the addition of a 1/2 x 1/2 x .060 inch 2024-T4 extruded angle, riveted over the wrinkle and extended to within 1/16 to 1/8 inch of the nearest structural members. Rivet pattern should be identical to the existing manufactured seam at the edge of the sheet.

19-60. REPAIRABLE DAMAGE. Fuselage skin repairs may be accomplished in the same manner as wing skin repairs outlined in paragraph 19-18. Stringers, formed skin flanges, bulkhead channels, and similar parts may be repaired as shown in figure 19-3.

19-61. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Fuselage skin major repairs may be accomplished in the same manner as wing skin repairs outlined in paragraph 19-19. Damaged fittings should be replaced. Seat rails serve as structural parts of the fuselage and should be replaced if damaged.

19-62. BULKHEADS.

19-63. LANDING GEAR BULKHEADS. Since these bulkheads are highly stressed members irregularly formed to provide clearance for control lines, actuators, fuel lines, etc., patch type repairs will be, for the most part, impractical. Minor damage, consisting of small nicks or scratches, may be repaired by dressing out the damaged area, or by replacement of rivets. Any other such damage should be repaired by replacing the landing gear support assembly as an aligned unit.

19-64. REPAIR AFTER HARD LANDING. Buckled skin or floorboards and loose or sheared rivets in the area of the main gear support will give evidence of damage to the structure from an extremely hard landing. When such evidence is present the entire support structure should be carefully examined and all support forgings should be checked for cracks, using a dye penetrant and proper magnification. Bulkheads in the area of possible damage should be checked for alignment and a straightedge should be used to determine deformation of the bulkhead webs. Damaged support structure, buckled floorboards and skins, and damaged or questionable forgings should be replaced. Landing gear components should be replaced and rigged properly.

19-65. REPLACEMENT OF HI-SHEAR RIVETS with close tolerance bolts or other commercial fasteners of equivalent strength properties is permissible. Holes should not be elongated and the Hi-shear substitute should be a smooth push fit. Forgings may be spot-faced the least amount necessary for proper seating of the fasteners.

19-66. NOSE GEAR WHEEL WELL. The nose gear wheel well is made of stainless steel, as is the firewall bulkhead. Any repair in this area should be accomplished as any other firewall repair and will require resealing of joints after repair.

19-67. LANDING GEAR DOORS. Landing gear doors may be repaired by any method consistent with good sheet metal practice. However, any repairs to these doors should be made only after carefully consideration of the door function and clearance is made. Close tolerances are required here for correct landing gear operation.

19-68. ENGINE MOUNT. (Model 210 and 210A.)

19-69. DESCRIPTION. The mount for the aircraft engine is constructed of 4130 chrome-molybdenum steel tubing. A truss structure, fastened to the firewall at four points, supports a cradle arrangement. This cradle arrangement, with its supporting lugs, forms the base for rubber shock mounted engine supports.

19-70. REPAIR CONSIDERATIONS. All welding on the engine mount should be of the highest quality since the tendency of vibration is to accentuate any minor defect present and cause fatigue cracks. Engine mount members are preferably repaired by using a large diameter replacement tube, telescoped over the stub of the original member, using fishmouth and rosette welds. However, reinforced 30-degree scarf welds in place of the fishmouth welds are considered satisfactory for engine mount repair work.

19-71. ENGINE MOUNT SUPPORT CRADLE DAMAGE. Minor damage such as a crack adjacent to an engine attaching lug may be repaired by rewelding the cradle tube and extending a gusset past the damaged area. Extensively damaged parts should not be repaired but should be replaced.

19-72. DAMAGE INVOLVING ENGINE MOUNTING LUGS AND ENGINE MOUNT TO FUSELAGE ATTACHING FITTINGS. Engine mounting lugs and engine mount to fuselage attaching fittings should not be repaired but should be replaced.

19-73. BAFFLES

19-74. CONSIDERATIONS. Baffles ordinarily should be replaced if damaged or cracked. However, small plate reinforcements riveted to the baffle will often prove satisfactory both to the strength and cylinder cooling requirements of the unit.

19-75. ENGINE COWLING.

19-76. REPAIR OF COWLING SKINS. If extensively damaged, complete sections of cowling should be replaced. Standard flush-type skin patches, however, may be used if repair parts are formed to fit. Small cracks may be stop-drilled and dents straightened, if they are reinforced on the inner side with a doubler of the same material.

19-77. REPAIR OF REINFORCEMENT ANGLES. Cowl reinforcement angles, if damaged, should be replaced. Due to their small size they are easier to replace than to repair.

19-78. ROYALITE REPAIRS.

19-79. Repair of puncture or holes in Royalite and similar thermoplastic materials can be made by trimming out the damaged area and installing an overlapping, beveled, or flush Royalite patch. Doublers may be installed behind the patch where additional strength is desired. Acetone, or any commercially available cohesive for Royalite, may be used as the bonding agent. Moderate pressure is recommended for best results. Curing time will vary with the agent used, but repairs should not be strained until fully cured. Cracks can be repaired by saturating the crack itself with the cohesive, then filling with an epoxy filler or a paste made of Royalite shavings and the cohesive. Again, the crack may be reinforced with a doubler on the back side for additional strength. After the repair has been made, the area may be sanded smooth and painted.

19-80. FIBERGLAS REPAIRS.

19-81. Fiberglas items on the aircraft may be repaired as stipulated in instructions furnished in SK182-12. Observe the resin manufacturer's recommendations concerning mixing and application of the resin. Epoxy resins are preferable for making repairs, since epoxy compounds are usually more stable and predictable than polyester, and in addition give better adhesion.

SECTION 20

PAINTING

20-1. PAINTING an airplane requires little special equipment. The average shop will have the compressor, spray gun and clean place to work required for a good paint job. Ordinarily, painting involves three basic steps. They are:

1. Cleaning - Washing down the aircraft thoroughly to remove all oil, grease, and dirt.
2. Priming - Applying one priming coat before painting with vinyl and an extra intermediate priming coat before painting with lacquer.
3. Painting - Applying three or more coats of final paint, then adding decorative stripes.

20-2. PROCEDURE FOR PAINTING WITH ENMAR 27H SERIES LACQUER.

20-3. PREPARATION. Thoroughly clean all surfaces, beyond area to be painted, with MIL-T-6094 thinner. Extreme care should be taken to remove all letters, grease, bugs, etc. Mask off stripe areas to be painted carefully - see that all tapes are firmly adhered to metal to prevent ragged edges. Class "A" wrapping paper and thinner proof masking tape should be used to cover the Plexiglas area. This will prevent damage from solvent and thinner vapors. (Newspapers will not provide adequate protection.)

20-4. MIXTURE AND APPLICATION OF PRIMER.

NOTE

Mix EX-2016 primer only in quantities required for use within six hours and then only in stainless steel bucket.

a. Mix EX-2016 primer and T-6070 thinner in a 1:1 ratio and stir thoroughly.
b. Apply EX-2016 primer in a well broken up, wet, even coat.
c. Mix 1 part EX-2414 yellow lacquer primer with 2 parts MIL-T-6094 thinner.
d. Apply one well broken up, wet, even coat of the EX-2414 primer over the EX-2016 primer 30 minutes after application of the EX-2016 primer.

20-5. PREPARATION OF 27H LACQUER COLORS.
a. Thoroughly stir and mix in original container to make sure all pigments are in solution.
b. Thin required amount of lacquer color with MIL-T-6094 thinner in a 1:1 ratio. Mix thoroughly and strain into cups before using.

20-6. APPLICATION OF 27H LACQUER COLORS. Apply three well broken, wet, even coats of lacquer color. Air pressure at the gun should not exceed 40 pounds. At all times, keep gun from 6 to 8 inches from the work and perpendicular to surfaces being painted. DO NOT PAINT WITH ARCING MOTION. Keep paint room around 75 to 80° F. Burn down with MIL-T-6094 thinner to give smooth, even surfaces free from overspray.

20-7. PROCEDURE FOR PAINTING WITH ENMAR 82 SERIES VINYL.

NOTE

82A, 82B, and 82 are interchangeable, although 82A and 82B have better flow characteristics.

20-8. PREPARATION. Thoroughly clean all surfaces and seams with MIL-T-6094 thinner. Extreme care should be taken to assure that no oil seepage occurs from seams, splices or rivet heads. All bugs and foreign matter should be removed from airplane before painting. Thoroughly inspect after cleaning to be sure all surfaces are ready for priming. Class "A" wrapping paper and thinner proof masking tape should be used to cover the Plexiglas area. This will prevent damage from solvent and thinner vapors. (Newspapers will not provide adequate protection.)

20-9. MIXTURE AND APPLICATION OF PRIMER.

NOTE

Mix EX-2016 primer only in quantities required for use within six hours and then only in stainless steel bucket.

a. Mix equal parts of EX-2016 primer and EX-2016C reducer and stir thoroughly.
b. Apply EX-2016 primer in a well broken up, wet, even coat. If primer has to be sanded, sand and reprime. Sanding breaks film, resulting in poor adhesion.

NOTE

On all leading edge surfaces, apply cross coat, wet and even, of EX-2016 primer.

c. Clean equipment immediately after use and under no consideration use EX-2016 primer that has been mixed longer than six hours.

20-10. PREPARATION OF 82 SERIES VINYL ENAMEL COLORS. Thoroughly mix and stir in original container and make sure all pigments are in solution. Thin required amount of vinyl color with T-1866 vinyl thinner in a 1:1 ratio. Mix thoroughly and strain into either a cup or pressure pot.

20-11. APPLICATION OF 82 SERIES VINYL COLORS.

NOTE

If vinyl is to be applied from pressure pot, do so under following conditions: Pressure of 10 pounds. Regulate gun pressure at gun with test gauge to 25 pounds, using gun with FX needle and fluid tip, with fan set wide open and yield two turns open. If cups are used, set gun at 30 pounds with EX needle and fluid tip, fan set one turn open and yield wide open.

a. Apply first coat even and wet; second and third coats in same manner.
b. Check carefully before second and third coats for defects and correct before final coats.
c. On second and third coats, mask off and lightly sand with 400 paper the painted surfaces of previous color that is in area to be painted.

NOTE

On all leading edges apply a fourth coat. After finishing each color coat, burn down with T-1411 burn down thinner. Remove all masking from painted surfaces after each color application. If you have a Heat Room, turn up the heat and dry paint at temperatures of 125 to 145°F., for at least three hours. Heat will give a very good reflow on vinyl paint.

20-12. REFINISHING OF FIBERGLAS SPEED FAIRINGS. Main wheel speed fairings are painted with a lacquer base coat.

NOTE

In most cases refinishing or retouching of fiberglas speed fairings will require the removal of all the finish down to the primer surfacer. However, if the damage is local and the work is carefully done, the "spotting in" method may be used.

a. To remove fuel stains or damage, the finish must be removed as deep as the fuel has penetrated. Do not attempt to finish over fuel damaged area, as the fuel will bleed through. In case of yellowed finish, all finish must be removed. If the fiberglas has been repaired, the repair shall be sanded smooth.
b. Nose wheel speed fairings should be finished with colored epoxy. The epoxy finishes are very difficult to remove with thinner or solvent and must be sanded or a paint remover, such as Turco Paint-Gon, must be used. If the finish has been removed until the bare fiberglas has been exposed, it must be refinished with an automotive type primer surfacer or special fiberglas primer surfacer and sanded smooth.
c. After the area being spotted or the whole speed fairing has been sanded and edges of the old finish feathered, it should be finished in the usual manner with lacquer, vinyl or epoxy colors as required. The nose wheel fairing should be painted with colored epoxy after the other materials have dried. An epoxy coat is impervious to gasoline softening or discoloration after 36 to 48 hours.

NOTE

Repair of speed fairings is covered in SK182-12.

20-13. PROCEDURE FOR APPLICATION OF HI-VISIBILITY PAINT.

20-14. MATERIALS REQUIRED are:

3 qts Switzer Orange Day-Glo

2 qts Toluene Thinner

2 qts Switzer Filteray, Type B Top Coat

2 qts Xylene Thinner

2 qts White Base Coat

2 qts Thinner

20-15. MIXING PROCEDURE: All paint shall be thinned to spraying consistency as follows:
a. Hi-Visibility paint shall be thinned with two parts Toluene thinner to three parts paint.
b. Clear top coat shall be thinned with one part Xylene thinner to one part paint.
c. White base coat shall be thinned with one part thinner to one part paint. This formula applies to either lacquer or vinyl.

NOTE

Either Toluene or Xylene may be used as the thinner for Hi-Visibility paint and the top coat. Toluene is recommended for the Hi-Visibility paint and Xylene for the top coat.

20-16. SURFACE PREPARATION. Hi-Visibility paint must be applied over a good white undercoat. The preferred white undercoat is white lacquer. If, however, the airplane is already painted with vinyl base paint, the white undercoat may consist of white vinyl. A white primer may also be used as the undercoat.

20-17. APPLICATION.
a. Apply three well broken even coats of white undercoat. Allow sufficient drying time. Wipe with tack rag.
b. Apply one heavy wet coat of Hi-Visibility paint. This coat should consist of three wet passes over the entire area. Allow two or three minutes drying time between passes. Dry coat should be 2.5 to 3.5 mils thick. Allow one to two hours drying time.
c. Wipe surface with tack rag to remove overspray.
d. Apply two wet coats of clear top coat, consisting of two passes per coat. Dry coat should be 1.5 to 2.5 mils thick.

NOTE

Hi-Visibility paint is not offered at the factory.

APPENDIX A

HYDRAULIC COMPONENTS REPAIR
MODEL 210 AND 210A ONLY

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SECTION A1

GENERAL

A1-1. GENERAL

A1-2. The following pages cover, in step-by-step order, the repair of the Power Pack and other hydraulic components. Since emphasis here is on repair, not overhaul, of the basic components of the hydraulic system it is unlikely that the mechanic will go through all of the operations described. Instead, he will repair the particular item which has been causing difficulty.

NOTE

To isolate the hydraulic item causing malfunction, see the Trouble Shooting Charts in Section 5 and Section 7, and,if possible, perform Hydro Test unit testing.

A1-3. REPAIR VERSUS REPLACEMENT. Often the moderate trade-in price of a factory-rebuilt component is less than the accumulated cost of local labor, parts and (often time consuming) trial and error adjustment. A great deal depends on the time, equipment, and skill locally available.

A1-4. REPAIR parts and special tools are available from the Cessna Spare Parts Department.

A1-5. EQUIPMENT AND TOOLS.

A1-6. HYDRO TEST. The Hydro Test is a portable Hydraulic Service Unit, designed specifically for the Model 210, to supply hydraulic pressure for cycling the landing gear and flaps when checking or servicing these systems when the engine is not running. In addition to cycling the gear and flaps, the Hydro Test can be used for filling the reservoir, bleeding the system, reading system pressure, checking the condition of the fluid and testing components prior to installation. This unit is mounted in an all-metal cabinet and is on wheels.

A1-7. POWER PACK HOLDING FIXTURE, HF794. (See figure A1-1.) A special holding fixture is available to hold the Power Pack during repair work. The power pack attaches to the fixture by means of bolts threaded into the regular mounting nuts of the power-pack reservoir. A square bar protruding from the fixture makes it easy to hold in a large bench vise. The fixture is included in SK210-26, or, if desired, may be locally fabricated from dimensions presented in figure A1-1.

A1-8. HAND TOOLS. The following items are necessary for repair work on the Power Pack and other hydraulic components:

Service Kit SK210-1
- EL-2739 Poppet Cap Wrench
- EL-18084 Snap Ring Pliers

Service Kit SK210-26
- 3-3/4 Spanner Wrench (for removing lock ring on accumulator body)
- Strap Wrench (for removing accumulator cylinder barrel and powerpack hand pump barrel)
- MIT796 Special Allen Wrench (for adjusting handle release pressure, priority valve, etc.)
- MIT795 O-ring Installation Tool
- .001 Feeler Strip, 1/2" wide (for protecting O-rings when installing handle release spools)
- HF794 Holding Fixture (To hold power pack or accumulator during bench repairs)

Common hand tools required are:
- Pin punches
- Needle-nose pliers
- Water pump pliers
- Duck-bill pliers
- Box and Open end wrenches (1/2 Thru 7/8)
- 1/2" Thin-wall socket
- Sharp-pointed scribe

Home-made items, handy for power pack repair, are various 1/4" aluminum rods ground to a gradual taper and wire hooks to extricate small plungers from hydraulic ports. These items may be fabricated as needed.

A1-9. 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 take endless "fishing" operations to extricate otherwise. An air hose and nozzle is a common-sense tool.

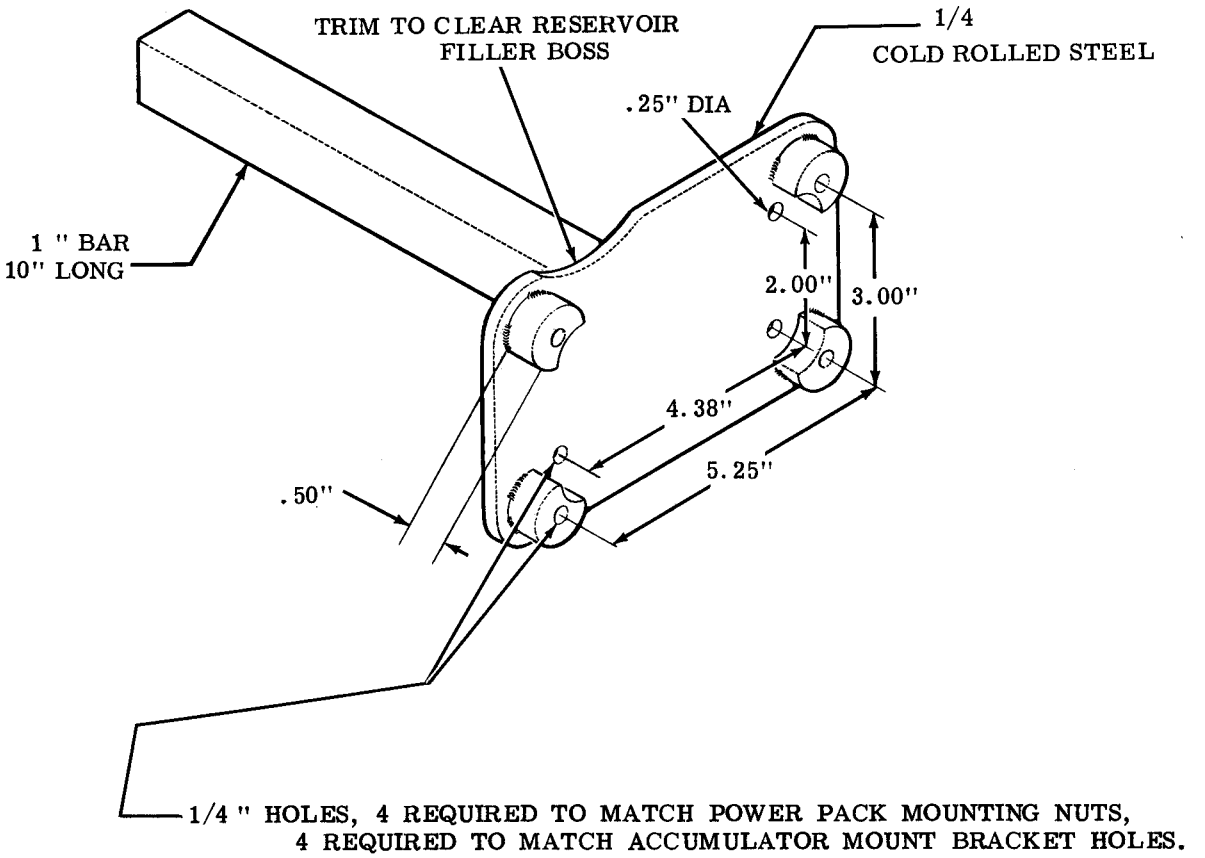

Figure A1-1. Holding Fixture, HF794

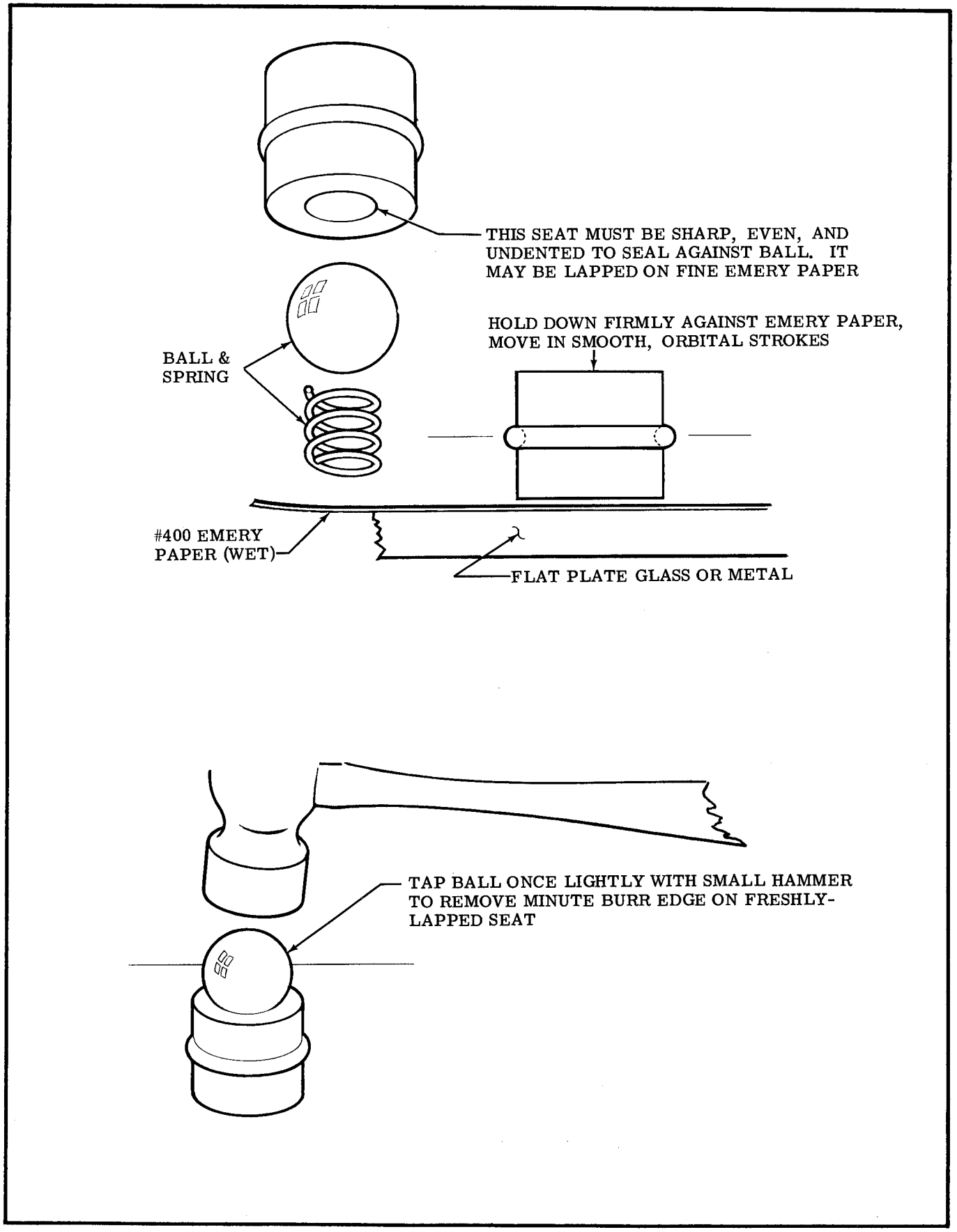

Figure A1-2. Lapping of Hydraulic Valve Seats

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SECTION A2

POWER PACK REPAIR

A2-1 LEADING PARTICULARS.

System operating pressure	1500 psig
System proof pressure	2250 psig
System burst pressure	3750 psig
Powerpack reservoir operating pressure (max)	15 psig
System reservoir volume	
Total	116^{+4}_{-0} cu. in.
Allowance for engine pump	53±1 cu. in.
Airspace (min)	12 cu. in.
Handpump capacity per cycle (2 strokes)	0.50 cu. in.
System flow rate	1.2 gal per min
Hydraulic fluid	MIL-H-5606A
Operating temperature range	-40°C(-40°F) to +71.1°C(160°F)
Check valves	Unseat at 2 to 8 psig
Main relief valve (system)	To crack at 1750 psig To reseat at 1450 psig
Thermal relief valves	To crack at 1850+50-0 psig To reseat at 1750 psig
Landing gear release (up and down)	
Adjust to release at	1350±50 psi
Priority valve	
Adjust to unseat at	750^{+50}_{-0} psig
Solenoid (door opening valve)	
Operating voltage-continuous duty	.12 Vdc
Minimum	9 Vdc
Maximum inrush current	5 amp
Solenoid (gear down safety interlock)	
Operating voltage-continuous duty	.12 Vdc
Maximum	.15 Vdc
Minimum	9 Vdc
Power consumption-maximum at 13V	10 w
Continuous duty rating	15V at 71°C(160°F)
Dry weight (including harness and solenoids)	13-1/2 lb

A2-2 POWER PACK REPAIR.

NOTE

Repairs listed below which can be accomplished with the Power Pack in the airplane are so designated in the paragraph headings. The procedures are arranged with bench disassembly of the power pack as the first paragraph, since this must be accomplished before any internal valves are accessible for repair. Reassembly of the reservoir to the end assemblies is the second paragraph in the series below.

A2-3 DISASSEMBLY OF POWER PACK. (BENCH OPERATION)

NOTE

This paragraph tells how to separate the three basic components of the Power Pack to gain access to the internal items. See following paragraphs for individual repair of internal items.

a. Wash off the Power Pack with solvent, then blow it dry with compressed air to clean it of dirt and dust.

b. Drain oil from the reservoir by removing 3/8" elbow fitting in bottom of reservoir.

c. Cap all fittings on Power Pack.

d. Bolt Power Pack to holding fixture, with end and plug assembly up.

NOTE

If no holding fixture is available, the poppet section may be held in a large vise. Pad vise jaws with cloth to prevent marring the poppet caps and body.

e. Remove screws holding wire harness to reservoir

f. Using 1/2" thin wall socket (this may be ground down further to clear end and plug assembly) remove two nuts on thru bolts.

g. Carefully pry out the O-rings from around the thru bolts, using a sharp-pointed scribe.

h. Rocking and lifting on the end and plug assembly, work it free of the reservoir assembly.

NOTE

The wire harness is long enough to permit extraction of the end and plug assembly. Work carefully to prevent damage to wires.

i. Rock reservoir gently and pull it up, free of the poppet body.

NOTE

If main pressure tube (58, figure A2-2) has stuck in end and plug assembly, replace it in the valve body to retain the ball bearing check valve.

j. Remove all thru-tubes.
k. Remove all O-rings visible on removed parts.

A2-4 ASSEMBLY OF THE POWER PACK. (BENCH OPERATION)

NOTE

Install new O-rings, lubricated with petrolatum, on all parts as a standard procedure in reassembly of any hydraulic component.

a. Place poppet section with control handles down in holding fixture.
b. Install all thru-tubes, working flap handle to drain fluid pressure from valve assembly.

NOTE

It is assumed that the two thru-bolts are screwed securely into the poppet section. If not, install them prior to installing thru-tubes. If threads are damaged, install helicoil inserts to accommodate the thru-bolts. Damage to the extremely tough thru-bolts themselves is unlikely.

c. Place end and plug assembly in position on thru-tubes to check that tubes are installed in correct holes.
d. Lubricate mating surfaces of poppet section and large O-ring with petrolatum.
e. Align scribed mark on reservoir assembly with mating mark on poppet section, then, with rocking and shaking motion, work reservoir carefully down over poppet section until it seats against squared portion of poppet section.
f. Lubricate mating surface of end and plug assembly with petrolatum, check that thru-tubes are straight upright, align scribe marks on reservoir with those on end and plug assembly. Work into reservoir until squared part of end contacts the reservoir end.

NOTE

"Feel" is important here. Careless assembly can result in leaks past the large O-rings which seal the ends of the reservoir. Misaligned thru-tubes will cause trouble, too. Work carefully and do it right the first time.

g. Lubricate O-rings, then install them over thru-bolts. Use 1/2" thin wall socket to tighten nuts.
h. Check with feeler gauge that reservoir ends are firmly in contact with both ends of power pack.
i. Install screws attaching wire harness grounds and clamps to the reservoir.
j. Install elbow in reservoir.
k. Install all external fittings, but do not tighten.

A2-5 REPAIR OF THE PRIORITY VALVE. (BENCH OPERATION) (SEE FIGURE A2-1).

SYMPTOMS INDICATING PRIORITY VALVE FAILURE:

1. External leakage through priority valve adjustment screw hole.
2. Internal leakage characterized by gears unlocking before doors are completely open with handle in GEAR UP position. Or, on bench test of power pack, fluid flows from "gear up" fitting before 750 psi is built up from door line.

a. Make sure priority valve adjustment will not cure trouble. See figure 5-3B for priority valve adjustment.
b. Perform disassembly per paragraph A2-3
c. On end and plug assembly, remove plug (30) and spring (32). Grasp pin (35) with needle-nose pliers and pull out carefully. The entire priority check valve will come out.
d. Examine valve port and all removed parts to find source of trouble.
If leak is external, through priority adjustment hole, O-ring (37) is probably bad.
If leak is internal, seat on priority check (33) is probably bad.
e. Clean all parts thoroughly and replace defective parts.

NOTE

Sometimes the seat on priority check (33) may be lapped. Use # 400 emery paper on a perfectly flat surface. See figure A1-2.

f. Remove adjustment screw (50), spring (49), and disc (48), only if stuck or defective. Disc (48) may be removed from the gallery by directing a quick blast of air from the opposite end of the hole.
g. Install new O-rings on all parts. Grease with petrolatum.
h. Reinstall disc (48), spring (49) and priority valve adjustment (Allen) screw (50) if they have been removed. Use special Allen wrench (MIT 796) to install screw (50).
i. Assemble priority check (33) over priority poppet (36), then press parts carefully into the hole. Use a small screwdriver to press against inside of (33).

NOTE

Be sure priority valve is pressed in as far as it will go. Pin (35) will be approximately 3/16" below top of hole when parts are properly seated. Do not install plug (30) until you are sure valve is down.

j. Insert spring (32) over pin. Install plug (30) and safety.

A2-6 REPAIR OF THE PRIORITY CHECK VALVE. (BENCH OPERATION) (SEE FIGURE A2-1).

a. Unscrew and remove door check plug (38).
b. Remove check seat (40), balls (41), and spring (42).
c. Use compressed air to blow out check spacer (43) and lower ball seat (40).

NOTE

If an air nozzle is not available or if air fails to dislodge the parts, a tapered aluminum rod, driven gently into the spacer and seat may be used to fish them out. This will probably damage the seat. The parts are relatively inexpensive.

d. Examine all parts carefully to disclose reason for malfunction.
e. Clean out gallery carefully, then reinstall parts, using new parts to replace defective ones.

NOTE

Check valve balls should always seal against the "sharp" side of the seat; see figure A1-2. Do not install seats in a reversed position. The rounded, or chamfered end of the seat goes opposite, not against the ball.

A2-7 MAIN PRESSURE CHECK VALVE. (BENCH OPERATION) (SEE FIGURE A2-2).

NOTE

The main pressure check valve is easily accessible following the disassembly outlined in paragraph A2-3. Removal of the main pressure thru-tube (58) uncovers the valve ball.

a. With main pressure thru-tube removed, work the main check valve assembly loose from the poppet end of the pack.
b. Remove ball (60), guide (61), and spring (62).
c. Examine parts for cause of malfunction. Likely causes are: Bad seat for ball on pressure tube (58); lap or replace (58) or check guide (61) binding in check body (63); replace both parts.

NOTE

On later Power Packs, check guide (61) is longer, therefore affording less possibility of binding in the check body.

d. Replace defective parts and reassemble.
e. Reassemble Power Pack and check pressure of valve opening with Hydro Test or external hand pump.

A2-8. FLAP THERMAL RELIEF VALVES. (BENCH OPERATION) (SEE FIGURE A2-2).

NOTE

Flap thermal relief valves are mounted in the poppet end of the Power Pack and are easily accessible following the disassembly outlined in paragraph A2-3

a. Cut safety wire and unscrew valve, using 9/16 wrench on hex portion.
b. Screw adapter over 1/8 pipe threads of valve to adapt it to external hand pump hose.
c. Test valve release pressure with hand pump.
d. Adjust valve, if necessary, then recheck, If it leaks, replace the entire valve.
e. Install new or newly-adjusted valve and safety.

A2-9. MAIN PRESSURE RELIEF VALVE. (BENCH OPERATION) (SEE FIGURE A2-2).

NOTE

The main pressure relief valve (42) is easily accessible following the disassembly procedure outlined in paragraph A2-3

a. Cut safety wire and, using a 9/16 wrench on hex nearest poppet body, remove the entire valve assembly.
b. Install valve, with an adapter, to external hand pump line or hydro test pressure line and apply gradual pressure to check crack and reseat pressures of valve.
c. Adjust valve, if necessary. If adjustment fails to attain correct limits or valve leaks, replace the whole relief valve assembly.

A2-10. REPAIR OF THE EMERGENCY HANDPUMP ASSEMBLY. (BENCH OPERATION) (SEE FIG. A2-2).

NOTE

The Power Pack must be disassembled as outlined in paragraph A2-3 to gain access to repair of the emergency hand pump.

a. Remove cotter and clevis pin attaching handle linkage to pump piston rod.
b. Remove hand pump pickup line.
c. Use waterpump pliers on knurled locking ring around cylinder threads. When it is loose, unscrew the entire hand pump body from the poppet section, using a 5/8 end wrench on wrench flats of body.
d. Pull out the piston and examine all parts.
If pump had external leakage, check O-rings (78) and (80).
Check piston shaft for nicks which might damage O-ring (80).
If pump had internal leakage, check piston (79), valve seat (72) and O-rings (78) and (71).

NOTE

Valve seats (72) can usually be lapped; if not they should be replaced if defective. See fig-

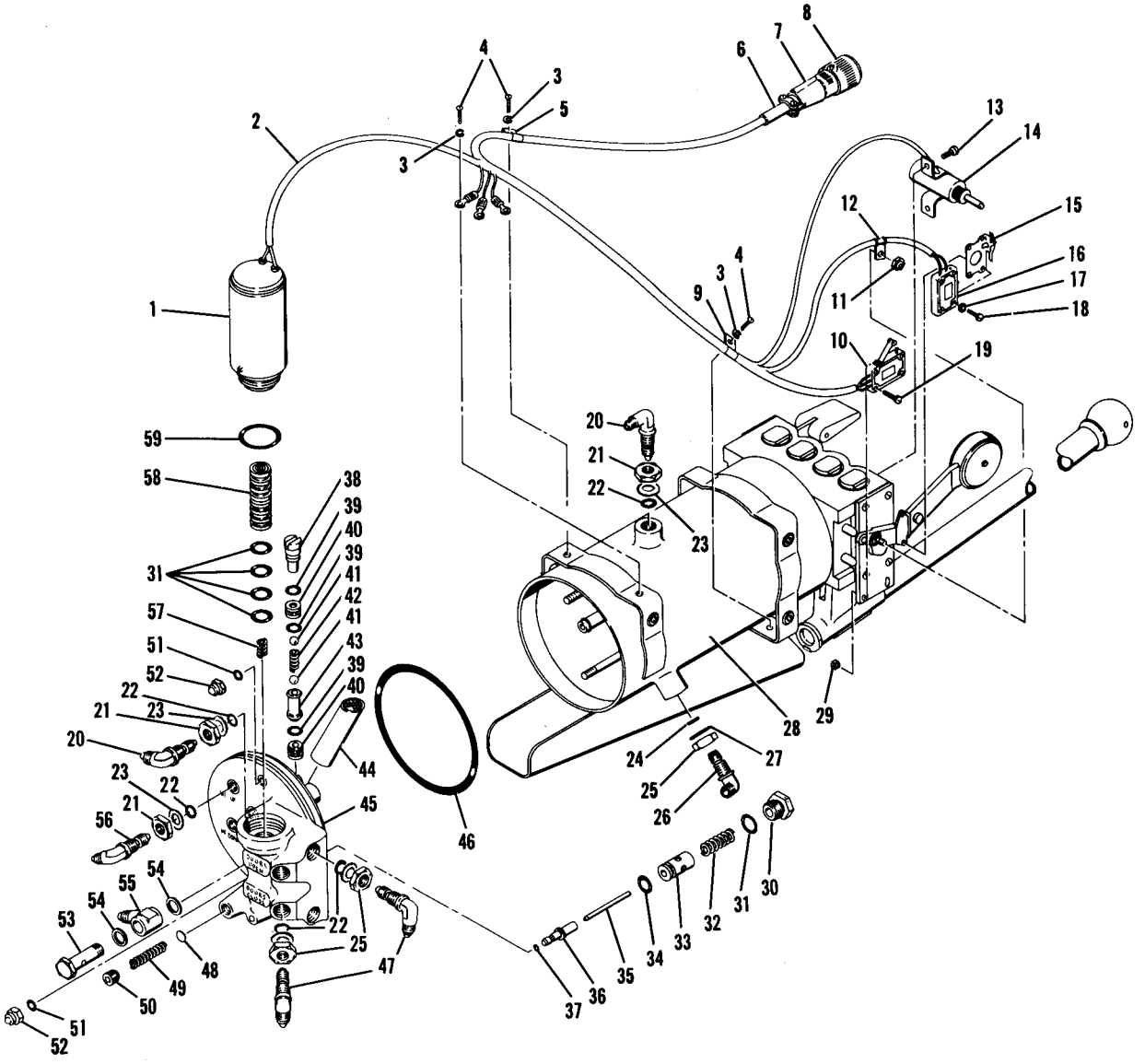


Figure A2-1. Power Pack

Reference to figure A2-1.

1. Solenoid
2. Solenoid Harness
3. Lockwasher
4. Screws
5. Wire Clamp
6. Sheathing
7. Plug
8. Plug
9. Wire Clamp
10. Switch
11. Nut
12. Wire Clamp
13. Screw
14. Handle Lockout Solenoid
15. Switch Actuator
16. Switch
17. Lockwasher
18. Screw
19. Screw
20. Elbow
21. Nut
22. O-Ring
23. Back-Up-Ring
24. O-Ring
25. Nut
26. Elbow
27. Back-Up-Ring
28. Reservoir
29. Nut
30. Plug (Priority Check Valve)
31. O-Ring
32. Spring
33. Priority Check Seat
34. O-Ring
35. Pin
36. Priority Poppet
37. O-Ring
38. Door Check Plug
39. O-Ring
40. Valve Seat
41. Ball
42. Spring
43. Spacer
44. Standpipe
45. End and Plug Assy
46. O-Ring
47. Elbows
48. Disc
49. Spring
50. Priority Adjustment Screw
51. O-Ring
52. Nut
53. Pressure Fitting (Banjo Fitting)
54. Gaskets
55. Pressure Fitting (Banjo Fitting)
56. Elbow
57. Spring
58. Door Control Valve
59. O-Ring

Reference to figure A2-2.

1. O-ring
2. Shaft & Pin
3. Slider Springs
4. Stop Sliders
5. Top Plate
6. Nylok Screws
7. Lock Nuts
8. Wing Flap Handle
9. Allen Head Screws
10. Washer
11. Knob
12. Detent Adjustment Plugs
13. Detent Bushings
14. Detent Sleeves
15. O-rings
16. Detent Springs
17. O-ring
18. Lever Release Plunger
19. O-ring
20. Lock Roll Pin
21. Stop
22. Link
23. Clevis Pin
24. Washer
25. Cotter Pin
26. Clevis Pin
27. Bolt
28. Nut
29. Washer
30. Fork & Bushing
31. Spring Clip
32. Washer
33. Screw
34. Pump Shaft
35. Lock Roll Pin
36. Plug
37. Spring
38. Poppet
39. O-ring
40. O-ring
41. Shim
42. Valve
43. O-ring
44. Reducer
45. O-ring
46. Valve
47. Reservoir (aft end)
48. Bushing
49. O-ring
50. Spool
51. Tube
52. Stud
53. O-ring
54. Snap Ring
55. Screen
56. Reservoir
57. Screen & Plug
58. Check Tube
59. Snap Ring
60. Ball
61. Check Guide
62. Check Spring
63. Check Body
64. Pipe Plug
65. Spring
66. Ball
67. Tube
68. Tube
69. Tube
70. Filter
71. O-ring
72. Seat
73. Spring
74. Lock Nut
75. Hand Pump Body
76. O-ring
77. Snap Ring
78. O-ring
79. Hand Pump Piston
80. O-ring
81. Top Plate
82. Nylok Screw
83. Snap Ring
84. Lever & Bushing
85. Knob
86. Lock Roll Pin
87. Tube
88. Stud
89. Spring
90. Lock Roll Pin
91. Nut
92. Landing Gear Plate
93. Stop Slider
94. O-ring

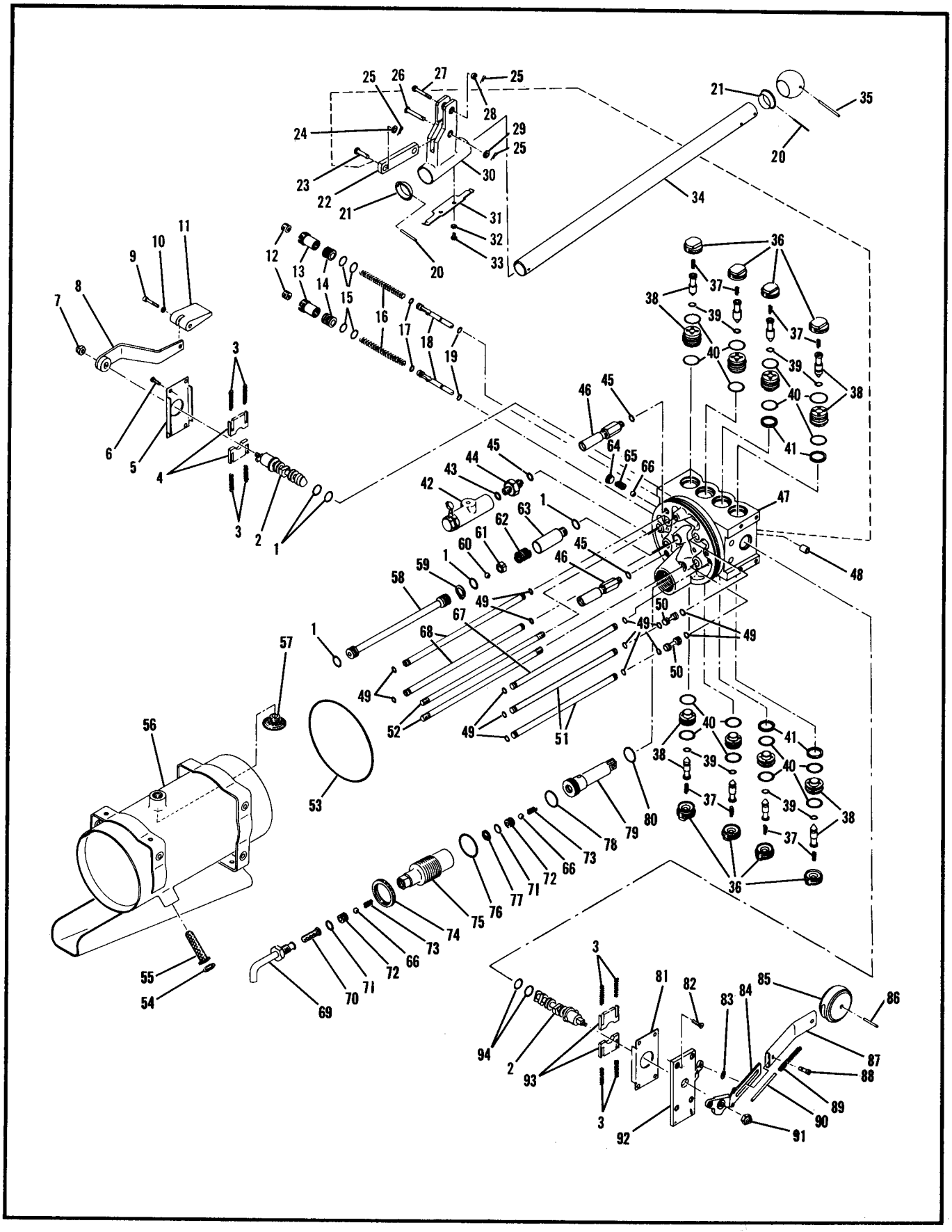


Figure A2-2. Power Pack

ure A1-2 Remove valve seat in piston by a sharp blast of air through hole in the side of the piston.

e. Install new O-rings throughout assembly, well lubricated with petrolatum, then reassemble.
f. Attach, but do not tighten, pickup line to the cylinder.
g. Insert cylinder body in poppet section, screw it down all the way, then tighten knurled locking ring (74).
h. Position the pickup line straight down with regard to the reservoir and then tighten.
i. Safety wire knurled nut (74) and tube (69) to. the thermal relief valve.
j. Install handle linkage to piston rod with clevis and cotter pin.

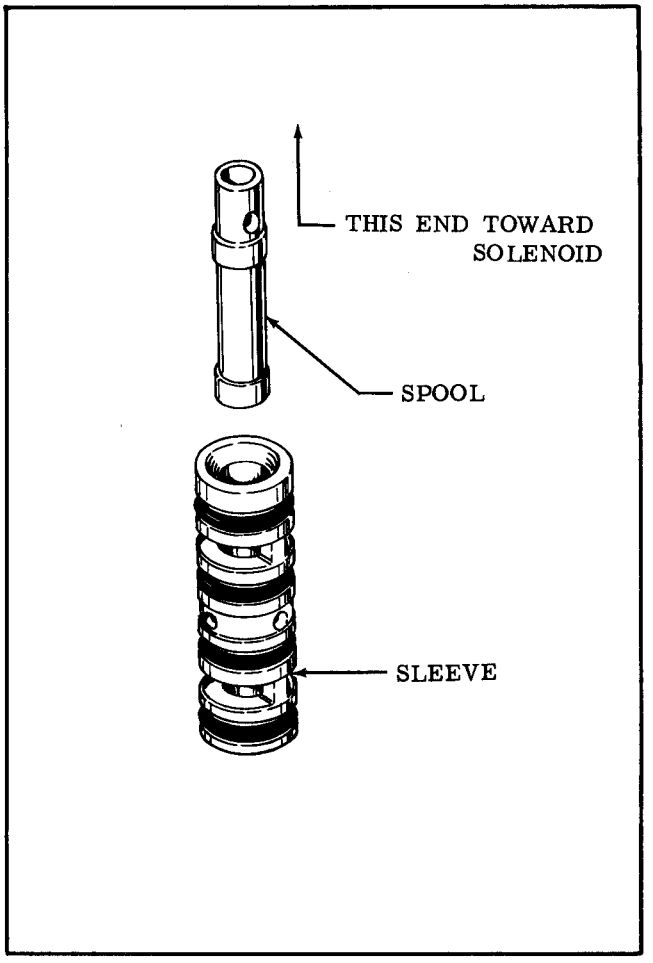


Figure A2-3. Solenoid Valve

A2-11. REPAIR OF THE SOLENOID DOOR CONTROL VALVE. (BENCH OPERATION)(SEE FIG.'s A2-1 and A2-3).

NOTE

The Power Pack need not be disassembled for work on the solenoid valve, but it must be removed from the airplane.

a. Detach all wire harness, switches, clamps, terminals, from the Power Pack.

b. Unscrew the solenoid from the end and plug assembly. Retain solenoid slugs.

CAUTION

Do not use a pipe wrench or other hard-jawed wrench on the solenoid. Use a strap wrench, or, if no strap wrench is available, many layers of friction tape as a strap around the solenoid, then use waterpump pliers to tighten the tape in the manner of a strap wrench.

c. Remove spring loaded spool and spring. Sleeve will remain in place.
d. Carefully, using a stiff wire hook engaged in the hole in the side of the door control valve sleeve, pull the sleeve from its port.

NOTE

Do not engage wire hook in the slots inside the valve sleeve, but in the hole in the side of the sleeve. The sleeve and its sliding spool are a hand-lapped fit, ground to a close tolerance. Do not scratch or cause a burr inside the sleeve, for this will ruin the fit of the two matched parts.

e. Examine spool and sleeve to make sure that spool will slide freely inside the sleeve. It must slide easily enough that spring will return the spool. Opposite motion is caused by solenoid slugs pressing suddenly against top of spool.

NOTE

Very slight corrosion or contamination can jam the spool inside the sleeve. Examine both parts for evidence of anything that might bind the spool. Any defect in the action is cause for replacement of the door spool and sleeve.

f. Install new O-rings on grooves of sleeve. Lubricate sleeve and install in hole. Do not install it upside down. The bottom O-ring groove is closer to the end of the spool than the top O-ring groove;that is, the top "land" is wider. Upside down, the sleeve will not function properly.
g. Install spool inside sleeve, then making sure solenoid slugs are in place, thread the solenoid (with a new O-ring) into place. Tighten with a strap wrench or as suggested under step "b."
h. Attach wire harness to power pack.

A2-12. GEAR UP/DOWN ISOLATION SPOOLS. (BENCH OPERATION)

NOTE

This operation requires removing the handle release detents as described in the following paragraph. It is a difficult operation and a rare one, for it is unlikely that the isolation spools will cause malfunction. However, bench test symptoms are: With Hydro Test power, L.G. handle full up, if no pressure builds up to door lines, the bottom spool may be defective. With handle full down and no pressure to door lines, the top spool may be defective.

a. On the upper or lower detent, depending on symptoms above, use special Allen wrench to take out detent adjusting screw.

b. Press detent plunger in. When it stops, turn detent plunger carefully with duck bill pliers and press further in. Remove the plunger, using an aluminum rod to push it all the way through to the adjustment screw side of the poppet section.

NOTE

The detent plungers are cut away on one side to clear the gear isolation spools, which they intersect inside the poppet end of the power pack. Turning the plunger permits it to pass the spool and thus be extricated on the opposite side of the pack.

c. After the handle release detent plunger is removed, use a long 1032 bolt, carefully threaded into the hole in the spool, to pull the spool out of its hole This may take several tries. Another method is to use a tapered aluminum rod tapped gently into the hole in the spool. The tapered rod will wedge into firm anchorage with the spool to permit extraction of the nearly inaccessible spool.

NOTE

Extraction of the spool in either manner described above may damage the spool. If so, replace it.

d. Clean and examine all removed parts. Clean and examine the drilled galleries exposed, now, in the poppet section.

e. Install new O-rings on spool and detent plunger.

f. Insert, in the hole for the spool, a piece of .001 feeler stock 1/2" wide. This is to protect the spool O-ring from the knife-sharp edges of the hole which intersects the spool hole. Lubricate the feeler with petrolatum. It will be pulled out after the spool is inserted in the hole.

NOTE

Be sure there is no burr on the feeler strip edges. Intended to protect the O-rings, a sharp-edged feeler could damage them.

g. With the feeler strip inserted to cover the intersecting hole, insert well-lubricated spool in the hole, push it in all the way, then, holding the spool in place with a small screwdriver or rod, pull the strip of feeler stock out of the hole.

h. Install handle release detent plunger as outlined in the following paragraph.

A2-13. REPAIR OF HANDLE-RELEASE DETENT PLUNGERS. (IN AIRPLANE OR ON BENCH)

Symptoms resulting from defective plungers are:

(a) Leakage — from handle or adjustment side. (Replace O-rings.)

(b) Handle release malfunction — (try adjustment at Allen-screw end of plunger — see figure 5-3A).

a. If Power Pack is in airplane remove Power Pack decorative cover, dissipate hydraulic pressure by flap operation plus manual flap movement. Spread drip cloth over carpet.

b. Use special Allen-wrench to remove adjustment screw. Remove spring.

c. Move gear handle to clear plunger, then push plunger in as far as it will go. Grasp plunger with duck bill pliers and turn it slowly while pushing it. At a certain point it can be pushed all the way in.

NOTE

The detent plungers are cut away on one side to clear the gear isolation spools, which they intersect inside the poppet end of the power pack. Turning the plunger permits it to pass the spool and thus be extricated on the opposite side of the pack.

d. Use an aluminum rod to push the plunger all the way out through the adjustment screw hole.

e. Clean and examine the plunger and the plunger hole for damage and particles which might cause malfunction.

f. Replace O-rings on plunger, lubricating them generously with petrolatum.

g. Align the flat (cut-away side) of the plunger with the gear isolation spool it intersects, then push the plunger back into place.

h. Install the spring and the adjustment screw.

NOTE

The special Allen wrench is necessary for this. The shoulder on the wrench affords a means of pushing the screw into place against spring pressure to start the threads. In an emergency a standard 3/16 Allen wrench with a short length of 1/4" I.D. tubing slipped over it may be used for this.

i. Adjust the detent plunger per figure 5-3A.

A2-14. REPAIR OF CONTROL CAM. (IN AIRPLANE OR ON BENCH) (See Figure A2-2)

NOTE

Study figure 5-3, which shows where cam O-rings could leak and the consequences of such leakage. Cam O-ring leaks will show symptoms similar to poppet leaks.

a. If Power Pack is in airplane, dissipate hydraulic pressure by operating flaps, then moving flaps manually until they hang limp.
b. Drain the reservoir.
c. Spread a drip cloth over carpet.
d. If landing gear cam is to be removed, remove the small screws holding the up-down limit switch (see figure 5-7).
e. Remove the handle after removing nut.
f. Remove four screws securing landing gear plate. Remove landing gear plate, then, carefully remove top plate over stop sliders and springs.
g. Carefully remove stop sliders and springs.
h. Scribe cam and poppet body (if it is not already marked) to ensure cam will not be installed upside down during installation.
i. Remove all four poppet caps and springs of the poppets actuated by the cam. (See figure 5-3.) Use poppet cap wrench.

NOTE

It is necessary to remove the cotter and clevis pin attaching the emergency hand pump linkage to the pump piston shaft to gain access to the lower inboard poppets.

j. Pull out each poppet valve approximately 3/16" to clear the cam shoulders as the cam is extracted, then pull the cam shaft out carefully.
k. Check and clean the cam shaft. Replace all O-rings, using petrolatum as lubricant.
l. Make sure cam is right side up (per scribe marks of step "h.") then push it carefully into place.
m. Grease stop slider springs, then install stop sliders and springs carefully.
n. Position top plate (81) and landing gear plate (92) and install four screws.
o. Install landing gear handle.
p. Install up-down switch. See figure 5-7 for adjustment.
q. Press poppet valves back into contact with cam lobes.
r. Install poppet springs and caps.
s. Connect emergency hand pump piston rod to handle linkage with clevis and cotter pin.
t. If power pack is in airplane, install decorative cover.
u. Fill reservoir and charge accumulator. Bleed system.
v. Test operate and check for leakage.

SHOP NOTES:

SECTION A3

ACCUMULATOR REPAIRS

A3-1. LEADING PARTICULARS.

Operating pressure	1500 psi
Proof pressure	3500 psi
Burst pressure	6000 psi
REGULATOR PRESSURES:	
Cut-in (EA 1330 Accumulator, serials up to 418)	1250+50-0 psi
(EA 1330 Accumulator, serials 419 and on, EA 1330-1 Accumulator serials No 1 and On)	1150+50 psi
Cut-out	1550+50-0 psi
Precharge	600 psi (nitrogen or air)

A3-2. ACCUMULATOR REPAIR. Repairs listed below are bench repairs and should not be attempted with the accumulator mounted in the airplane.

WARNING

Dissipate hydraulic pressure in the system by operating flaps, then rocking them until they hang limp before disconnecting accumulator plumbing, DISCHARGE ALL COMPRESSED AIR OR NITROGEN in the accumulator, before any disassembly, by opening the accumulator precharge valve. Failure to do so may result in severe damage or injury.

A3-3. HOLDING THE ACCUMULATOR FOR REPAIR Use the regular accumulator mounting bracket bolted to the holding fixture HF 794, which is, in turn, held in a bench vise.

A3-4. SPECIAL TOOLS. The only special tools required for accumulator repair are:

Snap ring pliers
Plug wrench
#80 drill bit
Strap wrench
Spanner wrench

A3-5. DISASSEMBLY OF THE ACCUMULATOR. Disassembly is outlined below in four major steps. Completion of all four steps, followed by reassembly steps will restore the accumulator to a completely overhauled unit, requiring only final adjustment.

a. Disassembly of the pilot section:(See Figure A3-1)
1. Cut safety wire, then unscrew cap (14).
2. Remove spring (11) and ball stop (10),using needle nose pliers. Remove plug (9) with wrench.
3. Using a compressed air nozzle thru system (SYI) port and holding hand over pilot port, blast air in to remove top seat (8). Remove seat spacer (5) and ball (6), then drop ball in again, hold it against seat with a pencil eraser, and blast air in again. This will lift out the lower seat, so that it may be worked free, out of the hole with a soft rod.
4. Turn accumulator upside down to dump out screen (1) and screen spacer
5. Place all parts in a clean container.

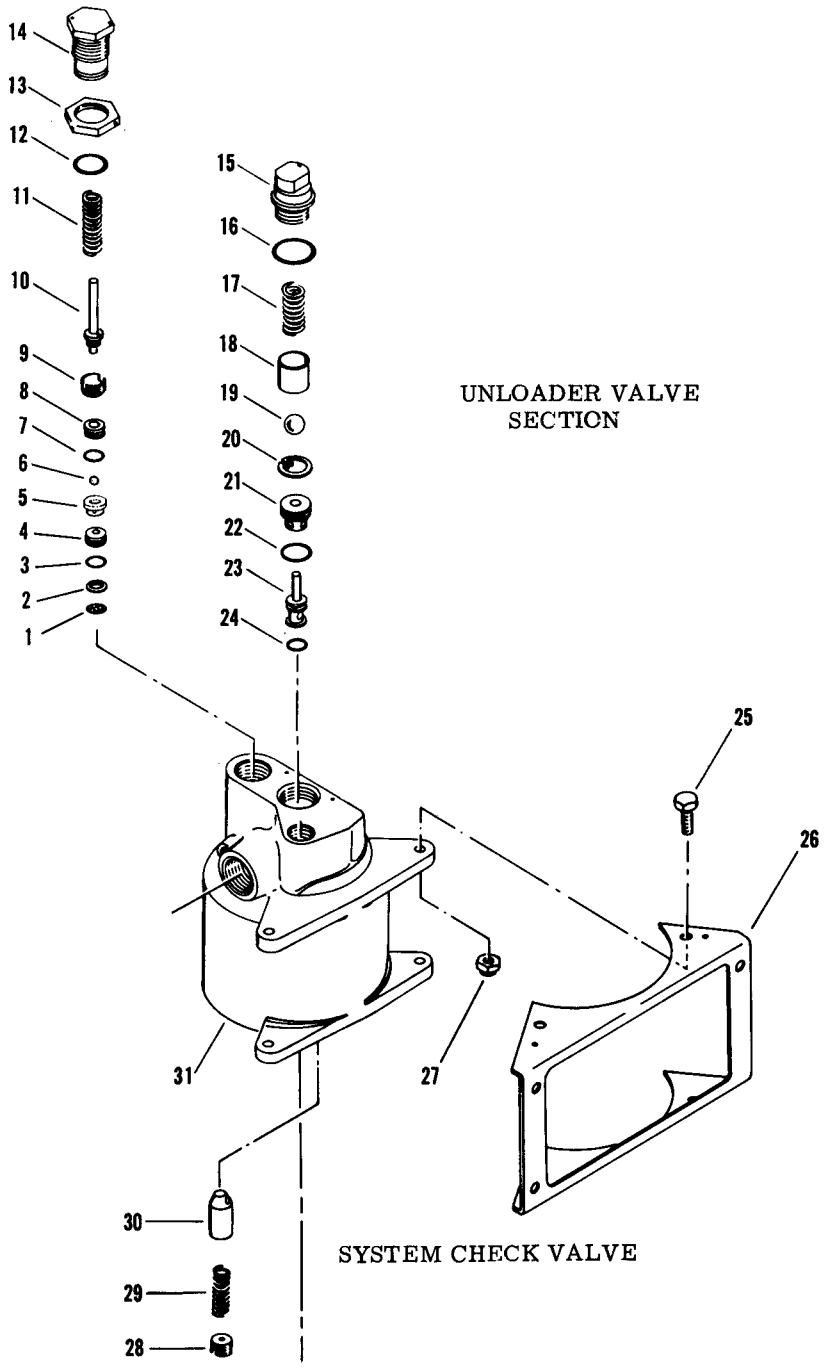
b. Disassembly of the unloader valve section:(See Figure A3-1)
1. Cut safety wire, then unscrew and remove unloader valve cap (15).
2. Remove ball guide (18) and ball (19).
3. With snap ring pliers, remove snap ring(20).
4. Drop ball (19) back on seat, then use a blast of air through the (1/2 inch) return line fitting to dislodge seat (21). Hold hand over hole during air blasting to prevent loss of parts.
5. Use needle nose pliers to pull out piston (23).
6. Place removed parts in a clean container.

c. Disassembly of cylinder body and piston from regulator section: (See figure A3-2)

WARNING

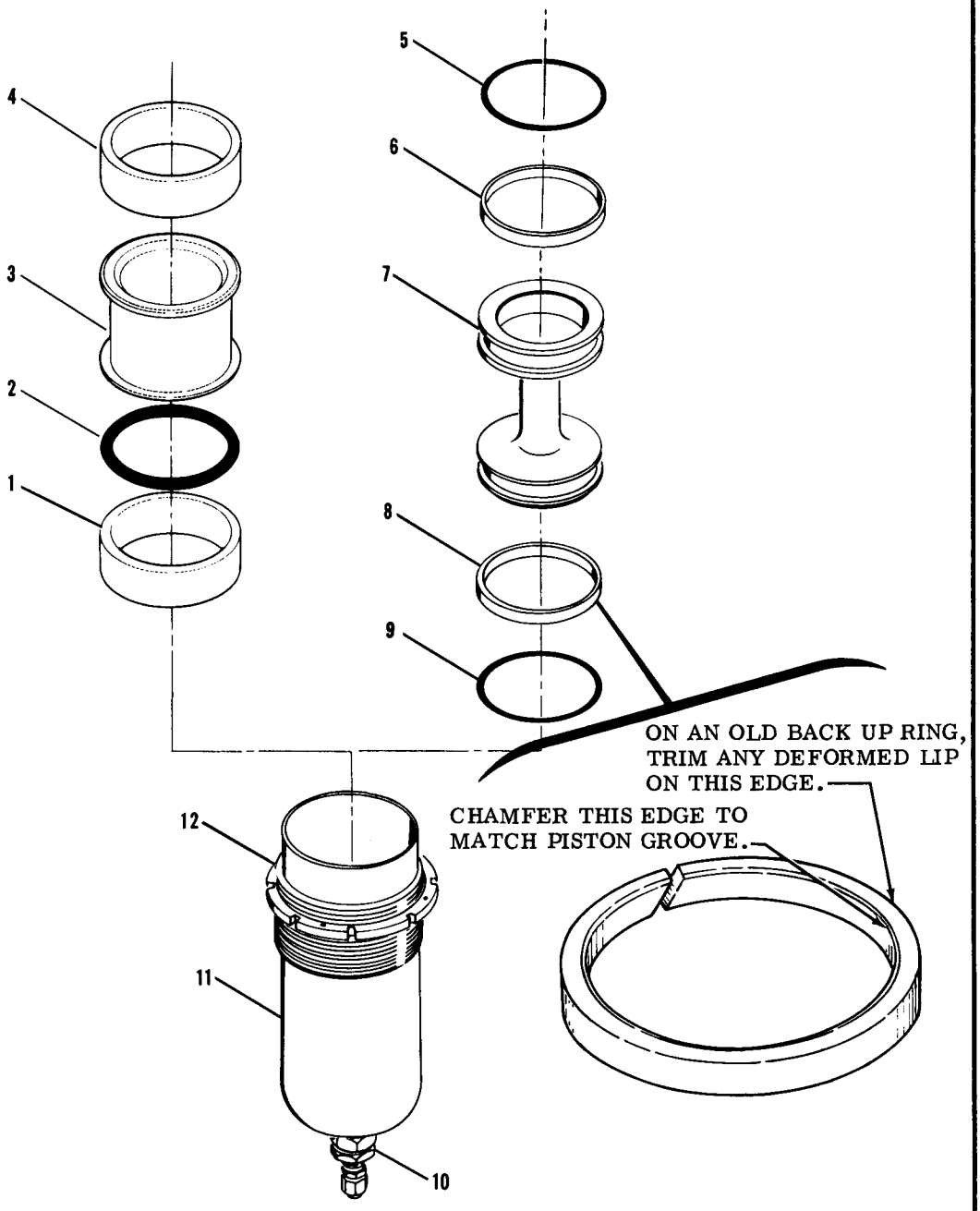
Be sure precharge valve is wide open, that all air pressure has been discharged. A 600 psi precharge can be dangerous.

1. Use spanner wrench to loosen lock nut then unscrew body with a strap wrench. Remove the body from the regulator head.
2. To remove piston from the cylinder body, screw the body back into the regulator head about five full threads. Open air valve, then, with air nozzle, use compressed air to push piston far enough out of cylinder that it can be pulled the rest of the way.



1. Screen
2. Screen Spacer
3. O-Ring
4. Valve Seat-Lower
5. Seat Spacer
6. Ball
7. O-Ring
8. Valve Seat-Upper
9. Plug
10. Ball Stop
11. Spring
12. O-Ring
13. Check Nut
14. Adjustment Cap - Pilot Valve
15. Unloader Cap
16. O-Ring
17. Spring
18. Ball Guide
19. Ball
20. Snap Ring
21. Seat
22. O-Ring
23. Piston
24. O-Ring
25. Bolt
26. Mounting Bracket
27. Nut
28. Plug
29. Spring
30. Poppet
31. Regulator Section Body

Figure A3-1. Regulator Section of Accumulator



1. Backup Ring
2. O-Ring
3. Piston
4. Backup Ring
5. O-Ring
6. Backup Ring
7. Piston (Early Type)
8. Backup Ring
9. O-Ring
10. Precharge Valve
11. Body
12. Lock Nut

Figure A3-2. Body and Piston of Accumulator

d. Removal of system check valve:

NOTE

The accumulator system check valve can be removed only after the body has been removed from the regulator head as described above.

1. Remove plug on system check valve.

NOTE

In some cases, the staked plug cannot be unscrewed. If this happens, screw the plug into the hole as far as it will go, then use a 1/2 x 20 bottom tap, to clean out the threads deformed by the staking. The plug may then be unscrewed.

2. Remove spring and poppet.

A3-6. REASSEMBLY OF THE ACCUMULATOR. Careful adherence to all the steps listed below should restore the accumulator to an overhauled condition. If thorough trouble shooting has disclosed that a particular valve or part is the source of accumulator malfunction, however, it may be more practical just to repair the defective part. For this reason the sub paragraphs below, as indicated by their titles, each outline a separate repair of a particular part.

a. Assembly of the pilot valve section: (See Fig A3-1)
1. Carefully clean and examine all parts removed per paragraph A3-5.a. Seats (4 and 8) may be lapped on fine emery paper to ensure a sharp, even seat against the valve ball. Install new O-rings, well lubricated with petrolatum, on all parts.
2. Insert screen (1) and screen spacer in the port, then press in the lower seat (4) with the seat up.
3. Examine seat spacer (5), using a small penlight bulb, make sure that the #80 hole in the side is not clogged. Shine light through it to examine it. Clean with # 80 drill if necessary.
4. Insert the spacer with the flange up.
5. Drop in the ball (6). Then press upper seat (8) in place with the seat down.
6. Install the seat retaining plug (9).
7. Install ball stop (10) inside retaining plug (9). Then install spring (11) and cap (14).

NOTE

Do not safety the pilot adjusting cap until pilot valve is adjusted under functional conditions, either on the airplane or on a test stand.

b. Assembly of the unloader valve section:
1. Carefully clean and examine all parts removed per paragraph A3-5. b. Seat (21) may be hand lapped, if necessary, to ensure a good seat for ball (19). The seat should be sharp and clean. Install new O-rings, well lubricated with petrolatum, on all parts.
2. Insert piston (23) in the hole with the pin up.
3. Insert ball seat (21) in hole, with side holes in its skirt to the bottom. The seat face should be up.
4. Install snap ring (20) in groove just above the ball seat.
5. Drop in the ball. Install ball guide (18), spring (17), and cap (15). Tighten cap all the way and safety to regulator body.

c. Installation of system check valve: (See Fig A3-1)
1. Examine regulator section milled seat for poppet (30). If this seat is bad, return regulator body for re-machining of this seat and get a new or reworked head, part number ED11474, unless local machine-shop facilities are capable of re-machining this seat accurately.
2. Install poppet, spring and plug. Using special wrench, install plug flush with top of hole, then stake carefully with a punch.

NOTE

The accumulator system check valve can be checked for leakage using a hand pump to supply pressure through the "SYT" fitting, Remove the fitting from the pressure port (the top fitting on the regulator head). Pump up pressure to 1400 psi. No fluid should flow into the pressure port. Look down into the pressure port to make sure there is no flow.

d. Assembly of the piston, body and regulator head: (See Figure A3-2)

NOTE

Early accumulators, part no EA1330, used the "double O-ring" type of piston. Later accumulators used a concave piston with a back up ring on each side of the single O-ring.

1. Clean all parts thoroughly, examine the parts for scratches, wear or pits which could impair their function.
2. Assemble back up rings and O-rings over piston. See figure A3-2 for fitting back up rings. Even new back up rings may require some fitting to the machining of the piston grooves. If old back up rings are to be reinstalled, examine them carefully for plastic "flow" which must be trimmed away so that it will not impede the piston sliding in the cylinder body.
3. Lubricate piston sliding surfaces, O-rings and back up rings with MIL-L-4343 pneumatic-system grease. With precharge valve open to drain compression, insert piston in body.

NOTE

The concave end of the piston should be opposite the precharge valve.

4. Lubricate and install O-ring in groove at top of body threads in the regulator head.
5. Back off on lock ring, then screw body all the way in to the regulator head. Use a strap wrench to tighten body securely, then run up the lock ring, tighten with a spanner wrench.

SECTION A4

MAIN GEAR ACTUATOR REPAIRS

A4-1. LEADING PARTICULARS.

Operating pressure	1500 psig
Proof pressure	2250 psig
Burst pressure	3750 psig
Operating temperature range (ambient)	-40°C(-40°F) to +71.1C°(+160°F)
Cylinder stroke	2.875 inches
Rod side of cylinder output shaft torque with 100 percent efficiency	3550 in. lb
Torque shaft limit load (static)	4200 in. lb
Torque shaft ultimate load	6300 in. lb
Rod side minimum dynamic operating output torque	3100 in. lb
Dry weight	5.8 lb

A4-2. DISASSEMBLY OF MAIN GEAR ACTUATOR. Disassemble actuator in the sequence of index numbers assigned in Figure A4-1. Pay particular attention to the following:

a. Do not disassemble nameplate (3) from cylinder body (28) unless replacement is required.

b. Do not disassemble bushings (4) and helicoils (5) unless replacement is necessary.

NOTE

Use extreme care in handling cover (6) and cylinder body (28) to prevent damage to their mating surfaces.

c. Do not disassemble split sleeve bearing (11)from cover (6) and cylinder body (28) unless excessive wear or damage is evident.

d. Do not disassemble nylon pellets (14) unless replacement is required.

e. Tag cover (6) and cylinder body (28) as a matched set.

f. After disassembly, clean all parts in dry-cleaning solvent, Fed. Spec. P-S-661 and dry with clean compressed air.

A4-3. INSPECTION OF PARTS. Perform the following inspections to ensure that all parts are in serviceable condition.

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

b. Inspect cover (6), dowels (9 and 12), spindle, flange and gear (15), rack piston (23), reaction roller (25) and cylinder body (28) for cracks, chips, scratches, scoring, wear or surface irregularities which may affect their function or the overall function of the main gear retraction actuator.

c. Inspect spindle, flange and gear (15) for lost motion or play in the spindle output flange. It shall not exceed 2 degrees.

d. Inspect bearings (10 and 26) for freedom of motion, scores, scratches and Brinnel marks.

A4-4. REPLACEMENT/REPAIR OF PARTS.

a. Repair of the detail parts of the main gear retraction 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).

b. Cover (6), and cylinder body (28) are procurable as a matched set only. If replacement of either part is required, replace as a matched set.

c. If replacement of one half of sleeve bearing (11) is required, replace both halves to maintain proper shaft-to-bearing fit, and proper gear backlash value. Replace preformed packings (21, 22 and 27) during reassembly.

A4-5. REASSEMBLY OF MAIN GEAR ACTUATOR. Reassemble actuator in reverse order of index numbers assigned in Figure A4-1, with attention to the following points:

a. Before assembly, immerse the O-rings (21, 22 and 27) in hydraulic fluid (Specification MIL-H-5606A).

b. Pack gears of parts (15 and 23) and bearings (10 and 26) with Texaco Uni Temp Grease TG1224-Spec. MIL-G-7711. Grease thoroughly but sparingly to avoid grease working past O-ring (27).

CAUTION

Overgreasing may cause contamination of the hydraulic cylinder with grease which works past (27). Apply grease sparingly.

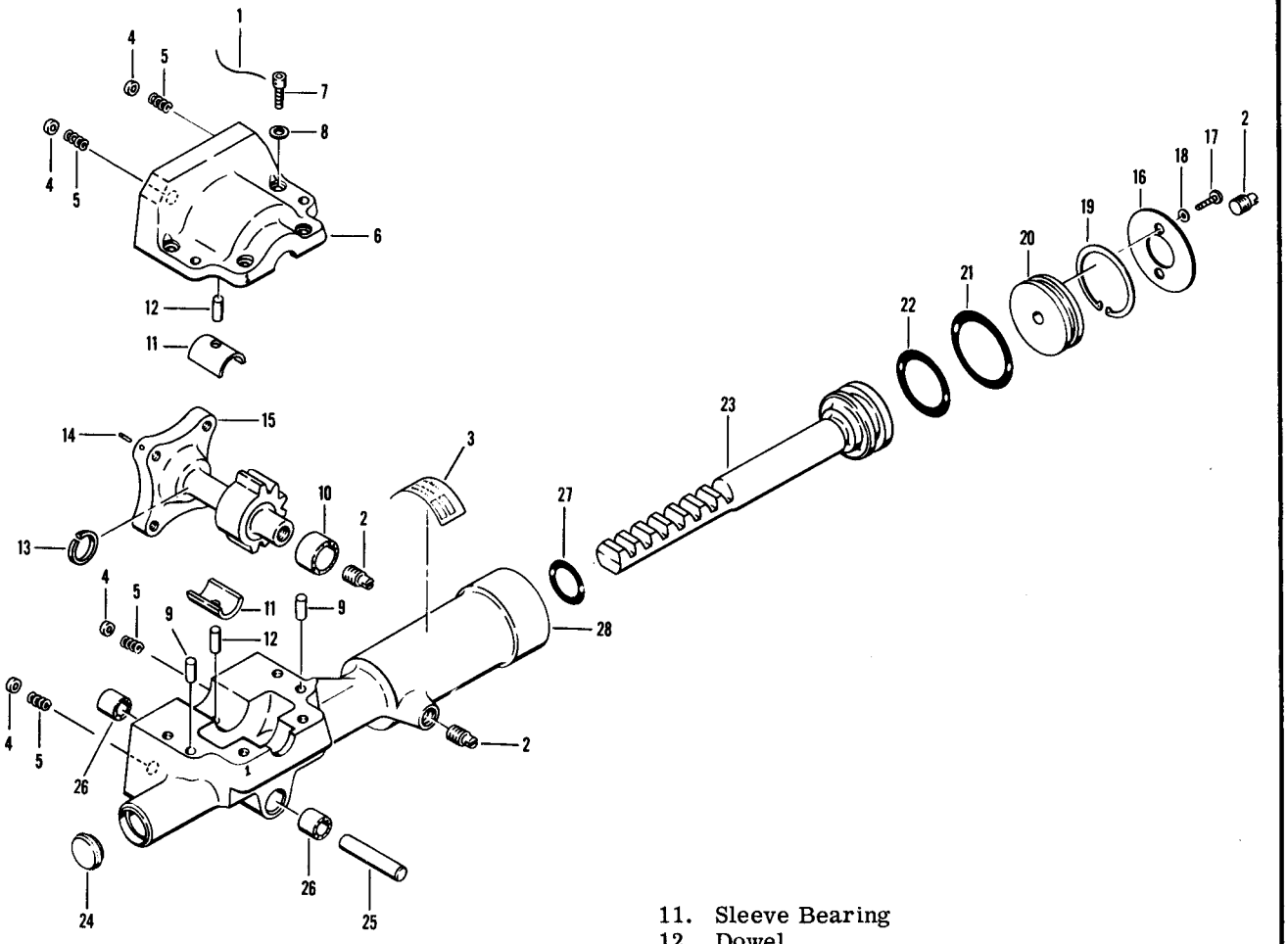
c. If bearings (26) or reaction roller (25) were replaced, press fit the bearings until they are flush against the retaining base in the cylinder body (28).

d. If sleeve bearing (11) was replaced, assemble one half to cylinder body (28) and one half to cover (6). Secure in position with dowels (12).

e. Using a standard torque wrench, apply a torque of 90 to 100 inch pounds to Allenhead screws (7).

NOTE

Lubricate reaction roller, piston rack gears, flange and gear spindle, and all bearings with MIL-G-3278 grease during assembly of the main gear actuator.



1. Lock Wire
2. Shipping Plugs
3. Nameplate
4. Bushings
5. Helicoils
6. Cover
7. Allen Head Screw
8. Washer
9. Dowels
10. Bearing
11. Sleeve Bearing
12. Dowel
13. Spindle Shaft Seal
14. Nylon Pellets
15. Spindle, Flange and Gear
16. End Plug Retainer
17. Screw
18. Washer
19. Snap Ring
20. End Plug
21. O-Ring
22. O-Ring
23. Rack Piston
24. Plug
25. Reaction Roller
26. Bearing
27. O-Ring
28. Cylinder Body

Figure A4-1 Main Gear Actuator

SECTION A5

NOSE GEAR ACTUATOR REPAIR

A5-1. LEADING PARTICULARS.

Operating pressure	1500 psig
Proof pressure	2250 psig
Burst pressure	3750 psig
Operating temperature range (ambient)	-40°C(-40°F) to +71.1°C(+160°F)
Compression load	658 lb
Tension load	434 lb
Overall length	12.892 ± 0.046 in
Piston stroke	8.204 in
Piston adjustment	+0.062, -0.125 in
Lock-Uplock travel	0.250 in

NOTE

After repair, rig the nose gear actuator in accordance with Figure 5-22 upon installation.

A5-2. DISASSEMBLY OF NOSE GEAR ACTUATOR. Disassemble actuator in the sequence of index numbers assigned to Figure A5-1. Attaching parts are listed following parts they attach. Observe the following points:

a. Do not disassemble nameplate (3) unless replacement is necessary.

b. Do not remove screw (8) and nut (9) from nose gear actuator bearing end (26) unless replacement is necessary.

c. Turn down nut (24) to facilitate removal of nose gear actuator rod end (23).

d. Back off nose gear actuator nut (33) to facilitate removal of nose gear actuator bearing end (26).

e. After disassembly, rinse all metallic parts in Dry-Cleaning Solvent, Federal Specification P-S-661, and dry with clean, dry, oil-free compressed air.

A5-3. INSPECTION OF PARTS. Make the following inspections to ensure that all parts in serviceable condition

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

b. Inspect nose gear actuator down lock spring (13), for breakage or distortion. The free length of the spring must be 2.406±0.080 inches.

c. Inspect nose gear actuator locking hooks (20, and 21, nose gear actuator spring guide (22), nose gear actuator rod end (23), nose gear actuator bearing end and pin assembly (26), nose gear actuator piston and rod (30), and nose gear actuator barrel (34) for cracks, chips, scratches, scoring wear, or surface irregularities which may affect their function or the overall function of the nose gear retraction and drag strut actuator assembly.

A5-4. REASSEMBLY OF NOSE GEAR ACTUATOR. Repair of most parts of the nose gear actuator assembly is impractical. Replace defective parts with serviceable ones. Minor scratches and scores may be polished out with fine crocus cloth. All O-rings and back up rings should be replaced during reassembly.

a. Assemble back-up rings and O-rings over piston, making sure O-ring is seated squarely between back-up rings.

b. Lubricate with petrolatum, then insert piston into barrel.

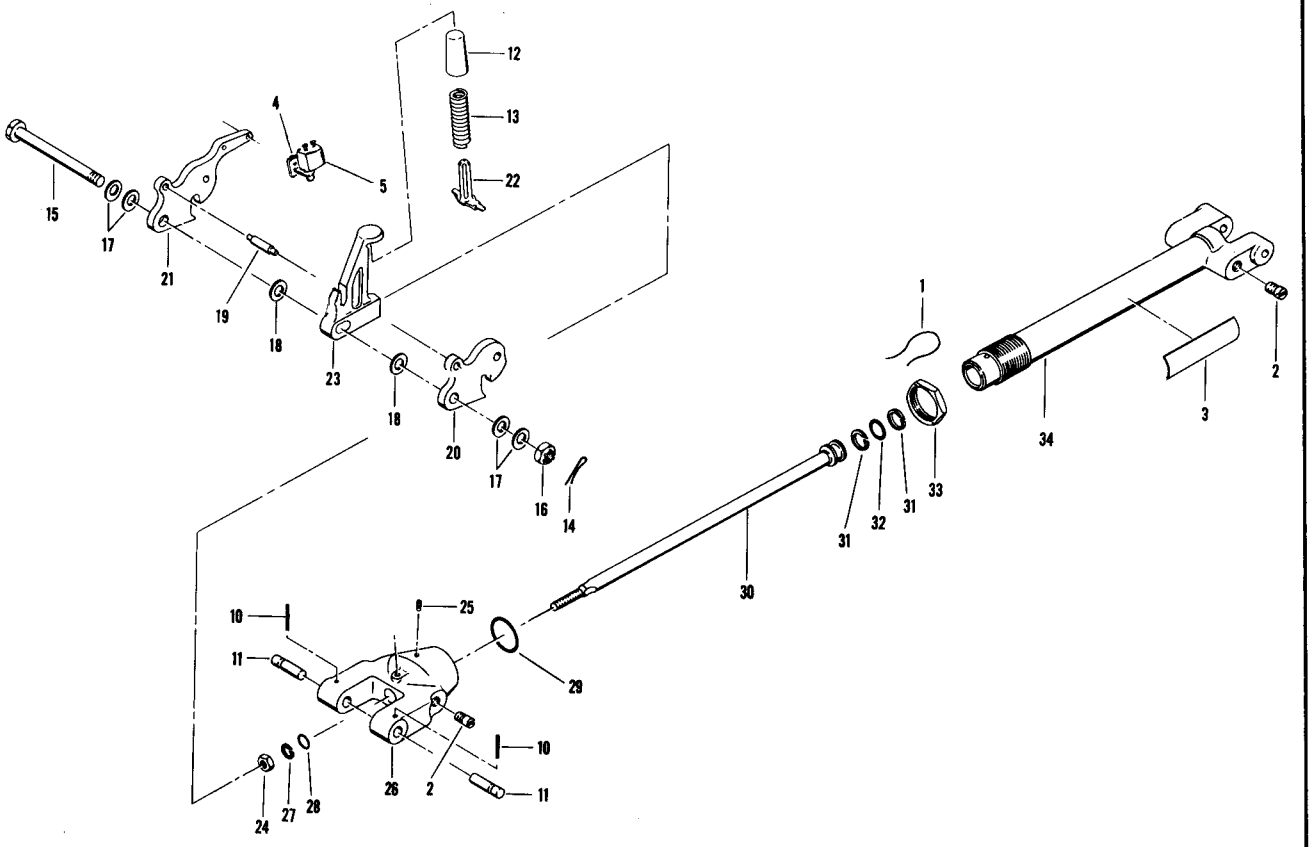
c. Install back-up and O-ring in actuator bearing end.

d. Slide bearing end over piston rod, then screw it onto barrel until length measured between the two anchor holes is 11.580±0.031 inches.

e. Check that tapped hole in bearing end is aligned with drilled hole in barrel, then install set screw.

f. Tighten jamb nut (33)

g. Install nut (24) and downlock hook assembly on piston rod.



1. Lock Wire
2. Shipping Plugs
3. Nameplate
4. Switch Bracket
5. Microswitch
6. Deleted
7. Deleted
8. Deleted
9. Deleted
10. Spring Pin
11. Locking Pin
12. Spring Shield
13. Down Lock Spring
14. Cotter Pin
15. Bolt
16. Nut
17. Washers
18. Washers
19. Down Lock Cross Bar
20. Locking Hook
21. Locking Hook
22. Spring Guide
23. Rod End
24. Nut
25. Setscrew
26. Bearing End
27. Backup Ring
28. O-Ring
29. O-Ring
30. Piston and Rod
31. Backup Rings
32. O-Ring
33. Nut
34. Nose Gear Actuator Barrel

Figure A5-1. Nose Gear Actuator

SECTION A6

STRUT DOOR ACTUATOR REPAIR

A6-1. LEADING PARTICULARS.

Operating pressure	1500 psig
Proof pressure	2250 psig
Burst pressure	3750 psig
Operating temperature range (ambient)	-40°C(-40°F)to +71.1°C(+160°F)
Compression load	458 lb
Retracted length	8.06 inches
Extended length	11.62 inches
Length of stroke	3.56±0.03 inches
Rod end adjustment	±0.12 inch
Weight	7 ounces

A6-2. DISASSEMBLY.

a. Cut safety wire and drive out rollpins carefully.

b. Remove rod end and then pull bearing end free of cylinder. Pull piston out of cylinder.

A6-3. REASSEMBLY OF ACTUATOR.

a. Wash metal parts in solvent.

b. Examine all parts for wear, cracks, scoring scratches or other defects which might cause malfunction or leaks. Replace defective parts.

c. Install back up rings and O-ring.

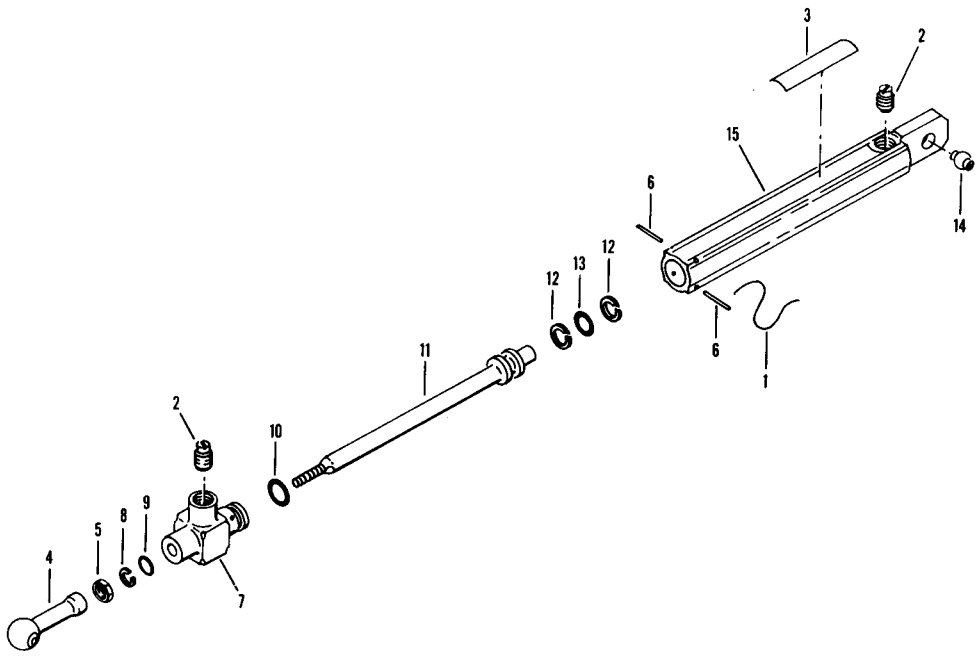
d. Lubricate cylinder lightly with petrolatum, then insert it in cylinder.

e. Replace back up ring and O-ring in bearing end, lubricate lightly with petrolatum and slide into place over piston shaft.

f. Install new rollpins and safety wire.

g. Install nut and rod end.

h. Coat bushing (14) O.D. with zinc chromate primer, then press in place.



1. Lock Wire
2. Shipping Plugs
3. Nameplate
4. Rod End
5. Check Nut
6. Spring Pins
7. Bearing End
8. Back-Up Ring
9. O-Ring
10. O-Ring
11. Rod and Piston
12. Back-Up Rings
13. O-Ring
14. Bushing
15. Barrel

Figure A6-1. Strut Door Actuator

SECTION A7

MAIN GEAR DOOR ACTUATOR

A7-1. LEADING PARTICULARS.

Operating pressure	1500 psig
Proof pressure	2250 psig
Burst pressure	3750 psig
Operating temperature range (ambient)	-40°C(-40°F)to +71.1°C(+160°F)
Compression load	458 lb
Tension load	343 lb
Retracted length	11.75 inches
Extended length	17.50 inches
Stroke	5.75 ± 0.03 inches
Rod end adjustment	0.12 inch
Weight	10 ounces

A7-2. DISASSEMBLY.

a. Cut safety wire and remove rollpins.

b. Remove rod end and then pull bearing end free of cylinder. Pull piston free of cylinder.

A7-3. REASSEMBLY OF ACTUATOR.

a. Wash metal parts in solvent.

b. Examine parts for wear, cracks, scoring scratches, or other defects which might cause malfunction or leaks. Replace defective parts.

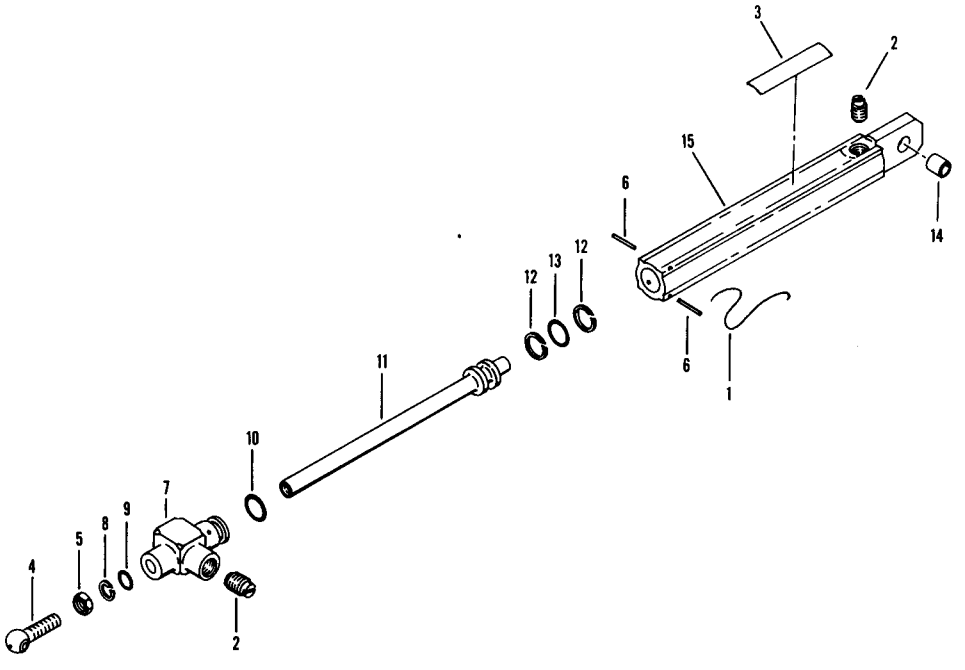
c. Install back-up rings and O-ring on piston.

d. Lubricate piston lightly with petrolatum, then insert it in cylinder.

e. Install new back up and O-ring in bearing end. Lubricate lightly with petrolatum, then slide it into place over piston shaft.

f. Install new spring pins and safety wire.

g. Install new bushing (14) if necessary and stake at 60-degree intervals on each side.



1. Lock Wire
2. Shipping Plugs
3. Nameplate
4. Rod End
5. Check Nut
6. Spring Pins
7. Bearing End
8. Backup Ring
9. O-Ring
10. O-Ring
11. Rod and Piston
12. Backup Ring
13. O-Ring
14. Bushing
15. Strut Door Actuator Barrel

Figure A7-1. Main Gear Door Actuator

SECTION A8

NOSE GEAR DOOR ACTUATORS

A8-1. LEADING PARTICULARS.

Operating pressure	1500 psig
Proof pressure	2250 psig
Burst pressure	3750 psig
Operating temperature range (ambient)	-40°C(-40°F)to +71.1°C(+160°F)
Compression load	458 lb
Tension load	343 lb
Retracted length	11.56 in
Extended length	17.31 in.
Stroke	5.75 ± .03 in
Rod end adjustment	±0.06 in
Weight.	10 ounces

A8-2. DISASSEMBLY.

a. Cut safety wire and drive out roll pins carefully.

b. Remove rod end and then pull bearing end free of cylinder. Pull piston out of cylinder.

A8-3. REASSEMBLY OF ACTUATOR.

a. Wash metal parts in solvent.

b. Examine all parts for wear, cracks, scoring, scratches or other defects which might cause malfunction or leaks, Replace defective parts.

c. Install backup rings and O-ring on piston.

d. Lubricate cylinder lightly with petrolatum, then insert it in cylinder.

e. Replace backup ring and O-ring in bearing end, lubricate lightly with petrolatum and slide into place over piston shaft.

f. Install new roll pins and safety wire.

g. Install nut and rod end.

h. Coat bushing (14) O. D. with zinc chromate primer, then press in place.

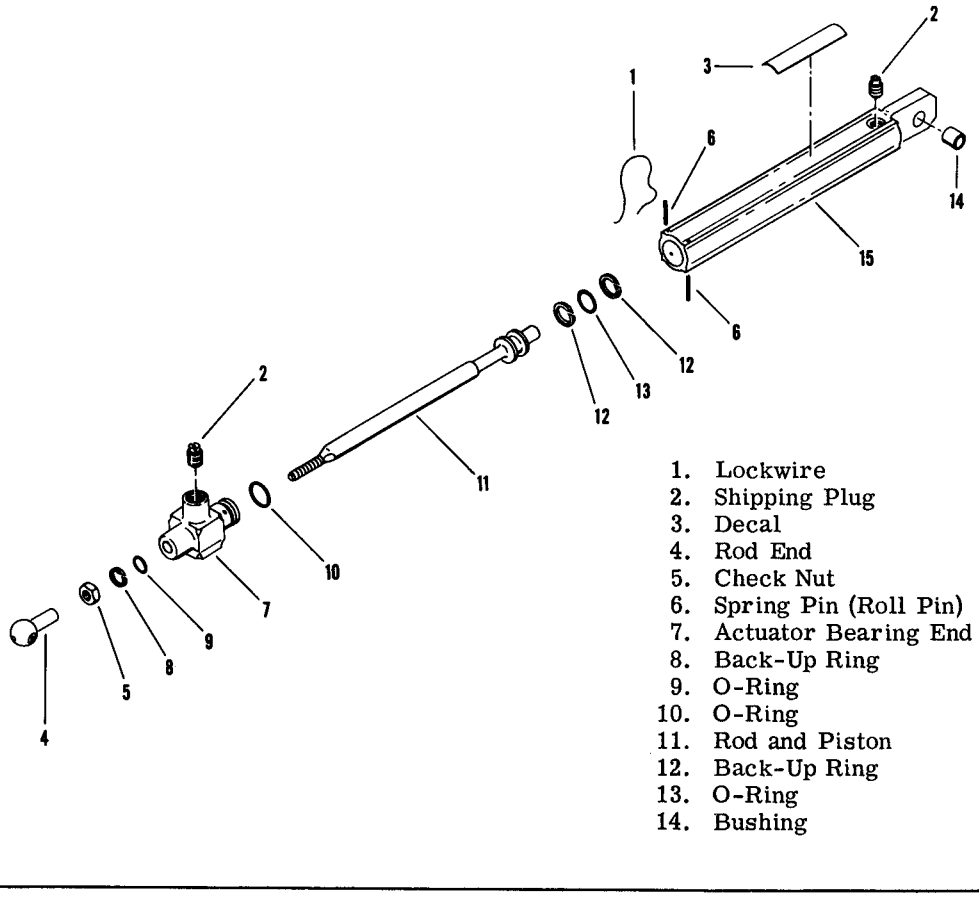


Figure A8-1. Nose Gear Door Actuator

SECTION A9

LOCK CYLINDER

A9-1. LEADING PARTICULARS.

Overall length (approx.)	6.875 inches
Overall height (approx.)	2.906 inches
Operating pressure	1500 psig
Proof pressure	2250 psig
Burst pressure	3750 psig
Operating temperature range (ambient)	-40°C(-40°F) to +71.1°C(+160°F)
Compression load	1175 lb
Tension load	1012 lb
Piston stroke	0.812 inch
Stroke to unseat valve	0.719±0.031 inch

A9-2. DISASSEMBLY.

a. Remove fitting (2), spring (4) and balls (5 and 6).

b. Cut safety wire and unscrew end plug. Remove springs, then push piston out of barrel.

A9-3. REASSEMBLY OF LOCK CYLINDER.

NOTE

Consult the 210 Parts Catalog for piston vs O-ring installations on the lock cylinder. Currently-available pistons do not use backup ring (11) and, instead, use a larger O-ring (12). Remember, backup and O-ring installations depend on the piston type.

a. Install new, petrolatum-lubricated O-rings and backup rings on the piston. Install new backup ring (16) and O-ring (14) in barrel, then slide piston into place.

b. Insert springs (8 and 9), install a new O-ring on end plug, then install and safety end plug (7).

1. Nameplate
2. Lock Cylinder Fitting
3. O-Ring
4. Spring
5. Ball
6. Ball
7. End Plug
8. Spring
9. Spring
10. Piston and Rod
11. Back-Up Ring
12. O-Ring
13. O-Ring
14. O-Ring
15. Barrel
16. Back-Up Ring
17. Washer
18. Back-Up Ring

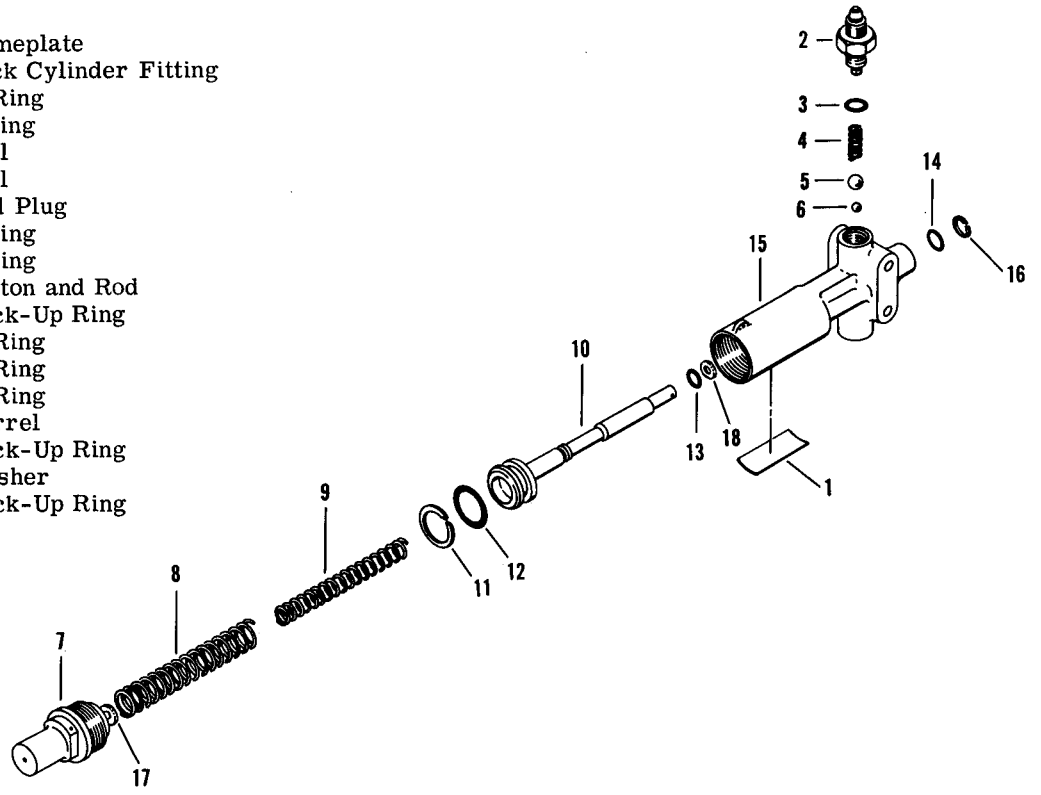


Figure A9-1. Lock Cylinder Assembly

SECTION A10

FLAP ACTUATOR REPAIRS

A10-1. LEADING PARTICULARS.

Operating pressure	1500 psig
Proof pressure	2250 psig
Burst pressure	3750 psig
Unlocking pressure (maximum required)	500 psi
Operating temperature range (ambient)	-40°C(-40°F) to +71.1°C(+160°F)
Compression load	293 lb
Tension load	178 lb
Retracted length	11.84 inches
Extended length	18.22 inches
Stroke	6.38±0.03 inches
Rod end adjustment	±0.12 inch
Weight	8 ounces

A10-2. DISASSEMBLY OF FLAP ACTUATOR.

a. Remove snap ring (15), washer (14), spring (13) and lock plunger (12).

b. Remove rod end and check nut, then cut safety wire and drive out spring pins (4) at both ends of actuator.

c. Pull anchor end and bearing end out of barrel, then pull piston out of barrel and bearing end.

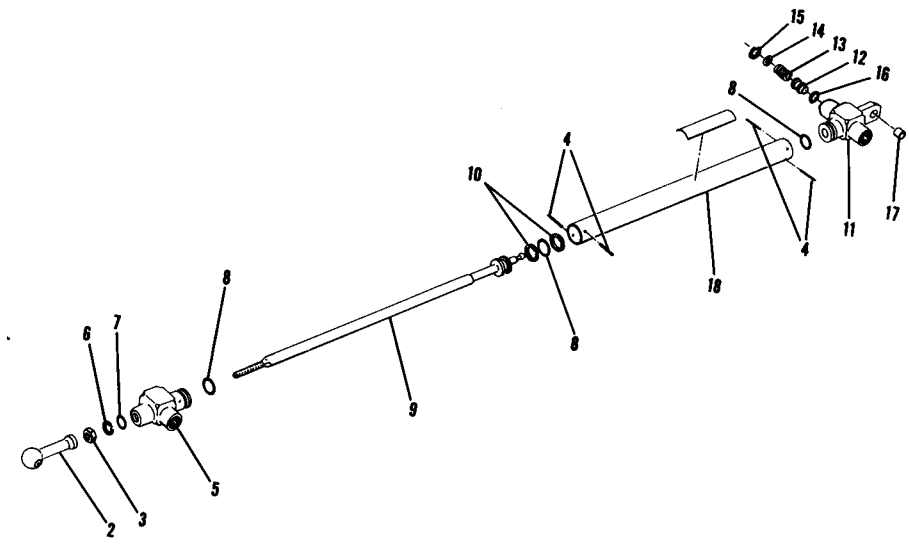
A10-3. ASSEMBLY OF FLAP ACTUATOR.

a. Inspect all parts for defects or damage which might cause malfunction. Replace all defective parts.

b. Install new O-rings and backup rings on all parts, then assemble barrel over piston, and install anchor end and bearing end.

c. Install lock plunger, spring, washer and snap ring in anchor end.

d. Install check nut and rod end on piston.



1. Nameplate
2. Rod End
3. Check Nut
4. Spring Pins
5. Bearing End
6. Back-Up Ring
7. O-Ring
8. O-Ring
9. Piston
10. Back-Up Ring
11. Anchor End
12. Lock Plunger
13. Spring
14. Washer
15. Snap Ring
16. O-Ring
17. Bushing
18. Barrel

Figure A10-1. Flap Actuator

SECTION A11

HYDRAULIC PUMP REPAIR

A11-1. DISASSEMBLY OF PUMP.

a. Remove eight socket-lead cap screws.
b. Remove rear-side, rocking it from side to side and sliding it off the two dowels.
c. Remove O-ring from rear side.
d. Remove centerplate by rocking it off the two dowels.
e. Remove secondary shaft and gear from the bearing.
f. Push drive shaft off until thrust ring can be removed.
g. Remove drive gear, then remove key from drive shaft.
h. Push drive shaft out of drive side.
i. Remove snap ring and seal from drive side.

NOTE

After disassembly, clean all parts in solvent and examine carefully for defects which could cause malfunction or leakage. Replace defective parts.

A11-2. REASSEMBLY OF THE PUMP. Reassembly is accomplished by reversing the order of the steps listed in paragraph A11-1. New O-rings and seals should be used throughout.

NOTE

The counterbore on the drive gear faces the rear side and fits over the thrust ring.

Prior to installing the seal, soak the seal in MIL-H-5606 fluid. Insert the O-ring in its groove and press in the seal. The spring-loaded lip faces the outside of the pump and the unloaded lip faces toward the bearing.

After assembly check for end play in the drive shaft, it should be several thousandths of an inch. The pump should turn freely by hand with no binding.

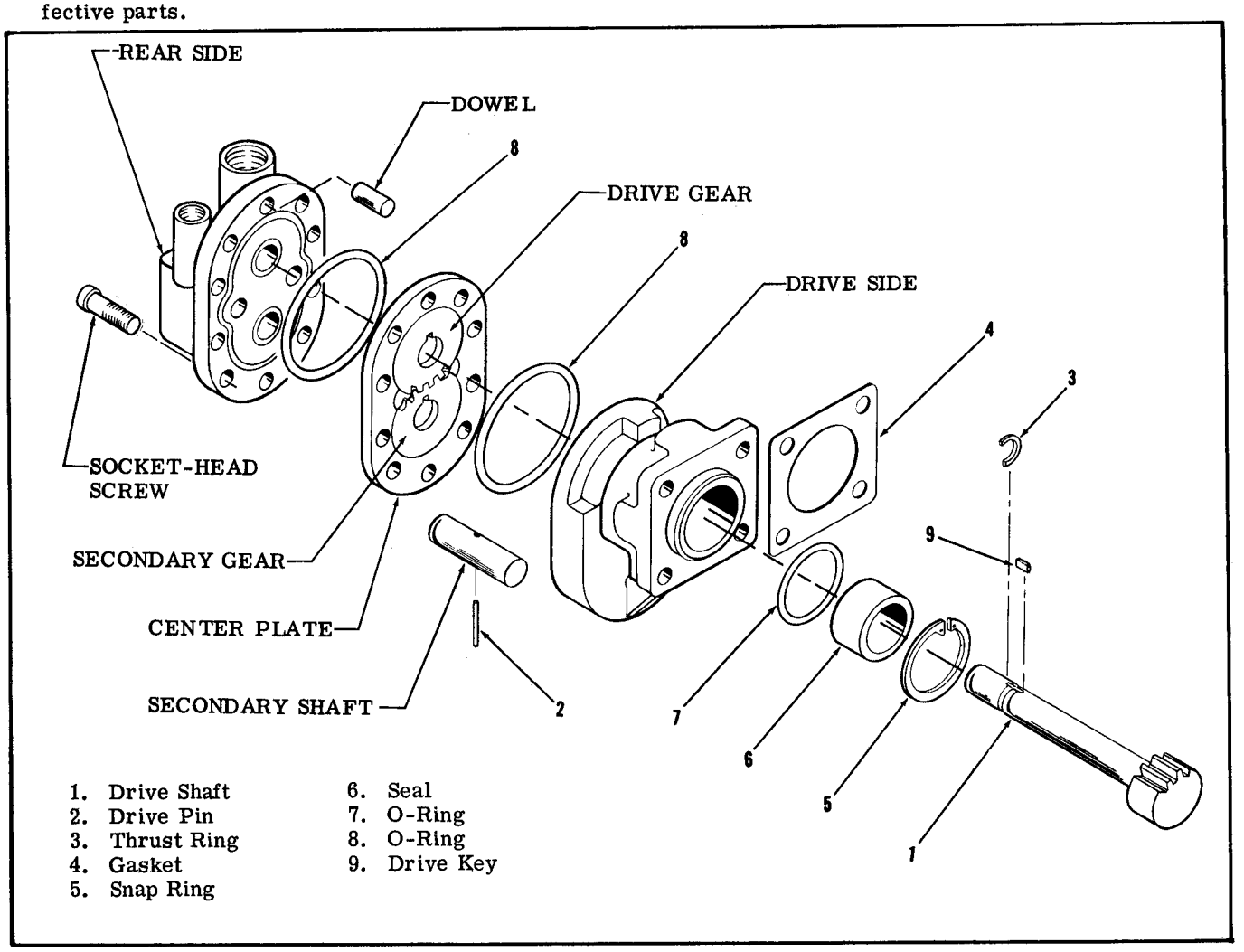


Figure A11-1. Hydraulic Pump

APPENDIX B

HYDRAULIC COMPONENTS REPAIR

MODELS 210B THRU 210D

NOTE

This appendix applies to the standard hydraulic components for the Models 210B thru 210D. Refer to Appendix D for the alternate components.

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SECTION B1

GENERAL INFORMATION

B1-1. The following pages cover, in step-by-step order, the repair of the Power Pack and other hydraulic components. Since emphasis here is on repair, not overhaul, of the basic components of the hydraulic system, it is unlikely that the mechanic will go through all of the operations described. Instead, he will repair the particular item which has been causing difficulty.

NOTE

To isolate the hydraulic item causing malfunction, see the Trouble Shooting Charts in Section 5A and Section 7, and, if possible, perform Hydro Test unit testing.

B1-2. REPAIR VERSUS REPLACEMENT. Often the moderate trade-in price of a factory-rebuilt component is less than the accumulated cost of labor, parts, and (often time consuming) trial and error adjustment. Repair or replacement will depend on the time, equipment, and skilled labor locally available.

B1-3. REPAIR parts and equipment are available from the Cessna Spare Parts Department.

B1-4. EQUIPMENT AND TOOLS.

B1-5. HYDRO TEST. The Hydro Test is a portable Hydraulic Service Unit, designed specifically to supply hydraulic pressure for cycling the landing gear and hydraulically operated wing flaps when checking or servicing these systems when the engine is not running. In addition to cycling the landing gear and wing flaps, the Hydro Test can be used for filling the reservoir, bleeding the system, reading system pressure, and testing components prior to installation. This unit is mounted in a metal cabinet and is on wheels.

B1-6. HAND TOOLS. The following items are necessary for repair work on the Power Pack and other hydraulic components:

- EL-18084 Snap Ring Pliers
- Strap Wrench (for removal of door solenoid and cylinder barrels of the landing gear actuators.)
- MIT796 Special Allen Wrench (for adjusting handle release pressure, priority valve, etc.)
- MIT795 O-ring Installation Tool

Common hand tools required are:

- Pin Punches
- Needle-nose Pliers
- Duck-bill Pliers
- Box and Open End Wrenches (1/2" thru 7/8")
- 1/2" Thin-wall Socket
- Sharp-pointed Scribe

Home-made items, handy for Power Pack repair, are various 1/4" aluminum rods ground to a gradual taper and wire hooks to extricate small plungers from hydraulic ports. These items may be fabricated as needed.

B1-7. 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 take endless "fishing" operations to extricate otherwise. An air hose and nozzle is a common-sense tool.

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SECTION B2

REPAIR OF THE HYDRAULIC POWER PACK

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EMERGENCY HAND PUMP	B2-12
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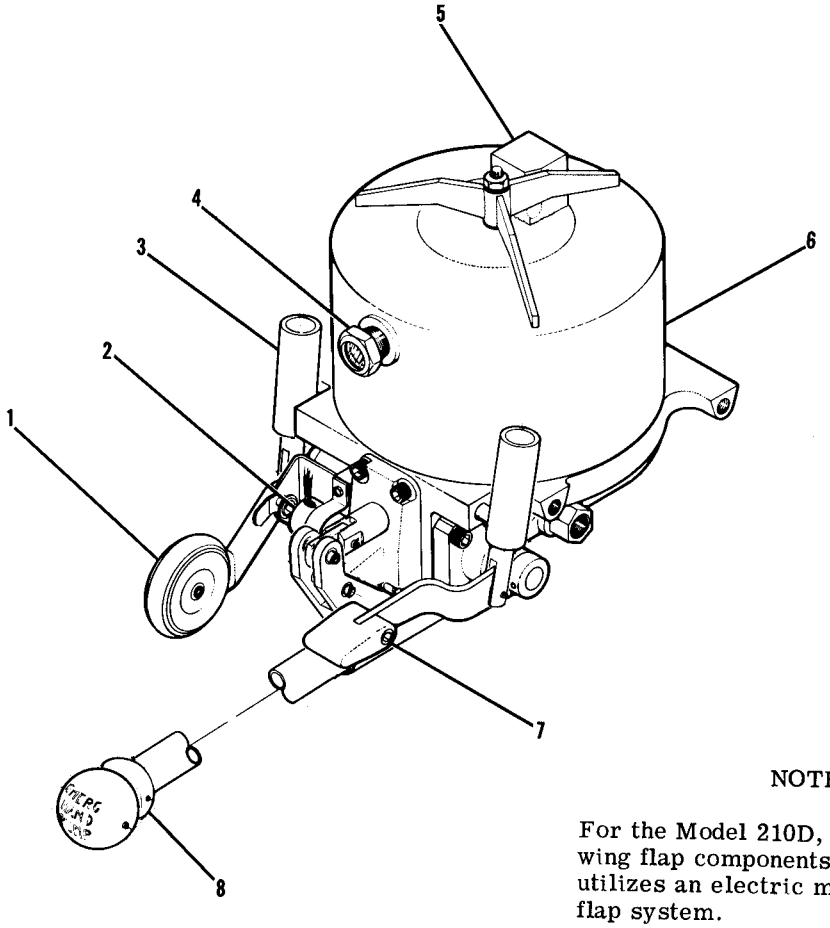


NOTE

For the Model 210D, delete the hydraulic wing flap components. The Model 210D utilizes an electric motor-driven wing flap system.

1. Landing Gear Knob
2. Handle Lockout Solenoid
3. Handle Return Bungee
4. Sight Window
5. Overboard Vent Port
6. Fluid Reservoir
7. Flap Control Knob

Figure B2-1. Powerpack Unit

B2-1. GENERAL. This section describes disassembly and repair of the open center power pack. The treatment here is divided into several sections, each of which will deal with one major component or section of the pack. The following paragraphs take each functional component of the pack through a removal, disassembly, inspection, repair and reassembly procedure. At the end of the section is a testing procedure.

B2-2. TROUBLE SHOOTING THE POWER PACK. Below each paragraph heading in the following paragraphs will be a note which will describe symptoms of power pack failure having to do with the components being repaired. This may be used in conjunction with the trouble shooting chart in Section 5A.

B2-3. CLEANING THE REMOVED POWER PACK. When the power pack is removed from the airplane it is usually covered with dust and dirt. Preliminary cleaning of the power pack is essential to proper repair. All of the ports and fittings in the pack should be capped or plugged and then the entire pack may be cleaned with solvent cleaner, P-S-661, or equivalent. After dousing the pack with cleaning fluid, it may be air-dried. Compressed air may be used to loosen any accumulated debris or dirt on the pack.

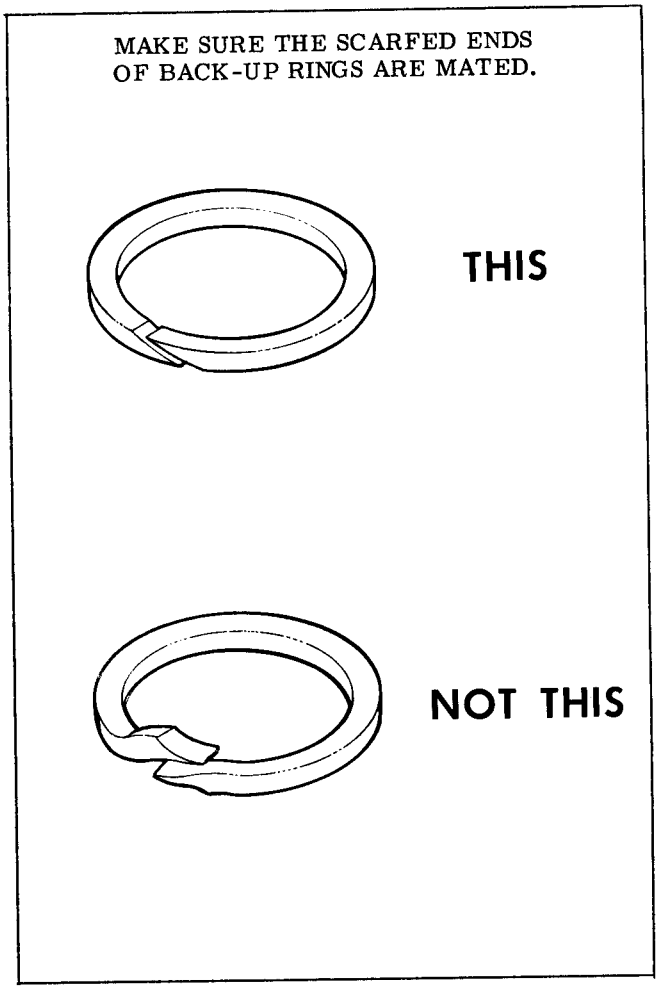


Figure B2-2. Installing Back-Up Rings

B2-4. PUMP LOADING VALVE. (See figure B2-4.)

NOTE

The pump loading valve is operated by cams on the landing gear and flap control shafts. The valve is a mechanically operated poppet. When this valve is opened, it unloads the engine-driven pump; when it is closed, it loads the engine-driven pump. Symptoms of loading valve failure are:

1. Landing gear or flaps will not operate from the engine-driven pump although they will operate off the emergency hand pump. This indicates a failure of the valve to close tight.

2. When the power pack overheats with both handles in neutral position, it indicates the valve is not opening sufficiently.

   When the pump loading valve is stuck partially open it may be diagnosed by using the Hydro Test. Pressure will then build up to over 100 psi on the Hydro Test with landing gear handle in neutral position.

B2-5. REMOVAL.

a. Remove cap (39) using special poppet wrench.

NOTE

Prior to removing cap (39), it will be necessary to swing aside the pump filler line tee.

b. Remove spring (38) directly under poppet cap.

c. Insert jaws of needle nose pliers in small holes in side of poppet, work the poppet up and down in hole to free O-ring (37). Remove O-ring (37) and then pull poppet (36) out of the cavity.

d. Extricate O-ring (35) from the cavity.

e. Rotate the pack to allow guide (32), spring (31) and plunger (30) to drop out. Note a shim washer between spring (31) and guide (32).

B2-6. INSPECTION OF LOADING VALVE PARTS.

a. Poppet spring (38). Check spring tension. Check that spring is not bent or deformed.

b. Poppet (33 thru 37). Replace large O-rings, remove poppet core and check smaller O-ring; replace if defective. Check the poppet seat for scratches, nicks, or dents. This poppet seat cannot be lapped. If it is defective the entire poppet must be replaced.

c. Plunger spring (31). Check that the spring is not bent or bowed. The ends of the spring must be square. Check the spring on a flat surface to disclose deformity.

d. Valve cavity. Check the valve cavity visually and wash out with solvent, making sure that the entire valve cavity is clean and free of foreign matter.

B2-7. INSTALLATION OF THE PUMP LOADING VALVE IN THE POWER PACK.

a. Drop plunger (30) in the cavity.

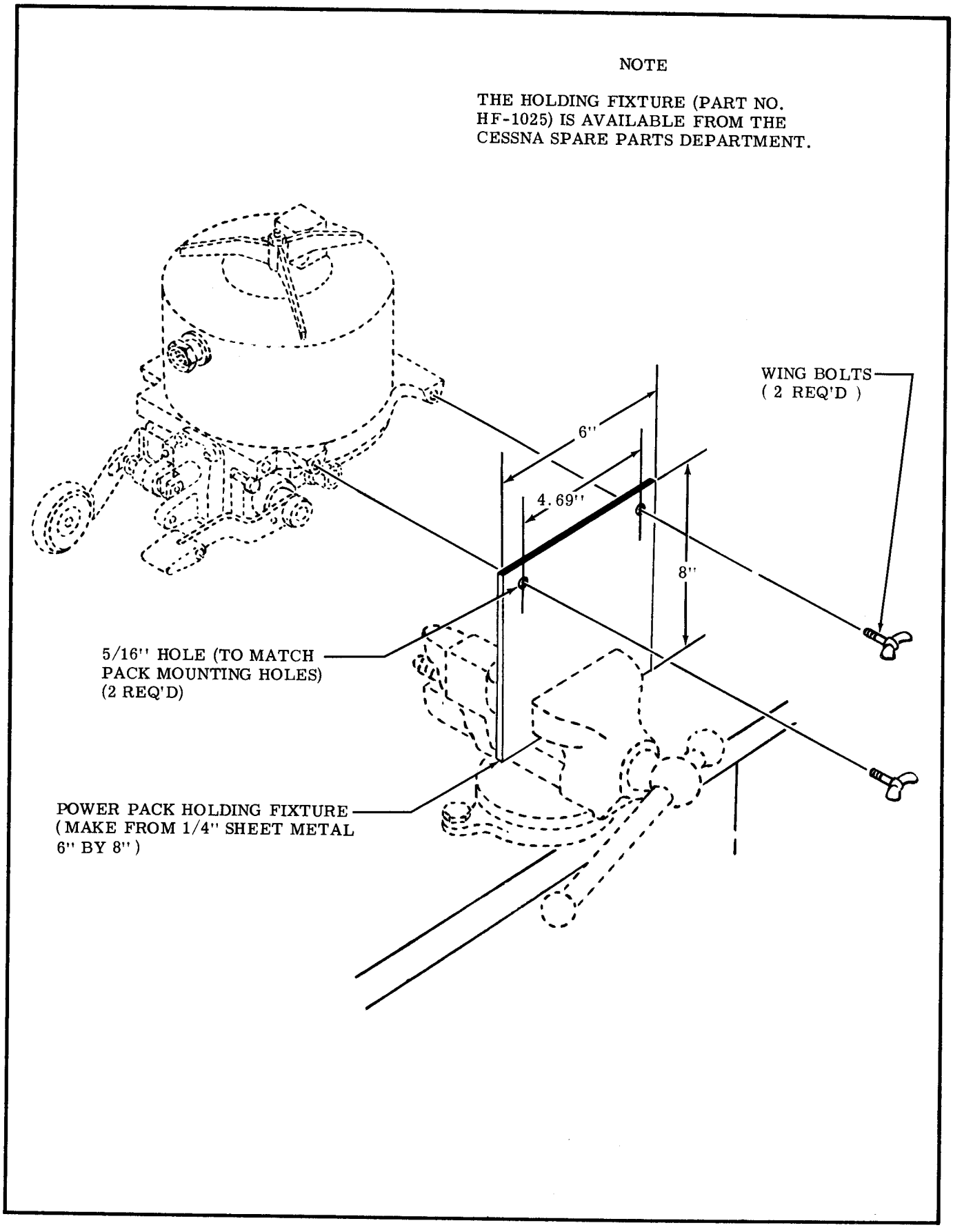


Figure B2-3. Power Pack Holding Fixture

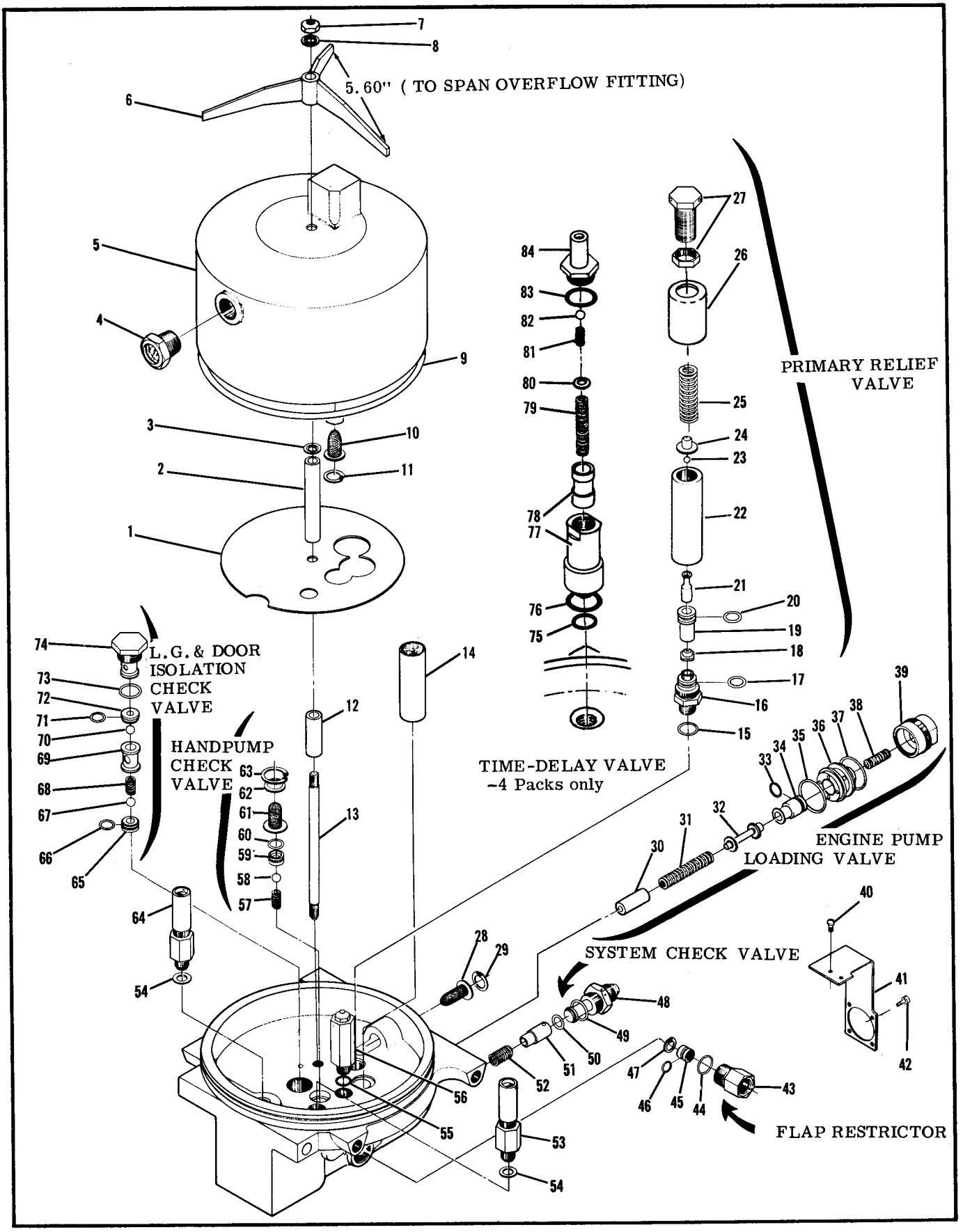


Figure B2-4. Reservoir and Center Section Components

b. Drop in spring (31).

c. Place shim washer over guide (32) then insert guide in spring (31).

d. Assemble the poppet, using O-ring lubricant, place the large O-ring on the outside of the seat end of the poppet. Lubricate the poppet.

CAUTION

Make sure the handles are in neutral before inserting poppet in the cavity.

e. Insert the poppet in the cavity, pushing steadily. Do not pull back on the poppet. This will loosen the O-ring on the seat end of the poppet.

f. Install the remaining large O-ring (37) on the outside of the poppet after the poppet is in place. There is a special tool for this but if this is not available, use a small punch to work the O-ring into position, using plenty of lubricant.

g. Grease poppet spring (38) and insert it in cap (39). The grease will hold it in the cap; then install the poppet cap using special wrench.

References For Figure B2-4

1. Baffle
2. Spacer
3. O-Ring
4. Sight Glass
5. Reservoir
6. Crowfoot
7. Nut
8. Washer
9. O-Ring
10. Spacer and Screen
11. Snap Ring
12. Spacer
13. Thru-Bolt
14. Standpipe and Screen

PRIMARY RELIEF VALVE

15. O-Ring
16. Fitting
17. O-Ring
18. Orifice
19. Poppet Sleeve
20. O-Ring
21. Poppet Spool
22. Valve Body
23. Ball
24. Spring Guide
25. Spring
26. Foam Shield
27. Adjustment Screw and Nut
28. Screen
29. Snap Ring

PUMP LOADING VALVE

30. Cam Plunger
31. Spring
32. Spring Guide and Shim
33. O-Ring
34. Poppet Spool
35. O-Ring
36. Poppet Sleeve
37. O-Ring
38. Spring
39. Cap
40. Screw
41. Electrical Connector Bracket
42. Screw

FLAP RESTRICTOR ORIFICE

43. Restrictor Fitting
44. O-Ring
45. Orifice and Screens
46. O-Ring
47. Snap Ring

SYSTEM CHECK VALVE

48. Fitting
49. O-Ring
50. O-Ring
51. Poppet
52. Spring
53. Primary Thermal Relief Valve
54. Gasket
55. O-Ring
56. Flap Down Vent Valve

HANDPUMP CHECK VALVE

57. Spring
58. Ball
59. Seat
60. O-Ring
61. Screen
62. Spacer
63. Snap Ring
64. Secondary Thermal Relief Valve

L.G. & DOOR ISOLATION CHECK VALVE

65. Seat
66. O-Ring
67. Ball
68. Spring
69. Spacer
70. Ball
71. O-Ring
72. Seat
73. O-Ring
74. Cap

GEAR HANDLE TIME DELAY VALVE (-4 PACKS ONLY)

75. O-Ring
76. O-Ring
77. Body
78. Spool
79. Sleeve
80. Spacer
81. Spring
82. Ball
83. O-Ring
84. Cap

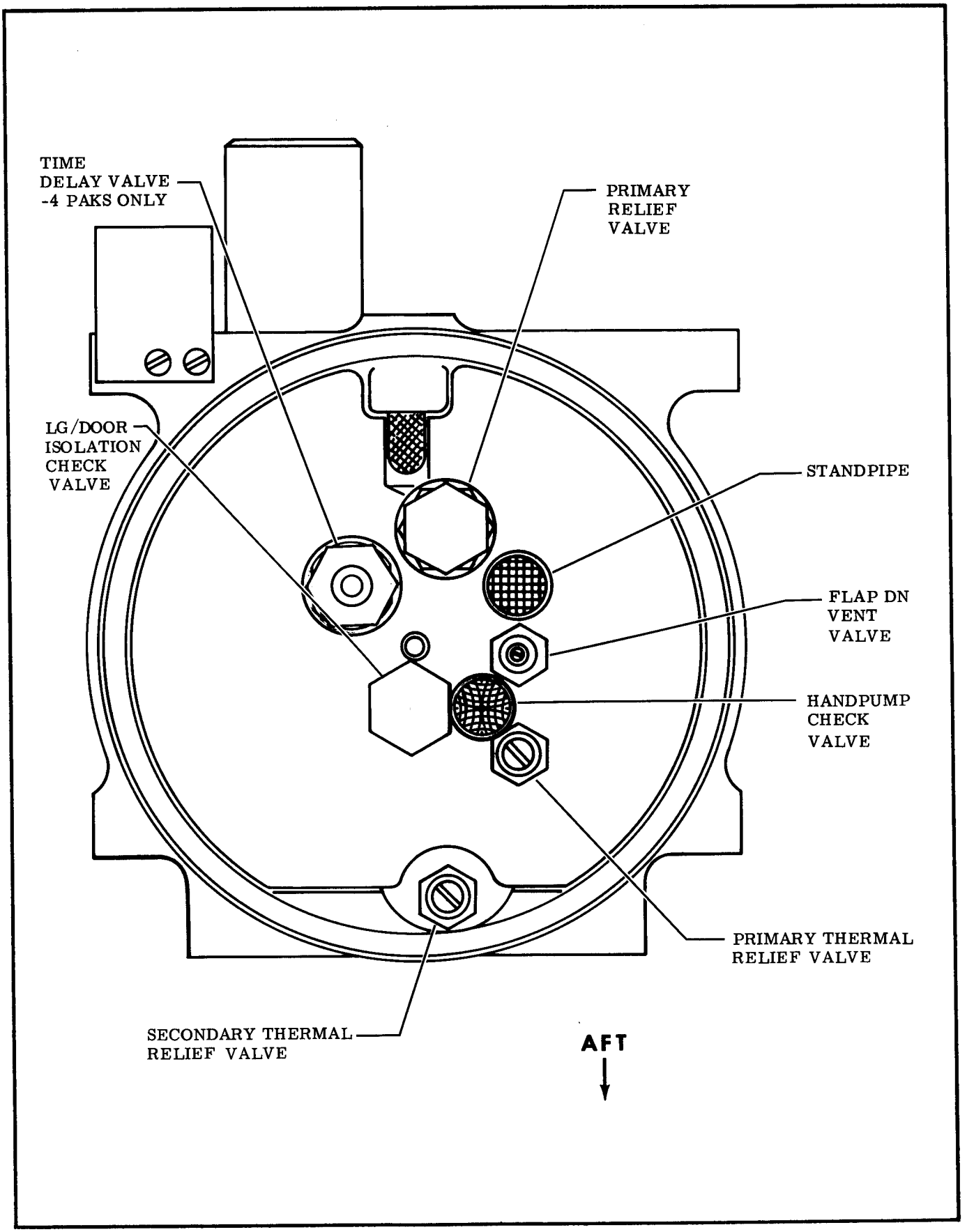


Figure B2-5. Top View of Center Section Components

B2-7A. TIME-DELAY VALVE. The Model 210C and on is equipped with a time-delay valve. Also Model 210B airplanes that are retrofitted with Model 210C hydraulic Power Pack incorporates this time-delay valve. See paragraph 2-59. Figure B2-4 may be used as a guide for removal and installation of the time-delay valve.

NOTE

When installing the time-delay valve, use care and prevent damage to O-rings, as they may become pinched and cause the valve to lock in the open or closed position.

B2-8. CHECKING POPPET SHIMMING OF LOADING VALVE USING SPECIAL DRILLED POPPET CAP AND DEPTH GAGE.

a. Remove the regular poppet cap and screw the special poppet cap into place. The hole drilled in the center of this special poppet cap allows the blade of depth gage to be inserted. Be sure poppet spring (38, figure B2-4) is in place.

b. Move both control handles to neutral position and measure the depth through hole in poppet cap.

c. Move the landing gear control handle to full up or down position and again measure the depth. The difference between open and closed poppet is attained this way. The poppet should have a movement of .025 to .035 when the landing gear or flap handle is moved from neutral to full up or down.

d. If movement is less than .025, add shims; if movement is more than .035, remove shims between spring (31) and guide (32).

e. Remove special cap and reinstall regular poppet cap (39).

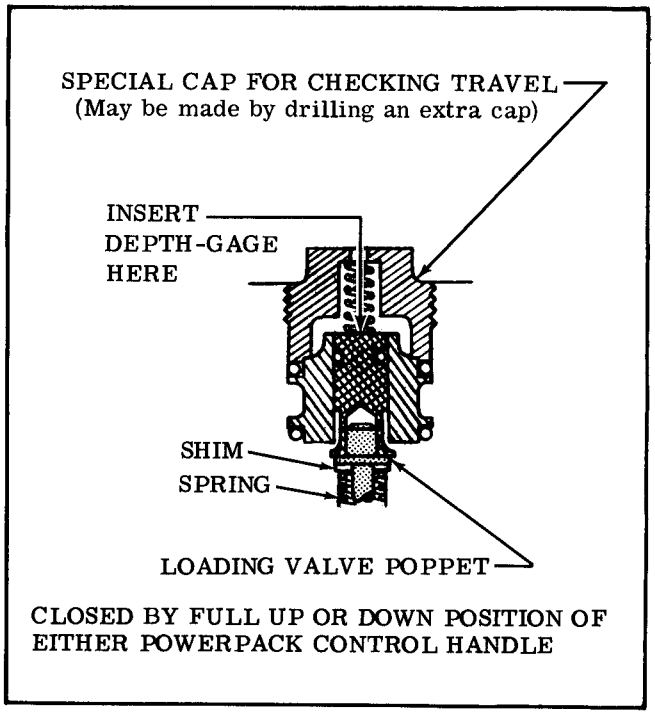


Figure B2-6. Checking Loading Valve Travel

B2-9. SYSTEM CHECK VALVE. (See figure B2-4.)

NOTE

The system check valve is located directly under the pump loader valve in the center portion of the pack. The purpose of this valve is to isolate and keep the emergency hand pump operable in the event of failure of the engine loading valve, the engine pump, a line from the pump to the pack, or the primary relief valve. This valve can fail only by not closing.

B2-10. REMOVAL OF THE SYSTEM CHECK VALVE. (See figure B2-4.)

a. Remove pressure port fitting (48).

b. Using a small hook, remove O-ring (50).

c. Tilt pack to allow poppet (51) and spring (52) to drop out.

B2-11. INSPECTION. After parts of the system check valve have been removed, inspect them carefully. Check poppet (51) to see that it is not scratched or rough in any way so that it could bind. It must have a smooth face on the flat forward end. Check the spring and replace all the O-rings.

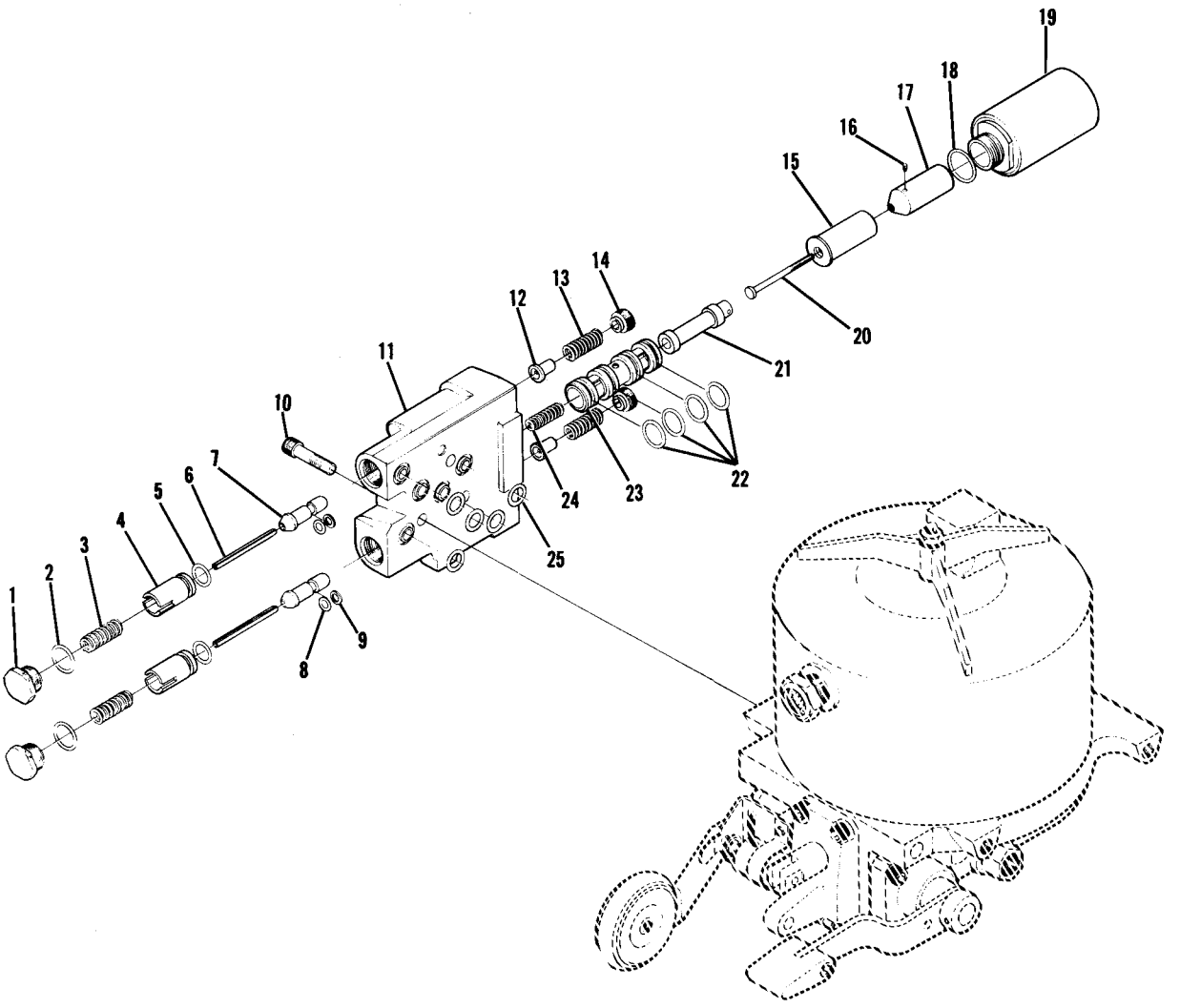
B2-12. INSTALLATION OF THE SYSTEM CHECK VALVE.

a. With the port up, drop spring (52) in the hole.

b. Drop in poppet (51), making sure that the smaller end goes into the spring. Make sure that poppet is in place by measuring down in the cavity. The poppet face should be at least one inch below the face of the hole.

c. Install O-ring (50) on end fitting (48) and O-ring (49) around the flange fitting. Lubricate and then push fitting directly into place. Start the threads and tighten securely.

B2-13. PRIORITY VALVE AND SOLENOID VALVE SECTION. (See figure B2-7.) This section is on the left-hand side of the pack and mounts the electrical solenoid. The priority valve section houses three functions of the power pack. It has the two priority valves — the up priority valve, and the down priority valve. It also contains the four-way door solenoid valve. The priority valves give "Priority" or first flow of fluid to the doors. Priority valve failure will cause the gear to actuate before the doors are fully opened. This can be true with either the up or down priority valve. The door solenoid valve is also related with the doors opening and closing. It can be stuck in either the "door-open" or the "door-close" position, in which case the doors will not open or they will not close. Door valve failure can be caused by electrical failure (which should leave the valve in "door-open" position) or by mechanical jamming of the valve spool in the sleeve. The latter trouble is caused by contamination or corrosion. The first trouble can be failure of the circuit or a burnt-out solenoid.



1. Cap
2. O-Ring
3. Spring
4. Seat
5. O-Ring
6. Pin
7. Poppet
8. O-Ring
9. Back-Up Ring
10. Allen Screw
11. Body
12. Spring Guide
13. Spring
14. Adjustment Plug
15. Plunger Stop
16. Setscrew
17. Solenoid Plunger
18. O-Ring
19. Solenoid Housing
20. Solenoid Plunger Pin
21. Spool
22. O-Rings
23. Sleeve
24. Spring
25. O-Rings

Figure B2-7. Priority and Door Valve Section

B2-14. REMOVAL OF PRIORITY SECTION.

a. Detach the ground lead screw. Disconnect the quick disconnect within the transflex tubing.

b. Cut safety wire and remove three Allen-head screws.

c. Slide the priority valve section out carefully.

CAUTION

After the priority solenoid section is removed from the main body of the pack, cover the exposed ports in the main body of the pack. A piece of paper taped in place over the exposed ports will prevent entry of foreign matter.

B2-15. REMOVAL OF PRIORITY VALVE. (See figure B2-7.)

NOTE

The priority valve is inaccessible with the priority valve and solenoid section still mounted on the pack. Remove the entire section before beginning the following steps (see preceding paragraph).

a. Remove cap (1) and spring (3).

b. With duckbill pliers, pull pin (6) out of the cavity. This will bring out the whole assembly of parts (4) through (7).

c. Using Allen wrench, remove adjustment plug (14). Tip up the priority valve section and drop out spring (13) and guide (12).

d. Wash out the priority valve cavity with solvent, then dry with compressed air.

B2-16. INSPECTION OF PRIORITY VALVE PARTS. Seat (4) should be checked to see that the seat is clean and sharp. This part may be lapped in accordance with figure A1-2, Appendix A. Spring (3) should be checked to see that it is not deformed. Poppet (7) should be checked to see that there is no deep groove that mates with seat (4). (A shiny ring around the poppet is normal.) Check that spring (13) is not deformed.

B2-17. INSTALLATION OF PRIORITY VALVE. (See figure B2-7.)

a. Install O-ring and back-up ring on poppet (7), pressing down on poppet with pin (6). This must be pressed firmly into place so that the pin is approximately 1/8" below the face of the priority valve cavity.

b. Install new O-ring on seat (4), lubricate it, and press it carefully down into place. Make sure that the lapped end of seat (4) goes down into contact with poppet (7). Press the seat down until it is approximately 3/16" below the face of the cavity.

c. Insert spring (3), put a new O-ring on cap (1), lubricate it, and screw it into place.

d. Grease guide (12) and insert it into spring (13). Apply enough grease that the guide will stay in the spring, then drop it in hole, with the guide going into the hole first.

e. Start the adjustment plug (14). Screw it in using an Allen wrench. This adjustable plug provides adjustment on priority valve opening and closing pressures. Install it flush at this time.

B2-18. REMOVAL OF THE SOLENOID AND SOLENOID VALVE. (See figure B2-7.)

a. Snip the safety wire on solenoid.

b. Using a strap wrench or padded jaws of water pump pliers, unscrew the solenoid from the priority valve section. Remove the solenoid carefully to avoid damaging the electrical wires.

c. Tip the priority valve section to try to get the spool (21) of the slide valve to come out. The spool is spring loaded so it should come out fairly easily.

NOTE

If this valve is contaminated so that the spool is stuck in the sleeve, the valve is not repairable, so the spool may be gripped with pliers to pull it out.

d. The solenoid valve sleeve (23) may be removed with a special tool or by using a tempered wire hook engaged in one of the round side holes in the sleeve. Use extreme care when lifting out the solenoid valve sleeve. Scratches on the inside of the sleeve will ruin this valve since the sleeve and spool are matched, precision parts.

CAUTION

When removing the solenoid valve sleeve with a wire hook make sure that the hook is hooked only in one of the round holes in the side of the sleeve. The non-round holes should never be used because a scratch on these holes would ruin the valve.

B2-19. INSTALLATION OF THE SOLENOID VALVE. (See figure B2-7.)

a. Install new O-rings around the outside of the valve sleeve (23). Lubricate thoroughly and then slide sleeve into the valve port. Press it down firmly until it is flush with the step bore in the cavity.

b. Drop in valve spring (24), then slide spool (21) in (with the cross-hole at top, that is, toward the solenoid). The spool should slide easily in the sleeve and will be spring loaded.

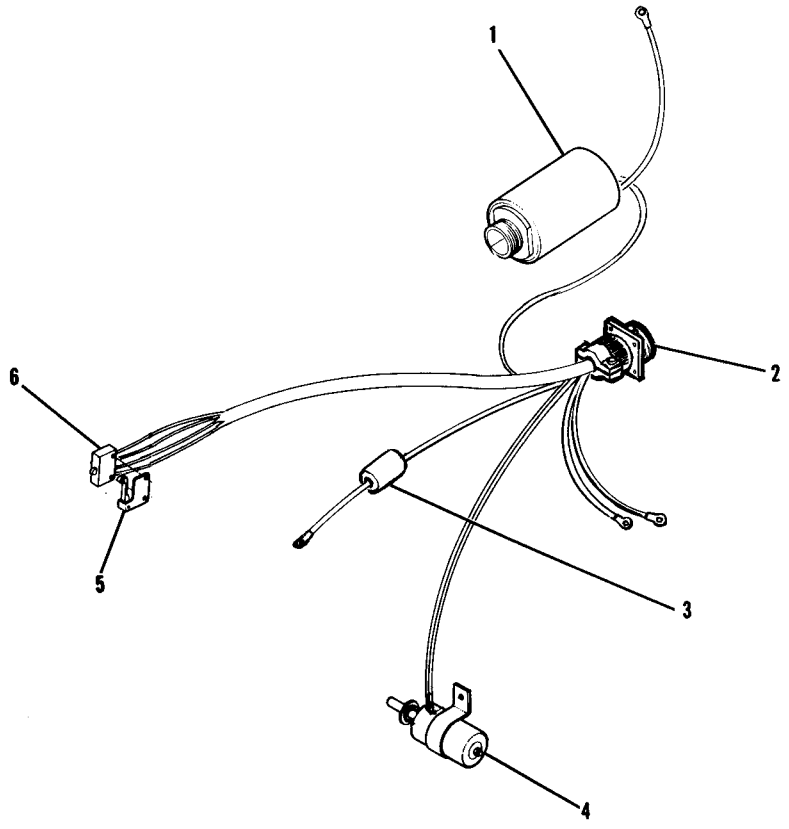
c. Assemble the core in the solenoid, place a new O-ring on the solenoid and screw it into its hole in priority valve section.

d. Tighten solenoid securely with a strap wrench or padded water pump pliers.

B2-20. INSTALLATION OF THE PRIORITY VALVE SECTION. (See figure B2-7.)

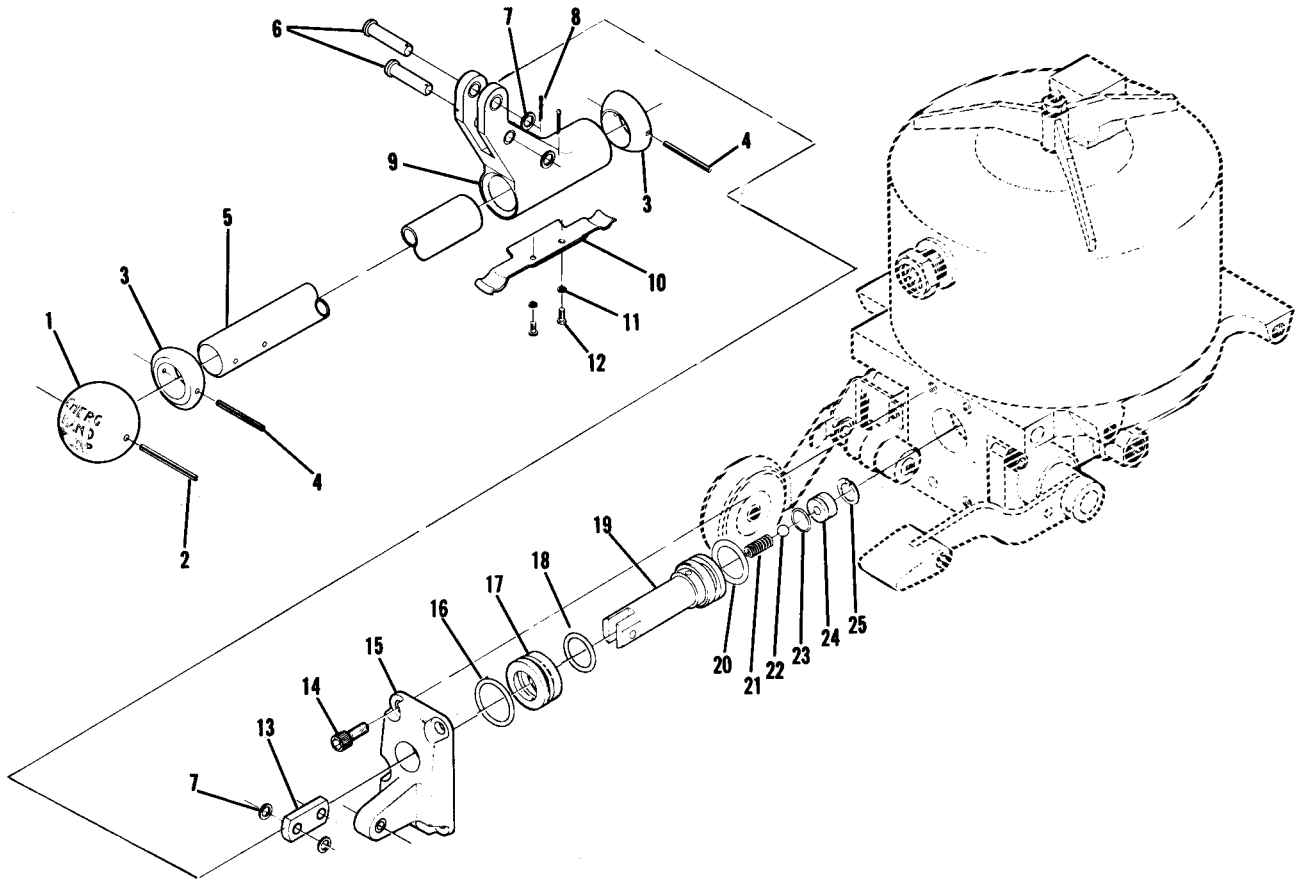
NOTE

Make sure the priority valve caps are safety wired before installing the priority valve section. It is difficult to safety wire these caps after the section is installed.



1. Door Valve Solenoid
2. Connector
3. Capacitor
4. Handle Lockout Solenoid
5. Roller Arm
6. Handle Switch

Figure B2-8. Power Pack Electrical Harness



1. Knob
2. Roll Pin
3. Stop Collar
4. Roll Pin
5. Shaft
6. Clevis Pins
7. Washer
8. Cotter Pins
9. Fork and Bushing Assembly
10. Handle Spring
11. Washer
12. Screw
13. Link
14. Allen Screw
15. Clevis End
16. O-Ring
17. Spool Gland
18. O-Ring
19. Piston
20. O-Ring
21. Spring
22. Ball
23. O-Ring
24. Seat
25. Snap Ring

Figure B2-9. Emergency Hand Pump

a. Install new O-rings (25) in grooves on mating surfaces of priority valve section.
b. Making sure that the O-rings between the two surfaces are in the grooves, slide the priority section into position and install the three Allen head screws. Tighten the screws evenly to 75 in.-lb. pressure.
c. Safety wire the Allen screws which secure the priority valve section.
d. Connect the solenoid quick disconnect wire and install screw which attaches ground lead to the center body of the pack.

B2-21. REMOVAL OF THE RESERVOIR. (See figure B2-4.)
a. Remove nut (7), washer and crowfoot (6).
b. Remove caps from tee at forward end of power-pack and cap from fitting at top of reservoir. Rotate power pack to make sure that the reservoir and the pack are completely drained. After all the oil has drained, replace the cap on the tee.
c. Remove the reservoir -- break it loose from the body by holding an air nozzle about one inch away from the overflow fitting which is now uncapped. Apply a sharp blast of air. The resulting shock of air pressure in the reservoir will break the reservoir loose from the body.

B2-22. REPAIR OF THE RESERVOIR. The only repairs necessary on the reservoir are removal and cleaning of the overboard vent screen, which is removed by removing a snap ring, and removal and possible replacement of the sight glass. When replacing the sight glass, use pipe thread compound on the threads.

B2-23. LANDING GEAR-DOOR ISOLATION CHECK VALVES. (See figure B2-4.) Landing gear and door isolation check valves are located beneath the reservoir cover in the main body of the power pack. The symptoms of malfunction are that the landing gear will go down but will not come up or will come up but will not go down with power from the engine pump or the emergency hand pump. These valves isolate either up or down flow from each other.
a. Cut safety wire which safeties all the valves within the reservoir.
b. Remove spacer (2), baffle (1).
c. Cut the safety wire which was located under baffle (1) and remove the safety wire and spacer (12).
d. Remove cap (74) on the body of the power pack.
e. Hold a rag over the isolation check valve port to catch the parts, then uncap and apply a sharp blast of air to the "landing gear down" fitting.

NOTE

This blast of air will blast out the upper seat (72) of the isolation check valve which is very difficult to get out otherwise.

f. Turn pack over to cause ball (70), spacer (69) and spring (68) to drop out.
g. Return pack to normal position and hold ball (67) down with a punch or rod while applying another blast of air from an air nozzle through "landing gear down" fitting. This blast should lift out seat (65).

B2-24. INSPECTION. (See figure B2-4.) Examine seat (65 and 72) to see that the seat edges are sharp. These parts may be lapped if necessary.

B2-25. INSTALLATION OF LANDING GEAR/DOOR ISOLATION CHECK VALVE. (See figure B2-4.)
a. Replace all O-rings in the isolation check valve. Lubricate all parts thoroughly before installation.
b. Install seat (65) with the sharp seating edge up, toward ball (67).
c. Drop in spacer (69), ball (67), spring (68), and ball (70).
d. Install seat (72), making sure that the sharp seating edge is down, toward ball (70).
e. Install cap (74) with a new O-ring (73). Tighten the cap securely.

B2-26. EMERGENCY HAND PUMP.

NOTE

The emergency hand pump can fail in the following ways: It can fail to produce pressure on the up stroke, the down stroke, or either stroke; or it may have an external leak. The latter malfunction is the most common. The emergency hand pump can be removed with pack mounted in the airplane; it is accessible after the Royalite decorative cover and the sheet metal shield are removed from the pedestal.

B2-27. REMOVAL OF THE EMERGENCY HAND PUMP. (See figure B2-9.)
a. Remove pins (6) after removing attaching cotter pins. This will allow the entire handle assembly to be removed.
b. Cut safety wire and remove Allen head screws (14). This will allow (15) to be removed.
c. Place a rod or punch through the holes in piston (19) and pull straight aft. This will remove parts (19) through (25).
d. After piston (19) is removed, slide gland (17) off piston rod.

B2-28. INSPECTION. Examine the piston shaft carefully for scores or scratches which might cut O-ring (16). This would be a cause of external leakage. The emergency hand pump piston shaft may be polished with extremely fine emery paper. Never use paper coarser than # 600 to remove scratches and burrs. If defects do not polish out, replace piston (19).

B2-29. DISASSEMBLY OF EMERGENCY HAND PUMP PISTON. Seat (24) may be removed from piston by directing a blast of compressed air in the side hole in the piston after removing snap ring (25).

B2-30. ASSEMBLY AND INSTALLATION OF EMERGENCY HAND PUMP. (See figure B2-9.)
a. Reinstall seat (24) with the sharp seat side toward ball (22) and with spring (21) properly installed.
b. Install gland (17) on piston shaft (19) with the shaft O-ring (16) toward the head of the piston.

c. Lubricate and install piston in pack while holding the flap lever down to avoid entrappment of pressure.
d. Install bracket (15) with four Allen screws (14). Torque these screws to 75 in.-lbs. Make sure that they are safety wired, then reinstall the handle by installing pins (6), and cotter pins.

B2-31. EMERGENCY HAND PUMP CHECK VALVE. (See figure B2-4.)

NOTE

This valve is accessible only with the reservoir cover and baffle removed.

B2-32. REMOVAL AND REINSTALLATION OF EMERGENCY HAND PUMP CHECK VALVE.
a. Remove snap ring (63), spacer (62), and screen (61).
b. Place the landing gear control lever full up or down. Move emergency hand pump shaft piston all the way out and apply a blast of air pressure to pump inlet port. This will blast the seat (59) up, out of the cavity. Lift out spring (57).
c. Inspect seat (59). This seat may be lapped if necessary. Clean screen (61).
d. Replace O-ring (60) and reinstall the valve.

B2-33. FLAP CONTROL VALVE. (See figure B2-10.)

NOTE

Symptoms of flap control valve failure are as follows: A common symptom is creeping of the flaps when the control valve is not in either up or down position. Another is external leakage of the flap control valve. If the flaps creep, it is ordinarily wear or defective discs in the valve. If the flap control valve leaks, it is ordinarily due to bad O-ring seals.

B2-34. REMOVAL OF FLAP CONTROL VALVE.
a. Remove cotter and clevis pin securing handle centering bungee to the flap control lever. Move the flap control handle full down and disengage bungee. Remove bungee from power pack.
b. Cut safety wire and remove four Allen head screws attaching flap control valve to power pack.
c. Prick-punch or scribe valve body on the aft side to prevent misalignment on reinstallation.
d. Move landing gear control full down to ease unloaded plunger pressure against flap cam and pull flap control valve straight outboard to remove it.

B2-35. DISASSEMBLY OF THE FLAP CONTROL VALVE.
a. With the flap control valve lever supported, using 1/8 drift punch, drive out the roll pin securing the handle to the flap control shaft.
b. Slide shaft and valve assembly out of disc housing (15). Remove spring washer (14) from the shaft.
c. Place handle end of shaft in padded jaws of vise and remove small O-ring from cam end of the shaft.
d. Pull fixed disc (9) up off shaft.
e. Remove backup ring (32) and O-ring from shaft, then lift off the selector disc (11).

NOTE

It is not necessary to remove roll pin (13) unless the roll pin or the shaft is damaged and needs to be replaced.

B2-36. INSPECTION OF FLAP CONTROL VALVE PARTS.
a. Selector and fixed discs in the valve: Check mating flat surfaces of discs for scratches, or other defects. If these parts are scratched or marked in any way they can be lapped on a surface plate, using emery paper no coarser than #600.

B2-37. REASSEMBLY OF FLAP CONTROL VALVE PARTS.
a. Place the selector disc on the shaft with the wider kidney-shaped groove toward the cam side of the shaft. The selector disc should go down over the roll pin so that it mates squarely with the roll pin. Put O-ring (33) and backup ring (32) on the shaft. Then place the fixed disc over the shaft, using lubricant to avoid cutting the O-ring and backup ring. Place it in the exact relative position illustrated. This is with the single O-ring hole on the same side as the "cam" of the cam shaft.
b. Install spring washer (14) on the handle end of the shaft, with the "fingers" of the washer toward the handle end of the shaft. This is important to prevent the fingers from catching in the grooves in selector disc (11). Make sure this washer is installed correctly.
c. Lubricate thoroughly the sliding valves, shaft, and needle bearings (16). Then assemble housing (15) over the shaft, making sure that the housing and valve are properly aligned. This means that the pricked surface, or marked surface of housing (15) is toward the aft or cam side of the valve shaft and that the guide hole on fixed disc (9) is aligned with the lower aft Allen screw hole in the housing. Slide the flap control lever (29) over cam shaft (12), and install roll pin (19).

B2-38. INSTALLATION OF FLAP CONTROL VALVE.

NOTE

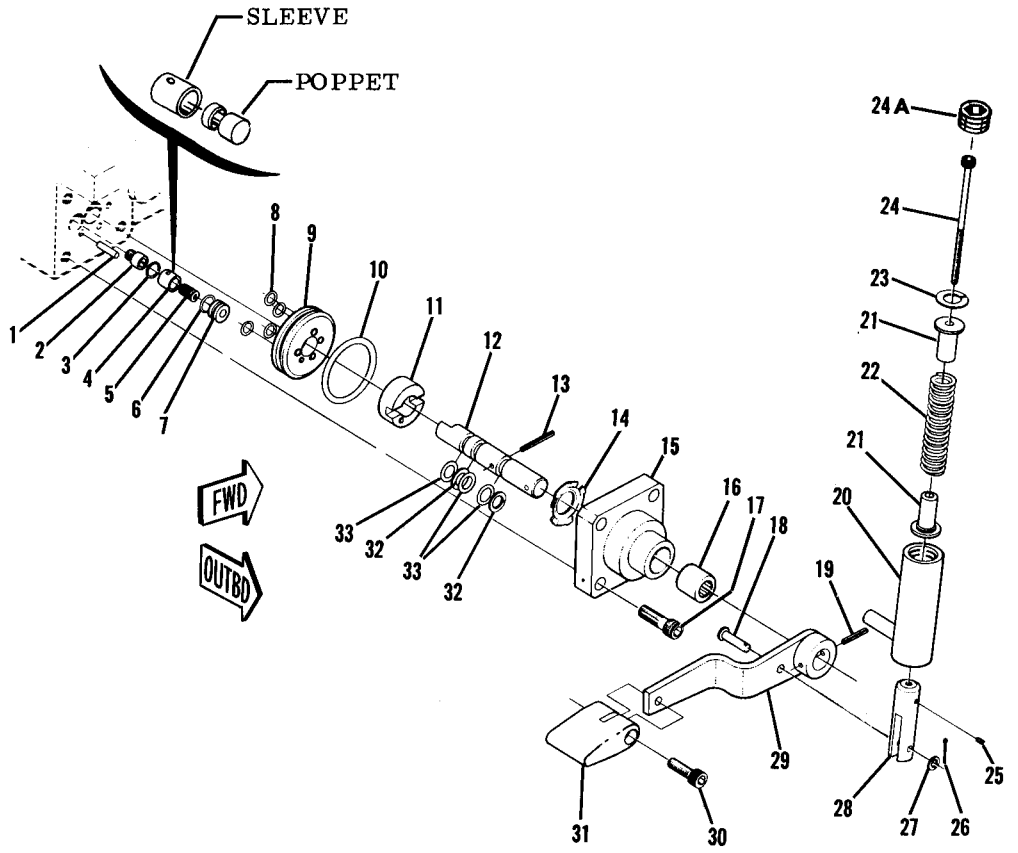
Repair the gear-flap isolation check valve, if necessary, in accordance with paragraph B2-39 thru B2-41, before installing the flap valve.

a. Make sure that landing gear control handle is placed full down.

NOTE

If landing gear control valve and flap control valve have both been removed, it is necessary to remove the engine pump loading valve in order to get the loading valve plunger out of the way of the landing gear and flap control cam shafts.

FLAP CONTROL VALVE



1. Fixed Disc Alignment Pin

GEAR-FLAP ISOLATION CHECK VALVE
2. Screw
3. O-Ring
4. Sleeve and Poppet
5. Spring
6. O-Ring

7. Orifice
8. O-Ring
9. Fixed Disc
10. O-ring
11. Selector Disc
12. Cam Shaft
13. Roll Pin
14. Finger Spring Washer
15. Disc Housing
16. Needle Bearing
17. Allen Screw
18. Clevis Pin
19. Roll Pin

HANDLE RETURN BUNGEE
20. Body
21. Spring Guide
22. Spring
23. Washer
24. Adjustment Screw
24A. Adjustment Plug
25. Setscrew
26. Cotter Pin
27. Washer
28. Centering Clevis

29. Flap Lever
30. Screw
31. Flap Knob
32. Back-Up Ring
33. O-Ring

Figure B2-10. Wing Flap and Landing Gear Control Valves (Sheet 1 of 2)

LANDING GEAR CONTROL VALVE

34. Fixed Disc
35. Selector Disc
36. Cam Shaft
37. Separator Disc
38. O-Ring
39. Handle Release Cam
40. O-Rings
41. Restrictor Tube
42. Handle Release Plunger
43. Spring Guide
44. Spring
45. Adjustment Plug
46. O-Ring
47. Back-Up Ring
48. Disc Housing
49. Switch Bracket
50. Handle Switch
51. Handle Centering Bungee
52. Allen Screw
53. Landing Gear Lever
54. Spring
55. Guide Pin
56. Clevis Pin
57. Tube
58. Knob
59. Roll Pin
60. Screws
61. Handle Lockout Solenoid
62. Bracket

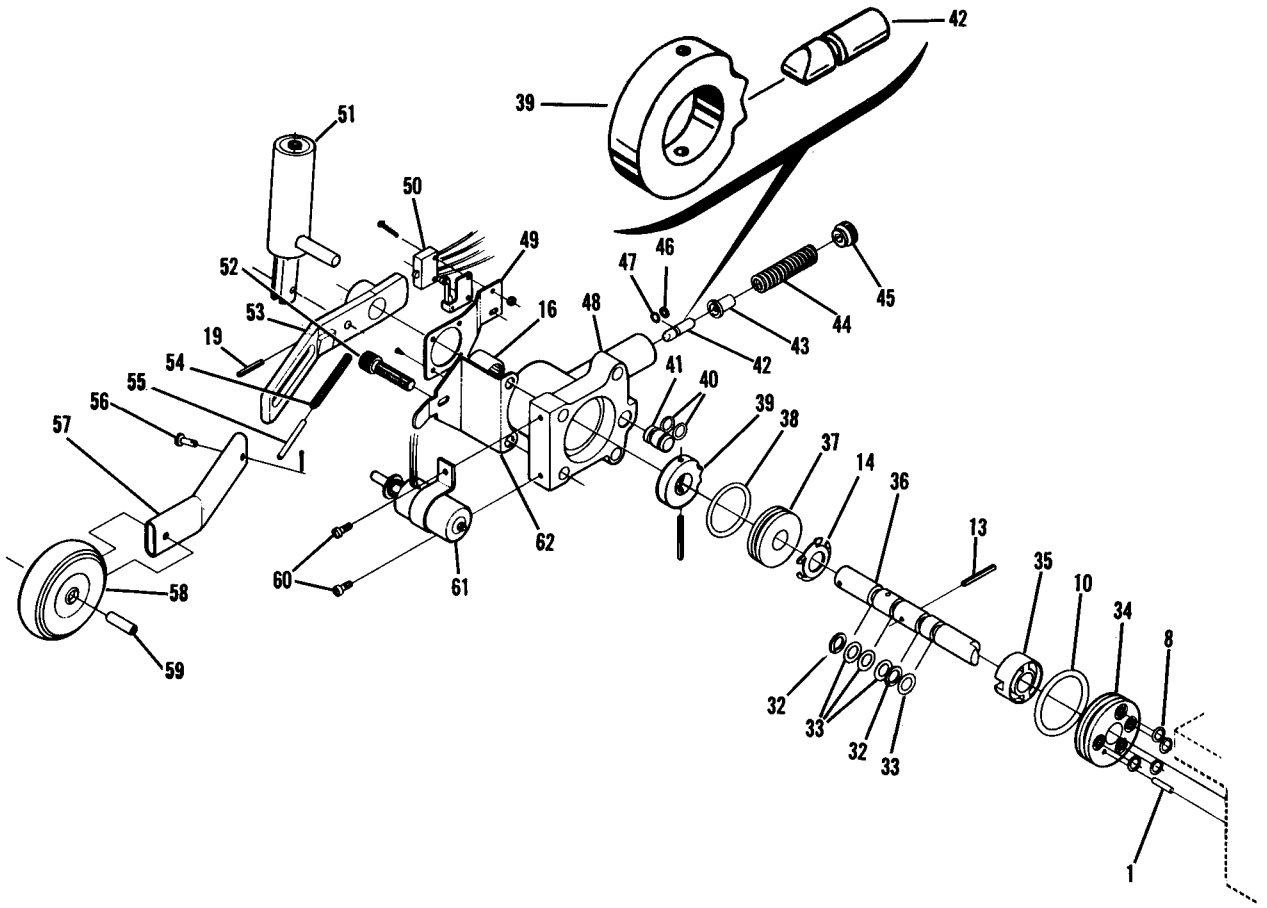


Figure B2-10. Wing Flap and Landing Gear Control Valves (Sheet 2 of 2)

b. Make sure that the flap control valve is properly aligned and that O-rings (8) on the fixed disc are properly installed. Lubricate the landing gear control shaft and O-rings. Slide it into place.

CAUTION

Make sure that alignment hole on stationary disc (9) is aligned with alignment pin on the body of the pack before sliding valve into position.

c. Install Allen screws (17).

CAUTION

Tighten these screws evenly. Remember that there will be clearance between housing (15) and the body of the pack. These screws should be torqued to 50 in-lbs. This torque should not be exceeded. Tighten these Allen screws evenly, tightening alternately opposite corners of the four screws. Draw them down evenly.

d. Tighten, torque, and safety wire Allen screws (17).

e. Install flap handle centering bungee in the power pack and then install the clevis pin (18), washer (27) and cotter pin (26).

B2-39. GEAR-FLAP ISOLATION CHECK VALVE.

NOTE

The purpose of this valve is to prevent fluid that is trapped in the flap circuit from bleeding back into the landing gear circuit during landing gear operation when the emergency hand pump is used. Symptoms of failure: If the flap-gear isolation check valve fails to close, the flaps may creep up in flight, due to air loading.

B2-40. REMOVAL OF THE GEAR-FLAP ISOLATION CHECK VALVE. (See figure B2-10.)

NOTE

The gear-flap isolation check valve can be removed only after the flap control valve has been removed, since it is covered by the flap valve housing. The following procedure assumes the flap valve has been removed.

a. Using an air nozzle, give a sharp blast of air in the engine pump port while holding the landing gear control valve full down and holding a rag over the isolation check valve. The sharp blast of air will force the isolation check valve seat (7) out of the hole. Parts (3) through (5) may then be lifted out of the hole.

b. Using an Allen wrench, back out screw (2) until the threads are disengaged. Then turn screw (2) back in. This will free the O-ring (3) and it may be lifted out of the hole.

B2-41. INSTALLATION OF GEAR-FLAP ISOLATION CHECK VALVE.

a. Install screw (2).

b. Start O-ring (3) in the hole. Press O-ring (3) into position using a flat-ended punch. Work it into position using plenty of lubricant.

c. Place sleeve (4) in the hole making sure that the cross-drilled hole is inboard in the port, that is, toward screw (2) and O-ring (3).

d. Install spring (5) in poppet (4), using plenty of lubricant to hold the spring in the poppet. Slide the poppet and spring into the hole.

e. Install a new O-ring on spool (7) and push the spool carefully into the port. The O-ring pressure there should hold the spool in against the compression of spring (5).

B2-42. LANDING GEAR CONTROL VALVE.

B2-43. REMOVAL OF LANDING GEAR CONTROL VALVE. (See figure B2-10.)

a. Remove the small screw which attaches the small capacitor directly over the landing gear control valve. Work the capacitor and attached wires out of the way.

b. Remove the landing gear up-down switch directly forward of the landing gear control valve. This is mounted on a switch bracket and is held by small screws and nuts. Move the switch and attaching wires out of the way.

c. Remove the two screws which attach the handle lockout solenoid just aft and inboard of the landing gear control valve. Move the handle lockout solenoid and attaching wires out of the way.

d. Remove cotter and clevis pin attaching landing gear control bungee to the landing gear control valve lever; force the handle beyond its normal detent travel to provide clearance to disengage the bungee clevis from the landing gear control lever.

e. Snip safety wire and remove the four Allen screws that secure the landing gear control valve to the body of the power pack.

f. Place landing gear control handle in neutral position and flap control handle full down, then pull the landing gear control valve out. When the landing gear control valve is pulled out, item (41) may come with the valve or it may remain in the body of the power pack.

B2-44. DISASSEMBLY OF LANDING GEAR CONTROL VALVE.

a. Using an Allen wrench, remove the handle release adjustment plug (45), spring (44) and spring guide (43). This will ease pressure on plunger (42).

b. Supporting the landing gear control handle, drive out roll pin (18). Remove the landing gear control handle from the shaft.

c. Push inboard on the shaft to free it from disc housing (48). The entire slide valve assembly will come out. Place the landing gear control shaft, handle-end down, in a padded vise. Remove O-ring (33) from the shaft and lift off the fixed disc (34).

d. Remove backup ring (32) and O-ring (33) and lift the selector disc (35) off the shaft. Support handle release cam (39) and drive out roll pin which secures it to the shaft. Remove backup ring (32) and

O-rings (33) which are just outboard of the handle release cam and then slide the release cam off the landing gear control shaft.

CAUTION

When driving out the roll pin which secures the handle release cam make sure that the valve is not supported by separator disc (37). This is soft material and could be damaged easily.

e. Remove disc (37) and spring washer (14).
f. Remove landing gear detent plunger (42).

B2-45. INSPECTION OF LANDING GEAR CONTROL VALVE PARTS. (See paragraph B2-36.)

B2-46. REASSEMBLY OF THE LANDING GEAR CONTROL VALVE. (See figure B2-10.)

a. Install the handle release plunger (42) in disc housing (48).

NOTE

Examine the shape of the handle release plunger, observing its contact with handle release cam. Install the handle release plunger from the inside of disc housing (48), aligning it by using needle nose pliers to make sure that it mates with notches in the cam. The landing gear handle release plunger (42) should be pushed back in the valve cavity of disc housing (48) until it is flush with the housing.

b. Install roll pin (13) in landing gear control shaft (36), then slide spring washer (14) over the shaft, making sure that the fingers on the washer are not in position to engage with the groove in selector disc (35). The fingers should bear against disc (37). Install O-ring that goes under disc (37).

NOTE

See figure B2-11 for correct relative positioning of valve parts on the cam shaft. Unless the fixed and selector discs are installed correctly, the valve will not function.

c. Install disc (37) and then slide the handle release cam into position, making sure that it is in the same relative position with the shaft as depicted in figure B2-11. Drive the roll pin in which secures the handle release cam (39) until it is centered in the hole, with the top of the roll pin below the surface of the cam. Install O-ring and backup rings at the handle end of the shaft.

d. Place the landing gear control shaft in a vise with the handle end down, the cam end up. Install the selector disc (35) over the roll pin, making sure that the longer kidney-shaped groove on the rotating valve is on the same side as the "cam" of the shaft. Install backup ring and O-ring, then place the fixed disc (34) on the shaft, with the alignment pin hole in its correct position with regard to the alignment pin in the pack. Install the disc in the exact relative position depicted in figure B2-11. It is important that this alignment hole in the fixed disc and the hole drilled through the selector disc, be on the same side as the cam of the landing gear control shaft. Insert the entire shaft and valve assembly in disc housing (48), making sure that the handle release cam detents are in a position to be engaged by the handle release plunger. The position pin hole on the fixed disc should be adjacent to the lower aft Allen screw hole in the disc housing. Push the entire valve and shaft into the housing, using plenty of lubricant.

NOTE

The needle bearing should be lubricated before this and pressed in position if it has been removed earlier.

e. Attach the landing gear control handle to the shaft with roll pin (19).

f. Lubricate spring (44) and guide (43). Use enough grease to hold guide (43) in the spring and insert these parts in the handle release port in disc housing (48).

g. Install adjustment plug (45), using Allen wrench. Screw adjustment plug (45) in until it is approximately 1/8" below the surface of the port.

h. Blow out the handle release passage in the body of the power pack with orifice (41) removed. Using an air nozzle, direct air in a door closed pressure port of the pack to clean out this passage, then install orifice (41), with new O-rings, in the port in the side of the pack. This orifice should be installed with the flat surface, the very small hole in the orifice, outboard. The counterbore is inboard.

B2-47. INSTALLATION OF LANDING GEAR CONTROL VALVE. (See figure B2-10.)

a. Holding the flap lever full down to ease pressure by the loading valve plunger, push the landing gear control valve carefully into position, making sure that the alignment pin (1) in body of the power pack is aligned with the pin hole in the fixed disc (34).

b. Install Allen screws securing disc housing (48).

CAUTION

Make sure that the two longer screws are used in the two aft holes. These screws secure the handle lockout solenoid bracket. If the longer screws are installed in the front Allen screw holes, they will bottom out. Make sure the screws are correct before installing them. Tighten the Allen screws evenly to a maximum torque of 100 in-lb.

c. Reinstall handle bungee and all electrical harness items.

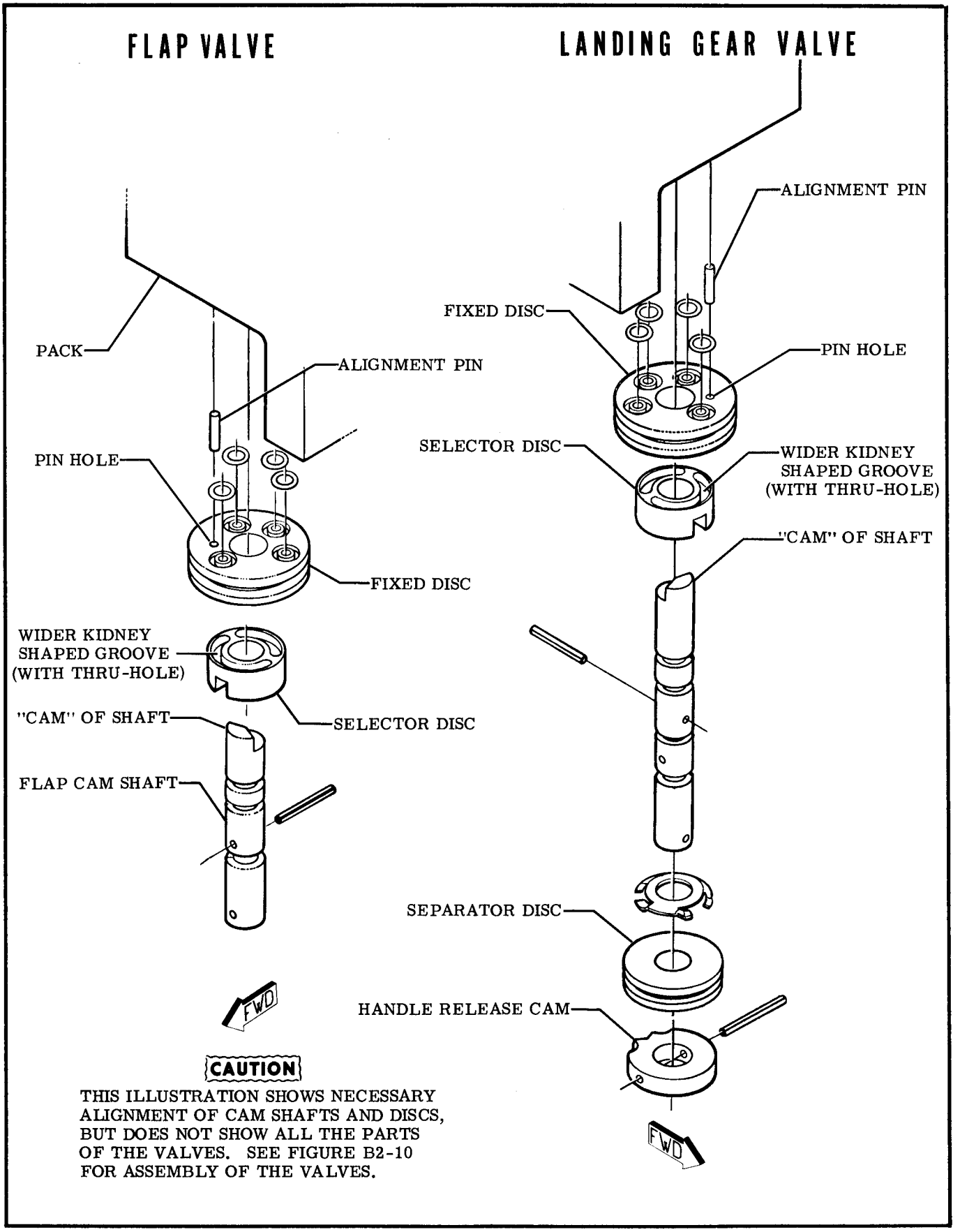


Figure B2-11. Alignment of Control Valve Parts

B2-48. ADJUSTING HANDLE CENTERING BUNGEE is accomplished by tightening screw (24, figure B2-10) until the handle has free play before spring tension is felt, then loosening the screw to the point at which there is no play in the handle-center position.

B2-49. FLAP ORIFICE. (See figure B2-4.) The flap orifice is externally mounted on the pack, directly forward of the flap control valve and may be removed with an end wrench. Inside the orifice body there is a snap ring, and a screened orifice. The orifice body may be removed by removing the snap ring and directing a sharp blast of air in the fitting end of the orifice body. After the orifice has been removed, the screen should be thoroughly washed and cleaned in solvent, a new O-ring installed, and then the orifice should be reinstalled in the body.

NOTE

The flap orifice fails in only one way. The symptoms of failure are that the flaps react very slow or sluggishly. This symptom can be caused by the screen or the orifice being plugged. If cleaning does not correct the trouble, a new orifice body should be installed.

B2-50. PRIMARY RELIEF VALVE. (See figure B2-4.)

NOTE

The primary relief valve is accessible only with the reservoir cover removed. Remove the reservoir cover in accordance with paragraph B2-21. Symptoms of primary relief valve failure are that it is impossible to build up sufficient pressure to operate the gear or flaps.

B2-51. REMOVAL OF PRIMARY RELIEF VALVE. Unscrew the valve from the center body of the power pack.

B2-52. DISASSEMBLY OF PRIMARY RELIEF VALVE. (See figure B2-4.)

a. Remove fitting (16) using a wrench on the fitting and a punch through the cross-drilled holes in valve (22).

b. Remove square orifice (18).

c. Push out poppet (19). Spool (21) will come out at the same time as poppet (19).

B2-53. INSPECTION OF PRIMARY RELIEF VALVE PARTS. Check poppet (19) and poppet spool (21). Check the seating of these parts. These parts are not repairable and cannot be lapped. If the seat is poor, then the part should be replaced. Examine orifice (18), clean it in solvent, make sure that the orifice is open. Replace all O-rings. Check spring for deformity.

B2-54. ASSEMBLY AND INSTALLATION OF PRIMARY RELIEF VALVE. (See figure B2-4.)

a. Coat sliding portion of spool (21) with grease and insert it in poppet (19). The grease will hold the spool in place when these parts are inserted in barrel (22).

b. Make sure that parts are installed in the sequence depicted in figure B2-4. Note that orifice (18) is installed with the flat surface down.

c. Install fitting (16), using new O-rings properly lubricated, in valve body (22).

d. Using plenty of lubricant, insert guide (24) in spring (25), and with lubricant attach ball (23) to guide (24). The lubricant will hold these parts together when they are dropped into the valve (22).

e. Install pump shield (26). Then install adjustment screw and nut (27), but do not tighten. This is the primary relief valve adjustment. Adjust as outlined in paragraph B2-55.

B2-55. PRIMARY RELIEF VALVE ADJUSTMENT. (See figure B2-4.) Adjust screw and nut (27) to obtain the values shown in paragraph B2-65. The adjusting screw is turned clockwise to increase pressure. Turning the adjusting screw counterclockwise will cause the pressure to be reduced.

B2-56. FLAP DOWN VENT VALVE. (See figure B2-4.)

NOTE

The flap down vent valve prevents flaps from unlocking and extending due to thermal expansion of fluid in the lines or from pressure leakage past the flap selector valve when the handle is neutral. If the valve fails the flaps will tend to creep down during flight.

B2-57. REMOVAL AND DISASSEMBLY OF FLAP DOWN VENT VALVE. Remove the hex body of the flap down vent valve from the body of the power pack. Figure B2-13 depicts the parts and may be used as a guide in disassembly.

B2-58. ASSEMBLY OF THE FLAP DOWN VENT VALVE. Set body of valve in vise with female end up. Drop in little cylindrical valve with the flat end down and the counterbore up. Insert the spring into the counter bore and assemble O-ring over shoulder of the upper cap. Lubricate the O-ring and insert cap in body. Screw it down tight.

NOTE

Do not change setting of adjustment screw unless the valve has indicated a pressure malfunction.

B2-59. INSTALLATION OF THE FLAP DOWN VENT VALVE. Assemble a new O-ring (55) over the body of the valve and screw it down into its port in the body of the power pack.

B2-60. INSTALLATION OF THE RESERVOIR COVER. (See figure B2-4.)

a. Make sure safety wires are installed below baffle (1).

b. Install lower spacer (12) over the center thru-bolt.

c. Drop baffle on over the thru-bolt (13). Install upper spacer (2).

d. Check all items under reservoir for proper installation and safetying.

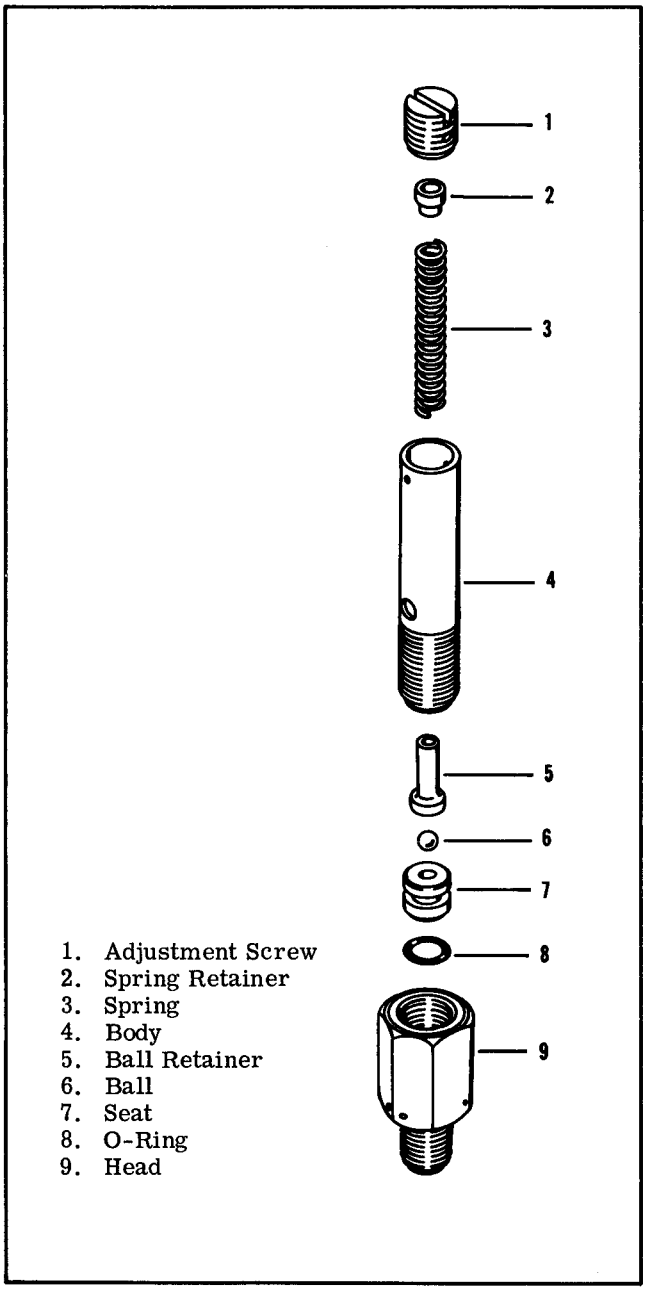
e. Check the inner surface of the reservoir to see that there are no cuts or scratches in the area of the cover which will mate with the body of the power pack. Check also the surface of the power pack that mates with the reservoir. Any scratches should be worked out with emery paper no coarser than #600. Check that the bottom edge of the reservoir is not sharp so that it might cut the large O-ring.

f. Examine reservoir in power pack body to find the scribe marks that indicate proper alignment of these two parts.

g. Thoroughly lubricate the large O-ring and position the reservoir over the body of the pack. Make sure that the scribe marks are aligned. Tap down the reservoir with the heel of the hand, making sure that it is not cocked. Work it down evenly.

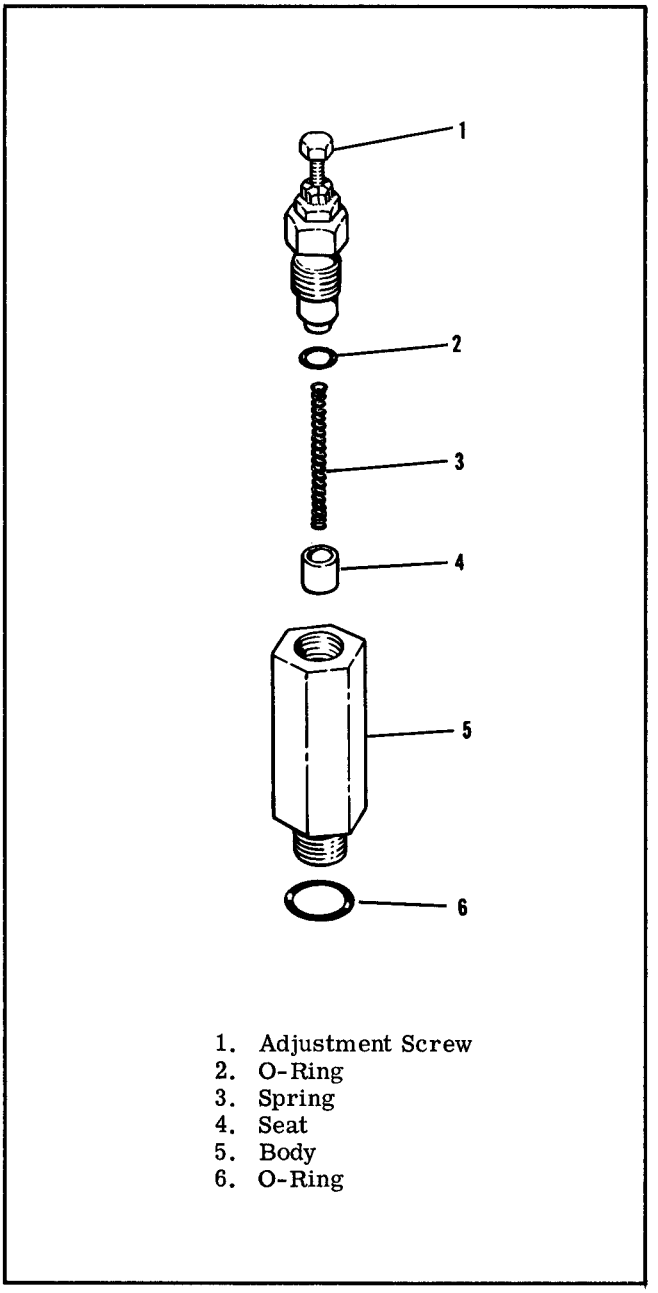
h. Install a new O-ring in crow foot (6). The crow foot has a different span between the three legs. The wide span should straddle the overflow vent so that there is proper clearance on the vent line fitting. Check the measurement depicted in figure B2-4 to make sure that the crow foot is properly installed.

i. Install nut (7).



1. Adjustment Screw
2. Spring Retainer
3. Spring
4. Body
5. Ball Retainer
6. Ball
7. Seat
8. O-Ring
9. Head

Figure B2-12. Thermal Relief Valve



1. Adjustment Screw
2. O-Ring
3. Spring
4. Seat
5. Body
6. O-Ring

Figure B2-13. Flap Down Vent Valve

B2-61. TESTING THE POWERPACK.

NOTE

This procedure requires a minimum of test equipment and is intended for bench-testing the pack after field repair.

B2-62. 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.

B2-63. GENERAL CONDITIONS of testing require all ports except the bottom port of filler tee-fitting be capped. Connect a drain hose to bottom port of this tee. Use only clean MIL-H-5606 hydraulic fluid for test.

B2-64. PUMP LOADING VALVE. (See figure B2-4.)

a. Remove reservoir.
b. Connect handpump and 2000 psi pressure gage to pressure port of pack.
c. Operate handpump until standpipe in pack is filled up.
d. Place flap handle full up.
e. Operate handpump until gage indicates 150 psi.
f. Observe standpipe; fluid in standpipe shall not overflow more than 10 drops-per-minute (indicating acceptable loading valve leakage).

B2-65. PRIMARY RELIEF VALVE. (See figure B2-4.)

a. Perform steps "a," "b," "d," and "e" of paragraph B2-64.
b. Slowly increase pressure with hand pump until relief valve opens, indicated by fluid coming out from under shield (26). Pressure gage should indicate 1750-1800 psi. See paragraph B2-55 for adjustment.
c. Move flap handle to neutral.
d. Move flap handle full up.
e. Increase pressure with hand pump to 1500 psi.
f. No fluid should come from under shield (26), indicating that the valve is closed tight.

B2-66. LANDING GEAR SELECTOR VALVE AND DOOR ISOLATION CHECK VALVE. (See figure B2-4.)

a. Perform steps "a" and "b" of paragraph B2-64.
b. Place landing gear handle in full-up position.
c. Apply 1500 psi pressure using hand pump, pumping rapidly.

NOTE

This circuit will "leak down" rapidly through the solenoid door valve; it may require pumping on the hand pump to compensate for this.

d. The allowable leakage at the landing gear down pressure port is 10 drops per minute.
e. Repeat steps above with the gear handle in full-down position, checking allowable leakage from the gear up pressure port.

B2-67. GEAR UP PRIORITY VALVE. (See figure B2-7.)

a. Perform steps "a" and "b" of paragraph B2-64.
b. Remove cap from gear up pressure port.
c. Place landing gear handle in full-up position.
d. Operate handpump until hydraulic fluid comes out of gear up port. Test gage should read 750-800 psi. Adjust priority valve to attain this.

NOTE

The maximum leakage out the gear up port before the priority valve opens is 20 drops per minute.

e. Re-cap gear up port.

B2-68. GEAR DOWN PRIORITY VALVE. (See figure B2-7.)

a. Perform steps "a" and "b" of paragraph B2-64.
b. Remove cap from gear-down pressure port.
c. Place landing gear control handle in down position.
d. Operate handle until fluid comes out gear down pressure port. Test gage should read 550-±50 psi. Adjust valve if necessary.

NOTE

The maximum leakage out of the gear down port before the priority valve opens is 20 drops per minute.

e. Re-cap the gear down port.

B2-69. DOOR SOLENOID VALVE AND WIRING HARNESS. (See figures B2-7 and B2-8.)

a. Perform steps "a" and "b" of paragraph B2-64.
b. Remove caps from door open pressure and door closed pressure ports.
c. Connect 12V DC across pins "A" and "C" of the wiring harness plug.
d. Place landing gear handle full down.
e. Operate hand pump. Fluid should come out of door open pressure port.
f. Place handle in full-up position.
g. Operate hand pump. Fluid should come out of door close pressure port.
h. Connect 12V DC across pins "B" and "C" of the wiring harness plug.
i. Operate hand pump. Fluid should come out of the door open pressure port.
j. Place handle in full-down position.
k. Operate hand pump. Fluid should come out of the door close pressure port.

B2-70. HANDLE LOCK SOLENOID. (See figure B2-8.)

a. Place landing gear handle in full-down position.
b. Move handle back to down-neutral position.

NOTE

The landing gear handle release plunger will offer some resistance at this point, but can be overcome.

c. Apply 12V DC across pins "D" and "C" of wiring harness electrical plug. This should energize

the solenoid, pulling the solenoid plunger clear of the handle lock "dog" on the handle.

d. Remove 12V DC power from pins. Solenoid plunger should extend outboard to engage locking "dog" on handle.

B2-71. FLAP DOWN SELECTOR AND GEAR-FLAP ISOLATION CHECK VALVE. (See figure B2-10.)

a. Remove reservoir.

b. Connect hand pump to pressure port of pack.

c. Connect 2000 psi test gage to flap down pressure port.

NOTE

Three to four feet of hose should be used between the flap down port and the pressure gage. Leave the fitting loose at the gage to bleed entrapped air.

d. Hold flap handle in full-down position.

e. Operate hand pump until all air is extracted from gage line, then tighten fitting at gage.

f. Operate hand pump until gage reads 1700 psi and let flap handle snap back to neutral.

NOTE

To attain the 1700 psi, the hand pump must be operated rapidly to close the flap vent valve.

NOTE

The pressure gage reading should not drop below 900 psi in two minutes.

g. There should be no leakage out the flap vent valve during the 1700-to-900 psi leakdown test.

B2-72. FLAP UP SELECTOR.

a. Perform steps "a" and "b" of paragraph B2-71.

b. Connect 2000 psi gage to flap up port.

c. Hold handle in full up position.

d. Perform steps "d," "e," "f," and "g" of paragraph B2-71.

B2-73. FLAP "NEUTRAL" SELECTOR.

a. Perform steps "a" and "b" of paragraph B2-71.

b. With flap handle neutral, operate hand pump until primary relief valve opens.

c. Observe leakage out flap return port; 10 drops per minute is the maximum allowable leakage.

B2-74. FLAP UP THERMAL RELIEF VALVE. (See figure B2-4.)

a. Remove reservoir.

b. Connect hand pump and 2000 psi test gage to flap up port.

c. Place flap handle in neutral.

d. Operate hand pump until thermal valve opens.

e. Observe cracking pressure on gage. It should indicate 1850-1900 psi. Adjust valve if necessary.

f. Move flap handle full down, then release back to neutral.

g. Operate hand pump until pressure gage indicates 1750 psi. There should be no leakage out the thermo relief valve.

B2-75. FLAP VENT VALVE. (See figure B2-4.)

a. Remove reservoir.

b. Connect hand pump and 150 psi gage to flap down port.

c. Place flap handle in neutral.

d. Operate hand pump slowly and observe fluid leakage out flap vent valve. Increase pressure until leakage stops. Leakage should stop at 100 psi maximum.

e. Crack fitting and slowly allow pressure to dissipate. The valve should start leaking again at 30 psi minimum.

B2-76. RESERVOIR LEAKAGE.

a. Install reservoir.

b. Connect hand pump and 150 psi gage to pressure port of pack.

c. Make sure landing gear and flap handles are in neutral and all ports are capped except the reservoir vent port at the top of the pack.

d. Operate hand pump until reservoir is completely full, indicated by fluid coming out of reservoir vent port.

e. Cap reservoir vent port.

f. Operate hand pump slowly until pressure gage indicates 15 psi maximum.

NOTE

There should be no external leakage.

g. Do not drain reservoir until after next test.

B2-77. EMERGENCY HAND PUMP TEST.

a. Remove hand pump and cap the pressure port on the pack.

b. Remove the cap from the door open pressure port and install 2000 psi test gage at this port.

c. Place landing gear handle in down position.

d. Operate emergency hand pump 15 complete cycles to prime pump.

e. Place landing gear handle neutral and cap the door open pressure port.

f. Hold flap handle in down position.

g. Operate emergency hand pump until pressure gage stops increasing, indicating the secondary relief valve has opened. Maximum indication should be 1900 - 1950 psi. During the pumping operation, the emergency hand pump should not feel spongy in either up or down stroke.

B2-78. SYSTEM CHECK VALVE. (See figure B2-4.)

a. Perform steps "a" through "g" of paragraph B2-77 with the pressure port of the pack uncapped.

b. Fluid leakage out the pressure port should not exceed five drops per minute.

SECTION B3

REPAIR OF HYDRAULIC PUMP

B3-1. DISASSEMBLY. (See figure B3-1.)

a. Plug all ports and clean outside of pump with solvent.

b. Clamp pump in vise, shaft down and remove cap screws and washers (1 and 2).

c. Remove rear housing (3) by rocking from side to side and sliding it off the gear shafts and dowel pins. In case of sticking, gently tap, with either plastic or rubber hammer, from side to side. Do not pry sections apart with a screwdriver. Scratches caused by pry tool will prevent sealing of mating surfaces.

NOTE

Do not disassemble rear housing (3).

d. Remove idler gear assembly (16).

e. Remove snap ring (4) from drive shaft, being careful 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).

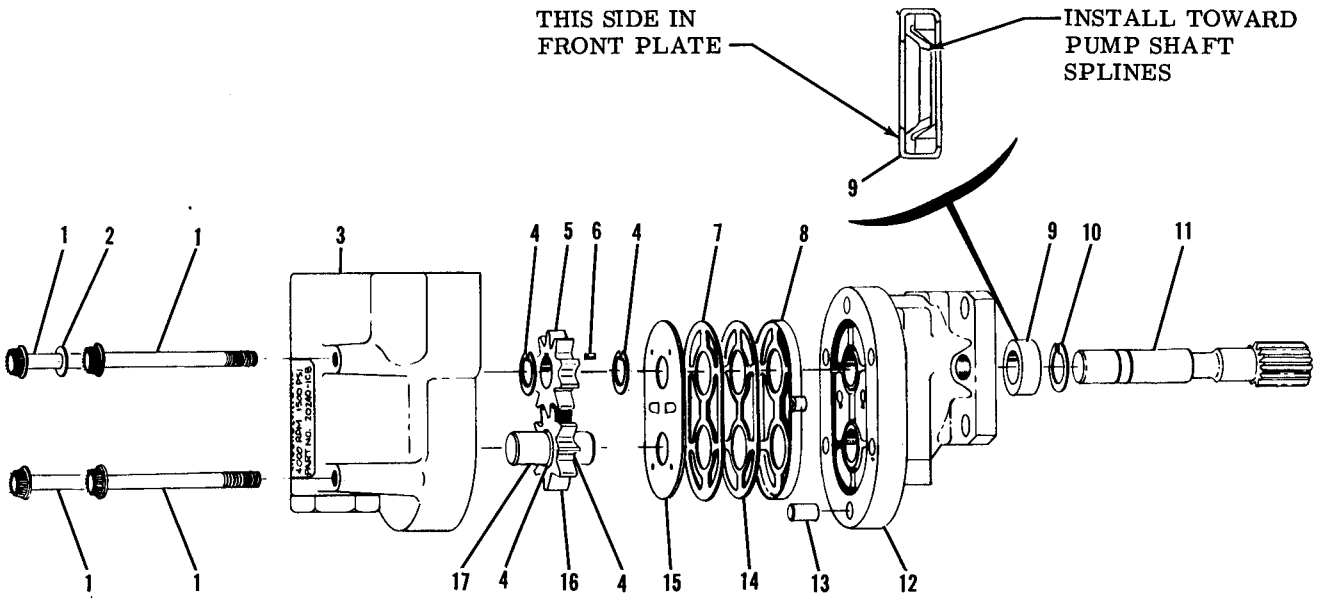
k. Remove diaphragm seal (8) from front plate (12).

l. Remove snap ring (10) and drive shaft seal (9) from bore in front plate (12).

B3-2. INSPECTION OF PUMP. Clean all metal parts with cleaning solvent and dry with filtered compressed air. Prior to reassembly of the pump, inspect all parts as follows:

ITEM	INSPECTION	REPAIR
Gears and Shafts.	Inspect drive gear shaft for broken splines.	Replace shaft if damaged.
Gears and Shafts.	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.	Visually inspect bearings for scratches or scoring. Measure I.D. 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).



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 B3-1. Hydraulic Pump Assembly

B3-3. REASSEMBLY.

NOTE

The 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. Major Seal Repair Kit No. 20240-36 consisting of the above parts is available from the Cessna Spare Parts Department.

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. Install snap ring (10) in groove in front plate with sharp edge of snap ring toward shaft splines.

b. 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. Be sure that seal is all the way down in grooves of front plate.

c. Press protector gasket (14) and phenolic back-up gasket (7) into cup of diaphragm seal.

d. 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).

e. Coat drive shaft (12) with grease to prevent damage to seal (9) as drive shaft is installed.

f. Work drive shaft (12) through shaft seal (9) and into position.

g. Install snap ring (4) in groove on shaft next to diaphragm.

h. Place key (6) in slot in drive shaft and install gear (5) over key in shaft.

i. Install snap ring (4) in groove of shaft (11) next to gear (5).

j. Install idler gear assembly (16).

k. Slide rear housing assembly (3) over gear shafts until dowel pins (13) are engaged.

l. 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 pounds-foot.

m. Rotate pump shaft by hand. Pump will have small amount of drag, but should turn freely after short period of use.

SHOP NOTES:

SECTION B4

REPAIR OF THE FLAP ACTUATORS

B4-1. LEADING PARTICULARS.

Operating pressure	1500 psig
Proof pressure	2250 psig
Burst pressure	3750 psig
Unlocking pressure	100±25 psi
Operating temperature range (ambient)	-40°C (-40°F) to +71.1°C (+160°F)
Compression load	293 lb
Tension load	178 lb
Retracted length	11.84 inches
Extended length	18.22 inches
Stroke	6.38±0.03 inches
Rod end adjustment	±0.12 inch
Weight	10 ounces

B4-2. DISASSEMBLY OF FLAP ACTUATOR.

a. Remove snap ring (15), washer (14), spring (13) and lock plunger (12).

b. Remove rod end (2) and check nut (3), then cut safety wire and drive out spring pins (4) at both ends of actuator.

c. Pull anchor end (11) and bearing end (5) out of barrel (18), then pull piston (9) out of barrel and bearing end.

d. Remove and replace on reassembly all O-rings (7, 8, and 16) and back-up rings (6 and 10).

e. Do not remove bushing (17) unless replacement is necessary. Before installing new bushing, apply zinc chromate primer to outside diameter of bushing.

B4-3. ASSEMBLY OF FLAP ACTUATOR.

a. Inspect all parts for defects or damage which might cause malfunction. Replace all defective parts.

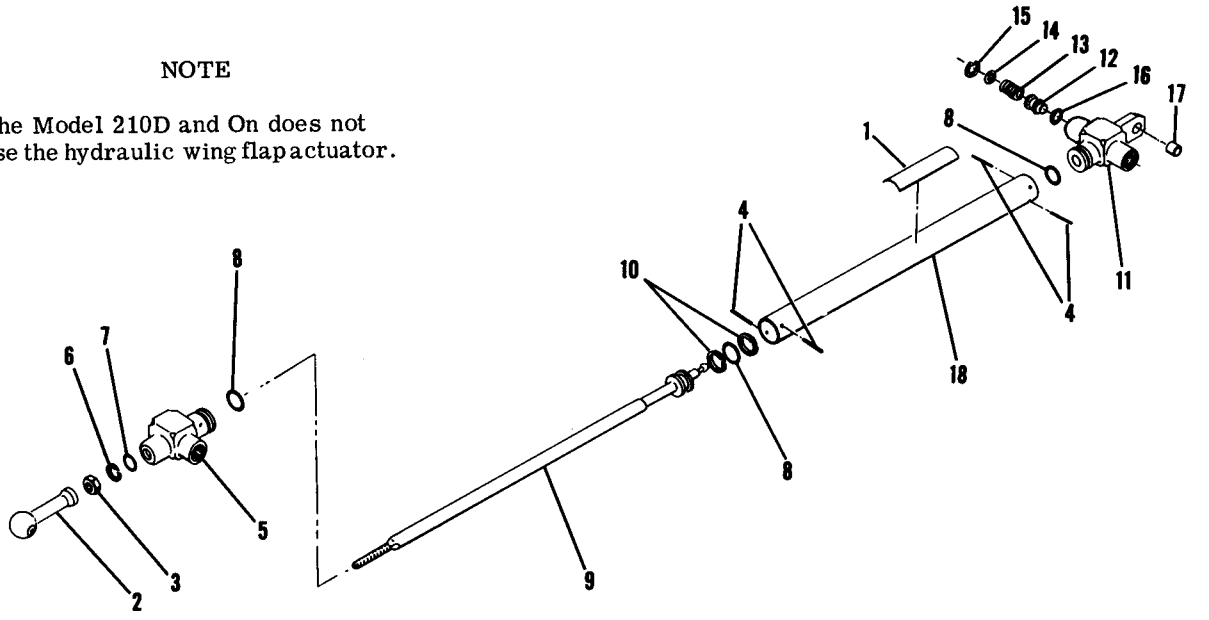
b. Install new O-rings and back-up rings on all parts, then assemble barrel over piston, and install anchor end and bearing end. Secure ends with spring pins (4) and lock with safety wire.

c. Install lock plunger, spring, washer, and snap ring in bearing end.

d. Install check nut and rod end on piston. Adjust rod end (2) to obtain retracted and extended length specified, then tighten check nut (3) against rod end.

NOTE

The Model 210D and On does not use the hydraulic wing flap actuator.



1. Nameplate
2. Rod End
3. Check Nut
4. Spring Pins
5. Bearing End
6. Back-Up Ring
7. O-Ring
8. O-Ring
9. Piston
10. Back-Up Ring
11. Anchor End
12. Lock Plunger
13. Spring
14. Washer
15. Snap Ring
16. O-Ring
17. Bushing
18. Barrel

Figure B4-1. Flap Actuator

SECTION B5

REPAIR OF THE MAIN GEAR ACTUATORS

B5-1. LEADING PARTICULARS.

Operating Pressure	1,500 psig
Proof Pressure	2,250 psig
Burst Pressure	3,750 psig
Operating Temperature Range (ambient)	-40°C (-40°F) to +71.1°C (+160°F)
Unloaded Shaft Rotation	167 deg max
Loaded Shaft Rotation	161 deg max
Cylinder Stroke	2.937 in.
Rod Side of Cylinder Output Shaft Torque with 100 Percent Efficiency	4,292 in. lb.
Torque Shaft Limit Load (Static)	4,500 in. lb.
Torque Shaft Ultimate Load	6,750 in. lb.
Rod Side Minimum Dynamic Operating Output Torque	3,600 in. lb.
Dry Weight	5.8 lb max

B5-2. DISASSEMBLY. (See figure B5-1.)

a. Remove Allen screws (7) and washers (8); using a fiber mallet, tap cover (6) to free it from dowels (9). Lift off cover (6) and spindle (15). Bearing (10) will come out with spindle.

b. Remove screws (17), washers (18) and retainers (16). Remove snap ring (19).

c. Extract end plug (20). This may be accomplished by pushing rack piston (23) toward the end plug, beyond its normal travel.

d. Remove rack piston (23).

e. Remove O-ring (27) from within shaft bore of cylinder body (28).

f. Remove reaction roller (25) and bearings (26).

NOTE

Unless defective, do not remove bushings (4), helicoil inserts (5), sleeve bearings (11), nameplate (3) or nylon pellets (14).

g. Thoroughly clean all parts in solvent.

B5-3. INSPECTION OF PARTS. Perform the following inspections to ensure that all parts are in serviceable condition.

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

b. Inspect cover (6), dowels (9 and 12), spindle, flange and gear (15), rack piston (23), reaction roller (25) and cylinder body (28) for cracks, chips, scratches, scoring, wear or surface irregularities which may affect their function or the overall function of the main gear retraction actuator.

c. Inspect spindle, flange and gear (15) for lost motion or play in the spindle output flange. It shall not exceed 0 degrees, 21 minutes.

d. Inspect bearings (10 and 26) for freedom of motion, scores, scratches and Brinnel marks.

B5-4. REPLACEMENT/REPAIR OF PARTS.

a. Repair of small parts of the main gear retraction 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).

b. Cover (6), and cylinder body (28) are procurable as a matched set only. If replacement of either part is required, replace as a matched set.

c. If replacement of one half of sleeve bearing (11) is required, replace both halves to maintain proper shaft-to-bearing fit, and proper gear backlash value. Replace O-rings (21, 22 and 27) during reassembly.

B5-5. ASSEMBLY. (See figure B5-1.)

a. Press bearings (26) in until they are flush against the retaining base in the cylinder body (28). Grease bearings and install reaction roller (25).

NOTE

Use MIL-G-7711 lubricant on roller (25), rack (23), gear (15), and bearings (11), (10), and (26).

b. Install O-ring (27) in bore of cylinder.

c. Install rack piston (23) in cylinder body. Install end plug (20), snap ring (19) and retainer (16).

d. Install lower sleeve bearing (11) if it has been removed. Make sure it is installed properly over dowel (12).

e. Install spindle shaft seal (13) and needle bearing (10) over shaft.

f. Lay spindle, flange and gear (15) in position. Make sure rack and gear are "timed" to get maximum travel, so that the gear will not bind up with full piston travel.

NOTE

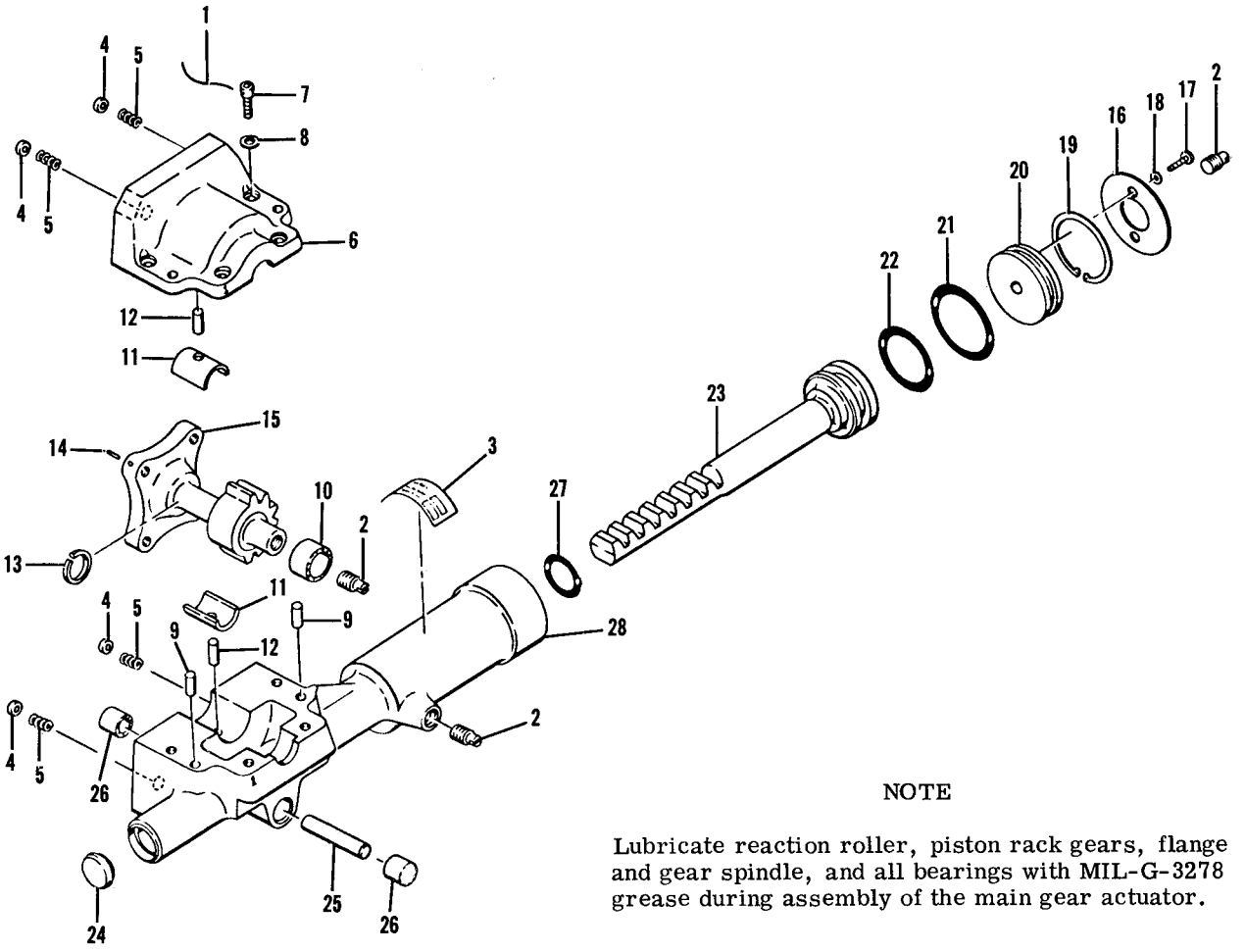
Hand-operate the gear by rotating the flange to check tooth engagement.

g. Make sure needle bearing (10) and shaft seal (13) are properly seated in cylinder body (28), then grease gear sparingly.

CAUTION

Overgreasing may cause contamination of the hydraulic cylinder with grease which works past (27). Apply grease sparingly.

h. Check upper sleeve bearing (11), grease lightly, and position upper cover (6), making sure that shaft seal (13) is fitting properly into cover. Install washers (8) and Allen screws (7). Torque screws 90-100 inch-lbs and install safety wire.



NOTE

Lubricate reaction roller, piston rack gears, flange and gear spindle, and all bearings with MIL-G-3278 grease during assembly of the main gear actuator.

1. Lock Wire
2. Shipping Plug
3. Nameplate
4. Bushing
5. Helicoil Thread Inserts
6. Cover
7. Allen Head Screw
8. Washer
9. Dowel
10. Bearing
11. Sleeve Bearing
12. Dowel
13. Spindle Shaft Seal
14. Nylon Pellets
15. Flange and Gear Spindle
16. End Plug Retainer
17. Screw
18. Washer
19. Snap Ring
20. End Plug
21. O-Ring
22. O-Ring
23. Rack Piston
24. Plug
25. Reaction Roller
26. Bearing
27. O-Ring
28. Cylinder Body

Figure B5-1. Main Gear Actuator

SECTION B6

REPAIR OF NOSE GEAR ACTUATOR

B6-1. LEADING PARTICULARS.

Operating pressure	1500 psi
Proof pressure	2250 psi
Burst pressure	3750 psi
Fluid	MIL-H-5606
Operating temperature range (ambient)	-65°F(-54°C) to +160°F(+71.1°C)
Ball lock-unlocking pressure	100 ± 25 psi
Ball lock-locking pressure	275 psi (max.)
Ball lock-unlocking pressure	250 psi (max.)
Length (C/L bushing to C/L of hook pins)	11.580 ± .031 inches
Stroke	8.238 ± .065 inches
Dry Weight	2.8 pounds

B6-2. DISASSEMBLY (See figure B6-1.)

a. Unlock cylinder by applying hydraulic pressure to port in head (25).

b. Loosen locknut (12) at end of piston rod and unscrew parts (1 thru 11) as an assembly from piston rod. Remove locknut (12) from piston rod.

c. Mark barrel (33) and head (25) so that same end of barrel may be reinstalled in head (25) when reassembling actuator. Remove safety wire from locknuts (32 and 35).

d. Remove setscrew (18) in bearing end (17) and loosen locknut (35). While using a strap wrench on barrel (33), remove bearing end (17) from barrel.

e. Pull piston (20) from barrel using care to prevent loss of balls (23) as piston is removed from barrel.

f. Remove setscrew (18) from head (25) and loosen locknut (32). Using a strap wrench on barrel (33), remove head (25) from barrel.

g. Remove O-ring (19) from head (25) and remove plunger (29) and parts (26 thru 31) by applying a sharp blast of air in the vent hole located in head (25).

h. Remove all O-rings and backup rings.

i. Disassemble hook assembly.

B6-3. 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 freedom from cracks and excessive wear.

b. Inspect spring (6) for evidence of breaks and distortion. The free length of the spring must be 2.460±.080 inches and compress to 2.00 inches under a 19.5±1.95 pound load.

c. Inspect spring (26) 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.

d. Inspect hooks (4 and 10), spring guide (7), bearing end (17), piston and stop assembly (20), barrel (33), head (25) and bushing (24) for cracks, chips, scratches, scoring, wear, or surface irregularities which may affect their function or the overall function of the nose landing gear actuator.

B6-4. REASSEMBLY. Repair of most parts of the nose gear 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. Install all new O-rings and backup rings during reassembly of the actuator.

a. Install O-ring (28) and backup ring (27) in groove on plunger (29).

b. Insert spring (26) and plunger (29) into head (25). Install stop washer (30) and race (31) over end of plunger (29) and install O-ring (19) in groove in head (25).

c. With locknut (32) on barrel, screw barrel (33) into head (25) until tapped hole in head is aligned with hole in barrel.

NOTE

Be sure that marked end of barrel is installed in head (25). Barrel should tighten against race to prevent any movement between stop washer and race.

d. Install and tighten set screw (18) in head (25). Tighten locknut (32).

e. Install O-ring (22) and backup rings (21) in groove on piston and install balls (23) in holes of piston.

f. Insert piston into barrel. Be sure all six balls are in place in piston.

g. Install O-rings (19 and 14) and backup ring (13) in grooves in bearing end (17).

h. With locknut (35) on barrel, screw bearing end (17) on barrel until tapped hole in bearing end is aligned with hole in barrel. Install and tighten setscrew in bearing head (17). Tighten locknut (35).

NOTE

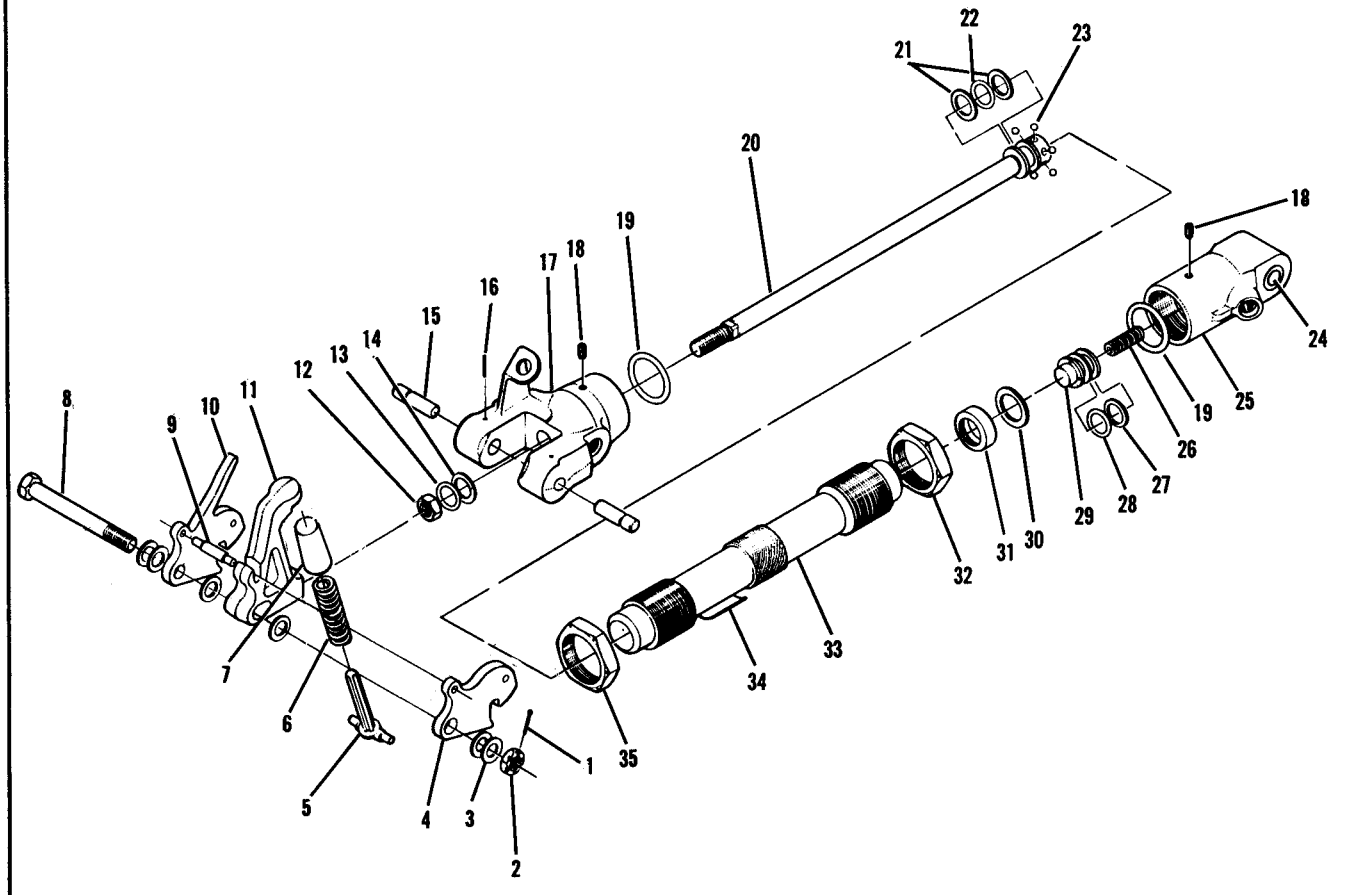
Centerline of hook pins and centerline of bushing hole must align within .005 inch with cylinder locked at a length of 11.580 ±.031 inches from centerline of hookpins to centerline of bushing (24) in head (25).

i. Install locknut (12) on end of piston. Assemble and install hook assembly on piston.

NOTE

When assembling hook assembly, lubricate as shown in figure 2-7.

j. After repair, rig nose gear actuator as shown in figure 5A-15.



1. Cotter Pin
2. Nut
3. Washers
4. Hook
5. Spring Guide
6. Spring
7. Shield
8. Bolt
9. Crossbar
10. Hook
11. Rod End
12. Nut
13. Back-Up Ring
14. O-Ring
15. Pin
16. Pin
17. Bearing End
18. Setscrew
19. O-Ring
20. Piston
21. Back-Up Rings
22. O-Ring
23. Balls
24. Bushing
25. Head
26. Spring
27. Back-Up Ring
28. O-Ring
29. Plunger
30. Washer
31. Race
32. Nut
33. Barrel
34. Nameplate
35. Nut

Figure B6-1. Nose Gear Actuator

SECTION B7

REPAIR OF LOCK CYLINDER

B7-1. LEADING PARTICULARS.

Operating pressure	1500 psi
Proof pressure	2250 psi
Burst pressure	3750 psi
Fluid	MIL-H-5606
Operating range (ambient)	-40°F (-40°C) to +160°F (+71.1°C)
Piston stroke (total)	.812 inches max.
Stroke to unseat valve	.719±.031 inches

B7-2. DISASSEMBLY (See figure B7-1.)

a. Remove fitting (14), spring (12), and balls (11 and 10).

b. Cut safety wire and unscrew end plug (1) from barrel and valve body (9).

c. Remove springs (2 and 3) and push piston (6) from barrel and valve body.

d. Remove and discard O-rings (5, 7, and 15) and remove and discard back-up rings (4, 8, and 16).

B7-3. 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 freedom from cracks and excessive wear.

b. Inspect spring (3) for evidence of breaks and distortion. The free length of the spring must be 2.95±.09 inches and compress to 1.969 inches under a 22.5±2.2 pound load.

c. Inspect spring (2) for evidence of breaks and distortion. The free length of the spring must be 2.98±.09 inches and compress to 1.969 inches under a 10.6±1.1 pound load.

d. Inspect spring (12) for evidence of breaks and distortion. The free length of the spring must be .446±.015 and compress to .359 inches under a .18 ±.02 pound load.

e. Inspect plug (1), piston and rod (6), barrel and valve body (9), 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.

B7-4. REASSEMBLY. Repair of most parts of the lock cylinder 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. Install all new O-rings and back-up rings during reassembly of the lock cylinder.

a. Install new O-rings (5 and 7) and back-up rings (4 and 8) in grooves on piston and rod (6).

b. Install new O-ring (15) and back-up ring (16) in groove of barrel and valve body (9).

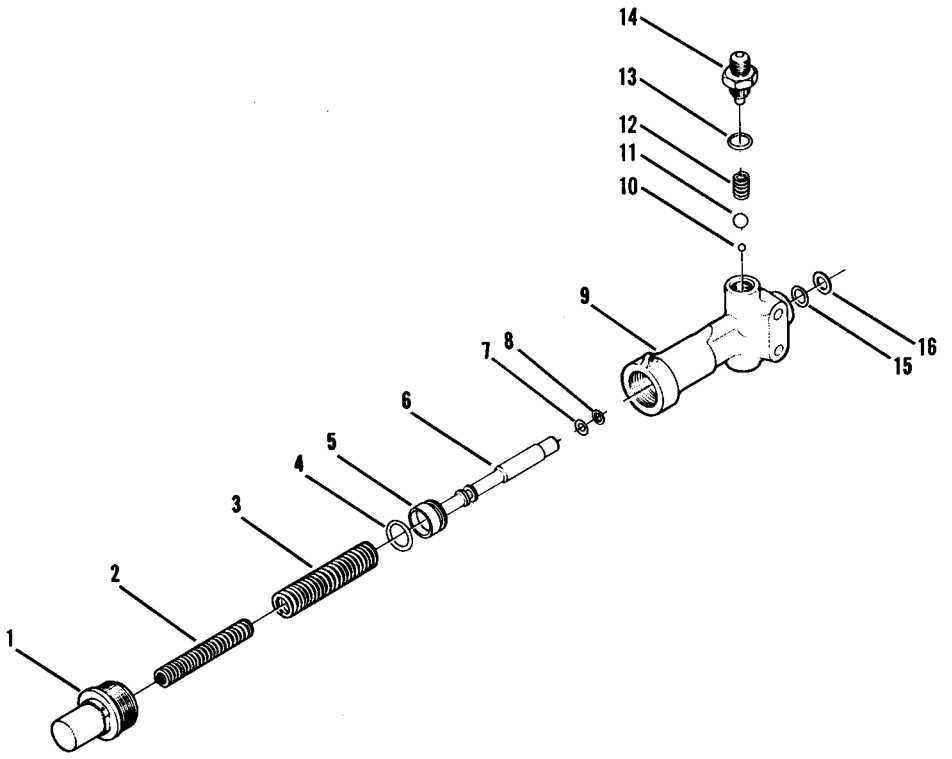
c. Slide piston and rod (6) into barrel and valve body (9). Use care to prevent damage to O-rings and back-up rings.

d. Insert springs (2 and 3), then install and safety end plug to barrel and valve body.

e. Insert balls (10 and 11) and spring (12) in barrel and valve body.

f. Install a new O-ring (13) on fitting (14), install and tighten fitting.

SHOP NOTES:



1. End Plug
2. Spring
3. Spring
4. Back-Up Ring
5. O-Ring
6. Piston and Rod
7. O-Ring
8. Back-Up Ring
9. Barrel and Valve Body
10. Ball
11. Ball
12. Spring
13. O-Ring
14. Fitting
15. O-Ring
16. Back-Up Ring

Figure B7-1. Lock Cylinder

SHOP NOTES:

SECTION B8

REPAIR OF DOOR ACTUATORS

B8-1. LEADING PARTICULARS.

Operating pressure	1500 psi
Proof pressure	2250 psi
Fluid	MIL-H-5606
Operating temperature range (ambient)	-65°F (-54°C) to +160°F (+71.1°C)
Ball lock-unlocking pressure	100 ± 25 psi
Ball lock-locking pressure	275 psi (max.)
Length-extended (nosegear and main gear strut)	17.50 + .06, -.03 inches
Length-extended (main gear wheel)	17.10 + .06, -.03 inches
Retracted (all)	11.75 inches
Stroke (nose gear and main gear strut)	5.75 + .06, -.03 inches
Stroke (main gear wheel)	5.35 + .06, -.03 inches
Rod end adjustment	±.12 inch

B8-2. DISASSEMBLY. (See figure B8-1.)

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.

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.

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

B8-3. 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 freedom 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.

B8-4. REASSEMBLY. Repair of most parts of the landing gear door 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. Install all new O-rings and back-up rings during reassembly of the actuator.

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 down 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 actuator.

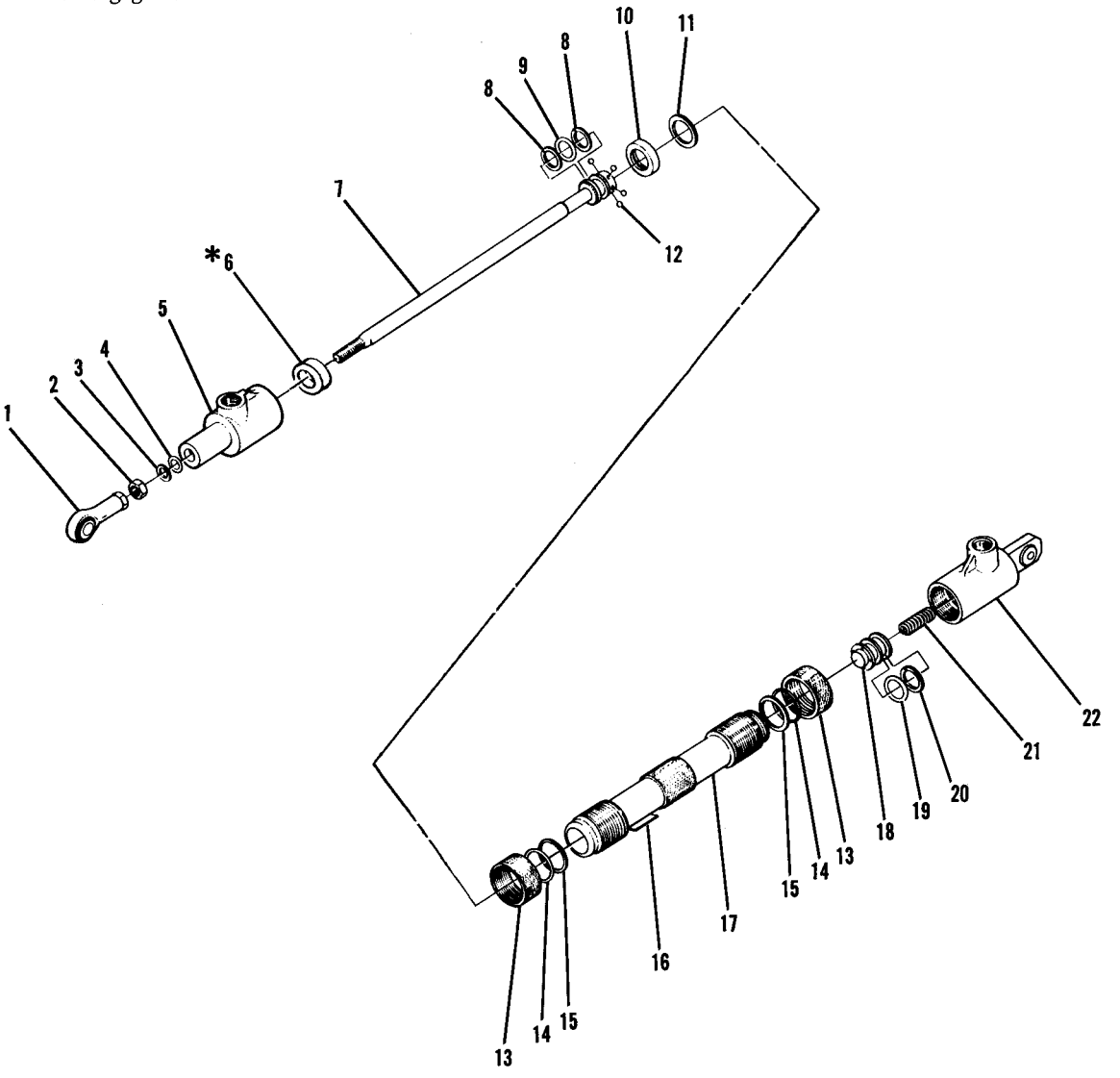
h. Install O-ring (4) and back-up ring (3) in bore groove of gland end (5), lubricate piston rod and slide gland end over rod. Tighten gland end on barrel, aligning hydraulic port fittings of the gland end with the port fitting in the clevis end.

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).

k. Check actuator per paragraph B8-1 specifications.

* Spacer (6) used only in the main landing gear wheel door actuator.



1. Rod End
2. Nut
3. Back-Up Ring
4. O-Ring
5. Gland End
* 6. Spacer
7. Piston and Plug
8. Back-Up Ring
9. O-Ring
10. Race
11. Washer
12. Balls
13. Nut
14. O-Ring
15. Back-Up Ring
16. Nameplate
17. Barrel
18. Plunger
19. O-Ring
20. Back-Up Ring
21. Spring
22. Clevis End

Figure B8-1. Door Actuator

SECTION B9

REPAIR OF UNLOCK AND SEQUENCE ACTUATORS

B9-1. LEADING PARTICULARS.

Operating pressure	1500 psi
Proof pressure	2250 psi
Burst pressure	3750 psi
Fluid	MIL-H-5606
Operating temperature range (ambient)	-40°F (-40°C) to +160°F (+71.1°C)
Piston stroke (total at 1.0 GPM)	.812 inches max.
Stroke to unseat valve	.719 ± .031 inches

B9-2. DISASSEMBLY. (See figure B9-1.)

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

b. Cut safety wire and unscrew end plug (1 or 19) from barrel and valve body (4 or 12).

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

d. If sleeve (3) is installed, remove it from barrel and valve body (4).

e. Remove and discard all O-rings and back-up rings from piston and rod, barrel and valve body and sleeve (3) if used.

B9-3. 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 freedom from cracks and excessive wear.

b. Inspect spring (7) for evidence of breaks and distortion. The free length of the spring must be .446±.015 inch and compress to .359 inches under a .18±.02 pound load.

c. Inspect spring (17) for evidence of breaks and distortion. The free length of the spring must be 2.95±.09 inches and compress to 1.969 inches under a 22.5±2.2 pound load.

d. Inspect spring (18) for evidence of breaks and distortion. The free length of the spring must be 2.98±.09 inches and compress to 1.969 inches under a 10.6±1.10 pound load.

e. Inspect plug, piston and rod, barrel and valve body, 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.

B9-4. REASSEMBLY. Repair of most parts of the unlock cylinder 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. Install all new O-rings and back-up rings during reassembly of the unlock cylinder.

a. Install new O-rings (15 and 16) 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. If used, install O-ring (2) on sleeve (3) and insert sleeve in barrel and valve body (4).

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

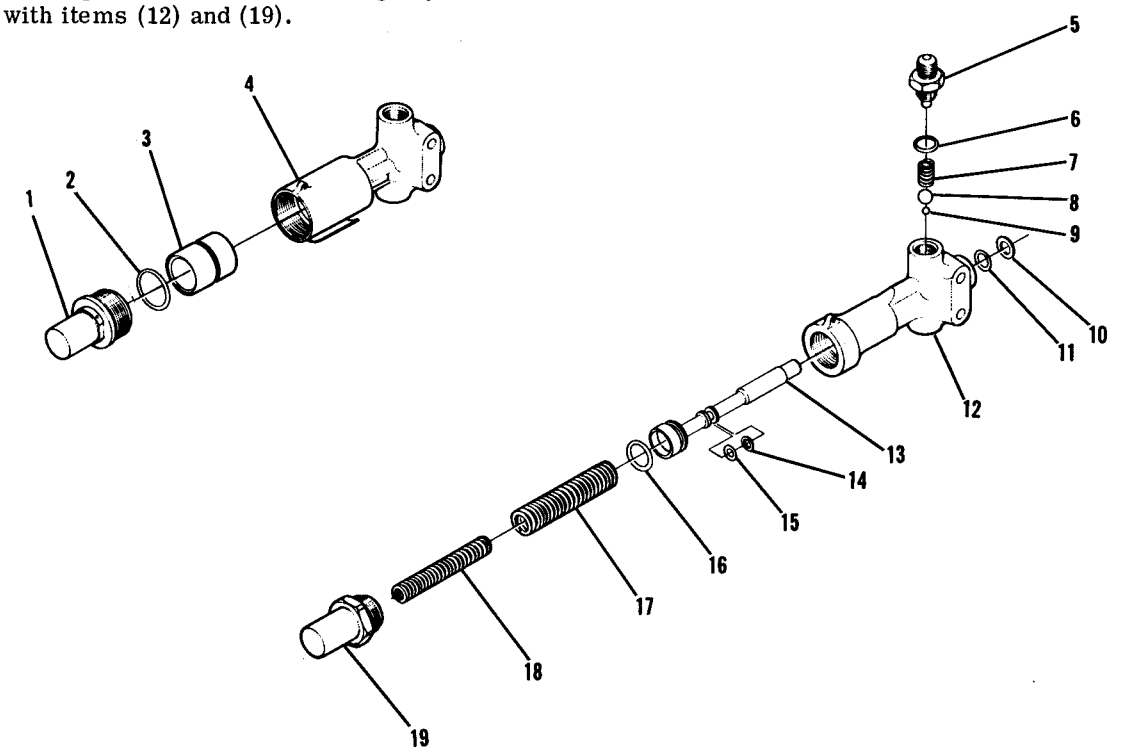
e. Insert springs (17 and 18), then install and safety end plug (1 or 19) to barrel and valve body.

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

g. Install a new O-ring (6) on fitting (5), install and tighten fitting.

SHOP NOTES:

*These parts are used interchangably with items (12) and (19).



*1. End Plug
*2. O-Ring
*3. Sleeve
*4. Barrel and Valve Body
5. Fitting
6. O-Ring
7. Spring
8. Ball
9. Ball
10. Back-Up Ring
11. O-Ring
12. Barrel and Valve Body
13. Piston and Rod
14. Back-Up Ring
15. O-Ring
16. O-Ring
17. Spring
18. Spring
19. End Plug

Figure B9-1. Unlock and Sequence Actuators

SHOP NOTES:

APPENDIX C

ELECTRICAL WIRING DIAGRAMS

210 Aircraft Prior to 1963 . . . . . Section C1

210 Aircraft - 1963 and on. . . . . Section C2

Model 205, 206, P206 & U206 . . . . . Section C3

NOTE

The page numbering method in Section C2 and C3 of this appendix differs from that of the rest of the book. However, each section begins with an index of the diagrams contained therein, which will facilitate locating any particular diagram.

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SECTION C1

ELECTRICAL WIRING DIAGRAMS - 210 PRIOR TO '63

	Figure
Auxiliary Fuel Pump Circuit	C1-4
Battery Circuit	C1-3
Cigarette Lighter Circuit	C1-13
Clock Circuit	C1-3
Compass Light Circuit	C1-14
Courtesy Lights Circuit	C1-14
Cylinder Head Temperature Gage Circuit	C1-10
Dome Light Circuit	C1-14
Flap Indicator Circuit	C1-8
Fuel Quantity Indicators Circuit	C1-10
Generator Circuit	C1-3
Ground Service Receptacle Circuit ±	C1-3
Gyro Horizon Indicator Circuit	C1-9
Instrument Lights Circuit	C1-14
Magneto Circuit	C1-12
Landing Gear Control Circuit	C1-7
Landing Gear Indicator Lights Circuits	C1-6
Landing Gear Limit Switches Circuit	C1-4
Landing Light Circuit	C1-12
Map Light Circuit	C1-14
Navigation Lights Circuit	C1-13
Oil Dilution Circuit	C1-13
Pitot Heat Circuit	C1-11
Rotating Beacon Circuit	C1-15
Stall and Gear Down Warning Unit Circuit	C1-5
Stall Warning Circuit	C1-5
Stall Warning Heater Circuit	C1-11
Starter Circuit	C1-3
Taxi Light Circuit	C1-12
Turn-and-Bank Indicator Circuit	C1-9

This section contains wiring diagrams of factory installed electrical equipment only. If equipment has been installed in the field some wire numbers may not correspond to the numbers supplied in this manual. If the situation exists refer to the wiring diagrams supplied with the accessory kit instructions. Some accessory kits are now being issued which have wires prefixed with the letters AK.

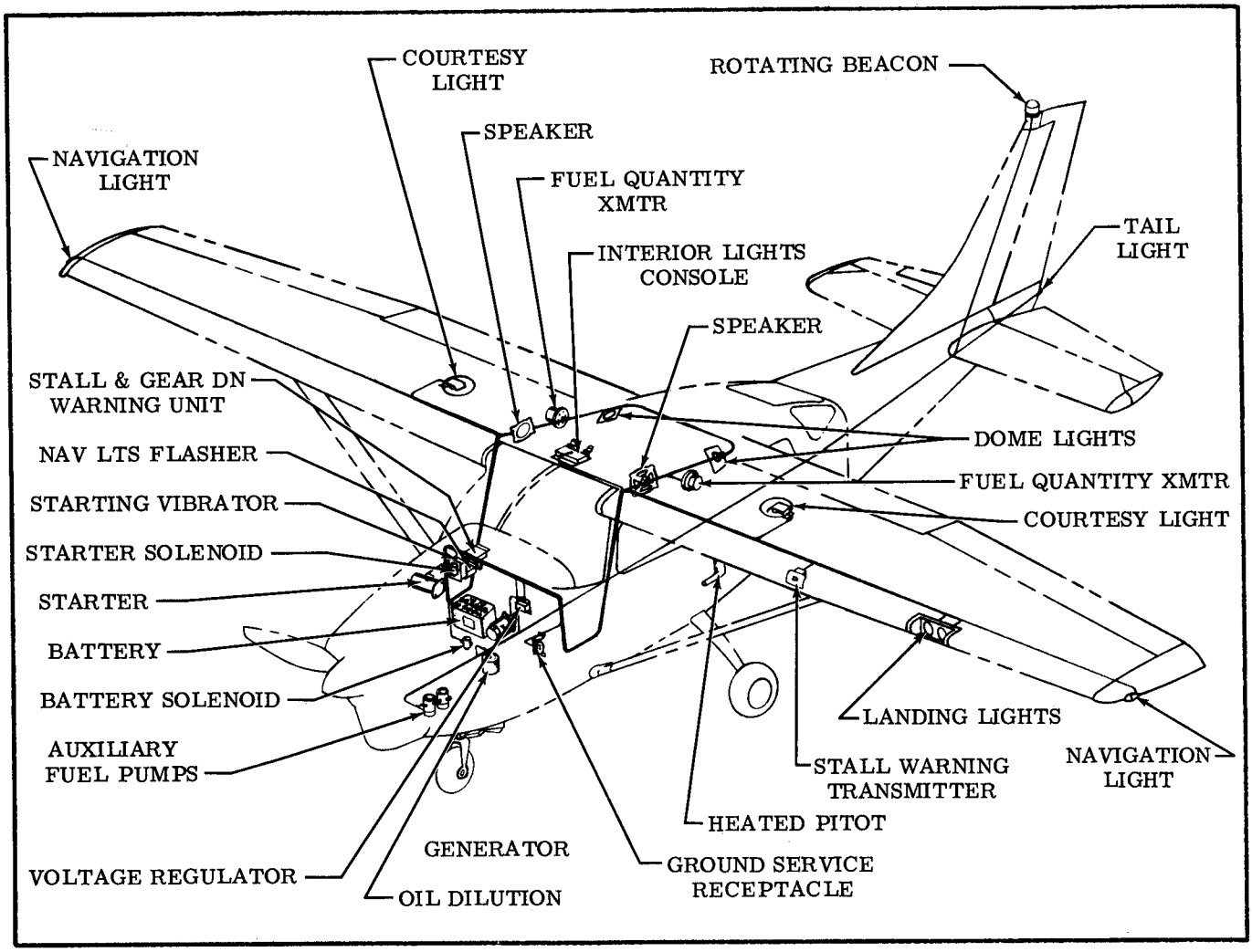


Figure C1-1. Electrical Equipment Installation - Model 210

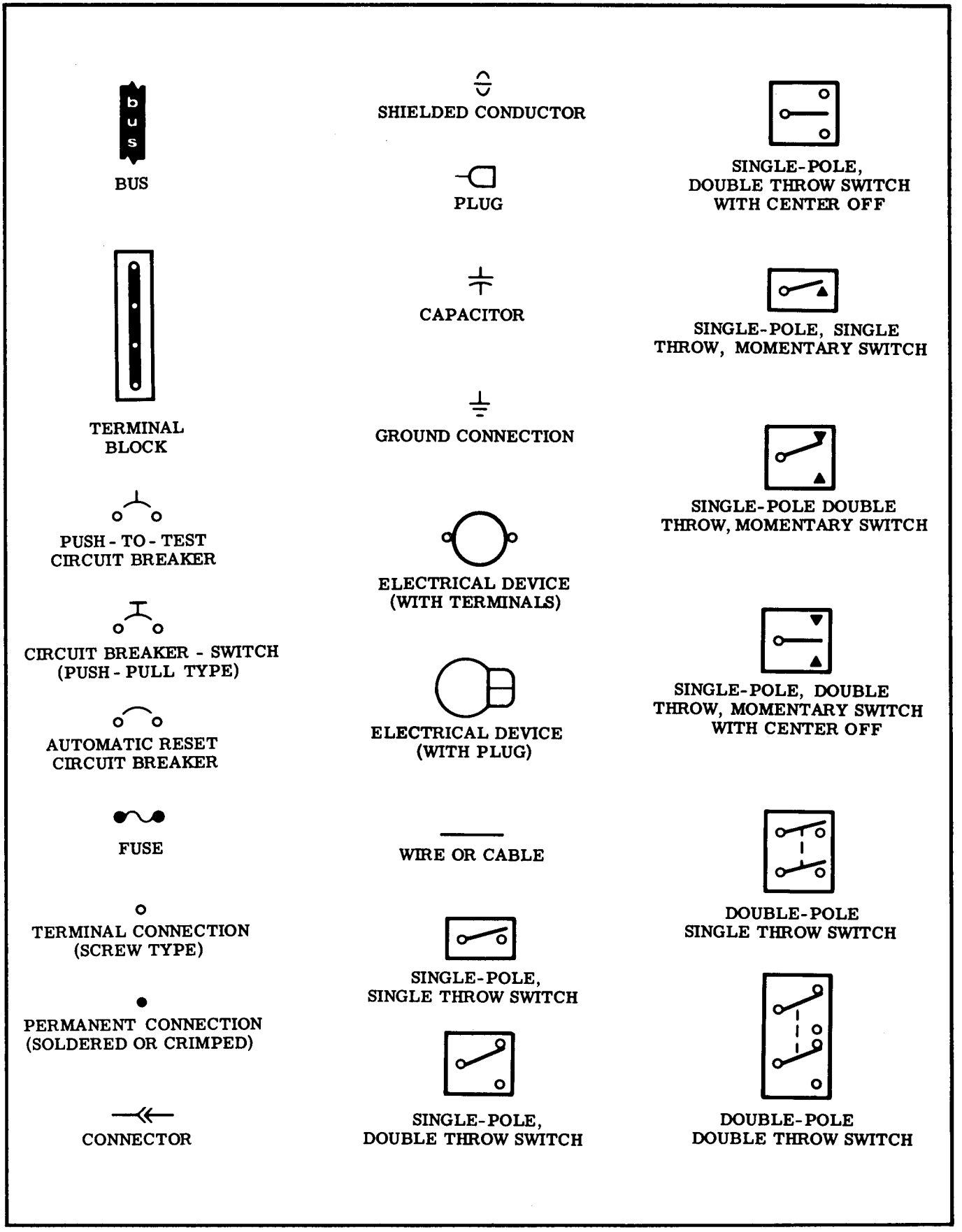
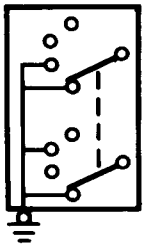


Figure C1-2. Symbols Chart (Sheet 1 of 2)

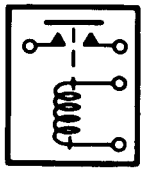


DOUBLE-POLE
FOUR POSITION SWITCH

VS

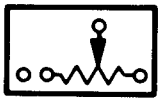
VENDOR SUPPLIED
TO CESSNA

PUSH-BUTTON SWITCH
MOMENTARY

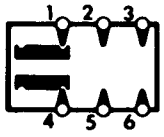


SOLENOID

BATTERY

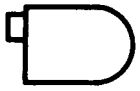


RHEOSTAT
WITH OFF
POSITION

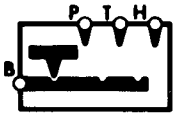


THREE POSITION
TWO CIRCUIT
PULL SWITCH

RESISTOR



MAGNETO

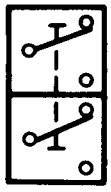


THREE POSITION
PULL SWITCH

SPEAKER OR HORN

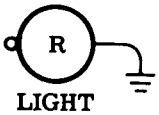
DIODE

PRESS-TO-TEST
LIGHT



INTERLOCKING, SPLIT-
ROCKER TYPE SWITCH

NOTE: THE INTERLOCKING SPLIT ROCKER TYPE SWITCH IS MADE UP OF TWO SINGLE-POLE, DOUBLE THROW SWITCHES WHICH HAVE BEEN MECHANICALLY INTERCONNECTED TO PROVIDE A SINGLE SPLIT ROCKER TYPE SWITCH



LIGHT

R= RED G = GREEN
W = WHITE, C = CLEAR

Figure C1-2. Symbols Chart (Sheet 2 of 2)

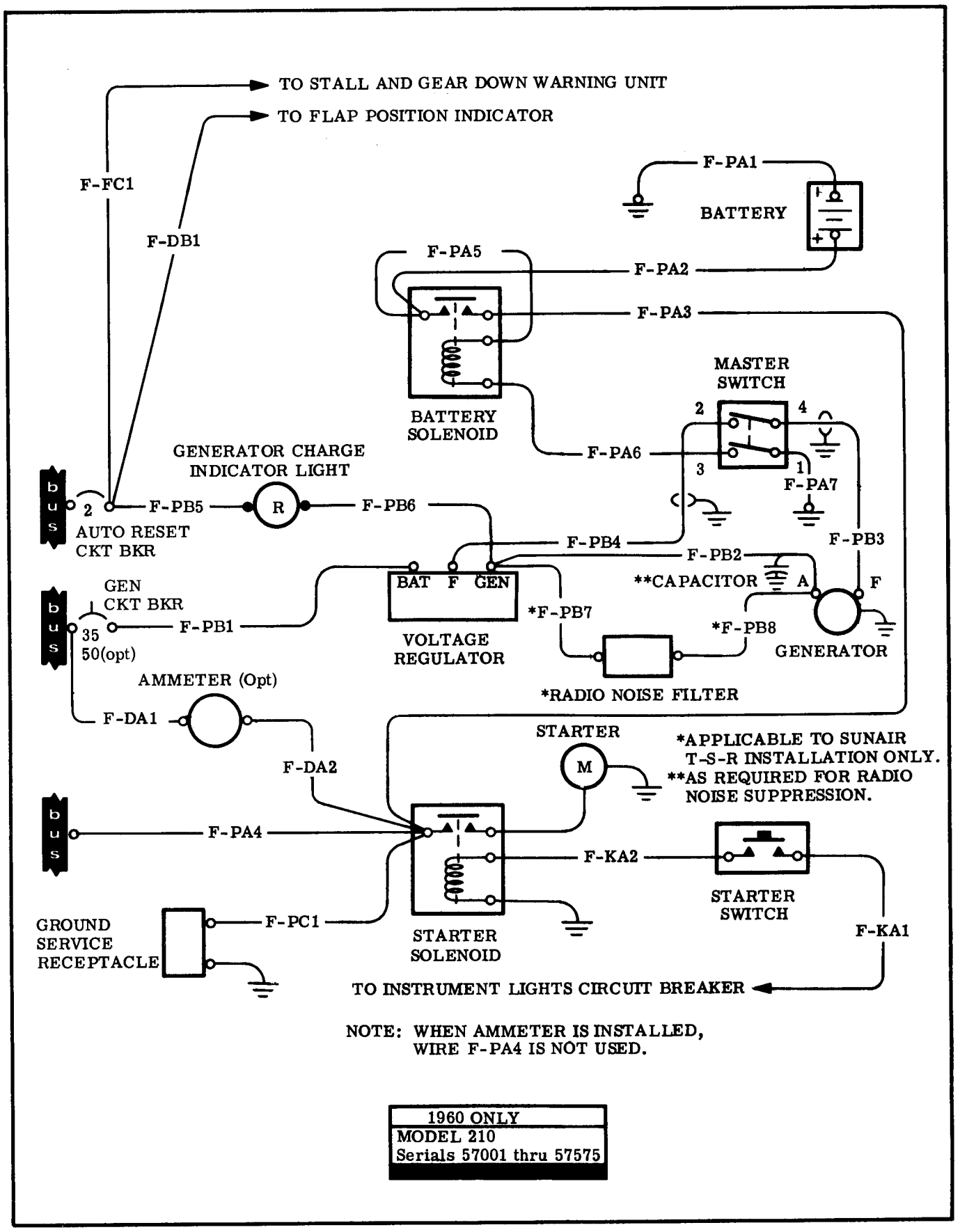
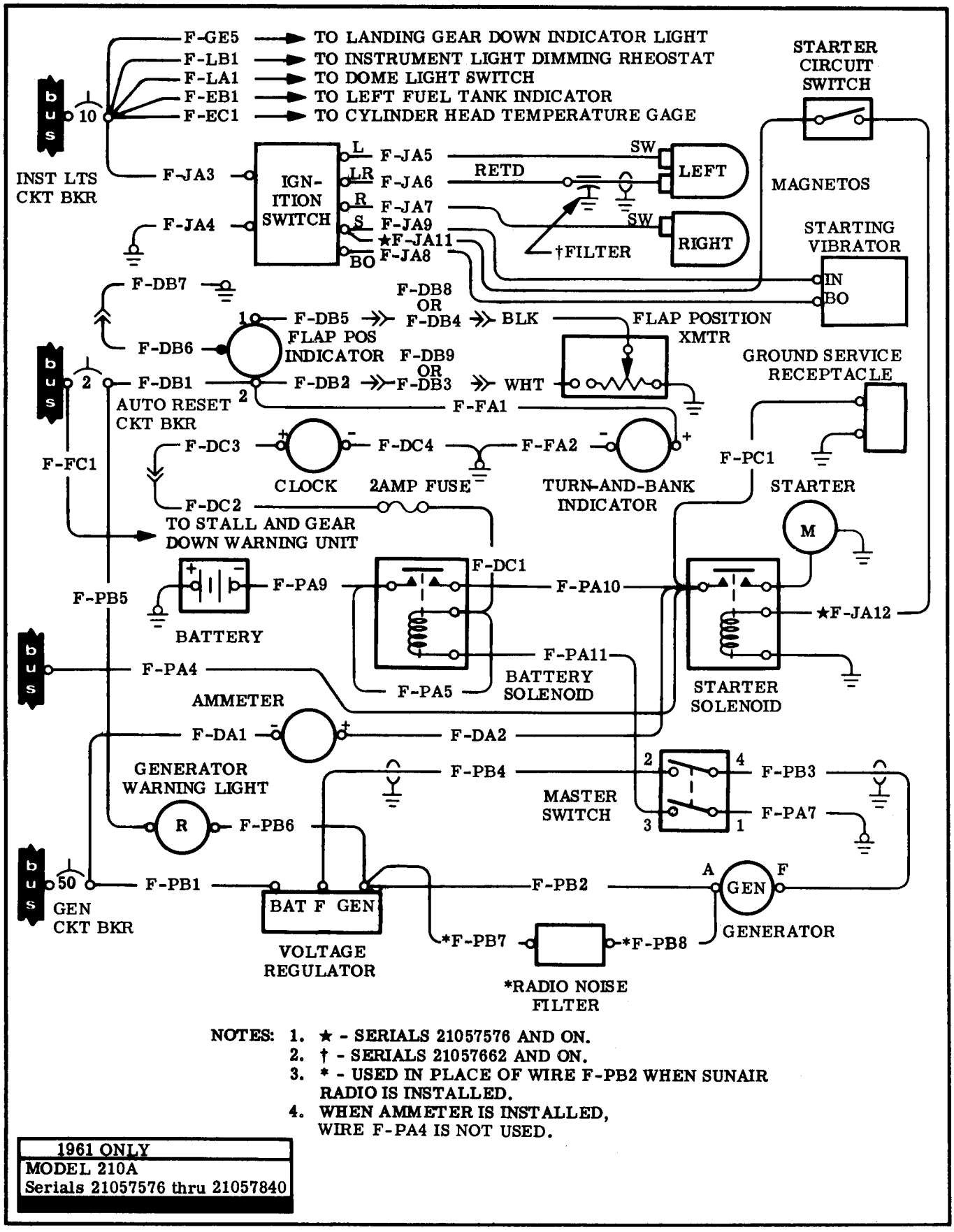


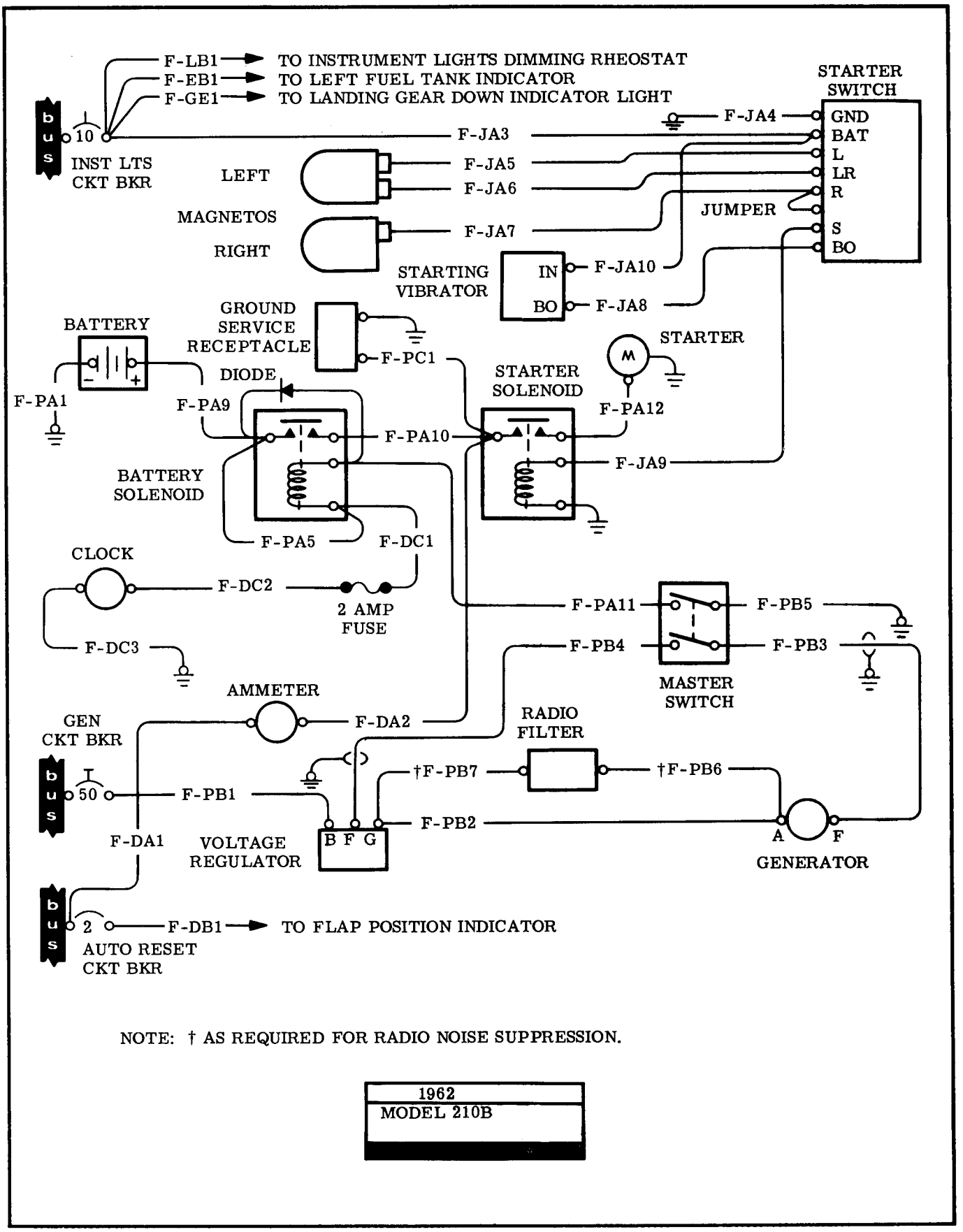
Figure C1-3. Flap Ind, T & B Ind, Bat, Gen, Vol Reg, Starter and Gnd Ser Recpt Ckts - Model 210 (Sheet 1 of 3)



NOTES:
1. ★ - SERIALS 21057576 AND ON.
2. † - SERIALS 21057662 AND ON.
3. * - USED IN PLACE OF WIRE F-PB2 WHEN SUNAIR RADIO IS INSTALLED.
4. WHEN AMMETER IS INSTALLED, WIRE F-PA4 IS NOT USED.

1961 ONLY
MODEL 210A
Serials 21057576 thru 21057840

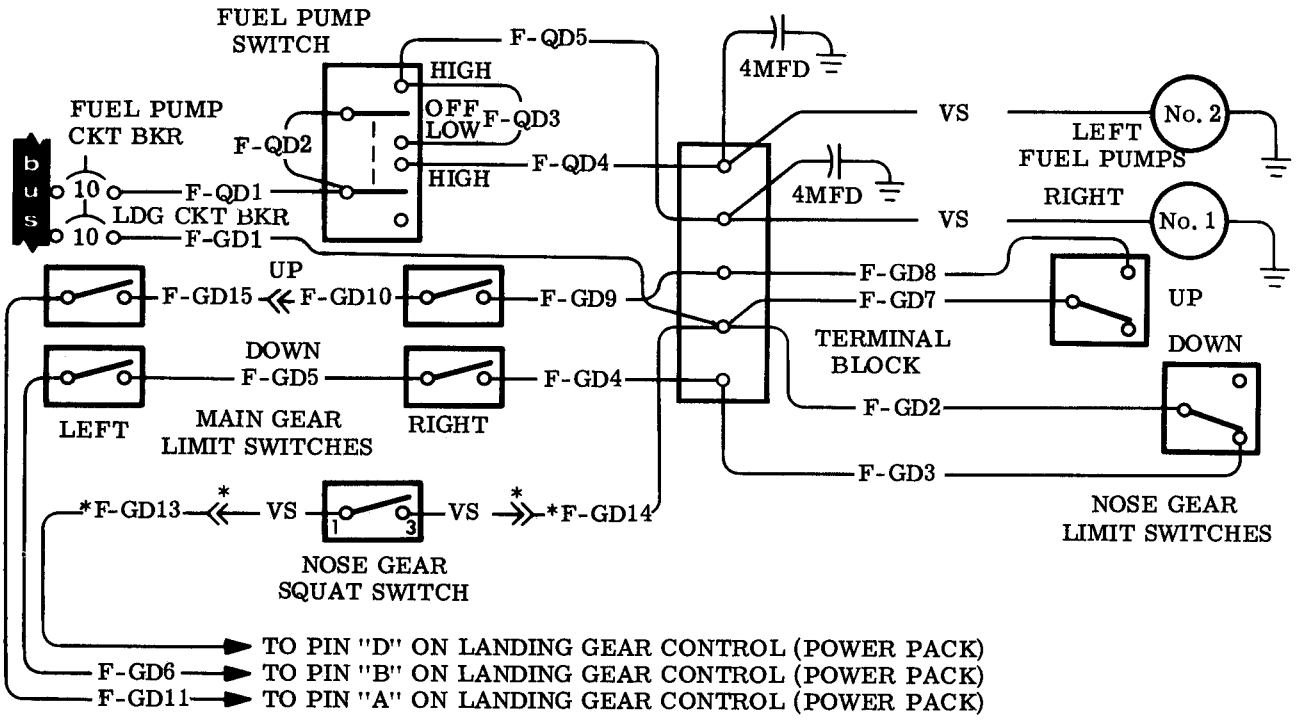
Figure C1-3. Flap Ind, T&B Ind, Bat, Gen, Vol Reg, Starter and Gnd Ser Recpt Ckts - Model 210 (Sheet 2 of 3)



NOTE: † AS REQUIRED FOR RADIO NOISE SUPPRESSION.

1962
MODEL 210B

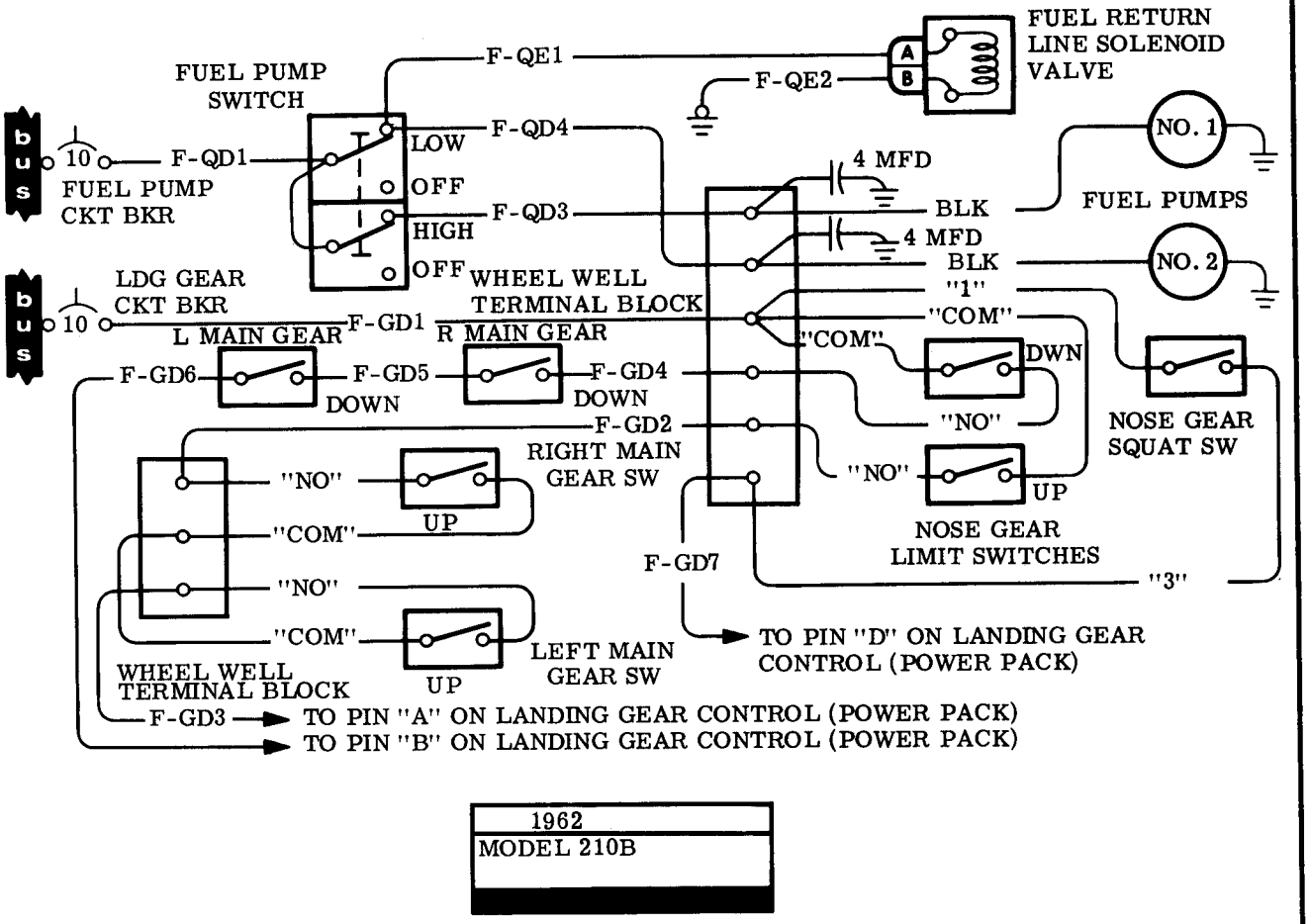
Figure C1-3. Flap Ind, T& B Ind, Bat, Gen, Vol Reg, Starter and Gnd Ser Recpt Ckts - Model 210 (Sheet 3 of 3)



1960 THRU 1961
MODELS 210 & A
Serials 57001 thru 21057840
*Serials 57001 thru 57524; Later Serials have Vendor Furnished Wires

NOTE: THE NOSE GEAR SQUAT SWITCH IS CLOSED WHEN STRUT IS EXTENDED.

Figure C1-4. Auxiliary Fuel Pumps and Landing Gear Limit Switches Circuits (Sheet 1 of 2)



1962
MODEL 210B

NOTE: THE NOSE GEAR SQUAT SWITCH IS CLOSED WHEN STRUT IS EXTENDED.

Figure C1-4. Auxiliary Fuel Pumps and Landing Gear Limit Switches Circuits (Sheet 2 of 2)

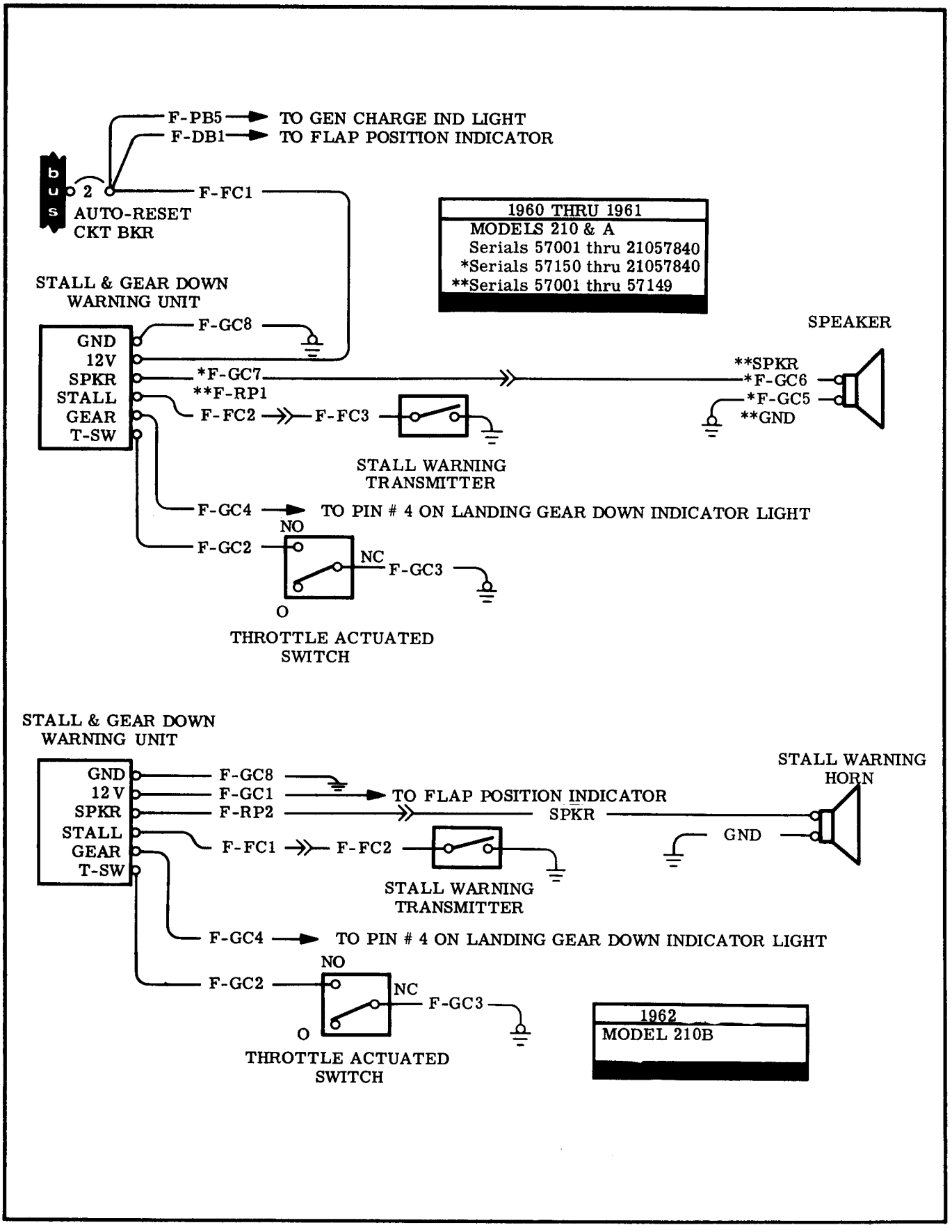
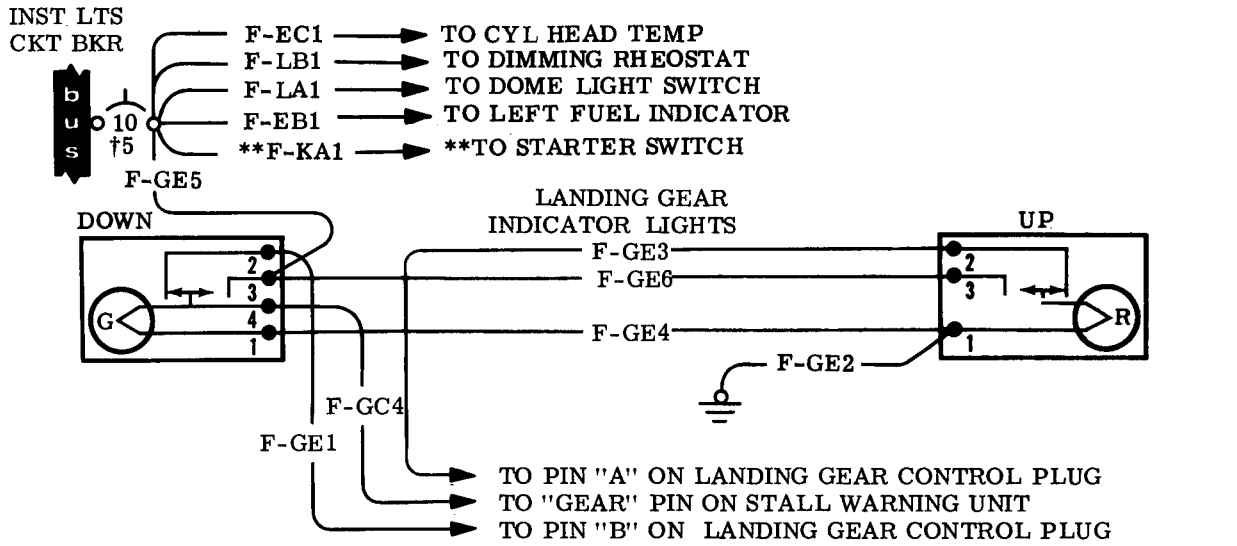
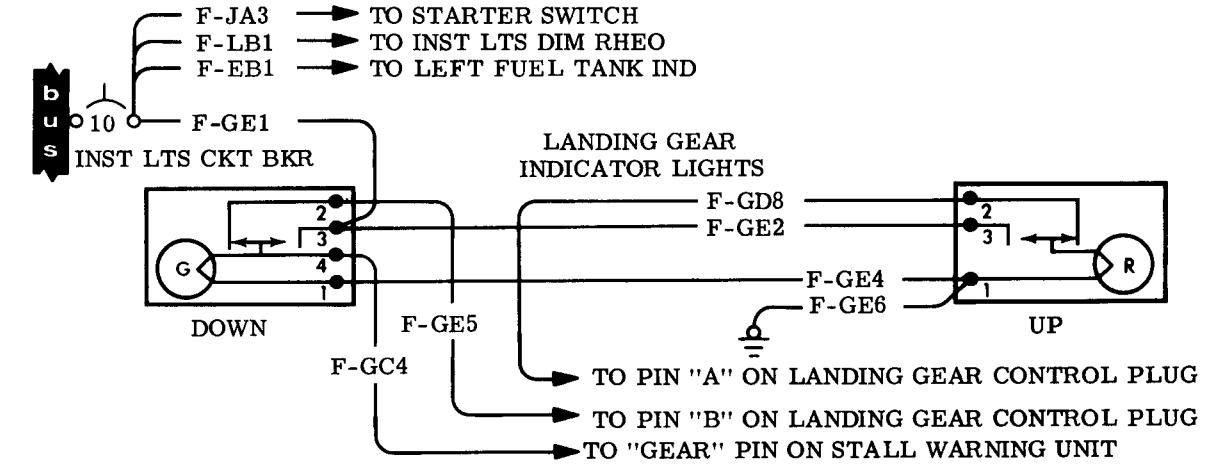


Figure C1-5. Stall and Gear Warning Circuits



1960 THRU 1961
MODELS 210 & A
Serials 57001 thru 21057840
**Serials 57001 thru 57529
†Serials 57001 thru 21057575



1962
MODELS 210B

Figure C1-6. Landing Gear Indicator Lights Circuits

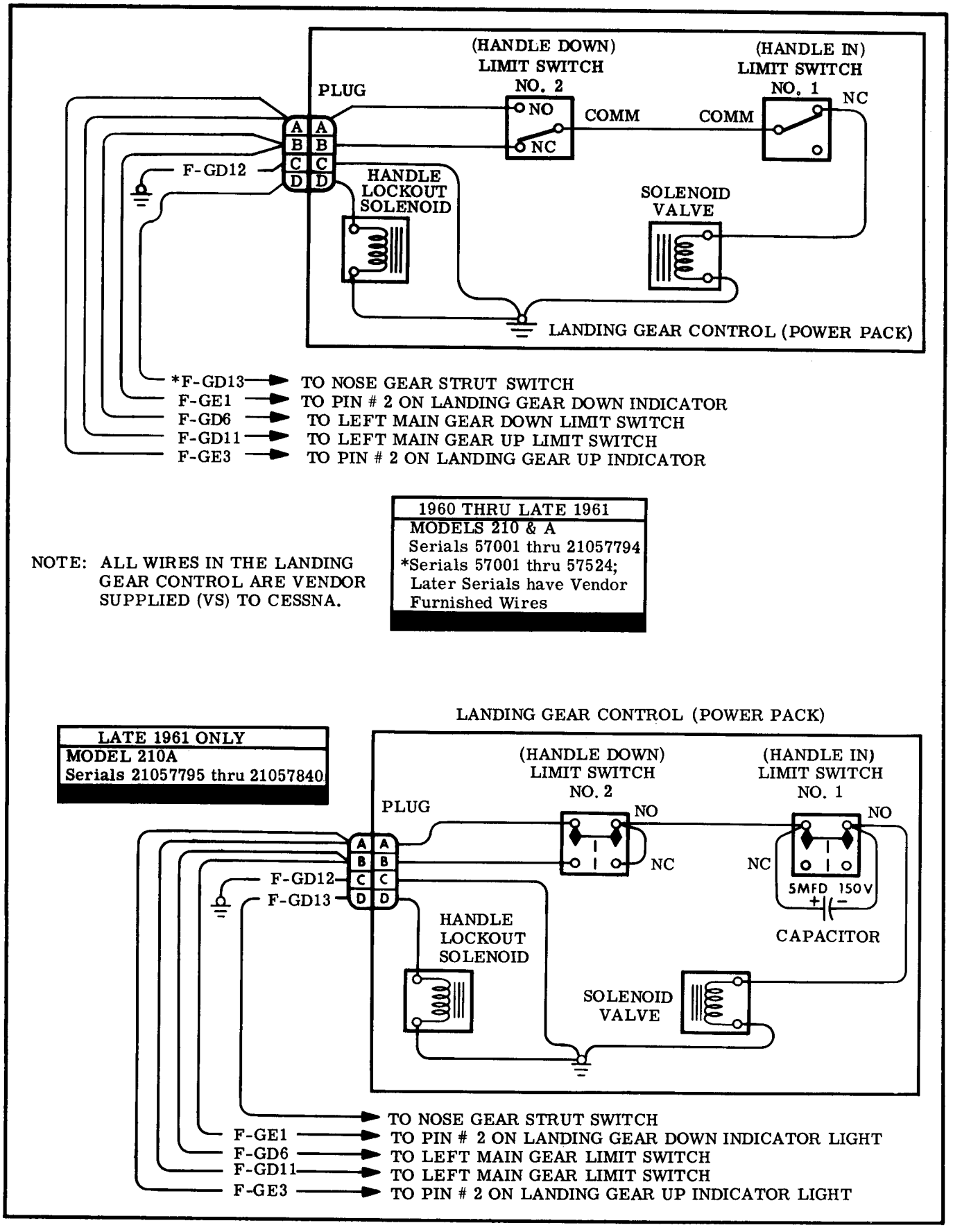
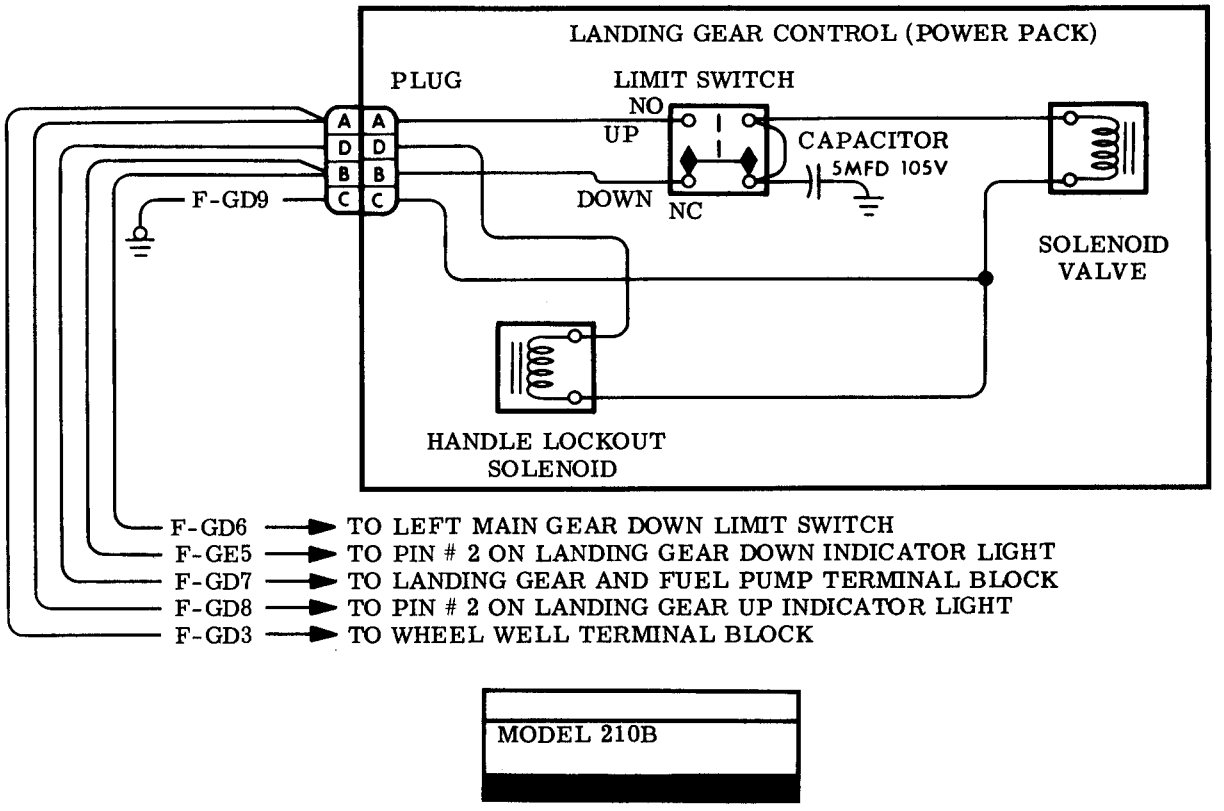


Figure C1-7. Landing Gear Control Circuits (Sheet 1 of 2)



MODEL 210B

NOTE: ALL WIRES IN THE LANDING GEAR CONTROL ARE VENDOR SUPPLIED (VS) TO CESSNA.

Figure C1-7. Landing Gear Control Circuits (Sheet 2 of 2)

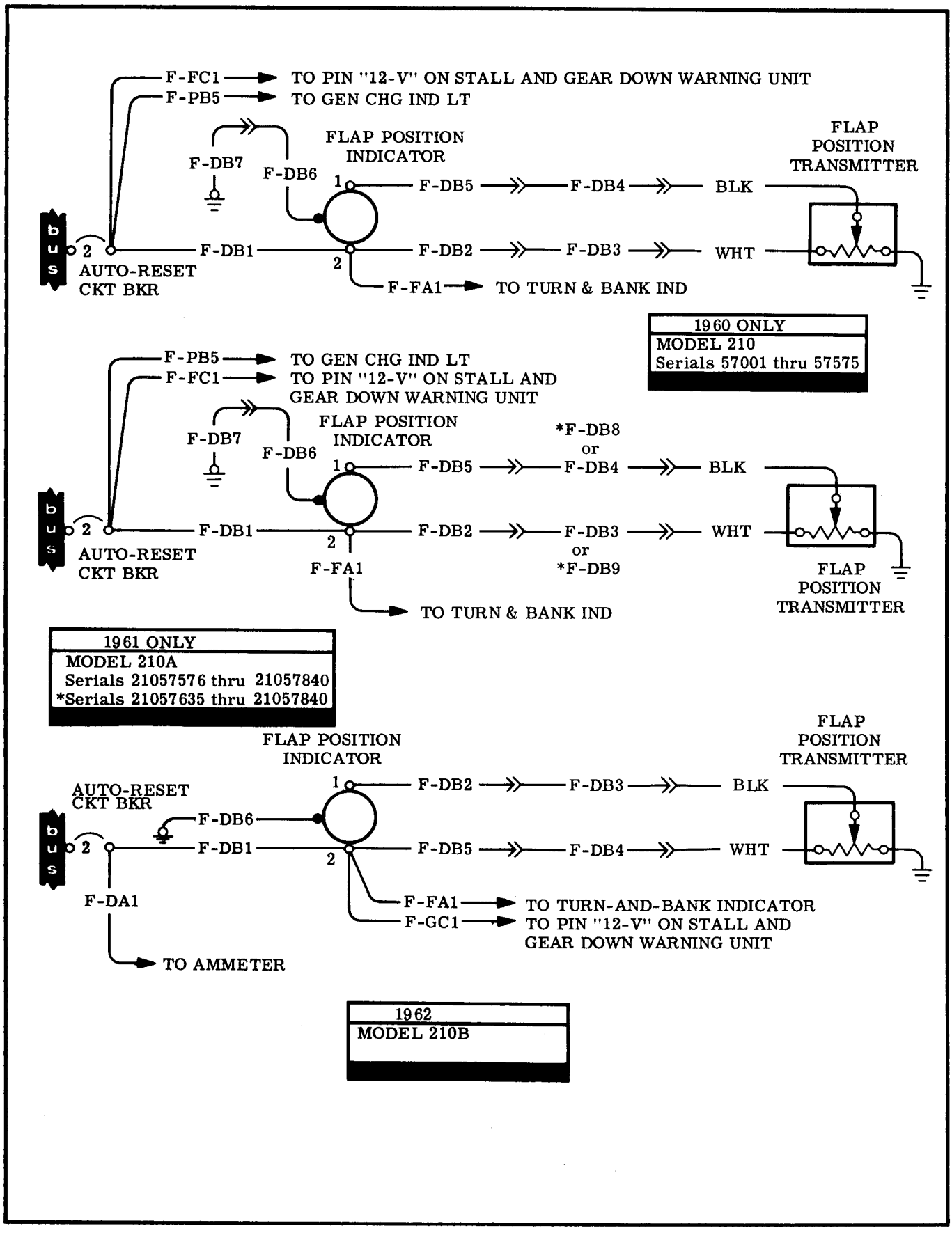


Figure C1-8. Flap Position Indicator Circuits

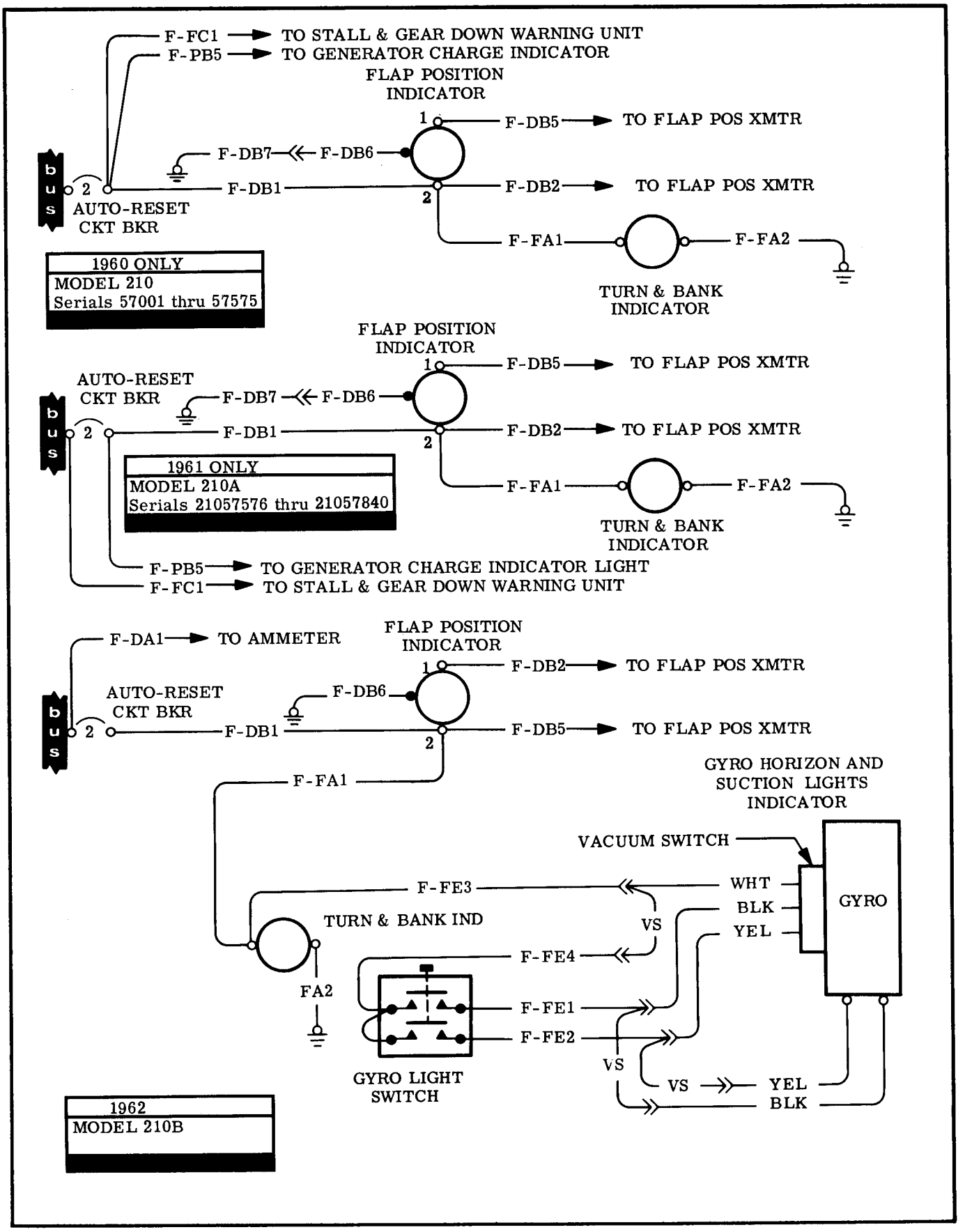


Figure C1-9. Turn & Bank and Gyro Horizon Indicator Circuits

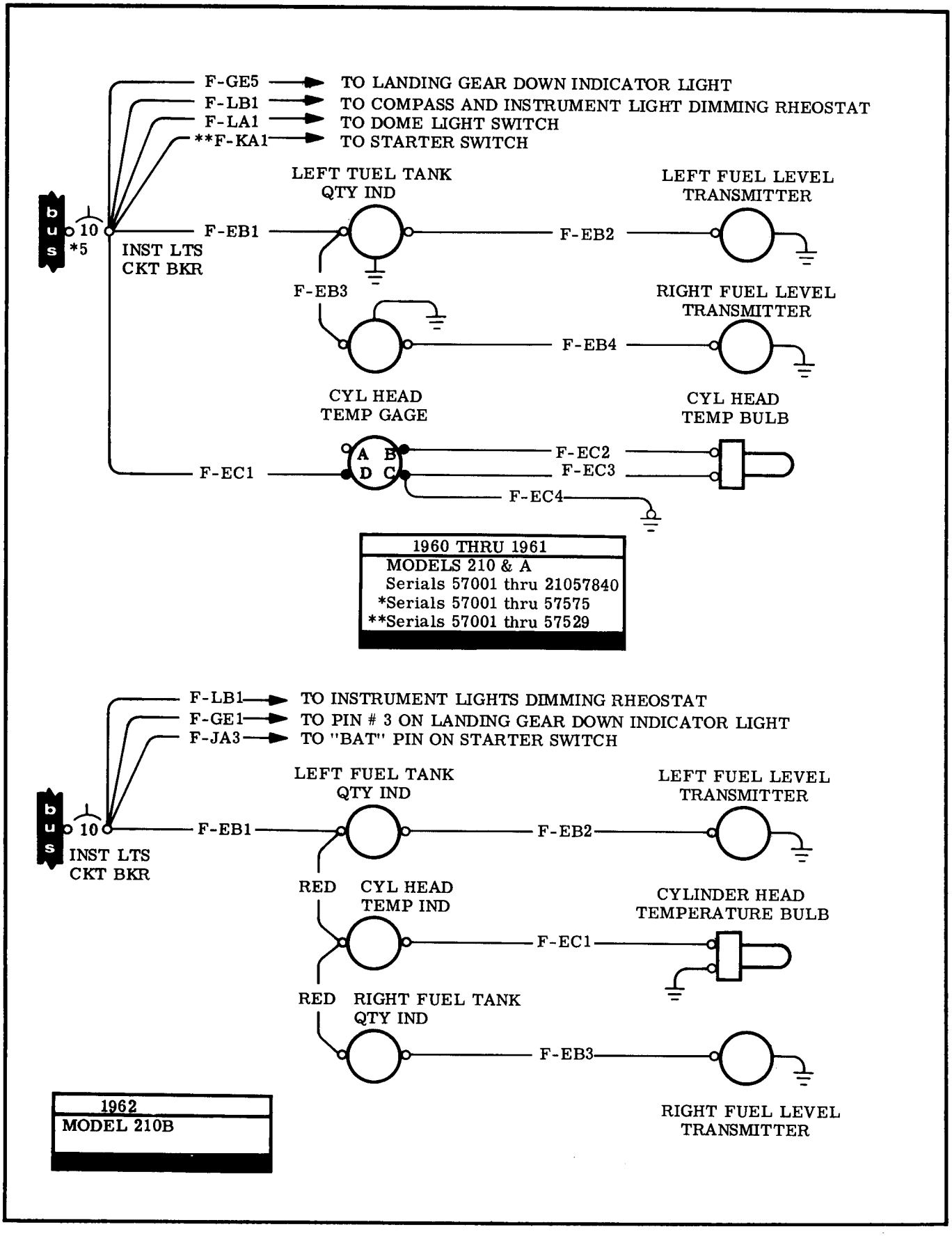


Figure C1-10. Cylinder Head Temp. and Fuel Quantity Ind. Circuits

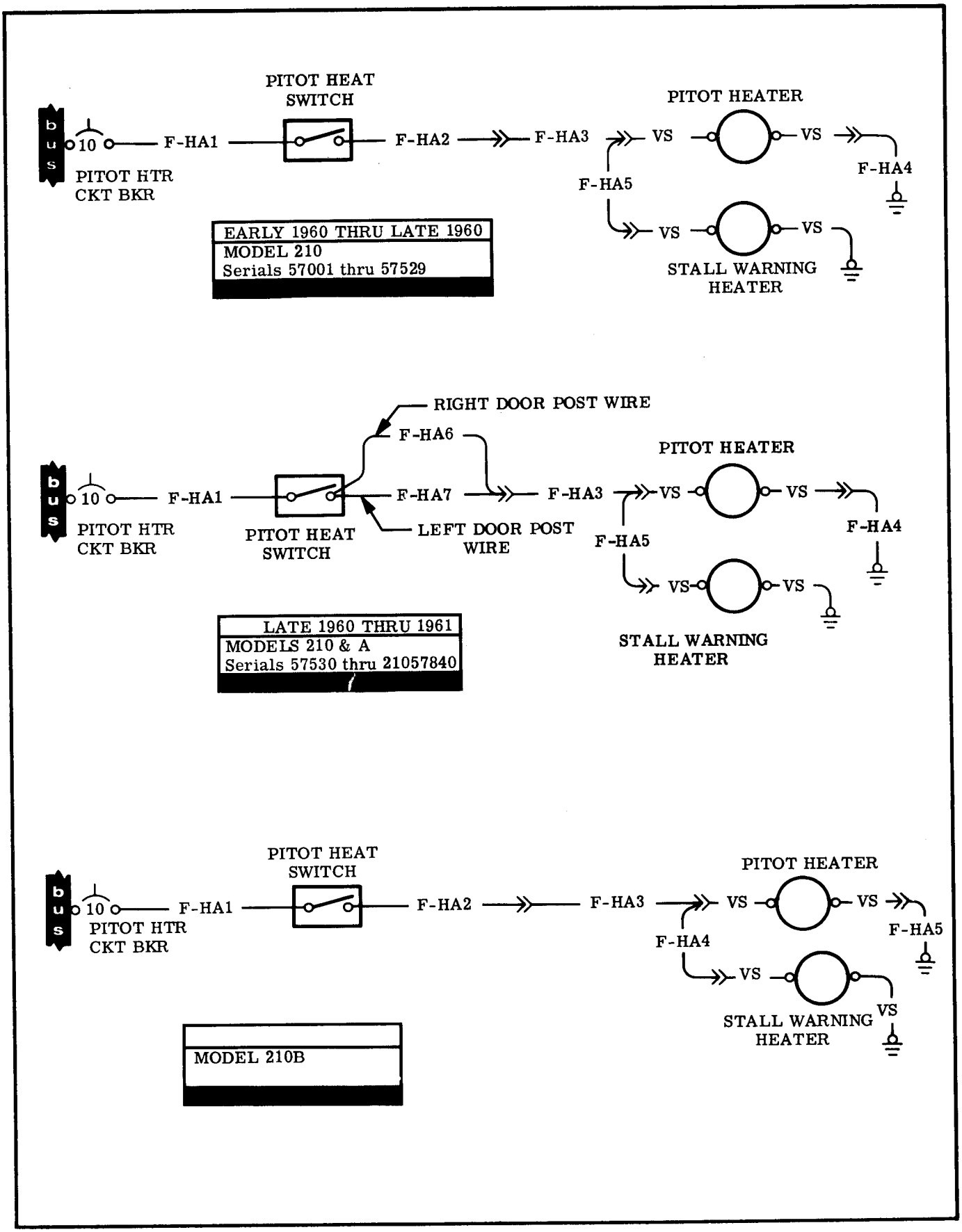


Figure C1-11. Pitot and Stall Warning Heater Circuits

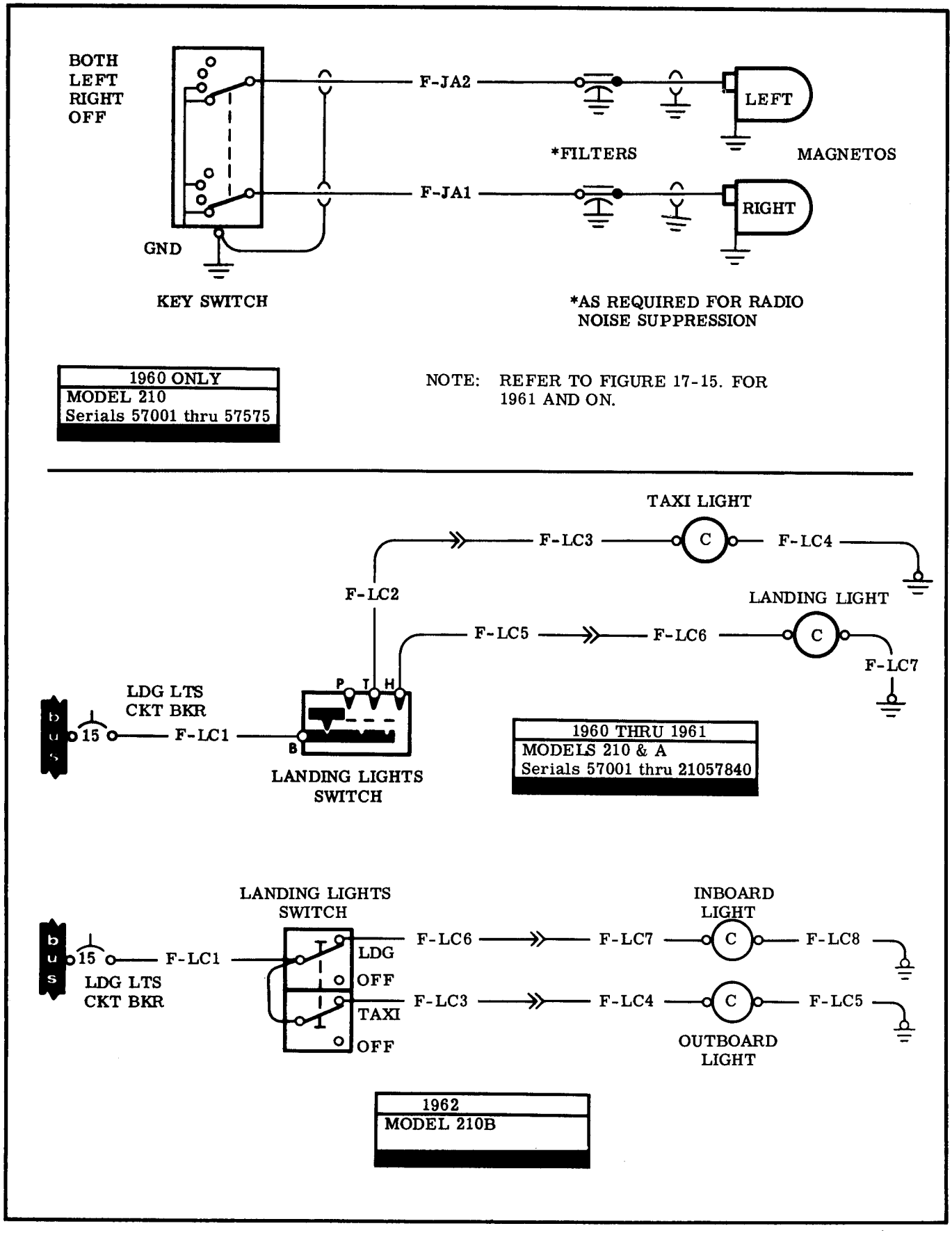
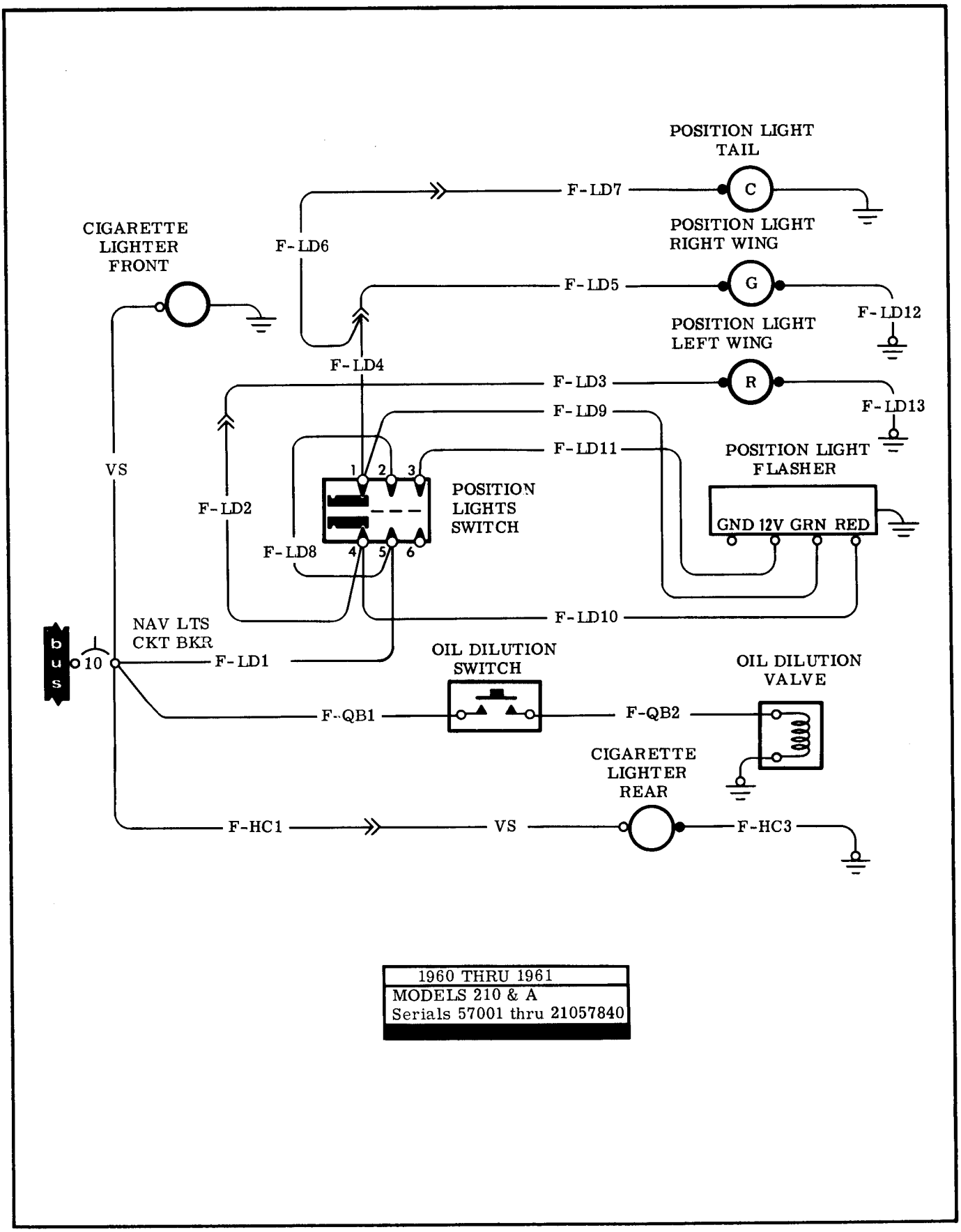


Figure C1-12. Magnetos, Landing and Taxi Lights Circuits



1960 THRU 1961
MODELS 210 & A
Serials 57001 thru 21057840

Figure C1-13. Navigation Lights, Cigarette Lighter and Oil Dilutions Circuits (Sheet 1 of 2)

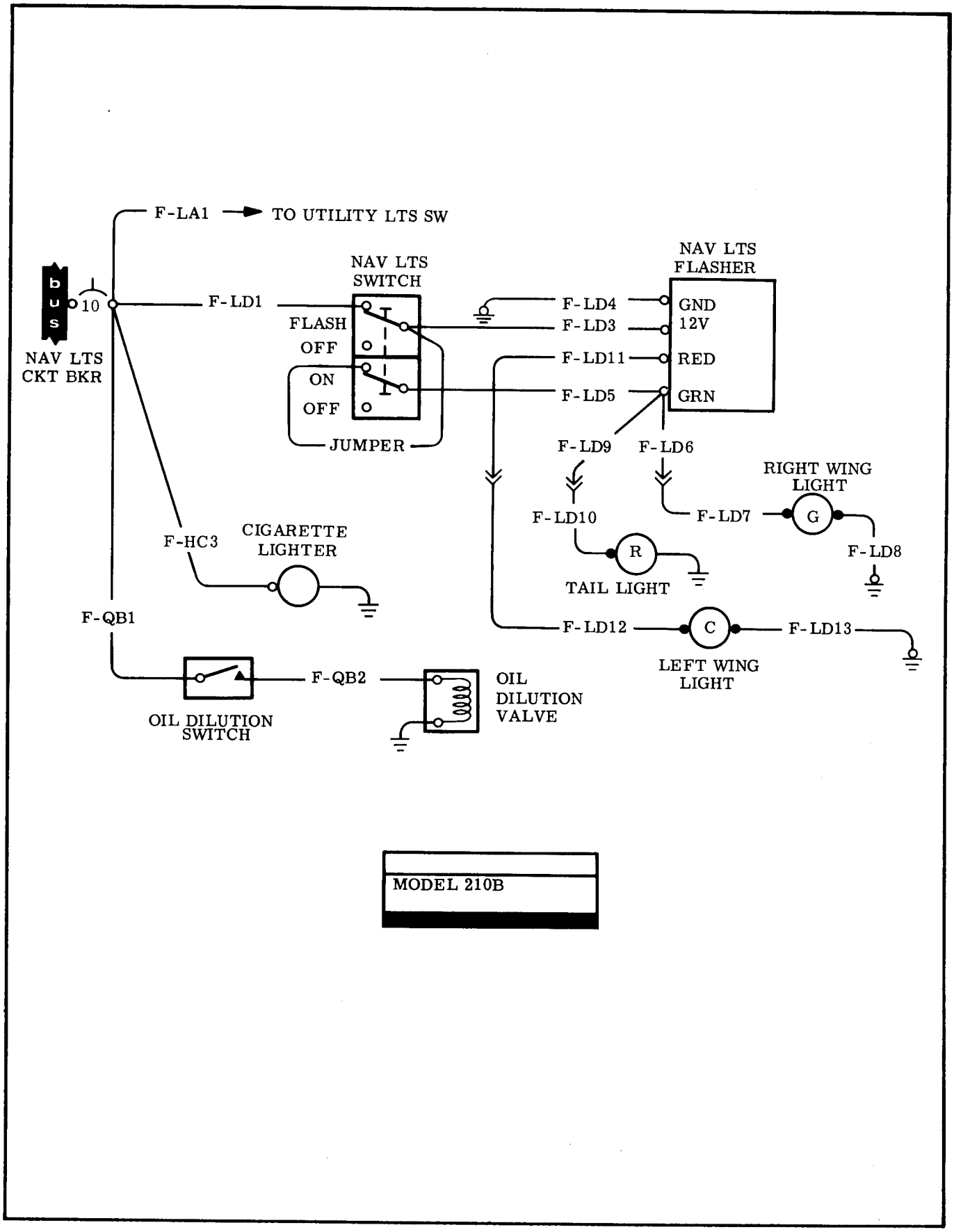


Figure C1-13. Navigation Lights, Cigarette Lighter and Oil Dilution Circuits (Sheet 2 of 2)

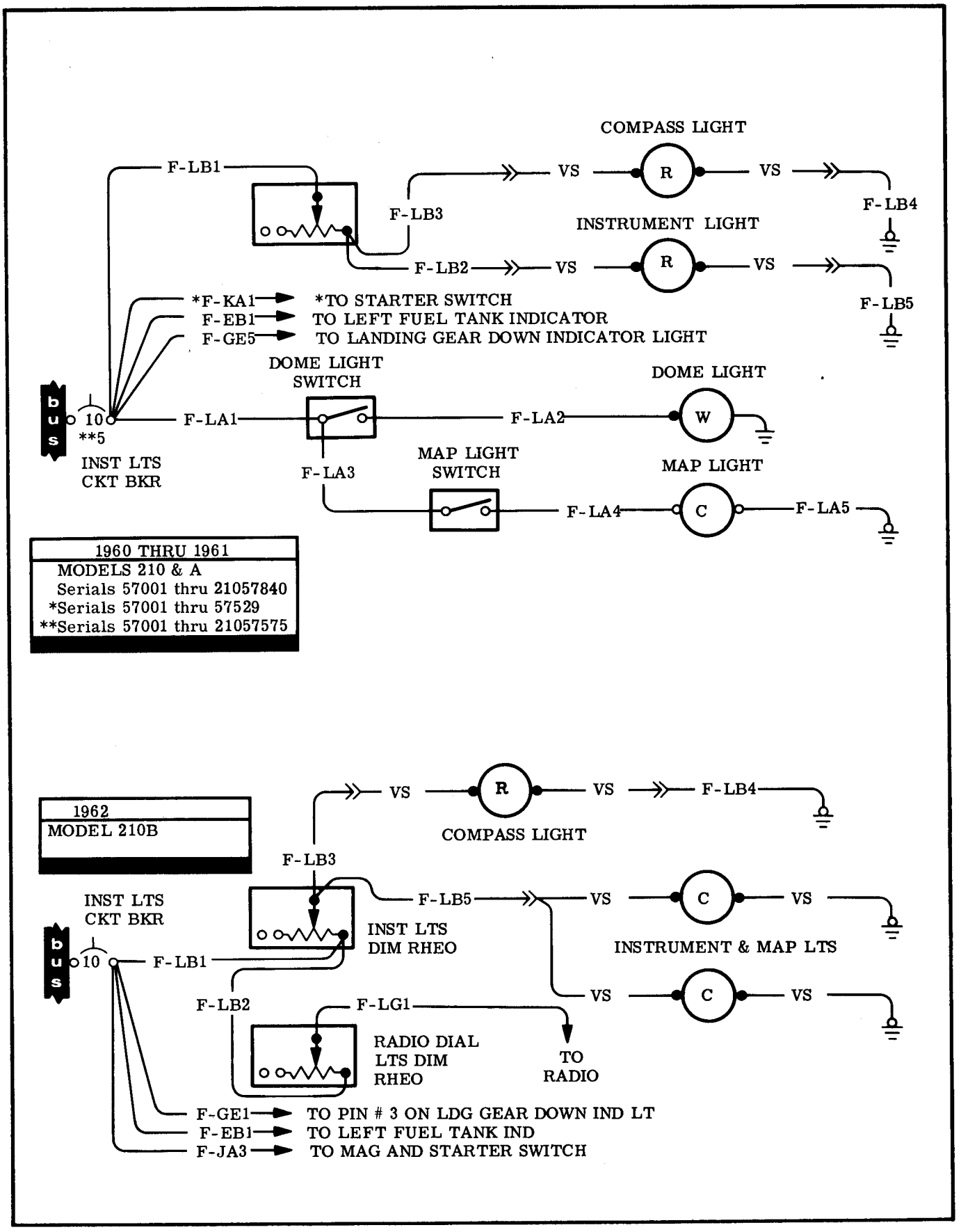


Figure C1-14. Compass Lt., Instrument Lt., Map Lt. and Courtesy Lts. Circuits (Sheet 1 of 2)

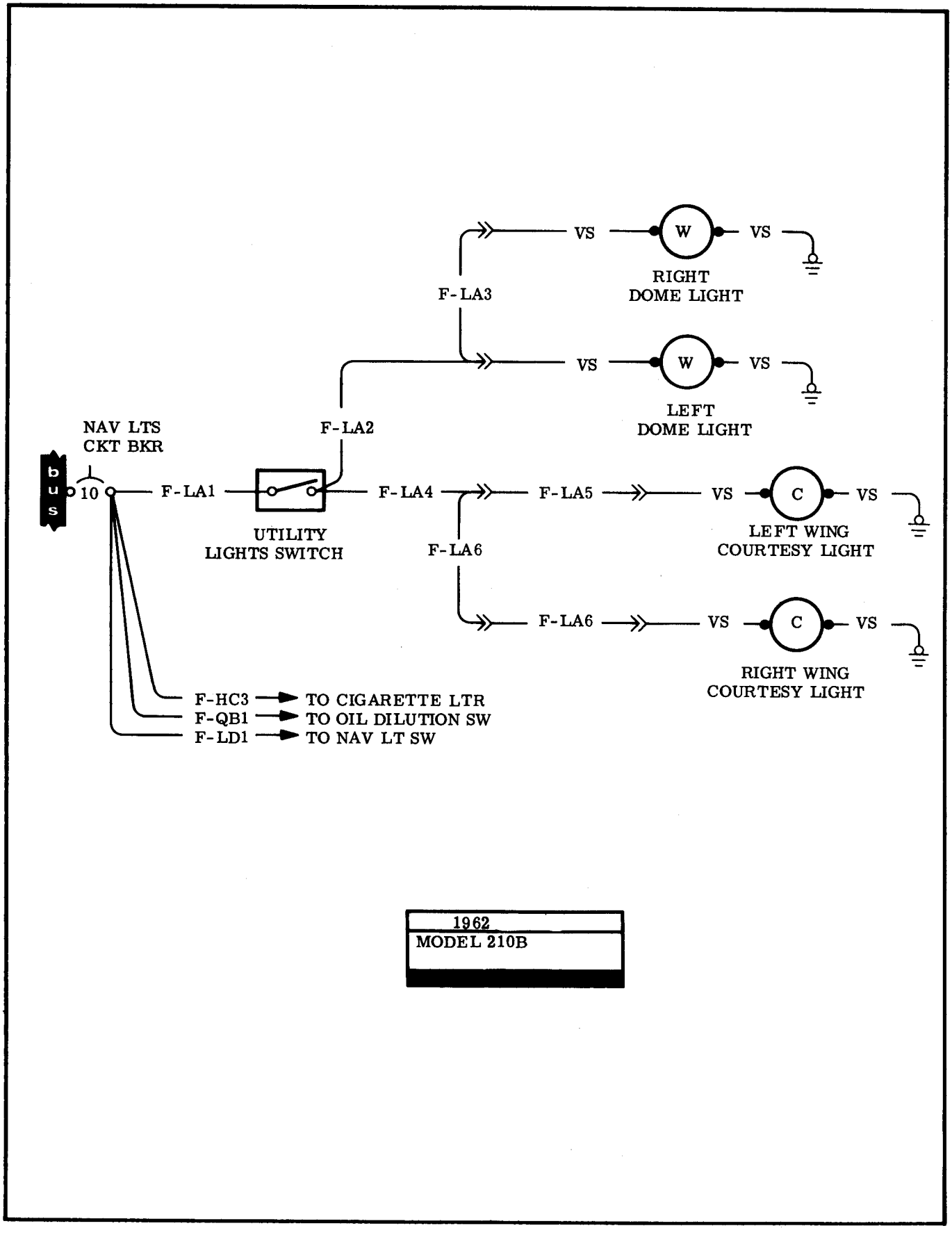


Figure C1-14. Compass Lt., Instrument Lt., Map Lt. and Courtesy Lts. Circuits (Sheet 2 of 2)

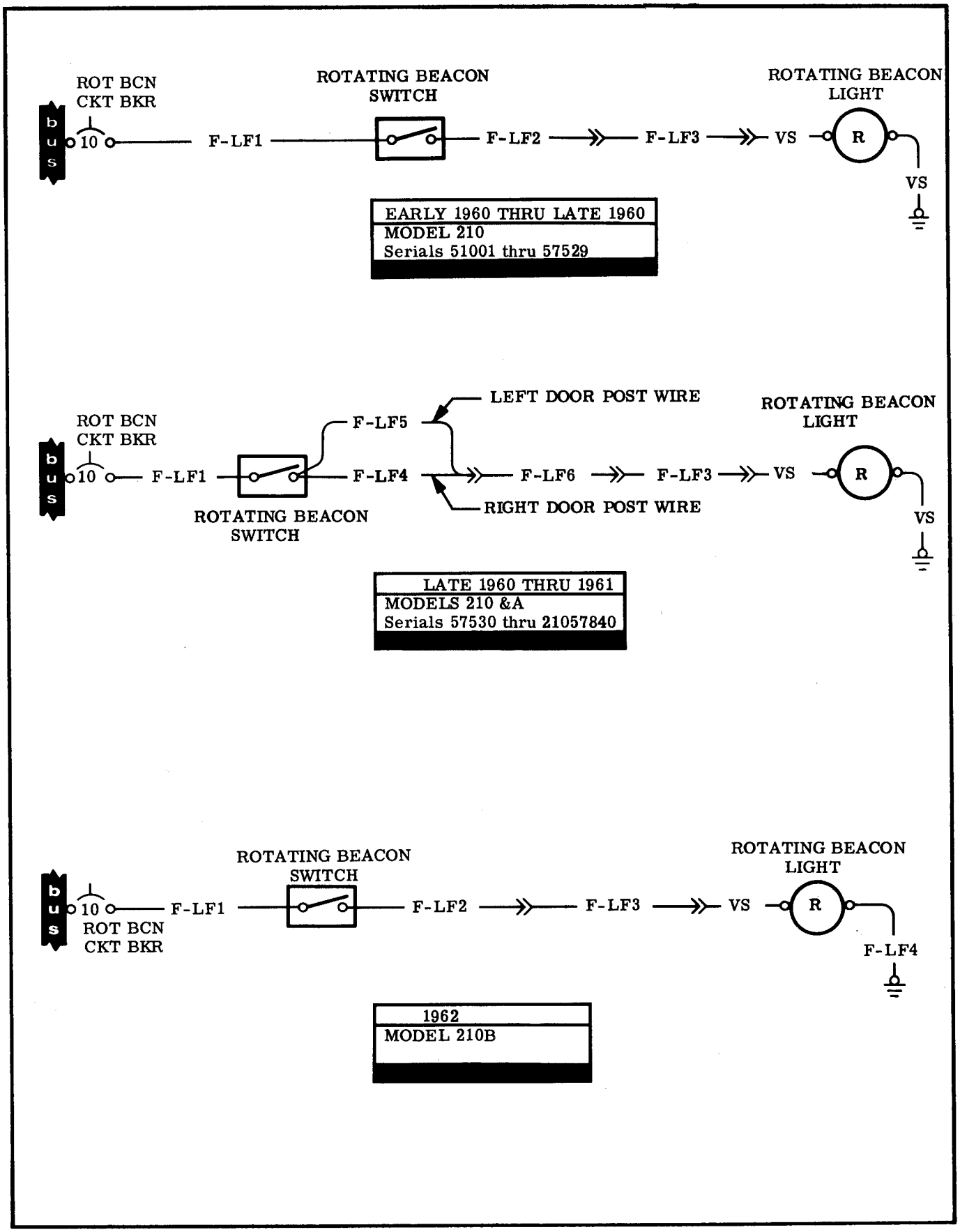


Figure C1-15. Rotating Beacon Circuits

SECTION C2

WIRING DIAGRAMS - 1963 AND ON

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Cessna®

WIRING DIAGRAM

MODEL 210

DWG. NO. 1270405

Serials 21058086 and on

FORM NO. 80-158

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

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2.1	Table of Contents	3-1-65	
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5.0	Ignition	10-18-62	
5.1	Ignition System	8-18-64	A
6.0	Engine Control	10-18-62	
6.1	Starter System	8-18-64	A
7.0	Fuel & Oil	10-18-62	
7.1	Fuel Pump System	4-1-63	Inac.
7.1.1	Fuel Pump System	4-18-64	A
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8.2	Fuel Quantity Indicator	8-18-64	A
9.0	Flight Instruments	11-5-62	
9.1	Turn & Bank and Gyro Horizon Indicator	8-20-64	A
10.0	Other Instruments	10-18-62	
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11.0	Lighting	11-5-64	
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11.2	Instrument Lights	9-3-64	A
11.3	Landing Lights	9-3-64	B
11.4	Navigation Lights	9-3-64	B
11.5	Rotating Beacon (Opt.)	9-3-64	A
11.6	Map Light (Opt.)	9-3-64	A-Inac.
11.6.1	Map Light (Opt.)	9-10-64	
11.7	Post Lighting & Back Lighting (Opt.)	1-27-65	A
11.8	Nav-O-Matic 300 Post Light (Opt.)	11-17-64	Inac.
12.0	Landing Gear	11-5-62	
12.1	Landing Gear Door Control System	9-3-64	A

Cessna.

TITLE: WIRING DIAGRAM--- MODEL 210

DRAWING NO. 1270405

DATE: 4-23-62

PAGE: 2.0

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13.2	Heated Pitot Tube & Heated Stall Warning System	9-10-64	A
14.0	Control Surface	11-5-62	
14.1	Wing Flaps Position Indicator	9-10-64	A-Inac.
14.2	Wing Flaps - Electric, & Flap Position Indicator	9-10-64	A
15.0	Warning & Emergency	11-5-62	
15.1	Stall Warning System (Non-Heated)	9-10-64	A-Inac.
15.1.1	Stall Warning System (Non-Heated)	9-10-64	A
15.2	Gear Warning System	9-10-64	A-Inac.
15.2.1	Gear Warning System	9-10-64	A
16.0	Miscellaneous Section	9-17-63	
16.1	Vertically Adjusting Seat (Opt.)	9-10-64	A

NOTES

1. WIRE CODE DESIGNATIONS PER CES 1100.
2. WIRE CODE APPLICATION AND WIRE LENGTH TOLERANCES PER CES 1015.
(A) 3. "S" SUFFIX ON WIRE GAUGE IN WIRE TABLE DENOTES SHIELDED WIRE. "DS" Suffix on wire gauge in wire table denotes a double-shielded wire per S-1462.
4. NON-SHIELDED WIRES TO BE PER S-1460 white. Wires 10-gauge and larger to be Type II construction.
(B) 5. SHIELDED WIRES TO BE PER S-1461 white, unless designated otherwise by note on the field of the wiring diagram.
6. Part numbers shown in the "equipment table" of the various pages are for reference only and do not constitute a material requirement unless specifically noted on the individual page. Refer to the various equipment installation drawings for verification of part numbers.
7. Equipment part numbers shown on the various pages that are for reference only, (see Note 6,) will not be changed unless it affects wire terminals and fabrication.
8. Vendor codes per S-1400. Vendor codes are shown in parentheses.
9. Wires noted herein as "(opt)" are optional to the standard airplane.
10. All wires not specified as "(opt)" are to be installed as standard equipment. The airplane assembly will specify the additional equipment required for deluxe versions.
11. When "(opt)" is used in the title block of a diagram, all wires shown therein are optional except where noted as "(std)".

Cessna

DRAWN	WJR	TITLE: WIRING DIAGRAM--- MODEL 210	DRAWING NO. 1270405
DATE	4-23-64		
APP'D	RRS HSW and NMC	REV: B	PAGE: 3.0

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

D. C. POWER SECTION

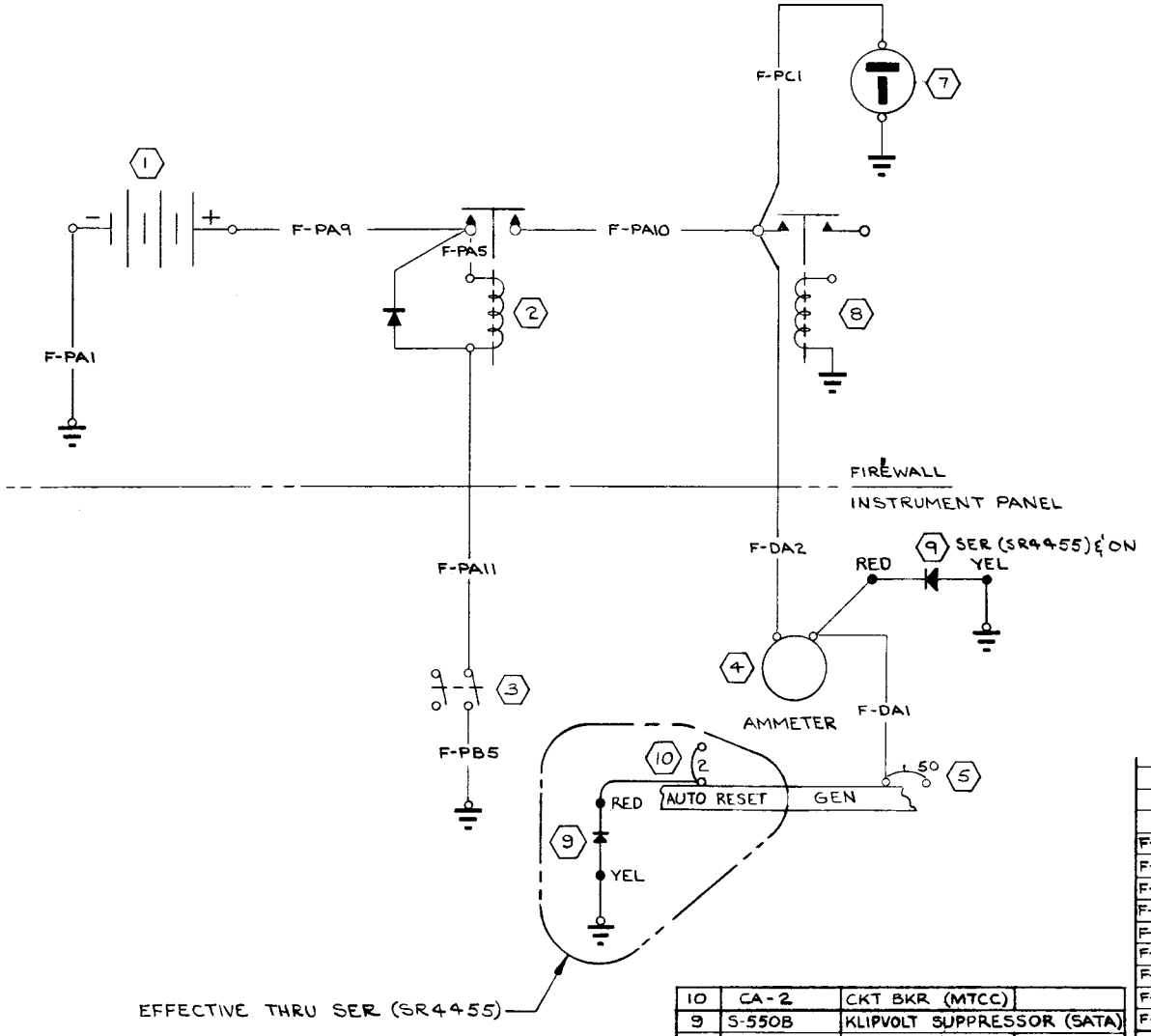
Cessna.

DRAWN	RIDDER	TITLE: WIRING DIAGRAM--- MODEL 210	DRAWING NO. 1270405
DATE	9-10-62		
APP'D	RRS WMC	REV:	PAGE: 4.0

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

FORM NO. 80-162

CHG LET	REVISION	BY / DATE	CHK / APPD
A	ADD S-550B KLIPVOLT SUPPRESSOR S-1360-50 WAS S-1232-50 1270461-1 WAS 1270429-1 1213505-2 WAS 0712602-1 (SR 4478)	GLW 12-30-63	DRS AAG JAM
B	ADDED LIMITING SERIALS TO FIELD; REMOVED 1270461-1 BUS BAR FROM E/T; ADD WIRE LENGTHS TO W/T; C669502-0104 WAS 1213505-2 (SR4455)	WJR 6/16/64	DRS JAM WJW



F-DA2	8		58	S-1367-4-10	S-1367-4-14			
F-DA1	8		42	S-1367-4-10	S-1367-4-8			
F-PC1	2		55	S-1367-7-14	S-1368-7-14	1270434	(OPT)	
F-PB5	18			S-1367-1-6	S-1367-1-8			
F-PA11	18		141	S-1367-1-6	S-1367-1-6			
F-PA10	2		21	S-1367-7-14	S-1367-7-12			
F-PA9	2		21	S-1367-7-12	S-1367-7-13			
F-PA5	18			S-1367-1-6	S-1367-1-12			
F-PA1	2		14	S-1367-7-12	S-1367-7-13			
WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS	

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
10	CA-2	CKT BKR (MTCC)	
9	S-550B	KLIPVOLT SUPPRESSOR (SATA)	
8	0750027-1	START. SOLENOID	
7	AN2552-3A	RECEPTACLE	
6			
5	S-1360-50	CKT BKR	
4	C669502-0104	INST CLUSTER KIT	
3	S-1159-1-1	SWITCH-MASTER	
2	0712603-2	CONTACTOR BAT.	
1	0712605-1	BATTERY	

EQUIPMENT TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION, WICHITA, KANSAS

	NAME	DATE
DRAWN	RIDDER	9-10-62
GROUP	[illegible]	10-15-62
CHECK	R Stuck	10-12-62
PROJ	[illegible]	10-17-62

TITLE: WIRING DIAGRAM — BATTERY & EXTERNAL POWER SYSTEMS

Cessna.

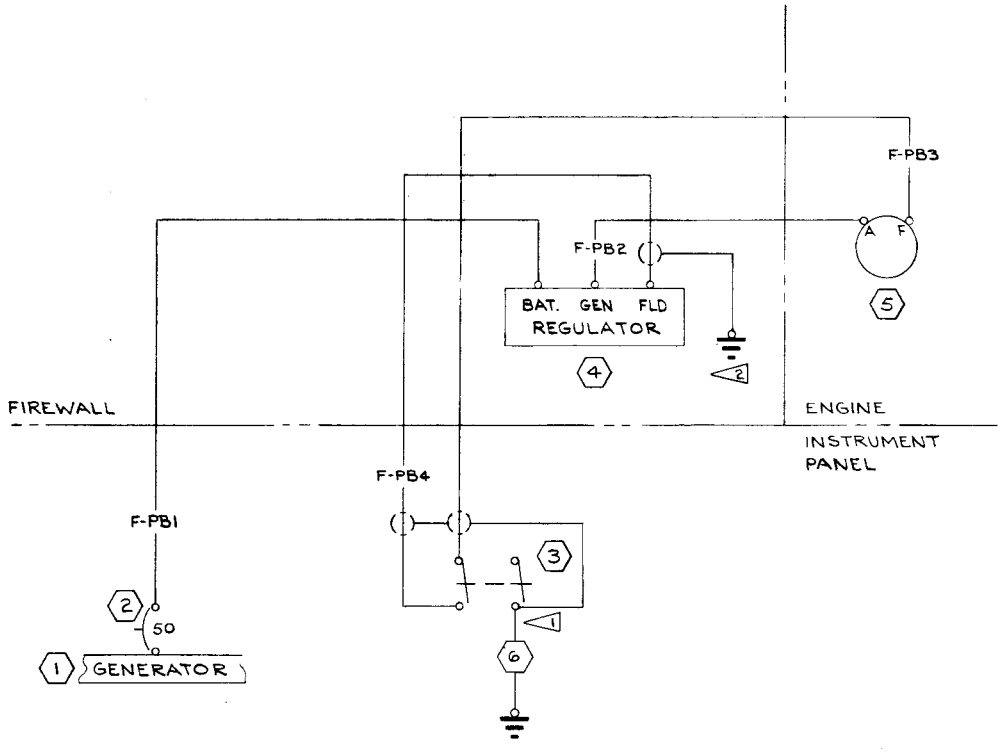
DWG NO. 1270405

SUPERSEDED BY	SUPERSEDES	MODEL: 210	REV: B	PAGE: 4-1

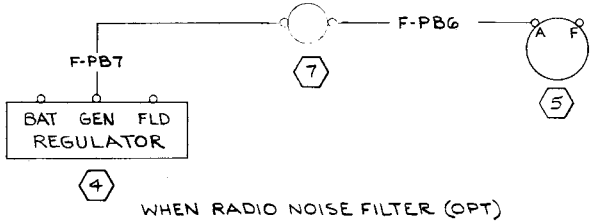
FORM NO. 80-161

CHG LET	REVISION	BY / DATE	CHK / APPD

NOTES:
1. S-1367-2-6 TERMINAL ON SHIELDS.
2. S-1367-2-12 TERMINAL ON SHIELDS.
3. PART OF 1250400 ENGINE INSTL.



Practice SER 21058511 & ON
W. J. R. 3-26-62
RRS



WHEN RADIO NOISE FILTER (OPT) IS REQD, REPLACE F-PB2 AS SHOWN

ITEM NO	PART NO	DESCRIPTION	INSTALLED ON
7	145329	NOISE FILTER (SPR)	
6	F-PB5	WIRE	
5	3	GENERATOR	
4	0413205-11	REGULATOR	
3	S-1159-1-1	SWITCH-MASTER	
2	S-1360-50	CIRCUIT BREAKER	
1	1270461-1	BUS BAR	

EQUIPMENT TABLE

WIRE CODE NO	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS
F-PB7	8			S-1367-4-10	S-1367-4-10	1200418	(OPT)
F-PB6	8			S-1367-4-12	S-1367-4-10	1200418	(OPT)
F-PB4	18S			S-1367-1-6	S-1367-1-10		
F-PB3	18S			S-1367-1-6	S-1367-1-12		
F-PB2	8			S-1367-4-12	S-1367-4-10		
F-PB1	8			S-1367-4-8	S-1367-4-10		

WIRE TABLE

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIVISION, WICHITA, KANSAS

	NAME	DATE
DRAWN	RIDDER	9-10-62
GROUP	Gal Mayo	10-15-62
CHECK	P. Stuck	10-12-62
PROJ	N. McCarter	10-17-62

TITLE: WIRING DIAGRAM — GENERATOR SYSTEM

Cessna.

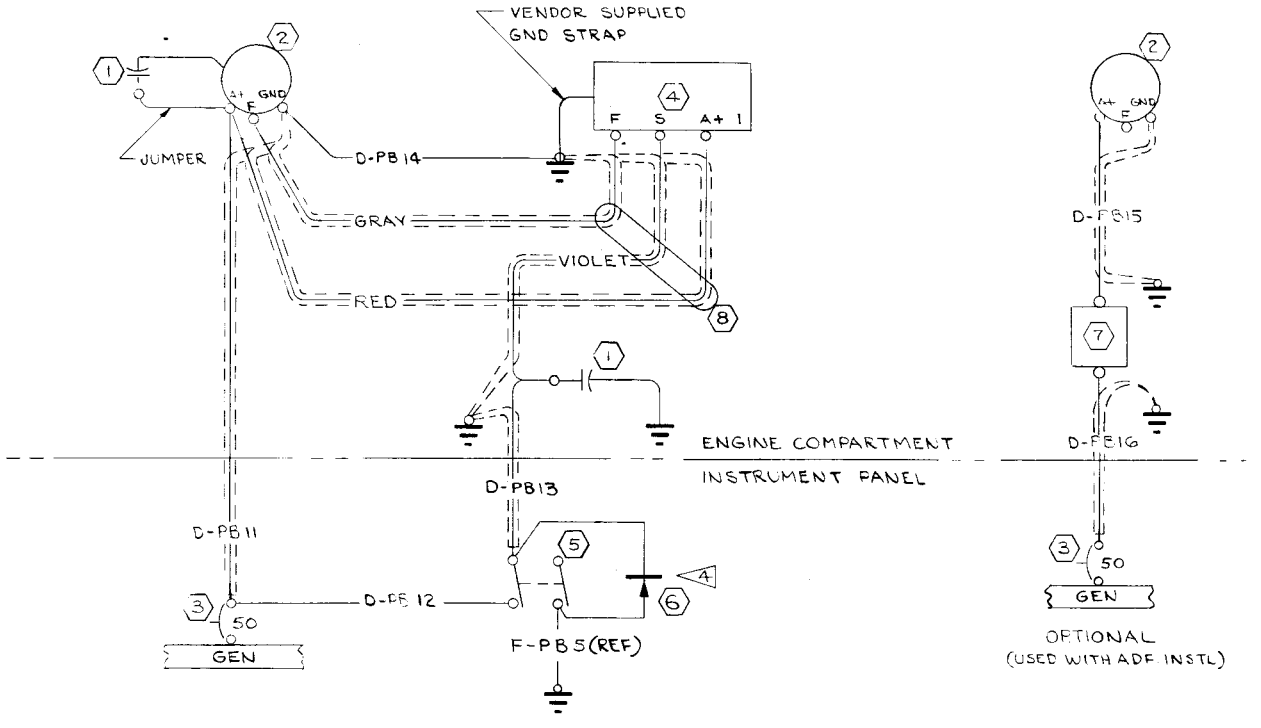
DWG NO: 1270405

SUPERSEDED BY 1270405 PAGE 4.3 | SUPERSEDES | MODEL: 210 | REV: | PAGE: 4.2

FORM NO. 80-161

(SR4455)

CHG LET	REVISION	BY / DATE	CHK / APPD
A	BY REV: CHANGED WIRE CODE D-PB WAS D-DP (SR4455)	RJS R 5-7-64	RRS



STANDARD

NOTES:

1. TERMINALS C3XB-14462A & B-14463 ARE (FOR) PART NUMBERS.
2. "D" PREFIX USED ON THIS DRAWING INSTEAD OF "F" BECAUSE WIRES ARE SAME AS THOSE USED IN MODEL 182. THIS DIAGRAM IS SCHEMATALLY IDENTICAL TO 0770610 PAGE 4.4 AND IS FOR REF ONLY.

3 > 8 GAUGE SHIELDED WIRE MATERIAL PER S-1534.

4 > OBSERVE POLARITY SYMBOL ON DIODE ASSY WHEN INSTALLING ON SWITCH TERMINALS OR DIODE WILL FAIL WHEN SYSTEM IS ENERGIZED

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
8	C4-FF-10A-568A	PLUG ASSY (FOR)	
7	145329	NOISE FILTER (SPR)	
6	0770719-1	DIODE ASSY	
5	S-1159-1-1	SWITCH - MASTER	
4	0750216-1	REGULATOR ASSY	
3	S-1360-50	CIRCUIT BREAKER	
2	0750217-1	ALTERNATOR ASSY	
1	0770038-2	FILTER	

EQUIPMENT TABLE

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS
JUMPER	18			S-1367-1-6	S-1367-1-12	1250206	
D-FB16	8S	3		S-1367-4-10 S-1367-3-8	S-1367-4-6	(OPT)	
D-FB15	8S	3		(3XB-14462A S-1367-3-8	S-1367-4-10 S-1367-3-8	(OPT)	
D-FB14	10			B-14463	S-1367-3-12		
D-FB13	18S			S-1367-1-6	S-1367-1-6 S-1367-3-8		
D-FB12	18			S-1367-1-6	S-1367-1-6		
D-FB11	8S	3		(3XB-14462A S-1367-3-6	S-1367-4-6		

WIRE TABLE

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIVISION, WICHITA, KANSAS

	NAME	DATE
DRAWN	RIDDER	3-26-64
GROUP	[illegible]	4-30-64
CHECK	R. Stick	4-28-64
PROJ	W. McCarter	5-1-64

TITLE: WIRING DIAGRAM — ALTERNATOR SYSTEM, 52 AMP

Cessna.

DWG NO. 1270405

SUPERSEDED BY

SUPERSEDES 1270905 PAGE 4.2

MODEL: 210

REV: A

PAGE: 4.3

FORM NO. 80-161

IGNITION SECTION

Cessna.

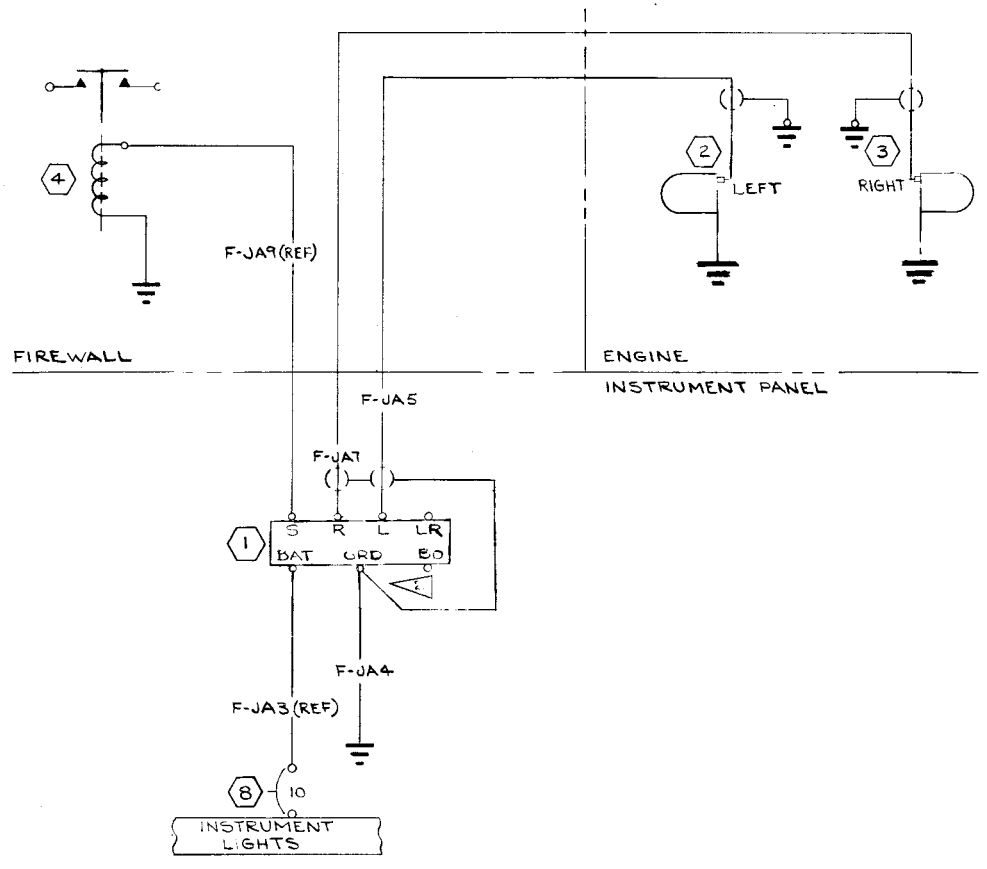
			DRAWING NO.
DRAWN	RIDDER	TITLE: WIRING DIAGRAM--- MODEL 210	1270405
DATE	9-10-62		
APP'D	RRS Hm[e]	REV:	PAGE: 5.0
CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.			

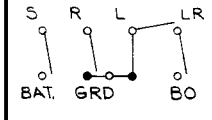
FORM NO. 80-163

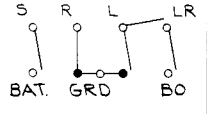
NOTES:

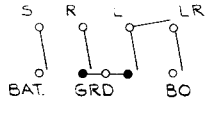
1. SHORTING BAR BETWEEN "R" AND UNMARKED TERMINAL ADJACENT TO IT IS NOT USED FOR THIS CIRCUIT.
2. TERMINATE SHIELDS ON F-JA5 & F-JA7 WIRES AT THE SWITCH WITH S-1367-2-6 TERMINALS & CONNECT TO "GND" TERMINAL ON SWITCH.
3. S-1367-1-10 TERMINAL ON HOT LEAD, S-1367-3-10 ON SHIELD.

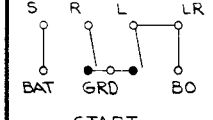
CHG LET	REVISION	BY / DATE	CHK / APPD
A	REROUTE F-JA9 TO COIL TERMINAL; S-1360-10 WAS S-1232-10; REMOVED 1270029-1 BUS BAR, F-JA3 & F-JA9 FROM E/T; ADDED WIRE LENGTHS TO W/T	WJR 6-25-64	RRS 7/1/64

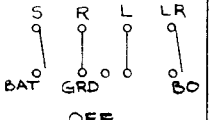












DIAGRAMS SHOW NOT ACTUAL SWITCH BUT CIRCUIT CONTINUITY AT EACH POSITION.

o EXTERNALLY ACCESSIBLE TERMINAL.

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
8	S-1360-10	CIRCUIT BREAKER	
7			
6			
5			
4	0750027-1	START. SOLENOID	
3	SLICK #662	RIGHT MAGNETO	
2	SLICK #662	LEFT MAGNETO	
1	0713129-1	SWITCH, MAG	

EQUIPMENT TABLE

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS			SERIALS
F-JA7	18-DS		65	S-1367-1-6	3	2	
F-JA5	18-DS		65	S-1367-1-6	3	2	
F-JA4	18		9	S-1367-1-6	S-1367-1-8		

WIRE TABLE

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIVISION, WICHITA, KANSAS

	NAME	DATE
DRAWN	RIODER	9-11-62
GROUP	M	10-15-62
CHECK	R Stuck	10 5 62
PROJ	W. McCabe	10-12-62

TITLE: WIRING DIAGRAM — IGNITION SYSTEM

Cessna.

DWG NO. 1270405

SUPERSEDED BY	SUPERSEDES	MODEL:	REV:	PAGE:
		210	A	5.1

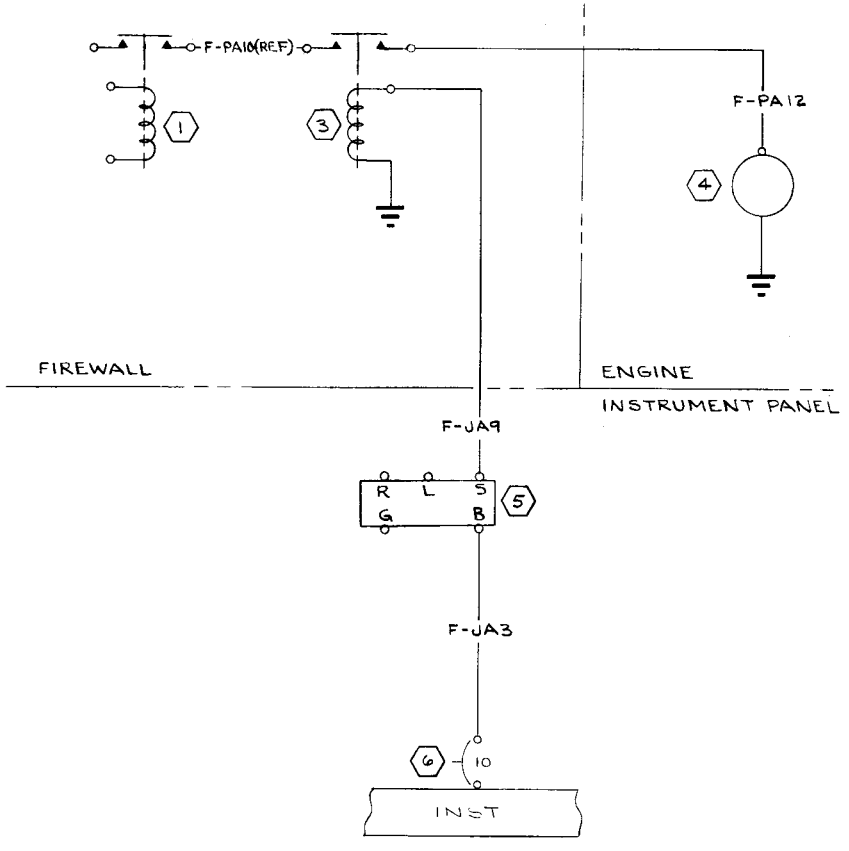
FORM NO. 80-161

ENGINE CONTROL SECTION

Cessna.

			DRAWING NO.
DRAWN	RIDDER	TITLE: WIRING DIAGRAM--- MODEL 210	1270405
DATE	9-11-62		
APP'D	RRS	REV:	PAGE: 6.0

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.



NOTES:

1. PART OF 1250400 ENGINE INSTALLATION.

CHG LET	REVISION	BY DATE	CHK APPD
A	INST WAS INSTRUMENT LIGHTS REMOVED 1270429-1 BUS BAR FROM E/T. S-1360-10 WAS S-1232-10 REMOVED F-PA10 FROM E/T; ADDED WIRE LENGTHS TO W/T	WJR 6-29-66	RPS JMW HHW

ITEM NO	PART NO	DESCRIPTION	INSTALLED ON
7			
6	S-1360-10	CIRCUIT BREAKER	
5	0713129-1	SWITCH	
4	1	STARTER	
3	0750027-1	START. SOLENOID	
2			
1	0712603-2	CONTACTOR BAT.	

EQUIPMENT TABLE

WIRE CODE NO	GA	MATERIAL	LG	TERMINALS		SERIALS
F-PA12	2		12	S-1367-7-14	S-1367-7-14	
F-JA9	18		89	S-1367-1-6	S-1367-1-10	
F-JA3	18		10	S-1367-1-6	S-1367-1-8	

WIRE TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION, WICHITA, KANSAS

	NAME	DATE
DRAWN	RIDDER	9-11-62
GROUP		10-12-62
CHECK		10-12-62
PROJ		10 12 62

TITLE: WIRING DIAGRAM — STARTER SYSTEM

Cessna.

DWG NO. 1270405

SUPERSEDES ID: | SUPERSEDES: | MODEL: 210 | REV. A | PAGE: 6.1

FORM NO. 80-161

FUEL AND OIL SECTION

Cessna.

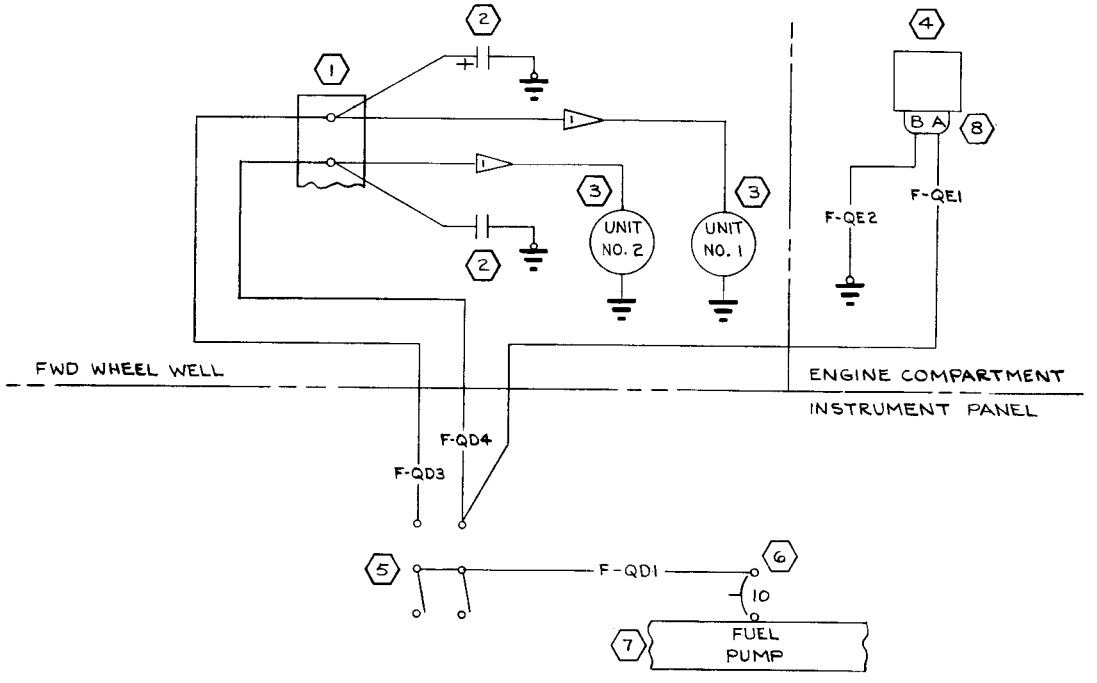
			DRAWING NO.
DRAWN	RIDDER	TITLE: WIRING DIAGRAM--- MODEL 210	1270405
DATE	9-11-62		
APP'D	ERS NMC	REV:	PAGE: 7.0

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

FORM NO. 80-165

NOTES:
1. DENOTES PART OF 1216012 FUEL PUMP.

CHG LET	REVISION	BY / DATE	CHK / APPD



Mactul
SERIAL 210-58221 & ON
3-25-63
Gw Myers
NMC

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS			SERIALS
F-QE2	18			S-1367-1-6	SOLDER		
F-QE1	18			S-1367-1-6	SOLDER		
F-QD4	18			S-1367-1-6	S-1367-1-6		
F-QD3	18			S-1367-1-6	S-1367-1-6		
F-QD1	18			S-1367-1-6	S-1367-1-8		

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
8	MS3106-10SL-4S	PLUG	
7	1270429-1	BUS BAR	
6	S-1232-10	CIRCUIT BREAKER	
5	S-1160-1-1	SWITCH	
4	A76	VALVE (HFP)	
3	1216012-1	FUEL PUMP	
2	30D192A1	CAPACITOR	
1	AN3436-2-6	TERMINAL BLOCK	

EQUIPMENT TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	RIDDER	9-12-62
GROUP	Ted Mark	10-12-62
CHECK	C. Stuck	10-5-62
PROJ	H. McCain	10-12-62

TITLE: WIRING DIAGRAM — FUEL PUMP SYSTEM

Cessna.

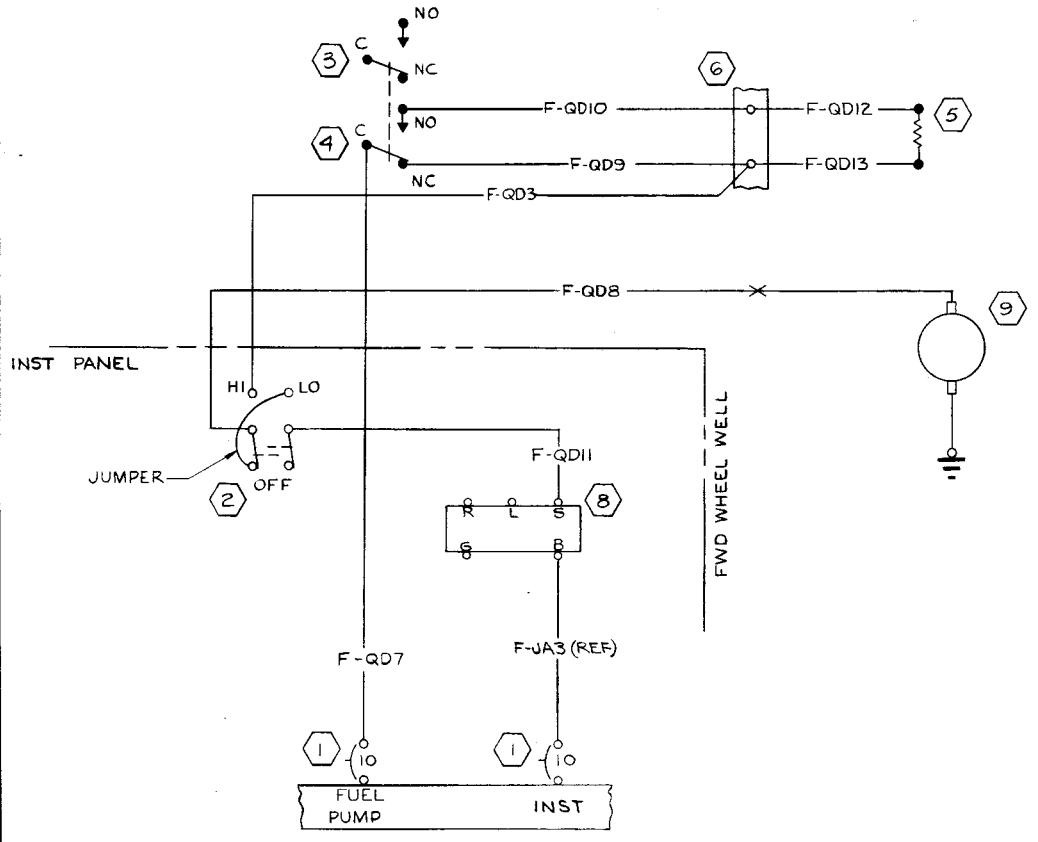
DWG NO: 1270405

SUPERSEDED BY:	SUPERSEDES:	MODEL:	REV:	PAGE:
1270405 PAGE 7.1.1		210		7.1

FORM NO. 80-161

(SR 4039-9)

CHG LET	REVISION	BY / DATE	CHK / APPD
A	S-1160-1-2 WAS S-1160-1-1; INST WAS INST LIGHTS; REMOVED 1270461-1 BUS BAR & 1270405-JA3 FROM E/T; ADDED WIRE LENGTHS TO W/T	WJR 6-30-64	RRS TMF HLW



ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
11			
10			
9	4140-00-1	FUEL PUMP (DUKA)	
8	0713129-1	SWITCH, MAG	
7			
6	AN3436-2-6	TERMINAL BLOCK	
5	MOR-20-2	RESISTOR (TRTA)	
4	USM5-B	SWITCH, FUEL PUMP	(UMX)
3	USMW76-B	SWITCH, T-SW	(UMX)
2	S-1160-1-2	SWITCH	
1	S-1360-10	CIRCUIT BREAKER	

EQUIPMENT TABLE

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		SERIALS
F-QD3	18		100	S-1367-1-6	S-1367-1-6	
F-QD13	18		6	S-1367-1-6	SOLDER	
F-QD12	18		5	S-1367-1-6	SOLDER	
F-QD11	18		8	S-1367-1-6	S-1367-1-8	
F-QD10	18		120	S-1367-1-6	SOLDER	
F-QD9	18		120	S-1367-1-6	SOLDER	
F-QD8	18		100	S-1367-1-6	S-1370-1	
F-QD7	18		100	SOLDER	S-1367-1-6	

WIRE TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION WICHITA, KANSAS

	NAME	DATE
DRAWN	G WOOD	1-17-63
GROUP		3-26-63
CHECK	R Stuck	3-28-63
PROJ	N. McCarta	3-29-63

TITLE: WIRING DIAGRAM — FUEL PUMP SYSTEM

Cessna.

DWG NO: 1270405

SUPERSEDED BY:

SUPERSEDES 1270405 PAGE 7.1

MODEL: 210

REV: A

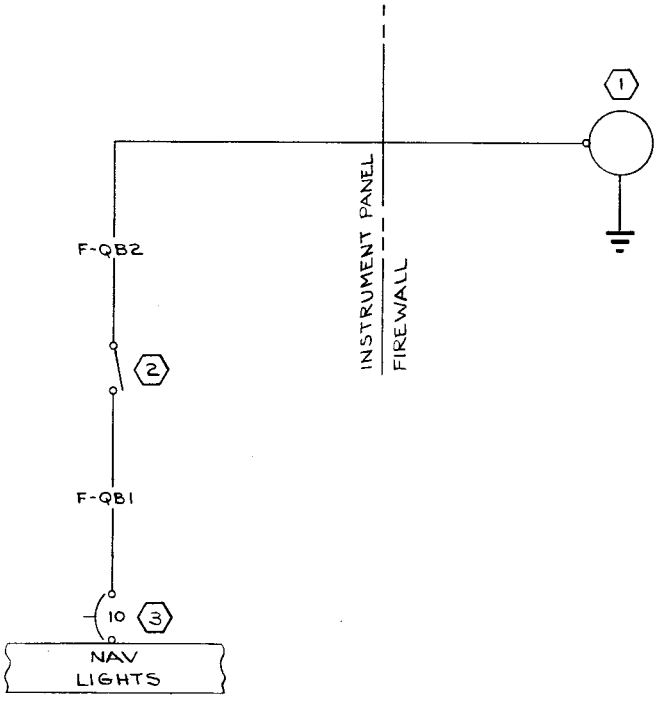
PAGE: 7.1.1

FORM NO. 80-161

NOTES:

1. WIRES MADE PER THIS DRAWING ARE USED ON MODELS 205 & P206 U206. CHANGES MADE TO THIS DRAWING SHOULD ALSO BE MADE TO WIRING DIAGRAM ON 1270625 PAGE 7.2.

CHG LET	REVISION	BY DATE	CHK APPD
A	S-1360-10 CKT BKR WAS S-1232-10; 1270961-1 BUS BAR WAS 1270429-1; ADDED NOTE 2.; 1200687 N/A WAS 1200437	WJR 11-1-63	RRS
B	REMOVED 1270461-1 BUS BAR FROM E/T; ADDED WIRE LENGTHS TO W/T	WJR 7-1-64	RRS TM



WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS
F-QB2	18		60	S-1367-1-6	S-1367-1-10	1200687	
F-QB1	18		7	S-1367-1-6	S-1367-1-8	1200687	

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
4			
3	S-1360-10	CIRCUIT BREAKER	
2	S-1158-1-1	SWITCH	
1	AN4078-1	OIL DIL VALVE	

EQUIPMENT TABLE

CESSNA AIRCRAFT CO COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	RIDDER	9-12-62
GROUP	[illegible]	10-12-62
CHECK	R. Stuck	10-5-62
PROJ	N. McCarter	10-12-62

TITLE: WIRING DIAGRAM — OIL DILUTION SYSTEM (OPT)

Cessna.

DWG NO: 1270405

SUPERSEDED BY: | SUPERSEDES: | MODEL: 210 | REV: B | PAGE: 7.2

FORM NO. 80-161

ENGINE INSTRUMENTS SECTION

Cessna.

			DRAWING NO.
DRAWN	H WISE	TITLE: WIRING DIAGRAM--- MODEL 210	1270405
DATE	8-27-62		
APP'D	RRS NMC	REV:	PAGE: 8.0

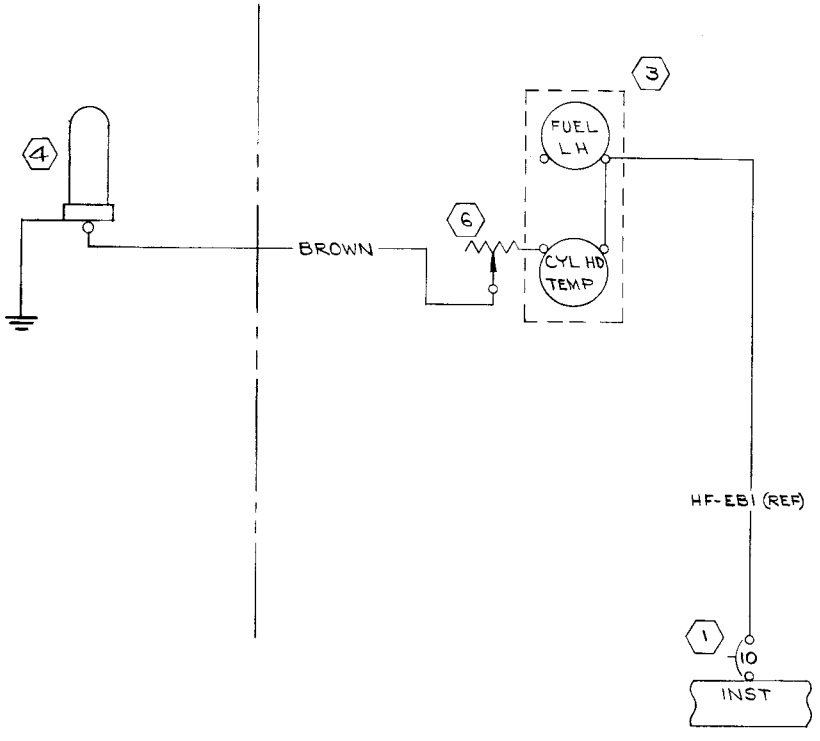
CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

FORM NO. 80-166

(SR 3971)

NOTES:
1. PART NO. 110691 (PRSO) COLOR: BROWN
2. AT GIVEN SERIALS, MODEL 210 TEMP BULB MOVES FROM NO. 1 CYL TO NO. 2 CYL.

CHG LET	REVISION	BY / DATE	CHK / APPD
A	ADDED NOTE 1. MATL WAS PER MIL-W-5086A, TYPE T 1213505-2 WAS 0713602-1 S-1360-10 WAS S-1232-10 S-1372-1 WAS 0750603-1 1270461-1 WAS 1270489-1 INFT WAS INST LIGHTS 1270405-EB1 WAS 0700603-EB1 (SR4039)	HLW 8-16-63	RRS
B	1 WAS MATL PER MIL-W-16878D TYPE "E" 200°C GRADE EXTRUDED TEFLON DILECTRIC. REMOVED 1 FROM H-EC1; INACTIVATED H-EC1 & ADDED BROWN WIRE; ADDED WIRE LENGTHS & 2; REMOVED 1270461-1 BUS BAR & 1270405-EB1 FROM E/T: C669502-0104 WAS 1213505-2 (SR4455)	WJR 7-6-64	RRS



WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS			SERIALS
BROWN	18	1		S-1367-1-8	S-1367-1-4	NO. 2 CYL 2	(SR4455) & ON
BROWN	18	1	93	S-1367-1-8	S-1367-1-4	NO. 1 CYL 2	21058231 THRU (SR4455)
F-EC1	18		93	S-1367-1-8	S-1367-1-4		INACTIVE 21058231 & ON

WIRE TABLE

ITEM NO.	PART NO.	DESCRIPTION	INSTALLED ON
6	0713602-4	POTENTIOMETER	
5			
4	S-1372-1	BULB, CYL HD TEMP	
3	C669502-0104	INST CLUSTER KIT	
2			
1	S-1360-10	CIRCUIT BREAKER	

EQUIPMENT TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION, WICHITA KANSAS

	NAME	DATE
DRAWN	H. WISE	8-27-62
GROUP	C.V. Martin	9.28.62
CHECK	R. Stuck	9-5-62
PROJ		

TITLE: WIRING DIAGRAM — CYLINDER HEAD TEMPERATURE

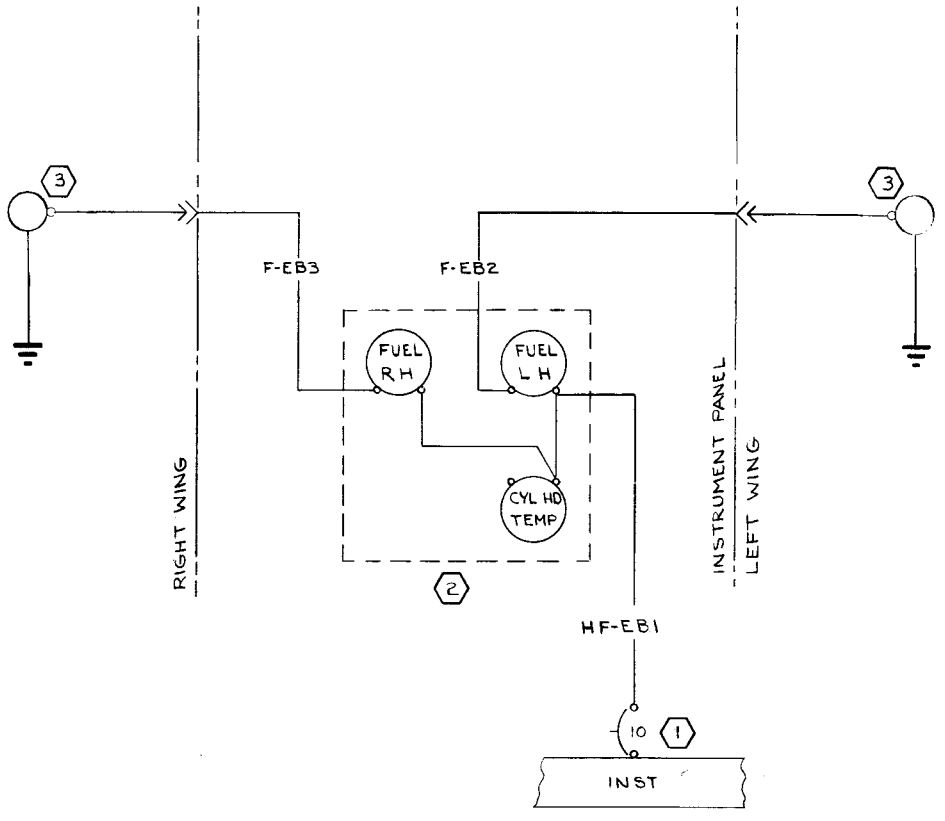
Cessna.

DWG NO: 1270405

SUPERSEDED BY | SUPERSEDES | MODEL: 210 | REV: B | PAGE: 8.1

FORM NO. 80-161

CHG LET	REVISION	BY / DATE	CHK / APPD
A	ADDED WIRE LENGTHS TO W/T; HF-EB1 WIRE WAS F-EB1; S-1360-10 WAS S-1232-10; CG69502-0104 WAS 0713602-1; REMOVED 1270929-1 BUS BAR FROM E/T; INST WAS INST LIGHTS	WJR 7-6-64	RLS JM HW



WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS			SERIALS
HF-EB1	18		50	S-1367-1-8	S-1367-1-8		
F-EB3	18		88	S-1367-1-10	S-341-2		
F-EB2	18		120	S-1367-1-10	S-341-2		

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
5			
4			
3	0726110-1	XMTR, FUEL LEVEL	
2	CG669502-0104	INST CLUSTER	KIT
1	S-1360-10	CIRCUIT BREAKER	

EQUIPMENT TABLE

CESSNA AIRCRAFT CO COMMERCIAL AIRCRAFT DIVISION WICHITA, KANSAS

	NAME	DATE
DRAWN	RIDDER	9-13-62
GROUP		10-15-62
CHECK		10-5-62
PROJ		10-17-62

TITLE: WIRING DIAGRAM — FUEL QUANTITY INDICATOR

Cessna

DWG NO: 1270405

SUPERSEDED BY: | SUPERSEDES: | MODEL: 210 | REV: A | PAGE: 8.2

FORM NO. 80-161

FLIGHT INSTRUMENTS SECTION

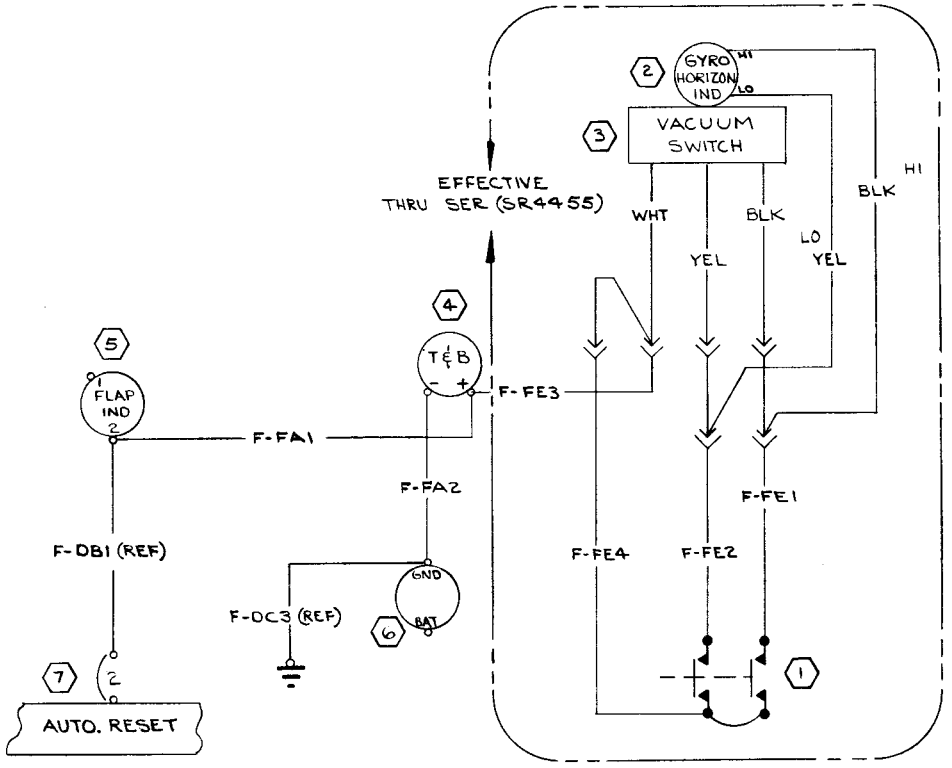
Cessna.

DRAWN	RIDDER	TITLE: WIRING DIAGRAM--- MODEL 210	DRAWING NO. 1270405
DATE	9-14-62		
APP'D	RRS NHC	REV:	PAGE: 9.0

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

FORM NO. 30-167

CHG LET	REVISION	BY / DATE	CHK / APPD
A	ADDED LIMITING SERIALS TO FIELD (INACTIVATED WIRES F-FE1 THRU F-FE4; REMOVED F-DB1 & 1270429-1 FROM E/T; ADDED WIRE LENGTHS TO W/T; F-FA2 WAS GROUNDED TO AIR FRAME; ADDED CLOCK TO E/T & FIELD (SR 4455)	WJR 7-19-64	RRS JM WHO



ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
8			
7	CA-2	CKT BKR (MTCC)	
6	S-1317N1	CLOCK	
5	S-1318-1	INDICATOR, FLAP POS	
4	S-1302N1	INDICATOR, T & B	
3	S-1365-1	SWITCH, VACUUM	
2	S-1326N1	IND, GYRO HORIZON	
1	S-1284-1	SWITCH	

EQUIPMENT TABLE

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS			SERIALS
F-FE4	20		6	S-341-2	SOLDER	0713705	(OPT) Inactive SER (SR4455) & ON
F-FE3	20		8	S-341-2	S-1367-1-8	0713705	(OPT) Inactive SER (SR4455) & ON
F-FE2	20		6	S-341-2	SOLDER	0713705	(OPT) Inactive SER (SR4455) & ON
F-FE1	20		6	S-341-2	SOLDER	0713705	(OPT) Inactive SER (SR4455) & ON
F-FA2	18		16	S-1367-1-8	S-1367-1-8		
F-FA1	18		12	S-1367-1-8	S-1367-1-10		

WIRE TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION, WICHITA, KANSAS

	NAME	DATE
DRAWN	RIDDER	9-14-62
GROUP		10-29-62
CHECK		10-26-62
PROJ	W. McCarter	11-2-62

TITLE: WIRING DIAGRAM — TURN & BANK AND GYRO HORIZON INDICATOR

Cessna.

DWG NO: 1270405

SUPERSEDED BY:	SUPERSEDES	MODEL: 210	REV: A	PAGE: 9.1

FORM NO. 80-161

OTHER INSTRUMENTS SECTION

Cessna.

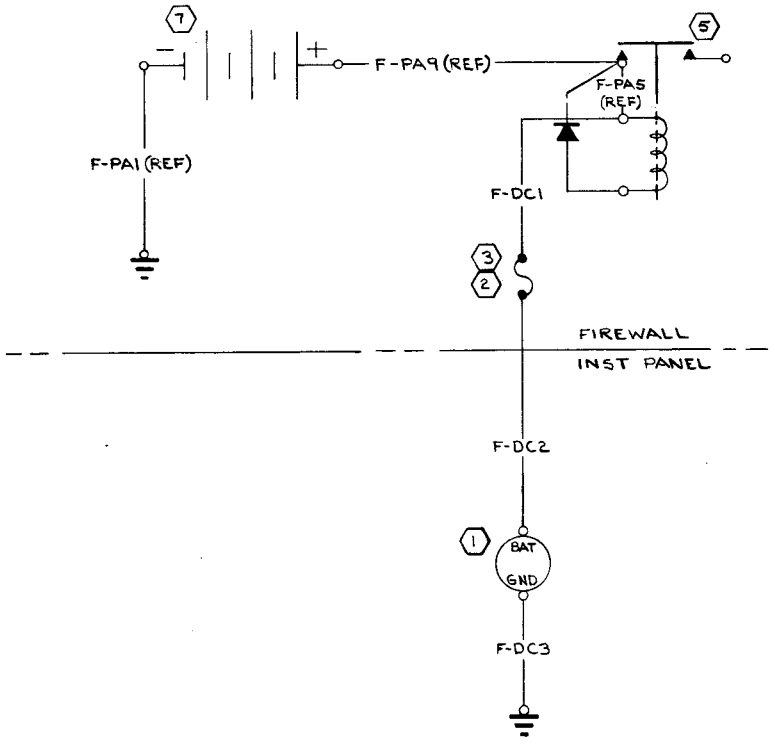
			DRAWING NO.
DRAWN	RIDDER	TITLE: WIRING DIAGRAM--- MODEL 210	1270405
DATE	10-8-62		
APP'D	RRS	REV:	PAGE: 10.0

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

FORM NO. 80-168

(SR4021)

CHG LET	REVISION	BY / DATE	CHK / APPD
A	ADDED WIRE LENGTHS TO W/T; REMOVED F-PA1, F-PA5 & F-PA9 FROM E/T	WJR 7-16-64	RES and JM HLW



ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
8			
7	0712605-1	BATTERY	
6			
5	0712603-2	CONTACTOR BAT.	
4			
3	S-1091-1	FUSE	
2	S-1090-22	FUSEHOLDER	
1	S-1317N1	CLOCK ASSY	

EQUIPMENT TABLE

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS			SERIALS
F-DC3	18		11	S-1367-1-6	S-1367-1-8		
F-DC2	18		120	S-1367-1-6	SOLDER		
F-DC1	18		8	S-1367-1-6	SOLDER		

WIRE TABLE

CESSNA AIRCRAFT CO COMMERCIAL AIRCRAFT DIVISION, WICHITA, KANSAS

	NAME	DATE
DRAWN	RIDER	10-8-62
GROUP	JM	12-12
CHECK	R. Stucki	10-11-62
PROJ	W. McCarter	10-12-62

TITLE: WIRING DIAGRAM — CLOCK

Cessna.

DWG NO: 1270405

SUPERSEDED BY:	SUPERSEDES:	MODEL: 210	REV: A	PAGE: 10.1

FORM NO. 80-161

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LIGHTING SECTION

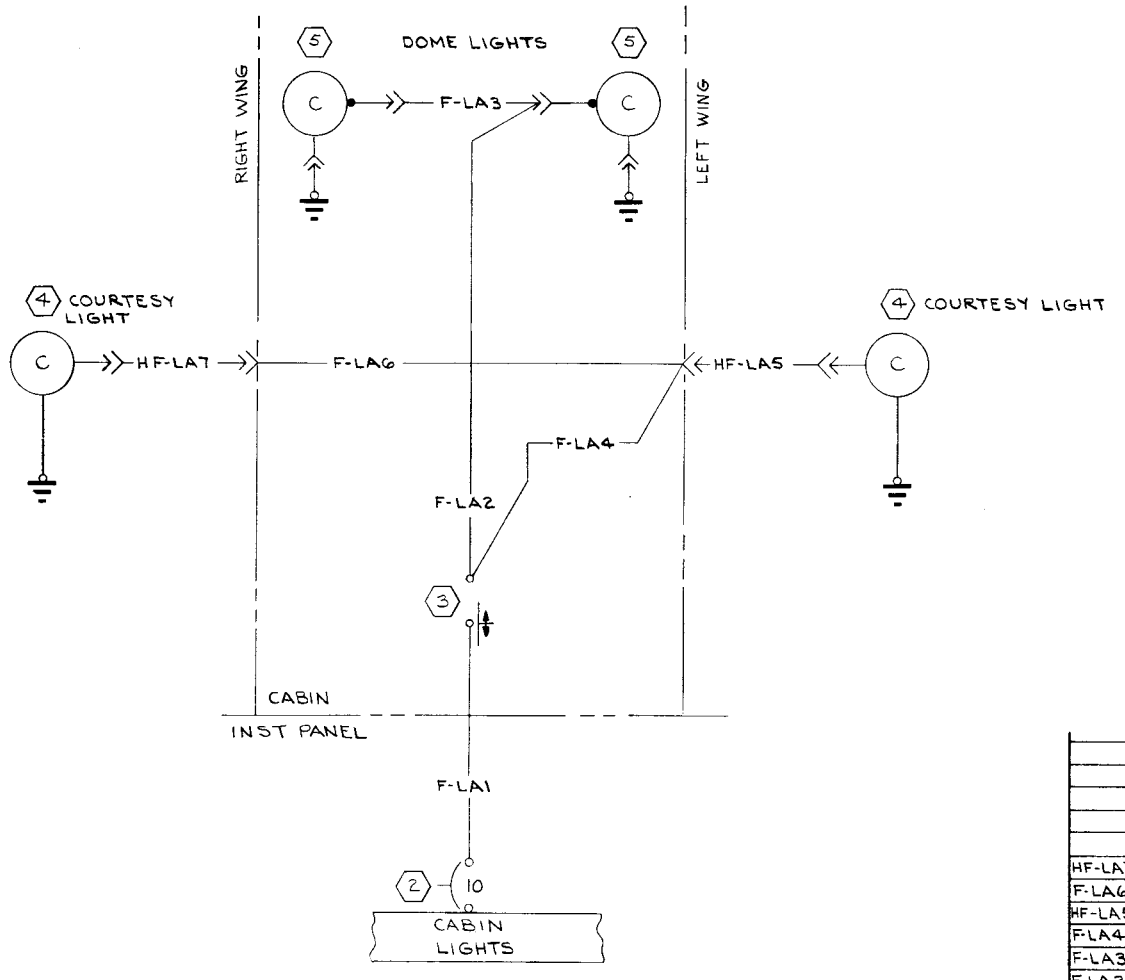
Cessna.

DRAWN	RIDDER	TITLE: WIRING DIAGRAM--- MODEL 210	DRAWING NO. 1270405
DATE	9-18-62		
APP'D	RRS Nm²	REV:	PAGE: 11.0

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

FORM NO. 80-169

CHG LET	REVISION	BY / DATE	CHK / APPD
A	ADDED WIRE LENGTHS TO W/T; HF-LA5 WAS F-LA5 & HF-LA7 WAS F-LA7; CABIN LIGHTS WAS NAV LIGHTS; S-1360-10 WAS S-1232-10; REMOVED 1270429-1 FROM E/T; ADDED NOTE 1. (SR4455)	WJR 7-17-69	RRS JM HW



NOTES:
1. COURTESY LIGHTS ARE OPTIONAL SER 21058221 & ON. WIRES ARE STANDARD.

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS
HF-LA7	18		150	S-341-2	S-341-2	1220004	
F-LA6	18		88	S-341-2	SEE F-LA4		
HF-LA5	18		150	S-341-2	S-341-2	1220005	
F-LA4	18		53	S-1367-1-6	S-341-2		
F-LA3	18		43	S-341-2	S-341-2		
F-LA2	18		36	S-1367-1-6	SEE F-LA3		
F-LA1	18		114	S-1367-1-6	S-1367-1-8		

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
5	181522	LIGHT ASSY (UCTE)	
4	1270430-1	LIGHT ASSY	
3	0713029	SWITCH	
2	S-1360-10	CIRCUIT BREAKER	
1			

EQUIPMENT TABLE

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIVISION, WICHITA, KANSAS

	NAME	DATE
DRAWN	RIDDER	9-18-62
GROUP	Ved M Lady	10-24-62
CHECK	R. Stuck	10-26-62
PROJ	H. McCarter	11-2-62

TITLE: WIRING DIAGRAM — DOME & COURTESY LIGHTS

Cessna.

DWG NO: 1270405

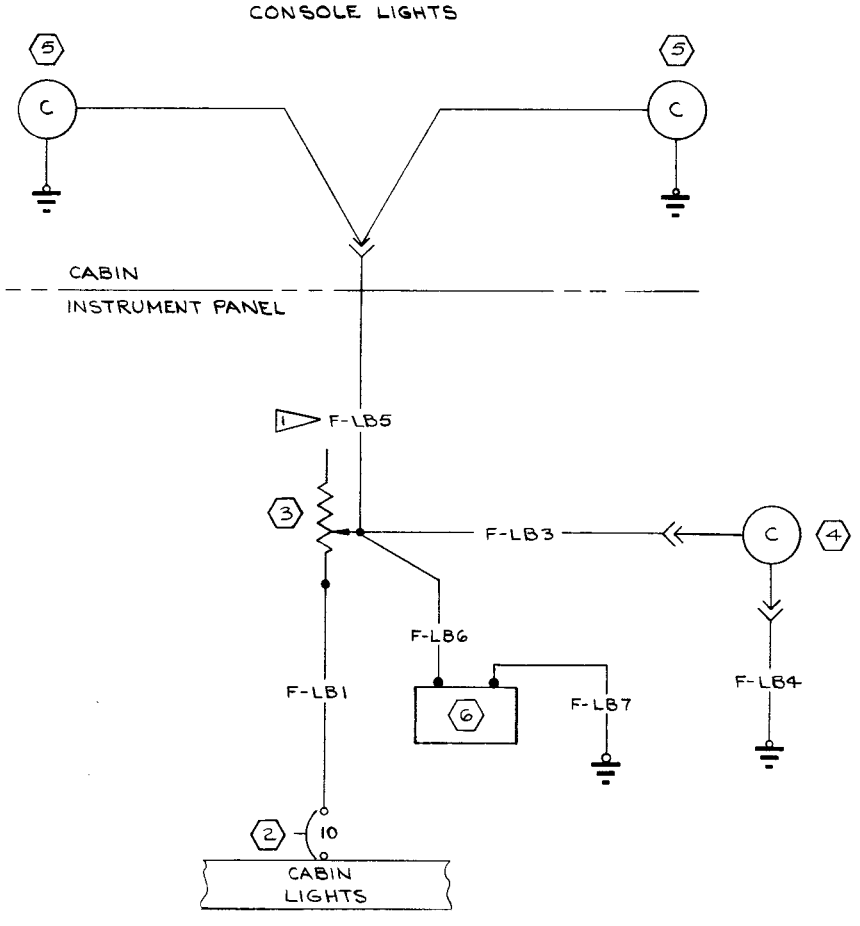
SUPERSEDED BY: | SUPERSEDES: | MODEL: 210 | REV: A | PAGE: 11.1

FORM NO. 80-161

CHG LET	REVISION	BY DATE	CHK APPD
A	CABIN LIGHTS WAS INST LIGHTS; REMOVED 1270429-1 FROM E/T; S-1360-10 WAS S-1232-10; C660501-0101 WAS 0713068-1; ADDED WIRE LENGTHS TO W/T; ADDED F-LB6, F-LB7 & C669502-0104; ADDED NOTE 1 (SR4455)-9	WJR 8-6-69	RRS JM NMC

NOTES:

1. WHEN (OPT) POST & BACK LIGHTING IS INSTALLED, WIRE F-LB5 IS CONNECTED TO CONSOLE SIDE OF S-1238-2-1 SWITCH REF 1270405 PAGE 11.7.



WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS			SERIALS
F-LB7	20			SOLDER	S-1367-1-8		SER (SR4455) & ON
F-LB6	20			SOLDER	SOLDER		SER (SR4455) & ON
F-LB4	18		41	S-341-2	S-1367-1-6		
F-LB5	18		90	S-341-2	SOLDER		
F-LB3	18		50	S-341-2	SOLDER		
F-LB1	18		4	S-1367-1-8	SOLDER		

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
6	C669502-0104	INST CLUSTER KIT	
5	0700621-1	MAP LIGHT INSTL	
4	C660501-0101	COMPASS	
3	R-12½-8-RS34	RHEOSTAT (TRTA)	
2	S-1360-10	CIRCUIT BREAKER	
1			

EQUIPMENT TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION WICHITA, KANSAS

	NAME	DATE
DRAWN	RIDDER	9-19-62
GROUP	C.J. Moody	10-29-62
CHECK	R. Stuck	10-26-62
PROJ	Wm. McCarty	11-2-62

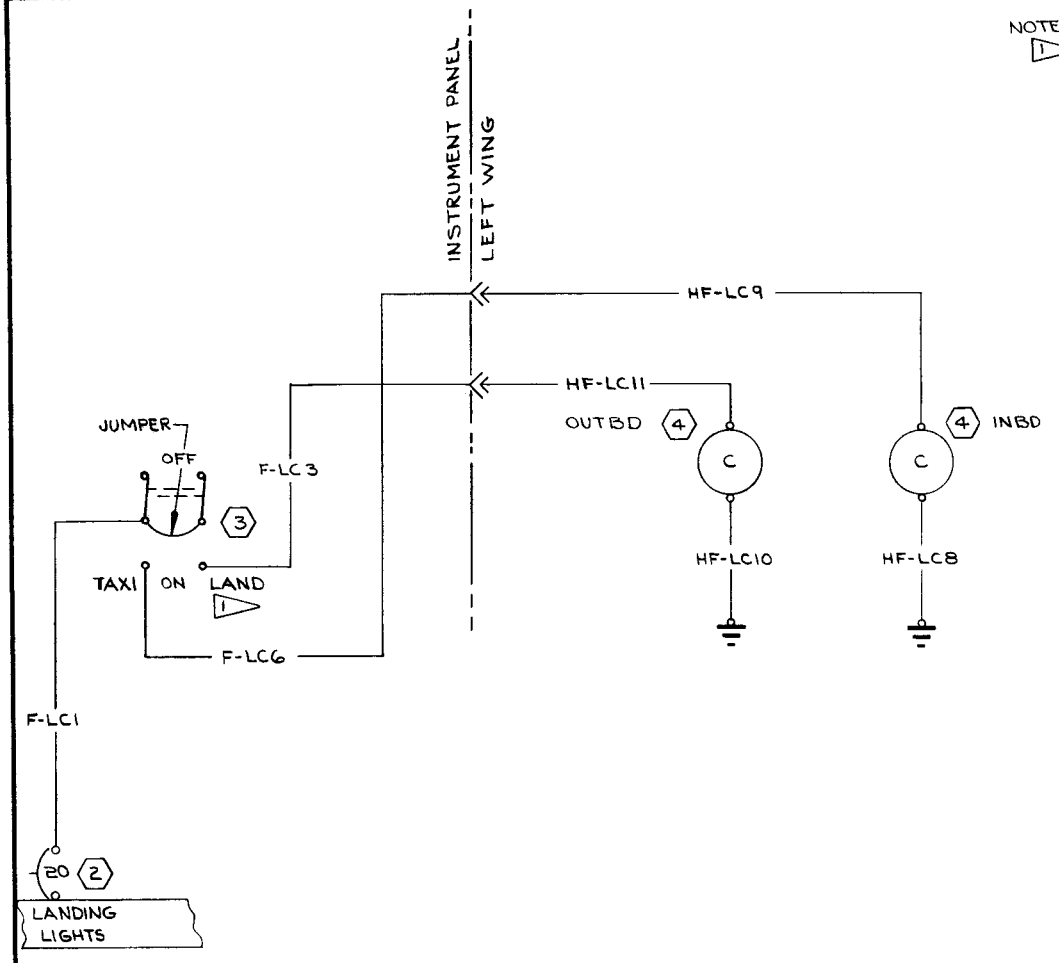
TITLE: WIRING DIAGRAM — INSTRUMENT LIGHTS

Cessna.

DWG NO. 1270405

SUPERSEDED BY	SUPERSEDES	MODEL:	REV:	PAGE:
		210	A	11.2

FORM NO. 80-161



NOTES:

1. SWITCH IS MECHANICALLY INTERCONNECTED SO THAT DEPRESSING "LAND" PORTION OF SWITCH TO "ON" POSITION ALSO CARRIES "TAXI PORTION OF SWITCH TO "ON" POSITION.

CHG LET	REVISION	BY / DATE	CHK / APPD
A	S-1360-20 CKT BKR WAS S-1232-15; 1270461-1 BUS BAR WAS 1270429-1; WIRES F-LC3 & F-LC6 WERE 16 GA (SR 4356)	HLW 9-17-63	RRS JM MAC
B	ADDED WIRE LENGTHS TO W/T; REMOVED 1270461-1 FROM E/T; HF-LC8 WAS F-LC8; OBSOLETED F-LC4, F-LC5 & F-LC7; HF-LC9 WAS F-LC7; HF-LC10 WAS F-LC5; HF-LC11 WAS F-LC4 (SR4455)	WJR 8-10-64	RRS JM HFW

HF-LC11	14				S-1367-2-8	S-341-1	1220090	SER (SR4455) & ON
HF-LC10	14				S-1367-2-8	S-1367-2-8	1220090	SER (SR4455) & ON
HF-LC9	14				S-1367-2-8	S-341-1	1220090	SER (SR4455) & ON
HF-LC8	14			6	S-1367-2-8	S-1367-2-8	1220025	
F-LC7	14			162	S-1367-2-8	S-341-1	1220003	OBSOLETE
F-LC6	14			26	S-1367-2-6	S-341-1		
F-LC5	14			6	S-1367-2-8	S-1367-2-8	1220025	OBSOLETE
F-LC4	14			168	S-1367-2-8	S-341-1	1220003	OBSOLETE
F-LC3	14			26	S-1367-2-6	S-341-1		
F-LC1	14			4	S-1367-2-6	S-1367-2-8		
WIRE CODE NO.	GA	MATERIAL		LG	TERMINALS		N/A	SERIALS

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
4	0523118-1	LANDING LIGHT	
3	S-1160-1-1	SWITCH	
2	S-1360-20	CIRCUIT BREAKER	
1			

EQUIPMENT TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION, WICHITA, KANSAS

	NAME	DATE
DRAWN	RIDDER	9-20-62
GROUP	[illegible]	10-29-62
CHECK	R. Stuck	10-26-62
PROJ	H. McCarter	11-2-62

TITLE: WIRING DIAGRAM — LANDING LIGHTS

Cessna.

DWG NO: 1270405

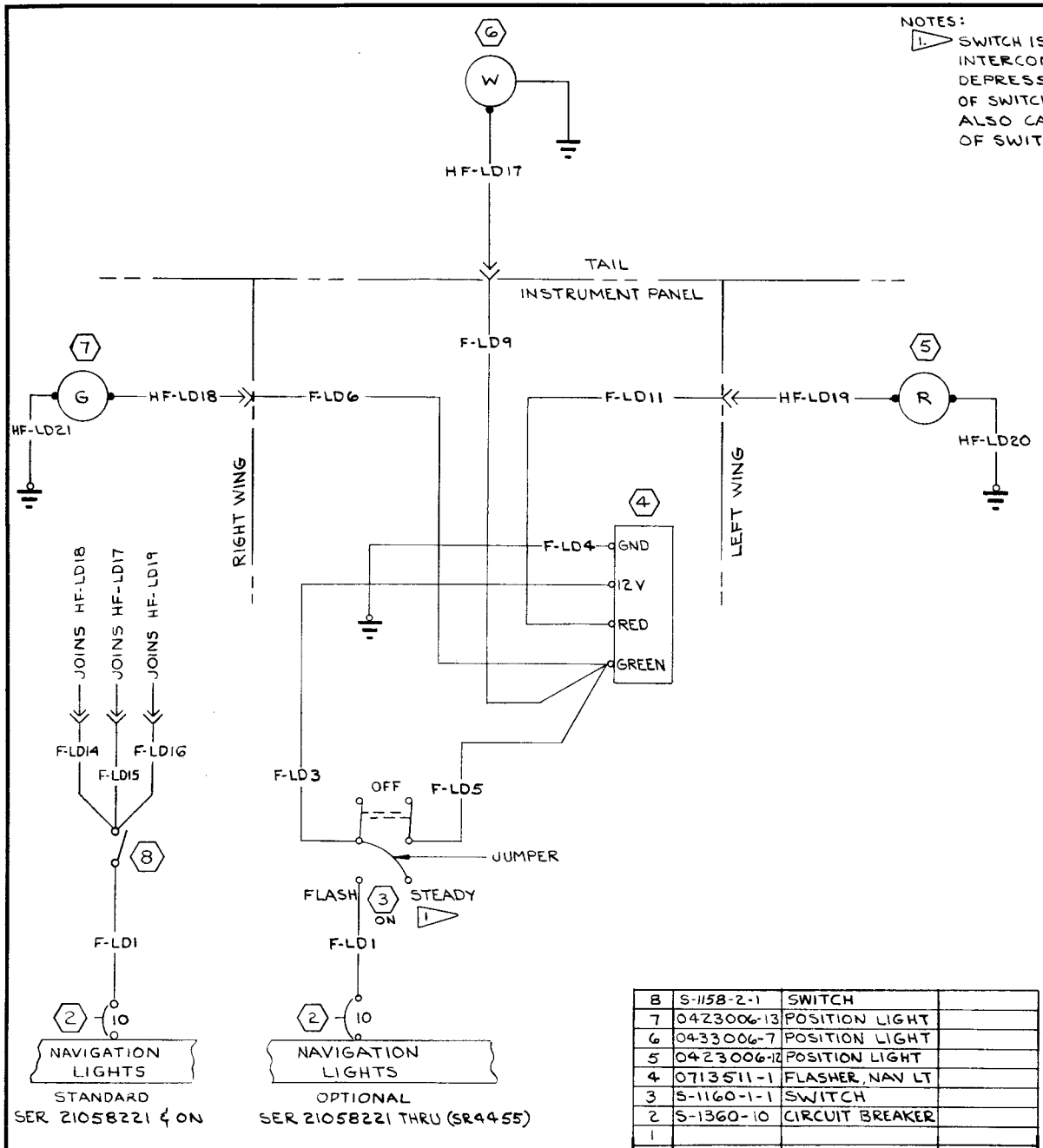
SUPERSEDED BY	SUPERSEDES	MODEL:	REV:	PAGE:
		210	B	11.3

FORM NO. 80-161

NOTES:

1. SWITCH IS MECHANICALLY INTERCONNECTED SO THAT DEPRESSING "STEADY" PORTION OF SWITCH TO "ON" POSITION ALSO CARRIES "FLASH" PORTION OF SWITCH TO "ON" POSITION.

CHG LET	REVISION	BY DATE	CHK APPD
A	ADD OPTIONAL & STANDARD CONFIGURATIONS. ADD WIRES F-LD14 F-LD15 & F-LD16. ADD S-1158-2-1 SWITCH WIRES F-LD3 THRU F-LD6, F-LD9 & F-LD11 BECOME OPTIONAL 1270461-1 BUS BAR WAS 1270429-1 BUS BAR (SR 4039-9)	GLW 2-26-65	[illegible]
B	ADDED WIRE LENGTHS TO W/T; ADDED LIMITING SERIALS TO FIELD INACTIVATED F-LD3, F-LD4, F-LD5, F-LD6, F-LD9 & F-LD11; REMOVED 1270461-1 FROM E/T; OBSOLETED F-LD8, F-LD7, F-LD12, F-LD13 & F-LD10; HF-LD17 WAS F-LD10; HF-LD18 WAS F-LD7; HF-LD20 WAS F-LD13; HF-LD21 WAS F-LD8 HF-LD19 WAS F-LD12 (SR4455)-9	WJR 8-11-69	[illegible]



ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
8	S-1158-2-1	SWITCH	
7	0423006-13	POSITION LIGHT	
6	0433006-7	POSITION LIGHT	
5	0423006-12	POSITION LIGHT	
4	0713511-1	FLASHER, NAV LT	
3	S-1160-1-1	SWITCH	
2	S-1360-10	CIRCUIT BREAKER	
1			

EQUIPMENT TABLE

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS
HF-LD21	18			S-1367-1-8	SOLDER		SER (SR4455) & ON
HF-LD20	18			S-1367-1-8	SOLDER		SER (SR4455) & ON
HF-LD19	18			S-341-2	SOLDER		SER (SR4455) & ON
HF-LD18	18			S-341-2	SOLDER		SER (SR4455) & ON
HF-LD17	18			S-341-2	SOLDER		
F-LD16	18		27	S-341-2	S-1367-1-6		SER 21058221 & ON
F-LD15	18		352	S-341-2	S-1367-1-6		SER 21058221 & ON
F-LD14	18		50	S-341-2	S-1367-1-6		SER 21058221 & ON
F-LD13	18		14	S-1367-1-8	SOLDER		OBSOLETE
F-LD12	18		250	S-341-2	SOLDER		OBSOLETE
F-LD11	18		65	S-1367-1-6	S-341-2	1270462	(OPT) Inactive SER (SR4455) & ON
F-LD10	18		23	S-341-2	SOLDER		OBSOLETE
F-LD9	18		335	S-1367-1-6	S-341-2	1270462	(OPT) Inactive SER (SR4455) & ON
F-LD8	18		14	SOLDER	S-1367-1-8		OBSOLETE
F-LD7	18		250	S-341-2	SOLDER	1220004	OBSOLETE
F-LD6	18		66	S-1367-1-6	S-341-2	1270462	(OPT) Inactive SER (SR4455) & ON
F-LD5	18		46	S-1367-1-6	S-1367-1-6	1270462	(OPT) Inactive SER (SR4455) & ON
F-LD4	18		19	S-1367-1-6	S-1367-1-8	1270462	(OPT) Inactive SER (SR4455) & ON
F-LD3	18		45	S-1367-1-6	S-1367-1-6	1270462	(OPT) Inactive SER (SR4455) & ON
F-LD1	18		4	S-1367-1-8	S-1367-1-6		

WIRE TABLE

CESSNA AIRCRAFT CO COMMERCIAL AIRCRAFT DIVISION WICHITA, KANSAS

	NAME	DATE
DRAWN	RIDDER	9-21-62
GROUP	[illegible]	10-24-62
CHECK	C. Stuck	10-26-62
PROJ	N. McCarty	11-2-62

TITLE: WIRING DIAGRAM — NAVIGATION LIGHTS

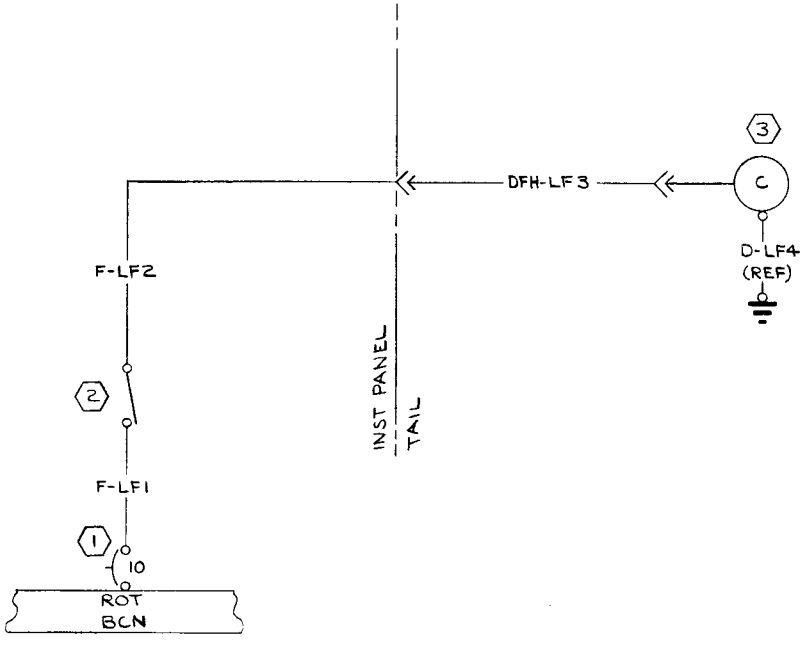
Cessna.

DWG NO: 1270405

SUPERSEDED BY	SUPERSEDES	MODEL:	REV:	PAGE:
		210	B	11-4

FORM NO. 80-161

CHG LET	REVISION	BY DATE	CHK APPD
A	ADDED WIRE LENGTHS TO W/T; DFH-LF3 WAS F-LF3; S-1360-10 WAS S-1232-10; REMOVED 1270429-1 & 0770610-LF4 FROM E/T DELETED NOTE ▷ (SR4456)	WJR 8-11-64	RRS TM N+W



WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS
DFH-LF3	16		70	S-341-1	S-341-1		(STD)
F-LF2	16		325	S-1367-2-6	S-341-1		(STD)
F-LF1	16		4	S-1367-2-6	S-1367-2-8	1270427	

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
5			
4			
3	0700120-1	ROTATING BCN	
2	S-1158-2-1	SWITCH	
1	S-1360-10	CIRCUIT BREAKER	

EQUIPMENT TABLE

CESSNA AIRCRAFT CO COMMERCIAL AIRCRAFT DIVISION WICHITA, KANSAS

	NAME	DATE
DRAWN	RIDDER	10-5-62
GROUP	[illegible]	10-29-62
CHECK	[illegible]	10-26-62
PROJ	N. McCarty	11-2-62

TITLE: WIRING DIAGRAM — ROTATING BEACON (OPT)

Cessna.

DWG NO: 1270405

SUPERSEDED BY:	SUPERSEDES	MODEL: 210	REV: A	PAGE: 11-5

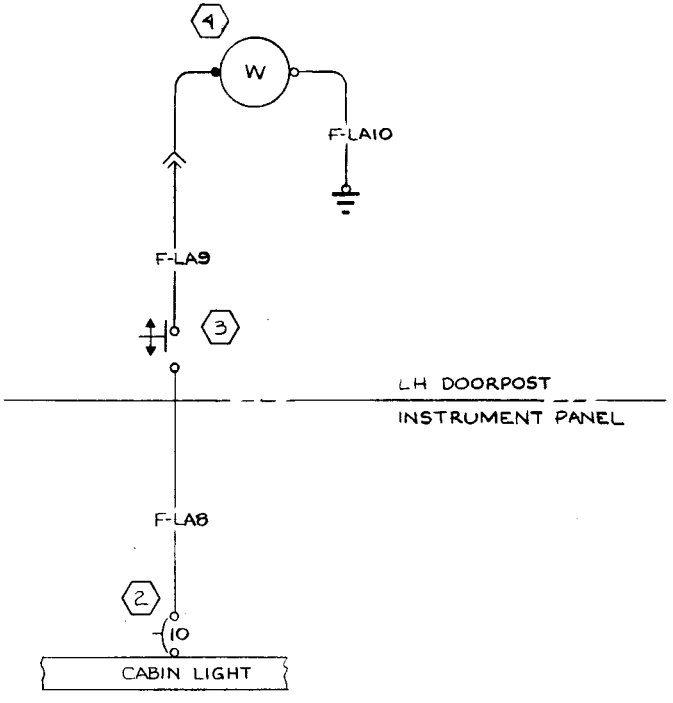
FORM NO. 80-161

(SR 4039)

NOTE:

1. WIRES MADE PER THIS DRAWING ARE USED ON MODELS OTHER THAN 210. CHANGES MADE ON THESE WIRES SHOULD ALSO BE MADE ON OTHER WIRING DIAGRAMS.

CHG LET	REVISION	BY / DATE	CHK / APPD
A	REMOVED 1270461-1 FROM E/T ADDED WIRE LENGTS TO W/T: INACTIVATED DRAWING	WJR 8-12-64	265 HW



Inactive SER 21058511 & ON
WJR 8-12-64 HW
RRS

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS			SERIALS
F-LA10	18		18	S-1367-1-8	S-1367-10	1270463	
F-LA9	18		14	S-1367-1-4	S-341-2	1270463	
F-LA8	18		38	S-1367-1-4	S-1367-1-6	1270463	

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
4	1470089-10	MAP LIGHT ASSY	
3	0713029	SWITCH	
2	S-1360-10	CIRCUIT BREAKER	
1			

EQUIPMENT TABLE

CESSNA AIRCRAFT CO COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	G WOOD	3-29-63
GROUP	[illegible]	3-30-63
CHECK	R. Stuck	4-22-63
PROJ	W. McCarter	3-30-63

TITLE: WIRING DIAGRAM — MAP LIGHT (OPTIONAL)

Cessna.

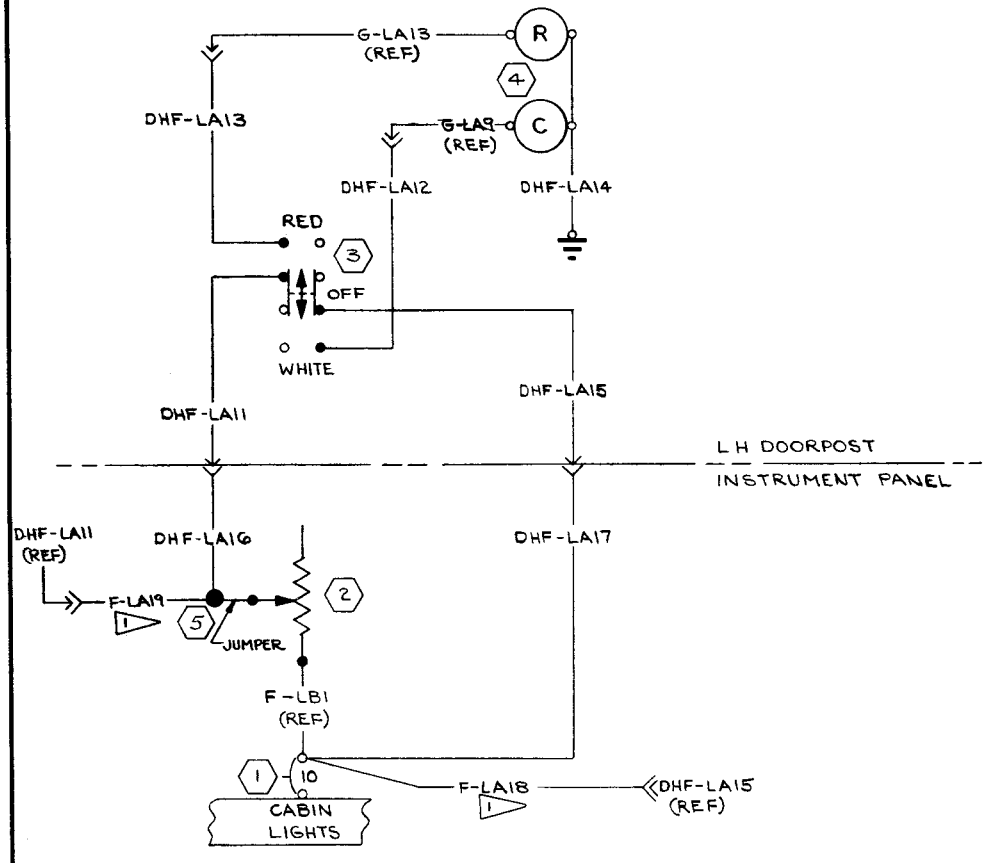
DWG NO: 1270405

SUPERSEDED BY	PAGE	SUPERSEDES	MODEL:	REV:	PAGE:
1270405	11.6.1		210	A	11.6

(SR4455)

NOTES:
1. WIRES F-LA18 & F-LA19 REQUIRED FOR RH MAP LIGHT INSTL.

CHG LET	REVISION	BY DATE	CHK APPD



	WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		
1	F-LA19	18			SOLDER	S-391-2	
1	F-LA18	18			S-1367-1-6	S-391-2	
	DHF-LA17	18			S-1367-1-6	S-391-2	
	DHF-LA16	18			SOLDER	S-391-2	
	DHF-LA15	18			SOLDER	S-391-2	0770725
	DHF-LA14	18			S-1367-1-8	S-1367-10	0770725
	DHF-LA13	18			SOLDER	S-391-2	0770725
	DHF-LA12	18			SOLDER	S-391-2	0770725
	DHF-LA11	18			SOLDER	S-391-2	0770725

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
5	18-1	INSULATOR (GRAY)	
4	1470089-14	LIGHT ASSY	
3	S-1501-1	SWITCH	
2	R-12½-8-RS34	RHEOSTAT (TRTA)	
1	S-1360-10	CIRCUIT BREAKER	

EQUIPMENT TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION WICHITA, KANSAS

	NAME	DATE
DRAWN	RIDDER	8-13-69
GROUP	J. Mady	8-31-69
CHECK	R. Stuck	8-24-69
PROJ	H. Wise	9-1-69

TITLE: WIRING DIAGRAM — MAP LIGHT (OPT)

Cessna.

DWG NO. 1270405

SUPERSEDED BY:

SUPERSEDES 1270405 PAGE 11-6

MODEL: 210

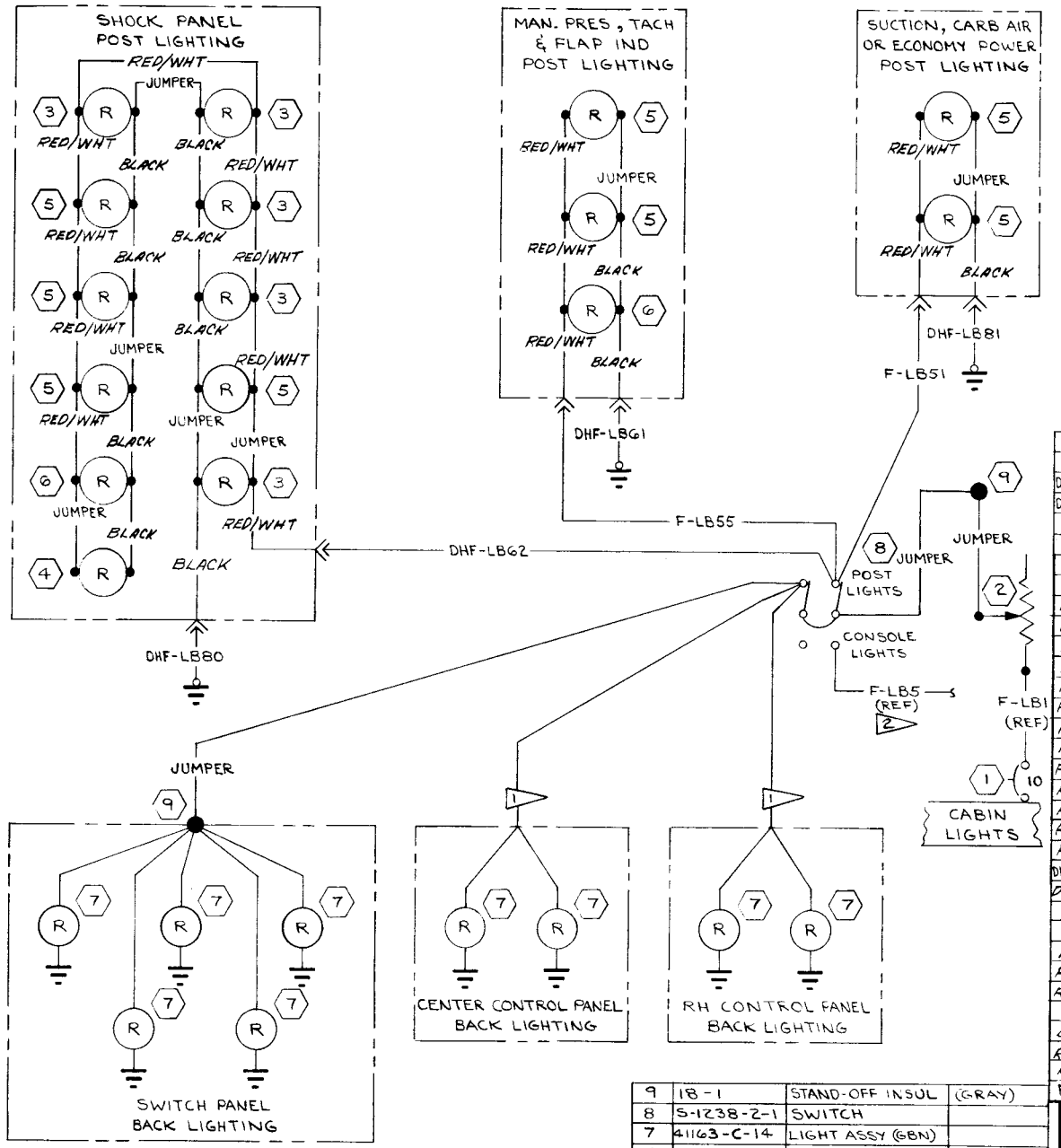
REV:

PAGE: 11.6.1

FORM NO. 80-161

(SR4607)

CHG LET	REVISION	BY DATE	CHK APPD
A	BY REV: RED/WHT & BLACK WIRES BETWEEN POST LIGHTS WERE 20 GA NUMBERED WIRE (NEVER USED)	LPB 1-7-69	RRS TM HW



DHF-LB81	18			S-1367-1-8	S-341-2	1200686	
DHF-LB80	18			S-341-2	S-1367-1-8		
BLACK	22	S-1460-22-0		SOLDER	S-341-2		
BLACK	22			SOLDER	SOLDER		
BLACK	22			SOLDER	SOLDER		
BLACK	22			SOLDER	SOLDER		
BLACK	22			SOLDER	SOLDER		
BLACK	22			SOLDER	SOLDER		
BLACK	22			SOLDER	SOLDER		
BLACK	22	S-1460-22-0		SOLDER	SOLDER		
RED/WHT	22	S-1460-22-2-9		SOLDER	SOLDER		
RED/WHT	22			SOLDER	SOLDER		
RED/WHT	22			SOLDER	SOLDER		
RED/WHT	22			SOLDER	SOLDER		
RED/WHT	22			SOLDER	SOLDER		
RED/WHT	22			SOLDER	SOLDER		
RED/WHT	22			SOLDER	SOLDER		
RED/WHT	22			SOLDER	SOLDER		
RED/WHT	22	S-1460-22-2-9		S-341-2	SOLDER		
DHF-LB62	18			S-1367-1-6	S-341-2		
DHF-LB61	18			S-341-2	S-1367-1-8		
BLACK	22	S-1460-22-0		SOLDER	S-341-2		
BLACK	22	-22-0		SOLDER	SOLDER		
RED/WHT	22	-22-2-9		SOLDER	SOLDER		
RED/WHT	22	-22-2-9		SOLDER	SOLDER		
RED/WHT	22	S-1460-22-2-9		S-341-2	SOLDER		
F-LB55	18			S-341-2	S-1367-1-6		
BLACK	22	S-1460-22-0		S-341-2	SOLDER		
RED/WHT	22	S-1460-22-2-9		SOLDER	SOLDER		
RED/WHT	22	S-1460-22-2-9		SOLDER	S-341-2		
F-LB51	18			S-1367-1-6	S-341-2	1200686	
WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
9	18-1	STAND-OFF INSUL	(GRAY)
8	S-1238-2-1	SWITCH	
7	41163-C-14	LIGHT ASSY (GBN)	
6	5602M-3RH-R-14	LIGHT ASSY (GBN)	
5	5952-3RH-R-14	LIGHT ASSY (GBN)	
4	5602M-3LH-R-14	LIGHT ASSY (GBN)	
3	5952-3LH-R-14	LIGHT ASSY (GBN)	
2	R-12½-8-RS34	RHEOSTAT (TRTA)	
1	S-1360-10	CIRCUIT BREAKER	

EQUIPMENT TABLE

NOTES:

1. VENDOR FURNISHED LEADS TERMINATE AT SWITCH WITH S-1367-1-6 TERMINAL.
2. WHEN MAP LIGHT & CONSOLE LIGHTS ARE INSTALLED WITH POST & BACK LIGHTING, WIRE F-LB5 IS CONNECTED TO CONSOLE SIDE OF S-1238-2-1 SWITCH INSTEAD OF R-12½-8-RS34 RHEOSTAT.

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIVISION, WICHITA, KANSAS

	NAME	DATE
DRAWN	RIDDER	8-20-69
GROUP		9-22-69
CHECK	R. Shook	9-22-69
PROJ	H Wiles	9-23-69
	W. McCabe	9-29-69

TITLE: **WIRING DIAGRAM— POST LIGHTING & BACK LIGHTING (OPT)**

Cessna

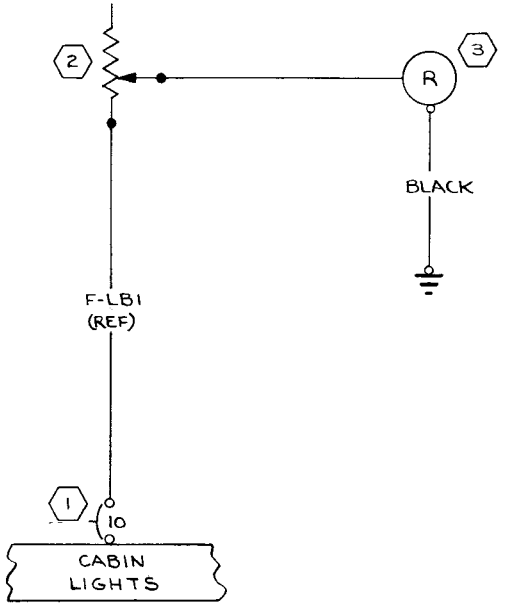
DWG NO: 1270405

SUPERSEDED BY:	SUPERSEDES:	MODEL:	REV:	PAGE:
		210	A	11.7

FORM NO. 80-161A

(SR4455)

CHG LET	REVISION	BY DATE	CHK APPD



Inactive SER 2105838 & ON
W.O.R. 10-30-64
W & W
RRS

BLACK	22	S-1460-22-0		S-1367-1-8	S-1367-1-10	0770646	
WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
3	A5299-12	LIGHT ASSY (GMC)	
2	R-12½-8-RS34	RHEOSTAT (TRTA)	
1	S-1360-10	CIRCUIT BREAKER	

EQUIPMENT TABLE

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIVISION, WICHITA KANSAS

	NAME	DATE
DRAWN	RIDDER	8-18-64
GROUP	[illegible]	9-2-64
CHECK	R. Stuck	9-1-64
PROJ	W. McCabe	9-2-64

TITLE: **WIRING DIAGRAM— NAV-O-MATIC 300 POST LIGHT (OPT)**

Cessna

DWG NO: 1270405

SUPERSEDED BY:	SUPERSEDES:	MODEL: 210	REV:	PAGE: 11.8

FORM NO. 80-161A

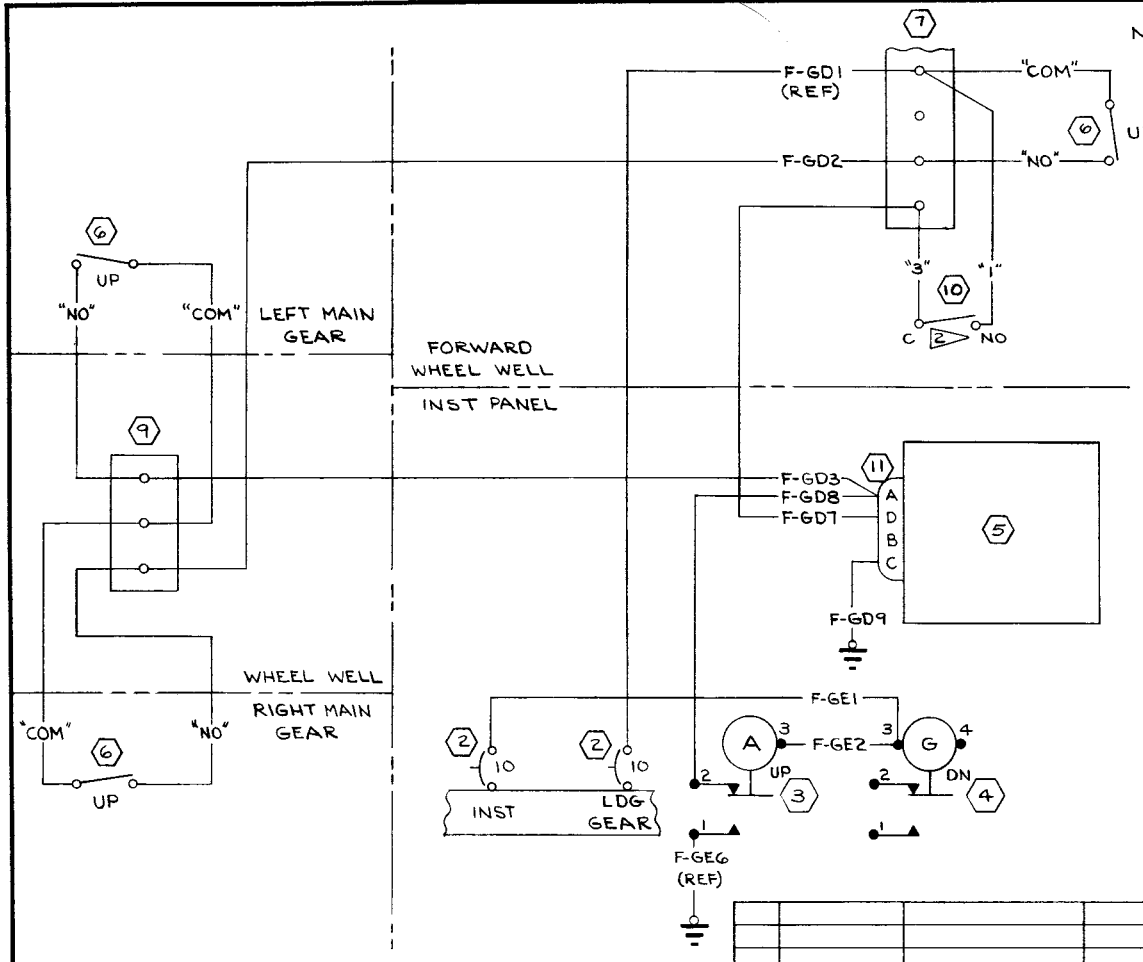
LANDING GEAR SECTION

Cessna.

DRAWN	RIDDER	TITLE: WIRING DIAGRAM--- MODEL 210	DRAWING NO. 1270405
DATE	10-8-62		
APP'D	RRS Nm²	REV:	PAGE: 12.0

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

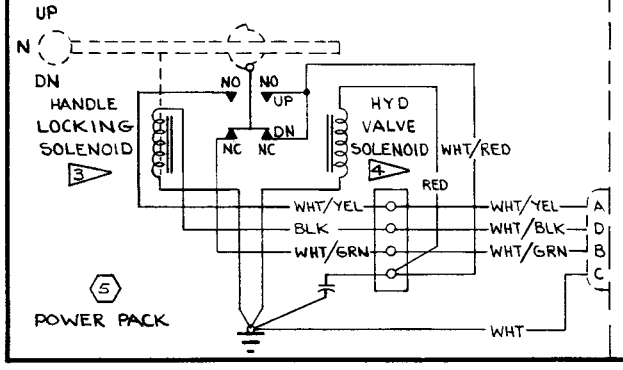
FORM NO. 80-170



NOTES:

1. FOR GEAR DOWN SWITCHES REFER TO 1270405 PAGE 15.2
2. NOSE GEAR SQUAT SWITCH CLOSED WHEN STRUT IS EXTENDED.
3. CONTROL HANDLE CANNOT BE PLACED IN GEAR - UP POSITION EXCEPT WHEN SOLENOID IS ENERGIZED I.E. WHEN NOSE GEAR STRUT IS EXTENDED.
4. HYD VALVE SOLENOID IS ENERGIZED WHEN GEARS ARE EITHER LOCKED UP OR LOCKED DOWN AND POWER PACK CONTROL HANDLE IS IN ITS UP-NEUTRAL OR DN-NEUTRAL POSITION.
5. GEAR UP SWITCHES ARE CLOSED WHEN GEARS ARE LOCKED.

CHG LET	REVISION	BY DATE	CHK APPD
A	ADDED WIRE LENGTHS TO W/T; REMOVED 1270429-1 FROM E/T; S-1360-10 WAS S-1232-10; 2940-1 WAS 1280500-1; S-1377-1 WAS 65-430001; REMOVED F-GD1 FROM E/T; INST WAS INST LIGHTS; ADDED COLOR CODED WIRES TO (OAC) POWER PACK DIAGRAM; VM911M-9A WAS VM911-2A (SR99-5579	WJR 8-13-64	RES WM HW



ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
11	MS3106A-14S-2S	PLUG	
10	1270039-1	SWITCH	
9	AN3436-2-3	TERMINAL	
8			
7	AN3436-2-6	TERMINAL	
6	S-1377-1	SWITCH	
5	2940-1	POWER PACK (OAC)	
4	VM920M-3	LIGHT ASSY (MARI)	
3	VM911M-4A	LIGHT ASSY (MARI)	
2	S-1360-10	CIRCUIT BREAKER	
1			

EQUIPMENT TABLE

WIRE CODE NO	GA	MATERIAL	LG	TERMINALS		SERIALS
F-GD9	18		35	S-1367-1-8	SOLDER	
F-GD8	18		26	SOLDER	SOLDER	
F-GD7	18		58	S-1367-1-6	SOLDER	
F-GD3	18		170	S-1367-1-6	SOLDER	
F-GD2	18		210	S-1367-1-6	S-1367-1-6	
F-GE2	18		3	SOLDER	SOLDER	
F-GE1	18		13	S-1367-1-8	SOLDER	

WIRE TABLE

CESSNA AIRCRAFT CO COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	RIDDER	10-10-62
GROUP	[illegible]	10-29-62
CHECK	R. Stuck	10-26-62
PROJ	W. McCarta	11-2-62

TITLE: WIRING DIAGRAM — LANDING GEAR DOOR CONTROL SYSTEM

Cessna.

DWG NO: 1270405

SUPERSEDED BY:

SUPERSEDES:

MODEL: 210

REV: A

PAGE: 12.1

FORM NO. 80-161

HEATING, VENTILATING, AND DE-ICING SECTION

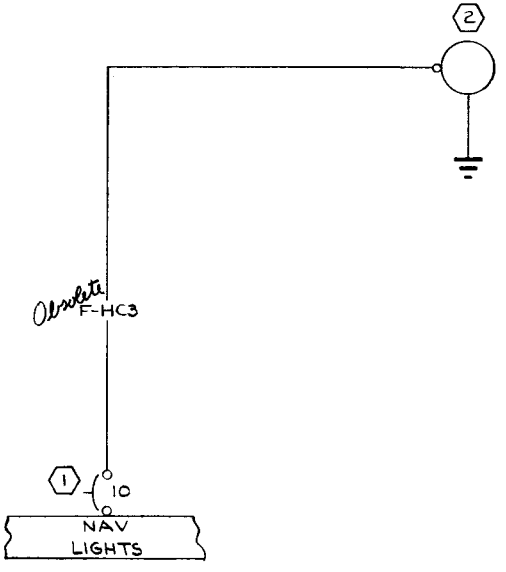
Cessna.

DRAWN	RIDDER	TITLE: WIRING DIAGRAM--- MODEL 210	DRAWING NO. 1270405
DATE	10-5-62		
APP'D	C.B.S. Nhe	REV:	PAGE: 13.0

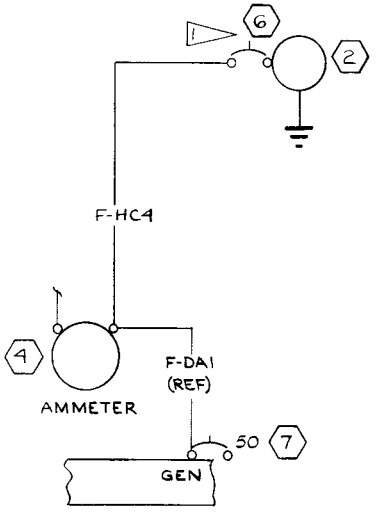
CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

FORM NO. 80-171

CHG LET	REVISION	BY / DATE	CHK / APPD
A	ADD 60232-1 CKT BKR TO CIGAR LIGHTER F-HC4 WIRE, NOTE 1, S-1232-50 & 0713602-1. OBSOLETE F-HC3 H-HC3 WIRE WAS 18 GA S-1367-2-8 TERM WAS S-1367-1-8 (SR 4081)	G L W 12-10-62	RRS
B	ADDED WIRE LENGTH TO W/T; C669502-0104 WAS 0713602-1; S-1360-50 WAS S-1232-50; REMOVED 1270429-1 & 1270405 -DA1 FROM E/T	W J R 8-14-64	RRS TM NAC



THRU SER 21058161



SER 21058162 & ON

NOTE:
1. CIRCUIT BREAKER IS RESET BY INSERTING A PROBE INTO THE 5/64 DIA HOLE IN BREAKER FACE AND PUSHING LIGHTLY UNTIL A CLICK IS HEARD.

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
7	S-1360-50	CIRCUIT BREAKER	
6	60232-1	CKT BKR (CUE)	
5			
4	C669502-0104	INST CLUSTER KIT	
3			
2	0513052-1	CIGAR LIGHTER	
1	S-1232-10	CIRCUIT BREAKER	

EQUIPMENT TABLE

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS			SERIALS
F-HC4	16		15	S-1367-2-10	S-1367-2-8		SER 21058162 & ON
F-HC3	16		14	S-1367-2-8	S-1367-2-8		OBSOLETE 21058162 & ON

WIRE TABLE

CESSNA AIRCRAFT CO COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	RIDDER	10-5-62
GROUP	[illegible]	10-29-62
CHECK	R. Strunk	10-29-62
PROJ	N. McCoots	11-2-62

TITLE: WIRING DIAGRAM — CIGAR LIGHTER

Cessna.

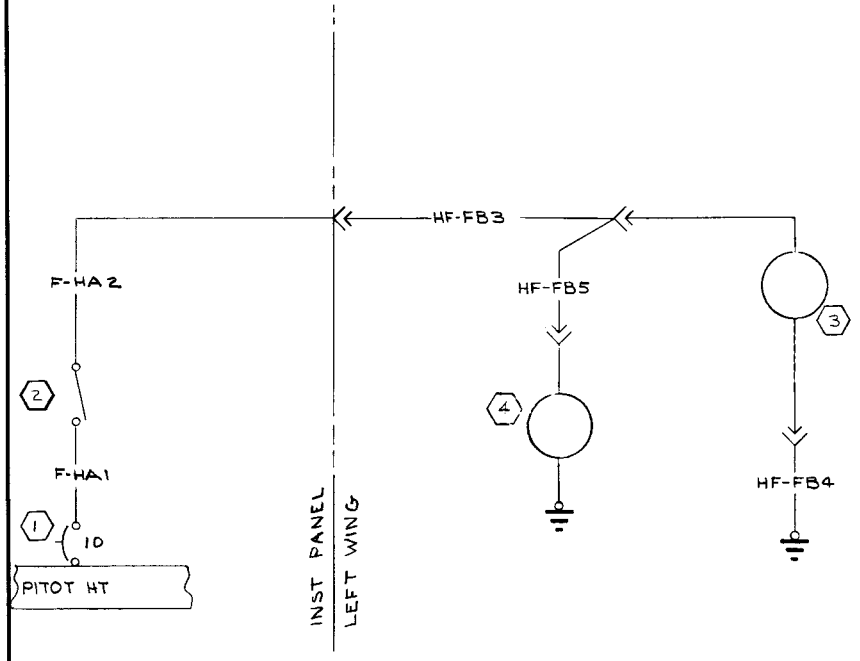
DWG NO: 1270405

SUPERSEDED BY: | SUPERSEDES: | MODEL: 210 | REV: B | PAGE: 13.1

NOTES:

1. ONLY HEATER CIRCUITS SHOWN. FOR STALL WARNING CIRCUIT SEE PAGE 15.1.

CHG LET	REVISION	BY DATE	CHK APPD
A	ADDED WIRE LENGTHS TO W/T; S-1360-10 WAS S-1232-10; REMOVED 1270429-1 FROM E/T; OBSOLETED F-HA3, F-HA4 & F-HA5; HF-FB3 WAS F-HA3; HF-FB4 WAS F-HA5; HF-FB5 WAS F-HA4 (SR4455)	WJR 8-15-69	RES TM NAC



WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS
HF-FB5	18			SEE HF-FB3	S-341-2	1220090	(STD) SER (SR4455) & ON
HF-FB4	18			S-1369-1	S-1367-1-8	1220090	(STD) SER (SR4455) & ON
HF-FB3	16			S-341-1	S-1369-2	1220090	(STD) SER (SR4455) & ON
F-HA5	18		6	S-1369-1	S-1367-1-8	1220003	(STD) OBSOLETE
F-HA4	18		38	SEE F-HA3	S-341-2	1220003	(STD) OBSOLETE
F-HA3	16		80	S-341-1	S-1369-2	1220003	(STD) OBSOLETE
F-HA2	16		23	S-1367-2-6	S-341-1	1200440	
F-HA1	16		4	S-1367-2-6	S-1367-2-8	1200440	

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
5			
4	0511062-5	XMTR STALL WARN, HTD	
3	0721105-2	PITOT TUBE, HEATED	
2	S-1158-2-1	SWITCH	
1	S-1360-10	CIRCUIT BREAKER	

EQUIPMENT TABLE

CESSNA AIRCRAFT CO COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	RIDDER	10-5-62
GROUP	Ed Mosby	10-26-62
CHECK	R. Stuck	10-25-62
PROJ	H. McCarter	11-2-62

TITLE: WIRING DIAGRAM — HEATED PITOT TUBE & HEATED STALL WARNING SYSTEM (OPT)

Cessna.

DWG NO. 1270405

SUPERSEDED BY:

SUPERSEDES:

MODEL: 210

REV: A

PAGE: 13.2

FORM NO. 80-161

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CONTROL SURFACE SECTION

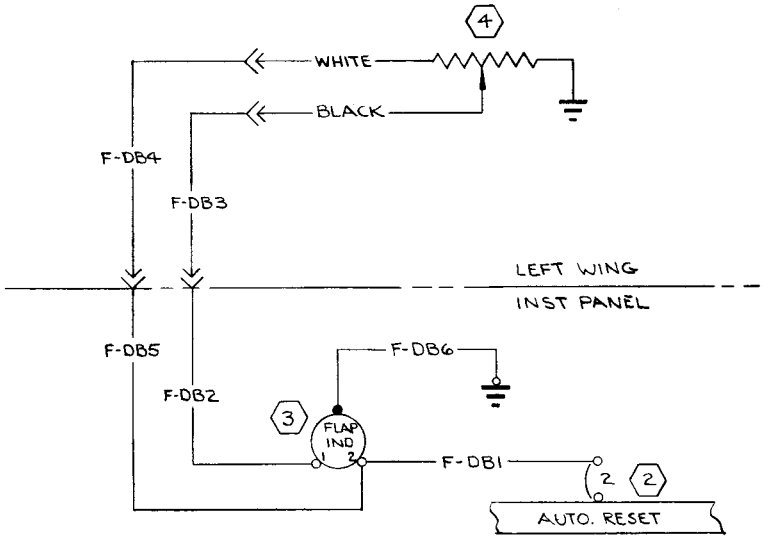
Cessna.

DRAWN	RIDDER	TITLE: WIRING DIAGRAM--- MODEL 210	DRAWING NO. 1270405
DATE	10-23-62		
APP'D	RRS Wmc	REV:	PAGE: 14.0

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

FORM NO. 80-172

CHG LET	REVISION	BY / DATE	CHK / APPD
A	ADDED WIRE LENGTHS TO W/T; REMOVED 1270429-1 FROM E/T	WJR 8-19-69	[illegible]



Inactive SER 21058221 ON 2-28-63 Gw RRS A/m e

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS
F-DB6	18		6	S-1367-1-8	SOLDER		
F-DB5	18		48	S-1367-1-10	S-391-2		
F-DB4	18		165	S-391-2	S-391-2	1220003	
F-DB3	18		165	S-391-2	S-391-2	1220003	
F-DB2	18		49	S-1367-1-8	S-391-2		
F-DB1	18		37	S-1367-1-8	S-1369-1-10		

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
4	1260068-1	FLAP POS. XMTR	
3	S-1318-1	INDICATOR, FLAP POS	
2	CA-2	CKT BKR (MTCC)	
1			

EQUIPMENT TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION, WICHITA, KANSAS

	NAME	DATE
DRAWN	RIDDER	10-23-62
GROUP	[illegible]	10-24-62
CHECK	R. Stuck	10-26-62
PROJ	N. McCarty	11-2-62

TITLE: WIRING DIAGRAM — WING FLAPS POSITION INDICATOR

Cessna.

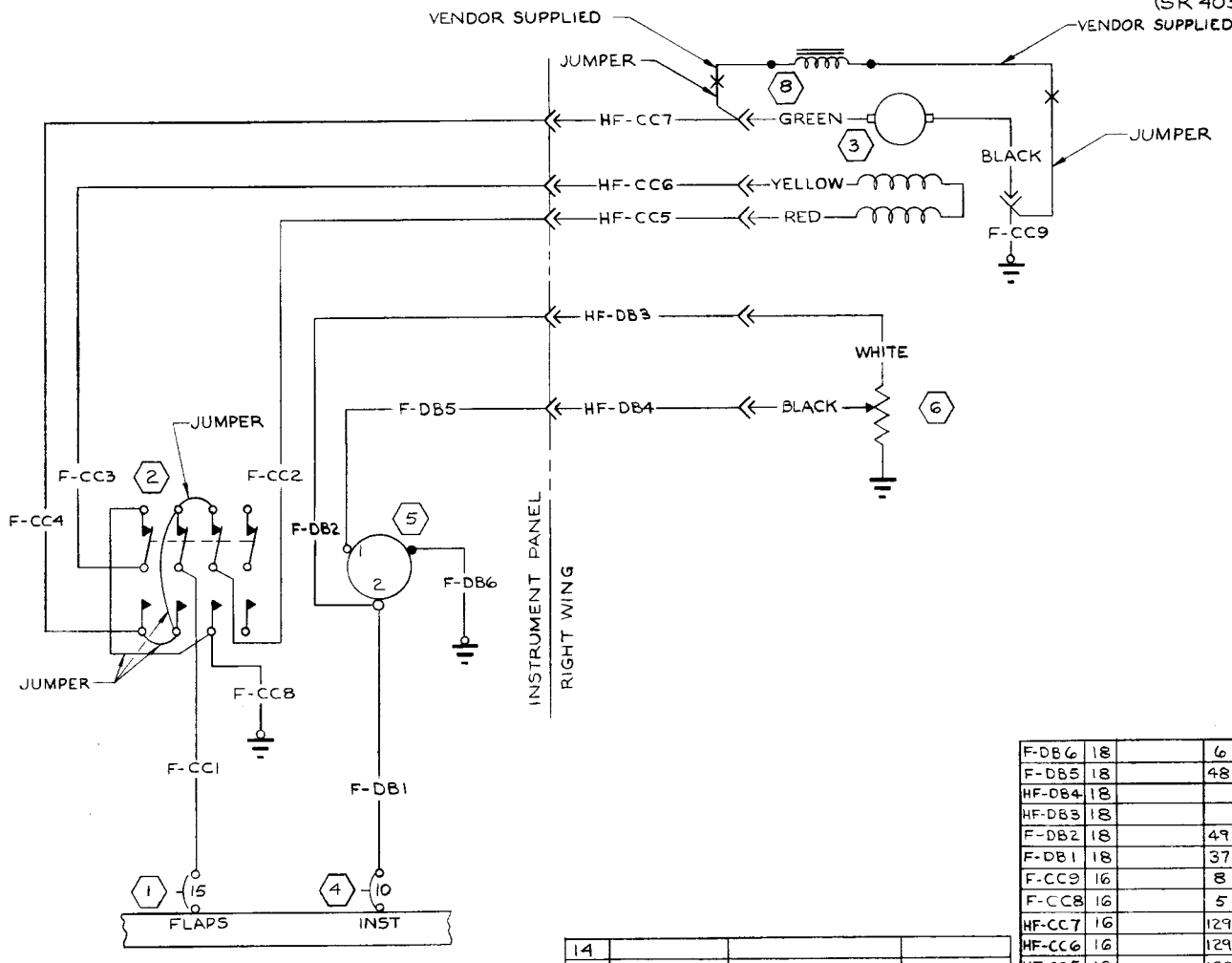
DWG NO: 1270405

SUPERSEDED BY	SUPERSEDES	MODEL	REV	PAGE
1270905 PAGE 14.2		210	A	14.1

FORM NO. 80-161

(SR 4039-9)

CHG LET	REVISION	BY / DATE	CHK / APPD
A	BY REVISION: ADD JUMPER WIRES TO SOLENOID. "DOWN" WAS "UP". DELETE ▷ EXISTING WIRES ON SOLENOID USED FOR INSTALLATION. REMOVED "R" FROM INST; ADDED WIRE LENGTHS TO W/T; REMOVED 1270405-DB1 THRU 1270405-DB6 & 1270461-1 FROM E/T; HF-CC5 WAS F-CC5; HF-CC6 WAS F-CC6; HF-CC7 WAS F-CC7; ADDED WIRES F-DB1 THRU F-DB6 TO W/T; HF-DB3 WAS F-DB3; HF-DB4 WAS F-DB4	WJR 8-18-64	RRS TM Mac



NOTE:
1. FLAP SWITCH SHOWN IN FLAP "DOWN" POSITION.

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
14			
13			
12			
11			
10			
9			
8	28INT-12D	SOLENOID (GN)	
7			
6	1260068-2	XMTR, FLAP POS	
5	S-1318-1	INDICATOR, FLAP POS	
4	S-1360-10	CIRCUIT BREAKER	
3	0760657-1	FLAP ACTUATOR	
2	0760632-1	SWITCH, ELECT. FLAP	
1	S-1360-15	CIRCUIT BREAKER	

EQUIPMENT TABLE

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		SERIALS
F-DB6	18		6	S-1367-1-8	SOLDER	
F-DB5	18		48	S-1367-1-10	S-391-2	
HF-DB4	18			S-341-2	S-341-2	
HF-DB3	18			S-341-2	S-341-2	
F-DB2	18		49	S-1367-1-8	S-391-2	
F-DB1	18		37	S-1367-1-8	S-1367-1-10	
F-CC9	16		8	S-341-1	S-1367-1-8	
F-CC8	16		5	S-1367-2-6	S-1367-2-6	
HF-CC7	16		129	S-341-1	S-341-1	
HF-CC6	16		129	S-341-1	S-341-1	
HF-CC5	16		129	S-341-1	S-341-1	
F-CC4	16		25	S-1367-2-6	S-341-1	
F-CC3	16		25	S-1367-2-6	S-341-1	
F-CC2	16		25	S-1367-2-6	S-341-1	
F-CC1	16		32	S-1367-2-6	S-1367-2-6	

WIRE TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION. WICHITA, KANSAS

	NAME	DATE
DRAWN	G WOOD	2-5-63
GROUP		4-5-63
CHECK		4-2-63
PROJ		4-5-63

TITLE: WIRING DIAGRAM — WING FLAPS - ELECTRIC, & FLAP POSITION INDICATOR

Cessna.

DWG NO. 1270405

SUPERSEDED BY

SUPERSEDES 1270405 PAGE 14.1

MODEL: 210

REV: A

PAGE: 14.2

FORM NO. 80-161

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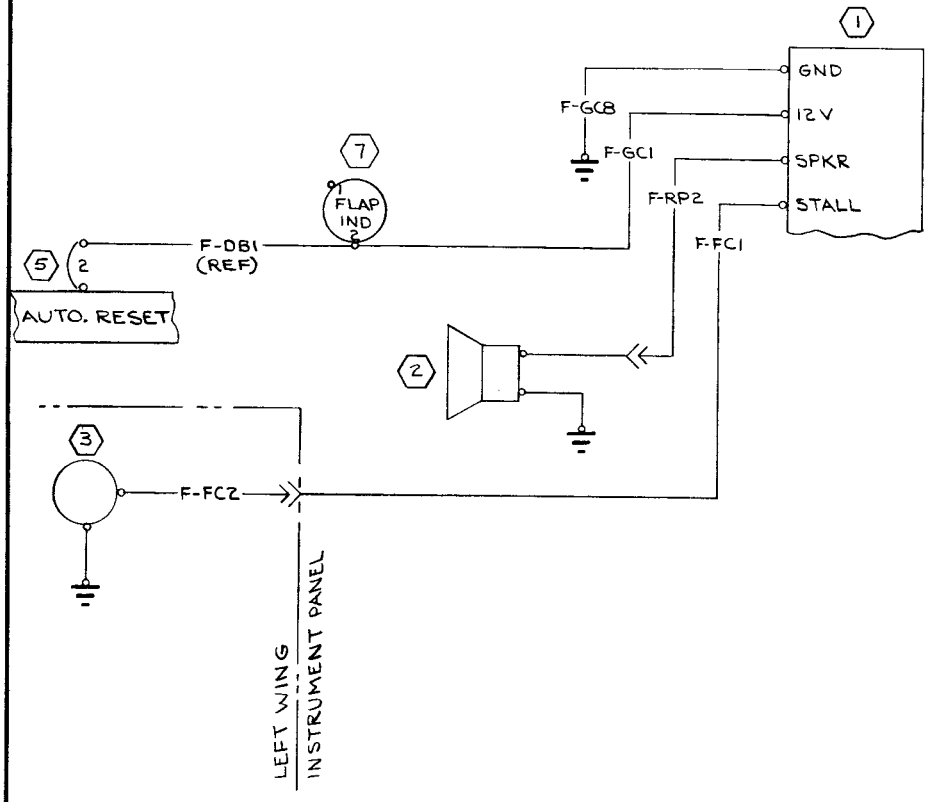
WARNING AND EMERGENCY SECTION

Cessna.

			DRAWING NO.
DRAWN	RIDDER	TITLE: WIRING DIAGRAM--- MODEL 210	1270405
DATE	10-23-62		
APP'D	RES Hmc	REV:	PAGE: 15.0
CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.			

FORM NO. 80-173

CHG LET	REVISION	BY / DATE	CHK / APPD
A	ADDED WIRE LENGTHS TO W/T; REMOVED 1270429-1 & F-DB1 FROM E/T	WJR 8-15-64	RRS JM



Inactive SER 21058236 & ON
3-22-63
RRS
Nme

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
7	S-1318-1	INDICATOR, FLAP POS	
6			
5	CA-2	CKT BKR (MTCC)	
4			
3	0511062-4	XMTR, STALL WARN	
2	1270035-1	WARNING SPKR	
1	1213239-1	WARNING UNIT	

EQUIPMENT TABLE

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		SERIALS
F-GC8	18		14	S-1367-1-6	S-1367-1-8	
F-GC1	18		16	S-1367-1-8	S-1367-1-6	INACTIVE SER 21058263 & ON
F-RP2	18			S-1367-1-6	S-341-2	INACTIVE SER 21058263 & ON
F-FC2	18		115	S-1367-1-6	S-341-2	
F-FC1	18		57	S-1367-1-6	S-341-2	

WIRE TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	RIDDER	9-17-62
CHK'D	[illegible]	10-24-62
CHECK	R. Stuck	10-25-62
PROJ	N. McCabe	11-2-62

TITLE: WIRING DIAGRAM — STALL WARNING SYSTEM (NON-HEATED)

Cessna.

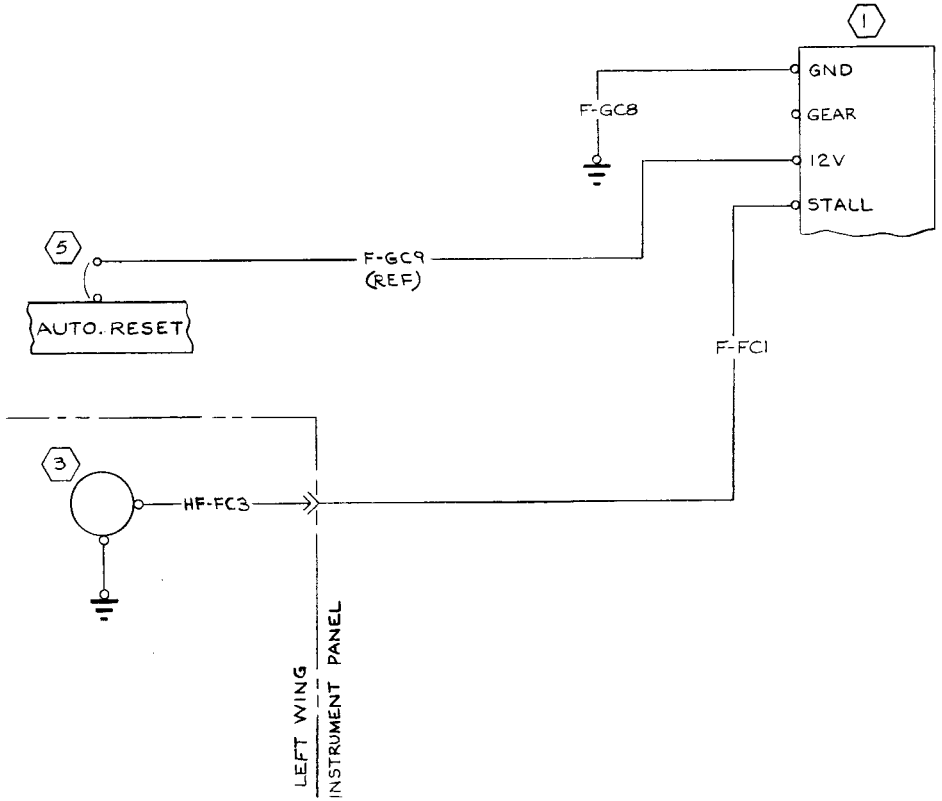
DWG NO: 1270405

SUPERSEDED BY	PAGE	SUPERSEDES	MODEL:	REV:	PAGE:
1270405	15.1&1		210	A	15.1

FORM NO. 80-161

(SR 4203)

CHG LET	REVISION	BY DATE	CHK APPD
A	ADDED WIRE LENGTHS TO W/T; REMOVED 1270461-1 & F-GC9 FROM E/T; OBSOLETE F-FC2. HF-FC3 WAS F-FC2 (SR4455)	WJR 8-15-64	RRS JM RME



WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		SERIALS
HF-FC3	18		S-1367-1-6	S-341-2		SER (SR4455) & ON
F-GC8	18		14 S-1367-1-6	S-1367-1-8		
F-FC2	18		115 S-1367-1-6	S-341-2		OBSOLETE
F-FC1	18		57 S-1367-1-6	S-342-1		

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
8			
7			
6			
5	CA-2	CIRCUIT BREAKER	(MTCC)
4			
3	0511062-4	XMTR, STALL WARN	
2			
1	1213242-1	WARNING UNIT	

EQUIPMENT TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION. WICHITA, KANSAS

	NAME	DATE
DRAWN	G WOOD	3-22-63
GROUP	Jed Willard	4-2-63
CHECK	R. Stuck	4-2-63
PROJ	Wm McCants	4-5-63

TITLE: WIRING DIAGRAM — STALL WARNING SYSTEM (NON-HEATED)

Cessna.

DWG NO. 1270405

SUPERSEDED BY:

SUPERSEDES 1270405 PAGE 15.1

MODEL: 210

REV: A

PAGE: 15.1.1

FORM NO. 80-161

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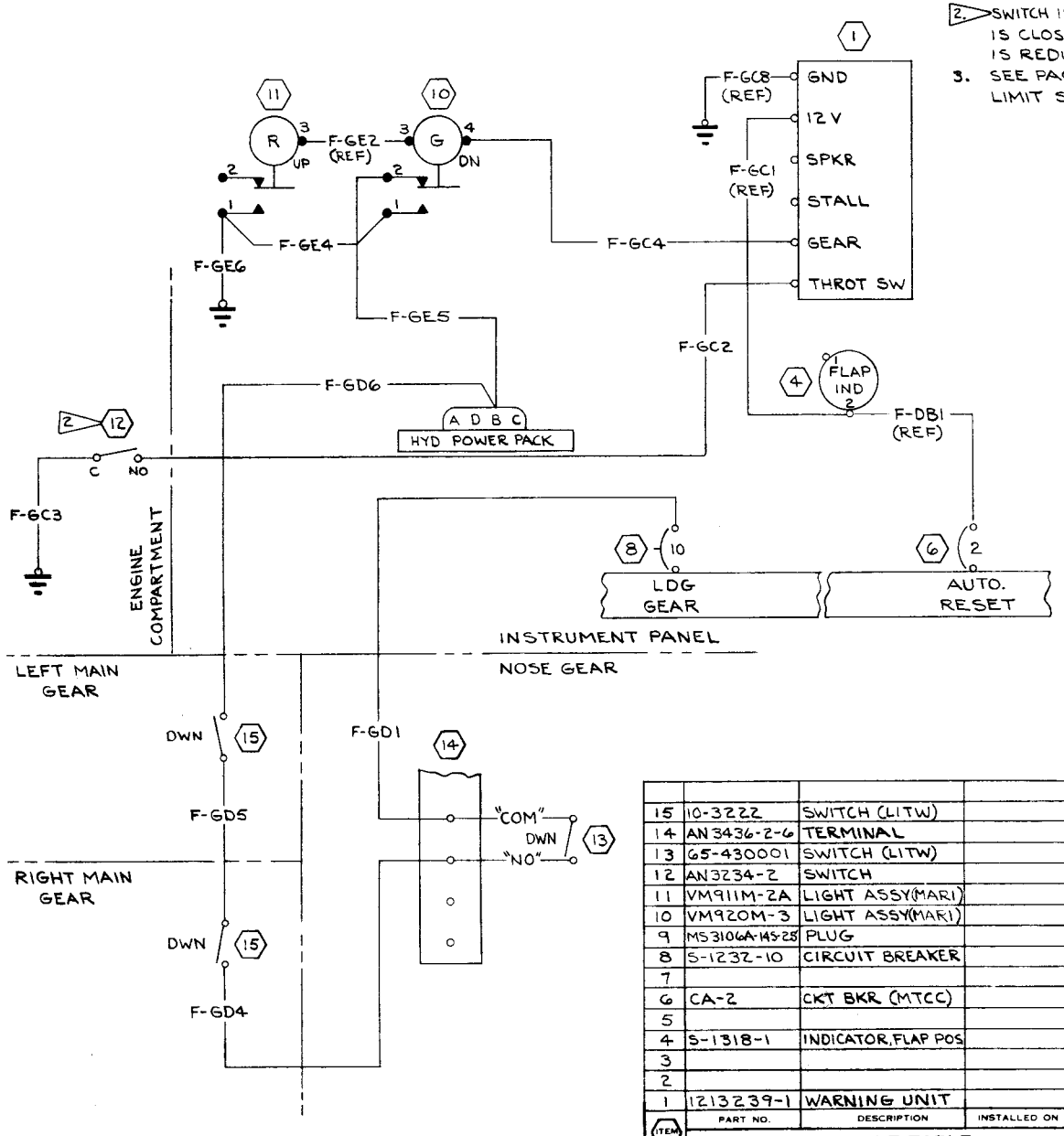
NOTES:

1. GEAR DOWN SWITCHES ARE CLOSED WHEN GEARS ARE LOCKED DOWN.
2. SWITCH IS CLOSED WHEN THROTTLE IS CLOSED I.E. ENGINE POWER IS REDUCED.
3. SEE PAGE 12.1 FOR GEAR UP LIMIT SWITCHES.

CHG LET	REVISION	BY / DATE	CHK / APPD
A	ADDED WIRE LENGTHS TO W/T; REMOVED 1270429-1, F-DB1, F-GC1 & F-GC8;	WJR 8-15-69	EES



Inactive SER 21058221 & ON 2-22-63 gw DM AES NMC

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
15	10-3222	SWITCH (LITW)	
14	AN3436-2-6	TERMINAL	
13	65-430001	SWITCH (LITW)	
12	AN3234-2	SWITCH	
11	VM911M-2A	LIGHT ASSY(MARI)	
10	VM920M-3	LIGHT ASSY(MARI)	
9	MS3106A-14S-2S	PLUG	
8	S-1232-10	CIRCUIT BREAKER	
7			
6	CA-2	CKT BKR (MTCC)	
5			
4	S-1318-1	INDICATOR, FLAP POS	
3			
2			
1	12132391	WARNING UNIT	

EQUIPMENT TABLE

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS			SERIALS
F-GE6	20		6	S-1367-1-6	SOLDER		
F-GE5	20		26	SOLDER	SOLDER		
F-GE4	18		3	SOLDER	SOLDER		
F-GD6	18		164	S-1367-1-4	SOLDER		
F-GD5	18		80	S-1367-1-4	S-1367-1-4		
F-GD4	18		205	S-1367-1-4	S-1367-1-6		
F-GD1	18		65	S-1367-1-8	S-1367-1-6		
F-GC4	18		38	S-1367-1-6	SOLDER		
F-GC3	18		10	S-1367-1-4	S-1367-1-6		INACTIVE 21058221 & ON
F-GC2	18		58	S-1367-1-4	S-1367-1-6		INACTIVE 21058221 & ON

WIRE TABLE

CESSNA AIRCRAFT CO COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	R IDDER	9-18-62
GROUP		10-24-62
CHECK	R. Stuck	10-25-62
PROJ		11-2-62

TITLE: WIRING DIAGRAM — GEAR WARNING SYSTEM

Cessna.

DWG NO: 1270405

REV: A

PAGE: 15.2

SUPERSEDED BY: 1270405 PAGE 15.2.1

SUPERSEDES:

MODEL: 210

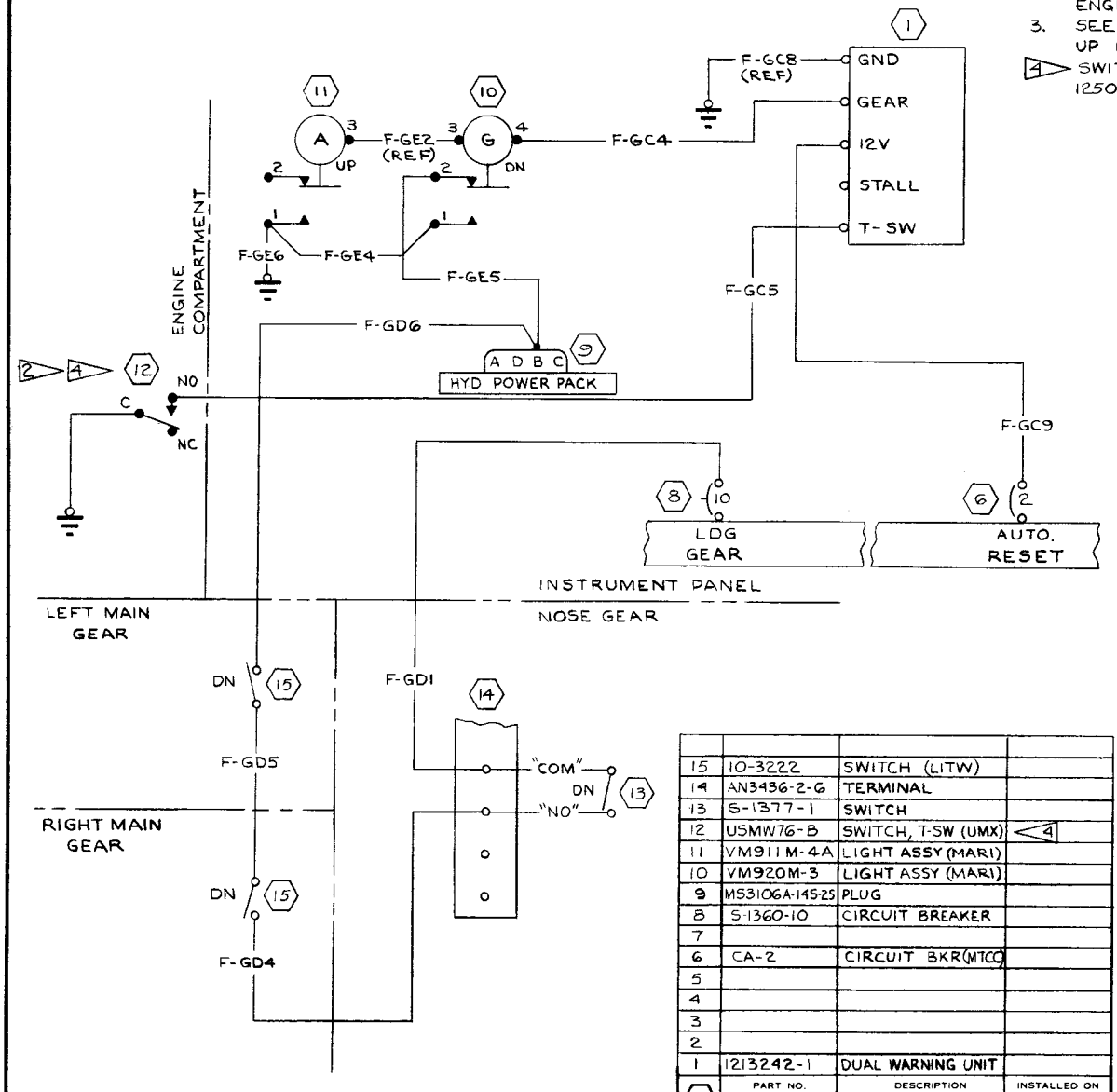
FORM NO. 80-161

NOTES:

1. GEAR DOWN SWITCHES ARE CLOSED WHEN GEARS ARE LOCKED DOWN.
2. SWITCH IS CLOSED WHEN THROTTLE IS CLOSED I.E. ENGINE POWER IS REDUCED.
3. SEE PAGE 12.1 FOR GEAR UP LIMIT SWITCHES.
4. SWITCH IS PART OF 1250706-1 ASSY.

(SR 40395)
(SR 4203)

CHG LET	REVISION	BY DATE	CHK APPD
A	ADDED WIRE LENGTHS TO W/T; REMOVED 1270461-1 & F-GC8 FROM E/T; GEAR UP LIGHT "A" WAS "R"; VM911M-4A WAS VM911M-2A; S-1377-1 WAS 65-430001 (SR4455)	WJR 8-15-69	RES TM NAC



ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
15	10-3222	SWITCH (LITW)	
14	AN3436-2-6	TERMINAL	
13	S-1377-1	SWITCH	
12	USMW76-B	SWITCH, T-SW (UMX)	4
11	VM911M-4A	LIGHT ASSY (MARI)	
10	VM920M-3	LIGHT ASSY (MARI)	
9	MS3106A-14S-2S	PLUG	
8	S-1360-10	CIRCUIT BREAKER	
7			
6	CA-2	CIRCUIT BKR (MTCO)	
5			
4			
3			
2			
1	1213242-1	DUAL WARNING UNIT	

EQUIPMENT TABLE

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS			SERIALS
F-GC9	18		47	S-1367-1-6	S-1367-1-8		SER 21058263 & ON
F-GE6	20		6	S-1367-1-6	SOLDER		
F-GE5	20		26	SOLDER	SOLDER		
F-GE4	18		3	SOLDER	SOLDER		
F-GD6	18		164	S-1367-1-4	SOLDER		
F-GD5	18		80	S-1367-1-4	S-1367-1-4		
F-GD4	18		205	S-1367-1-4	S-1367-1-6		
F-GD1	18		65	S-1367-1-8	S-1367-1-6		
F-GC5	18		58	S-1367-1-6	SOLDER		
F-GC4	18		38	S-1367-1-6	SOLDER		

WIRE TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION WICHITA, KANSAS

	NAME	DATE
DRAWN	G WOOD	2-22-63
GROUP	[illegible]	3-26-63
CHECK	R. Stuck	3-28-63
PROJ	N. McCabe	3-29-63

TITLE: WIRING DIAGRAM — GEAR WARNING SYSTEM

Cessna.

DWG NO. 1270405

SUPERSEDED BY:

SUPERSEDES 1270405 PAGE 15.2

MODEL: 210

REV: A

PAGE: 15.2.1

FORM NO. 80-161

MISCELLANEOUS SECTION

Cessna.

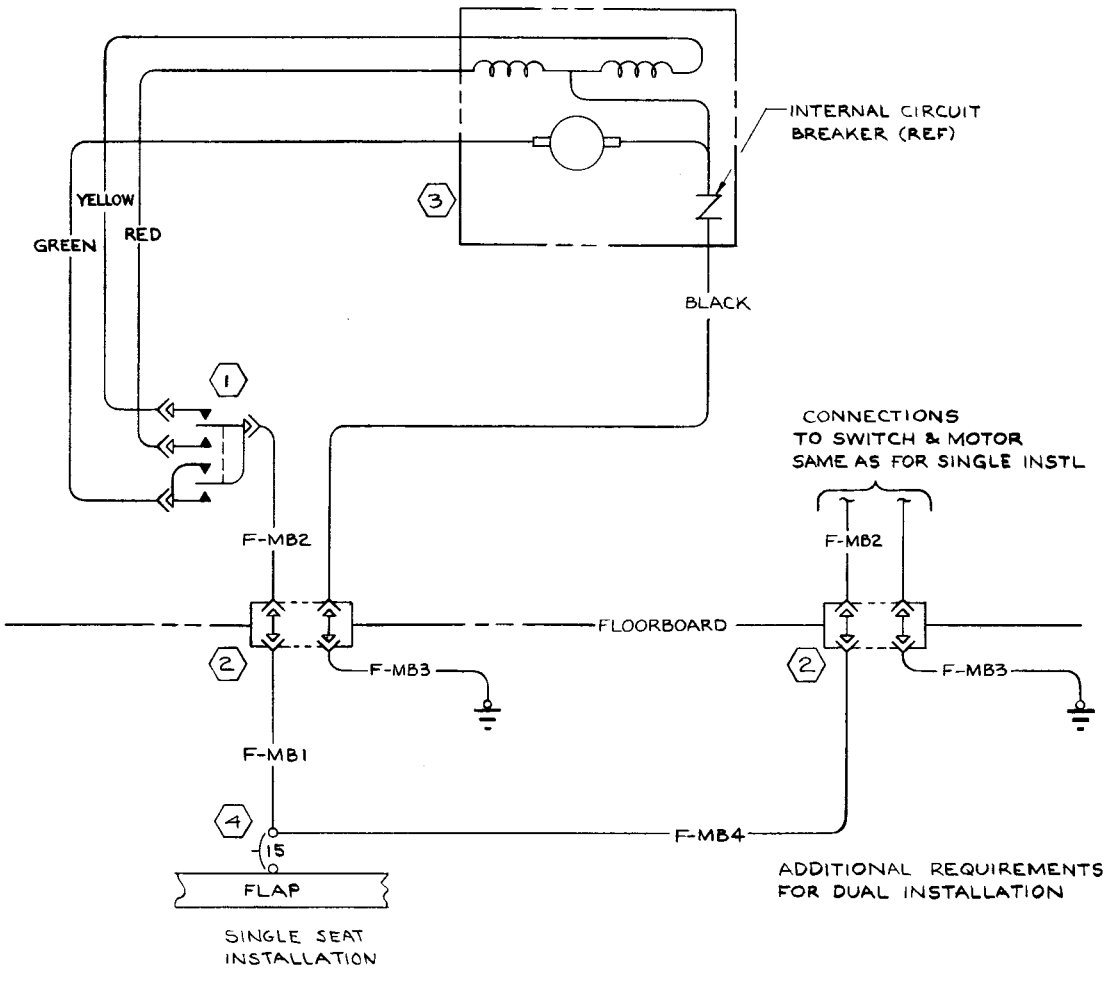
			DRAWING NO.
DRAWN	GLW	TITLE: WIRING DIAGRAM--- MODEL 210	1270405
DATE	9-5-63		
APP'D	RRS	REV:	PAGE: 16.0

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

FORM NO. 80-174

(SR 4204)

CHG LET	REVISION	BY / DATE	CHK / APPD
A	ADDED WIRE LENGTHS TO W/T REMOVED 1270961-1 FROM E/T	WJR 8-18-64	[illegible]



NOTES:
1. COLOR CODED WIRES ARE VENDOR FURNISHED.
2. WIRES ESTABLISHED ON THIS PAGE ARE USED ALSO ON MODELS 205-206 & 182. REF 1270625 PAGE 16.1 & 0770610 PAGE 16.1 FOR RESPECTIVE WIRING DIAGRAMS.

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
5			
4	S-1360-15	CIRCUIT BREAKER	
3	1414249-2	MOTOR ASSY	
2	S-1491-1	BUSHING-TERMINAL	
1	1414268-1	SWITCH ASSY	

EQUIPMENT TABLE

WIRE CODE NO	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS
F-MB4	16		131	S-1493-2	S-1367-2-6	0700718	
F-MB3	16		12	S-1493-2	S-1367-2-6	0700718	
F-MB2	16		26	S-1493-2	S-1493-2	0700718	
F-MB1	16		113	S-1367-2-6	S-1493-2	0700718	

WIRE TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION, WICHITA, KANSAS

	NAME	DATE
DRAWN	G. WOOD	8-28-63
GROUP	[illegible]	9-[illegible]-63
CHECK	R. Stuck	9-23-63
PROJ	W. McCarter	9-25-63

TITLE: WIRING DIAGRAM — VERTICALLY ADJUSTING SEAT (OPT)

Cessna.

DWG NO. 1270405

SUPERSEDED BY	SUPERSEDES	MODEL:	REV:	PAGE:
		210	A	16.1

FORM NO. 80-161

SECTION C3

WIRING DIAGRAMS - MODELS 205, 206, P206 & U206

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Cessna®

WIRING DIAGRAM

MODEL 205, 206, P206 & U206

DWG. NO. 1270625

SERIALS 205-0001 THRU 205-0577

SERIALS 206-0001 THRU 206-0275

SERIALS P206-0001 AND ON

SERIALS U206-0276 AND ON

FORM NO. 80-158

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

TABLE OF CONTENTS

PAGE NO.	TITLE	DATE ISSUED	REV
1.0	Title Page		
2.0	Table of Contents	3-1-65	
2.1	Table of Contents	3-1-65	
3.0	Notes	5-1-64	C
4.0	D. C. Power		
4.1	Battery & External Power Systems	8-20-64	D
4.2	Generator System	5-1-64	Inac.
4.3	Alternator System, 52 Amp	5-26-64	A
5.0	Ignition		
5.1	Ignition System	8-20-64	D
6.0	Engine Control		
6.1	Starter System	8-20-64	C
7.0	Fuel and Oil		
7.1	Fuel Pump System	8-20-64	E
7.2	Oil Dilution System (Opt.)	8-20-64	D
8.0	Engine Instruments		
8.1	Cyl. Head Temp.	8-20-64	E
8.2	Fuel Quantity Indicator	8-20-64	C
9.0	Flight Instruments		
9.1	Turn & Bank and Gyro Horizon Indicator	8-20-64	C
9.2	Stall Warning System (Non-Heated)	8-20-64	D
10.0	Other Instruments		
10.1	Clock	9-21-64	D
11.0	Lighting		
11.1	Dome & Courtesy Lights	8-20-64	C
11.2	Instruments Lights	9-8-64	C
11.3	Landing Lights	9-8-64	D
11.4	Navigation Lights	9-8-64	D
11.5	Rotating Beacon	9-8-64	C
11.6	Map Light (Opt.)	9-8-64	A-Inac
11.6.1	Map Light (Opt.)	9-8-64	
11.7	Post Lighting & Back Lighting (Opt.)	1-27-65	A
11.8	Nav-O-Matic 300 Post Light (Opt.)	11-17-64	Inac.
12.0	Not Used		

Cessna.

TITLE: **WIRING DIAGRAM---**
MODEL 205, 206, P206 & U206

DRAWING NO. 1270625

DATE: 1-2-62

PAGE: 2.0

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

FORM NO. 80-159A

TABLE OF CONTENTS

PAGE NO.	TITLE	DATE ISSUED	REV
13.0	Heating, Venting & De-Icing		
13.1	Cigar Lighter	9-8-64	D
13.2	Heated Pitot Tube & Heated Stall (Warning System, Opt.)	9-8-64	C
14.0	Control Surface		
14.1	Wing Flaps	9-8-64	E
14.1.1	Wing Flaps (Floatplane) (Opt.)	9-8-64	E
14.1.2	Wing Flaps	9-8-64	D
15.0	Not Used		
16.0	Miscellaneous Section	9-27-63	
16.1	Vertical Adjusting Seat (Opt.)	9-8-64	A

NOTES

1. WIRE CODE DESIGNATIONS PER CES 1100.
2. WIRE CODE APPLICATION AND WIRE LENGTH TOLERANCES PER CES 1015.
3. "S" SUFFIX ON WIRE GAUGE IN WIRE TABLE DENOTES SHIELDED WIRE.
(B) "DS" suffix on wire gauge in wire table denotes double-shielded wire per S-1462.
4. NON-SHIELDED WIRES TO BE PER S-1460 white. Wires 10-gauge and larger to to be Type II construction.
(C) 5. SHIELDED WIRES TO BE PER S-1461 white, unless designated otherwise by note on the field of the wiring diagram.
6. Part numbers shown in the "equipment table" of the various pages are for reference only, and do not constitute a material requirement unless specifically noted on the individual page. Refer to the various equipment installation drawings for verification of part numbers.
7. Equipment part numbers shown on the various pages that are for reference only, (see Note 6), will not be changed unless it affects wire terminals and fabrication.
8. Vendor codes per S-1400. Vendor codes are shown in parentheses.
9. Wires noted herein as ("opt") are optional to the standard airplane.
10. All wires not specified as "(opt)" are to be installed as standard equipment. The airplane assembly will specify the additional equipment required for deluxe versions.
11. When "(opt)" is used in the title block of a diagram, all wires shown therein are optional except where noted as "(std)".

Cessna

DRAWN	WJR	TITLE: WIRING DIAGRAM---	DRAWING NO.
DATE	4-23-64	MODEL 205, P206 & U206	1270625
APP'D	RRS and WMC	REV: D	PAGE: 3.0

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

FORM NO. 80-160

D. C. POWER SECTION

Cessna.

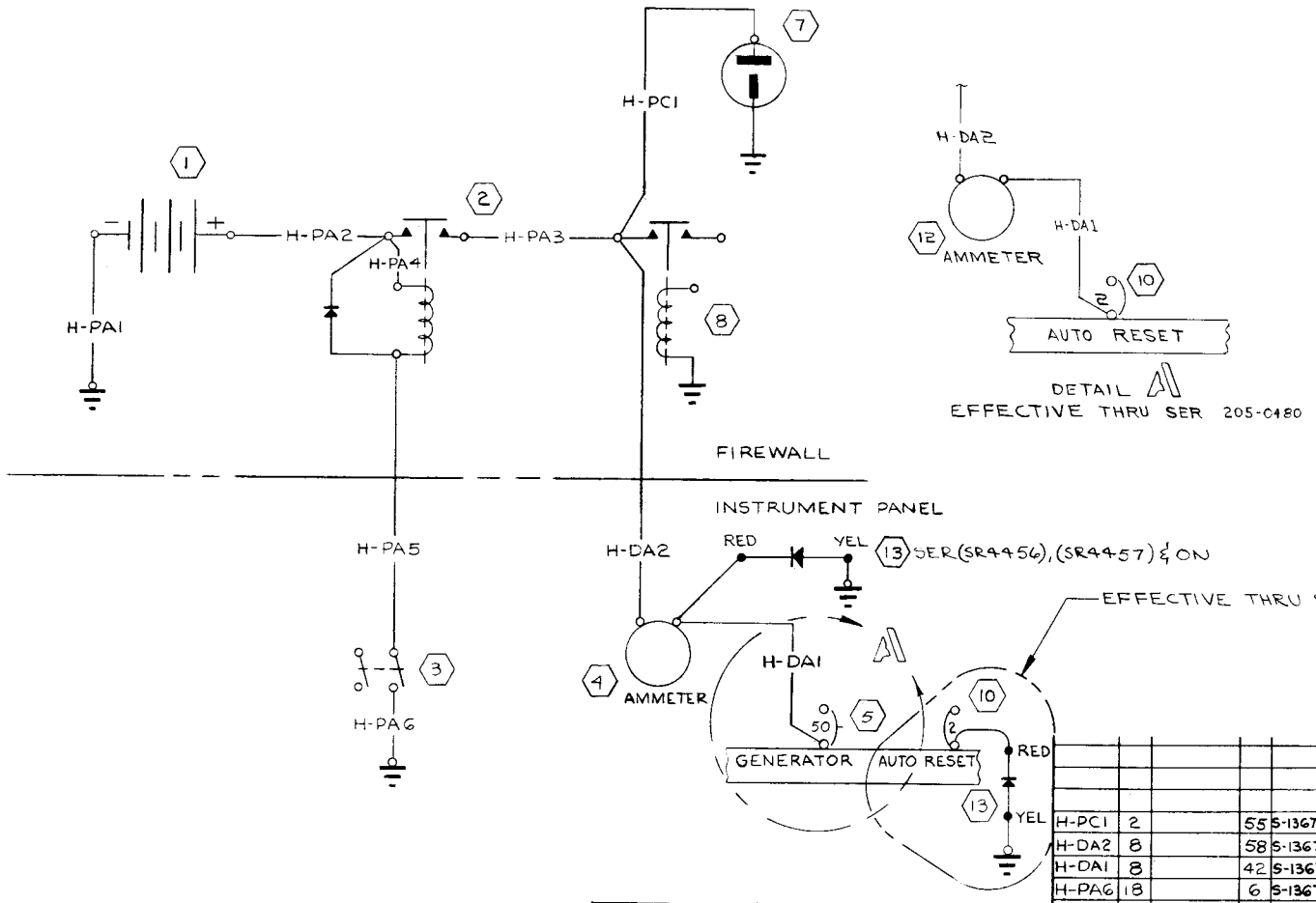
DRAWN	G WOOD	TITLE: WIRING DIAGRAM---	DRAWING NO.
DATE	1-25-62	MODEL 205 & 206	1270625
APP'D		REV:	PAGE: 4.0

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

FORM NO. 80-162

(SR 3694-10)

CHG LET	REVISION	BY DATE	CHK APPD
A	REMOVED N/A FROM STD WIRES; ADD (OPT) TO OPT WIRES (SR3694-10)	GLW 4-2-62	RRS
B	ADD MODEL 210G ADDED 1270461-1 BUS BAR ADD 1213505-1E-2 INST CLUST. ADDED S-1360-50 CIRCUIT BREAKER ADDED DETAIL A (SR3983-6)(SR4038-6)	GLW 6-17-63	RRS
C	ADD S-550B KLIPVOLT SUPPRESSOR (SR 4478)	GLW 12-30-63	RRS
D	ADDED LIMITING SERIALS TO FIELD; REMOVED 1270461-1 BUS BAR FROM E/T; ADDED WIRE LENGTHS TO W/T; ADDED P206 & U206 TO MODEL BLOCK; C669502-0104 WAS 1213505-1 & 1213505-2 (SR4456) & (SR4457)	WJR 6-17-64	RRS



ITEM NO	PART NO.	DESCRIPTION	SERIALS
13	S-550S	KLIPVOLT SUPPRESSOR (SATA)	
12	0713602-1	INST CLUSTER	
11			
10	CA-2	CKT BKR (MTCC)	
9			
8	0750027-1	START. SOLENOID	
7	AN2552-3A	RECEPTACLE	
6			
5	S-1360-50	CIRCUIT BREAKER	
4	C669502-0104	INST CLUSTER KIT	
3	S-1159-1-1	SWITCH (MASTER)	
2	0712603-2	CONTACTOR, BAT.	
1	0712605-1	BATTERY	

EQUIPMENT TABLE

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS
H-PC1	2		55	S-1367-7-14	S-1368-7-14	1270434	(OPT)
H-DA2	8		58	S-1367-4-10	S-1367-4-14		
H-DA1	8		42	S-1367-4-10	S-1367-4-8		
H-PA6	18		6	S-1367-1-6	S-1367-1-8		
H-PA5	18		141	S-1367-1-6	S-1367-1-6		
H-PA4	18		5	S-1367-1-6	S-1367-1-12		
H-PA3	2		21	S-1367-7-14	S-1367-7-12		
H-PA2	2		21	S-1367-7-12	S-1367-7-13		
H-PA1	2		14	S-1367-7-12	S-1367-7-13		

WIRE TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION, WICHITA, KANSAS

	NAME	DATE
DRAWN	G WOOD	12-6-61
GROUP	[illegible]	1-24-62
CHECK	R. Stuck	2-5-62
PROJ	[illegible]	2-7-62

TITLE: WIRING DIAGRAM — BATTERY & EXTERNAL POWER SYSTEMS

Cessna.

DWG NO: 1270625

SUPERSEDED BY	SUPERSEDES	MODEL:	REV:	PAGE:
1270625 P6 4.1.1		205, P206 & U206	D	4.1

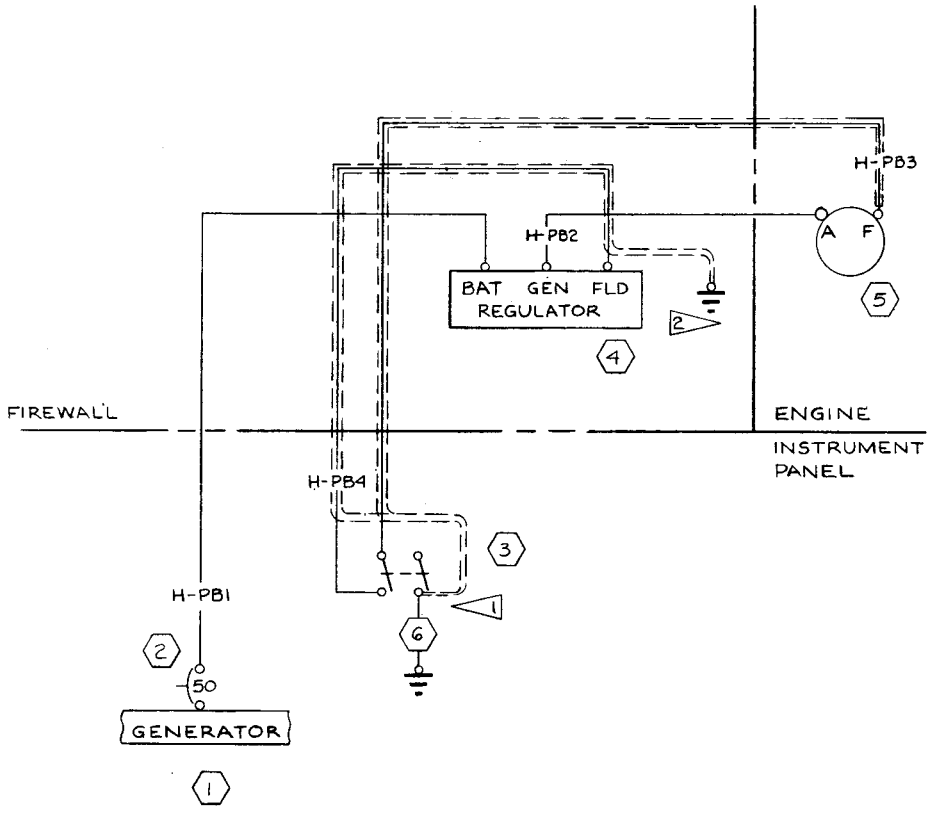
FORM NO. 80-161

(SR 3694-10)

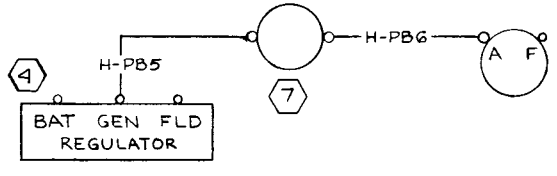
NOTES:

1. S-1367-2-6 TERMINAL ON SHIELDS.
2. S-1367-2-12 TERMINAL ON SHIELD.
3. PART OF 1250600 ENGINE INSTALLATION.

CHG LET	REVISION	BY / DATE	CHK / APPD
A	REMOVED N/A FROM STD WIRES. ADD (OPT) TO OPT WIRES. (SR3694-10)	GLW 4-2-62	
B	ADD MODEL 206 1270461-1 BUS BAR WAS 1270429-1 S-1360-50 CKT BKR WAS S-1232-50 (SR 3983-G) (SR 4039-G)	GLW 6-17-63	



Inactive SER (SR 4456) & (SR 4457) E/ON
W.J.R. 3-26-64
RRS ALA GE TM NMC



WHEN RADIO NOISE FILTER (OPT) IS REQD, REPLACE H-PB2 AS SHOWN

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS
H-PB6	8			S-1367-4-12	S-1367-4-10	1270635	(OPT)
H-PB5	8			S-1367-4-10	S-1367-4-10	1270635	(OPT)
H-PB4	18S			S-1367-1-6	S-1367-1-10		
H-PB3	18S			S-1367-1-6	S-1367-1-12		
H-PB2	8			S-1367-4-12	S-1367-4-10		
H-PB1	8			S-1367-4-8	S-1367-4-10		

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	SERIALS
7	145329	NOISE FILTER (SPR)	
6	H-PA6	WIRE	
5	3	GENERATOR	
4	0413205-11	REGULATOR	
3	S-1159-1-1	SWITCH, MASTER	
2	S-1360-50	CIRCUIT BREAKER	
1	1270461-1	BUS BAR	

EQUIPMENT TABLE

CESSNA AIRCRAFT CO COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	G WOOD	12-7-61
GROUP	[illegible]	1-29-62
CHECK	R. Stuck	2-5-62
PROJ	[illegible]	2-7-62

TITLE: WIRING DIAGRAM — GENERATOR SYSTEM

Cessna.

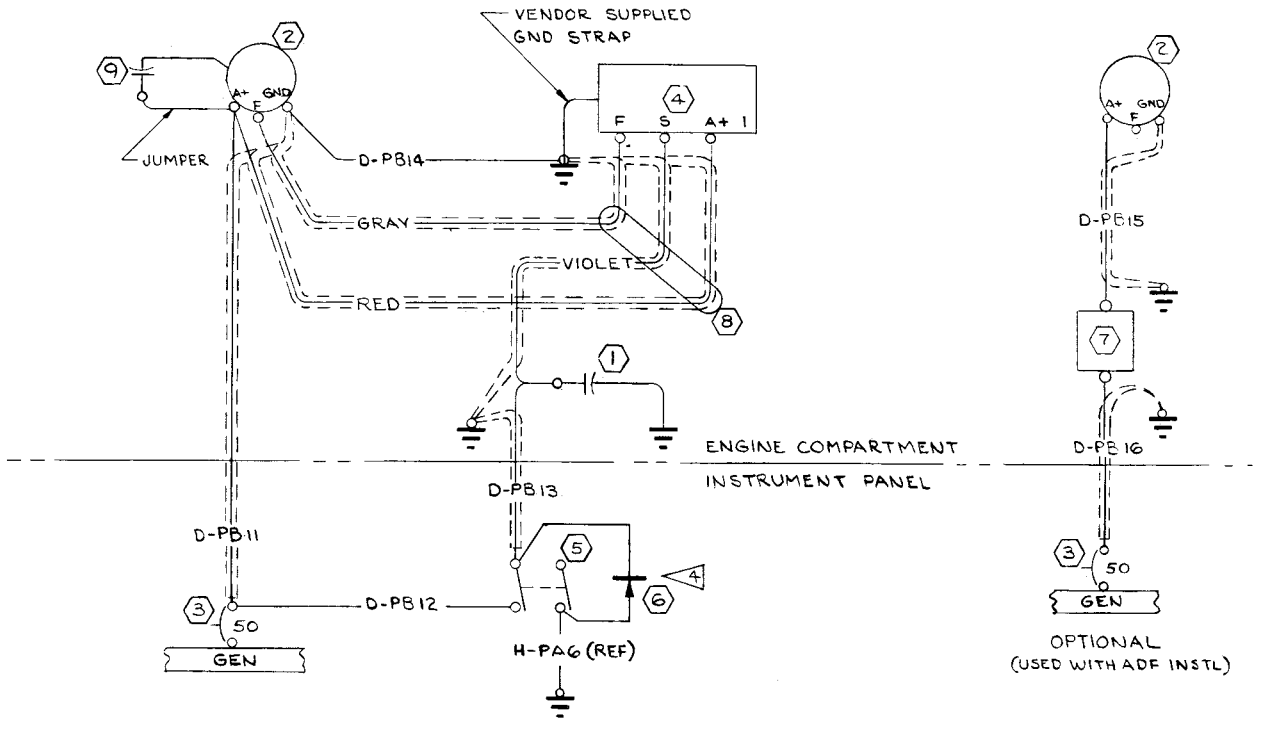
DWG NO. 1270625

SUPERSEDED BY: 1270625 PAGE 4-3 | SUPERSEDES: | MODEL: 205, 206 | REV: B | PAGE: 4-2

FORM NO. 80-161

(SR 4456)
(SR 4457)

CHG LET	REVISION	BY / DATE	CHK / APPD
A	BY REV: CHANGED WIRE CODE D-PB WAS D-DP (SR4456) & (SR4457)	WJR 5-8-64	[illegible]



STANDARD

NOTES:
1. TERMINALS C3XB-14462A & B-14463 ARE (FOR) PART NUMBERS.
2. "D" PREFIX USED ON THIS DRAWING INSTEAD OF "H" BECAUSE WIRES ARE SAME AS THOSE USED IN MODEL 182. THIS DRAWING IS SCHEMATALLY IDENTICAL TO 0770610 PAGE 4.4 AND IS FOR REF ONLY.
3. 8 GAUGE SHIELDED WIRE MATERIAL PER S-1534.
4. OBSERVE POLARITY SYMBOL ON DIODE ASSY WHEN INSTALLING ON SWITCH TERMINALS OR DIODE WILL FAIL WHEN SYSTEM IS ENERGIZED.

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
9	1250209-1	FILTER ASSY	
8	C5-FF-10A-568A	PLUG ASSY (FOR)	
7	145329	NOISE FILTER (SPR)	
6	0770719-1	DIODE ASSY	
5	S-1159-1-1	SWITCH - MASTER	
4	0750216-1	REGULATOR ASSY	
3	S-1360-50	CIRCUIT BREAKER	
2	0750217-1	ALTERNATOR ASSY.	
1	0770038-2	FILTER	

EQUIPMENT TABLE

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		SERIALS
JUMPER	18		6	S-1367-1-6	S-1367-1-12	1250206
D-PB16	8S	3	39	S-1367-4-10 S-1367-3-8	S-1367-4-6	(OPT)
D-PB15	8S	3	22	(3XB-1446-2A S-1367-3-10	S-1367-4-10 S-1367-3-8	(OPT)
D-PB14	10		22	B-14463	S-1367-3-12	
D-PB13	18S		24	S-1367-1-6	S-1367-1-6 S-1367-3-8	
D-PB12	18		20	S-1367-1-6	S-1367-1-6	
D-PB11	8S	3	56	(3XB-14462A S-1367-3-10	S-1367-4-6	

WIRE TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION, WICHITA KANSAS

	NAME	DATE
DRAWN	RIDDER	3-26-64
GROUP	[illegible]	4-23-64
CHECK	R. Stuck	4-28-64
PROJ	[illegible]	5-1-64

TITLE: WIRING DIAGRAM — ALTERNATOR SYSTEM 52 AMP

Cessna.

DWG NO. 1270625

SUPERSEDED BY 1270625 PAGE 4.4 | SUPERSEDES 1270625 PAGE 4.2 | MODEL: 205 & 206 | REV: B | PAGE: 4.3

FORM NO. 80-161

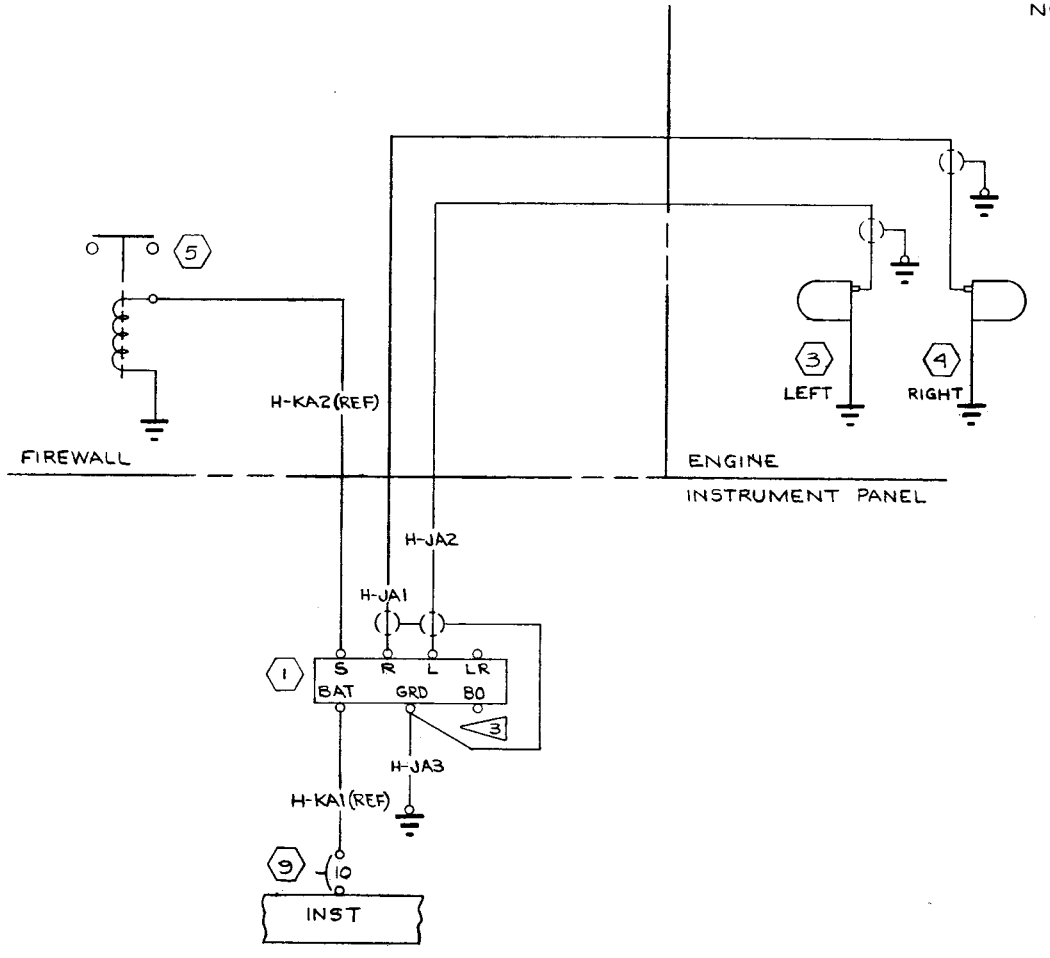
IGNITION SECTION

Cessna.

DRAWN	G WOOD	TITLE: WIRING DIAGRAM--- MODEL 205 & 206	DRAWING NO. 1270625
DATE	1-25-62		
APP'D	NEW CM RRS Jam NMC	REV:	PAGE: 5.0

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

FORM NO. 80-163



NOTES: (SR 3694-10)

1. TERMINATE WITH (7) SHORTING BAR BETWEEN "R" AND UNMARKED TERMINAL ADJACENT TO IT IS NOT USED FOR THIS CIRCUIT.
3. TERMINATE SHIELDS ON JA-1 & JA-2 WIRES AT THE SWITCH WITH S-1367-2-6 TERMINALS & CONNECT TO "GRD" TERMINAL ON SWITCH S-1367-1-10 TERMINAL ON HOT LEAD, S-1367-3-10 ON SHIELD.
4. TERMINATE SHIELDS ON JA-1 & JA-2 WIRES AT THE SWITCH WITH S-1367-2-6 TERMINALS & CONNECT TO "GRD" TERMINAL ON SWITCH S-1367-1-10 TERMINAL ON HOT LEAD, S-1367-3-10 ON SHIELD.

CHG LET	REVISION	BY / DATE	CHK / APPD
A	REMOVED N/A FROM STD WIRES 0713129-1 WAS S-1255-1 ADD NOTE 2 & 3 REMOVED PUSH FROM SWITCH POSITIONS ADD SHIELDED WIRE TO JA1 & JA2 WIRES ADD NOTE 4 (SR3694-10)	GLW 4-2-62	RRS
B	18DS WAS 18S MATERIAL ON JA1 & JA2 WIRES	[illegible] 10-17-62	RRS
C	ADD MODEL 206 1270461-1 BUS BAR WAS 1270429-1 S-1360-10 CKT BKR WAS S-1232-10 ON BUS BAR, INST WAS INST LIGHTS (SR4038-6) (SR3983-6)	GLW 6-17-63	RRS
D	ADDED P206 & U206 TO MODEL BLOCK REMOVED 1270461-1 BUS BAR, H-KA1 & H-KA2 FROM E/T; ADDED WIRE LENGTHS TO W/T	WJR 6-26-64	RRS

S R L LR BAT GRD BO	S R L LR BAT GRD BO	S R L LR BAT GRD BO	
R-MAG	L-MAG	BOTH MAGS	
DIAGRAMS SHOW NOT ACTUAL SWITCH BUT CIRCUIT CONTINUITY AT EACH POSITION o EXTERNALLY ACCESSIBLE TERMINAL		S R L LR BAT GRD BO START	

ITEM NO.	PART NO.	DESCRIPTION	SERIALS
9	S-1360-10	CIRCUIT BREAKER	
8			
7			
6			
5	0750027-1	START SOLENOID	
4	SLICK #662	RIGHT MAGNETO	
3	SLICK #662	LEFT MAGNETO	
2			
1	0713129-1	SWITCH	

EQUIPMENT TABLE

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		SERIALS
H-JA3	18		9	S-1367-1-6	S-1367-1-8	
H-JA2	18DS		63	S-1367-1-6	<4	<3
H-JA1	18DS		63	S-1367-1-6	<4	<3

WIRE TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	G WOOD	12-7-61
GROUP	[illegible]	1-29-62
CHECK	[illegible]	2-5-62
PROJ.	[illegible]	2-7-62

TITLE: WIRING DIAGRAM — IGNITION SYSTEM

Cessna.

DWG NO. 1270625

SUPERSEDED BY:	SUPERSEDES	MODEL:	REV:	PAGE:
		205, P206, U206	D	5.1

FORM NO. [illegible]

ENGINE CONTROL SECTION

Cessna.

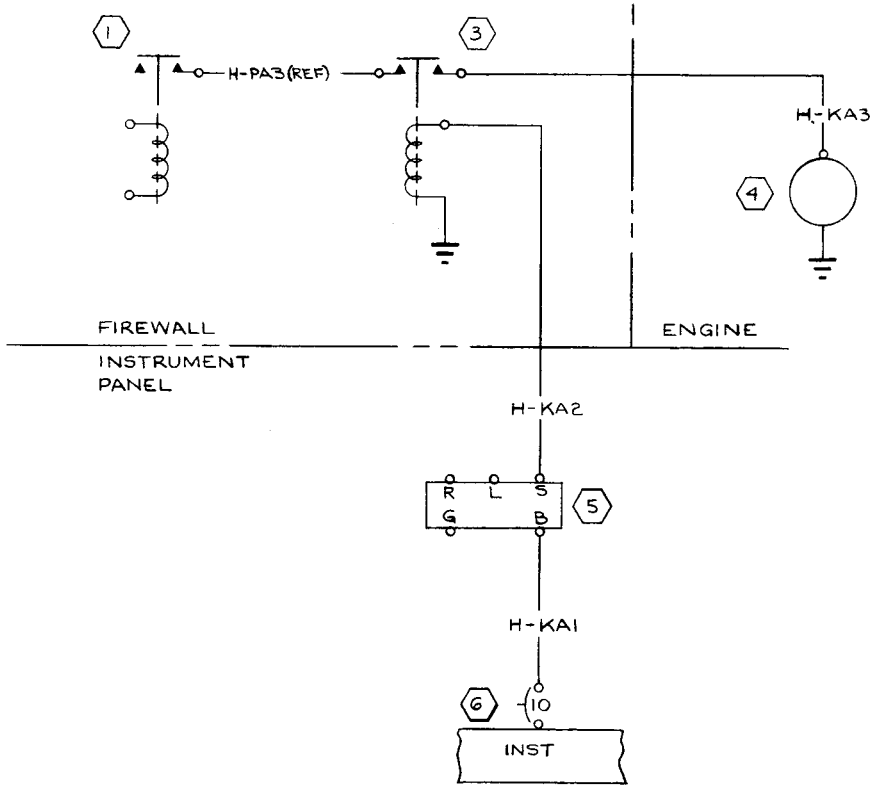
DRAWN	G WOOD	TITLE: WIRING DIAGRAM--- MODEL 205 & 206	DRAWING NO. 1270625
DATE	1-25-62		
APP'D		REV:	PAGE: 6.0

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

(SR.3694-10)

NOTE:
1. PART OF 1250600 ENGINE INSTALLATION.

CHG LET	REVISION	BY DATE	CHK APPD
A	REMOVED N/A FROM STD WIRES 0713129-1 WAS S-1255-1 (SR.3694-10)	G L W 4-3-62	RRS
B	ADD MODEL 206 S-1360-10 CKT BKR WAS S-1232-10 1270461-1 BUS BAR WAS 1270429-1 ON BUS BAR, INST WAS INST LIGHTS (SR.4038-6)(SR.3983-6)	G L W 6-17-63	RRS
C	REMOVED 1270461-1 BUS BAR FROM E/T; ADDED P206 E'U 206 TO B/M REMOVED H-PA3 FROM E/T; ADDED WIRE LENGTHS TO W/T	W J R 6-29-64	RRS TM WH



WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		SERIALS
H-KA3	2		12	S-1367-7-14	S-1367-7-14	
H-KA2	18		89	S-1367-1-6	S-1367-1-10	
H-KA1	18		8	S-1367-1-6	S-1367-1-8	

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	SERIALS
7			
6	S-1360-10	CIRCUIT BREAKER	
5	0713129-1	SWITCH, MAG	
4	1	STARTER	
3	0750027-1	START. SOLENOID	
2			
1	0712603-2	BAT. CONTACTOR	

EQUIPMENT TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	G WOOD	12-6-61
GROUP	New Cum	1-24-62
CHECK	R. Stuck	2-5-62
PROJ	H. McCart	2-7-62

TITLE: WIRING DIAGRAM — STARTER SYSTEM

Cessna.

DWG NO: 1270625

SUPERSEDED BY:

SUPERSEDES:

MODEL: 205, P206 E'U206

REV: C

PAGE: 6.1

FORM NO. 60-151

FUEL AND OIL SECTION

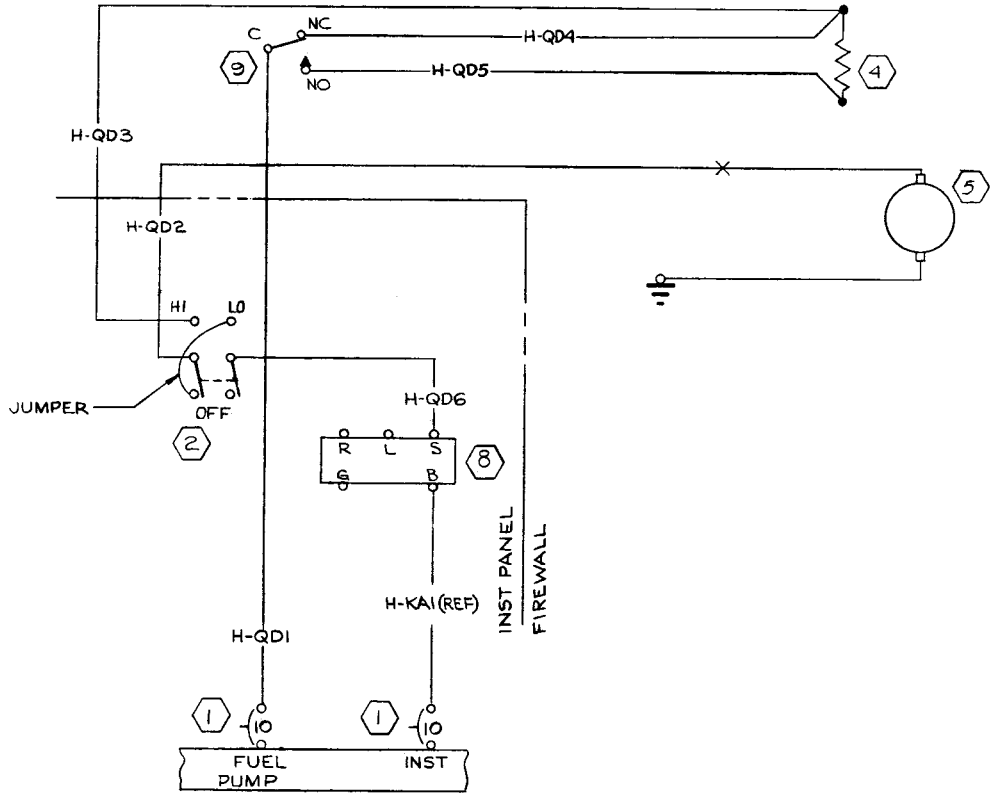
Cessna.

			DRAWING NO.
DRAWN	G WOOD	TITLE: WIRING DIAGRAM---	1270625
DATE	1-25-62	MODEL 205 & 206	
APP'D		REV:	PAGE: 7.0

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

FORM NO. 80-165

(SR 3694-10)



CHG LET	REVISION	BY / DATE	CHK / APPD
A	REMOVED N/A FROM STD WIRES REMOVED AN546-2-3 TERM. BLOCK, MS310GA-10SL-4S PLUG, MS3057-4A ADAPTER & A-76 VALVE. 4140-00-1 FUEL PUMP WAS 1216012-1. ADD MOR-20-2 RESISTOR REMOVED H-QE1 & H-QE2 (SR3694-10)	GLW 4-4-62	RRS
B	REMOVED FROM FIELD RADIO COMPARTMENT & TUNNEL; ADDED FIRE WALL (SR 3694-10)	WJR 5/24/62	RRS
C	REWIRED FUEL PUMP. ADDED H-QD4 H-QD5 H-QD6 WIRES. ON H-QD2 S-1370-1 WAS S-1367-1-6 H-QD3. SOLDER WAS S-1367-1-6 ADD V3-1 SW. ADD JUMPER. REMOVED 30D192A1 CAP. (SR3694-10)	GLW 6-21-62	RRS
D	ADD MODEL 206 S-1360-10 CKT BKR WAS S-1232-10 1270461-1 BUS BAR WAS 1270429-1 ON BUS BAR, INST WAS INST LIGHTS (SR 4038-6) (SR3983-6)	GLW 6-17-63	RRS
E	S-1160-1-2 WAS S-1160-1-1; REMOVED 1270461-1 BUS BAR FROM E/T ADDED P206 & U206 TO B/M; REMOVED H-KA1 FROM E/T; ADDED LENGTHS TO W/T	WJR 6-30-64	RRS

ITEM NO	PART NO.	DESCRIPTION	SERIALS
9	AN3234-1	SWITCH	
8	0713129-1	SWITCH	
7			
6			
5	4140-00-17	FUEL PUMP	
4	MOR-20-2	RESISTOR (TRTA)	
3			
2	S-1160-1-2	SWITCH	
1	S-1360-10	CIRCUIT BREAKER	

EQUIPMENT TABLE

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		SERIALS
H-QD6	18		8	S-1367-1-6	S-1367-1-8	
H-QD5	18		32	S-1367-1-4	SOLDER	
H-QD4	18		32	S-1367-1-4	SOLDER	
H-QD3	18		135	S-1367-1-6	SOLDER	
H-QD2	18		135	S-1367-1-6	S-1370-1	
H-QD1	18		108	S-1367-1-4	S-1367-1-8	

WIRE TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	G WOOD	12-30-61
GROUP	[illegible]	1-29-62
CHECK	[illegible]	2-5-62
PROJ	[illegible]	2-7-62

TITLE: WIRING DIAGRAM — FUEL PUMP SYSTEM

Cessna.

DWG NO: 1270625

SUPERSEDED BY:

SUPERSEDES:

MODEL: 205, P206 & U206

REV: E

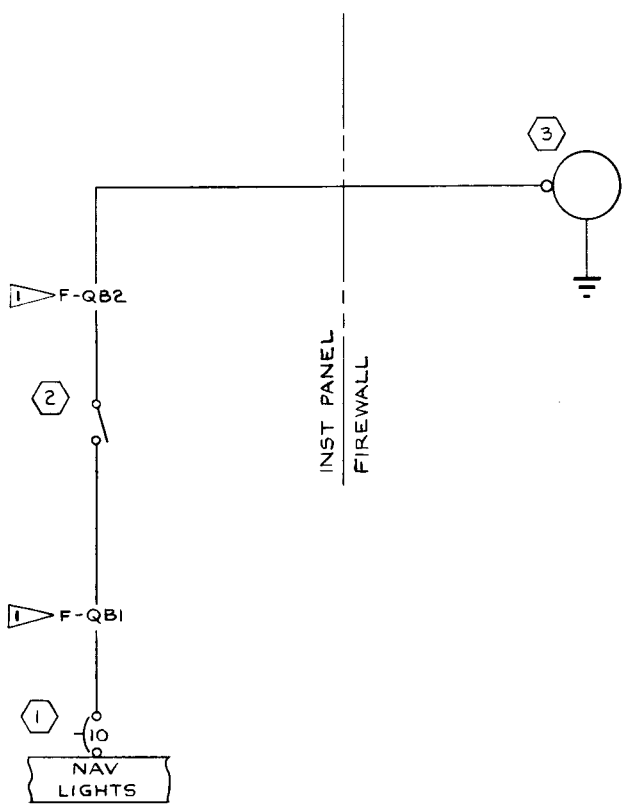
PAGE: 7-1

FORM NO. [illegible]

(SR 3694-10)

NOTE:
1. "F" PREFIX USED ON THIS DRAWING INSTEAD OF "H" BECAUSE WIRES ARE SAME AS THOSE USED ON MODEL 210. THIS DIAGRAM IS SCHEMATICALLY IDENTICAL TO 1270405 PAGE 7.2.

CHG LET	REVISION	BY / DATE	CHK / APPD
A	ADD "OPT" TO TITLE (SR 3694-10)	GLW 4-4-62	
B	ADD MODEL 206 S-1360-10 CKT BKR WAS S-1232-10 1270461-1 BUS BAR WAS 1270429-1 (SR 4038-6)(SR 3983-6)	GLW 6-18-63	
C	CHANGED PREFIX ON WIRES FROM "H" TO "F"; ADDED NOTE 1; OBSOLETED H-QB1 & H-QB2 WIRES	WJR 11-1-63	
D	REMOVED 1270461 BUS BAR FROM E/T; ADDED P206 & U206 TO B/M; ADDED LENGTHS TO W/T	WJR 6-30-64	



WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS
H-QB2	18		60	S-1367-1-6	S-1367-H0	1200437	OBSOLETE
H-QB1	18		7	S-1367-1-6	S-1367-H8	1200437	OBSOLETE

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	SERIALS
4			
3	AN4078-1	OIL DIL VALVE	
2	S-1158-1-1	SWITCH	
1	S-1360-10	CIRCUIT BREAKER	

EQUIPMENT TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION WICHITA, KANSAS

	NAME	DATE
DRAWN	G WOOD	12-27-61
GROUP		1-29-62
CHECK		2-5-62
PROJ		2-7-62

TITLE: WIRING DIAGRAM — OIL DILUTION SYSTEM (OPT)

Cessna.

DWG NO: 1270625

REV: D

PAGE: 7.2

SUPERSEDED BY:

SUPERSEDES:

MODEL: 205, P206 & U206

FORM NO. 80-181

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ENGINE INSTRUMENTS SECTION

Cessna.

DRAWN	G WOOD	TITLE: WIRING DIAGRAM---	DRAWING NO. 1270625
DATE	1-25-68	MODEL 205 & 206	
APP'D	[illegible]	REV:	PAGE: 8.0

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

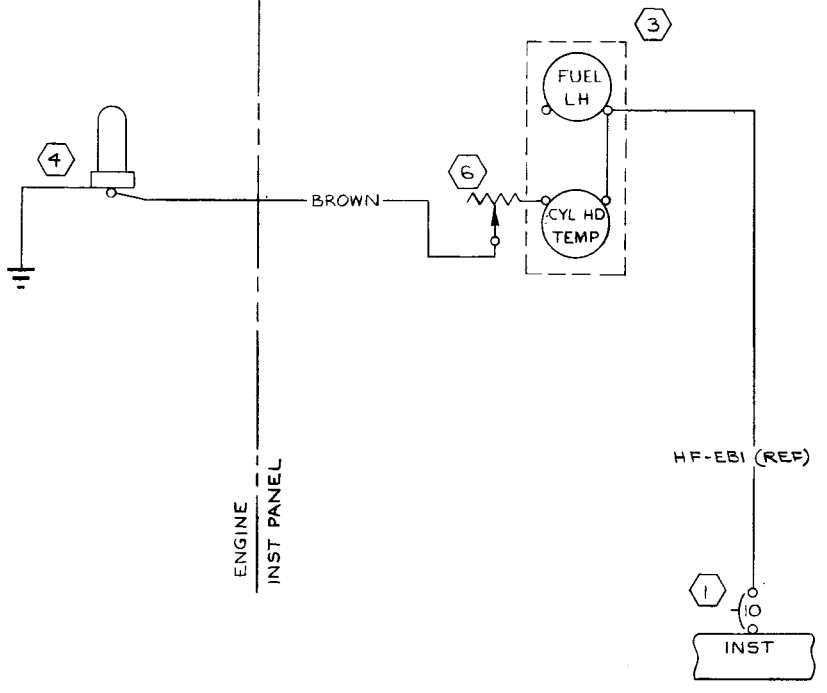
FORM NO. 80-166

(SR 3694-10)

NOTES:

1. PART NO. 110691 (PR50) COLOR: BROWN
2. TEMP BULB FOR 205, P206 & U206 HAVE BEEN LOCATED ON NO. 1 CYL. AT GIVEN SERIALS, MODEL 205 TEMP BULB MOVES TO NO. 6 CYL. MODEL P206 & U206 TEMP BULB REMAINS AT NO. 1 CYL.

CHG LET	REVISION	BY / DATE	CHK / APPD
A	REMOVED N/A FROM STD WIRES (SR3694-10)	GLW 4-4-62	RRS
B	ADDED 0713602-4 POTENTIOMETER SR 3981	HLW 8-27-62	RRS
C	ADD MODEL 206 S-1360-10 CKT BKR WAS S-1232-10 1270461-1 BUS BAR WAS 1270429-1 1213505-1 WAS 0713602-1; ADD 1213505-2 ON BUS BAR, INST WAS INST LIGHTS H-EBI WIRE WAS 0700603-EBI WIRE ADDED NOTE 1 MATL WAS PER MIL-W-5086A, TYPE I (SR 4038-6)(SR 3983-6)	GLW 6-18-63	RRS NMc HLW
D	BY REVISION: 1 WAS MATL PER MIL-W-16878D TYPE E 200°C GRADE EXTRUDED TEFLON DIELECTRIC. REMOVED 1 FROM H-ECI ADD 2 IN FIELD, BROWN WAS H-ECI. SER (SR4464)	GLW 2-12-64	RRS TM NMc
E	ADDED WIRE LENGTHS TO W/T; ADDED P206 & U206 TO TITLE BLOCK; REMOVED 1270461-1 BUS BAR & 1270625-EBI FROM E/T; C669502-0104 WAS 1213505-1 & 1213505-2	WJR 7-6-64	RRS TM HLW



WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS			SERIALS
BROWN	18	1		S-1367-1-8	S-1367-1-9	NO. 6 CYL 2	205-0055 & ON
BROWN	18	1	93	S-1367-1-8	S-1367-1-4	NO. 1 CYL 2	205-0493 THRU 205-0654 206-0029 & P206-0001E ON
H-ECI	18	*	93	S-1367-1-8	S-1367-1-4	NO. 1 CYL	INACTIVE 205-0993 & ON 206-0029 & ON

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	SERIALS
7			
6	0713602-4	POTENTIOMETER	
5			
4	S-1372-1	BULB, CYL HD TEMP	
3	C669502-0104	INST CLUSTER KIT	
2			
1	S-1360-10	CIRCUIT BREAKER	

EQUIPMENT TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION, WICHITA, KANSAS

	NAME	DATE
DRAWN	G. WOOD	12-27-61
GROUP	[illegible]	1-24-62
CHECK	R. Stuck	2-5-62
PROJ	H. McCarter	2-7-62

TITLE: WIRING DIAGRAM — CYLINDER HEAD TEMPERATURE

Cessna.

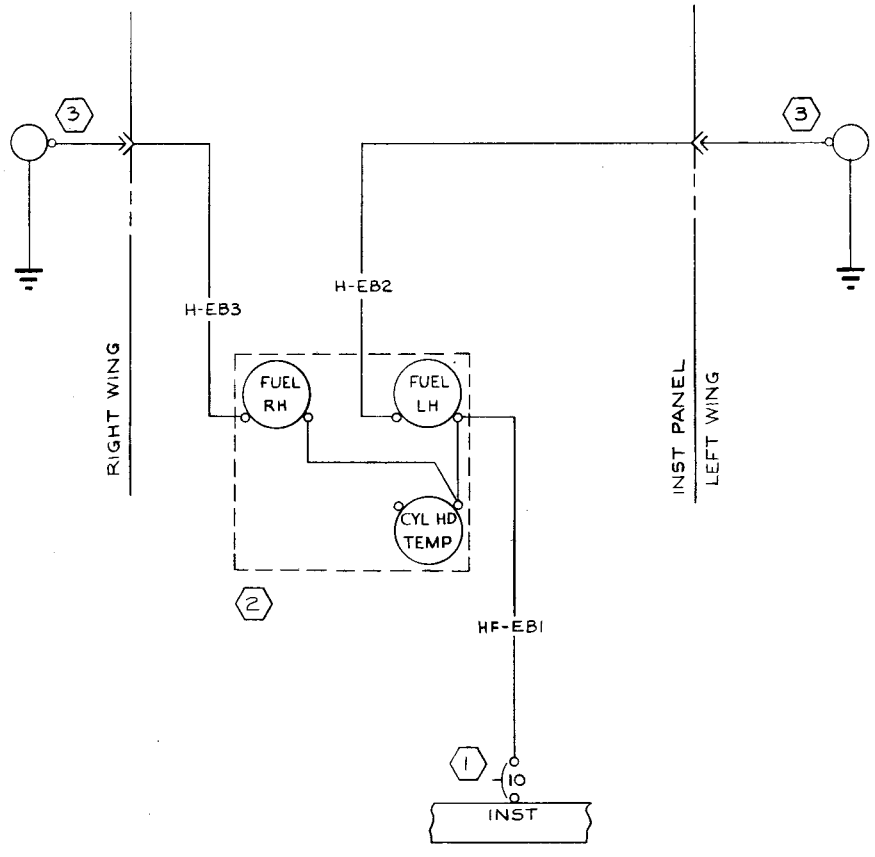
DWG NO: 1270625

SUPERSEDED BY: | SUPERSEDES: | MODEL: 205, P206 & U206 | REV: E | PAGE: 8.1

FORM NO. 80-161

(SR 3694-10)

CHG LET	REVISION	BY / DATE	CHK / APPD
A	BY REVISION: S-341-2 WAS S-1367-1-8 ADD SHORT WIRE TO FUEL LEVEL XMTR REMOVED N/A FROM STD WIRES (SR3694A)	GLW 2-20-62	
B	ADD MODEL 206 ADD H-EB1 WIRE S-1360-10 CKT BKR WAS S-1232-10 1213505-1 WAS 0713602-1; ADD 1213505-2 1270461-1 BUS BAR WAS 1270429-1 0726110-1 WAS 0726600-1 ON BUS BAR INST WAS INST LIGHTS DELETE 0700603-EB1 WIRE (SR4038-6)(SR3983-6)	GLW 6-18-63	
C	ADDED WIRE LENGTHS TO W/T's; HF-EB1 WIRE WAS H-EB1 WIRE; ADDED P206 & U206 TO B/M; REMOVED 1270461-1 BUS BAR FROM E/T; C669502-0109 WAS 1213505-1 & 1213505-2	WJR 7-6-64	



WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		SERIALS
H-EB3	18		88	S-1367-H10	S-341-2	
H-EB2	18		120	S-1367-1-10	S-341-2	
HF-EB1	18		50	S-1367-1-8	S-1367-1-6	

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	SERIALS
6			
5			
4			
3	0726110-1	XMTR, FUEL LEVEL	
2	C669502-0109	INST CLUSTER KIT	
1	S-1360-10	CIRCUIT BREAKER	

EQUIPMENT TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	G WOOD	12-26-61
GROUP	HFW	1-29-62
CHECK	R. Stuck	2-5-62
PROJ	H. McCarter	2-7-62

TITLE: WIRING DIAGRAM — FUEL QUANTITY INDICATOR

Cessna.

DWG NO: 1270625

SUPERSEDED BY:

SUPERSEDES:

MODEL: 206, P206 & U206

REV: C

PAGE: 8.2

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FLIGHT INSTRUMENTS SECTION

Cessna.

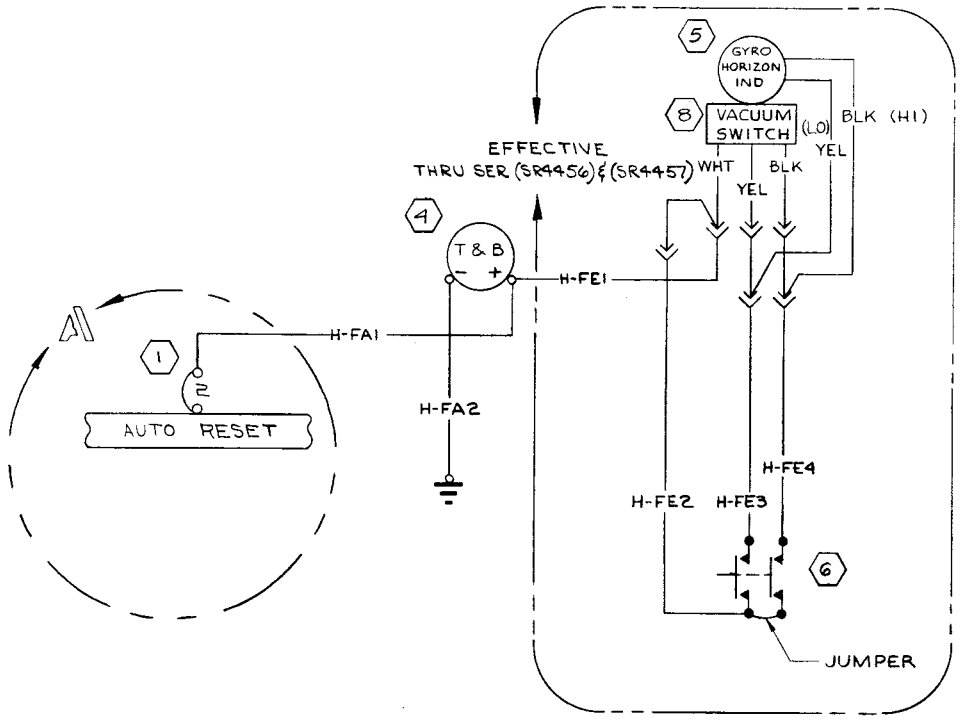
			DRAWING NO.
DRAWN	G WOOD	TITLE: WIRING DIAGRAM---	1270625
DATE	1-25-62	MODEL 205 & 206	
APP'D		REV:	PAGE: 9.0

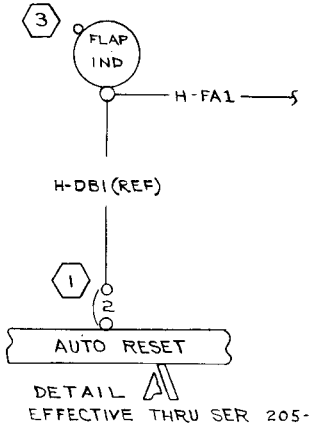
CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

FORM NO. 80-167

(SR 3694-10)

CHG LET	REVISION	BY / DATE	CHK / APPD
A	REMOVED N/A FROM STD WIRES. ADD "OPT" TO OPT WIRES. (SR3694-10)	GLW 4-4-62	
B	ADD MODEL 206 ADDED: 1270461-1 BUS BAR, DETAIL A (SR4038-G) (SR3983-G)	GLW 6-18-63	RRS WLW
C	ADDED LIMITING SERIALS TO FIELD & INACTIVATED WIRES H-FE1 THRU H-FE4; ADDED P206 & U206 TO B/M, REMOVED H-DB1, 1270461-1 & 1270429-1 FROM E/T; ADDED WIRE LENGTHS TO W/T (SR4956) & (SR4957)	WJR 7-19-64	RRS WLW





DETAIL A
EFFECTIVE THRU SER 205-0480

ITEM NO	PART NO.	DESCRIPTION	SERIALS
9			
8	S-1365-1	SWITCH, VACUUM	
7			
6	S-1284-1	SWITCH	
5	S-1326N1	IND, GYRO HORIZON	
4	S-1302N1	INDICATOR, T & B	
3	S-1318	INDICATOR, FLAP POS	
2			
1	CA-2	CKT BKR (MTCC)	

EQUIPMENT TABLE

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS
H-FE4	20		6	S-341-2	SOLDER	0713705	(OPT) Inactive SER (SR4956) & (SR4957) & ON
H-FE3	20		8	S-341-2	SOLDER	0713705	(OPT) Inactive SER (SR4956) & (SR4957) & ON
H-FE2	20		6	S-341-2	SOLDER	0713705	(OPT) Inactive SER (SR4956) & (SR4957) & ON
H-FE1	20		6	S-341-2	S-1367-1-8	0713705	(OPT) Inactive SER (SR4956) & (SR4957) & ON
H-FA2	18		16	S-1367-1-8	S-1367-1-8		
H-FA1	18		11	S-1367-1-8	S-1367-1-10		

WIRE TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	G WOOD	12-27-61
GROUP	[illegible]	1-29-62
CHECK	R. Stuck	2-5-62
PROJ	H. McCarter	2-7-62

TITLE: WIRING DIAGRAM — TURN & BANK AND GYRO HORIZON INDICATOR

Cessna.

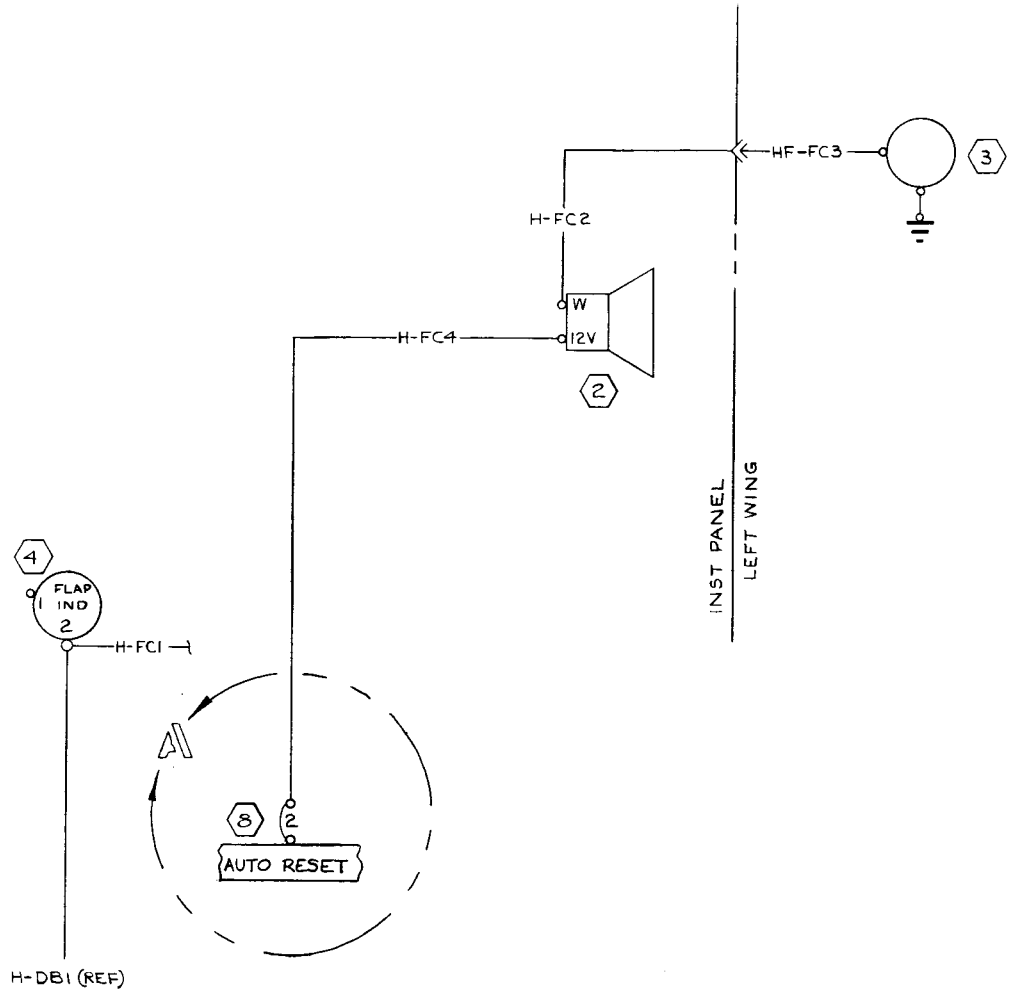
DWG NO: 1270625

SUPERSEDED BY:	SUPERSEDES:	MODEL: 205, P206 & U206	REV: C	PAGE: 9.1

FORM NO. SD-161

(SR 3694-10)

CHG LET	REVISION	BY DATE	CHK APPD
A	REMOVED N/A FROM STD WIRES (SR3694-10)	GLW 4-4-62	RRS GLW
B	ADD MODEL 206 ADDED 1270461-1 BUS BAR, ADDED S-1360-10 CKT BKR, ADDED DETAIL A (SR4038-6)(SR3983-6)	GLW 6-17-63	RRS HRW
C	BY REVISION: ADD H-FC4 WIRE "AUTO RESET" WAS "INST" INACTIVATED H-FC1 WIRE DELETE S-1360-10 CKT BKR	GLW 9-20-63	RRS TM
D	ADDED P206 & U206 TO B/M; HF-FC3 WAS H-FC3; ADDED WIRE LENGTHS TO W/T; REMOVED H-DB1, 1270429-1 & 1270461-1 FROM E/T; S-1407-6 WAS 0511062-10 (SR4456) & (SR4457)	WJR 7-14-64	RRS TM



DETAIL A
EFF THRU SER 205-0480

H-FC4	18		80	S-1367-1-G	S-1367-1-G		SER 205-0481, SER 206-0001 & ON
HF-FC3	18		100	S-1367-1-G	S-341-2		
H-FC2	18		61	S-1367-1-G	S-341-2		
H-FC1	18		27	S-1367-1-G	S-1367-1-8		INACTIVE SER 205-0481 & ON
WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	SERIALS
8	CA-2	CKT BKR (MTCC)	
7			
6			
5			
4	S-1318-1	IND, FLAP POSITION	
3	0511062-4	XMTR, STALL WARN.	
2	S-1407-6	HORN, STALL WARN.	
1			

EQUIPMENT TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION WICHITA, KANSAS

	NAME	DATE
DRAWN	G WOOD	12-22-61
GROUP	HRW	1-29-62
CHECK	R. Stuck	2-5-62
PROJ	H. McCarter	2-7-62

TITLE: WIRING DIAGRAM — STALL WARNING SYSTEM (NON-HEATED)

Cessna.

DWG NO: 1270625

SUPERSEDED BY:

SUPERSEDES:

MODEL: 205, P206 & U206

REV: D

PAGE: 9.2

FORM NO. 80-161

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OTHER INSTRUMENTS SECTION

Cessna.

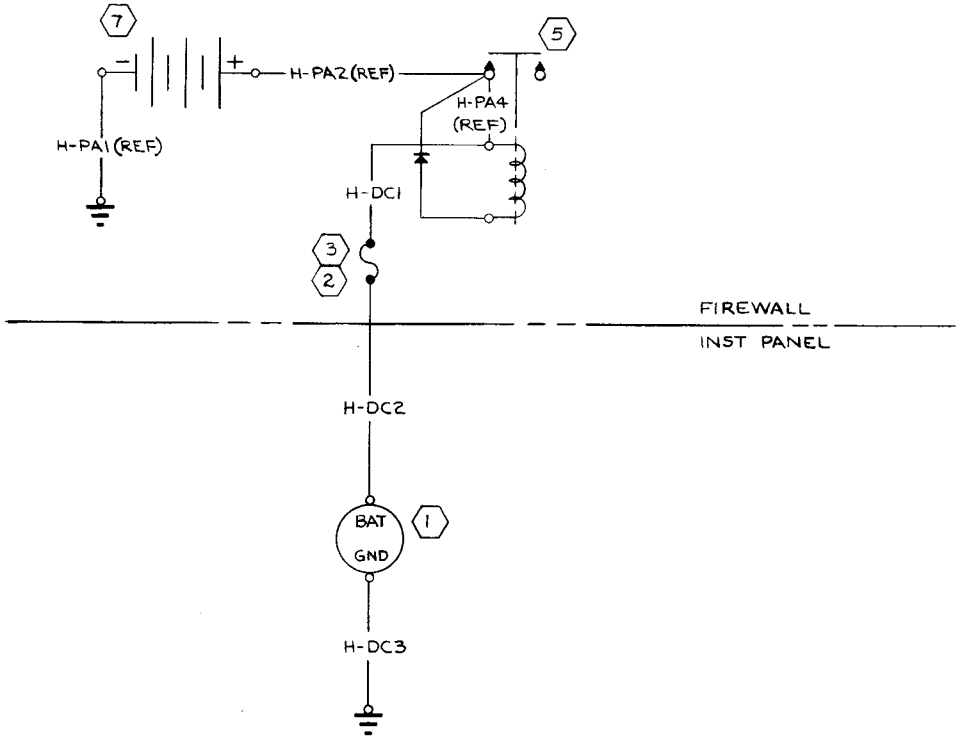
DRAWN	G WOOD	TITLE: WIRING DIAGRAM--- MODEL 205 & 206	DRAWING NO. 1270625
DATE	2-5-62		
APP'D	HEW CRS Dom Nmc	REV:	PAGE: 10.0

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

FORM NO. 80-168

(SR3694-10)

CHG LET	REVISION	BY / DATE	CHK / APPD
A	REMOVED N/A FROM STD WIRES (SR3694-10)	GLW 4-9-62	
B	REMOVED OBSOLETE, NEVER USED FROM FACE OF DRAWING; S-1091-1 WAS -2; S-1090-22 WAS -18 (SR4021	WJR 10-8-62	
C	ADD MODEL 206 (SR 3983-6)	GLW 6-18-63	
D	ADDED P206 & U206 TO B/M; ADDED WIRE LENGTHS TO W/T; REMOVED H-PA1, H-PA2 & H-PA4 FROM E/T	WJR 7-16-64	



H-DC3	18		11	S-1367-1-6	S-1367-1-8		205-0129 & ON
H-DC2	18		120	S-1367-1-6	SOLDER		205-0129 & ON
H-DC1	18		8	S-1367-1-6	SOLDER		205-0129 & ON
WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	SERIALS
8			
7	0712605-1	BATTERY	
6			
5	0712603-2	CONTACTOR, BAT.	
4			
3	S-1091-1	FUSE	
2	S-1090-22	FUSEHOLDER	
1	S-1317N1	CLOCK ASSY	

EQUIPMENT TABLE

CESSNA AIRCRAFT CO COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	G WOOD	12-27-61
GROUP		1-29-62
CHECK	R Stuck	2-5-62
PROJ	Wm McCoste	2-7-62

TITLE: WIRING DIAGRAM — CLOCK

Cessna.

DWG NO: 1270625

SUPERSEDED BY: | SUPERSEDES | MODEL: 205, P206 & U206 | REV: D | PAGE: 10.1

FORM NO. 80-161

LIGHTING SECTION

Cessna.

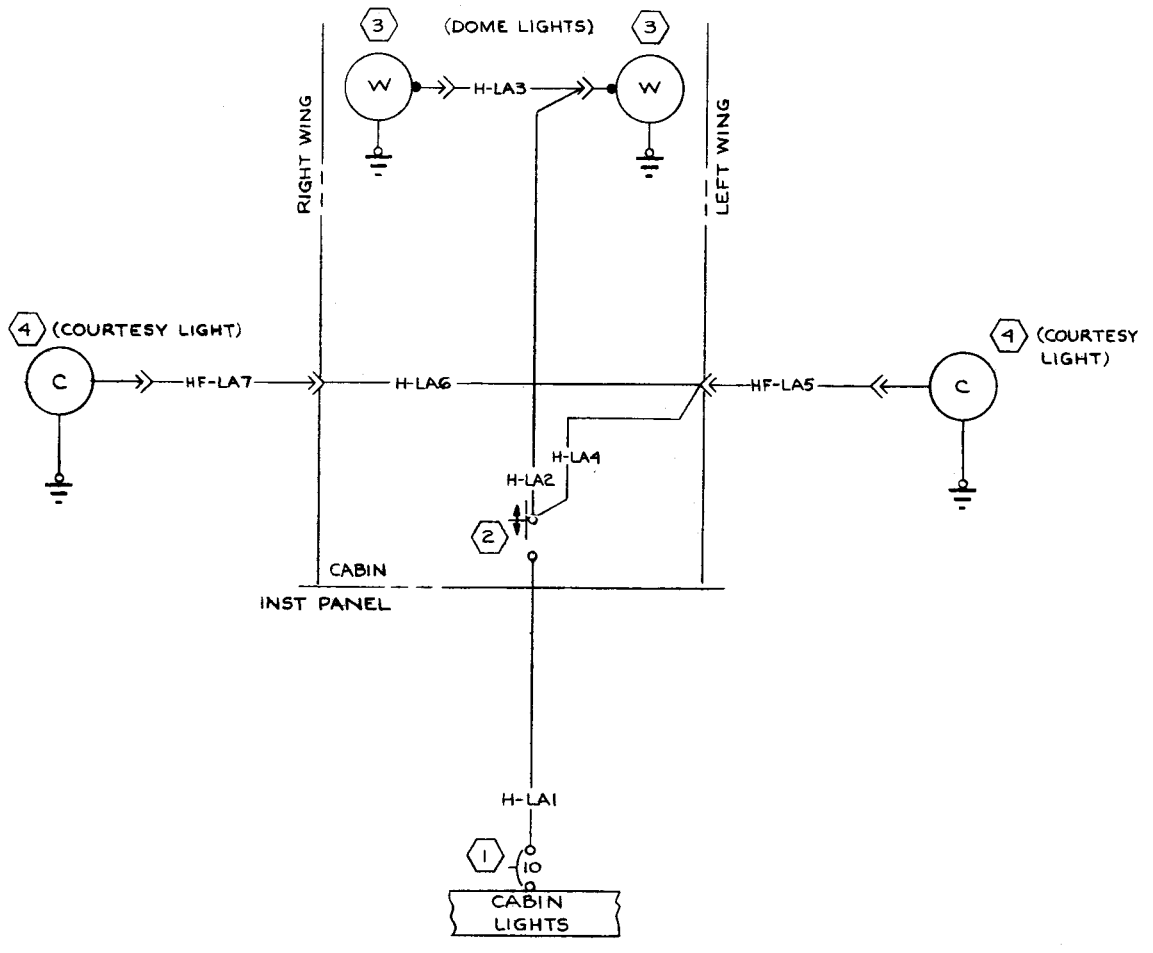
DRAWN	G WOOD	TITLE: WIRING DIAGRAM--- MODEL 205 & 206	DRAWING NO. 1270625
DATE	1-25-62		
APP'D	HRW CWM RRS [illegible] NHC	REV:	PAGE: 11.0

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

FORM NO. 80-169

(SR3694-10)

CHG LET	REVISION	BY / DATE	CHK / APPD
A	REMOVED N/A FROM STD WIRES (SR 3694-10)	GLW 4-4-62	RRS WJR
B	ADD MODEL 206 S-1360-10 CKT BKR WAS S-1232-10 1270461-1 BUS BAR WAS 1270429-1 ADD NOTE 1 ON BUS BAR CABIN LIGHTS WAS NAVIGATION LIGHTS (SR 4038-6) (SR 3983-6)	GLW 6-18-63	RRS WJR
C	ADDED P206 & U206 TO B/M; REMOVED 1270461-1 FROM E/T; ADDED WIRE LENGTHS TO W/T HF-LA5 WAS H-LA5 & HF-LA7 WAS H-LA7 (SR4956) (SR4957)	WJR 7-16-64	RRS



NOTE:
1. COURTESY LIGHTS ARE OPTIONAL SER 205-0481 & ON, SER U206-0001 & ON & P206-0001 & ON. WIRES ARE STD.

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS
HF-LA7	18		150	S-341-2	S-341-2		
H-LA6	18		88	S-341-2	SEE H-LA4		
HF-LA5	18		150	S-341-2	S-341-2		
H-LA4	18		51	S-1367-1-6	S-341-1		
H-LA3	18		43	S-341-1	S-341-2		
H-LA2	18		36	S-1367-1-6	SEE H-LA3		
H-LA1	18		114	S-1367-1-6	S-1367-1-8		

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	SERIALS
5			
4	1270430-1	LIGHT ASSY	
3	181522	LIGHT ASSY (UCTE)	
2	0713029	SWITCH	
1	S-1360-10	CIRCUIT BREAKER	

EQUIPMENT TABLE

CESSNA AIRCRAFT CO COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	G WOOD	12-19-61
GROUP	[illegible]	1-29-62
CHECK	[illegible]	2-5-62
PROJ	[illegible]	2-7-62

TITLE: WIRING DIAGRAM — DOME & COURTESY LIGHTS

Cessna.

DWG NO: 1270625

SUPERSEDED BY: | SUPERSEDES: | MODEL: 205, P206 & U206 | REV: C | PAGE: 11.1

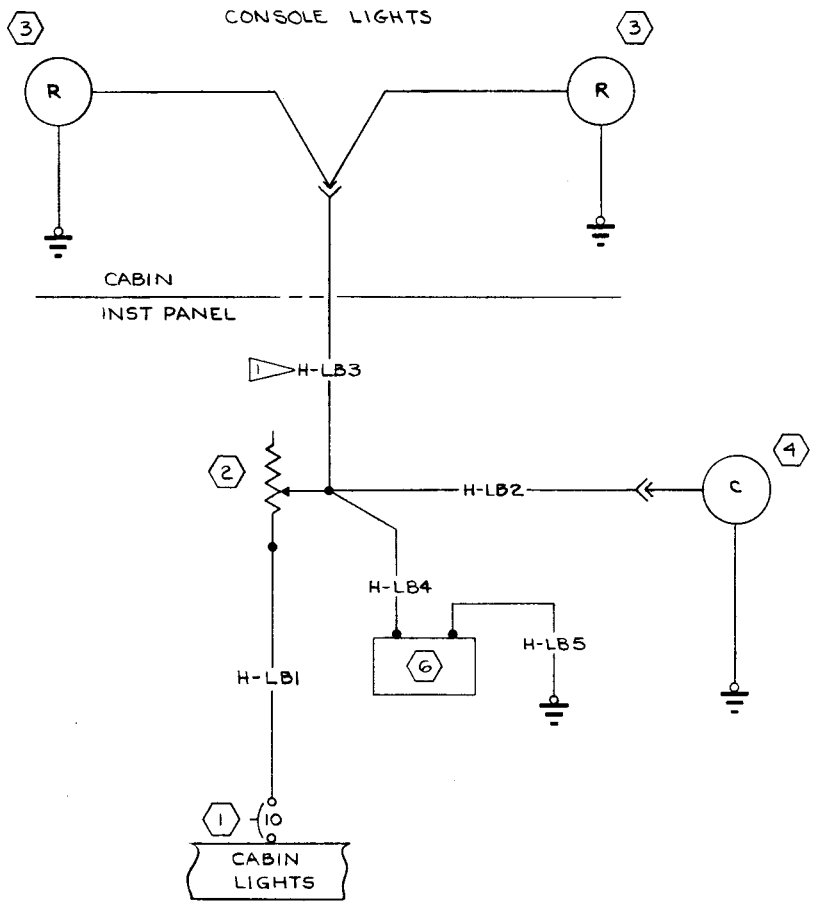
FORM NO. SD-161

(SR 3694-10)

NOTES:

1. WHEN (OPT) POST & BACK LIGHTING IS INSTALLED, WIRE H-LB3 IS CONNECTED TO CONSOLE SIDE OF S-1238-2-1 SWITCH REF 1270405 PAGE 11.7.

CHG LET	REVISION	BY DATE	CHK APPD
A	REMOVED N/A FROM STD WIRES (SR3694-10)	GLW 9-9-62	RRS Non HLW
B	ADD MODEL 206 S-1360-10 CKT BKR WAS S-1232-10 1270461-1 BUS BAR WAS 1270429-1 0700621-3 LIGHT INSTL WAS 0700621-1 R-12 1/2-8-RS34 WAS 0105-351 ON BUS BAR, CABIN LIGHTS WAS INST LIGHTS (SR4038-6)(SR3983-6)	GLW 6-19-63	RRS HLW HLW
C	REMOVED 1270461-1 FROM E/T; ADDED P206 & U206 TO MODEL BLOCK; ADDED H-LB4, H-LB5 & C669502-0104; ADDED WIRE LENGTHS TO WIT; C660501-0101 WAS 0713068-1 (SR4569) & (SR4573) ADDED ▷	WJR 8-6-64	RRS JM NHC



WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS
H-LB5	20			SOLDER	S-1367-1-8		SER (SR4456), (SR4457) & ON
H-LB4	20			SOLDER	SOLDER		SER (SR4456), (SR4457) & ON
H-LB3	18		90	S-341-2	SOLDER		
H-LB2	18		50	S-341-2	SOLDER		
H-LB1	18		4	S-1367-1-8	SOLDER		

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	SERIALS
6	C669502-0104	INST CLUSTER KIT	
5			
4	C660501-0101	COMPASS	
3	0700621-3	LIGHT INSTL	
2	R-12 1/2-8-RS34	RHEOSTAT (TRTA)	
1	S-1360-10	CIRCUIT BREAKER	

EQUIPMENT TABLE

CESSNA AIRCRAFT CO COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	G WOOD	12-27-61
GROUP	[illegible]	1-29-62
CHECK	[illegible]	2-5-62
PROJ	[illegible]	2-7-62

TITLE: WIRING DIAGRAM — INSTRUMENT LIGHTS

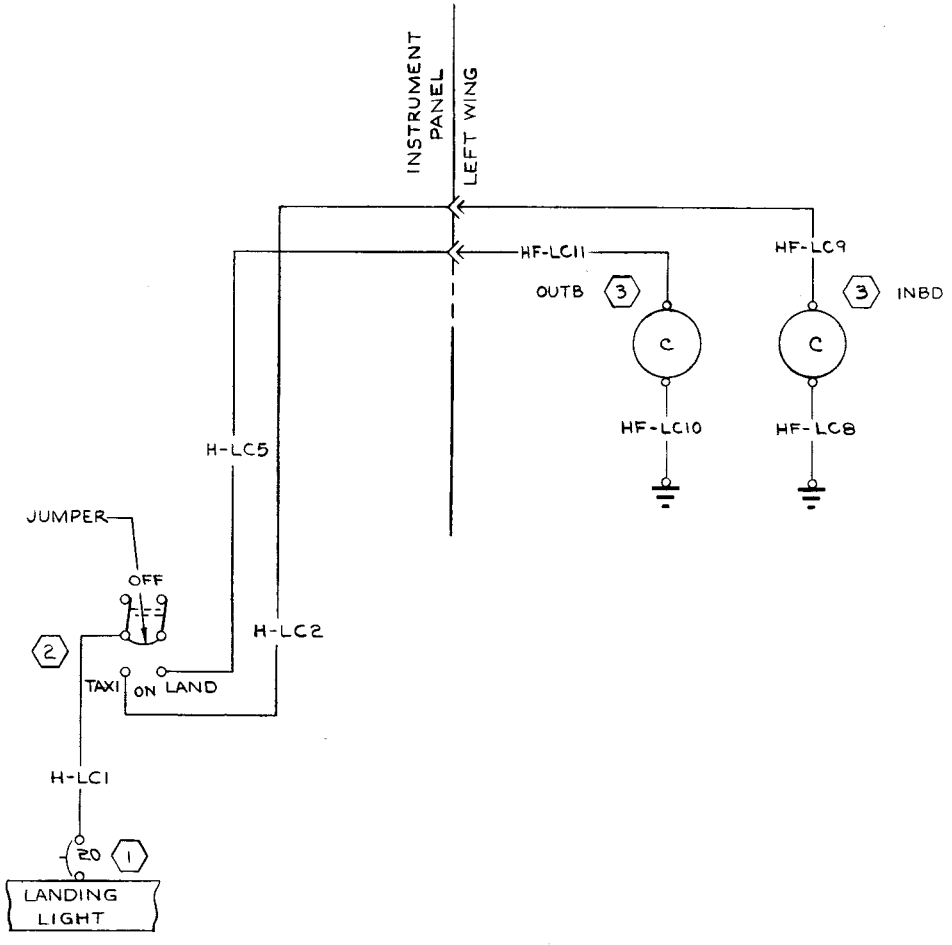
Cessna.

DWG NO: 1270625

SUPERSEDED BY:	SUPERSEDES:	MODEL:	REV:	PAGE:
		205, P206 & U206	C	11.2

FORM NO. 80131

(SR3694-10)



CHG LET	REVISION	BY / DATE	CHK / APPD
A	REMOVE N/A FROM STD WIRES (SR3694-10)	GLW 4-9-62	
B	ADD MODEL 206 S-1360-15 CKT BKR WAS S-1232-15 1270461-1 BUS BAR 1270429-1 ON WIRES H-LC2 & H-LC5 14 GA WAS 16GA (SR 4038-G) (SR3983-G)	GLW 6-19-63	
C	S-1360-20 CKT BKR WAS S-1360-15 (SR 4356)	HLW 9-17-63	
D	ADDED P206 & U206 TO MODEL BLOCK; ADDED WIRE LENGTHS TO W/T; REMOVED 1270461-1 FROM E/T; OBSOLETED H-LC3, H-LC4, H-LC6 & H-LC7; HF-LC8 WAS H-LC9; HF-LC9 WAS H-LC3; HF-LC10 WAS H-LC7; HF-LC11 WAS H-LC6 (SR4456) & (SR4457)	WJR 8-10-64	

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS
HF-LC11	14			S-1367-2-8	S-341-1	1220090	SER (SR4456), (SR4457) & ON
HF-LC10	14			S-1367-2-8	S-1367-2-8	1220090	SER (SR4456), (SR4457) & ON
HF-LC9	14			S-1367-2-8	S-341-1	1220090	SER (SR4456), (SR4457) & ON
HF-LC8	14			S-1367-2-8	S-1367-2-8	1220090	SER (SR4456), (SR4457) & ON
H-LC7	14		6	S-1367-2-8	S-1367-2-8		OBSOLETE
H-LC6	14		155	S-1367-2-8	S-341-1		OBSOLETE
H-LC5	14		26	S-1367-2-6	S-341-1		
H-LC4	14		6	S-1367-2-8	S-1367-2-8		OBSOLETE
H-LC3	14		161	S-1367-2-8	S-341-1		OBSOLETE
H-LC2	14		26	S-1367-2-6	S-341-1		
H-LC1	14		4	S-1367-2-6	S-1367-2-8		

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	SERIALS
4			
3	0523118-1	LANDING LIGHT	
2	S-1160-1-1	SWITCH	
1	S-1360-20	CIRCUIT BREAKER	

EQUIPMENT TABLE

CESSNA AIRCRAFT CO COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	G WOOD	12-30-61
GROUP	[illegible]	1-29-62
CHECK	R. Stuck	2-5-62
PROJ	H. McCoy	2-7-62

TITLE: WIRING DIAGRAM — LANDING LIGHTS

Cessna.

DWG NO: 1270625

SUPERSEDED BY:

SUPERSEDES:

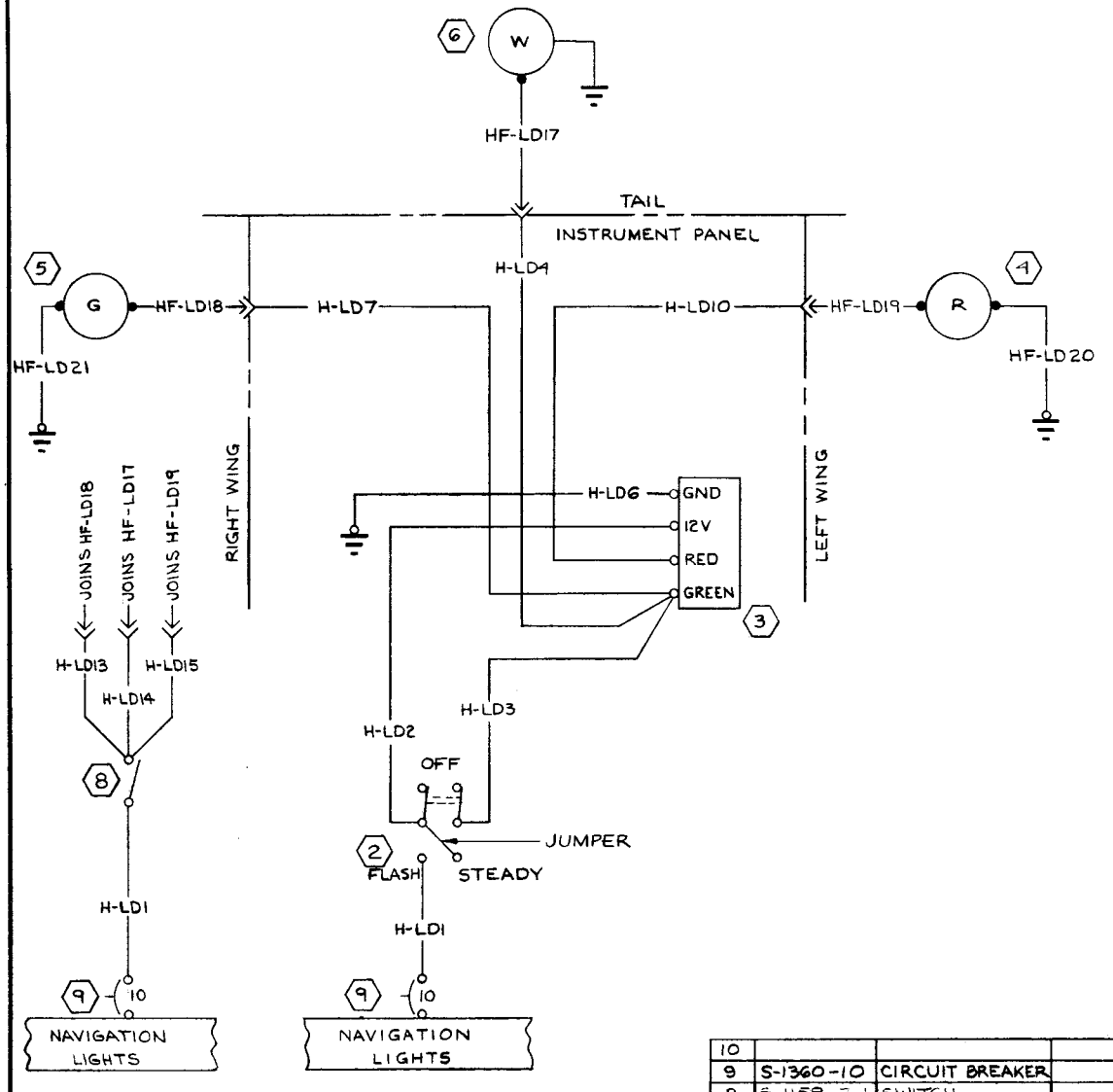
MODEL: 205, P206 & U206

REV: D

PAGE: 11.3

FORM NO. 80-161

(SR3694-10)



STANDARD
SER 205-0481 & ON
SER 206-0001 & ON

OPTIONAL
SER 205-0481 THRU (SR4457)

CHG LET	REVISION	BY DATE	CHK APPD
A	REMOVED N/A FROM STD WIRES (SR3694-10)	G L W 4-4-62	
B	ADDED OPTIONAL & STANDARD CONFIGURATIONS; ADDED WIRES H-LD13, H-LD14 & H-LD15, S-1158-2-1 SWITCH, 1270461-1 BUS BAR. H-LD2, THRU H-LD4, H-LD6 & H-LD7 & H-LD10 BECOME OPT (SR4038-9) (SR3983-9)	W J R 4-15-63	
C	ADD MODEL 206 WIRE HF-LD17 WAS H-LD5 H-LD5 WIRE BECOMES OBSOLETE	G L W 6-19-63	
D	ADDED P206 & U206 TO MODEL BLOCK; ADDED WIRE LENGTHS TO W/T; ADDED LIMITING SERIALS TO FIELD; INACTIVATED H-LD2, H-LD3, H-LD4 H-LD6, H-LD7 & H-LD10; REMOVED 1270429-1 & 1270461- FROM E/T; S-1360-10 WAS S-1232-10; OBSOLETED H-LD8, H-LD9, H-LD11 & H-LD12; HF-LD18 WAS H-LD8; HF-LD19 WAS H-LD11; HF-LD20 WAS H-LD12; HF-LD21 WAS H-LD9 (SR4456) & (SR4457)	W J R 8-11-64	

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS	N/A	SERIALS
HF-LD21	18			S-1367-1-8	SOLDER	(SR4456), (SR4457) & ON
HF-LD20	18			S-1367-1-8	SOLDER	(SR4456), (SR4457) & ON
HF-LD19	18			S-341-2	SOLDER	(SR4456), (SR4457) & ON
HF-LD18	18			S-341-2	SOLDER	(SR4456), (SR4457) & ON
HF-LD17	18			S-341-2	SOLDER	
H-LD15	18		27	S-341-2	S-1367-1-6	205-0481, 206-0001 & ON
H-LD14	18		352	S-341-2	S-1367-1-6	205-0481, 206-0001 & ON
H-LD13	18		50	S-341-2	S-1367-1-6	205-0481, 206-0001 & ON
H-LD12	18		14	S-1367-1-8	SOLDER	OBSOLETE
H-LD11	18		230	S-341-2	SOLDER	OBSOLETE
H-LD10	18		65	S-1367-1-6	S-341-2 1270462	(OPT) Inactive SER (SR4457) & ON
H-LD9	18		14	SOLDER	S-1367-1-8	OBSOLETE
H-LD8	18		230	S-341-2	SOLDER	OBSOLETE
H-LD7	18		66	S-1367-1-6	S-341-2 1270462	(OPT) Inactive SER (SR4457) & ON
H-LD6	18		19	S-1367-1-6	S-1367-1-8 1270462	(OPT) Inactive SER (SR4457) & ON
H-LD5	18		23	S-341-2	SOLDER	OBSOLETE
H-LD4	18		335	S-1367-1-6	S-341-2 1270462	(OPT) Inactive SER (SR4457) & ON
H-LD3	18		45	S-1367-1-6	S-1367-1-6 1270462	(OPT) Inactive SER (SR4457) & ON
H-LD2	18		45	S-1367-1-6	S-1367-1-6 1270462	(OPT) Inactive SER (SR4457) & ON
H-LD1	18		4	S-1367-1-8	S-1367-1-6	

WIRE TABLE

ITEM NO.	PART NO.	DESCRIPTION	SERIALS
10			
9	S-1360-10	CIRCUIT BREAKER	
8	S-1158-2-1	SWITCH	
7			
6	0433006-7	POSITION LIGHT	
5	0423006-13	POSITION LIGHT	
4	0423006-12	POSITION LIGHT	
3	0713511-1	FLASHER, NAV LT	
2	S-1160-1-1	SWITCH	
1			

EQUIPMENT TABLE

CESSNA AIRCRAFT CO COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	G WOOD	12-18-61
GROUP		1-29-62
CHECK	R Stuck	2-5-62
PROJ	H. McCuistion	2-7-62

TITLE: WIRING DIAGRAM — NAVIGATION LIGHTS

Cessna.

DWG NO: 1270625

SUPERSEDED BY:

SUPERSEDES:

MODELS: 205, P206 & U206

REV: D

PAGE: 11-9

FORM NO. 80-161

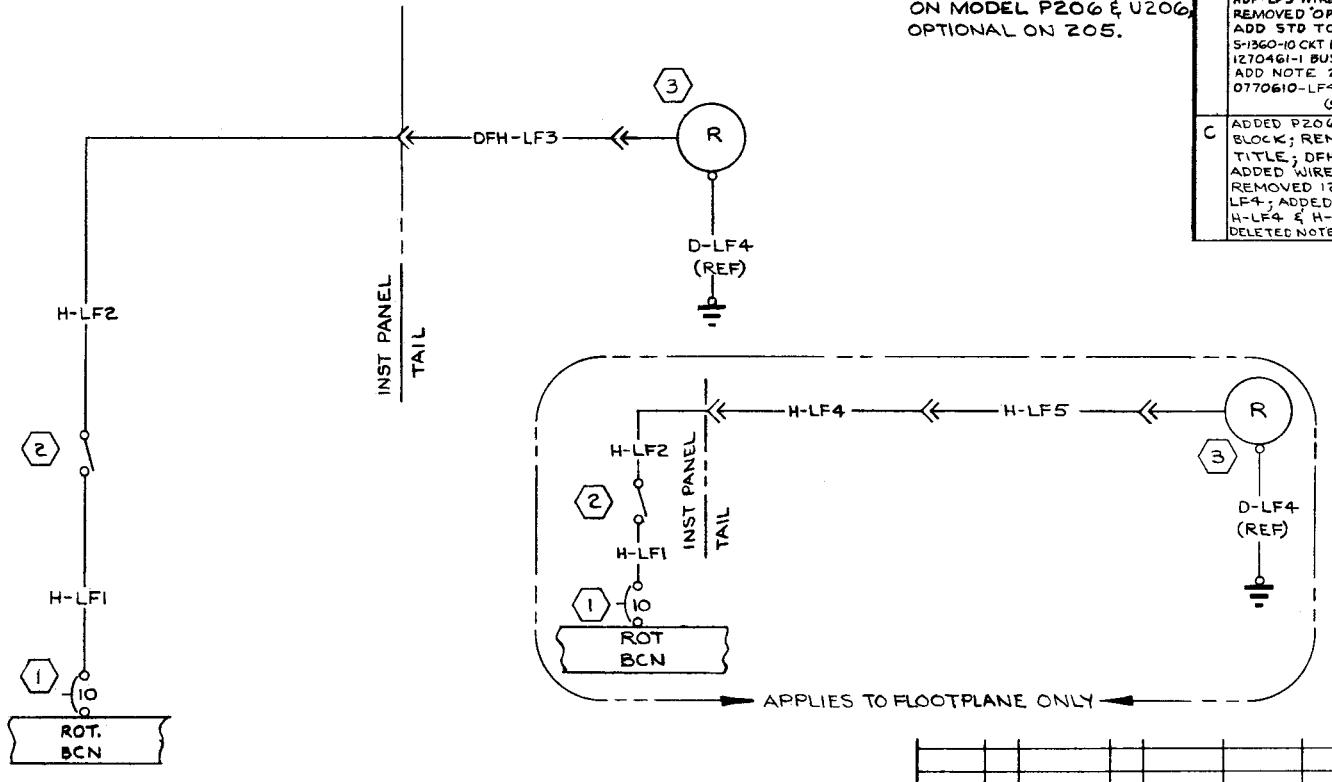
NOTE:

1.

2. THE ROTATING BEACON INSTL IS STD EQUIPMENT ON MODEL P206 & U206, OPTIONAL ON 205.

(SR3694-10)

CHG LET	REVISION	BY DATE	CHK APPD
A	REMOVED N/A FROM STD WIRES ADD "OPT" TO OPT WIRE (SR3694-10)	GLW 4-4-68	RRS
B	ADD MODEL 206 ADD "OPT" TO TITLE HDF-LF3 WIRE WAS H-LF3 WIRE REMOVED "OPT" FROM H-LF1 WIRE ADD STD TO H-LF2 & HDF-LF3 WIRES S-1360-10 CKT BKR WAS S-1232-10 1270461-1 BUS BAR WAS 1270429-1 ADD NOTE 2 0770610-LF9 WIRE WAS 0700603-LF4 (SR4038-6) (SR3983-6)	GLW 6-19-68	RRS N4C NPW
C	ADDED P206 & U206 TO MODEL BLOCK; REMOVED (OPT) FROM TITLE; DFH-LF3 WAS HDF-LF3; ADDED WIRE LENGTHS TO W/T; REMOVED 1270461-1 & 0770610-LF4; ADDED FLOOTPLANE VERSION H-LF4 & H-LF5 (SR4456) & (SR4457) DELETED NOTE 1	WJR 8-11-69	RRS NPW



WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS
H-LF5	16			S-341-1	S-341-1	1270672	
H-LF4	16			S-341-1	S-341-1	1231000	
DFH-LF3	16		70	S-341-1	S-341-1		
H-LF2	16		325	S-1367-2-6	S-341-1		
H-LF1	16		4	S-1367-2-6	S-1367-2-8	1270427	

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
5			
4			
3	0700120-1	ROTATING BEACON	
2	S-1158-2-1	SWITCH	
1	S-1360-10	CIRCUIT BREAKER	

EQUIPMENT TABLE

CESSNA AIRCRAFT CO COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	G WOOD	12-28-61
GROUP		1-29-62
CHECK		2-5-62
PROJ		2-7-62

TITLE: WIRING DIAGRAM — ROTATING BEACON

Cessna.

DWG NO: 1270625

REV: C

PAGE: 11.5

SUPERSEDED BY:

SUPERSEDES:

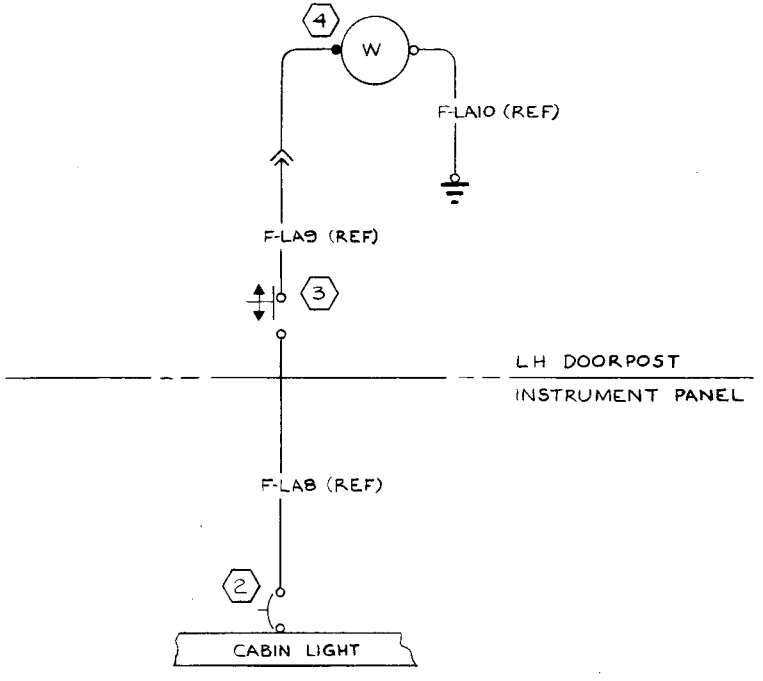
MODEL: 205, P206 & U206

FORM NO. BO-981

CHG LET	REVISION	BY / DATE	CHK / APPD
A	REMOVED 1270461-1 FROM E/T & INACTIVATED DWG	WJR 8-12-64	RRS HIW

NOTE: (SR 4038) (SR 3983)

1. "F" PREFIX USED ON THIS DRAWING INSTEAD OF "H" BECAUSE WIRES ARE SAME AS THOSE USED ON MODEL 210. THIS DIAGRAM IS SCHEMATICALLY IDENTICAL TO 1270405 PAGE 11.6.



Inactive SER 205-0577 & ON
206-0275 & ON
WJR 8-12-64 HIW
RRS

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		SERIALS

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
4	1470089-10	MAP LIGHT ASSY	
3	0713029	SWITCH	
2	S-1360-10	CIRCUIT BREAKER	
1			

EQUIPMENT TABLE

CESSNA AIRCRAFT CO COMMERCIAL AIRCRAFT DIVISION, WICHITA KANSAS

	NAME	DATE
DRAWN	G WOOD	3-29-63
GROUP	[illegible]	4-19-63
CHECK	R. Stuck	4-22-63
PROJ	H. McCarter	4-24-63

TITLE: WIRING DIAGRAM — MAP LIGHT (OPTIONAL)

Cessna.

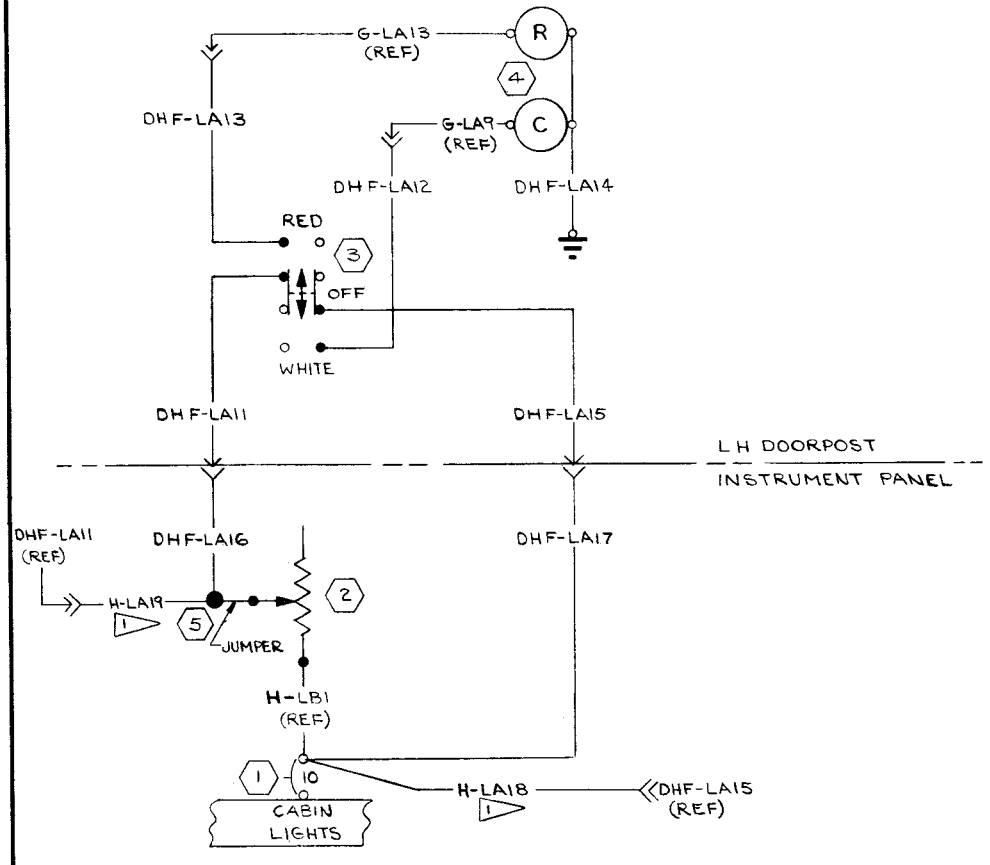
DWG NO: 1270625

SUPERSEDED BY:	SUPERSEDES	MODEL:	REV:	PAGE:
1270625 PAGE 11.6.1		205, 206	A	11.6

FORM NO. 80-161

NOTES:
1. WIRES H-LA18 & H-LA19 REQUIRED FOR RH MAP LIGHT INSTL. (SR4456) (SR4457)

CHG LET	REVISION	BY / DATE	CHK / APPD



1 H-LA19	18			SOLDER	S-341-2		
1 H-LA18	18			S-1367-1-6	S-341-2		
DHF-LA17	18			S-1367-1-6	S-341-2		
DHF-LA16	18			SOLDER	S-341-2		
DHF-LA15	18			SOLDER	S-341-2	0770725	
DHF-LA14	18			S-1367-1-8	S-1367-1-10	0770725	
DHF-LA13	18			SOLDER	S-341-2	0770725	
DHF-LA12	18			SOLDER	S-341-2	0770725	
DHF-LA11	18			SOLDER	S-341-2	0770725	
WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
5	18-1	INSULATOR (GRAY)	
4	1470089-14	LIGHT ASSY	
3	S-1501-1	SWITCH	
2	R-12½-8-RS39	RHEOSTAT (TRTA)	
1	S-1360-10	CIRCUIT BREAKER	

EQUIPMENT TABLE

CESSNA AIRCRAFT CO COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	RIDDER	8-13-64
GROUP	[illegible]	8-24-64
CHECK	[illegible]	8-24-64
PROJ	[illegible]	9-1-64

TITLE: WIRING DIAGRAM — MAP LIGHT (OPT)

Cessna.

DWG NO. 1270625

SUPERSEDED BY

SUPERSEDES 1270625 PAGE 11.6

MODEL: P206 & U206

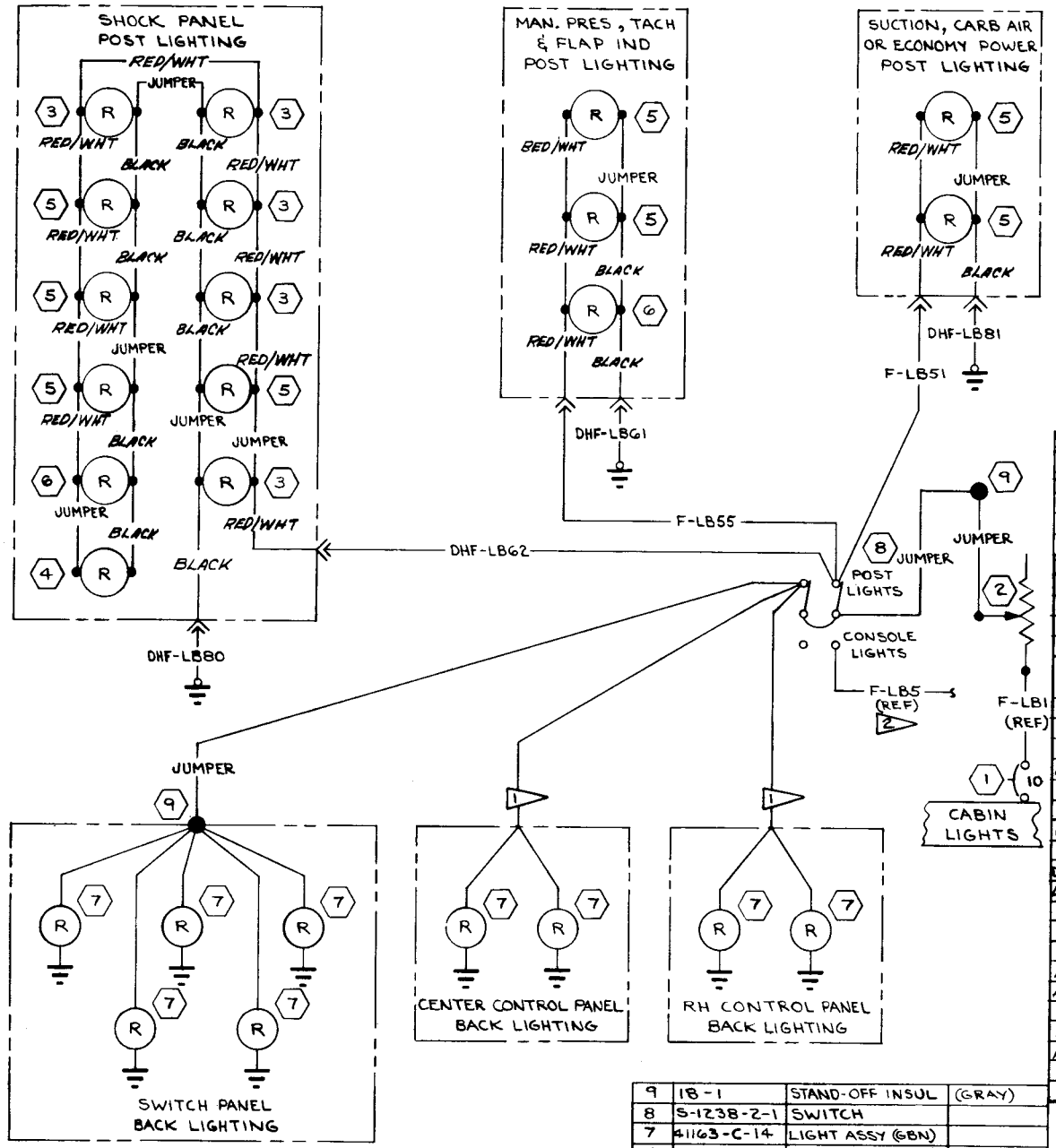
REV:

PAGE: 11.6.1

FORM NO. 80-161

(SR4607)

CHG LET	REVISION	BY / DATE	CHK / APPD
A	BY REV: RED/WHITE & BLACK WIRES BETWEEN POST LIGHTS WERE 20 GA NUMBERED WIRES (NEVER USED)	PB 7-7-65	RRS TM HLW



DHF-LB81	18			S-1367-1-8	S-341-2	1200686	
DHF-LB80	18			S-341-2	S-1367-1-8		
BLACK	22	S-1460-22-0		SOLDER	S-341-2		
BLACK	22			SOLDER	SOLDER		
BLACK	22			SOLDER	SOLDER		
BLACK	22			SOLDER	SOLDER		
BLACK	22			SOLDER	SOLDER		
BLACK	22			SOLDER	SOLDER		
BLACK	22			SOLDER	SOLDER		
BLACK	22	S-1460-22-0		SOLDER	SOLDER		
RED/WHT	22	S-1460-22-2-9		SOLDER	SOLDER		
RED/WHT	22			SOLDER	SOLDER		
RED/WHT	22			SOLDER	SOLDER		
RED/WHT	22			SOLDER	SOLDER		
RED/WHT	22			SOLDER	SOLDER		
RED/WHT	22			SOLDER	SOLDER		
RED/WHT	22			SOLDER	SOLDER		
RED/WHT	22	S-1460-22-2-9		S-341-2	SOLDER		
DHF-LB62	18			S-1367-1-6	S-341-2		
DHF-LB61	18			S-341-2	S-1367-1-8		
BLACK	22	S-1460-22-0		SOLDER	S-341-2		
BLACK	22	-22-0		SOLDER	SOLDER		
RED/WHT	22	-22-2-9		SOLDER	SOLDER		
RED/WHT	22	-22-2-9		SOLDER	SOLDER		
RED/WHT	22	S-1460-22-2-9		S-341-2	SOLDER		
F-LB55	18			S-341-2	S-1367-1-6		
BLACK	22	S-1460-22-0		S-341-2	SOLDER		
RED/WHT	22	S-1460-22-2-9		SOLDER	SOLDER		
RED/WHT	22	S-1460-22-2-9		SOLDER	S-341-2		
F-LB51	18			S-1367-1-6	S-341-2	1200686	
WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
9	18-1	STAND-OFF INSUL (GRAY)	
8	S-1238-2-1	SWITCH	
7	41163-C-14	LIGHT ASSY (GBN)	
6	6602M-3RH-R-14	LIGHT ASSY (GBN)	
5	5952-3RH-R-14	LIGHT ASSY (GBN)	
4	5602M-3LH-R-14	LIGHT ASSY (GBN)	
3	5952-3LH-R-14	LIGHT ASSY (GBN)	
2	R-12½-8-RS34	RHEOSTAT (TRTA)	
1	S-1360-10	CIRCUIT BREAKER	

EQUIPMENT TABLE

NOTES:

1. VENDOR FURNISHED LEADS TERMINATE AT SWITCH WITH S-1367-1-6 TERMINAL.
2. WHEN MAP LIGHT & CONSOLE LIGHTS ARE INSTALLED WITH POST & BACK LIGHTING, WIRE H-LB3 IS CONNECTED TO CONSOLE SIDE OF S-1238-2-1 SWITCH INSTEAD OF R-12½-8-RS34 RHEOSTAT.

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	RIDDER	8-20-64
GROUP	Waugh	9-22-64
CHECK	R. Stuck	9-22-64
PROJ	N. Wise	9-23-64
	W. McCoy	9-29-64

TITLE: **WIRING DIAGRAM— POST LIGHTING & BACK LIGHTING (OPT)**

Cessna.

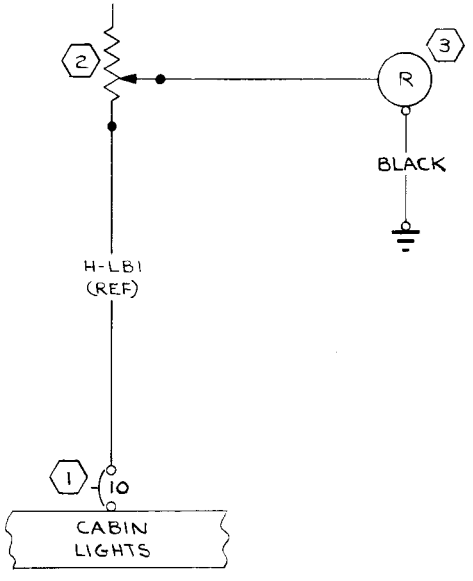
DWG NO: 1270625

SUPERSEDED BY: | SUPERSEDES: | MODEL: P206 & U206 | REV: A | PAGE: 11.7

FORM NO. 50-161A

(SR4956)
(SR4957)

CHG LET	REVISION	BY DATE	CHK APPD



Inactive SER P206-0028 & U206-0318 & ON
W.J.R. 10-30-64
RRS

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		SERIALS
BLACK	22	S-1960-22-0		S-1367-1-8	S-1367-1-10	0770646 N/A

WIRE TABLE

ITEM NO.	PART NO.	DESCRIPTION	INSTALLED ON
3	A5299-12	LIGHT ASSY (GMC)	
2	R-12½-8-RS34	RHEOSTAT (TRTA)	
1	S-1360-10	CIRCUIT BREAKER	

EQUIPMENT TABLE

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIVISION, WICHITA, KANSAS

	NAME	DATE
DRAWN	RIDDER	8-18-64
GROUP		9-1-64
CHECK		9-1-64
PROJ		9-2-64

TITLE: WIRING DIAGRAM— NAV-O-MATIC 300 POST LIGHT (OPT)

Cessna

DWG NO: 1270625

SUPERSEDED BY: | SUPERSEDES: | MODEL: 205, P206 & U206 | REV: | PAGE: 11.8

FORM NO. 80-161A

HEATING, VENTILATING, AND DE-ICING SECTION

Cessna.

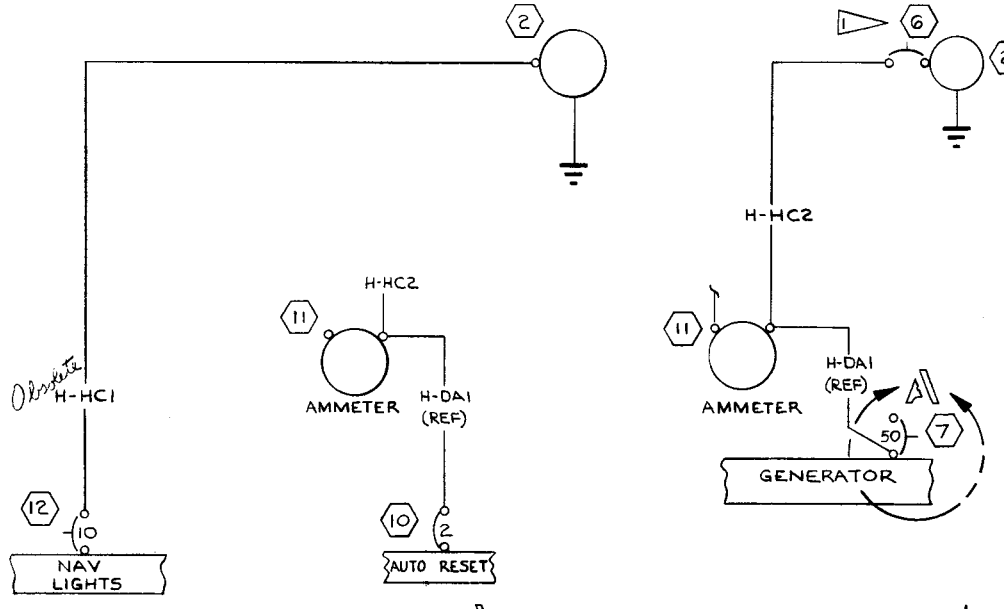
DRAWN	G WOOD	TITLE: WIRING DIAGRAM--- MODEL 205 & 206	DRAWING NO. 1270625
DATE	1-25-62		
APP'D	HCW CM RRS WM Nine	REV:	PAGE: 13.0

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

FORM NO. 80-171

(SR3694-10)

CHG LET	REVISION	BY DATE	CHK APPD
A	REMOVED N/A FROM STD WIRES (SR3694-10)	G L W 4-9-62	
B	ADD 60232-1 CKT BKR TO CIGAR LIGHTER. ADD H-HC2 WIRE ADD NOTE 1, CA-2 CKT BKR, 0713602-1 OBSOLETED F-HC1 H-HC1 WAS 18 GA S-1367-2-8 TERM WAS S-1367-18TERM (SR 4081)	G L W 12-10-62	
C	ADD MODEL 206 S-1360-10 CKT BKR 1270461-1 BUS BAR 1213505-1 INST CLUSTER S-1360-50 CKT BKR 1213505-2 INST CLUSTER & DETAIL A (SR 4038-6) (SR3983-6)	GLW 6-21-63	
D	ADDED P206 & U206 TO MODEL BLOCK ADDED WIRE LENGTHS TO W/T; C669502-0104 WAS 0713602-1, 1213505-2 & 1213505-1; REMOVED 1270429-1, 1270461, S-1360-10 & 1270625-DA1 FROM E/T	W J R 8-19-64	



THRU SER 205-0319

DETAIL A1
EFFECTIVE 205-0320
THRU SER 205-0480

NOTE:
1. CIRCUIT BREAKER IS RESET BY INSERTING A PROBE INTO THE 5/64 DIA HOLE IN BREAKER FACE AND PUSHING LIGHTLY UNTIL A CLICK IS HEARD.

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
12	S-1232-10	CIRCUIT BREAKER	
11	C669502-0104	INST CLUSTER KIT	
10	CA-2	CKT BKR (MTCC)	
9			
8			
7	S-1360-50	CIRCUIT BREAKER	
6	60232-1	CKT BKR (CUE)	
5			
4			
3			
2	0513039-7	CIGAR LIGHTER	
1			

EQUIPMENT TABLE

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS
H-HC2	16		15	S-1367-2-10	S-1367-2-8		SER 205-0320 & ON
H-HC1	16		35	S-1367-2-8	S-1367-2-8		THRU SER 205-0319

WIRE TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	G WOOD	12-30-61
GROUP	W&C Comp	1-29-62
CHECK	R Stuck	2-5-62
PROJ	N. McCarty	2-7-62

TITLE: WIRING DIAGRAM — CIGAR LIGHTER

Cessna.

DWG NO: 1270625

SUPERSEDED BY:

SUPERSEDES:

MODEL: 205, P206 & U206

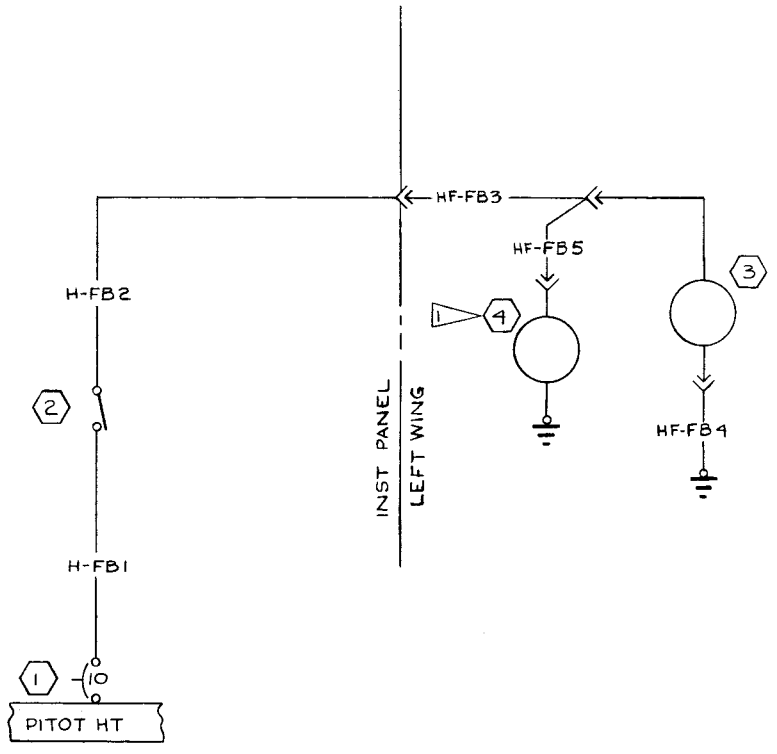
REV: D

PAGE: 13.1

FORM NO. SD-161

NOTE:
1. ONLY HEATER CIRCUIT SHOWN. FOR STALL WARNING CIRCUIT, SEE PAGE 9.2. (SR 3694-10)

CHG LET	REVISION	BY DATE	CHK APPD
A	1200400 WAS 1270626 ADD "OPT" TO TITLE (SR3694-10)	G L W 4-4-62	RBS WMc
B	ADD MODEL 206 S-1360-10 CKT BKR WAS S-1232-10 1270461-1 BUS BAR WAS 1270929-1 (SR 4038-6)(SR3983-6)	GLW 6-21-63	RBS WMc & HLW
C	ADDED P206 & U206 TO MODEL BLOCK; ADDED WIRE LENGTHS TO W/T REMOVED 1270461-1 FROM E/T; HF-FB3 WAS H-FB3 ; HF-FB4 WAS H-FB4 & HF-FB5 WAS F-FB5 (SR4456) & (SR4457)	WJR 8-14-64	ERS WMc



WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS
HF-FB5	18			SEE H-FB3	S-341-2	1220003 1220002	(STD)
HF-FB4	18			S-1369-1	S-1367-1-8	1220003 1220002	(STD)
HF-FB3	16			S-341-1	S-1369-2	1220003 1220002	(STD)
H-FB2	16		23	S-1367-2-6	S-341-1	1200440	
H-FB1	16		4	S-1367-2-6	S-1367-28	1200440	

WIRE TABLE

ITEM NO.	PART NO.	DESCRIPTION	INSTALLED ON
5			
4	0511062-5	XMTR STALL WARN. HTD	
3	0721105-2	PITOT TUBE, HEATED	
2	S-1158-2-1	SWITCH	
1	S-1360-10	CIRCUIT BREAKER	

EQUIPMENT TABLE

CESSNA AIRCRAFT CO COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	G WOOD	12-26-61
GROUP	[illegible]	1-29-62
CHECK	[illegible]	2-5-62
PROJ	[illegible]	2-7-62

TITLE: WIRING DIAGRAM — HEATED PITOT TUBE & HEATED STALL WARNING SYSTEM (OPT)

Cessna.

DWG NO: 1270625

SUPERSEDED BY:

SUPERSEDES

MODEL: 205, P206 & U206

REV: C

PAGE: 13.2

FORM NO. 80-161

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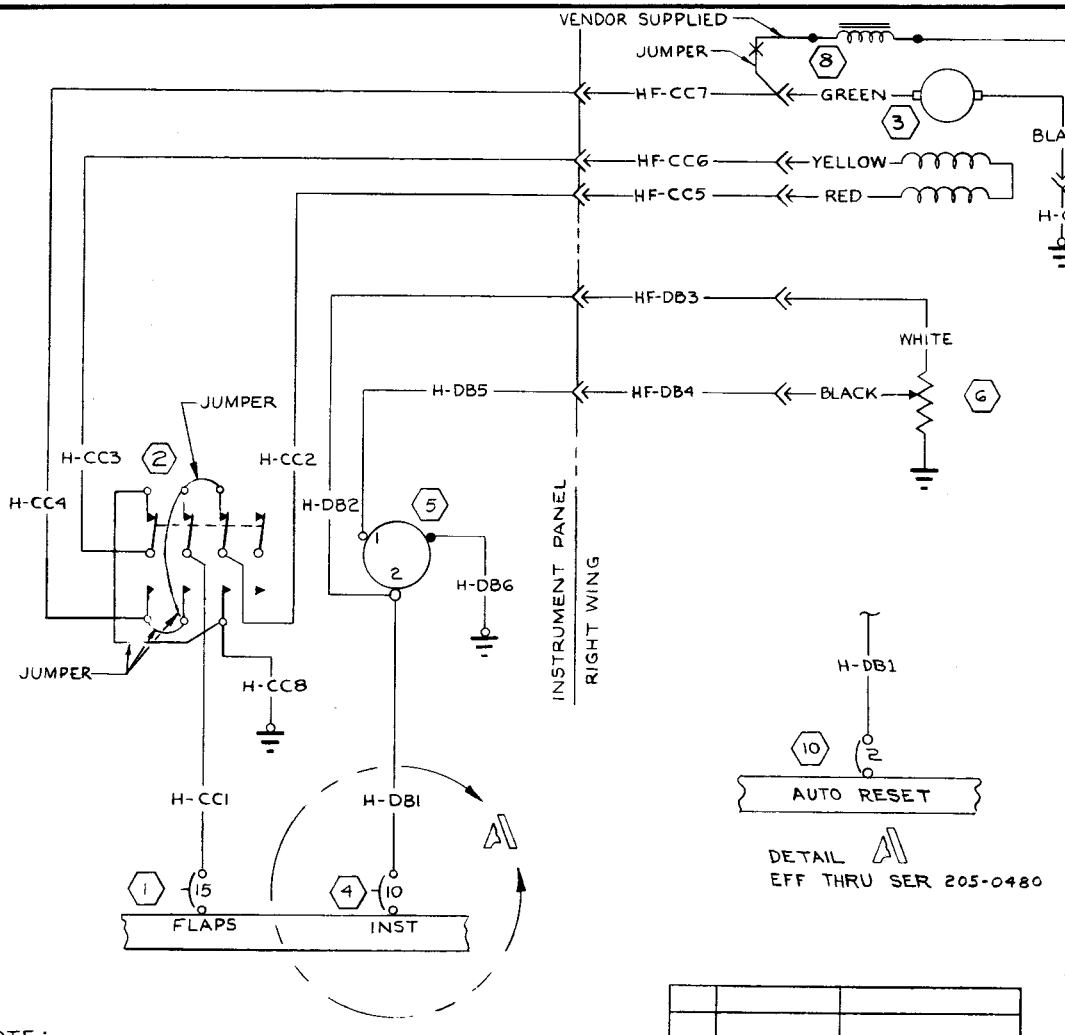
CONTROL SURFACE SECTION

Cessna.

DRAWN	G WOOD	TITLE: WIRING DIAGRAM--- MODEL 205 & 206	DRAWING NO. 1270625
DATE	1-25-62		
APP'D	NEW CUM RR'S	REV:	PAGE: 14.0

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

FORM NO. 80-172



(SR3694-10)

CHG LET	REVISION	BY / DATE	CHK / APPD
A	ADD H-CC9 WIRE. (SR 3694-10) REMOVED N/A FROM STD WIRES	GLW 4-4-62	RRS
B	ADD 28 INT-12D SOLENOID. (SR 3955)	GLW 7-18-62	RRS
C	ADD MODEL 206 S-1360-15 CKT BKR WAS S-1232-15 1270461-1 BUS BAR WAS 1270429-1 ADDED S-1360-10 CKT BKR & DETAIL A (SR 4038-6)(SR 3983-6)	GLW 6-21-63	RRS
D	BY REVISION: ADD JUMPER WIRES TO SOLENOID. "DOWN" WAS "UP" IN NOTE 1. DELETE 8> "EXISTING WIRES ON SOLENOID USED FOR INSTALLATION ON PAGE 14.1. ADDED NOTE 2 ON PAGE 14.1, NOTES 3 & 4 PAGE 14.1.1. ADD E13-00M SWITCH, H-CC13 & H-CC14 WIRES. ADD PAGE 14.1.2 (SR 4454)	GLW 3-2-64	RRS
E	ADDED P206 & U206 TO MODEL BLOCK; ADDED WIRE LENGTHS TO W/T; REMOVED 1270429-1 & 1270461-1 FROM E/T; HF-CC5 WAS H-CC5; HF-CC6 WAS H-CC6; HF-CC7 WAS H-CC7; HF-DB3 WAS H-DB3; HF-DB4 WAS H-DB4; (SR4456) & (SR4457)	WJR 8-19-64	RRS

NOTE:
1. FLAP SWITCH SHOWN IN FLAP "DOWN" POSITION
2. THIS DIAGRAM APPLICABLE TO MODEL 206 THRU 206-0195 . REFER TO PAGE 14.1.2 FOR LATER SERIALS.

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
12	E13-00M	SWITCH (CRYE)	
11	BZ-7RW2T04	LIMIT SWITCH (MCS)	
10	CA-2	CKT BKR (MTCC)	
9			
8	28INT-12D	SOLENOID (GN)	
7			
6	1260068-2	XMTR, FLAP POS	
5	S-1318-1	INDICATOR, FLAP POS	
4	S-1360-10	CIRCUIT BREAKER	
3	0760657-1	FLAP ACTUATOR	
2	0760632-1	SWITCH, ELECTRIC FLAP	
1	S-1360-15	CIRCUIT BREAKER	

EQUIPMENT TABLE

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS
H-CC14	16		100	S-1493-2	S-341-1		SER 206-0196 & ON
H-CC13	16		100	S-1493-2	S-341-1		SER 206-0196 & ON
H-CC12	16		155	S-1367-2-6	SEE H-CC4		SER 206-0064 & ON
H-CC11	16		149	S-1367-2-6	S-341-1		SER 206-0064 & ON
H-CC10	16		25	S-1367-2-6	S-341-1		SER 206-0064 & ON
H-CC9	16		8	S-341-1	S-1367-1-8		
H-DB6	18		6	SOLDER	S-1367-1-8		
H-DB5	18		26	S-341-2	S-1367-1-8		
HF-DB4	18			S-341-2	S-341-2		
HF-DB3	18			S-341-2	S-341-2		
H-DB2	18		26	S-1367-1-10	S-341-2		
H-DB1	18		37	S-1367-1-10	S-1367-1-8		
H-CC8	16		5	S-1367-2-8	S-1367-2-6		
HF-CC7	16		129	S-341-1	S-341-1		
HF-CC6	16		129	S-341-1	S-341-1		
HF-CC5	16		129	S-341-1	S-341-1		
H-CC4	16		25	S-1367-2-6	S-341-1		
H-CC3	16		25	S-1367-2-6	S-341-1		
H-CC2	16		25	S-1367-2-6	S-341-1		
H-CC1	16		34	S-1367-2-6	S-1367-2-8		

WIRE TABLE

CESSNA AIRCRAFT CO COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	G WOOD	12-21-61
GROUP		1-29-62
CHECK		2-5-62
PROJ		2-7-62

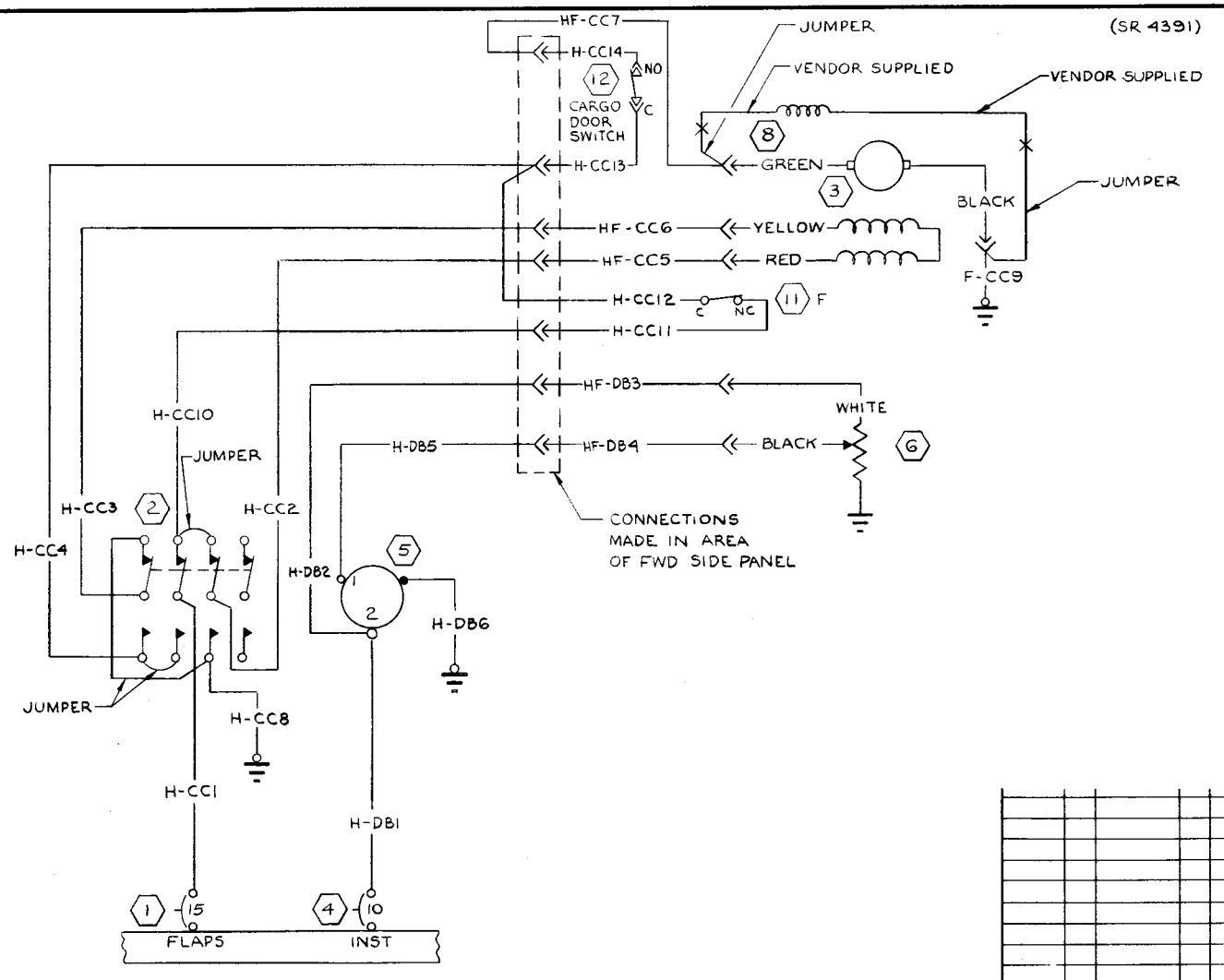
TITLE: WIRING DIAGRAM — WING FLAPS

Cessna.

DWG NO: 1270625

SUPERSEDED BY: | SUPERSEDES: | MODEL: 205, P206 & U206 | REV: E | PAGE: 14.1

FORM NO. 80-161



CHG LET	REVISION	BY / DATE	CHK / APPD
	SEE PAGE 14.1		

(SR 4391)

NOTE:
1. FLAP SWITCH SHOWN IN FLAP "DOWN" POSITION.
2. REF 1270625 PAGE 14.1 FOR WIRE TABLE.
3. CARGO DOOR SWITCH SHOWN ACTUATED (CARGO DOORS CLOSED).
4. (12) SWITCH & WIRES H-CC13 & H-CC14 APPLICABLE SER 206-0196 & ON.

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		SERIALS

WIRE TABLE

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON

EQUIPMENT TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION, WICHITA, KANSAS

	NAME	DATE
DRAWN	G WOOD	10-28-63
GROUP		11-5-63
CHECK	R. Stuck	11-5-63
PROJ	H.M. Coates	11-6-63

TITLE: WIRING DIAGRAM — WING FLAPS (FLOATPLANE) (OPT)

Cessna

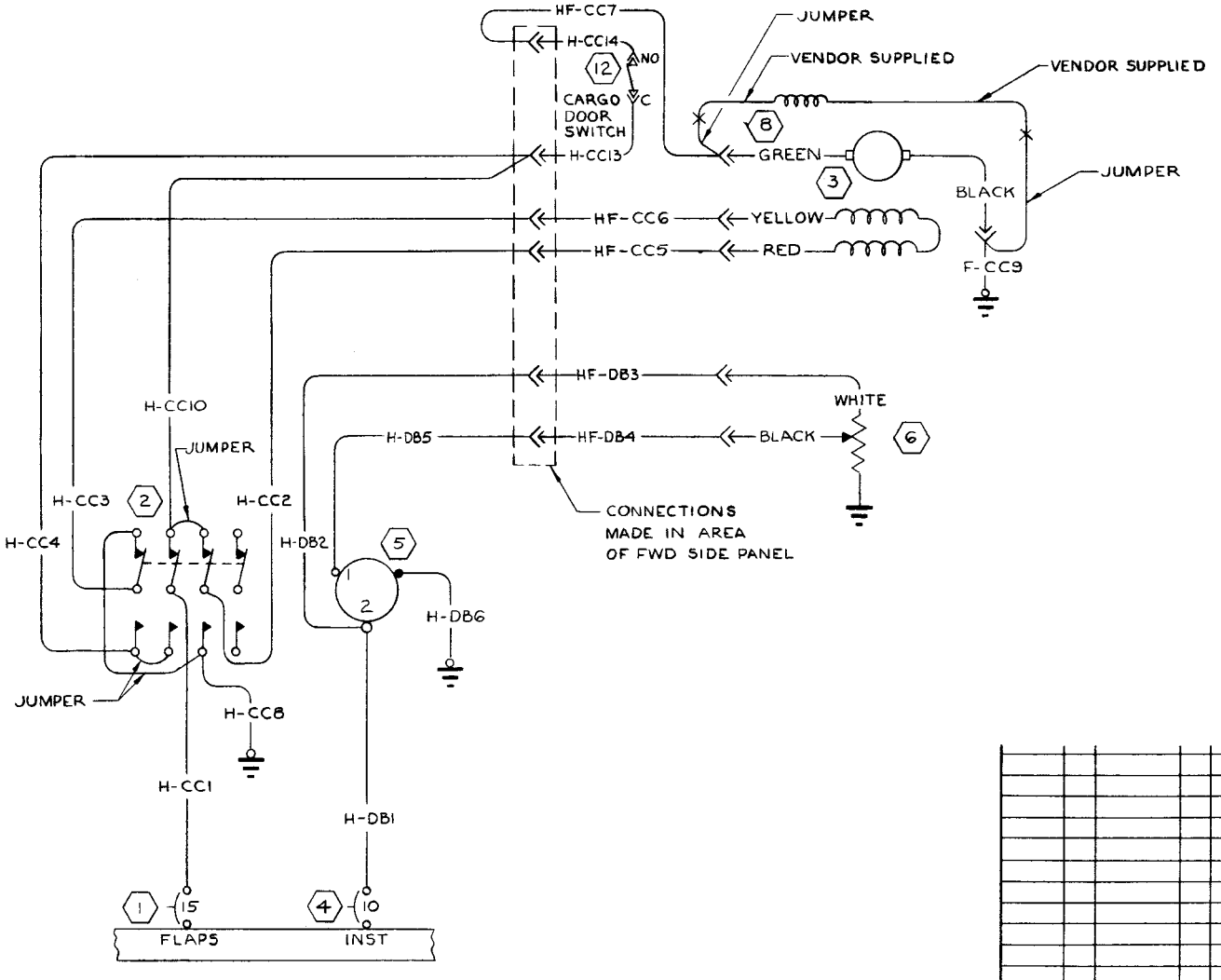
DWG NO. 1270625

SUPERSEDED BY	SUPERSEDES	MODEL	REV.	PAGE
		206 & U206	E	14.1.1

FORM NO. BO-161

(SR 4454)

CHG LET	REVISION	BY DATE	CHK APPD
	SEE PAGE 14.1		



NOTES:
1. FLAP SWITCH SHOWN IN FLAP "DOWN" POSITION.
2. REF 1270625 PAGE 14.1 FOR WIRE TABLE.
3. CARGO DOOR SWITCH SHOWN ACTUATED (CARGO DOORS CLOSED).
4. THIS DIAGRAM APPLICABLE SER 206-0196 & ON REFER TO PAGE 14.1 FOR PRIOR SERIALS.

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		SERIALS

WIRE TABLE

ITEM NO.	PART NO.	DESCRIPTION	INSTALLED ON

EQUIPMENT TABLE

CESSNA AIRCRAFT CO. COMMERCIAL AIRCRAFT DIVISION WICHITA KANSAS

	NAME	DATE
DRAWN	G WOOD	3-2-69
GROUP	[illegible]	3-10-69
CHECK	R. Black	3-11-69
PROJ	N. Wise	9-9-69

TITLE: WIRING DIAGRAM — WING FLAPS

Cessna.

DWG NO: 1270625

SUPERSEDED BY:	SUPERSEDES:	MODEL: 206 & U206	REV: E	PAGE: 14.1.2

FORM NO. 80-181

MISCELLANEOUS SECTION

Cessna.

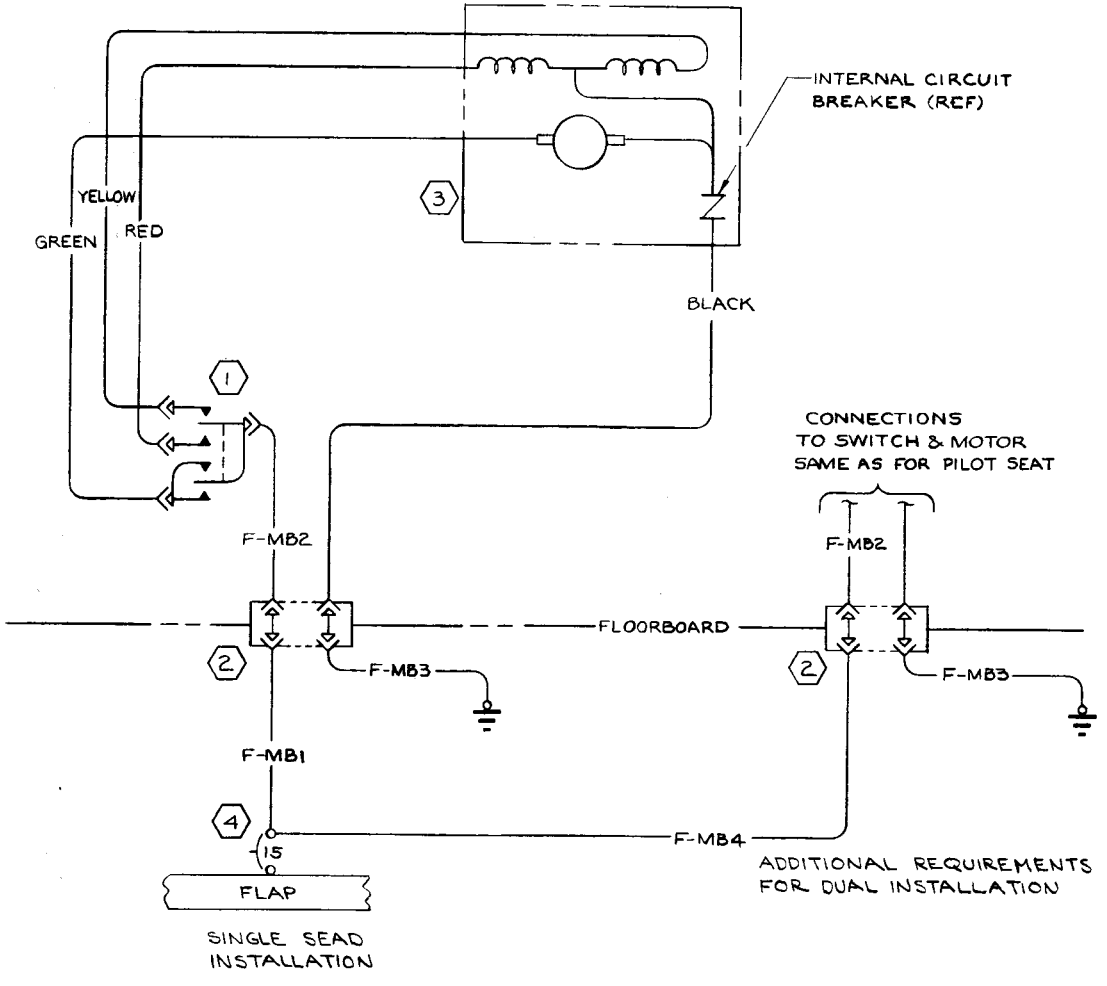
			DRAWING NO.
DRAWN	GLW	TITLE: WIRING DIAGRAM--- MODEL 205, 206	1270625
DATE	9-5-63		
APP'D	RRS	REV:	PAGE: 16.0

CESSNA AIRCRAFT CO., COMMERCIAL AIRCRAFT DIV., WICHITA, KANS.

FORM NO. 80-174

(SR 4209)

CHG LET	REVISION	BY / DATE	CHK / APPD
A	ADDED WIRE LENGTHS TO W/T; REMOVED 1270461-1 FROM E/T ADDED P206 & U206 TO MODEL BLOCK	WJR 8-18-64	RES TV NWC



NOTES:
1. COLOR CODED WIRES ARE VENDOR FURNISHED.
2. "F" PREFIX USED ON THIS DRAWING INSTEAD OF "H" BECAUSE THE WIRES ARE THE SAME AS THOSE USED IN MODEL 210. THIS DIAGRAM IS SCHEMATICALLY IDENTICAL TO 1270405 PAGE 16.1 WIRING DIAGRAM AND IS FOR REF ONLY.

ITEM NO	PART NO.	DESCRIPTION	INSTALLED ON
5			
4	S-1360-15	CIRCUIT BREAKER	
3	1414249-2	MOTOR ASSY	
2	S-1491-1	BUSHING TERMINAL	
1	1414268-1	SWITCH ASSY	

EQUIPMENT TABLE

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS		N/A	SERIALS
F-MB4	16		113	S-1493-2	S-1367-2-6	0700718	
F-MB3	16		26	S-1493-2	S-1367-2-6	0700718	
F-MB2	16		12	S-1493-2	S-1493-2	0700718	
F-MB1	16		131	S-1367-2-6	S-1493-2	0700718	

WIRE TABLE

CESSNA AIRCRAFT CO COMMERCIAL AIRCRAFT DIVISION WICHITA, KANSAS

	NAME	DATE
DRAWN	G WOOD	9-6-63
GRP ENG		9-6-63
CHECK	R Stuck	9-23-63
PROJ	H McPeters	9-25-63

TITLE: WIRING DIAGRAM — VERTICALLY ADJUSTING SEAT (OPT)

Cessna.

DWG NO: 1270625

SUPERSEDED BY:

SUPERSEDES:

MODEL: 205, P206 & U206

REV: A

PAGE: 16.1

FORM NO. 80-161

APPENDIX D

HYDRAULIC COMPONENTS REPAIR

MODEL 210E AND ON

NOTE

This Appendix applies to the Model 210E and on. The Power Pack may also be used as an alternate for the Model 210D. The main and nose gear actuators, door cylinders, and locking cylinders may also be used as alternates for the Models 210B thru 210D. Refer to Section 5C for the other required changes when alternate components are used.

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		Page
D1	GENERAL INFORMATION	D1-1
D2	REPAIR OF POWER PACK	D2-1
D3	REPAIR OF HYDRAULIC PUMP	D3-1
D4	REPAIR OF MAIN GEAR ACTUATOR	D4-1
D5	REPAIR OF NOSE GEAR ACTUATOR	D5-1
D6	REPAIR OF LOCK CYLINDERS	D5-1
D7	REPAIR OF DOOR CYLINDERS	D5-1
D8	REPAIR OF UNLOCK AND SEQUENCE CYLINDERS	D5-1

SECTION D1

GENERAL INFORMATION

D1-1. The following pages cover, in step-by-step procedure, the repair of the Power Pack and other hydraulic system components. Since emphasis here is on repair, not overhaul, of the basic components of the hydraulic system, it is unlikely that the mechanic will go through all of the operations described. Instead, he will repair the particular item which is causing the difficulty.

NOTE

To isolate the hydraulic item causing malfunction, see the Trouble Shooting Charts in Section 5C, and if possible, perform Hydro Test testing.

D1-2. 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.

D1-3. REPAIR parts and equipment are available from the Cessna Spare Parts Department.

D1-4. EQUIPMENT AND TOOLS.

D1-5. HYDRO TEST. The Hydro Test is a portable Hydraulic Service Unit, designed specifically to supply hydraulic pressure for cycling the landing gear for checking or servicing this system when the engine is not operating. In addition to cycling the landing gear, the Hydro Test can be used for filling the Power Pack reservoir, bleeding the system, reading system pressure, and testing components prior to installation. The unit is mounted in a metal cabinet and is on wheels.

D1-6. HAND TOOLS. The following 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)
Needle-nose Pliers
Pin Punches
Duck-bill Pliers
Box and Open End Wrenches (sizes 1/2" thru 7/8")
1/2" Thin-wall Socket

Locally fabricated items, handy for Power Pack repair, 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. 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.

D1-7. 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 take endless "fishing" operations to extricate otherwise. An air hose and nozzle is a common-sense tool.

D1-8. GENERAL REASSEMBLY CONDITIONS. During reassembly of the hydraulic components, lubricate O-rings and back-up rings with petrolatum (VV-P-236) or hydraulic fluid. Use petrolatum sparingly on O-rings and back-up rings. All other moving parts should be lubricated with hydraulic fluid (MIL-H-5606).

SECTION 2

REPAIR OF POWER PACK

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Disassembly of Manifold	D2-4
COMPONENTS DISASSEMBLY	D2-4
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Secondary Relief Valve	D2-4
Primary Relief Valve	D2-4
Priority Valve	D2-4
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Handle and Handle-Release Mechanism	D2-4
POWER PACK REASSEMBLY	D2-9
Standpipe and Filter	D2-9
System Inlet Check Valve	D2-9
Priority Valve	D2-9
Primary Relief Valve	D2-9
Secondary Relief Valve	D2-9
Hand Pump Valves	D2-9
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Handle and Handle-Release Mechanism	D2-11
Manifold Installation	D2-11
PRESSURE ADJUSTMENTS	D2-12
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Handle-Release Mechanism	D2-12
Secondary Relief Valve	D2-13
Primary Relief Valve	D2-13
Priority Valve	D2-13
Emergency Hand Pump Test	D2-13
Reservoir Leakage Test	D2-13

D2-1. POWER PACK DISASSEMBLY. After the Power Pack has been removed from the airplane and all 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 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 bolt, 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

The holding fixture shown in figure B2-3 may be used instead of removing the center stud if desired.

e. Remove pivot clevis pin and forward clevis pin from hand pump handle linkage, and remove hand pump handle assembly.

f. 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.

g. Cut safety wire and remove screws attaching landing gear up-down switch and bracket. Retain washers between bracket and Power Pack.

h. Cut safety wire and remove four Allen head screws attaching hand pump bracket, and remove bracket.

i. Remove lock-out solenoid retaining nut from hand pump bracket and remove solenoid from bracket. Use care to prevent damage to solenoid electrical wires.

j. Turn Power Pack over and cut safety wire at time-delay valve.

k. 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.

l. Cut safety wire and remove screws attaching gear and rack protective cover. Remove cover.

m. Remove clamp attaching electrical wires to door solenoid valve and remove safety wire from door solenoid valve.

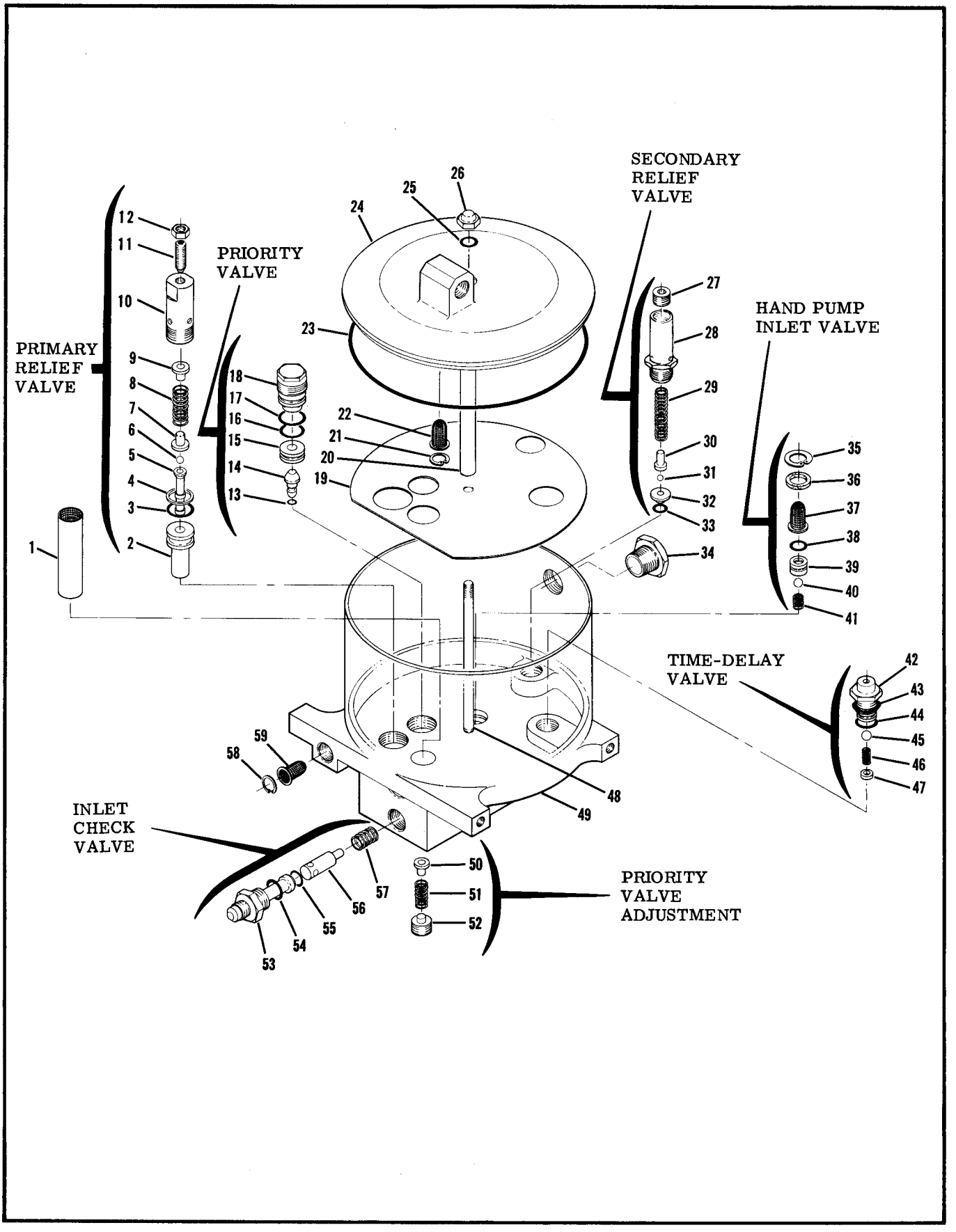


Figure D2-1. Reservoir and Main Body Components

References for Figure D2-1

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. Lock Nut

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

HANDPUMP INLET VALVE

35. Snap Ring
36. Spacer
37. Filter
38. Seat O-Ring
39. Seat
40. Ball
41. Spring

TIME-DELAY VALVE

42. Retainer
43. Retainer Hex O-Ring
44. Retainer Body O-Ring
45. Ball
46. Spring
47. Spacer

48. Center Bolt
49. Reservoir and Body Assembly

PRIORITY VALVE ADJUSTMENT

50. Button
51. Spring
52. Retainer (Adjusting Plug)

INLET CHECK VALVE

53. Pressure Inlet Fitting
54. Fitting O-Ring
55. O-Ring
56. Plunger
57. Spring

58. Snap Ring
59. Filler Line Filter

SHOP NOTES:

n. 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.
o. Remove the seven transfer tubes from manifold or Power Pack.

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.

D2-2. DISASSEMBLY OF MANIFOLD.
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.

D2-3. COMPONENTS DISASSEMBLY.

D2-4. HAND PUMP VALVES.
a. Pull hand pump plunger from Power Pack body.
b. Using snap ring pliers, remove snap ring at inboard end of hand pump plunger.
c. Remove gland and scraper from plunger.
d. Inside reservoir, remove snap ring, spacer, and filter screen. Use a brass hook to remove seat, ball, and spring.

D2-5. SECONDARY RELIEF VALVE.
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.

D2-6. 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 1/8-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.

D2-7. 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.

D2-8. 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.

D2-9. 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.

D2-10. LANDING GEAR HANDLE AND 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.

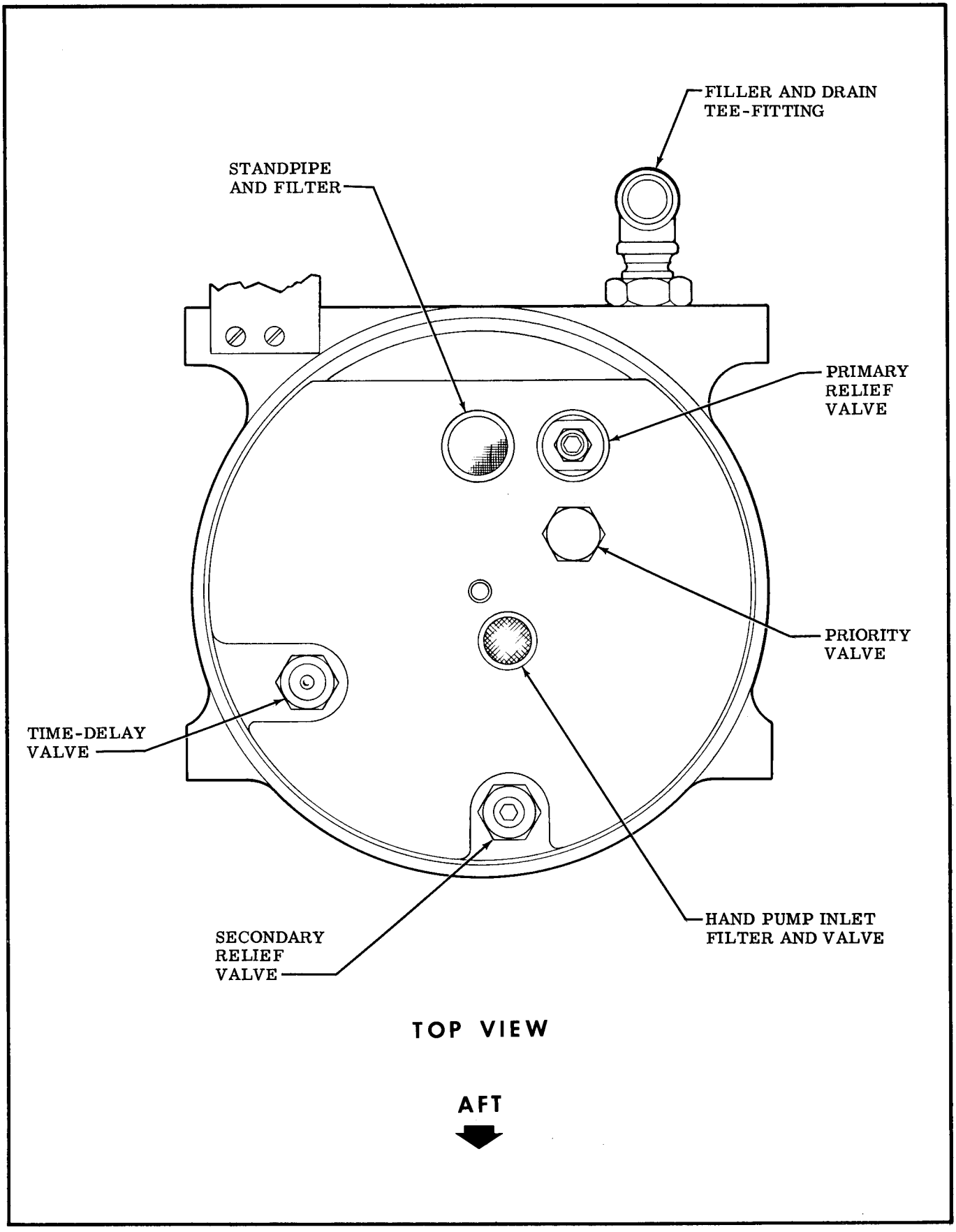
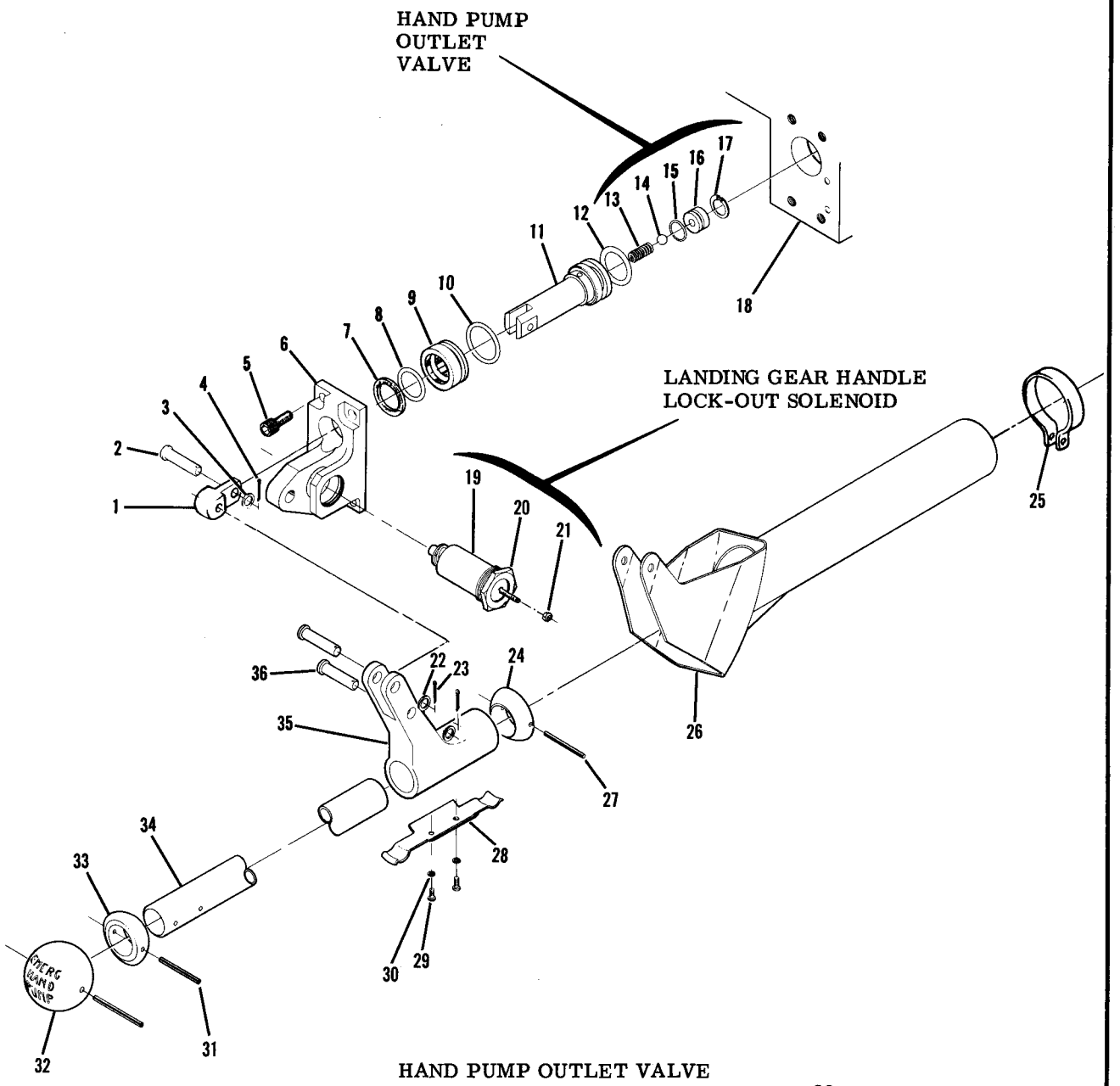


Figure D2-2. Center Section Components



HAND PUMP OUTLET VALVE

13. Spring
14. Ball
15. Seat O-Ring
16. Seat
17. Snap Ring

18. Power Pack Body

LANDING GEAR HANDLE LOCK-OUT SOLENOID

19. Solenoid
20. Retaining Nut
21. Stroke Adjusting Nut

1. Link
2. Pin
3. Washer
4. Cotter Pin
5. Allen Screw
6. Hand Pump Bracket
7. Scraper
8. Gland O-Ring (Internal)
9. Gland
10. Gland O-Ring (External)
11. Hand Pump Plunger
12. Plunger O-Ring

22. Washer
23. Cotter Pin
24. Handle Stop
25. Clamp
26. Handle Guard
27. Pin
28. Handle Latch Spring
29. Screw
30. Washer
31. Pin
32. Handle Knob
33. Handle Stop
34. Handle
35. Lever Assembly
36. Pin

Figure D2-3. Emergency Hand Pump

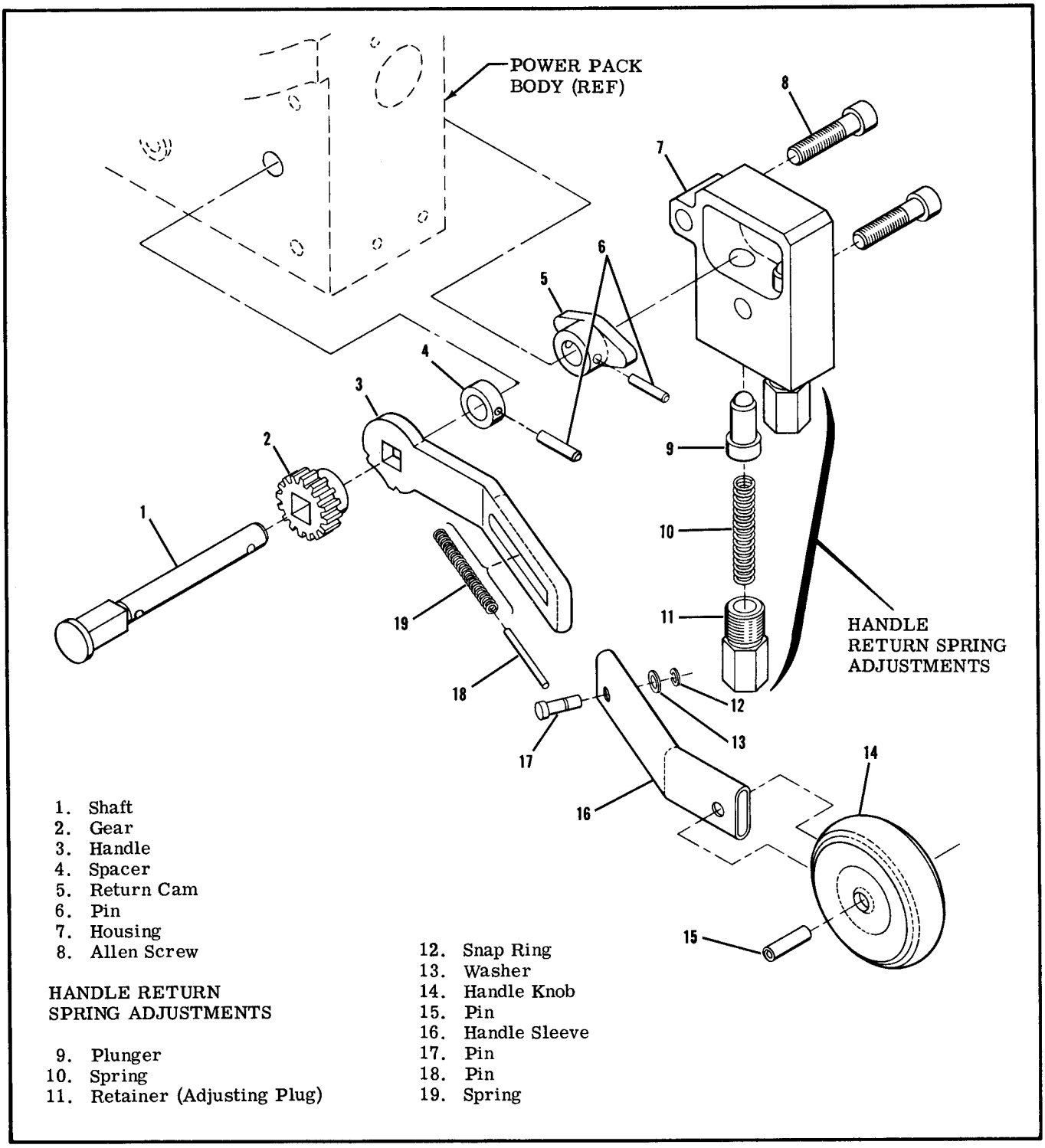


Figure D2-4. Handle and Handle-Release Mechanism

c. Using a punch, drive roll pin from cam, and remove cam from landing gear handle shaft.

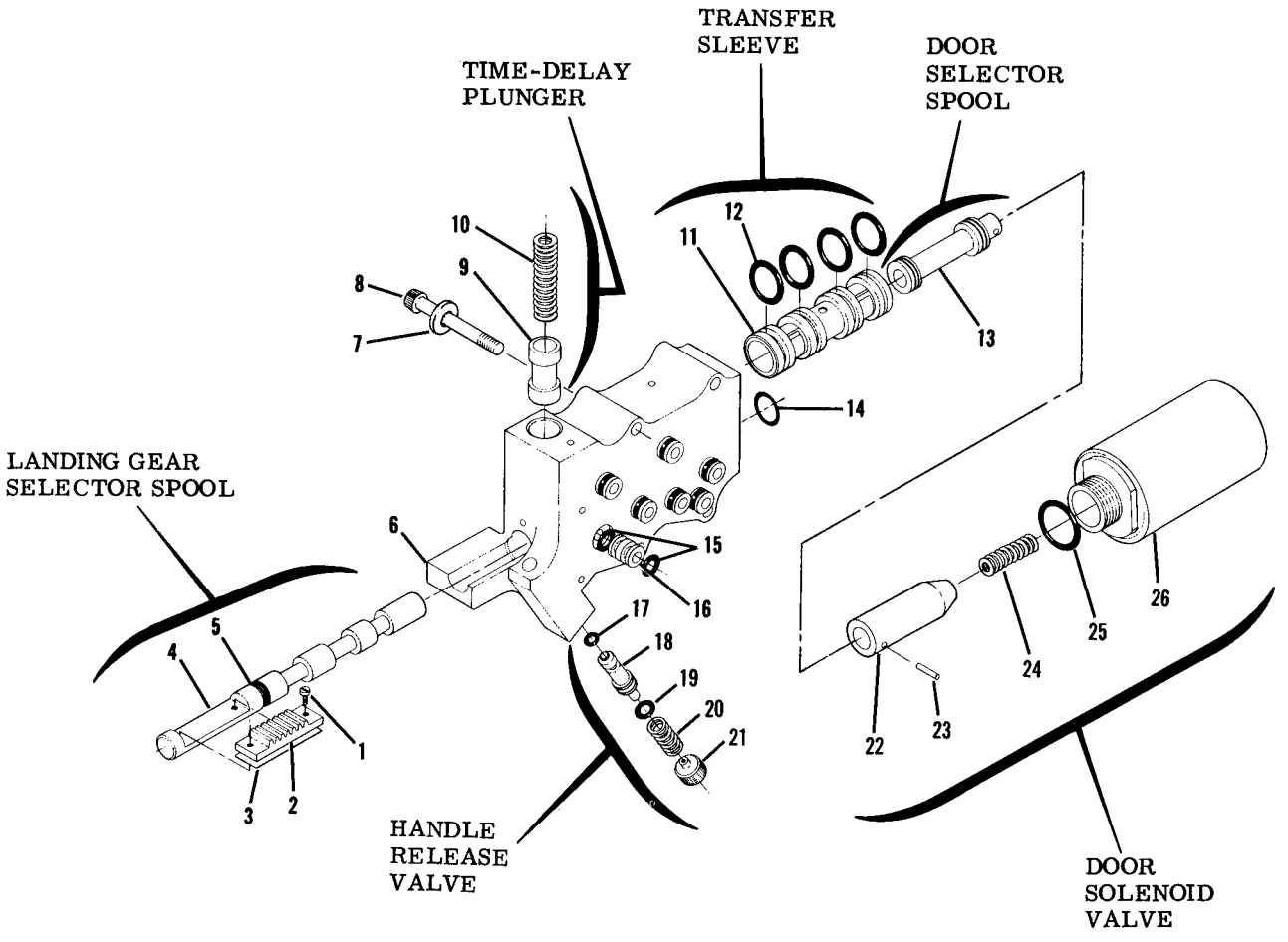
d. Pull handle assembly from Power Pack.

NOTE

Do not remove spacer, handle, or gear from handle shaft except for replacement of parts.

e. Landing gear handle may be disassembled as illustrated in figure D2-4.

f. Emergency hydraulic hand pump handle may be disassembled as illustrated in figure D2-3.



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 D2-5. Manifold Assembly

D2-11. POWER PACK REASSEMBLY. 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-7711 grease (or equivalent) before installing.

D2-12. 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 as shown in figure 5-9.

D2-13. 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-7711), insert fitting, start the threads, and tighten securely.

D2-14. 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-7711), and install retainer. Tighten securely.

e. Turn Power Pack upside down, lubricate spring and button (MIL-G-7711) and install body. Apply lubricant to hold button in spring and install with button in hole first.

f. Lubricate (MIL-G-7711) threads on retainer (adjusting plug) and install. This plug provides adjustment for the priority valve. Install flush at this time.

D2-15. 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-7711). Install with ball entering hole first. Be sure that ball enters cavity at top of poppet.

d. Lubricate threads on retainer (MIL-G-7711) and install over button and spring. Tighten securely.

e. Lubricate threads of adjusting screw (MIL-G-7711) 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.

D2-16. SECONDARY RELIEF VALVE.

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-7711) to hold ball, button and spring together, and insert in body with ball toward seat.

e. Lubricate threads on retainer (MIL-G-7711). Start retainer over spring and tighten securely.

f. Lubricate threads on adjusting plug (MIL-G-7711) 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.

D2-17. HAND PUMP VALVES.

a. Insert spring and ball in body through reservoir.

b. Inspect seating surface of seat. It should have a very sharp edge. Seat may be lapped if necessary to obtain a sharp edge.

c. Lubricate and install O-ring on seat and install seat in body through reservoir.

d. Install filter screen, spacer, and snap ring in body through reservoir.

e. Install spring and ball in hand pump plunger.

f. Inspect seating surface of seat. It should have a very sharp edge. Seat may be lapped if necessary to obtain a sharp edge.

g. Lubricate and install O-ring on seat and install seat in hand pump plunger. Secure with snap ring.

h. Lubricate and install O-ring on plunger, and internal and external O-rings on bronze gland.

i. Install gland on plunger, and insert plunger and gland into body.

j. Install scraper ring in counterbore of gland. Install so that flat surface of scraper is in counterbore of gland and inner protruding part of scraper faces outward.

k. Thread lock-out solenoid wires through hand pump bracket, position solenoid, and install retainer nut. Do not tighten lock-out solenoid retainer nut at this time.

l. Attach hand pump bracket to Power Pack. Shift bracket so that lock-out solenoid plunger does not bind in any way with the landing gear handle barrier, then tighten bracket attaching screws, but do not safety at this time.

m. Install hand pump handle with pivot and linkage pins. Secure with cotter pins.

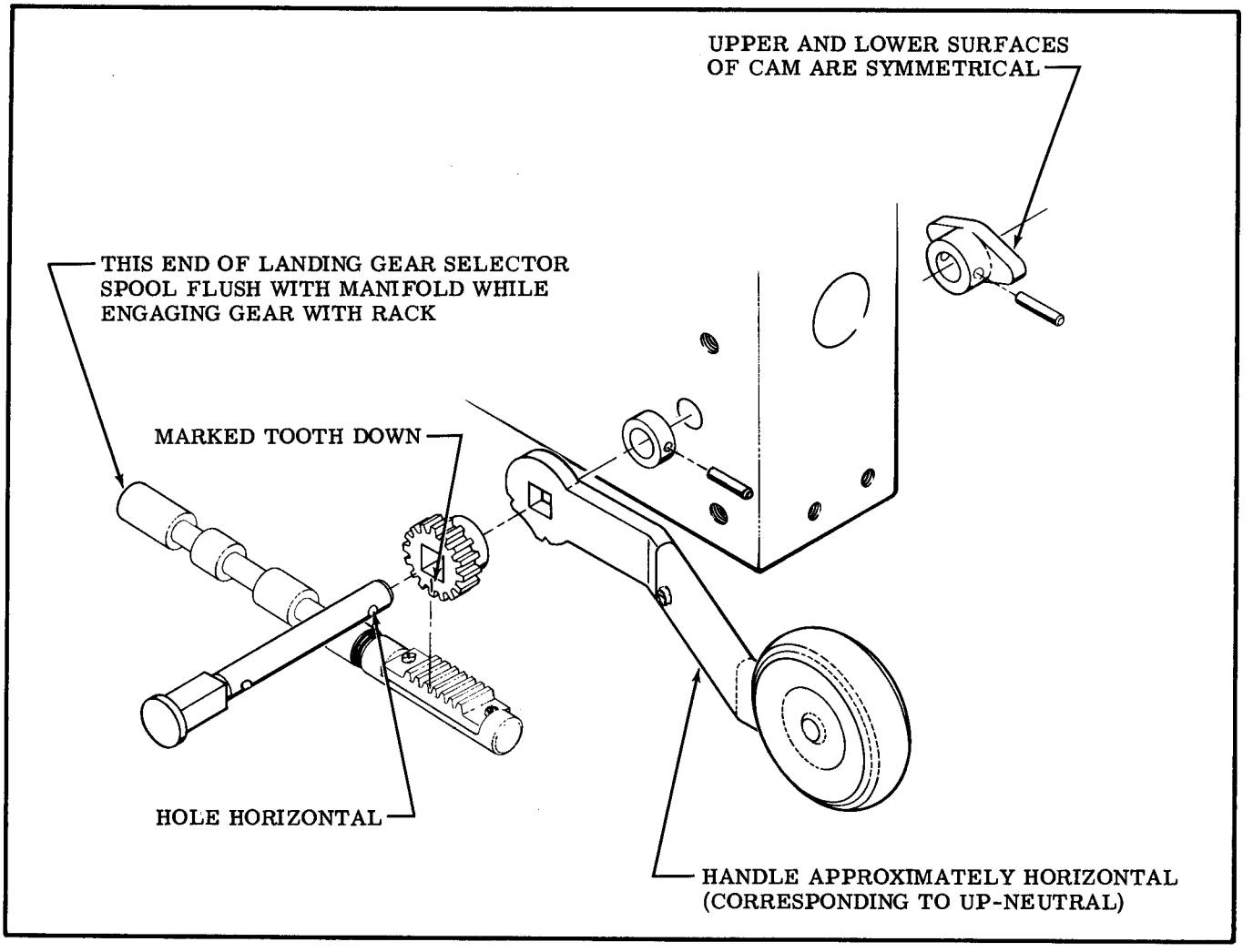


Figure D2-6. Timing of Handle and Selector Spool

D2-18. 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 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-7711) 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.

D2-19. LANDING GEAR HANDLE AND HANDLE-RELEASE MECHANISM.

a. Assemble emergency hydraulic hand pump handle as illustrated in figure D2-3.

b. If the landing gear handle was disassembled, assemble as illustrated in figure D2-4. When assembling gear handle, insert pin in spring and place in slot of handle. Using a small punch, compress spring slightly to install clevis pin.

c. If the landing gear handle shaft or gear was removed, the parts must be indexed and assembled as shown in figure D2-6.

d. Lubricate shaft (MIL-G-7711), install spacer on shaft with roll pin, and insert shaft into Power Pack.

e. Install cam with roll pin. Both sides of cam surfaces are identical. Check landing gear handle for freedom of movement in Power Pack. Check for slight end play in shaft. If handle binds, remove cam and lap inside boss of cam to obtain slight end play in shaft with cam installed.

f. Install handle-release housing and safety attaching screws. Check landing gear handle for freedom of movement.

NOTE

Do not install plungers, springs, and hex-head retainers (adjusting plugs) at this time.

D2-20. MANIFOLD INSTALLATION.

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 assembly to rack on selector spool as shown in figure D2-6. Refer to the following steps if binding exists.

e. Install four manifold attaching screws and washers. Torque screws to 35 pound-inches and safety. Do not over-torque screws, as this will cause binding in the movement of landing gear handle.

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 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-7711) and insert larger spring and spacer in body through reservoir.

h. Lubricate (MIL-G-7711) 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-7711) 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 and selector spool.

j. Thoroughly lubricate handle return springs and plungers (MIL-G-7711) 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-7711) 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 used between the bracket and Power Pack. Switch bracket has slotted holes for switch adjustment.

NOTE

With landing gear handle at centerline of barrier, adjust up-down switch so that switch clicks at an equal distance up and down from centerline of barrier as landing gear handle is moved up and down.

o. Install terminal strip and place capacitor alongside the strip. Connect electrical wires to terminal strip and ground, clamping wires to door solenoid valve. If the wires from the handle lock-out solenoid are not long enough, rotate the lock-out solenoid until the wires will reach their connections. Tighten the lock-out solenoid retainer nut, and safety the retainer nut and hand pump bracket attaching screws together.

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. A small nut is provided at the handle lock-out solenoid to adjust the stroke of the solenoid plunger. Adjust the nut so that the solenoid plunger fully engages the handle detent when released, but clears the handle when it is actuated, even when slight side-pressure is exerted manually on the handle.

q. Continue reassembly of Power Pack after pressure adjustments have been completed.

D2-21. PRESSURE ADJUSTMENTS.

NOTE

This procedure requires a minimum of test equipment and is intended for bench-testing the Power Pack after field repair.

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.
e. Drain hose to connect to Power Pack reservoir drain fitting.

D2-22. GENERAL CONDITIONS. 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.

D2-23. HANDLE RELEASE-MECHANISM. (See figure D2-7.) 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.

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 spring, however, must not bottom out.
b. Place handle in 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. Place handle in 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. Place handle in 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

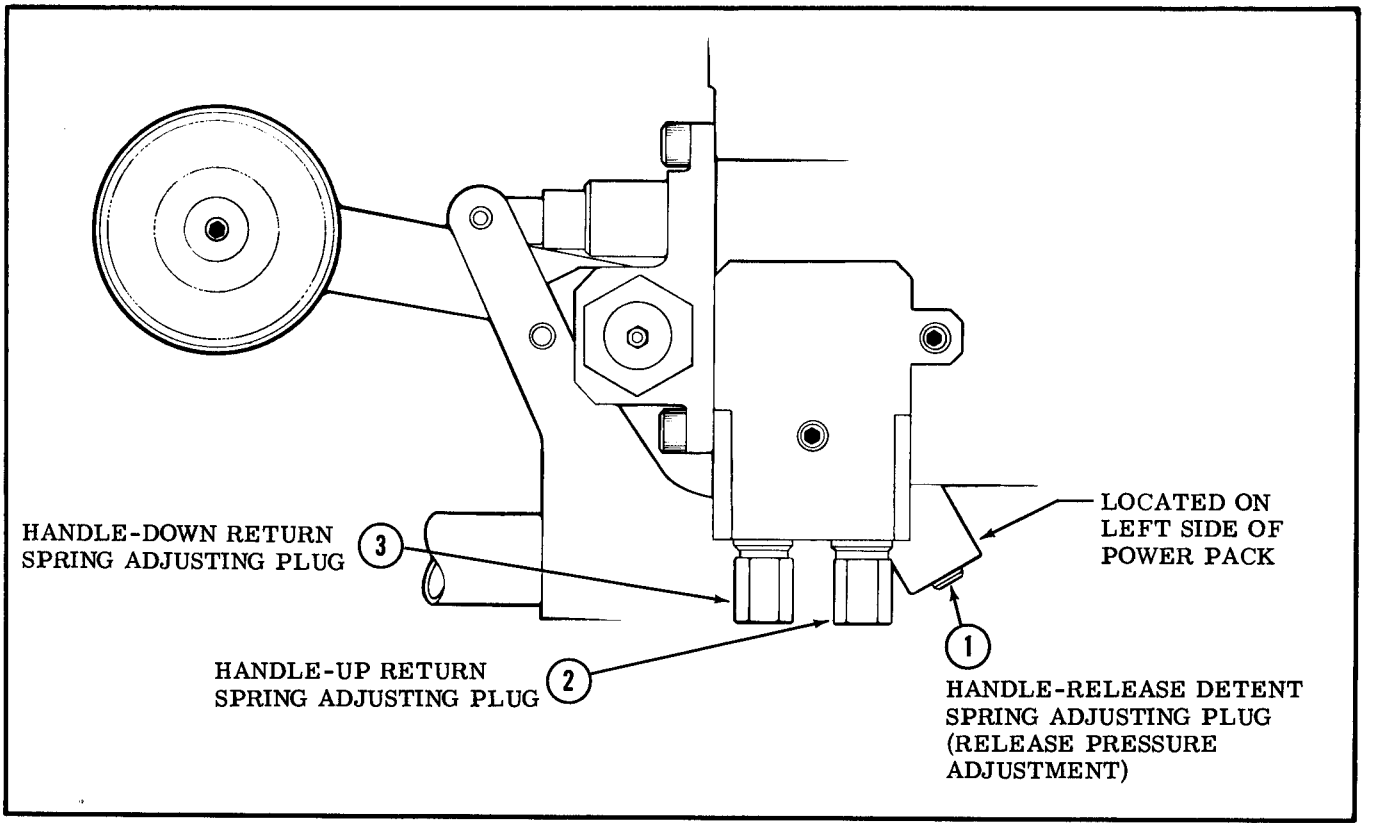


Figure D2-7. Handle Release Adjustments

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.

D2-24. SECONDARY RELIEF VALVE.

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 (using a slow flow). Bleed pressure by cracking cap on door-open fitting after each adjustment.

d. Safety wire the secondary relief valve to the time-delay valve.

D2-25. 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 1700 psi. Adjusting this valve to 1700 psi cracking pressure will give approximately 1800 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.

D2-26. 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.

D2-27. EMERGENCY HAND PUMP TEST.

a. Fill reservoir with clean MIL-H-5606 hydraulic fluid to the top of the standpipe in reservoir.

b. Remove cap from door-open port and operate emergency hand pump until fluid flows from port with no evidence of air in the system. Replenish reservoir with clean hydraulic fluid as necessary to maintain fluid level.

c. After pump is primed and bled of all air, remove fitting and install 2000 psi gage at door-open port.

d. Operate emergency hand pump until pressure on gage stops increasing, indicating the secondary relief valve has opened. Maximum indication on gage should be 1900 to 1950 psi. During the pumping operation, the emergency hand pump should not feel spongy in either the up or down stroke.

e. Crack gage in door-open port to release pressure, remove gage, reinstall and cap door-open fitting, and drain fluid from reservoir.

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 standpipe.

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 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.

D2-28. 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, refill reservoir.

SECTION D3

REPAIR OF HYDRAULIC PUMP

D3-1. The engine-driven hydraulic pump used on the Model 210E and on is the same pump used on the Model 210B. Repair of the pump may be accomplished as outlined in Section B3 of Appendix B.

SECTION D4

REPAIR OF MAIN GEAR ACTUATOR

D4-1. LEADING PARTICULARS. This paragraph is the same as paragraph B5-1 except for the dry weight of the actuator. The dry weight of the actuator is 7. 0 pounds verus 5. 8 pounds listed in paragraph B5-1.

D4-2. DISASSEMBLY. (See figure D4-1.)

a. Remove screw (11) and remove end gland (10) and metering pin (13) by unscrewing end gland from cylinder body (2).

b. Remove cap plug (24) and rotate shaft (1) to remove piston (5). Using a small rod push piston from cylinder body.

c. Cut safety wire and remove cap (18) by removing screws (20) and washers (19).

d. Remove set screw (21) from sector (16) and remove sector and shaft (1) from cylinder body. Retain washers (15).

NOTE

Unless defective, do not remove helicoils, name plate, bearings (14, 17, and 22), or roller (23).

e. Remove O-ring (4) from cylinder body (2).

f. Remove snap ring (8) and remove metering pin (13) from end gland (10). Remove and discard O-rings (7 and 9) from end gland.

g. Thoroughly clean all parts in solvent (Federal Specification P-S-661, or equivalent).

D4-3. INSPECTION OF PARTS. Perform the following inspections to ascertain that all parts are in serviceable condition.

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

b. Inspect cap (18), washers (15), sector (16), shaft (1) piston (5), roller (23), and cylinder body (2) for cracks, chips, scratches, scoring, wear, or surface irregularities which may affect their function or the overall operation of the actuator.

c. Inspect bearings (14, 17 and 22) for freeness of motion, scores, scratches and Brinnel marks.

D4-4. REPLACEMENT / REPAIR OF PARTS.

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

b. During reassembly install all new O-rings.

D4-5. ASSEMBLY. (See figure D4-1.)

NOTE

Use MIL-G-3278 lubricant on roller (23), bearings (14, 17 and 22), and sector (16), when installing parts in cylinder body.

a. Press one bearing (22) into cylinder body until flush. Install roller (23) and press other bearing (22) in place to hold roller. Use care to prevent damage to bearings and roller.

b. Press bearing (14) in until seated against retaining base in cylinder body. Press bearing (17) in until flush in cap (18).

c. Place shaft (1) in cylinder body and place one washer (15) over shaft in cylinder body.

d. Position sector (16) on splines of shaft so that index marks on shaft and sector are aligned, with teeth of sector toward cylinder end of actuator. Install and tighten set screw (21). Be sure end of set screw enters depression in shaft.

e. Install new O-ring (4) in cylinder body bore and install new O-ring (6) on piston (5).

f. Slide piston (5) into cylinder body, rotating shaft 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-3278 lubricant. Apply grease sparingly. Overgreasing may cause contamination of the hydraulic cylinder with grease, which may work past O-ring (4).

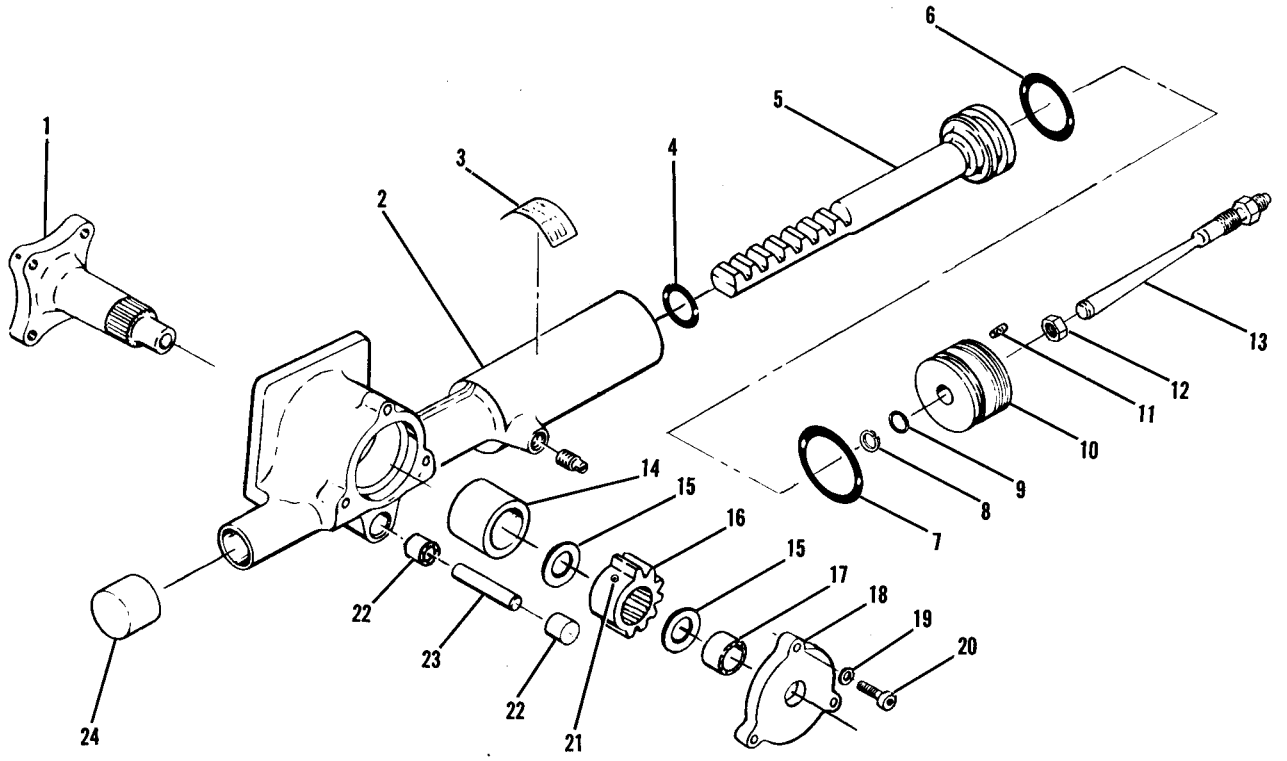
g. Install washer (15) on shaft next to sector and install cap (18), washers (19) and screws (20). Tighten screws evenly to a torque value of 90-100 lbs-in. and install lockwire.

h. Install new O-ring (9) in end gland (10) and install a new O-ring (7) on end gland.

i. Install metering pin (13) in end gland (10) and install snap ring (8) on metering pin.

j. Install end gland and metering pin assembly in cylinder and tighten until end of end gland is flush with end of cylinder. Install and tighten set screw (11).

k. Install cap plug (24) at end of actuator assembly.



NOTE

Metering pin (13) and associated parts are not installed in the actuator prior to the Model 210E.

Lubricate sector, piston rack gears, and all bearings with MIL-G-3278 grease during assembly of the main gear actuator.

1. Shaft
2. Cylinder Body
3. Name Plate
4. O-Ring
5. Piston
6. O-Ring
7. O-Ring
8. Snap Ring
9. O-Ring
10. End Gland
11. Set Screw
12. Locknut
13. Metering Pin
14. Bearing
15. Washer
16. Sector
17. Bearing
18. Cap
19. Washer
20. Screw
21. Set Screw
22. Bearing
23. Roller
24. Cap Plug

Figure D4-1. Main Gear Actuator

SECTION D5

REPAIR OF NOSE GEAR ACTUATOR

D5-1. NOSE GEAR ACTUATOR REPAIR. The nose gear actuator may be disassembled, inspected, repaired, and assembled as outlined in Section B6 of Appendix B.

SECTION D6

REPAIR OF LOCK CYLINDERS

D6-1. LOCK CYLINDERS REPAIR. The landing gear lock cylinders may be disassembled, inspected, repaired, and assembled as outlined in Section B7 of Appendix B.

SECTION D7

REPAIR OF DOOR CYLINDERS

D7-1. DOOR CYLINDERS REPAIR. The landing gear door actuating cylinders may be disassembled, inspected, repaired, and assembled as outlined in Section B8 of Appendix B.

SECTION D8

REPAIR OF UNLOCK AND SEQUENCE CYLINDERS

D8-1. UNLOCK AND SEQUENCE CYLINDERS REPAIR. The landing gear unlock and sequence cylinders may be disassembled, inspected, repaired, and assembled as outlined in Section B9 of Appendix B.

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