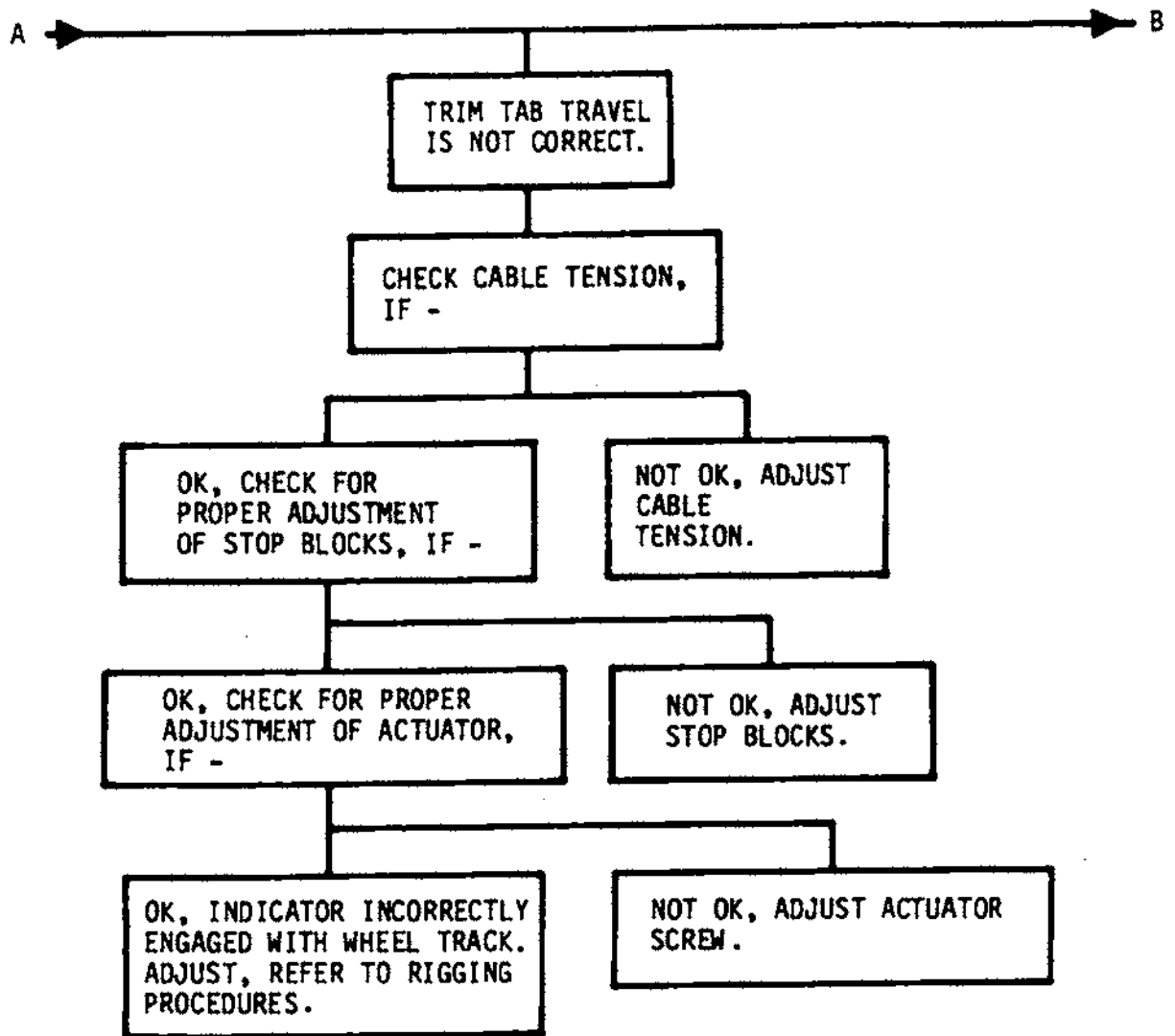


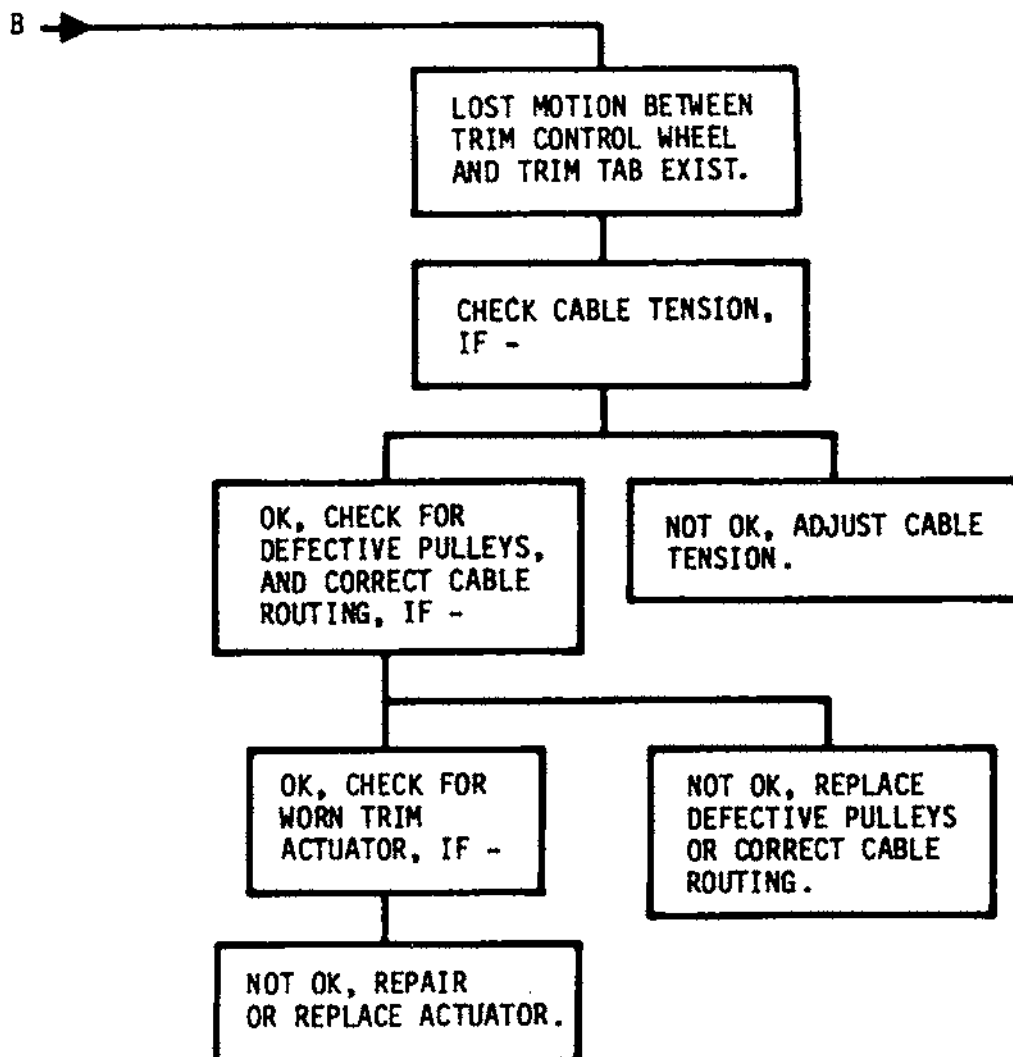
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Troubleshooting Chart - Rudder Trim Tab Control System
Figure 2 (Sheet 2)

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Troubleshooting Chart - Rudder Trim Tab Control System
Figure 2 (Sheet 3)

51988012

4. Troubleshooting Rudder and Trim Tab Control System.

- A. For guide to troubleshooting the rudder and trim tab control systems, refer to Figures 1 and 2. When troubleshooting the rudder and trim tab system, position the nose wheel fore and aft centering the rudder.

Adjustment/Test

1. Tools and Equipment.

NOTE: Refer to troubleshooting for tools and equipment requirements.

2. Rigging Rudder Control System (Refer to Figure 4).

NOTE: Cable tension should be adjusted when ambient temperature is 65°F to 95°F. Allow airplane temperature to stabilize for a period of 4 hours.

- A. Raise the nose wheel clear of the ground. Refer to Chapter 1, General Information.
- B. Position the nose wheel in neutral position by taping a straight edge on rudder pedals.
- C. Remove center carpet, center floorboard forward of fuel selector handles, and control cable access plates as necessary to gain access to cables.
- D. Remove tailcone access panel.
- E. Remove turnbuckle clips from rudder cable turnbuckles and relieve cable tension.
- F. Loosen clamps at left and right aileron cables so slide block is free to move. This relieves tension from interconnect springs.
- G. Adjust the position cable, which is a "balance" cable that is used to close the rudder system. The position cable turnbuckle should be adjusted so that the pivot point of the rudder pedals is 7.60 to 7.80 inches from the forward cabin bulkhead. Refer to Figure 3.

NOTE: It will be necessary to remove or lift up the carpet and insulation on the pressure bulkhead to obtain proper measurement.

- H. With the nose wheel and rudder pedals in neutral position, adjust the nose wheel steering cable tension. Refer to Chapter 1, General Information, for cable tension.
- I. With nose wheel, rudder pedals and rudder in neutral position, adjust the rudder cable turnbuckles to correct cable tension. Refer to Chapter 1, General Information, for cable tension.
- J. Remove straight edge from rudder pedals.

NOTE: If the tension on either nose wheel steering cable or rudder control system cable is adjusted, it will be necessary to recheck the tension on the cables which were not adjusted.

- K. Adjust the rudder bell crank stop bolts to provide rudder travel left and right (measured perpendicular to rudder hinge line). Refer to Chapter 1, General Information. Refer to Figure 3 for alternate method of measuring rudder travel.
- L. Resafety stop bolts and install turnbuckle clips on all turnbuckles.
- M. Check the tips of the pilot's rudder pedals for alignment, and if needed, adjust clevis rod ends (12, Figure 5) on brake master cylinders. Check and adjust the copilot's rudder pedals clevis and rod ends (13, Figure 5) for alignment. Allow positive clearance between brake master cylinder and rudder pedal torque tube bearing assemblies when rudder pedals are in either a full left or full right position.

WARNING: ENSURE THAT RUDDER MOVES THE PROPER DIRECTION WHEN OPERATED BY THE RUDDER PEDALS. PRESS ON THE LEFT RUDDER PEDAL, RUDDER WILL DEFLECT TO THE LEFT. PRESS ON THE RIGHT RUDDER PEDAL, RUDDER WILL DEFLECT TO THE RIGHT.

- N. Position ailerons in neutral position. Position clamps and slide blocks with the spring attached to the left and to the right aileron cables so there is no initial tension on the springs. Tighten clamps. Depress rudder pedals both full left and then full right, and ensure springs are completely enclosed in guide tube when springs are stretched. If the spring extends out of the guide tube, loosen guide tube clamp and adjust to ensure springs are completely enclosed when springs are stretched.

- O. Install access plates, center floorboard, center carpet and tailcone access panel.
 - P. Remove nose jack.
3. Rigging Rudder Trim Control System (Refer to Figure 6).
- NOTE:** Cable tension should be adjusted when ambient temperature is 65°F to 95°F. Allow airplane temperature to stabilize for a period of 4 hours.
- A. Remove the carpet in flight crew area and center floorboard at approximately Fuselage Station 238.13.
 - B. Remove fuel selector gear box access, pedestal access and rudder trim actuator access.
 - C. Loosen stop block (7) by loosening attaching nuts and screws.
 - D. Check and adjust the cable tension on the rudder trim control cables in accordance with Chapter 1, General Information. Install turnbuckle clips.
 - E. Move rudder trim control system to neutral by rotating trim control wheel so that the ends of the chains are equal length from trim tab actuator and control wheel sprockets.

NOTE: Neutral position of trim control system is with trim tab in streamline position with the rudder trailing edge.

- F. Check the rudder trim indicator (1) for neutral position indication. If requiring adjustment, insert a screwdriver beneath the indicator and prying out of track in the trim control wheel (2). Move the indicator (1) to neutral, then re-engage indicator in the track of control wheel (2).
- G. Disconnect rudder trim tab push rod (21) from trim tab horn by removing cotter pin (19), nut (18) and bolt (20).
- H. With control wheel (2), rudder and rudder trim tab in neutral, adjust the trim actuator (23) so that the hole in the push rod (21) is aligned with the hole in the trim tab horn. Connect push rod (21) to trim tab horn with bolt (20), nut (18) and cotter pin (19).
- I. Rotate rudder trim control wheel so rudder trim tab is deflected the correct degrees to the right (measured perpendicular to rudder hinge line). Slide (aft) stop block against trim cable stop and tighten.
- J. Rotate rudder trim control wheel so rudder trim tab is deflected the correct degrees to the left (measured perpendicular to rudder hinge line). Slide (fwd) stop block against (aft) stop block and tighten. Refer to Chapter 1, General Information, for proper travel.

NOTE: Airplane C0201 And On. Neutral position on the trim tab indicator is with tab deflected 1° left.

WARNING: ENSURE THAT RUDDER TRIM TAB MOVES IN THE PROPER DIRECTION WHEN OPERATED BY THE TRIM CONTROL WHEEL. ROTATE TRIM CONTROL WHEEL TO THE RIGHT, TRIM TAB TRAILING EDGE WILL MOVE TO THE LEFT RELATIVE TO THE RUDDER. ROTATE TRIM CONTROL WHEEL TO THE LEFT, TRIM TAB TRAILING EDGE WILL MOVE TO THE RIGHT RELATIVE TO THE RUDDER. ON AIRPLANES C0907 AND ON, ENSURE THAT THERE IS A MINIMUM OF ONE INCH OF CHAIN REMAINING AT FORWARD AND AFT SPROCKETS AT EACH EXTREME TRAVEL.

- K. Install all access covers and carpet.

Inspection/Check

- 1. Tools and Equipment

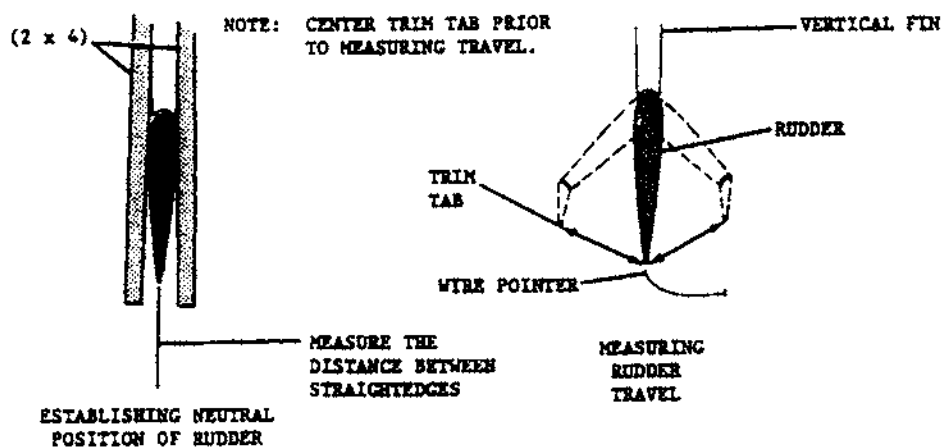
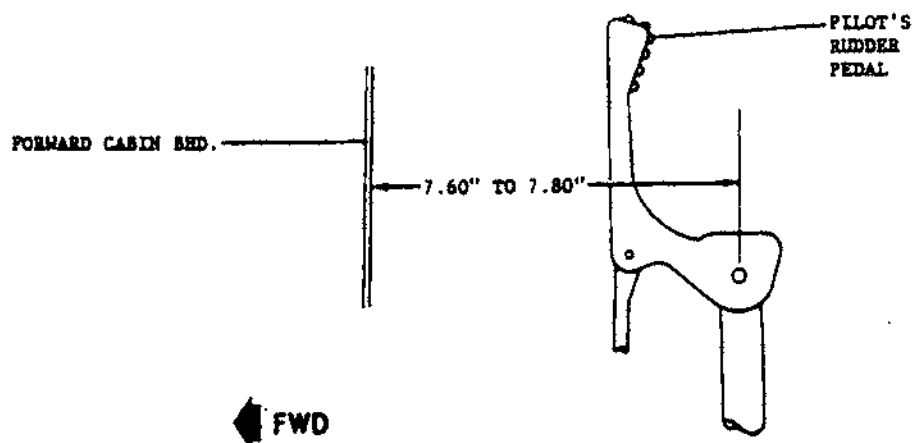
NOTE: See Troubleshooting for tools and equipment.

- 2. Rudder and Rudder Trim Tab Check.

NOTE: Angular dimensions for rudder and trim tab are measured perpendicular to rudder and trim tab hinge. The rudder is in neutral position when the nose wheel and rudder are fore and aft. The trim tab is in neutral position when streamlined with the rudder trailing edge.

- 3. Rudder and Rudder Trim Tab Cable Check.

NOTE: Cable tension should be adjusted when ambient temperature is 65°F to 95°F. Allow airplane temperature to stabilize for a period of 4 hours.



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1. Center nose wheel by raising clear of ground.
2. Establish neutral position of rudder by clamping straightedge (such as wooden 2 x 4) on each side of fin and rudder and measure half the distance between straightedges and adjust trim tab as required.
3. 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 (trim tab).
4. Using soft lead pencil, mark rudder at point corresponding to soft wire indexing point (neutral).
5. Remove straightedges.
6. 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 15.90" and 16.52".

Rudder and Rudder Pedal Adjustment
Figure 3

- A. Place rudder and rudder trim tab in neutral position.
- B. Place tensionometer on rudder cables and read tension. Refer to temperature/tension NOTE, refer to Adjustment/Test.

NOTE: Access to the rudder cables is gained by removing the tailcone access panel.

- C. Place tensionometer on the rudder trim cable and read cable tension. Refer to cable temperature/tension NOTE, refer to Adjustment/Test.

NOTE: Access to rudder trim cables is gained by removing the tailcone access panel.

4. Rudder and Trim Tab Deflection Check.

- A. For rudder and trim tab deflection check, refer to Chapter 2, Detailed Inspection Procedures.

5. Inspect Rudder and Rudder Trim Tab

- A. Remove access cover on pedestal, cabin floor panels, tailcone access panel, stabilizer fairings and trim tab actuator access cover to provide visual inspection of cables and pulleys.
- B. Install access covers, fairings and floor panels and tailcone access panel.

Maintenance Practices

WARNING: WHEN MAINTENANCE IS PERFORMED ON ANY FLIGHT CONTROL SYSTEM OR FLIGHT CONTROL TRIM SYSTEM REQUIRING REMOVAL/INSTALLATION OF CABLES, ENSURE CABLES ARE NOT CROSSED DURING CABLE REINSTALLATION.

1. Removal/Installation Rudder (Refer to Figure 4).

NOTE: Access to the rudder torque tube and bellcrank is through access fairings at the base of the vertical stabilizer. Rudder cable turnbuckles are located in the tailcone. Refer to Chapter 1, Access Plates/Panels Identification, for access cover locations.

A. Remove Rudder.

- (1) (Refer to Figure 6.) Disconnect the trim tab push rod (21) from the trim tab horn by removing cotter pin (19), nut (18), and bolt (20).
- (2) Disconnect the bonding strap at center hinge by removing nut and screw.
- (3) Loosen turnbuckles and disconnect cable links from the rudder bellcrank by removing cotter pins, nuts, washers and bolts.
- (4) Support the rudder and remove cotter pins, nuts, washers and bolts at rudder hinge brackets.
- (5) Remove rudder by pulling aft while guiding trim tab push rod out through the rudder.

B. Install Rudder.

- (1) Position the rudder to vertical stabilizer attach points by guiding the trim tab push rod through the rudder.
- (2) Install bolts, washers, nuts, and cotter pins at rudder hinge brackets.

NOTE: Permissible to use AN960-416 and/or AN960-416L washers as required to match rudder hinges to bracket locations on rudder. Washers to fill gap between brackets on rudder and ends of bearings.

- (3) At center rudder hinge, install bonding strap, using screw and nut.
- (4) (Refer to Figure 6.) Connect trim tab push rod (21) to trim tab horn with bolt (20), nut (18) and cotter pin (19).
- (5) Connect cable links to rudder bellcrank with bolts, washers, nuts and cotter pins.
- (6) Rig rudder, refer to Adjustment/Test.
- (7) Install turnbuckle clips on turnbuckles.
- (8) Install access covers.

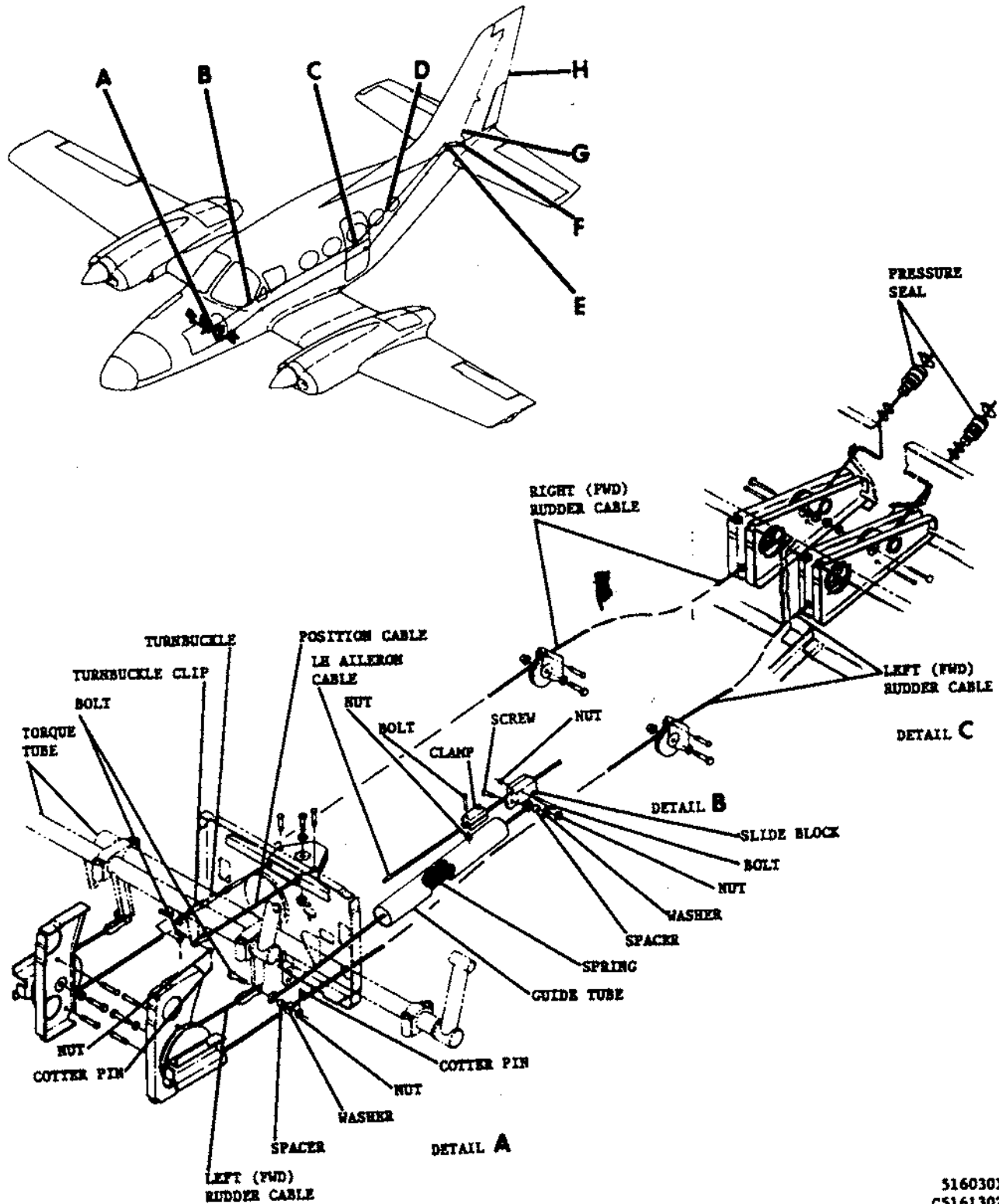
2. Removal/Installation Rudder Bellcrank (Refer to Figure 4).

A. Remove Rudder Bellcrank.

- (1) Remove stabilizer fairings.
- (2) Remove tailcone access panel.
- (3) Loosen turnbuckles connecting forward and aft rudder cables.
- (4) Disconnect the cable links from left and right side of the rudder bellcrank by removing cotter pins, nuts, washers and bolts.

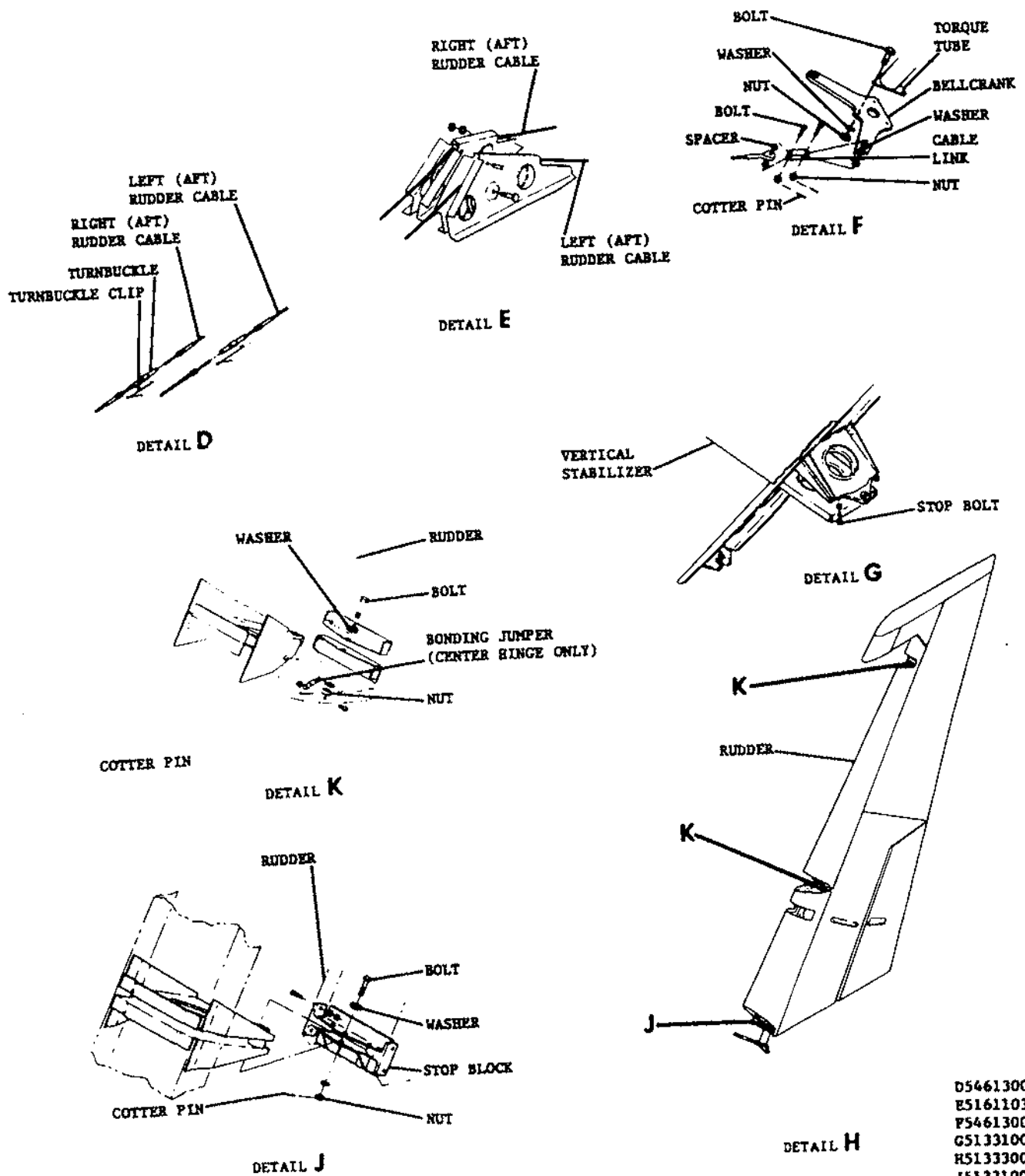
NOTE: Tag the cable links to aid reinstallation.

- (5) Remove nuts, washers and bolts, securing bellcrank to torque tube and remove bellcrank.



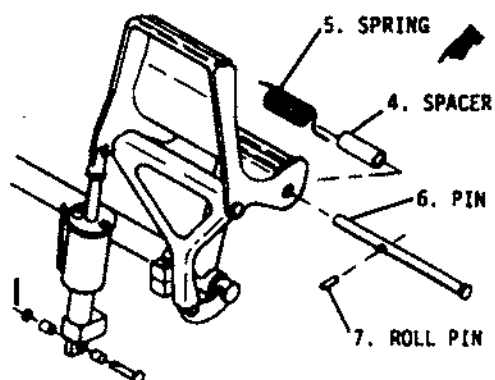
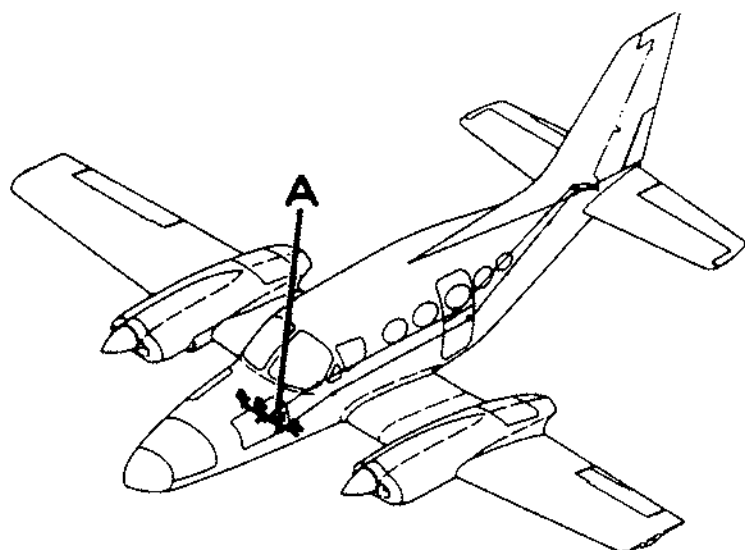
Rudder Control System
Figure 4 (Sheet 1 of 2)

51603014
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B51611034
A51614003R
A51613019



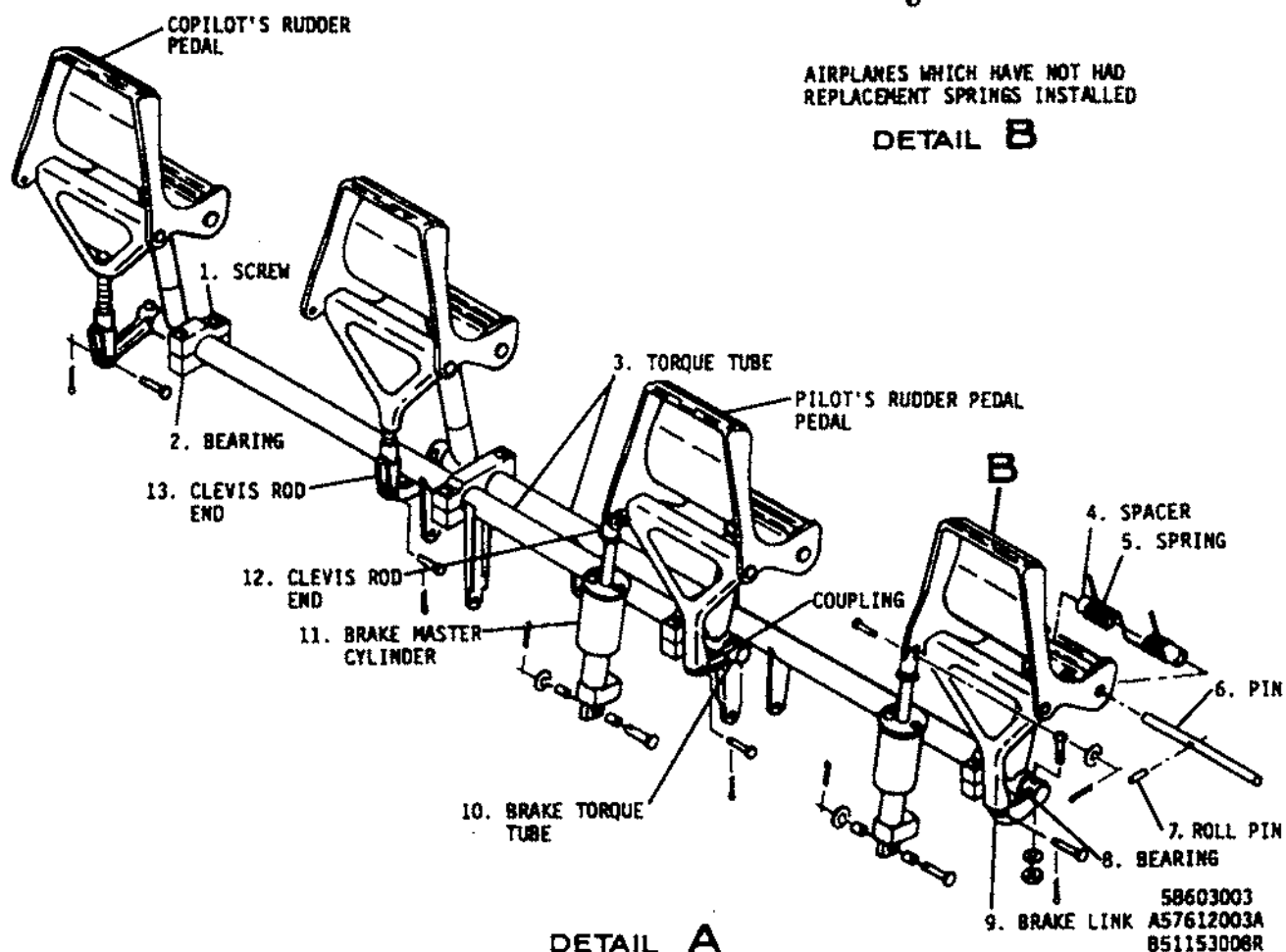
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E51611035
F54613003
G51331001
H51333002
J51331003
K51331002

Rudder Control System
Figure 4 (Sheet 2)



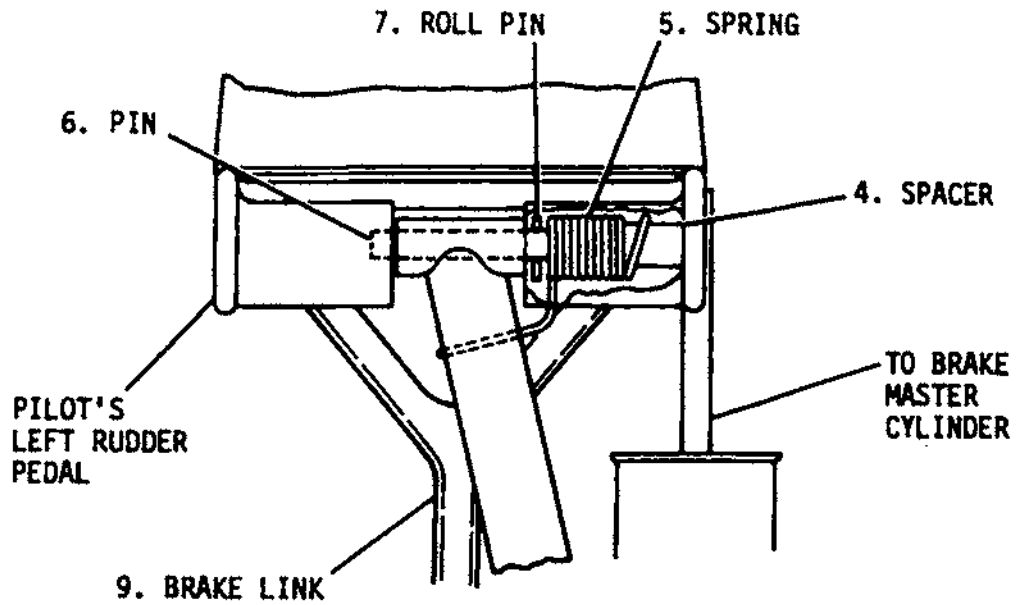
AIRPLANES WHICH HAVE NOT HAD
REPLACEMENT SPRINGS INSTALLED

DETAIL B



DETAIL A

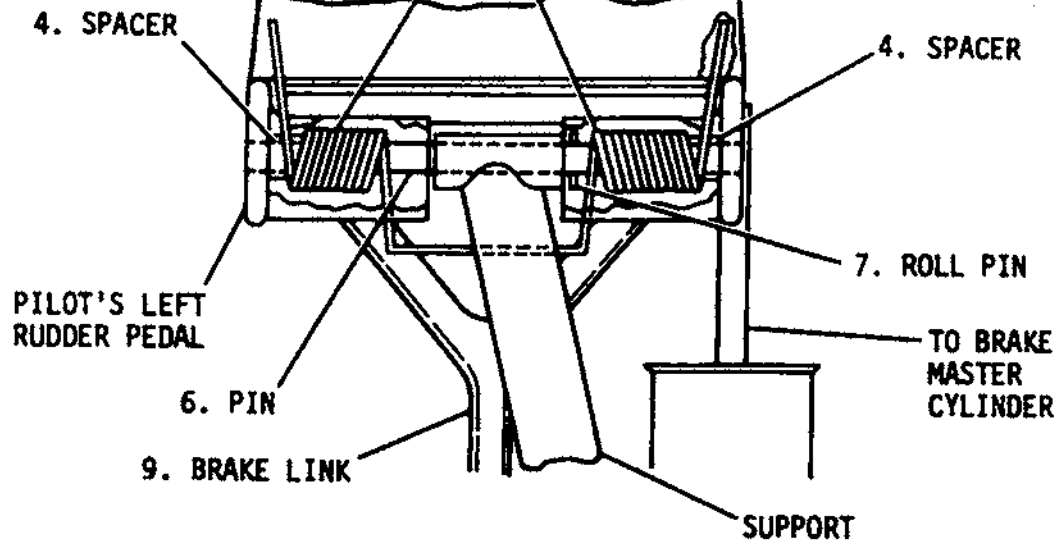
Rudder Pedal Installation
Figure 5 (Sheet 1)



VIEW LOOKING FORWARD

DETAIL C

5. SPRING



VIEW LOOKING FORWARD

DETAIL C

Rudder Pedal Installation
Figure 5 (Sheet 2)

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B. Install Rudder Bellcrank.

- (1) Align rudder bellcrank to torque tube and secure with bolts, washers and nuts.
- (2) Identify cable links and attach cable links to bellcrank with bolts, washers, nuts and cotter pins.
- (3) Rig rudder, refer to Adjustment / Test.
- (4) Install turnbuckles clips on turnbuckles.
- (5) Install tailcone access panel and fairings.

3. Removal / Installation Rudder Pedal Assembly (See Figure 5).

A. Remove Rudder Pedal Assembly.

- (1) Remove pilots seat and copilots seat, cabin divider (optional), cover plates, kick plates, carpet and pedestal filler, refer to Chapters 3 and 12.
- (2) Remove pilots floor access, copilots floor access and brake cylinder access, refer to Chapter 1 for access cover locations.
- (3) (See Figure 4). Release tension on nose wheel steering cables, rudder cables and rudder position cable.
- (4) (See Chapter 7). For removal of engine control cables.
- (5) For removal of elevator control cable (See 5-30 Figure 6).
- (6) For aileron cable removal (See 5-10 Figure 6).
- (7) For aileron trim tab cable removal (See 5-10 Figure 7).
- (8) (See Figure 4). Remove cables and springs from rudder torque tubes by removing cotter pins, nuts and bolts, washers and spacers.
- (9) Disconnect brake master cylinder (11) from the pilots rudder pedals by removing cotter pins and pins.
- (10) Remove brake links (9) from torque tubes (3) by removing cotter pins, spacers and pins.
- (11) Removing rudder pedal assemblies by removing screws (1) attaching bearings (2) to the torque tubes (3).

NOTE : THE UPPER AND LOWER HALVES OF EACH BEARING (2) ARE MATCHED PARTS AND SHOULD BE TAGGED AND KEPT IN PAIRS.

B. Install Rudder Pedal Assembly.

- (1) Install the rudder pedal assembly by placing the lower half of each bearing (2) over attached nutplates and locate the rudder pedal assembly torque tubes (3) in the bearing half, then install the upper bearing half and secure with screws (1).

NOTE : DURING THE INSTALLATION OF RUDDER PEDAL ASSEMBLIES, LUBRICATE IN ACCORDANCE WITH CHAPTER 2. RUDDER PEDAL TORQUE TUBES MUST ROTATE FREELY IN BEARINGS.

- (2) Connect break links (9) to torque tubes (3) with pins, spacers, and cotter pins.
- (3) Connect brake master cylinders (11) to pilots rudder pedals with pins and cotter pins.
- (4) (See Figure 4). Attach nose wheel steering cables and position cable to rudder pedal torque tubes with bolts, nuts and cotter pins.
- (5) Install aileron trim tab cable (See 5-10 Figure 7).
- (6) Install aileron cable (See 5-10 Figure 6).
- (7) Install elevator control cable (See 5-30 Figure 6).
- (8) Install engine control cables (See Chapter 7).
- (9) (See Figure 4). Attach rudder cables to torque tubes with bolts, spacers, springs, washers, nuts and cotter pins.
- (10) Rig rudder control system, refer to Adjustment / Test.
- (11) Install pilots floor access, copilots floor access and brake cylinder access.
- (12) Install pedestal filler, carpet, kick plate, cover plate, cabin divider (optional), and pilots and copilots seats.

4. Disassembly / Assembly Rudder Pedal Assembly (See Figure 5).

A. Disassemble Rudder Pedal Assembly.

- (1) Remove rudder pedal assembly, refer to Removal / Installation Rudder Pedal Assembly.
- (2) Remove brake links (9) by removing cotter pin and pins.
- (3) Remove pilot and copilot rudder pedals by driving out roll pins (7) and removing pins (6), springs (5), and spacers (4).

NOTE : COPILOT RUDDER PEDALS DO NOT HAVE SPRINGS (5) AND SPACERS (4) INSTALLED.

- (4) Remove brake torque tube (10) from torque tubes (3) by removing cotter pins, pins, and couplers.

NOTE: Bearing (8) in rudder pedal torque tubes (3) and torque tube arm are a press fit and should be removed only if the bearings need to be replaced.

B. Assemble Rudder Pedal Assembly.

- (1) Insert brake torque tubes (10) into rudder pedal torque tubes (3) and install couplings, using pins and cotter pins.
- (2) Install rudder pedals on rudder torque tube arms, using spacers (4), springs (5), pins (6) and roll pins (7).

NOTE: Copilot rudder pedals do not have springs (5) and spacers (4) installed.

- (3) Install brake links (9), using pins and cotter pins.
- (4) Install rudder pedal assembly in airplane refer to Removal/Installation Rudder Pedal Assembly.

5. Removal/Installation Rudder Cables (See Figure 4).

NOTE: Refer to Flight Control Maintenance Practices.

A. Remove Rudder Cables.

- (1) Remove seats, cabin dividers (optional), refreshment bar (optional) and carpet, refer to Chapter 12.
- (2) Remove access plates and tailcone access panel as required to gain access to cables, refer to Chapter 1.

NOTE: If an autopilot or IFCS (optional) equipment is installed, disconnect from rudder bellcrank when removing LH and RH aft rudder cables.

- (3) Remove turnbuckle clips and turnbuckles connecting LH and RH forward and aft rudder cables together.
- (4) Disconnect left and right forward cables from rudder pedal torque tubes by removing cotter pins, nuts, washers, springs, spacers and bolts.
- (5) Disconnect left and right aft cables from rudder bellcrank by removing cotter pins, nuts, spacers and bolts.
- (6) Remove pressure seals.
- (7) Remove cable guard pins; attach guide wires to forward and aft rudder cables and withdraw cables.
- (8) Disconnect guide wires from forward and aft cables and leave in place until ready to reinstall.

CAUTION: TENSION ON NOSE WHEEL STEERING CABLES MUST BE RELEASED BEFORE RUDDER POSITION CABLE IS DISCONNECTED, REFER TO CHAPTER 4.

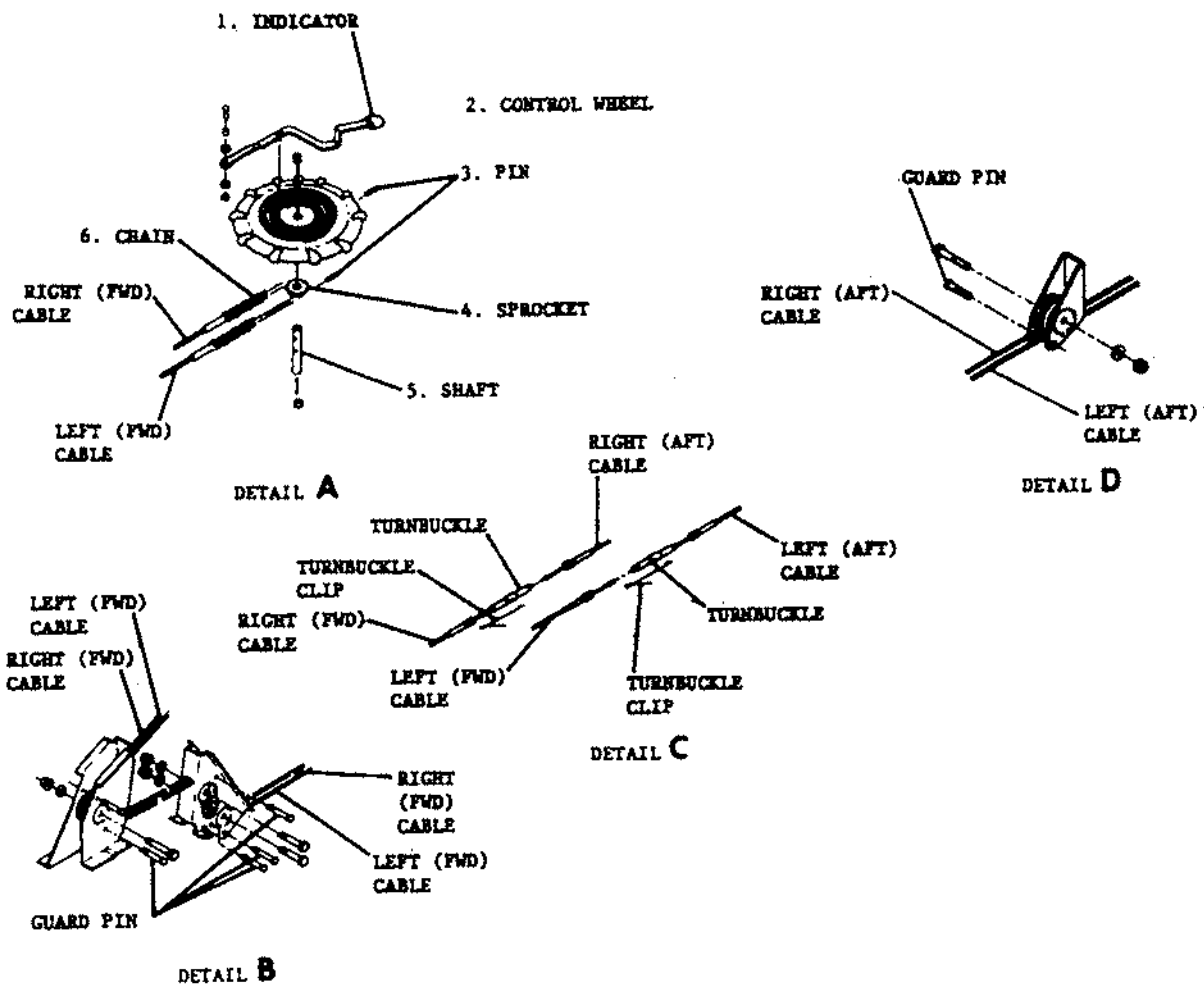
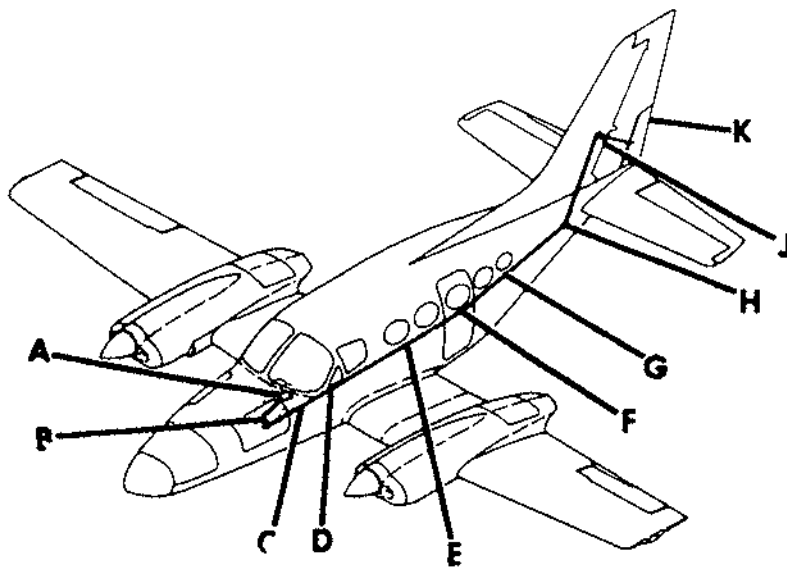
- (9) Remove turnbuckle clip and turnbuckle from position cable; remove cotter pin, nut and bolt securing cable to rudder pedal torque tube.
- (10) Remove cable guard pins from pulley bracket and route position cable from airplane.

B. Install Rudder Cables.

- (1) Install position cable in airplane and connect to rudder pedal torque tube using bolts, nuts and cotter pins.
- (2) Install turnbuckle on position cable and install guard pins at pulley bracket. Do not tighten turnbuckle.
- (3) Attach guide wires to forward and aft rudder cables and pull into position.
- (4) Install all pulley guard pins.
- (5) Connect left and right forward rudder cables to rudder pedal torque tube using bolts, spacers, springs, washers, nuts and cotter pins.
- (6) Connect left and right aft rudder cables to rudder bellcrank, using bolts, spacers, nuts and cotter pins.

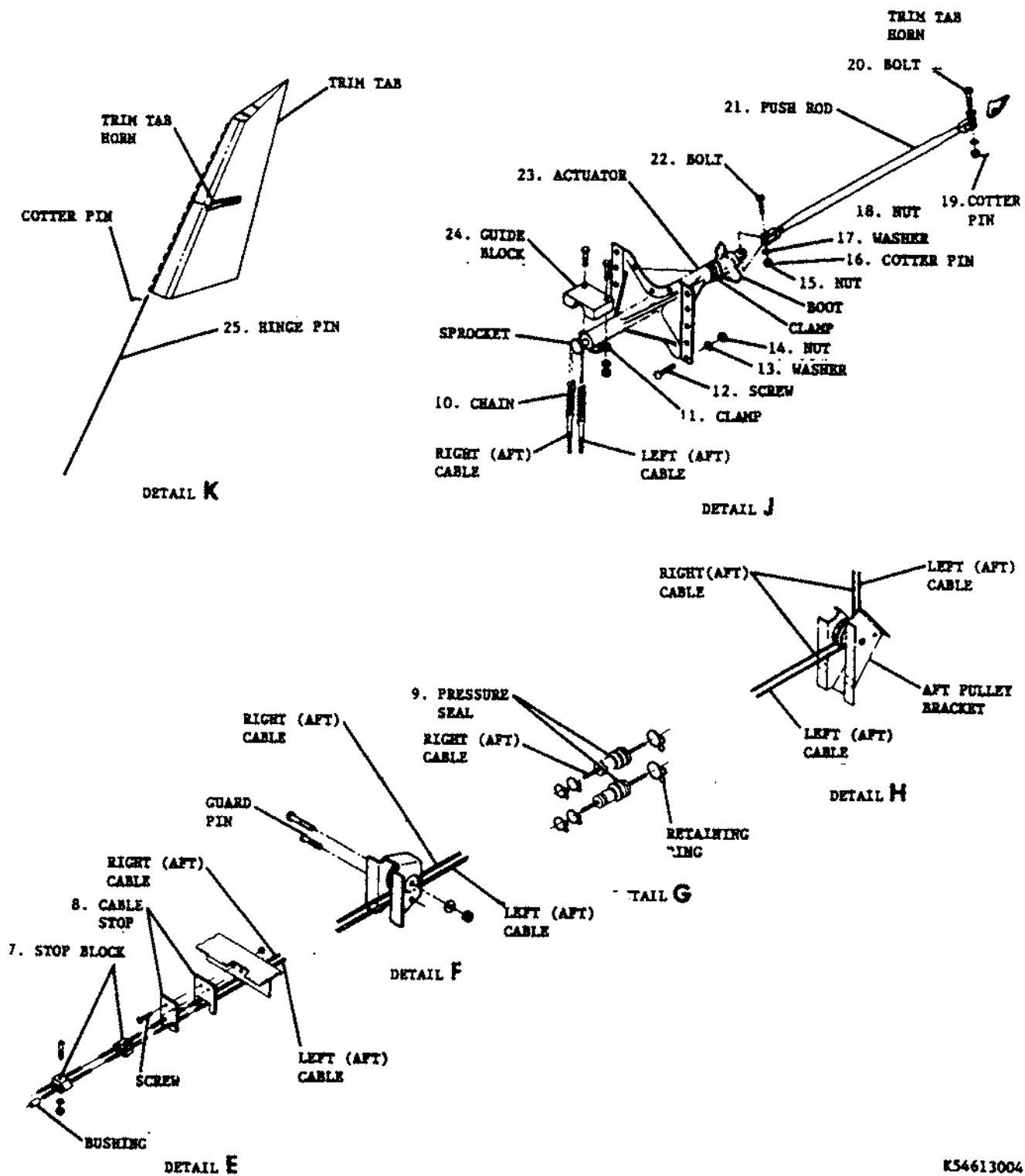
NOTE: If an autopilot or IFCS (optional) equipment is installed, install cables on rudder bellcrank, refer to Chapter 14.

- (7) Connect left and right forward and aft cables together with turnbuckles. Do not tighten turnbuckles at this time.
- (8) Install pressure seals on rudder cables as follows:
 - (a) Ensure that cables are lubricated for the full length of its travel within the seals.



Rudder Trim Control System
Figure 6 (Sheet 1 of 2)

51603009
051154009
C54613003
851611022
A14153018R



Rudder Trim Control System
Figure 6 (Sheet 2)

K54613004
J54613004
H54613004
G54613004
F51154009
E51611010

- (b) Pack the pressure seals with MIL-G-81322A lubricant.
- (c) Place pressure seals on cables on non-pressurized side of bulkhead with small end toward bulkhead.
- (d) Insert seal in the bulkhead hole so that bulkhead metal is seated within the retaining groove of seals and the small end of seal is in the pressurized section.
- (e) Install proper retaining rings in the grooves of the seal (two on small end and one on large end).
- (9) Rig rudder control system, refer to Adjustment/Test.
- (10) Install floor panels and access covers.
- (11) Install carpet, cabin dividers (optional), refreshment bar (optional) and seats, refer to Chapter 12.

6. Removal/Installation Rudder Trim Tab (See Figure 6).

A. Remove Rudder Trim Tab.

- (1) Remove cotter pin (19), nut (18) and bolt (20), securing push rod (21) to trim tab horn.
- (2) Remove cotter pins, securing hinge pin (25).
- (3) Remove hinge pin (25) and trim tab from rudder.

B. Install Rudder Trim Tab.

- (1) Position rudder trim tab to rudder, mating hinge halves; insert hinge pin (25) and secure with cotter pins.
- (2) Secure push rod (21) to trim tab horn with bolt (20), nut (18) and cotter pin (19).

7. Removal/Installation Rudder Trim Tab Actuator (See Figure 6).

A. Remove Rudder Trim Tab Actuator.

- (1) Remove fuel selector gear box access and rudder trim actuator access, refer to Chapter 1 for access cover locations.
- (2) Unsafety and loosen turnbuckles connecting forward and aft cables together.
- (3) Remove clamp securing boot to actuator (23) and slide boot aft.
- (4) Disconnect push rod (21) from actuator (23) by removing cotter pin (16), nut (15), washer (17) and bolt (22).
- (5) Remove guide block (24) from actuator (23) by removing nuts, washers, clamp (11) and screws. Disengage chain from sprocket.
- (6) Remove nuts (14), washers (13) and screws (12).
- (7) Remove actuator (23) through access hole.

NOTE: For actuator disassembly, refer to Disassembly/Assembly Rudder Trim Tab Actuator.

B. Install Rudder Trim Tab Actuator.

- (1) Insert actuator (23) through the access hole in the vertical stabilizer and secure with screws (12), washers (13) and nuts (14).
- (2) Position chain (10) on actuator sprocket and install guide block with clamp (11), screws, washers and nuts.

NOTE: Chain (10) must be evenly distributed around actuator sprocket.

- (3) Connect push rod (21) to actuator (23) with bolt (22), washer (17), nuts (15) and cotter pin (16).
- (4) Slide boot forward on actuator (23) and secure boot with clamp.
- (5) Rig the rudder trim system, refer to Adjustment/Test.
- (6) Install turnbuckle clip on turnbuckles.
- (7) Install fuel selector gear box access and rudder trim actuator access cover.

C. Removal/Installation of Trim Tab Actuator Screw Assembly.

NOTE: When removal of the trim tab actuator screw assembly is required for lubrication, replacement, etc., the following procedure should be used to insure the screw assembly is installed in its original location.

(1) Removal.

- (a) Position the trim tab and control surface assembly as necessary to allow removal of the push rod and the screw assembly. Disconnect push rod at the trim tab end. Accurately count and record the number of turns necessary to remove the push rod and screw assembly. Gently pull on the push rod during removal to ascertain the exact point when the threads become disengaged. Note this position accurately and also note the position of the bolt head that attaches the push rod to the screw assembly. This is necessary in order to replace the push rod and screw assembly in the exact same position as before removal.

WARNING: DO NOT MIX OR SUBSTITUTE SCREW ASSEMBLIES IN TRIM TAB ACTUATORS. ALWAYS CHECK RIGGING AFTER REMOVAL OF SCREW ASSEMBLY.

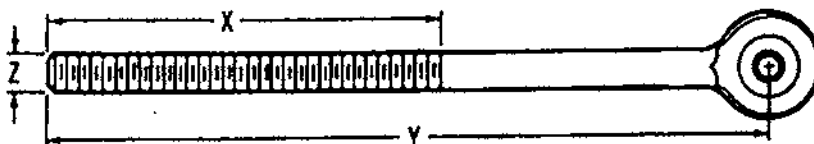
(2) Installation.

CAUTION: MAINTAIN A MINIMUM OF .40 INCH OF THREAD ENGAGEMENT OF ACTUATOR SCREW. MINIMUM ENGAGEMENT IS TO BE MEASURED AT THE FULLY EXTENDED POSITION.

- (a) Install push rod and screw assembly with the bolt head in the exact same position as noted during removal. Turn the push rod to the left (counterclockwise) 1/8 of a turn. Apply pressure on the push rod and screw assembly in a forward direction and turn to the right (clockwise) the same number of turns as noted during removal. Check the direction of the bolt that attaches the push rod to the screw assembly to ensure that it is located properly as shown (bolt head outboard).

NOTE: The screw assembly has a quad lead type thread. Following the above procedures exactly will insure the trim tab screw assembly has been installed in the exact same position.

Actuator Assembly	Screw Assembly	Used On
5115275-4	5115212-1	421C0001 Thru 421C0495
5115207-5	5815023-7	421C0496 and On



DIMENSIONS			
Screw Assembly Part No.	X	Y	Z
5115212-1	3.11	6.22	.245 +.001, -.000
5815023-7	3.80	7.10	.3075 +.001, -.000

WARNING: INSURE PROPER SCREW IS INSTALLED IN ACTUATOR ASSEMBLY. DO NOT SUBSTITUTE OR INTERMIX.

NOTE: This listing is not to be used for ordering parts. Spares replacement data is obtained from the airplane Parts Catalog.

Rudder Trim Tab Actuator and Screw Data
Figure 6A

8. Disassembly/Assembly Rudder Trim Tab Actuator (See Figure 7).

A. Tools and Equipment.

NOTE: Equivalent substitutes may be used for the following listed item.

Name	Number	Manufacturer	Use
Silicone Grease (Light Consistency)	No. 33	Dow Corning Corp. Midland, Michigan	To lubricate collars, screw housing and threads in rudder trim tab actuator.

B. Disassemble Trim Tab Actuator.

- (1) Disassemble actuator in accordance with exploded view.
- (2) Do not remove bearing (14) from screw (13) unless replacement of parts is required.
- (3) Clean all component parts, except bearing (14) by washing in suitable solvent. Do not clean sealed bearing (14).
- (4) Inspect all components for obvious indications of damage such as stripped threads, cracks, deep nicks and dents.
- (5) Check bearings (5 and 12), screw housing (8) and screw (13) for excessive wear and scoring.
- (6) Examine screws (8 and 13) for damaged threads or dirt particles that may impair smooth operation.

NOTE: If thread condition required replacement of either the screw or screw housing, replace both parts.

- (7) Check sprocket (3) for broken, chipped and/or worn teeth.
- (8) Check bearing (14) for smoothness of operation.

CAUTION: DO NOT ATTEMPT TO REPAIR DAMAGED OR WORN PARTS OF THE ACTUATOR. DISCARD ALL DEFECTIVE ITEMS AND INSTALL NEW PARTS DURING RE-ASSEMBLY.

C. Modification to Replace the Trim Tab Actuator Aft Bearing (Airplanes with an aft bearing that extends aft of the actuator housing).

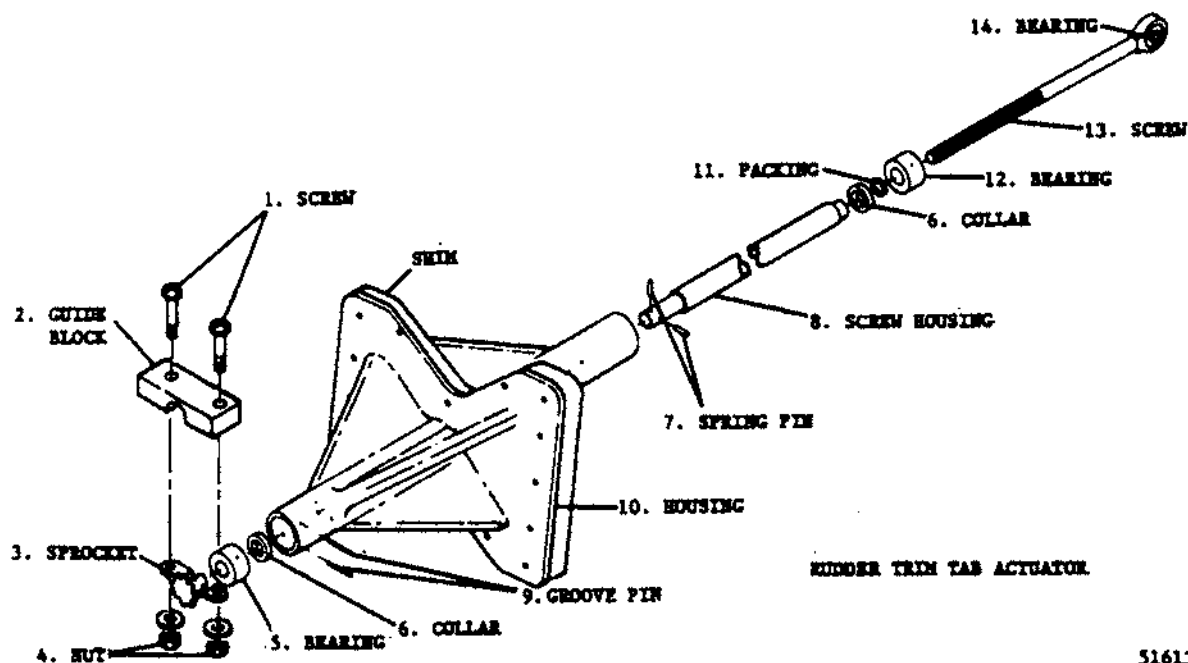
NOTE: The following procedure provides for replacement of the existing long aft bearing (.937 inches in length), which can be recognized because it extends aft to the actuator housing with an improved short aft bearing (.436 inches in length).

- (1) Remove the screw (13) from the aft end of the actuator.
- (2) Remove and discard the groove pins securing the aft bearing in the actuator housing. Discard the bearing (12) and packing (11).
- (3) Fabricate a shim of .008 thickness to fit on the end of the screw housing (8) and against the aft bearing (when installed). The shim will provide the proper end play to the actuator during installation of the new bearing and will be removed prior to final assembly of the actuator.
- (4) With the shim in position insert the new bearing (12) in the aft end of the actuator housing and apply pressure to tightly hold the bearing (12) forward against the screw housing (8).
- (5) Layout and mark two new locations for groove pins positioned 45° from the original holes .13 inch from the aft end of the actuator housing and .281 inch on each side of the housing centerline (.562 apart). Reinstall screw (13) to prevent entry of foreign matter and drill two holes for the groove pins at the marked locations as follows:
 - (a) Clamp the actuator housing (10) securely and mark two lines on the end of the actuator housing representing the angle of the hole to be drilled.

- (b) Using a sharp undersized drill bit (.047 diameter), begin drilling through the housing (10). Proceed slowly to allow the drill bit to cut through the material without the tendency to wander toward the outside edge of the actuator housing. Drill a hole .10 deep to provide a good start for the .062 diameter drill bit.
- (c) Drill the two holes .062 diameter through the housing and bearing and remove the bearing (12) and the fabricated shim. Discard the shim, clean any foreign material from within the actuator housing (10) and lubricate the screw housing (8) and inside of the bearing (12).
- (6) Reinstall the bearing (12) with new packing (11), align groove pin holes and secure bearing using new groove pins.
- (7) Reinstall the screw (14) and rotate the sprocket (3) while preventing rotation of the screw (14). The screw (14) should travel in and out of screw housing smoothly with no indication of binding.

WARNING: DO NOT MIX OR SUBSTITUTE SCREW ASSEMBLIES IN TRIM TAB ACTUATORS. ALWAYS CHECK RIGGING AFTER REMOVAL OR SCREW ASSEMBLY.

NOTE: Relative movement between internal thread screw and bearing to be from .008 to .012 inch when at room temperature. For actuator linear measurement procedure, refer to step D, substep (10).



51613018

Rudder Trim Tab Actuator
Figure 7

D. Assemble Trim Tab Actuator.

WARNING: DO NOT MIX OR SUBSTITUTE SCREW ASSEMBLIES IN TRIM TAB ACTUATORS.
ALWAYS CHECK RIGGING AFTER REMOVAL OF SCREW ASSEMBLY.

NOTE: Discard the following items and install new parts during assembly; spring pins (7), groov-pins (9) and packing (11).

NOTE: During assembly, lubricate collars, screw housing (8) and screw (13) with Silicone Grease (light consistency).

- (1) Insert screw housing (8) into housing (10).
- (2) Slide collar (6) and bearing (5) on screw housing (8); align holes and install new groov-pins (9).
- (3) Slide sprocket (3) in screw housing (8); align holes and install new spring pins (7).
- (4) Insert collar (6), new packing (11) and bearing (12) on end of housing (10).
- (5) Align pin holes in bearings (5 and 12) with housing (10); install new groov-pins (9).

NOTE: If a new bearing is installed, fabricate a shim of .008 thickness to fit on the end of screw housing (8) against bearing to maintain a minimum amount of free play while drilling new pin holes in the bearing. After holes are drilled in new bearing, remove and discard shim. If pin holes become oversize, drill out to .094 and install .094 roll pin.

- (6) If new parts are required, press bearing (14) into boss at end of screw (13). Be sure force bears against outer race of bearing (14).
- (7) Install screw (13) in screw housing (8).
- (8) Test adapter assembly by rotating sprocket (3) with fingers while holding bearing end of screw (13).
- (9) Screw (13) should travel in and out of screw housing smoothly with no indication of binding.

NOTE: Relative movement between internal thread screw and bearing to be from .008 to .012 inch when set at room temperature.

- (10) To measure actuator linear movement, use dial indicator as shown in figure 8.
 - (a) Restrain actuator with enough force to keep actuator from moving.

CAUTION: TO PREVENT DAMAGE TO ACTUATOR, DO NOT CLAMP ACTUATOR IN VISE. PREPARE CLAMP ARRANGEMENT SIMILAR TO THAT SHOWN IN FIGURE 8.
 - (b) Screw out actuator screw approximately .25 inch.
 - (c) Pull down on actuator screw. Set dial indicator against face of sprocket indicating "0".
 - (d) Using finger pressure only, push up on actuator screw rod end and read linear movement of actuator screw. Linear movement should be per dimensions in step (a).
- (11) If spring pins (7) are installed, secure with safety wire. If groov-pins are installed at these locations, no safety wire is required.

9. Removal/Installation Rudder Trim Tab Cables (See Figure 6).

NOTE: Refer to Flight Control Maintenance Practices.

A. Remove Trim Tab Cables.

- (1) Remove seats, cabin dividers (optional), refreshment bar (optional), carpet, refer to Chapter 12.
- (2) Remove pedestal cover, tailcone access panel, refer to Chapter 3.
- (3) Remove fuel selector gear box access, center control access, center floor panels, stabilizer fairing, actuator access cover, refer to Chapter 1 for locations.
- (4) Remove rudder trim stop blocks (7) and bushings by removing nut, washer and screw.
- (5) Remove cable stop (8) by removing screws and nuts.
- (6) Disconnect turnbuckles connecting forward and aft cables together.
- (7) Remove guide block (24) from actuator (23) by removing nuts, washers, clamp (11) and screws.
- (8) Remove pulleys from aft pulley bracket by removing nuts, washers, bolts and guard pins.
- (9) Disengage chain (10) from actuator sprocket attach a guide wire to the chain and remove cables and chain from vertical stabilizer by pulling out through opening in tailcone.

- (10) Remove pressure seals (9).
- (11) Remove cable guard pins from pulley brackets aft of turnbuckles.
- (12) Attach guide wire to aft cables at turnbuckle ends and remove by pulling out through opening in tailcone.
- (13) Remove forward cables by removing guard pins from pulley brackets forward of cable turnbuckles.
- (14) Remove chain (6) from sprocket (4).
- (15) Attach guide wires to forward cables at terminal ends and remove by pulling out through pedestal.

8. Install Trim Tab Cables.

- (1) Tie guide wires at pedestal to terminal end of forward cables, pull into position and remove guide wires.
- (2) Engage chain (6) with trim control wheel sprocket (4) and install guard pins in forward pulley brackets.

NOTE: Chain (6) must be distributed evenly over sprocket (4).

- (3) Attach chain (10) to guide wire in vertical stabilizer and pull into position and remove guide wire.
- (4) Engage chain (10) with actuator sprocket and install guide block (24) with clamp (11), screws, washers and nuts.

NOTE: Chain (10) must be evenly distributed over actuator sprocket.

- (5) Install cable pulleys at aft pulley bracket by installing bolts, washers, nuts and guard pins.
- (6) Attach guide wire to turnbuckle end of aft cables in tailcone, pull into position and remove guide wires.
- (7) Install guard pins in pulley brackets aft of turnbuckles.
- (8) Connect left and right forward and aft cables together using turnbuckles.
- (9) Install stop blocks (7) and bushings with screws, washers and nuts. Do not tighten at this time.
- (10) Install cable stop (8) with screws and nuts.
- (11) Install pressure seals (9) as follows:
 - (a) Ensure that the cables are lubricated for the full length of travel within the pressure seals (9).
 - (b) Pack the pressure seals with MIL-G-81322A lubricant.
 - (c) Place the pressure seals (9) on cables on non-pressurized side of bulkhead with small end toward bulkhead.
 - (d) Insert pressure seals (9) in bulkhead hole so that bulkhead metal is seated within the retaining groove of the seals.
 - (e) Install proper size retaining rings in the grooves of the pressure seals (9).
- (12) Rig the rudder trim system, refer to Adjustment/Test.
- (13) Install turnbuckle clips on cable turnbuckles.
- (14) Install all access covers, fairings, floor panels and tailcone access panel.
- (15) Install carpet, seats, cabin divider (optional), refreshment bar (optional).

10. Removal/Installation Rudder Trim Control Wheel Assembly (See Figure 6).

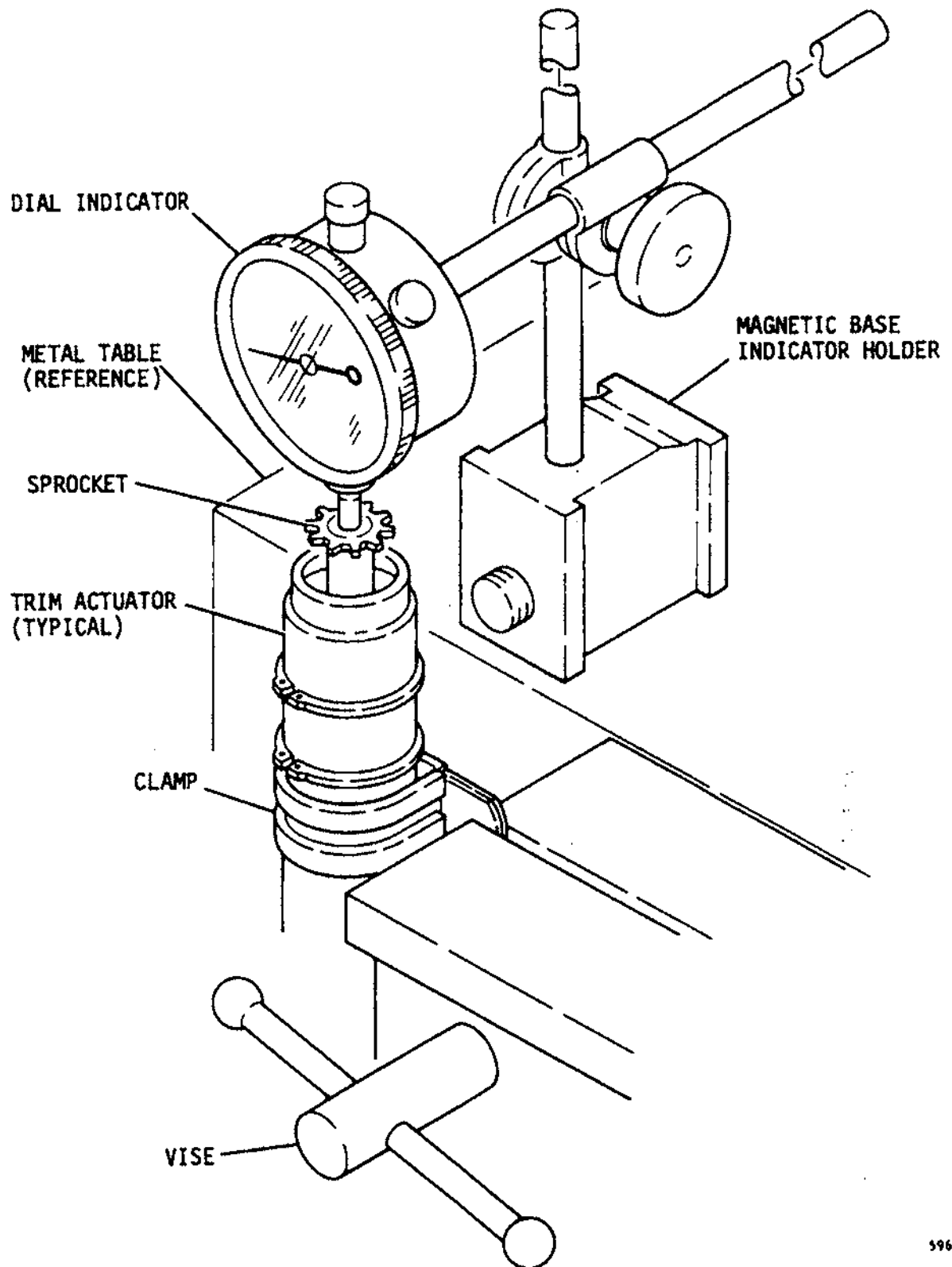
A. Remove Trim Control Wheel Assembly.

- (1) Remove the pedestal lower access cover, right access cover, and autopilot cover to autopilot panel (optional).
- (2) Remove fuel selector gear box access and loosen turnbuckle to release tension on rudder trim control system.
- (3) Disengage chain (6) and drive out pins (3) from control wheel (2) and sprocket (4).
- (4) Remove the control wheel and sprocket by removing shaft (5).

NOTE: To remove the rudder trim indicator assembly, the rivet, around which the indicator pivots, must be removed.

B. Install Trim Control Wheel Assembly.

- (1) Assemble sprocket (4), control wheel (2) to shaft (5) with pin (3).
- (2) Engage chain (6) evenly on sprocket (4).
- (3) Rig rudder trim system, refer to Adjustment/Test.
- (4) Install turnbuckle clips on turnbuckles.
- (5) Install all access covers.



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Trim Actuator Linear Measurement
Figure 8

11. Removal/Installation Rudder Pedal Spring (See Figure 5).

NOTE: Removal/Installation procedures typical left or right pilot's rudder pedals.

NOTE: If rudder pedal spring is to be replaced with replacement spring (airplanes 421C0001 thru 421C1081), refer to Parts Catalog for parts required for installation.

A. Remove Spring.

- (1) Remove pilot's seat.
- (2) Remove lower cotter pin, pin and spacer attaching pilot's left brake link to coupling. Retain pin and spacer and discard cotter pin.

NOTE: Do not remove brake link from rudder pedal.

- (3) Remove upper cotter pin and pin attaching brake master cylinder to pilot's left rudder pedal. Retain pin and discard cotter pin.
 - (a) Pivot pilot's rudder pedal aft and remove roll pin (7).
 - (b) (Airplanes 421C0001 thru 421C1081 not Incorporating Replacement Spring.) Remove pin (6) attaching pilot's rudder to torque tube support. Retain pin (6), spacer (4) and spring (5) for reinstallation.
 - (c) (Airplanes 421C1082 and On and Airplanes 421C0001 thru 421C1081 Incorporating Replacement Spring.) Remove pin (6) attaching pilot's rudder pedal to torque tube support. Retain pin (6), spacers (4) and spring (5) for reinstallation.

B. Install Spring.

- (1) (Airplanes 421C0001 thru 421C1081 not Incorporating Replacement Spring.) Insert spacer (4) in coils of spring (5). Position spring (5) in cavities on lower side of rudder pedal. Place rudder pedal in position on torque tube support and insert pin (6) through holes in rudder pedal and spacer (4). Insert roll pin (7) through existing hole in rudder pedal and pin (6).
- (2) (Airplanes 421C1082 and On and Airplanes 421C0001 thru 421C1081 Incorporating Replacement Spring.) Insert spacers (4) in coils of spring (5). Position spring (5) in cavities on lower side of rudder pedal. Place rudder pedal in position on torque tube support and insert pin (6) through holes in rudder pedal and spacers (4). Install roll pin (7) through existing hole in rudder pedal and pin (6).
- (3) Pivot rudder pedal forward to original position and attach brake master cylinder to rudder pedal using pin and cotter pin.
 - (a) Attach brake link to coupling using pin, spacer and cotter pin.
- (4) Install pilot's seat.

YAW DAMPER SYSTEM (OPTIONAL)Description

1. The Yaw Damper system is an independent system consisting of a gyro-computer (turn and slip indicator), control switch, yaw actuator and disengage switch, cables assemblies and electrical wiring.
2. The gyro picks up the signal, routes it through a built-in computer in the gyro, amplifies the signal and sends the amplified signal to the yaw actuator, located in the tailcone. The yaw damper control switch is mounted separately from integrated flight controller on all installations except the 800 (IFCS) integrated flight control system. On airplanes incorporating the 800 IFCS the yaw damper control switch is part of the autopilot flight controller. The yaw damper disengage switch on the control wheel is connected to the autopilot disengaging switch; disengaging the autopilot will also disengage the yaw damper.
3. The yaw actuator, located in tailcone is mounted to a bracket attached to a bulkhead and supported by support brackets. The yaw damper actuator drives a chain which is attached to cable assemblies connected to the rudder bellcrank.

CAUTION: PRIMARY AND SECONDARY FLIGHT CONTROL CABLES, PUSH-PULL TUBES, BELLCRANKS AND MOUNTINGS USE DUAL LOCKING FASTENERS. THE LOCK NUTS FOR THESE FASTENERS INCORPORATE A FIBER LOCK, AND ARE CASTELLATED FOR SAFETYING WITH A COTTER PIN. WHEN ANY OF THESE AREAS ARE DISCONNECTED, NEW DUAL LOCKING FASTENERS SHOULD BE INSTALLED. SEE THE AIRPLANE PARTS CATALOG FOR PART NUMBERS AND LOCATION OF THESE FASTENERS.

Troubleshooting

1. For troubleshooting the yaw damper system, refer to the Yaw Damper System Service/-Parts Manual.

Adjustment/Test

1. Tools and Equipment

NOTE: Equivalent substitutes may be used instead of the following listed items.

Name	Number	Manufacturer	Use
Tensiometer	T5-2002-101	Pacific Scientific Co. Los Angeles, Calif.	To measure cable tension.

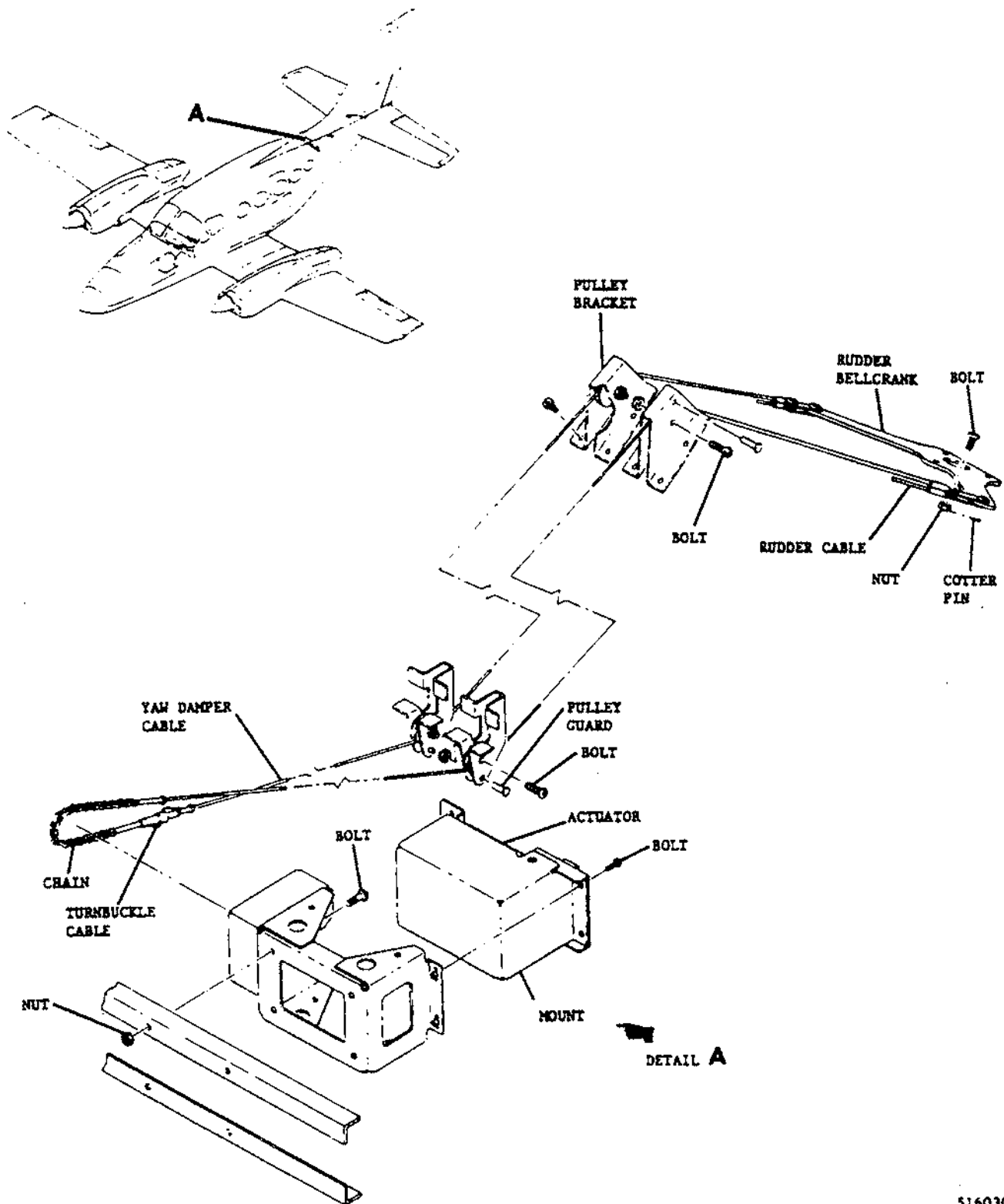
2. Rigging Yaw Damper System (See Figure 1).

- A. Refer to Rudder, Rudder Trim Tab and Controls Adjustment/Test and verify that the rudder control system is properly rigged.
- B. Refer to Chapter 1. Remove stabilizer fairings, for access to rudder bellcrank.
- C. Unsafety turnbuckle and rig cable tension, refer to Chapter 1 (rudder at neutral position). Safety turnbuckle.
- D. Install stabilizer fairing.

3. Yaw Damper Functional Test.

CAUTION: RELEASE RUDDER GUST LOCK, IF INSTALLED, BEFORE PERFORMING FUNCTIONAL TEST.

- A. Turn yaw damper on and allow gyro time to stabilize.
- B. With rudder in neutral position, push tailcone approximately 6 inches to the left (move airplane tail sharply) while observing rudder. Rudder should pivot to the left to compensate for nose of airplane moving right.



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Yaw Damper System
Figure 1

- C. With rudder in neutral position, push tailcone approximately 6 inches to the right (move airplane tail sharply) while observing rudder. Rudder should pivot to the right to compensate for the nose moving left.
- D. Check yaw damper disconnect switch for ON-OFF operation.

Maintenance Practices

1. Removal/Installation Yaw Damper Actuator (See Figure 1).

NOTE: The yaw damper motor can be removed from the actuator assembly mounting bracket without disturbing the yaw damper cable assemblies.

A. Remove Yaw Damper Actuator.

- (1) Ensure airplane's electrical power is OFF.
- (2) Place a suitable support under tailcone.
- (3) Refer to Chapter 3. Remove tailcone access panel.
- (4) Loosen turnbuckle and remove chain.
- (5) Disconnect electrical connector from yaw damper actuator.
- (6) Remove screws securing motor assembly to mounting bracket assembly and remove motor assembly.
- (7) Remove bolts and nuts securing mounting bracket assembly to mount and remove mounting bracket.

B. Install Yaw Damper Actuator.

- (1) Align mounting bracket assembly to mount and secure with bolts and nuts.
- (2) Slide motor assembly into mounting bracket engaging gears and secure with screws.
- (3) Connect electrical connector to motor assembly.
- (4) Engage chain on sprocket (see Figure 1). Ensure chain ends are even after engaging sprocket.
- (5) Rig yaw damper system, refer to Adjustment/Test.
- (6) Safety turnbuckles.
- (7) Install tailcone access panel.
- (8) Remove support from under tailcone.

RUDDER GUSTLOCK SYSTEMGeneral

1. The rudder gustlock is optional on airplanes C0600 through C1400 and standard on airplanes C1401 and On. The rudder gustlock allows the rudder to be locked in neutral position to prevent movement during strong, gusty wind conditions when the airplane is parked on the ground.
2. The gustlock is located inside the tail stinger at the lower edge of the rudder. The lock mechanism is operated by an external handle on the left side of the stinger which moves a pin in or out of a slotted striker plate in the bottom rib of the rudder. When engaged, the pin centers the rudder and locks it in place.
3. The rudder gustlock can be disengaged manually by placing the external handle in the DOWN position or automatically by moving the elevator up past its 6° DOWN position. When the elevator is moved, a cam on the elevator arm makes contact with a trigger on the lock mechanism which retracts the locking pin from the rudder.

Removal/Installation of the Rudder Gustlock (Refer to Figure 1).

1. Remove Gustlock.
 - A. Remove locking lever handle from gust.
 - B. Remove tail stinger and stabilizer fairing immediately below rudder to gain access to gustlock components.
 - C. Remove cam and lock mechanism by removing attaching hardware.
 - D. When removal of the rudder striker plate is required, remove rudder assembly from airplane, drill out attaching rivets and remove plate from rudder.

NOTE: Whenever components that attach to the rudder are added or deleted, the rudder assembly must be rebalanced.
2. Install Gustlock
 - A. Locate gustlock mechanism over existing holes on bulkhead and secure with attaching hardware.
 - B. Position cam on rudder arm and secure with attaching hardware. (Refer to gust lock rigging procedures for cam adjustment.)
 - C. When replacement of rudder striker plate is required, position new striker plate on rudder at location where removed plate was installed. Locate and drill two 0.625 diameter holes in rib to match nutplates on the striker plate. Rivet-plug the four rivet holes not to be utilized to secure the new striker plate. Secure new plate to rudder using the same type of rivets which secured the original plate. Rebalance rudder and reinstall on airplane. Airplanes C1401 and On, add shims as required (maximum 11 shims) to striker plate to achieve 0.15 inch minimum and 0.23 inch maximum. Lock pin to striker plate engagement; safety wire each bolt to a striker plate tab. Use the following list to determine the proper bolt length for the shims required.

SHIMS USED

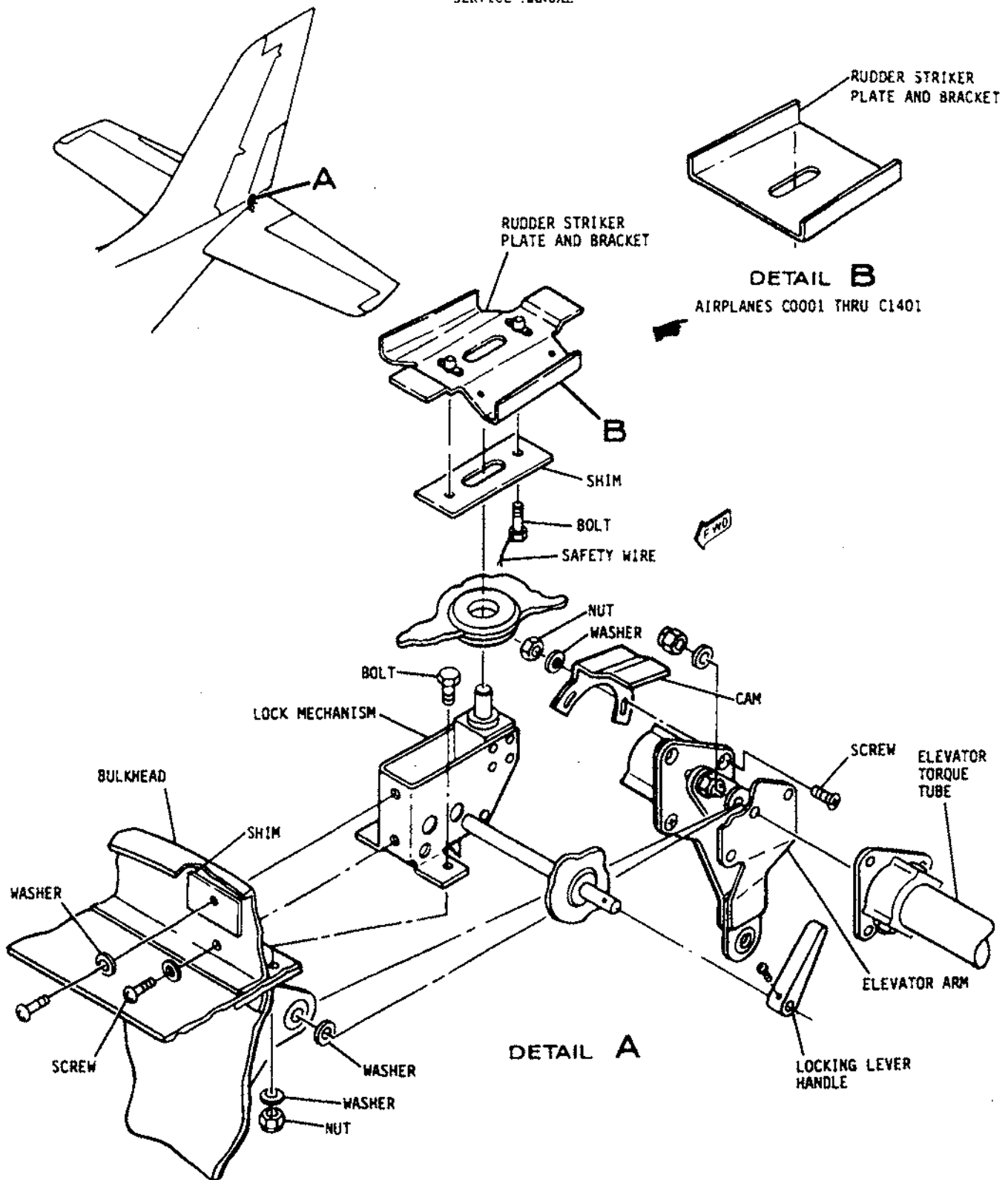
(1, 2)
 (3, 4, 5, 6)
 (7, 8, 9)
 (10, 11)

BOLT REQUIRED

AN4H5A
 AN4H6A
 AN4H7A
 AN4H10A

(Refer to Chapter 1-90 for balance procedures.)

- D. Rig the rudder gustlock system per adjustment/test procedures in this section.
- E. Reinstall fairings, stinger and locking lever handle.
- F. Check rudder gustlock operation.



Rudder Gust Lock Installation
Figure 1.

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Adjustment/Test (Refer to Figure 1.)

1. Remove tail stinger and stabilizer fairing immediately below rudder to gain access to rudder gustlock components.
NOTE: The locking lever handle must be removed from the rudder gustlock mechanism shaft before the stinger can be removed from the airplane.
2. Install control column lock in the pilots' control column. This will lock the elevator in a DOWN position of approximately 13 degrees.
3. Move the airplane nose wheel and rudder to the neutral position.
4. Engage the rudder gustlock by placing the locking lever handle to the LOCK (UP) position.
5. Rudder Gustlock Side Load Check.

A. Apply 20-pound side load on the rudder adjacent to gustlock pin and slowly raise the elevator. The rudder gustlock pin must release the rudder by 3 degrees down elevator.

6. (Airplanes C0001 thru C1401.) Rig rudder gustlock as follows:

- A. Loosen the gustlock cam attach bolts and rotate the cam until it touches the lock mechanism trigger. Back off the cam until there is a clearance of 0.100 inch between the cam and the trigger. Tighten the cam attach bolts.
- B. Remove the control column lock to allow movement of the elevator.
- C. With the elevator in the FULL-DOWN position (15, +1, -0 degrees) and the rudder gustlock engaged, move the elevator up until the gustlock cam contacts the lock mechanism trigger. This should occur when the elevator is approximately 9 degrees DOWN.
- D. Continue raising the elevator until the lock pin goes overcenter and retracts inside the lock mechanism. The overcenter disengagement must occur between 3 and 6 degrees down elevator. If overcenter disengagement does not occur between 3 to 6 degrees, ensure that horizontal flag shaft is not binding in grommet. If shaft is free, readjust cam to bring overcenter disengagement within 3 to 6 degree-limits (0.100 inch dimension in step 5 is an initial adjustment only).
- E. Operate the lock mechanism several times while visually checking for smooth operation and release. The elevator must be free to travel to the maximum UP and maximum DOWN position without any roughness or interference.
- F. Check the gustlock pin with the mechanism in the UNLOCKED position to insure that the pin has retracted completely and does not interfere with movement of the rudder.

NOTE: A minimal clearance of 0.10 between locking pin and any point of cam rotation is required when lock is in the stowed, unlocked position. Permissible to bend cam tongue down to achieve 0.10 minimal dimension. Readjust the cam as necessary in accordance with above rigging procedures to assure proper operation.

7. (Airplanes C1402 and On.) Rig rudder gustlock as follows:

- A. Apply an upward force of 20 pounds to the inboard trailing edge of the left elevator.
- B. Adjust the gustlock cam to allow an 0.08 clearance between the cam and the gustlock trigger. Tighten bolts and remove control column lock.
- C. Move the elevator to full-down position (15, +1, -0 degrees) and engage rudder gustlock.
- D. Apply a 20-pound side load on the rudder adjacent to gustlock pin and slowly raise the elevator. The rudder gustlock pin must release the rudder by 3 degrees down elevator.
- E. Prior to fairing installation, deflect rudder to full right travel. Operate rudder gustlock a minimum of six (6) times while visually inspecting for smooth operation. Ensure that rudder gustlock control lever is not binding in grommet. Check elevator for interference-free travel.

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CAUTION: WHENEVER THE RUDDER STRIKER HAS BEEN REPLACED, THE RUDDER MUST BE REBALANCED BEFORE REINSTALLATION ON THE AIRPLANE (REFER TO CHAPTER 1 FOR BALANCING PROCEDURES).

8. Install the stinger, fairing and locking lever handle and check gust lock operation for smoothness and complete lock release. Recheck elevator and rudder for freedom of travel with the gust lock mechanism disengaged.

NOTE: The locking lever handle must be installed with its red-painted surface DOWN and AFT.

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ELEVATOR, ELEVATOR TRIM TAB AND CONTROL SYSTEM

Description

1. The elevator system, which is mechanically operated, provides longitudinal control of the aircraft. The elevator trim system is operated mechanically and/or electrically.
2. The elevator control system consists of: Two elevator assemblies, control column quadrant, bellcrank, elevator arm and a torque tube installed in each elevator. Each elevator is attached to the rear spar of the horizontal stabilizer at two hinge points. Each elevator is 100 percent static balanced with the elevator trim tab and elevator arm attached, at the time of installation. The elevators are operated by the fore and aft movement of the control column. The control column quadrant assembly is attached to the control column by links which are attached to a swivel bearing on the control column. The elevator cable assemblies and adjustable turnbuckles are attached to the quadrant and then routed down under the floor, through the fuselage pulleys to the elevator bellcrank in the tailcone. A push-pull tube connects the bellcrank to the elevator arm, which is attached to the elevator torque tubes. Elevator travel stops, which consists of bolts mounted in a bracket just aft of the bellcrank, provide the recommended travel adjustment of the elevators. Elevator bobweights are attached to the quadrant assembly torque tube, one on each side. The bobweights are utilized to stabilize the aircraft in flight. An elevator down spring is attached to the bellcrank to provide for better elevator balance during flight.
3. The elevator trim tab is operated by a control wheel mounted on the left side of the pedestal. The control wheel is attached to a sprocket which drives a chain and cables. The chain and cables are routed to pulleys forward and down through the pedestal under the floor and aft to the tailcone of the aircraft. In the tailcone, the cables are routed aft just forward of the horizontal rear spar, then up and through the right horizontal stabilizer to a chain which operates the trim tab actuator. The trim tab push-pull tube connects the trim tab actuator to the elevator trim tab, mounted to the right elevator by a continuous hinge. Adjustable turnbuckles are located, in the forward inspection panel for cable tension adjustment. Stop blocks are located, in the tailcone for adjustment of the elevator trim tab travel.
4. The electric elevator trim control system (optional without autopilot or IFCS) consists of: Electric trim disengage switch, electric trim control switch, and an electric actuator assembly mounted in the tailcone at approximately Fuselage Station 300.00; a control cable attached to the left forward elevator trim control cable and routed around the actuator clutch assembly drum then aft connecting to the elevator trim actuator chain; and associated electrical wiring. The system is energized, when the electric trim disengage switch on the left hand control wheel is positioned to ENGAGE and the electric trim control switch (slider switch) on the left hand control wheel is positioned forward (DOWN) or aft (UP) position. The actuator motor drives the clutch assembly, which moves the elevator trim control cables and places the elevator trim tab in the corresponding UP or DOWN position. Manual override of the system can be accomplished by operating the elevator trim control wheel, mounted on the left side of the pedestal.

CAUTION : PRIMARY AND SECONDARY FLIGHT CONTROL CABLES, PUSH-PULL TUBES, BELLCRANKS AND MOUNTINGS USE DUAL LOCKING FASTENERS. THE LOCK NUTS FOR THESE FASTENERS INCORPORATE A FIBER LOCK, AND ARE CASTELLATED FOR SAFETYING WITH A COTTER PIN. WHEN ANY OF THESE AREAS ARE DISCONNECTED, NEW DUAL LOCKING FASTENERS SHOULD BE INSTALLED. SEE THE AIRCRAFT PARTS CATALOG FOR PART NUMBERS AND LOCATION OF THESE FASTENERS.

Troubleshooting

1. Troubleshooting the elevator and tab system is to determine if the trouble exists in the elevator control system or in the elevator trim control system. Remove the control column lock when troubleshooting. See Figures 1, 2 and 3 for Troubleshooting Chart.

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2. Tools and Equipment

NOTE : EQUIVALENT SUBSTITUTES MAY BE USED INSTEAD OF THE FOLLOWING LISTED ITEMS.

Name	Number	Manufacturer	Use
Inclinometer KELL-STROM "PRO 360"	518831	KELL-STROM TOOL INC 214 Church Street Wethersfield, CT SA 06109	To measure travel of control surfaces.
Tensiometer	T5-2002-0101	Pacific Scientific Co. Kin-Tech Division 1346 S. State College Blvd. Los Angeles, CA 92803	To measure cable tension.

Adjustment/Test

1. Tools and Equipment.

NOTE : REFER TO TROUBLESHOOTING FOR TOOLS AND EQUIPMENT.

2. Rigging Elevator Control System (Refer to Figure 6)

- A. Remove access cover from pedestal, tailcone access and necessary fairings to gain access to the bellcrank push-pull tube (29).
- B. Place a suitable support under the tailcone.
- C. Disconnect the bellcrank push-pull tube (29) from the elevator arm (25) by removing cotter pin (28), nut (27), washer (26) and bolt (24).

CAUTION : DO NOT OPERATE ELEVATOR FROM THE TIPS, DAMAGE COULD RESULT.

- D. Install temporary external control locks between elevator horns and the horizontal stabilizer.
- E. Fabricate and install a control column holding tool (refer to Figure 4) to secure the control column in neutral position. To install tool remove Royalite cover on control column.
- F. Disconnect elevator down spring (40).
- G. Adjust the elevator control cables until the bellcrank (44) is vertical (cable attachment holes equal distance from the bulkhead and cable tension on cables aft of turnbuckles is in accordance with Chapter 1-00. Connect elevator down spring (40).

NOTE : CABLE TENSION SHOULD BE MEASURED AFT OF 255.00 IN TAILCONE. CABLE TENSION SHOULD BE ADJUSTED WHEN AMBIENT TEMPERATURE IS 65°F TO 95°F. ALLOW AIRPLANE TEMPERATURE TO STABILIZE FOR A PERIOD OF FOUR HOURS.

- H. Zero position of the elevator is with the centerline of the elevator horn aligned with the centerline of the horizontal stabilizer.
- I. Zero position of the elevator trim tab is with the inboard end of the trim tab matching the trailing edge of the horizontal stabilizer. In this position the right (outboard) end of the trim tab must align with the inboard end of the right elevator with 0.15 inch.

NOTE : WITH ELEVATORS IN ZERO POSITION, THE INBOARD TRAILING EDGES MAY NOT ALIGN WITH HORIZONTAL STABILIZER TRAILING EDGE.

- J. Adjust bellcrank push-pull tube (29) length to obtain slip fit of push-pull tube attachment bolt (24) at the elevator arm (25); tighten jam nut and safety wire. Secure push-pull tube (29) with bolt (28), washer (26), nut (27) and cotter pin (28).

NOTE : INSPECT PUSH-PULL TUBE (29) AND FORK TO ENSURE THAT THREADS OF PUSH-PULL TUBE ARE ENGAGED PAST 0.06 INCH INSPECTION HOLE IN FORK.

- K. Remove temporary external control locks and control column holding tool.

- L. With inclinometer installed on elevator, adjust the bellcrank stop bolts (aft of bellcrank) to provide up travel and a down travel as indicated in Chapter 1, General Information.

CAUTION: MAKE SURE ELEVATOR BELLCRANK IS STRIKING STOP BOLT AND IS NOT LIMITED BY OTHER STRUCTURAL INTERFERENCE.

- M. Install turnbuckle clips (11) on the turnbuckles (12) and secure stop bolts with jamnuts.

WARNING: ENSURE THAT ELEVATOR CONTROL HAVE FREEDOM OF MOVEMENT AND ELEVATOR MOVES IN PROPER DIRECTION WHEN OPERATED BY THE CONTROL WHEEL. PULL THE CONTROL WHEEL AFT, BOTH ELEVATORS WILL DEFLECT UP. PUSH THE CONTROL WHEEL FORWARD, BOTH ELEVATORS WILL DEFLECT DOWN.

WARNING: ENSURE AILERON CONTROLS HAVE FREEDOM OF MOVEMENT AT THE EXTREME POSITION OF THE ELEVATOR CONTROL.

- N. Install stabilizer fairings, center pedestal cover and tailcone access.

3. Rigging Elevator Trim Control System (Refer to Figure 7).

- A. Remove the tailcone access and RH pedestal cover.
 B. Remove the center floor panel aft of pedestal and elevator trim access on the horizontal stabilizer.
 C. Place a suitable support under tailcone.
 D. Loosen the stop blocks by loosening attaching nuts and bolts.
 E. Adjust the cable tension on the elevator trim control cables. Refer to Chapter 1, General Information.

NOTE: If an electric trim or autopilot is installed, refer to Chapter 1, General Information, for cable tension.

NOTE: Cable tension should be adjusted when ambient temperature is 65°F to 95°F. Allow airplane temperature to stabilize for a period of 4 hours.

- F. Remove cotter pin, nut, washer and bolt from push-pull tube at trim tab.
 G. Rotate the elevator trim control wheel forward (nose down) until forward chain and the trim actuator chain have approximately two links clearing the sprockets.

NOTE: If the elevator trim indicator reaches its extreme travel during rigging, the indicator can be repositioned by removing the elevator trim control wheel, moving the indicator and reinstalling the control wheel.

- H. Establish neutral position of trim tab. Set inclinometer to 0 degrees.

NOTE: If trim tab and right elevator do not align within .15 inch (refer to figure 3A), the right elevator and trim tab assembly must be replaced.

- I. With the elevator in neutral (elevator horns aligned with stabilizer and the chains in position described in Step G, adjust trim actuator by rotating push-pull tube so that the push-pull tube hole and the elevator trim tab horn attaching hole align with the trim tab positioned approximately 12 degrees up from neutral (neutral position is alignment of the outboard trailing edge of the trim tab with the elevator trailing edge).
 J. Connect the push-pull tube to the elevator trim tab horn with bolt, washer, nut and cotter pin.
 K. With inclinometer installed on the trim tab, rotate the elevator trim control wheel so the elevator trim is positioned up. Slide aft stop block forward against the rub block and tighten.
 L. Rotate the elevator trim control wheel until trim tab is positioned down. Slide the forward stop block against the rub block and tighten.

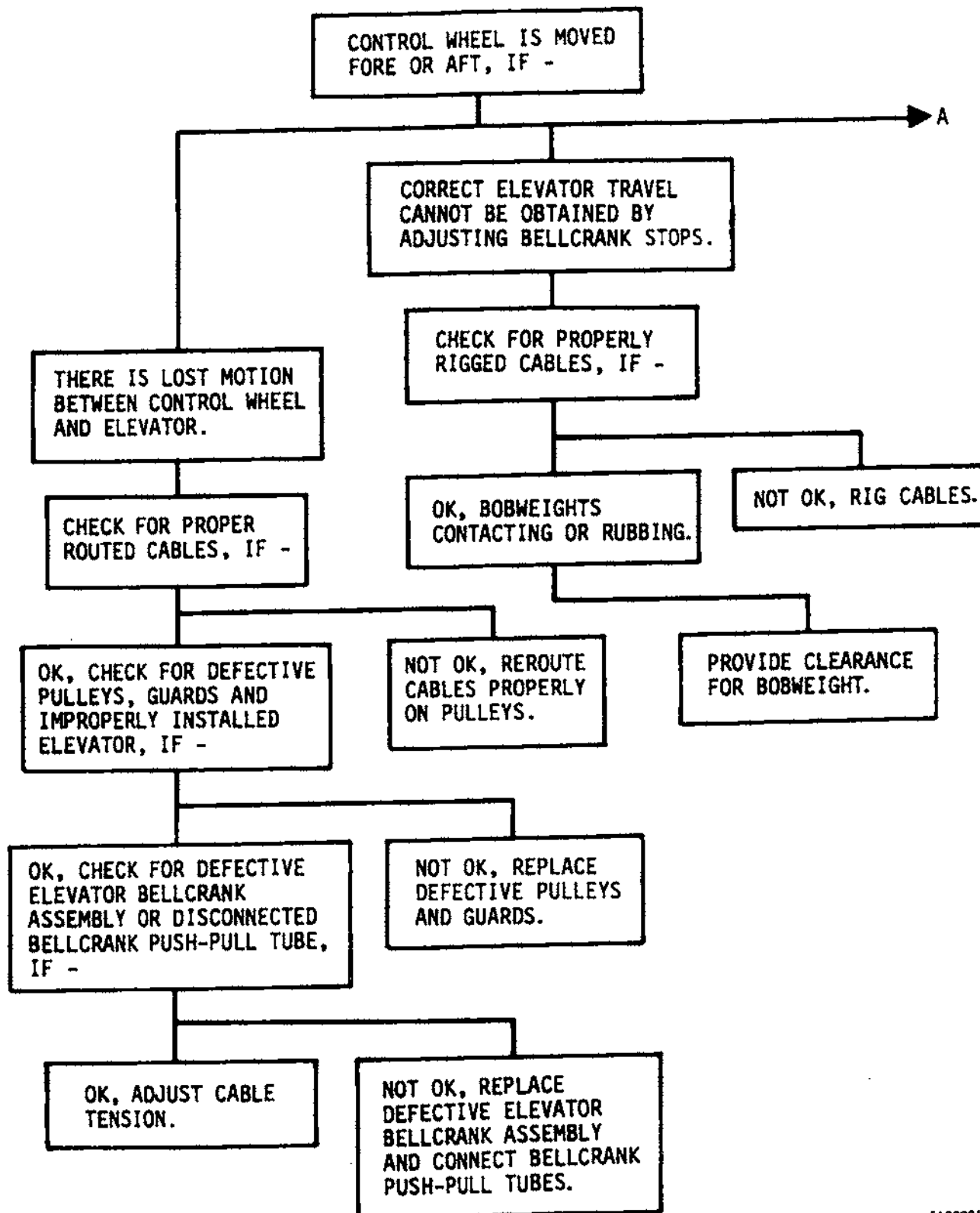
WARNING: ENSURE THAT WHEN TRIM CONTROL INDICATOR IS INDICATING NOSE UP, THE TRIM TAB IS IN THE DOWN POSITION AND THAT WHEN THE TRIM CONTROL INDICATOR IS INDICATING NOSE DOWN POSITION, THE TRIM TAB IS IN THE UP POSITION.

WARNING: ENSURE THAT THE TRIM TAB PUSH-PULL TUBE DOES NOT ASSUME AN OVERCENTER POSITION WHILE IN THE DOWN TRAVEL POSITION.

WARNING: ON AIRPLANES C0907 AND ON. ENSURE THAT THERE IS A MINIMUM OF ONE INCH REMAINING AT FORWARD AND AFT SPROCKETS AT EACH EXTREME TRAVEL.

- M. Install turnbuckle clips on the turnbuckle.
 N. Install floor panels, carpet, pedestal cover, tailcone access and elevator trim actuator access.

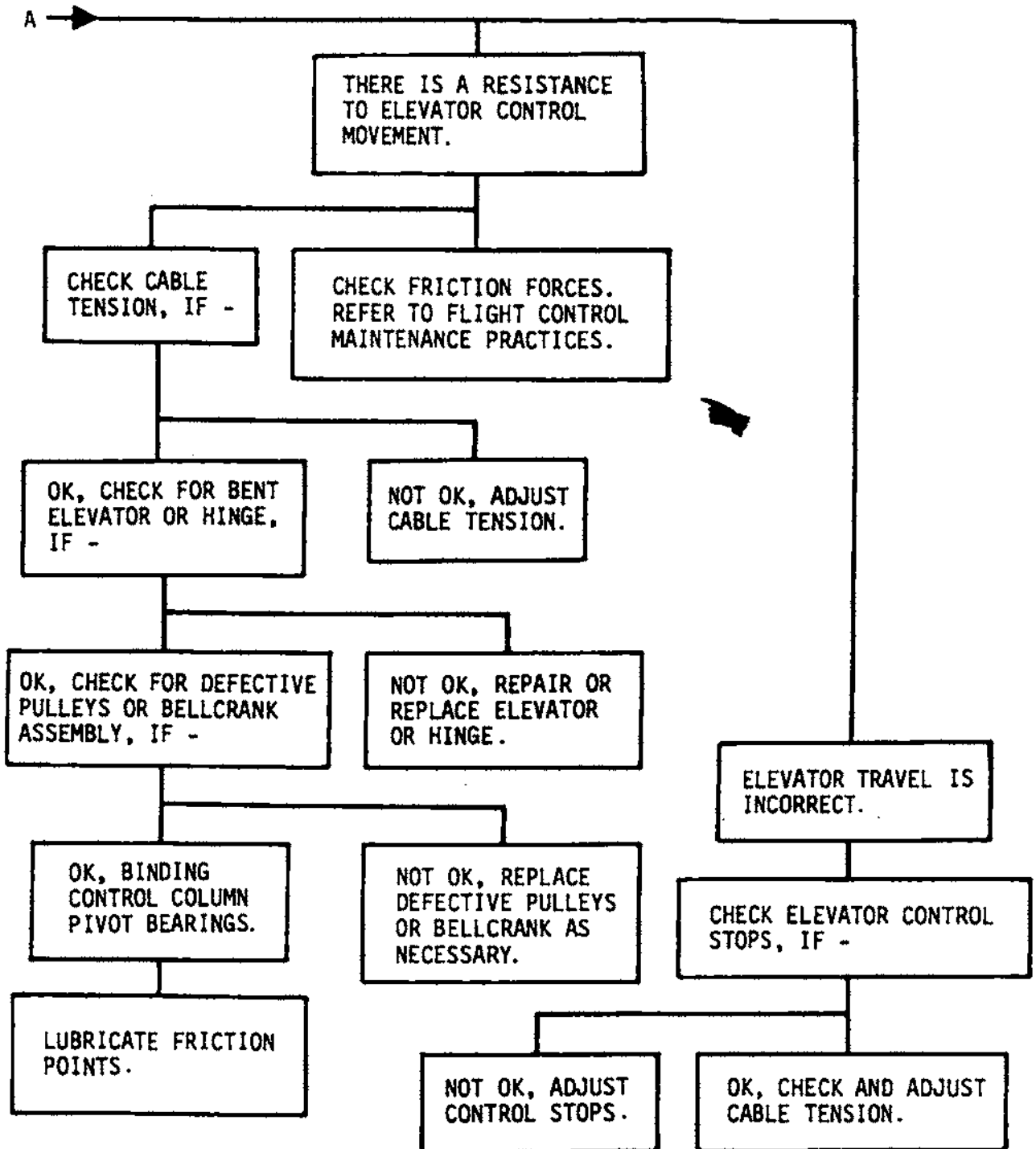
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Troubleshooting - Elevator System
Figure 1 (Sheet 1)

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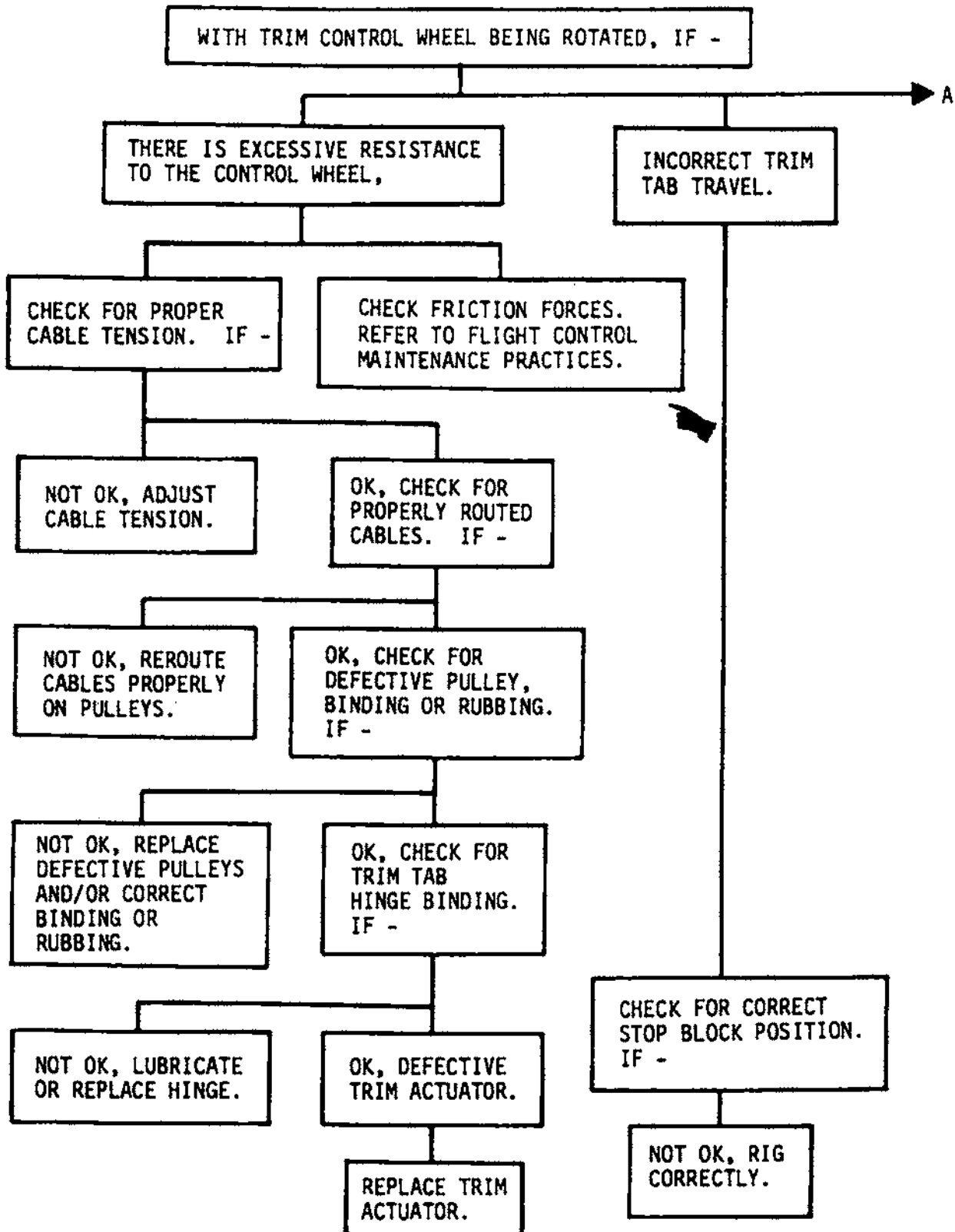
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Troubleshooting - Elevator System
Figure 1 (Sheet 2)

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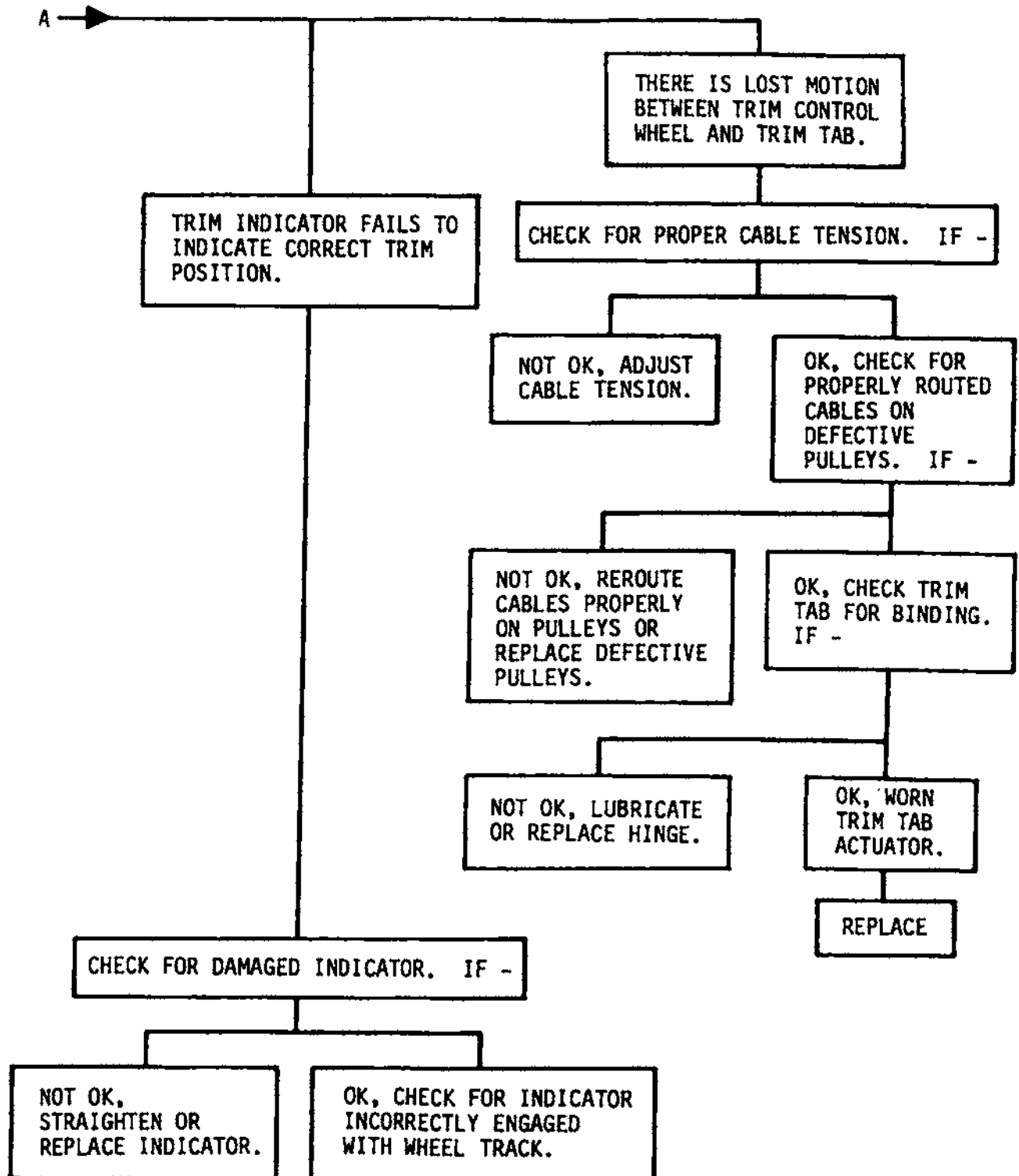
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Troubleshooting Chart - Elevator Trim
Figure 2 (Sheet 1)

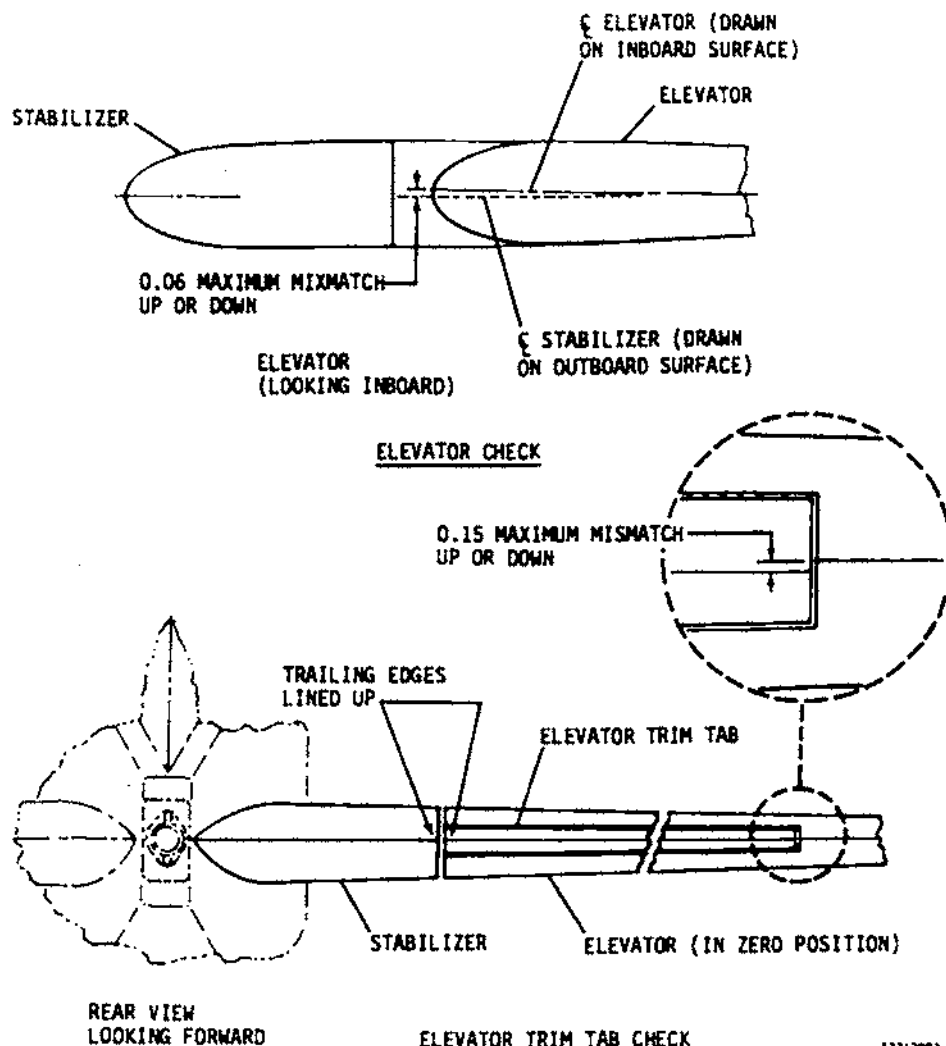
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Troubleshooting Chart - Elevator Trim
Figure 2 (Sheet 2)

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ELEVATOR TRIM TAB CHECK

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Inspection/CheckRigging Elevator Control and Elevator Trim Control Systems
Figure 3A

1. Tools and Equipment.

NOTE: Refer to troubleshooting for tools and equipment requirements.

2. Elevator and Elevator Trim Tab Cable Check.

NOTE: Angular dimensions for checking elevators and elevator trim tab are measured by placing an inclinometer on the elevator or elevator trim tab surface. Elevator is in neutral position when the elevator horns align with stabilizer. The elevator trim tab is in neutral position when streamlined with the elevator.

A. Elevator and Elevator Trim Tab Cable Check.

- (1) Place elevator and trim tab in neutral position.
- (2) Place tensiometer on the elevator cable and read the cable tension.
- (3) Place tensiometer on the elevator trim cable and read the cable tension.

NOTE: Access to elevator and elevator trim cables is gained through the tailcone.

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NOTE: Cable tension should be adjusted when ambient temperature is 65°F to 95°F. Allow airplane temperature to stabilize for a period of four hours.

3. Elevator and Trim Tab Deflection Check.

- A. For elevator and elevator trim tab deflection, refer to Chapter 2, Detailed Inspection Procedures.

4. Inspect Elevator and Elevator Trim Tab.

- A. Remove access covers on pedestal, cabin floor panels, tailcone access panel, stabilizer fairing and trim actuator access cover to provide visual inspection of cables and pulleys.
B. Install access covers, fairings, floor panels and tailcone access panels after inspection.

Maintenance Practices

WARNING: WHEN MAINTENANCE IS PERFORMED ON ANY FLIGHT CONTROL SYSTEM OR FLIGHT CONTROL TRIM SYSTEM REQUIRING REMOVAL/INSTALLATION OF CABLES, ENSURE CABLES ARE NOT CROSSED DURING CABLE REINSTALLATION.

1. Removal/Installation Elevator (Refer to Figure 5).

A. Remove Elevator.

- (1) Remove stinger and stabilizer fairings, refer to Chapter 3, Stabilizers.
- (2) Remove bonding straps from elevator.
- (3) Remove cotter pin (8), nut (7), washer (9) and bolt (11) attaching push-pull tube to trim tab horn (6).

NOTE: Steps (3 and 4) not applicable for left elevator.

- (4) Remove trim tab push-pull tube (10) by unscrewing from trim tab actuator.
- (5) Remove elevator tip by removing screws.
- (6) Remove nut (27), washer (28) and remove taper pin (20) by installing washers and nut on the opposite end of the taper pin. Tighten nut as required to free taper pin.
- (7) Remove nuts (22) and screws (19) from collar (21) and elevator arm (15).
- (8) Support the elevator and remove cotter pins (4), nuts (5), washers (2 and 3) and bolts (1) at elevator hinge brackets.
- (9) Remove collar (21) from torque tube (23).

CAUTION: THE COLLAR (21) AND TORQUE TUBE (23) ARE DRILLED AND TAPER REAMED AS A MATCHED SET AND MUST BE INSTALLED AS A MATCHED SET. WHEN A NEW COLLAR IS INSTALLED ON AN OLD TORQUE TUBE, A NEW MATCHED SET IS ESTABLISHED.

- (10) Remove the elevator by pulling aft and outboard while guiding the torque tube (23) through the horizontal stabilizer ribs.

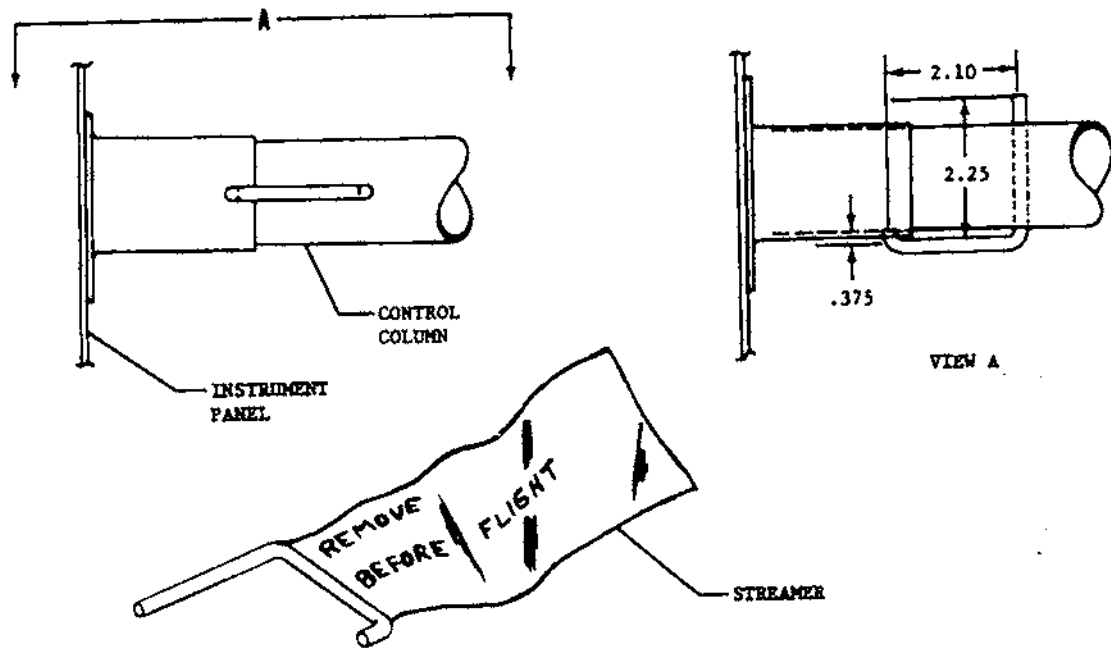
NOTE: Counterweights are located in the forward outboard elevator tips. Support the elevator tips during removal to prevent damage to elevator.

B. Install Elevator.

- (1) Insert torque tube (23) into horizontal stabilizer and slide collar (21) on torque tube (23).
- (2) Secure elevator to horizontal stabilizer with bolts (1), washers (2 and 3), nuts (5) and cotter pins (4). Install elevator tip with screws.
- (3) Align taper reamed hole in collar (21) and torque tube (23) and install taper pin (20) with washer (28) and nut (27).

NOTE: Install taper pin (20) with wet primer Zinc Chromate Primer Type 1-G, MIL-P-8585. Torque nut (27) to 50, +10, -10 inch-pounds.

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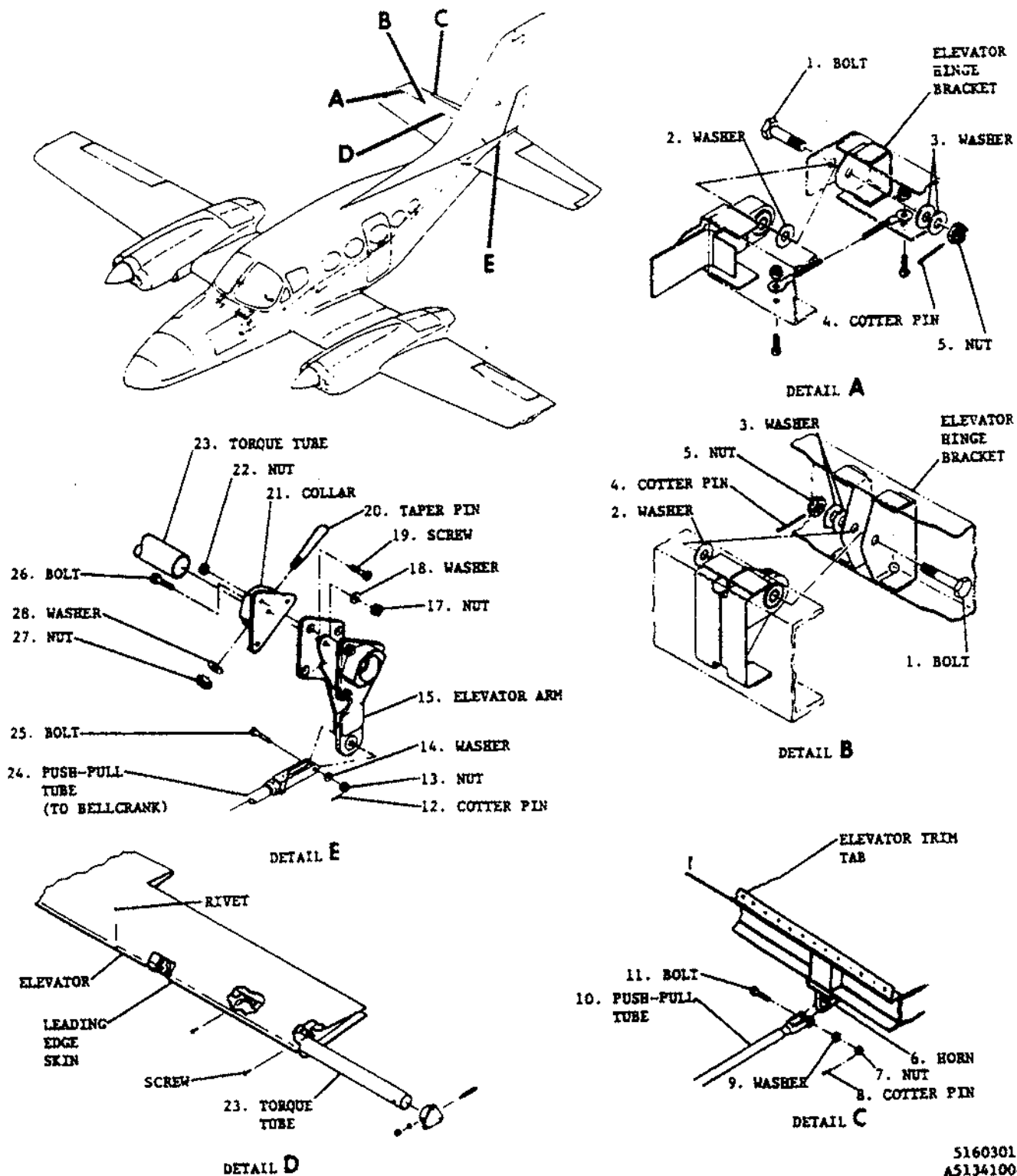


HOLDING TOOL
CONTROL COLUMN

FABRICATE TOOL FROM .187 DIA. 1025 CARBON STEEL
BEND RADIUS TO BE .12

Control Column Holding Tool
Figure 4

52801001



Elevator and Torque Tube Installation
Figure 5

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- (4) Secure collar (21) to elevator arm (15), using screws (19) and nuts (22).
- (5) If a new collar (21) is being installed on the original elevator torque tube (23), proceed as follows:
 - (a) Install elevator on aircraft with new collar (21) in accordance with steps (1), (2) and (4).

NOTE: The replacement collar will be 1.85 inches long. Ensure identification of collar part number, left and right-hand collars are not interchangeable.

- (b) Using temporary external lock, lock elevator in neutral position.
- (c) Using the pilot holes in the collar (21), drill a 1/8 (.125) hole through elevator torque tube (23).
- (d) Enlarge hole in stages until small end of a Number 4 B & S taper reamer will enter the hole.
- (e) Line ream hole with Number 4 reamer to a diameter which will permit taper pin (20) to extend not more than 1/16 inch above surface of collar (21).
- (f) Install taper pin (21) in accordance with Step (3).
- (6) Screw trim tab push-pull tube (10) with trim tab actuator attached into actuator. Secure trim tab push-pull tube (10) to trim tab horn (6) with bolt (11), washer (9), nut (7) and cotter pin (8).
- (7) Secure bonding straps to elevator and horizontal stabilizer.
- (8) Rig elevator and tab, refer to Adjustment/Test.
- (9) Install fairings and stinger.

2. Removal/Installation Elevator Torque Tube (See Figure 5).

NOTE: Do not remove the elevator torque tube unless replacement is necessary.

A. Remove Torque Tube.

- (1) Remove elevator from aircraft, refer to Removal/Installation Elevator.
- (2) Drill out rivets from leading edge skin of elevator as required to gain access to torque tube mounting screws.

CAUTION: DURING ALL DRILLING OPERATIONS, TAKE PRECAUTIONS TO PREVENT ENLARGING HOLES OR DAMAGE TO EXISTING STRUCTURE.

- (3) Drill out rivets, securing torque tube (23) to rib.
- (4) Spread leading edge skin and remove screws securing torque tube (23) to structure. Remove torque tube.

B. Install Torque Tube.

- (1) Install torque tube (23) in elevator and secure with screws.

NOTE: To facilitate installation of torque tube, drill out attaching rivets at rib and spar as required to gain access for bucking rivets.

- (2) Drill holes through torque tube flange to match drilled out rivet holes in elevator assembly rib.
- (3) Secure torque tube (23) flange to rib, using same size and type rivets removed.
- (4) Secure leading edge skin, using the same size and type rivet as that removed.
- (5) Install elevator, refer to Removal/Installation Elevators.

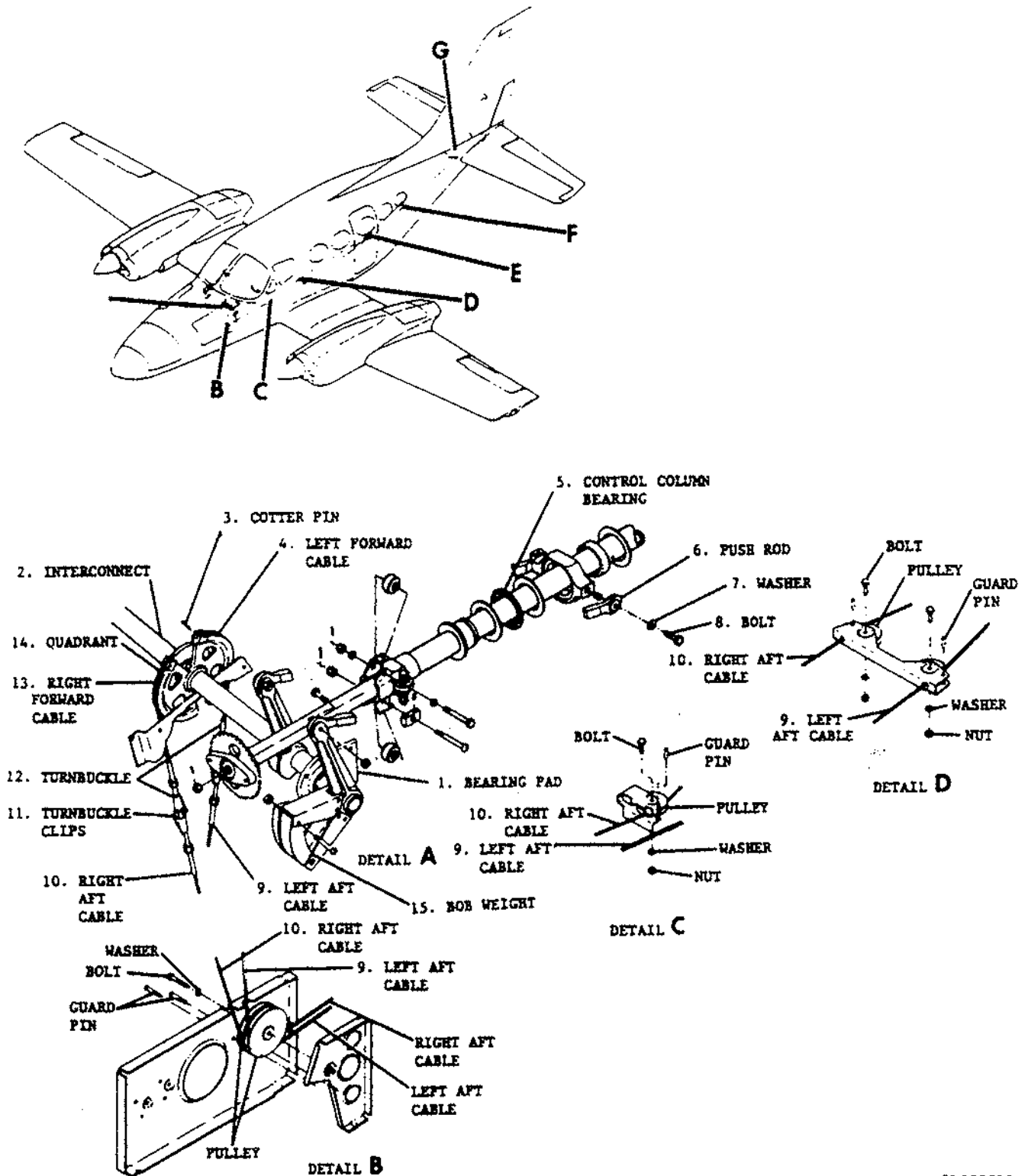
3. Removal/Installation Elevator Bellcrank (See Figure 6).

A. Remove Elevator Bellcrank.

- (1) Remove tailcone access and left access cover from pedestal.
- (2) Remove turnbuckle clip (11) and loosen either turnbuckle (12) to release cable tension on cables (9 and 10).
- (3) Disconnect cables (9 and 10) from bellcrank (44) by removing cotter pins (16 and 36), nuts (17 and 37) and bolts (20 and 34).

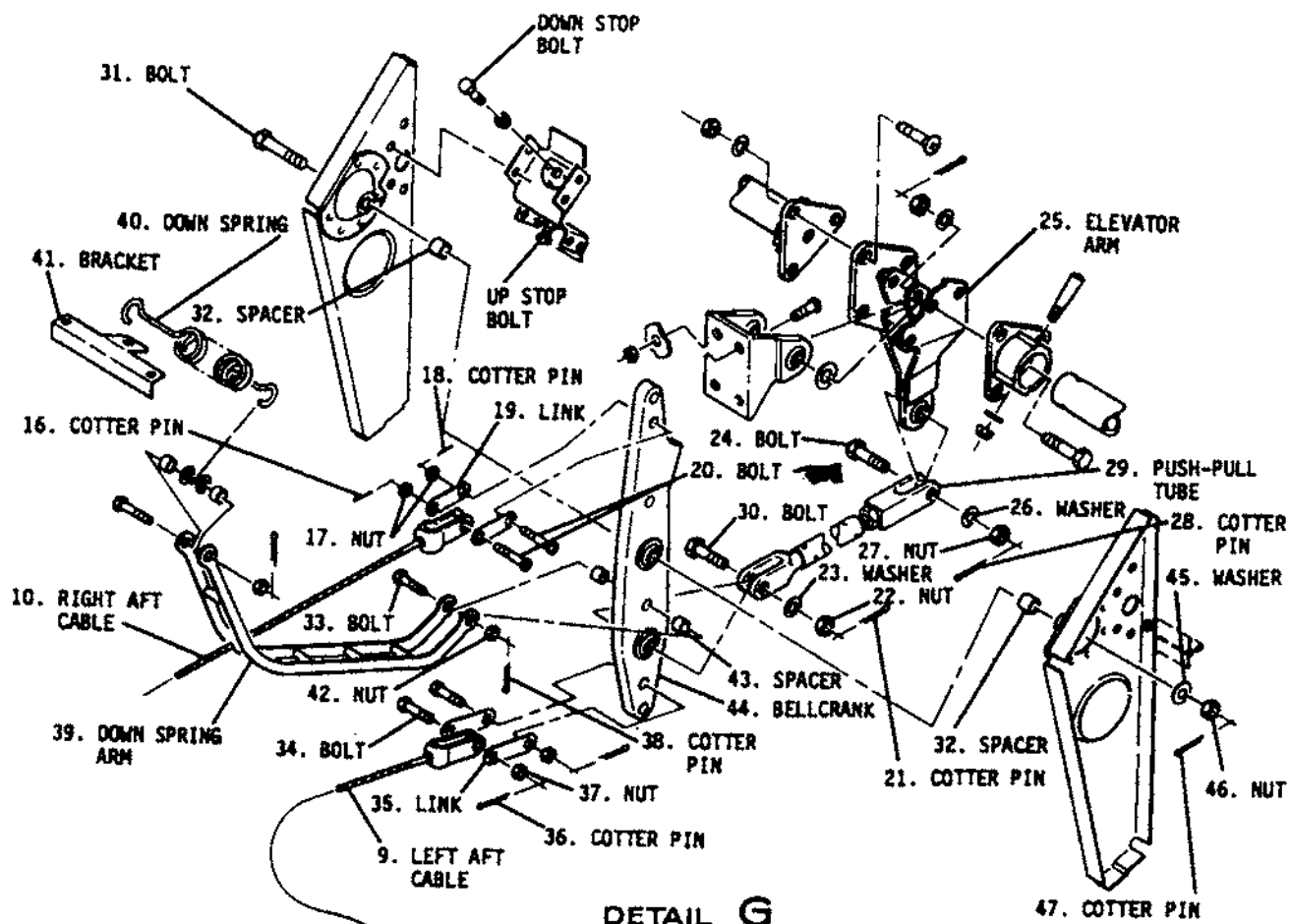
NOTE: When removing or installing the right aft cable (10), check the correct routing through the down spring arm (39).

NOTE: If an autopilot or IFCS (optional) equipment is installed, disconnect cables from elevator bellcrank, refer to Chapter 14.

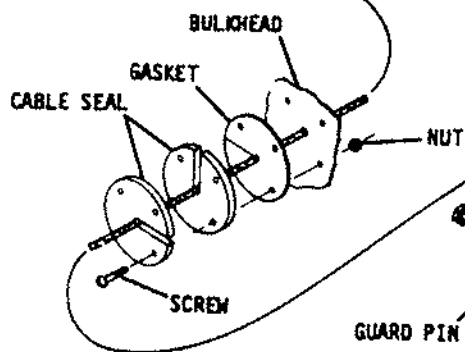


Elevator Control System Installation
Figure 6 (Sheet 1 of 2)

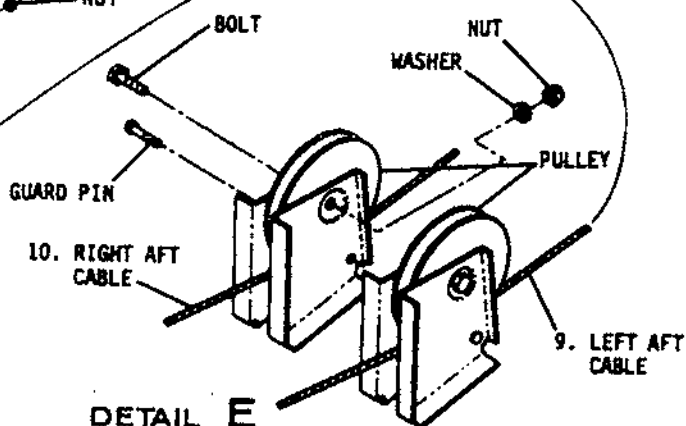
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DETAIL G



DETAIL F



DETAIL E

Elevator Control System Installation
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- (4) Disconnect bellcrank push-pull tube (29) from bellcrank (44) by removing cotter pin (21), nut (22), washer (23) and bolt (30).
- (5) Disconnect down spring (40) from bracket (41). At bellcrank (44) remove cotter pin (38), nut (42), bolt (33) and spacers (44) securing down spring arm (39) to bellcrank.
- (6) Remove bellcrank (44) from bracket by removing cotter pin (47), nut (46), washer (45), bolt (31) and spacers (32).

B. Install Elevator Bellcrank.

- (1) Position bellcrank (44) in bracket and secure with bolt (31), spacers (32), washer (45), nut (46) and cotter pin (47).
- (2) Connect down spring arm (39) to bellcrank (44), using bolt (33), spacers (43), nut (42) and cotter pin (38).
- (3) Connect down spring (40) to down spring arm (39) and bracket (41).
- (4) Connect bellcrank push-pull tube (29) to bellcrank (44), using bolt (30), washer (23), nut (22) and cotter pin (21).
- (5) Connect cables (9 and 10) to links (18 and 35), using bolts (20 and 34), nuts (17 and 37) and cotter pins (16 and 36).
- (6) Rig the elevator control system, refer to Adjustment/Test.
- (7) Install turnbuckle clips (11) on turnbuckles (12).
- (8) Install tailcone access and left access cover on pedestal.

4. Removal/Installation Elevator Quadrant (See Figure 6).

A. Remove Elevator Quadrant.

- (1) Remove pilot and copilot seats, refer to Chapter 12.
- (2) Remove elevator cable cover from pedestal.
- (3) Remove turnbuckle clips (11) and disconnect turnbuckles (12).
- (4) Disconnect push rods (6) from control column bearing (5) by removing bolts (8) and washer (7).
- (5) Disconnect bearing pads (1) from supports and the center pedestal structure by removing nuts and bolts.
- (6) Remove the interconnect (2) and quadrant (14) by tilting the right side up and working the interconnect assembly out on the left side of the aircraft.

B. Install Elevator Quadrant.

- (1) Slide the interconnect (2) and quadrant (14) into position and secure bearing pads (1) to supports with bolts and nuts.
- (2) Connect push rods (6) to control column bearing (5) with washers (7) and bolts (8).
- (3) Connect cables (9 and 10) to cables (4 and 13) with turnbuckles (11).
- (4) Rig elevator control system, refer to Adjustment/Test.
- (5) Install turnbuckle clips (11) on turnbuckles (12).
- (6) Install elevator cable cover.
- (7) Install pilot and copilot seats, refer to Chapter 12.

5. Removal/Installation Elevator Control Cables (See Figure 6).

A. Remove Elevator Cables.

- (1) Remove pilot and copilot seats and carpet as required to gain access to center floor panels.
- (2) Remove left access cover on pedestal and tailcone access.
- (3) Remove cable access on bottom of fuselage and floor panels along centerline of aircraft.
- (4) Remove turnbuckle clips (11) from turnbuckles (12) and disconnect turnbuckles.
- (5) Disconnect cables (4 and 13) from quadrant (14) by removing cotter pins (3).
- (6) Disconnect cables (9 and 10) from bellcrank (44) by removing cotter pins (16 and 36), nuts (17 and 37) and bolts (20 and 34).
- (7) Remove screws and nuts and remove cable seals and gaskets.
- (8) Remove guard pins from all the cable pulleys.
- (9) Tie guide wires to forward ends of cables (9 and 10) and remove cables by pulling aft into tailcone.

NOTE: When removing or installing the elevator cable (10), check the correct routing through the down spring arm (39).

B. Install Elevator Cables.

- (1) Attach guide wire to forward ends of cables (9 and 10) and pull forward into position.
- (2) Install guard pins in all cable pulleys.
- (3) Connect cables (9 and 10) to bellcrank links (19 and 35) with bolts (20 and 34), nuts (17 and 37) and cotter pins (16 and 36).
- (4) Install gaskets and cable seals to bulkhead with screws and nuts.
- (5) Route forward portions of cables (4 and 13) around quadrant (14) and secure cables to quadrant with cotter pins (3).
- (6) Connect forward cables (4 and 13) and aft cables (8 and 10) together with turnbuckles (12).
- (7) Rig elevator control system, refer to Adjustment/Test.
- (8) Install turnbuckle clips (11) on turnbuckles (12).
- (9) Install floor panels, tailcone access and access covers.
- (10) Install carpet, pilot and copilot seats.

6. Removal/Installation Elevator Arm (See Figure 5).**A. Remove Elevator Arm.**

- (1) Remove elevators, refer to Removal/Installation Elevators.
- (2) Disconnect bellcrank push-pull tube (24) from elevator arm (15) by removing cotter pin (12), nut (13), washer (14) and bolt (25).
- (3) Remove elevator arm (15) by removing cotter pins (16), nuts (17), washers (18) and bolts (26).

B. Install Elevator Arm.

- (1) Position elevator arm (15) in hinge bracket and secure with bolts (26), washers (18), nuts (17) and cotter pins (16).
- (2) Connect bellcrank push-pull tube (24) to elevator arm (15), using bolt (25), washer (14), nut (13) and cotter pin (12).
- (3) Install elevator, refer to Removal/Installation Elevators.

7. Removal/Installation Elevator Down Spring (See Figure 6).**A. Remove Elevator Down Spring.**

- (1) Remove tailcone access.
- (2) Remove cotter pin, nut, spacer and bolt from down spring arm (39).
- (3) Remove down spring (40) by unhooking from bracket (41).

B. Install Elevator Down Spring.

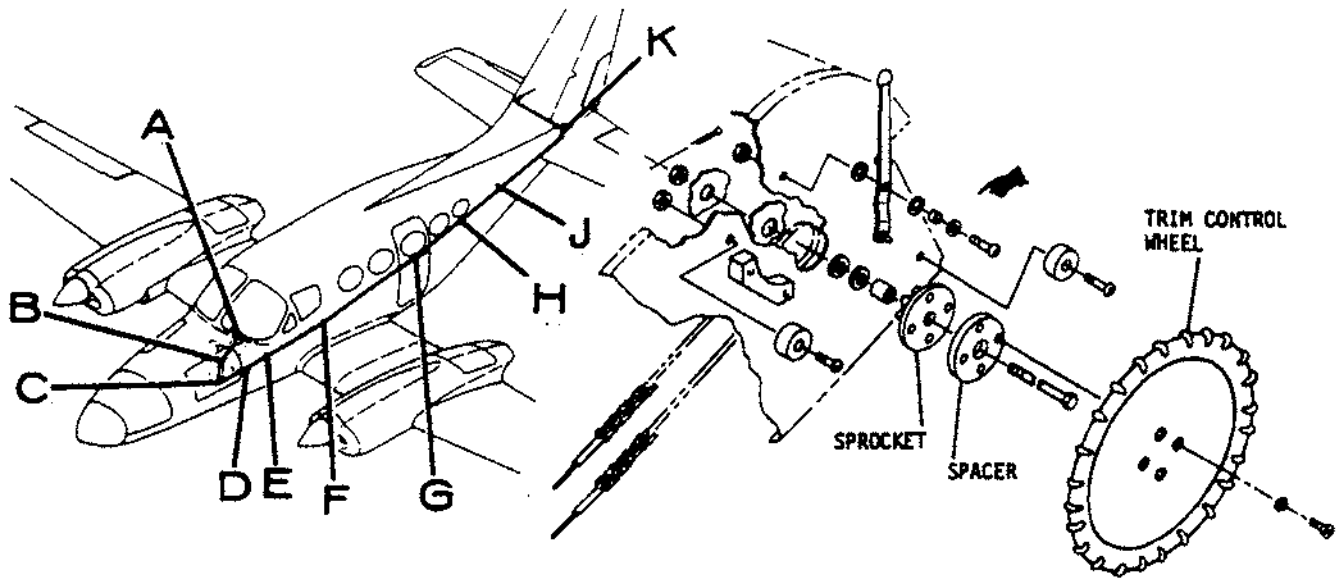
- (1) Connect down spring (40) to bracket (41).
- (2) Attach down spring (40) to down spring arm, using bolt, spacer, nut and cotter pin.
- (3) Install tailcone access.

8. Removal/Installation Elevator Aft Push-Pull Tube (See Figure 6).**A. Remove Elevator Aft Push-Pull Tube.**

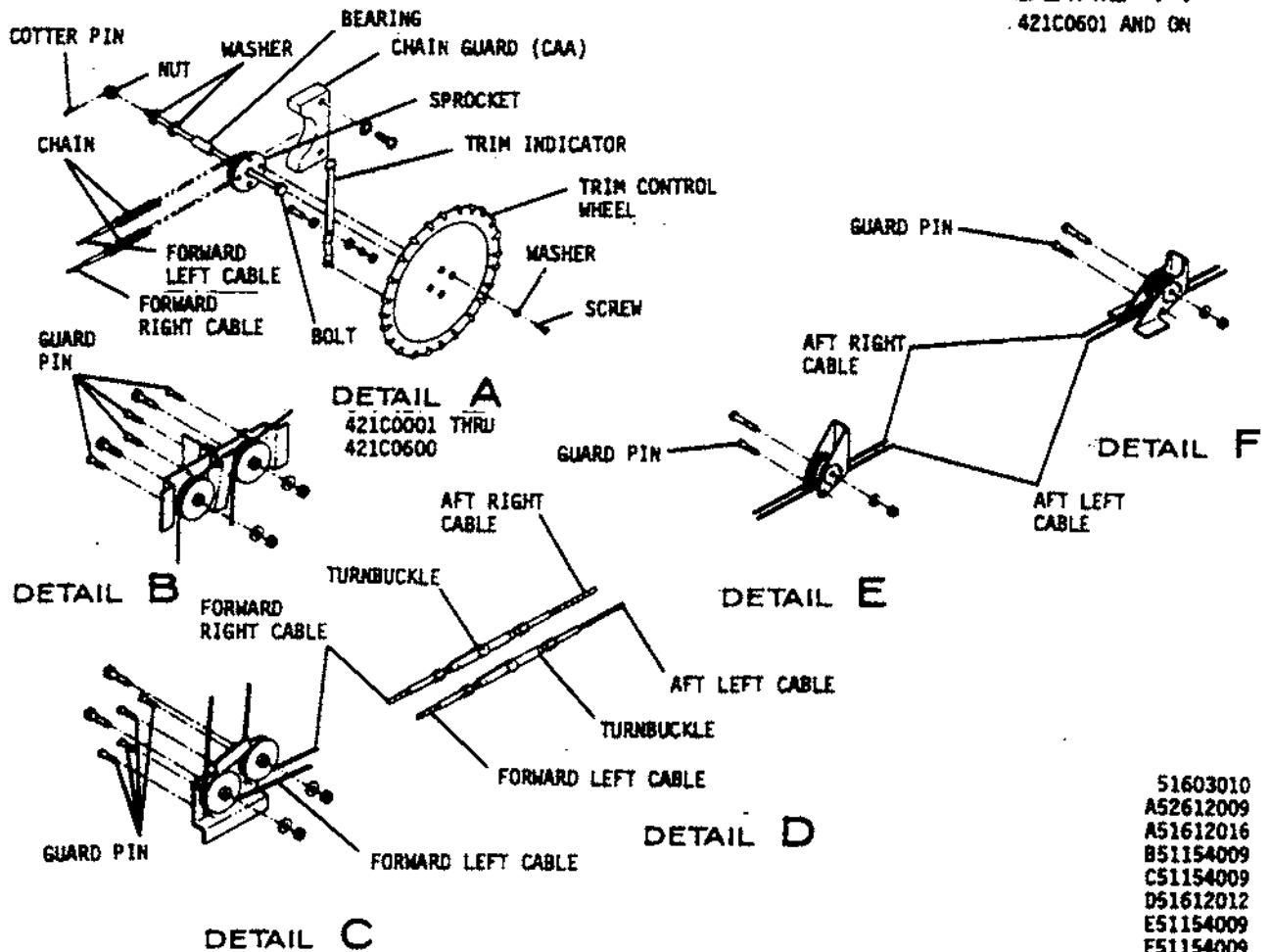
- (1) Remove tailcone access.
- (2) Remove stabilizer fairings and stinger.
- (3) Disconnect push-pull tube (29) from bellcrank (44) by removing cotter pin (21), nut (22), washer (21) and bolt (30).
- (4) Disconnect push-pull tube (29) from elevator arm (25) by removing cotter pin (28), nut (27), washer (26) and bolt (24).

B. Install Elevator Aft Push-Pull Tube.

- (1) Connect push-pull tube (29) to elevator arm (25) with bolt (24), washer (26), nut (27) and cotter pin (28).
- (2) Connect push-pull tube (29) to bellcrank (44) with bolt (30), washer (21), nut (22) and cotter pin (21).
- (3) Install stabilizer fairings and stinger.
- (4) Install tailcone access.



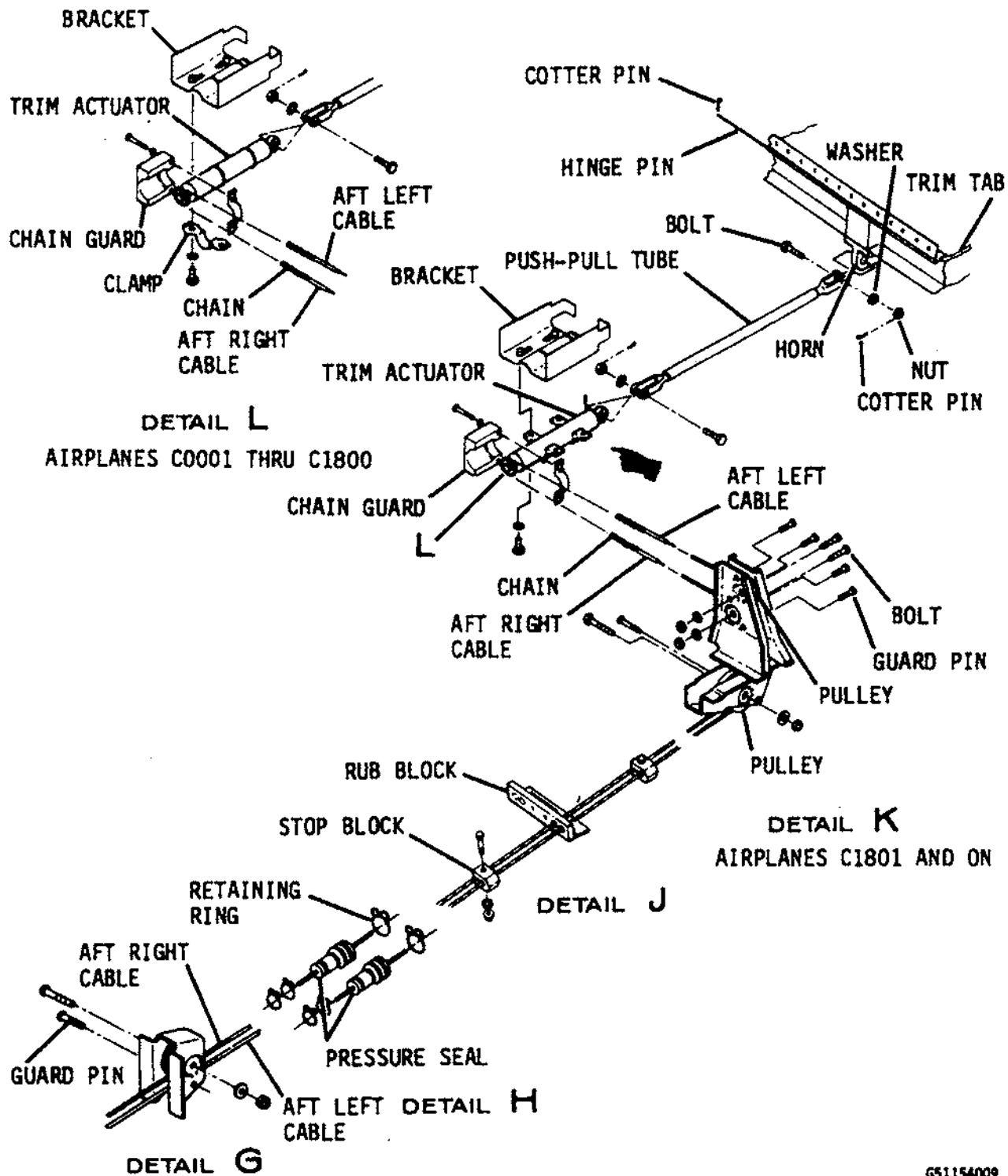
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Elevator Trim Control System
Figure 7 (Sheet 1 of 2)

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Elevator Trim Control System
Figure 7 (Sheet 2)

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9. Removal/Installation Elevator Trim Tab (See Figure 7).

A. Remove Elevator Trim Tab.

- (1) Disconnect the push-pull tube from trim tab horn by removing cotter pin, nut, washer and bolt.
- (2) Remove cotter pin from each end of the hinge pin.
- (3) Remove hinge pin and remove trim tab.

B. Install Elevator Trim Tab.

- (1) Position trim tab to elevator hinge half and secure with hinge pin. Secure hinge pin at both ends with cotter pins.
- (2) Connect push-pull tube to trim tab horn with bolt, washer, nut and cotter pin.
- (3) Rig elevator trim system, refer to Adjustment/Test.

10. Removal/Installation Elevator Trim Tab Actuator (See Figure 7).

A. Remove Elevator Trim Tab Actuator.

- (1) Refer to Chapter 1 and remove cable access panel just aft of pedestal and elevator trim actuator access panel on right horizontal stabilizer.
- (2) Remove turnbuckle clips and loosen turnbuckle to release tension on aft right and left cables.
- (3) Remove right elevator, refer to Removal/Installation Elevators.
- (4) Disconnect the push-pull tube from the actuator by removing cotter pin, nut, washer and bolt. Reinstall screw in actuator.
- (5) Remove chain guard from the trim actuator by removing screws and washers; disengage the chain from sprocket.
- (6) Remove clamps securing trim actuator to bracket by removing bolts and washer. Remove the actuator.

NOTE: For actuator disassembly, refer to Disassembly/Assembly Elevator Trim Tab Actuator.

B. Install Elevator Trim Tab Actuator.

WARNING: DO NOT MIX OR SUBSTITUTE SCREW ASSEMBLIES IN ACTUATORS. ALWAYS CHECK RIGGING AFTER REMOVAL OF SCREW ASSEMBLY.

- (1) Align trim actuator in the bracket and secure with clamps, washers and bolts.

NOTE: Ensure trim actuator retaining rings are seated in bracket grooves.

- (2) Connect push-pull tube to trim actuator screw, using bolt, washer, nut and cotter pin. Unscrew the push-pull tube from the trim actuator and retain for later installation.
- (3) Install the right elevator, refer to Removal/Installation Elevators.
- (4) Position chain on the trim actuator sprocket and rig trim control system, refer to Adjustment/Test.
- (5) Install turnbuckle clips on the cable turnbuckles.
- (6) Install chain guard on the trim actuator, using clamp, washer and screw.
- (7) Install cable access panel and trim actuator access panel.

C. Removal/Installation of Trim Tab Actuator Screw Assembly.

NOTE: When removal of the trim tab actuator screw assembly is required for lubrication, replacement, etc., the following procedure should be used to insure the screw assembly is installed in its original location.

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(1) Removal.

- (a) Position the trim tab and control surface assembly as necessary to allow removal of the push rod and the screw assembly. Disconnect push rod at the trim tab end. Accurately count and record the number of turns necessary to remove the push rod and screw assembly. Gently pull on the push rod during removal to ascertain the exact point when the threads become disengaged. Note this position accurately and also note the position of the bolt head that attaches the push rod to the screw assembly. This is necessary in order to replace the push rod and screw assembly in the exact same position as before removal.

WARNING: DO NOT MIX OR SUBSTITUTE SCREW ASSEMBLIES IN TRIM TAB ACTUATORS. ALWAYS CHECK RIGGING AFTER REMOVAL OF SCREW ASSEMBLY.

(2) Installation.

CAUTION: MAINTAIN A MINIMUM OF 0.40 INCH OF THREAD ENGAGEMENT OF ACTUATOR SCREW. MINIMUM ENGAGEMENT IS TO BE MEASURED AT THE FULLY EXTENDED POSITION.

- (a) Install push rod and screw assembly with the bolt head in the exact same position as noted during removal. Turn the push rod to the left (counterclockwise) 1/8 of a turn. Apply pressure on the push rod and screw assembly in a forward direction and turn to the right (clockwise) the same number of turns as noted during removal. Check the direction of the bolt that attaches the push rod to the screw assembly to ensure that it is located properly as shown (bolt head outboard).

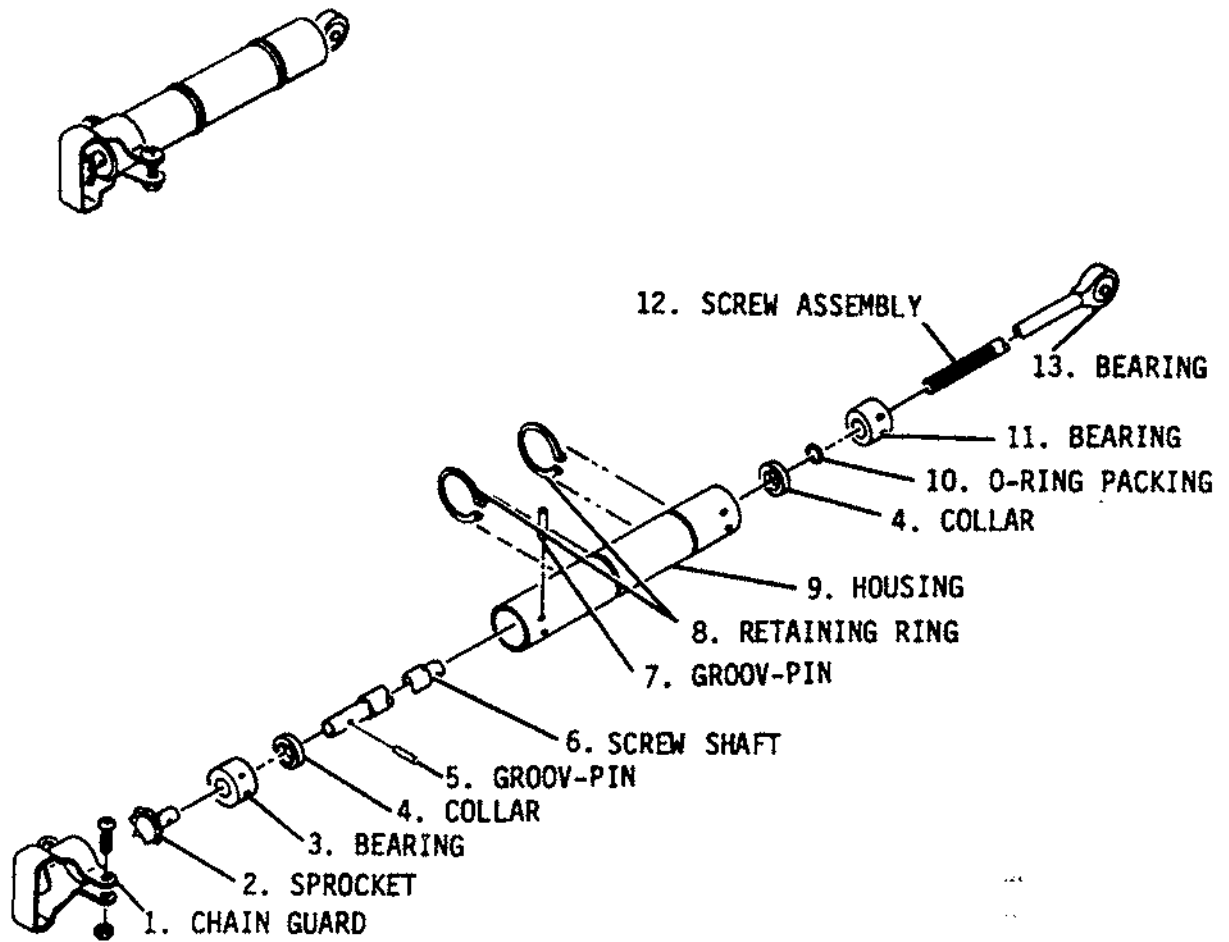
NOTE: The screw assembly has a quad lead type thread. Following the above procedures exactly will insure the trim tab screw assembly has been installed in the exact same position.

Actuator Assembly	Screw Assembly	Used On
1260074-4	0310362-5	Airplanes C0001 Thru C0600
0815097-2	0815096-1	Airplanes C0601 Thru 1800
5315097-1	5815203-1	Ariplanes C1801 and On

WARNING: INSURE PROPER SCREW IS INSTALLED IN ACTUATOR ASSEMBLY. DO NOT SUBSTITUTE OR INTERMIX.

NOTE: This listing is not to be used for ordering parts. Spares replacement data is obtained from the airplane Parts Catalog.

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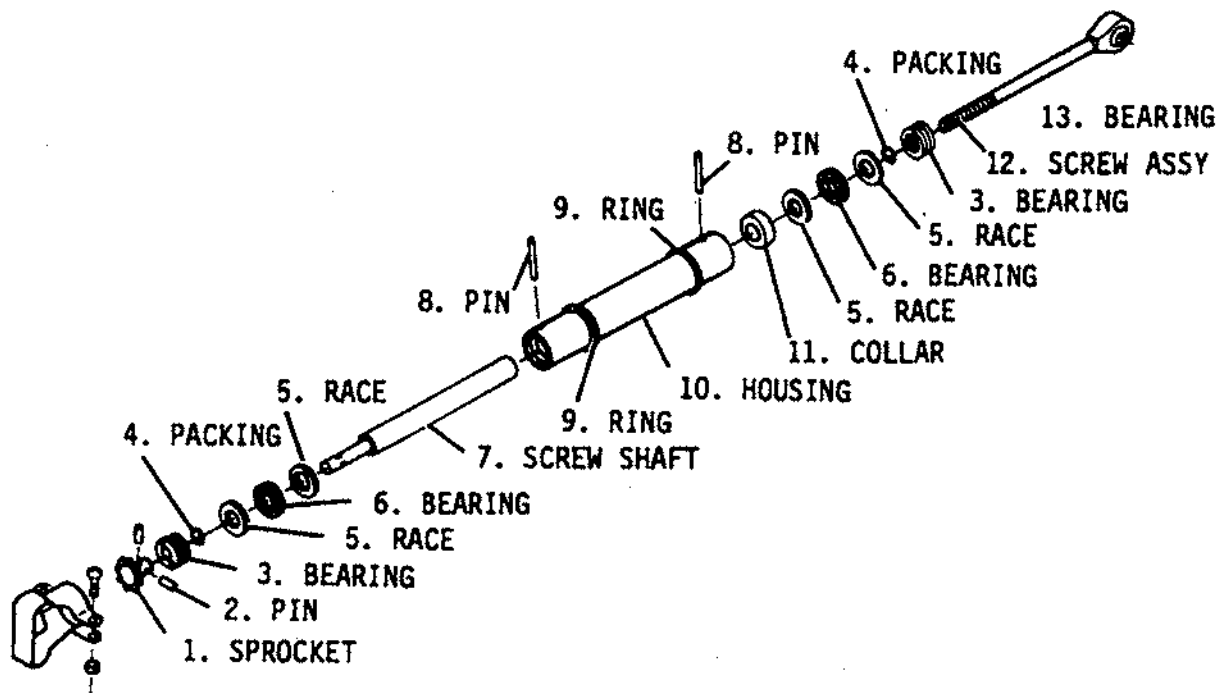
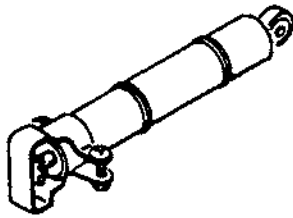


AIRPLANES C0001 THRU C0600

14631001

Elevator Trim Tab Actuator
Figure 8 (Sheet 1)

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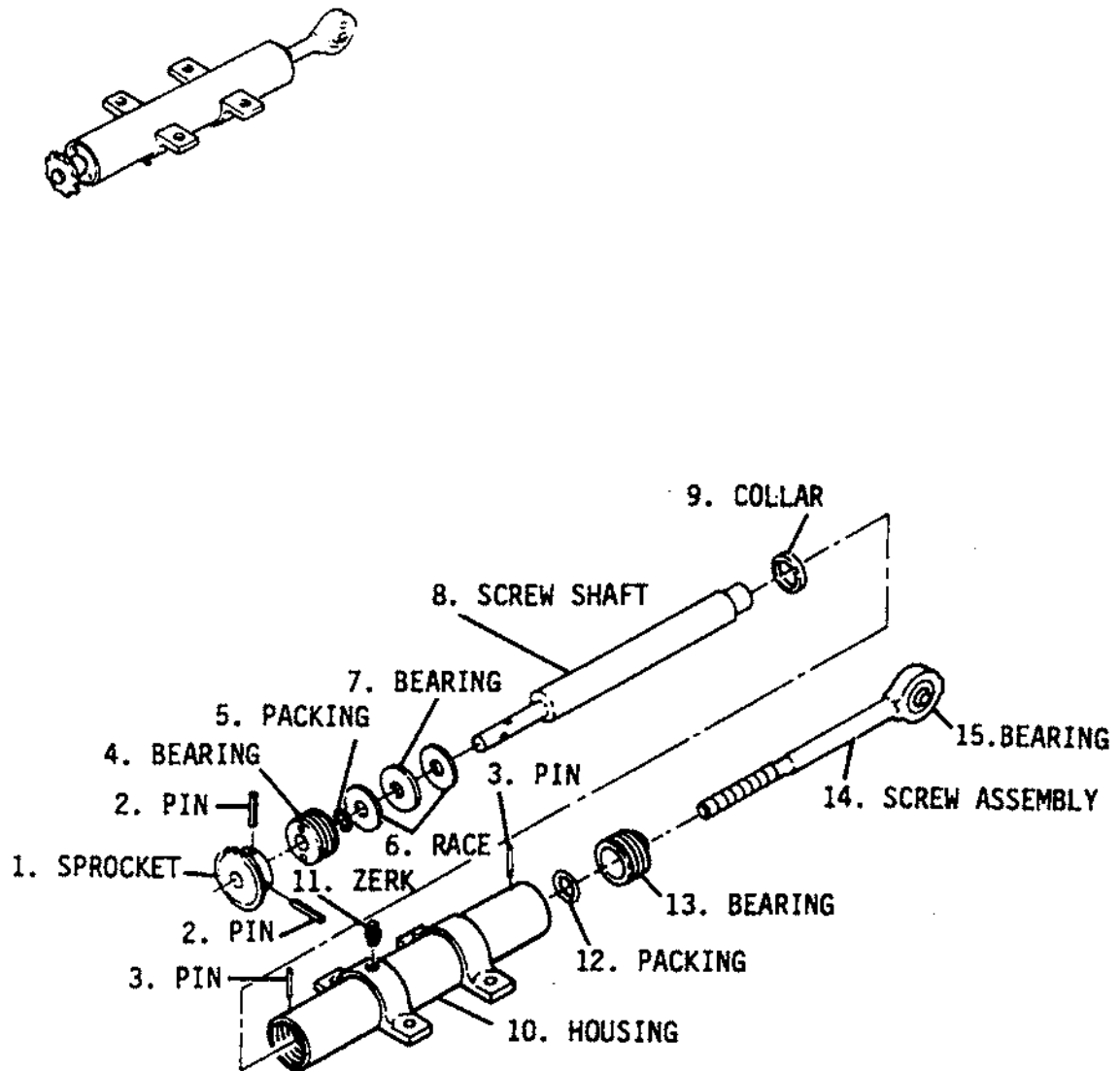


AIRPLANES C0601 THRU C1800

51612022

Elevator Trim Tab Actuator
Figure 8 (Sheet 2)

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AIRPLANES C1801 AND ON



Elevator Trim Tab Actuator
Figure 8 (Sheet 3)

52612010

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11. Disassembly/Assembly Elevator Trim Tab Actuator (Refer to Figure 8).

A. Tools and Equipment.

NOTE: Equivalent substitutes may be used for the following listed item.

Name	Number	Manufacturer	Use
Silicone Grease (Light Consistency)	No. 33	Dow Corning Corp. Midland, Michigan 48641	To lubricate screw housing and threads in trim tab actuator.

B. Disassemble Trim Tab Actuator (Airplanes C0001 Thru C0601).

- (1) Disassemble elevator trim tab actuator assembly in accordance with Figure 8. This view clearly illustrates the proper relationship of all component parts.
- (2) Do not remove bearing (13) from screw assembly (12) unless replacement parts are required.
- (3) Clean all component parts, except bearing (13), by washing in suitable solvent. Do not clean sealed bearing (13).
- (4) Inspect all component parts for obvious indications of damage such as stripped threads, cracks, deep nicks and dents.

NOTE: If thread condition requires replacement of either the internal or external screw, replace both parts.

- (5) Check bearing (3 and 11) and screw shaft (6) and screw assembly (12) for excessive wear and scoring. Refer to Figure 8A.

NOTE: Relative linear movement between internal thread screw shaft (6) and bearing (11) should be a maximum of 0.005 inches on actuator when set at room temperature.

- (6) Examine screws shaft(6) and screw assembly (12) for damaged threads or dirt particles that may impair smooth operation.
- (7) Check sprocket (2) for broken, chipped, and/or worn teeth.

CAUTION: DO NOT ATTEMPT TO REPAIR DAMAGED OR WORN PARTS OF THE ACTUATOR, DISCARD ALL DEFECTIVE ITEMS AND INSTALL NEW PARTS DURING REASSEMBLY.

- (8) Check bearing (13) for smoothness of operation.

C. Assembly Trim Tab Actuator (Airplanes C0001 thru C0601).

WARNING: DO NOT SUBSTITUTE ACTUATOR SCREWS. IMPROPER SCREW COULD CAUSE TRIM SYSTEM FAILURE.

NOTE: Discard the following items and install new parts during assembly: groov-pins (5 and 7) and o-ring packing (10).

- (1) During reassembly, lubricate collars (4) and screw shaft (6) with light consistency silicone grease (MIL-G-83261).

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- (2) Reassemble actuator in accordance with the following:
 - (a) Slip bearing (3) and collar (4) on screw shaft (6).
 - (b) Press sprocket (2) into hollow end of screw shaft (6), making sure pin holes are aligned. Press new groove-pins (5) into pin holes.
 - (c) Insert screw shaft (6), with assembled parts, into housing (9).

NOTE: Locate sprocket (2) at the end of housing (9) which is farthest from the groove for retaining ring (8).

- (d) Align pin holes in bearing (3) and housing (9). Press new groove-pin (7) into pin holes.
- (e) Insert collar (4), new o-ring packing (10), and bearing (11) into end of housing (9). Align pin holes in bearing and housing and install new groove-pin (7).

NOTE: If a new bearing is installed, fabricate a shim of 0.003 thickness to fit on the end of screw shaft (6) against bearing to maintain a minimum amount of free play while drilling new pin holes in the bearing. After holes are drilled in new bearing, remove and discard shim. If pin holes become oversize, drill out to 0.094 and install 0.094 roll pin.

- (f) If new parts are required, press bearing (13) into boss at end of screw assembly (12). Be sure force bears against outer race of bearing. Install screw assembly (12) in housing (9) and screw shaft (6).
- (g) Install retaining rings (8) in grooves provided on outside of housing (9).
- (h) Test actuator assembly by rotating sprocket (2) with fingers while holding bearing end of screw assembly (12). Screw assembly (12) should travel in and out of housing (9) smoothly, with no indication of binding.

D. Disassemble Trim Tab Actuator (Airplanes C0601 Thru C1800).

- (1) Disassemble elevator trim tab actuator assembly in accordance with Figure 8. This view clearly illustrates the proper relationship of all component parts.
- (2) Do not remove bearing (13) from screw assembly (12) unless replacement parts are required.
- (3) Clean all component parts except bearing (13) by washing in suitable solvent. Do not clean sealed bearing (13).
- (4) Inspect all component parts for obvious indications of damage such as stripped threads, cracks, deep nicks and dents.

NOTE: If thread condition requires replacement of either the internal or external screw, replace both parts.

- (5) Check bearings (3), screw shaft (7) and screw assembly (12) for excessive wear and scoring. Refer to Figure 8A.

NOTE: Relative free play between screw assembly (12) and actuator housing assembly should not exceed 0.010 inch. For actuator linear measurement procedure, refer to 5-20.

E. Assembly Trim Tab Actuator (Airplanes C0601 and C1800).

WARNING: DO NOT SUBSTITUTE ACTUATOR SCREWS. IMPROPER SCREW COULD CAUSE TRIM SYSTEM FAILURE.

NOTE: Discard the following items and install new parts during assembly: pins (2 and 8) and O-ring packing (4).

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- (1) During reassembly, lubricate collar (11) and screw shaft (7) with light consistency silicone grease (MIL-G-83261).
- (2) Reassemble actuator in accordance with the following:
 - (a) Slip bearing (6) and races (5), packing (4) and bearing (3) on screw shaft (7).
 - (b) Press sprocket (1) onto end of screw shaft (7), making sure pin holes are aligned. Press new pins (2) into pin holes.
 - (c) Insert screw shaft (7) with assembled parts into forward end of housing (10).

NOTE: Locate sprocket (1) at the end of housing (10) which is farthest from the groove for retaining ring (9).

- (d) Align pin holes in bearing (3) and housing (10). Press new pin (8) into pin holes.
- (e) Insert collar (11), races (5), bearing (6), packing (4) and bearing (3) into aft end of housing (10). Align pin holes in bearing and housing and install new pin (8).
- (f) If new parts are required, press bearing (13) into boss at end of screw assembly (12). Refer to Chapter 20 for bearing installation procedures. Be sure force bears against outer race of bearing. Install screw assembly (12) in housing (10) and screw shaft (7).
- (g) Install retaining rings (9) in grooves provided on outside of housing (10).
- (h) Test actuator assembly by rotating sprocket (1) with fingers while holding bearing end of screw assembly (12). Screw assembly (12) should travel in and out of housing (10) smoothly with no indication of binding.

F. Disassemble Trim Tab Actuator (Airplanes C1801 and On).

- (1) Disassemble elevator trim tab actuator assembly in accordance with Figure 8. This view clearly illustrates the proper relationship of all component parts.
- (2) Do not remove bearing (15) from screw assembly (14) unless replacement parts are required.
- (3) Clean all component parts except bearing (15) by washing in suitable solvent. Do not clean sealed bearing (15).
- (4) Inspect all component parts for obvious indications of damage such as stripped threads, cracks, deep nicks and dents.

NOTE: If thread condition requires replacement of either the internal or external screw, replace both parts.

- (5) Check bearings (4), screw shaft (8) and screw assembly (14) for excessive wear and scoring. Refer to Figure 8A.

NOTE: Relative free play between screw assembly (12) and actuator housing assembly should not exceed 0.010 inch. For actuator linear measurement procedure, refer to 5-20.

G. Assembly Trim Tab Acuator (Airplanes C1801 and On).

WARNING: DO NOT SUBSTITUTE ACTUATOR SCREWS. IMPROPER SCREW COULD CAUSE TRIM SYSTEM FAILURE.

NOTE: Discard the following items and install new parts during assembly: pins (2 and 3) and O-ring packing (5).

- (1) During reassembly, lubricate collar (9) and screw shaft (8) with light consistency silicone grease (MIL-G-83261).
- (2) Reassemble actuator in accordance with the following:
 - (a) Slip bearing (7) and races (6), packing (5) and bearing (4) on screw shaft (8).
 - (b) Press sprocket (1) onto end of screw shaft (8), making sure pin holes are aligned. Press new pins (2) into pin holes.

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- (c) Place collar (9) onto screw shaft (8).
- (d) Insert screw shaft (8) with assembled parts into forward end of housing (10).

NOTE: Locate sprocket (1) at the end of housing (10) which is nearest zerk fitting (11).

- (e) Align pin holes in bearing (4) and housing (10). Press new pin (3) into pin holes.
- (f) Insert packing (12) and bearing (13) into aft end of housing (10). Align pin holes in bearing and housing and install new pin (3).
- (g) If new parts are required, press bearing (15) into boss at end of screw assembly (14). Refer to Chapter 1, Bearings for bearing installation procedures.
- (h) Carefully install screw assembly (14), threading carefully to avoid damaging packing (12).

H. Replacing Actuator Parts (Airplanes C0601 Thru C1800) (Refer to Figure 8).

- (1) If new parts are required, press bearing (13) into boss at end of screw assembly (12). Be sure force bears against outer race of bearing.
- (2) Install bearing (3), races (5) and bearing (6) on screw assembly (12) as shown.

CAUTION: PUSHING THE SCREW INTO THE ACTUATOR CAN DAMAGE THE O-RING PACKING WHICH WOULD REQUIRE DISASSEMBLY AND REPAIR OF THE ACTUATOR.

- (3) Turn screw assembly (12) into housing (10) and turn screw assembly (12) clockwise until it is fully engaged in screw shaft (7).
- (4) Screw bearings (3) into housing (10), align holes and install new pin (8) to secure each bearing (3).

NOTE: The relative free-play between the screw assembly and housing (bearings) will not exceed 0.002 inch when set at room temperature. If free-play is excessive, tighten bearing (3). Drill new pin hole in bearing to match housing and reinstall pin.

- (5) On reassembly of actuator assembly, if bearing (3) or collar (11) are replaced, drill 0.062 hole in new part to match existing applicable hole in housing after adjustment to obtain free-play tolerance. Any portion of groove-pin extending beyond the surface of the housing (10) shall be removed.

NOTE: If pin hole (0.078) is worn oversize, drill out to 0.094 +0.003, -0.000 and install 0.094 diameter roll pin to hold bearing in place.

- (6) Slip sprocket (1) on forward end of screw shaft (7), align holes and install new pins (2).

I. Replacing Actuator Parts (Airplanes C1801 and On) (Refer to Figure 8).

- (1) Do not remove bearing (15) from screw assembly (14) unless replacement parts are required.
- (2) Clean all component parts except bearing (15) by washing in suitable solvent. Do not clean sealed bearing (15).
- (3) Inspect screw assembly (14) and screw shaft (8) for rust, damage threads, or dirt particles.
- (4) Assemble screw assembly (14) and screw shaft (8) together and check free-play. If any free-play exist replace screw assembly (14) and screw shaft (8).
- (5) Check bearings (4) and (13), screw shaft (8) and screw assembly (14) for excessive wear and scoring. Replace parts as required.

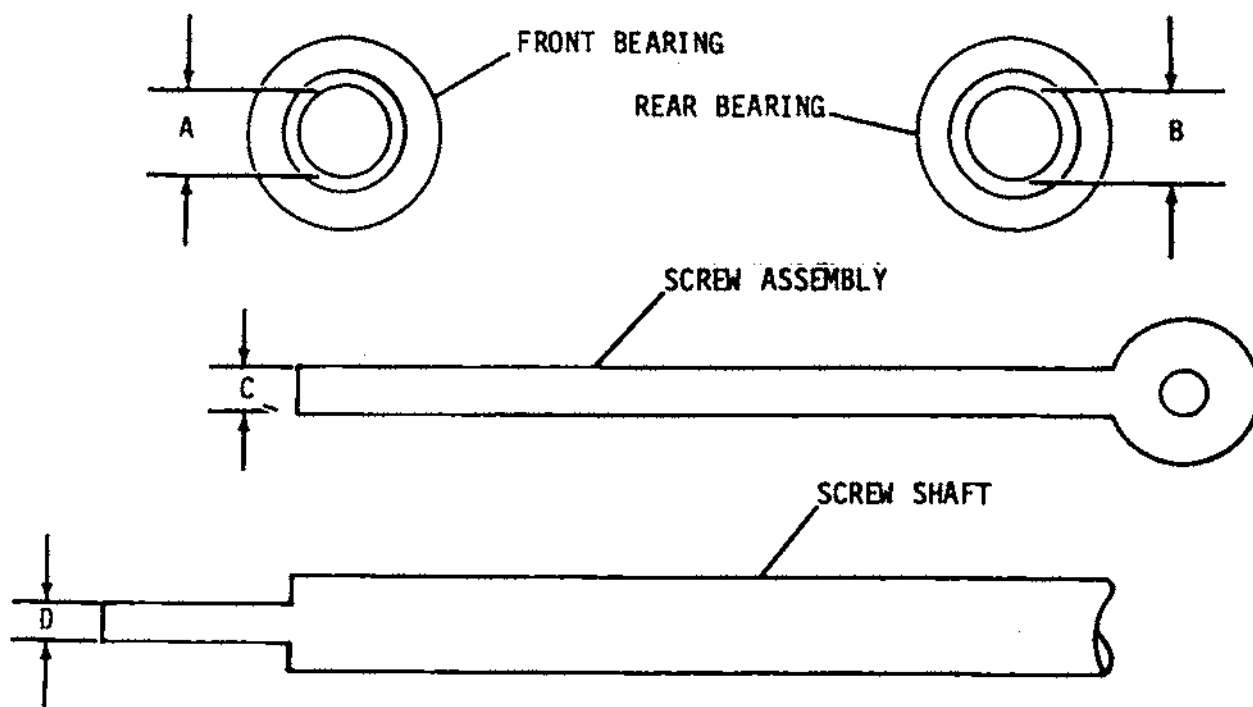
WARNING: Do not substitute actuator screws. Improper screws could cause trim system failure.

NOTE: Discard the following items and install new parts during assembly: pins (2) and (3) and O-ring packing (12).

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- (6) During reassembly, lubricate collar (9) and screw shaft (8) with light consistency silicone grease (MIL-G-83261).
- (7) Slip bearing (7) and races (6), packing (5) and bearing (4) on screw shaft (8).
- (8) Press sprocket (1) onto end of screw shaft (8), making sure pin holes are aligned. Press new pin (2) into pin holes.
- (9) Insert screw shaft (8) with assembled parts into forward end of housing (10).
- (10) Test actuator assembly by rotating sprocket (1) with fingers while holding bearing end of screw assembly (14). Screw assembly (14) should travel in and out of housing (10) smoothly with no indication of binding.

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A

0.248 IN MINIMUM, 0.253 IN MAXIMUM AIRPLANES C0001 THRU C0600
0.248 IN MINIMUM, 0.253 IN MAXIMUM AIRPLANES C0601 THRU C1800
0.247 IN MINIMUM, 0.248 IN MAXIMUM AIRPLANES C1801 AND ON

B

0.248 INCH MINIMUM, 0.253 INCH MAXIMUM AIRPLANES C0001 THRU C0600
0.248 INCH MINIMUM, 0.253 INCH MAXIMUM AIRPLANES C0601 THRU C1800
0.310 INCH MINIMUM, 0.311 INCH MAXIMUM AIRPLANES C1801 AND ON

C

0.242 INCH MINIMUM, 0.256 INCH MAXIMUM AIRPLANES C0001 THRU C0600
0.242 INCH MINIMUM, 0.246 INCH MAXIMUM AIRPLANES C0601 THRU C1800
0.308 INCH MINIMUM, 0.309 INCH MAXIMUM AIRPLANES C1801 AND ON

D

0.245 INCH MINIMUM, 0.246 INCH MAXIMUM TYPICAL ALL AIRPLANES

Elevator Trim Tab Actuator Tolerance
Figure 8A

51344004

12. Removal/Installation Elevator Trim Tab Cables (See Figure 7).

NOTE: Refer to Flight Control Maintenance Practices.

A. Remove Elevator Trim Tab Cables.

NOTE: The following procedures describe removal of elevator trim cables from the turnbuckles aft to the trim tab actuator. Refer to Removal/Installation Elevator Trim Control Wheel Assembly.

- (1) Remove cabin furnishings and carpet as required to gain access to floor panels at centerline of aircraft.
- (2) Remove center floor panels, tailcone access, stabilizer fairings, stinger and elevator trim tab actuator access, refer to Chapter 1 for locations.
- (3) Remove elevator trim cable stop blocks and bushings by removing nuts, washers and screws.
- (4) Remove turnbuckle clips and remove turnbuckles from the cables.
- (5) Remove the pressure seals.
- (6) Remove cable pulley guard pins.
- (7) Remove the two pulleys from the upper pulley bracket in the tailcone by removing nuts, washers and bolts.
- (8) Disengage chain from the trim actuator sprocket.
- (9) Attach a guide wire to the chain and remove chain and cables by pulling out through opening in the tailcone.
- (10) Attach guide wires to aft left and right cables. Remove by pulling out through opening in tailcone.

B. Install Elevator Trim Cables.

- (1) Attach chain of trim actuator to guide wire in tailcone and pull chain into position at actuator. Remove guide wire.
- (2) Evenly distribute chain around the sprocket of trim actuator. Install chain guard on actuator with clamp, washers and screws.
- (3) Install cable pulleys in upper pulley bracket, using bolts, washers, nuts and guard pins.
- (4) Attach guide wires to turnbuckle ends of cables in tailcone; pull cables into position and remove guide wires.
- (5) Connect the aft cables to the forward cables, using turnbuckles.
- (6) Install cable guard pins on pulley brackets.
- (7) Install pressure seals as follows:
 - (a) Ensure that cables are lubricated for the full length of travel within the pressure seals.
 - (b) Pack the pressure seals with MIL-G-81322A lubricant.
 - (c) Place pressure seals on cables on non-pressurized side of bulkhead with small end toward bulkhead.
 - (d) Insert pressure seals in bulkhead so that bulkhead metal is seated within the retaining groove.
 - (e) Install proper retaining rings in the grooves of the pressure seals (two on small end and one on large end).
- (8) Install stop blocks and bushings, using screws, washers and nuts. Do not tighten at this time.
- (9) Rig the elevator trim control system, refer to Adjustment/Test.
- (10) Install all floor panels, access covers, fairings and cabin furnishings.

13. Removal/Installation Elevator Trim Control Wheel Assembly and Cables (See Figure 7).

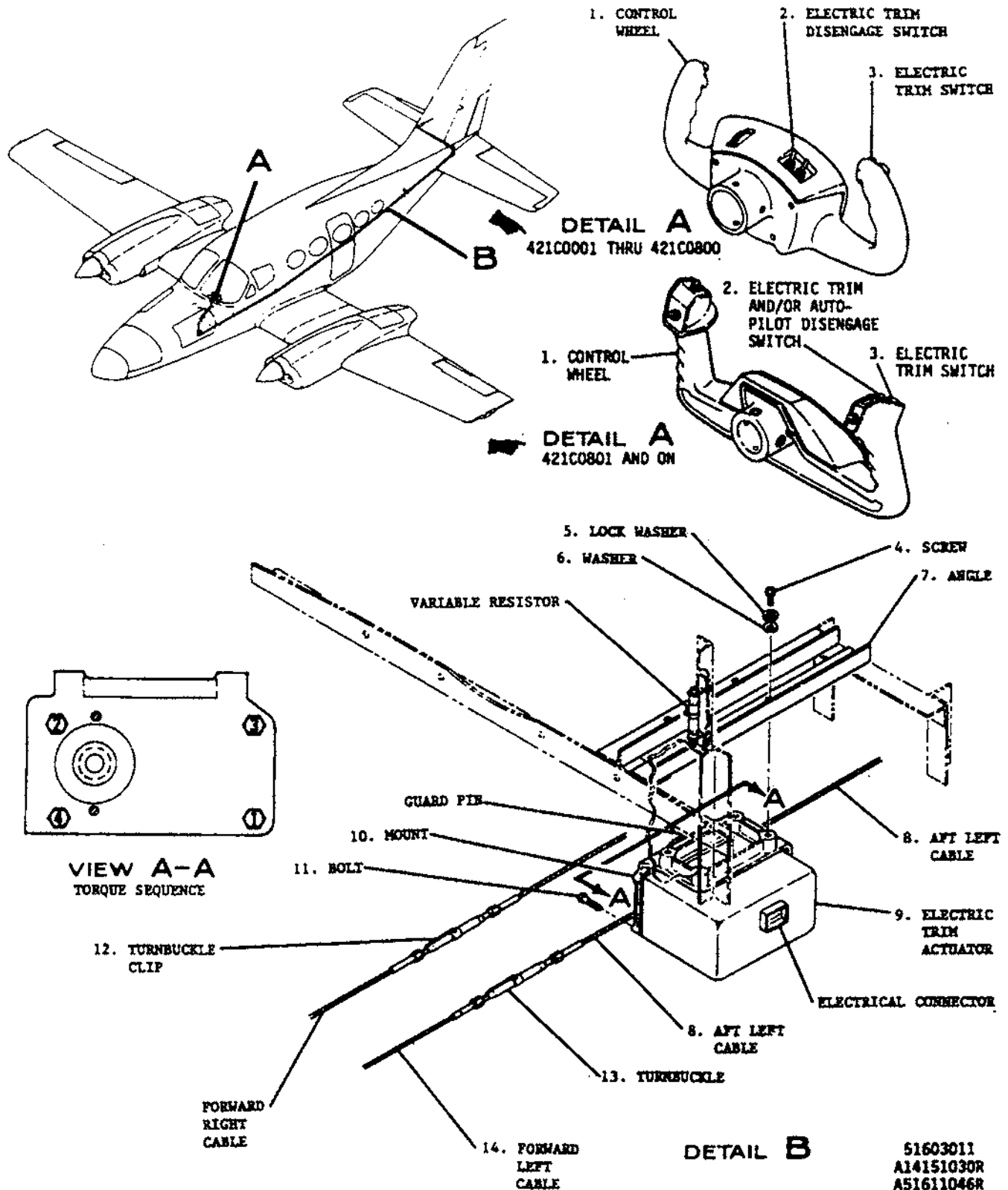
NOTE: Refer to Flight Control Maintenance Practices.

A. Remove Elevator Control Wheel Assembly.

- (1) Remove carpet, center floor panel aft of the pedestal to gain access to cable turnbuckles.
- (2) Remove turnbuckle clips and loosen turnbuckles to release tension on elevator trim control system.
- (3) Remove elevator trim control wheel by removing screws and washers.
- (4) Remove the quadrant cover, right side panel and forward panel from pedestal.

NOTE: To remove the elevator trim indicator, the rivet around which the indicator pivots must be removed.

- (5) Disengage chain from sprocket; remove sprocket from pedestal by removing cotter pin, nut, washer, bearing and bolt.



Electric Elevator Trim Actuator Installation
Figure 9

51603011
A14151030R
A51611046R
851612012
51611040

B. Install Elevator Control Wheel Assembly.

- (1) If indicator was removed, secure to pedestal cover with rivet, washers and spacer.
- (2) Install sprocket, using bolt, bearing, washer, nut and cotter pin.
- (3) Distribute chain around the sprocket evenly.
- (4) Install trim control wheel on the sprocket and secure with washer and screws.
- (5) Rig the trim control system, refer to Adjustment/Test.
- (6) Install turnbuckle clips on the cable turnbuckles.
- (7) Install pedestal access covers, floor panel and carpet.

C. Remove Forward Trim Tab Cables.

NOTE: The following procedures describe removal of elevator trim cables from the turnbuckles forward to the trim tab control wheel sprocket.

- (1) Remove the carpet.
- (2) Remove pedestal forward and right access.
- (3) Remove center floor panel aft of pedestal and cable access on bottom surface of the forward fuselage, refer to Chapter 1 for locations.
- (4) Remove turnbuckle clip and disconnect turnbuckles on left and right forward cables.
- (5) Remove the guard pins from the forward cable pulley brackets.
- (6) Attach guide wires to forward cables at turnbuckle ends and remove by pulling out through opening in pedestal.

D. Install Forward Trim Tab Cables.

- (1) Tie guide wires at pedestal to turnbuckle end of forward cables and pull cables into position.
- (2) Distribute chain evenly around sprocket in the pedestal.
- (3) Remove guide wires and connect turnbuckles to left and right cables. Do not tighten turnbuckles.
- (4) Install guard pins in the forward pulley brackets.
- (5) Rig the trim control system, refer to Adjustment/Test.
- (6) Install turnbuckle clips on turnbuckles.
- (7) Install floor panel, pedestal access covers, cable access and carpet.

14. Removal/Installation Electric Elevator Trim Actuator (Optional) (See Figure 9).

A. Remove Electric Trim Actuator.

- (1) Ensure aircraft's electrical power is OFF.
- (2) Place a suitable support under tailcone.
- (3) Remove tailcone access.
- (4) Disconnect electrical connector from electric elevator trim actuator (9).

NOTE: The electric elevator trim actuator can be removed from the mount without disturbing the elevator trim cable tension.

- (5) Remove electric elevator trim actuator (9) from mount by removing bolts (11).
- (6) If complete trim actuator and mounting removal is desired, proceed as follows:
 - (a) Remove center floor panels as necessary, to gain access to the elevator trim control cable turnbuckles (13).
 - (b) Disconnect turnbuckle (13) from cables (8 and 14).
 - (c) Remove guard pin from mount (10) and unwrap cable (8) from clutch pulley.
 - (d) Remove mount (10) from angles (7) by removing screws (4), lockwasher (5) and washers (6).

B. Install Electric Trim Actuator.

- (1) To install electric elevator trim actuator (9) on mount (10) proceed as follows:
 - (a) Align electric elevator trim actuator (9) to shaft of mount (10).
 - (b) Slide electric elevator trim actuator (9) onto shaft of mount (10).

- (c) Secure electric elevator trim actuator (9) to mount (10) with bolts (11). Torque bolts evenly in a crisscross pattern to 15-20 inch-pounds. Safety wire bolts.
- (2) If complete trim actuator and mounting is being installed, proceed as follows:
 - (a) Install mount (10) under angles (7) using screws (4), lock washers (5) and washers (6).
 - (b) Install electric elevator trim tab cable as follows:
 - 1) Position capstan of mount so that slot of capstan is facing forward and hold in this position using a suitable wrench on shaft of mount.
 - 2) Position and hold elevator trim control wheel and elevator trim tab in the normal full nose down position.
 - 3) With parts held in position, pull slack in LH aft cable forward to actuator.
 - 4) Start on the aft side with the fourth groove in from end of capstan and wrap cable counterclockwise three full turns around capstan with swaged ball of cable positioned in slot on forward side of capstan.
 - 5) Connect turnbuckle (13) to cables (8 and 14).
 - 6) Connect electrical connector to electric elevator trim actuator (9).
- (3) If procedures in Step (1) were used for installation, check for correct trim tab deflection. Refer to Inspection/Check.
- (4) If procedures in Step (2) were used for installation, rig elevator trim control system. Refer to Adjustment/Test.

NOTE: Operate electric elevator trim actuator through entire travel and observe that cable remains in groove and the swaged ball does not move out of the horizontal groove.

- (5) Check electric elevator trim actuation time as follows:
 - (a) Turn elevator trim control wheel so that indicator is at the maximum nose up position.
 - (b) Using a grease pencil or equivalent, make a reference mark on the elevator trim control wheel.

NOTE: Use external power supply and ensure voltage on airplane bus is $27.5 \pm .25$ volts.

- (c) With electrical power on airplane set electrical trim switch to nose down position and check the time in seconds to obtain three revolutions of the elevator trim control wheel. Proper time is 21 ± 2 , -0 seconds.
- (d) Manually turn elevator trim control wheel in the opposite maximum position and repeat Step (c).
- (e) If the time to obtain three revolutions of the elevator trim control wheel is not 21 ± 2 , -0 seconds, adjust the external variable resistor and repeat Steps (c) and (d).
- (f) If by adjusting the external variable resistor it is impossible to obtain proper time, remove the plug button from the actuator and adjust the potentiometer inside the actuator to obtain the specified time.
- (g) Recheck the elevator trim indicator for correct indication in the NOSE UP position, NOSE DOWN position and TAKEOFF position.

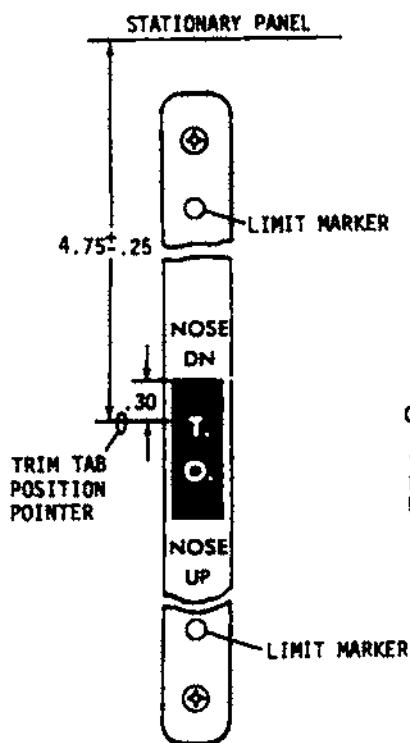
WARNING: INSURE THAT ELEVATOR TRIM TAB MOVES IN THE PROPER DIRECTION WHEN OPERATED BY THE ELEVATOR TRIM CONTROL WHEEL AND THE ELECTRIC TRIM SWITCH.

- (6) Install all floor panels removed and install tailcone access panel.

15. Removal/Installation Elevator Trim Tab Position Marker.

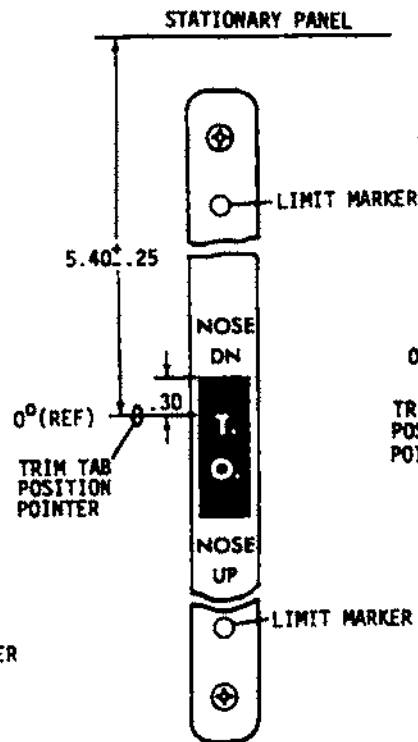
A. Remove Elevator Trim Tab Position Marker.

- (1) Pry out marker indicating pointer travel limits.
- (2) Remove screws at each end of placard.
- (3) Remove placard from pedestal.



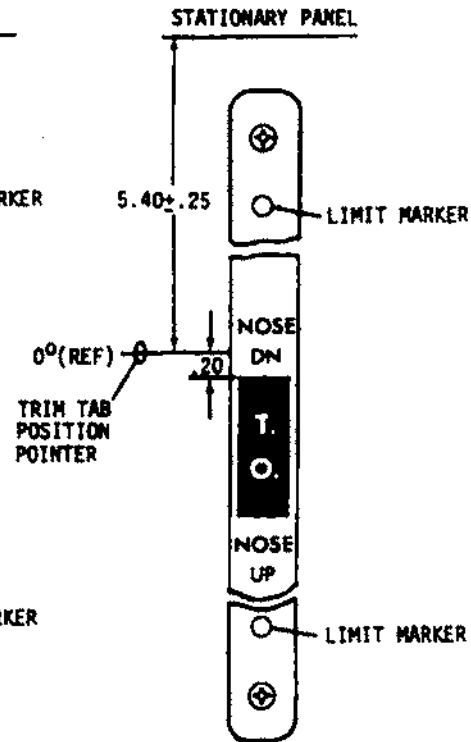
421C0001 THRU 421C0600

Elevator Tab Position Marker
Figure 10.



421C0601 THRU 421C0800

Elevator Tab Position Marker
Figure 11.



421C0801 AND ON

Elevator Tab Position Marker
Figure 12.

5100180

- B. Install Elevator Trim Tab Position Marker.
- (1) Place placard on pedestal.
 - (2) Install screws at each end of placard and limit markers in holes they were removed from.
- C. If a new placard is installed use old placard as template for drilling holes in new placard (See Figure 10, 11 or 12 for dimensions).
- D. If a New Pedestal Cover is Installed (See Figure 9, 10, 11 or 12).
- (1) Set elevator tab at neutral (0°) and adjust pointer (if necessary) to limits.
 - (2) Locate placard as shown. Install screws and trim ends as required.
 - (3) Rotate trim wheel to limits (full up, full down) and locator markers.

FLAP CONTROL SYSTEMDescription

1. The flap system is electrically actuated. The flap system provides lift to the wing when partially extended and increases drag to reduce speed when fully extended during landing. The system consists of a flap preselect assembly and flap actuator assembly. The flap actuator assembly is an electric motor which drives a gear reduction unit. Sprockets (two), connected in tandem to the reduction unit output shaft; drive two chain cables. The chain cables actuate three bellcranks in each wing. The bellcranks are interconnected by push-pull tubes. The flap preselect assembly consists of a preselect lever assembly mounted on the instrument panel and a flap preselect control cable. The flap preselect control cable is attached to the preselect lever assembly and routed aft under the floor and connected to the right flap extend cable. When the preselect lever assembly is placed in the 0° (UP), or 15°, 30° or 45° (DOWN) positions, microswitches attached to the preselect lever assembly arm actuates the flap motor, which drives the flaps until the corresponding flap position is reached. As the flaps reach the preselected position, the preselect microswitches are de-energized. Also, a flap and landing gear warning switch is mounted on the preselect bracket to provide an aural warning any time the preselect lever is lowered past the 15° position with the landing gear not extended and locked. For more information on flap/landing gear switch, refer to Chapter 4.

CAUTION: PRIMARY AND SECONDARY FLIGHT CONTROL CABLES, PUSH-PULL TUBES, BELLCRANKS AND MOUNTINGS USE DUAL LOCKING FASTENERS. THE LOCK NUTS FOR THESE FASTENERS INCORPORATE A FIBER LOCK, AND ARE CASTELLATED FOR SAFETYING WITH A COTTER PIN. WHEN ANY OF THESE AREAS ARE DISCONNECTED, NEW DUAL LOCKING FASTENERS SHOULD BE INSTALLED. SEE THE AIRCRAFT PARTS CATALOG FOR PART NUMBERS AND LOCATION OF THESE FASTENERS.

Troubleshooting

1. Troubleshooting of the flap control system is determining if the trouble exists in the flap preselect system or flap actuation system.
2. Tools and Equipment.

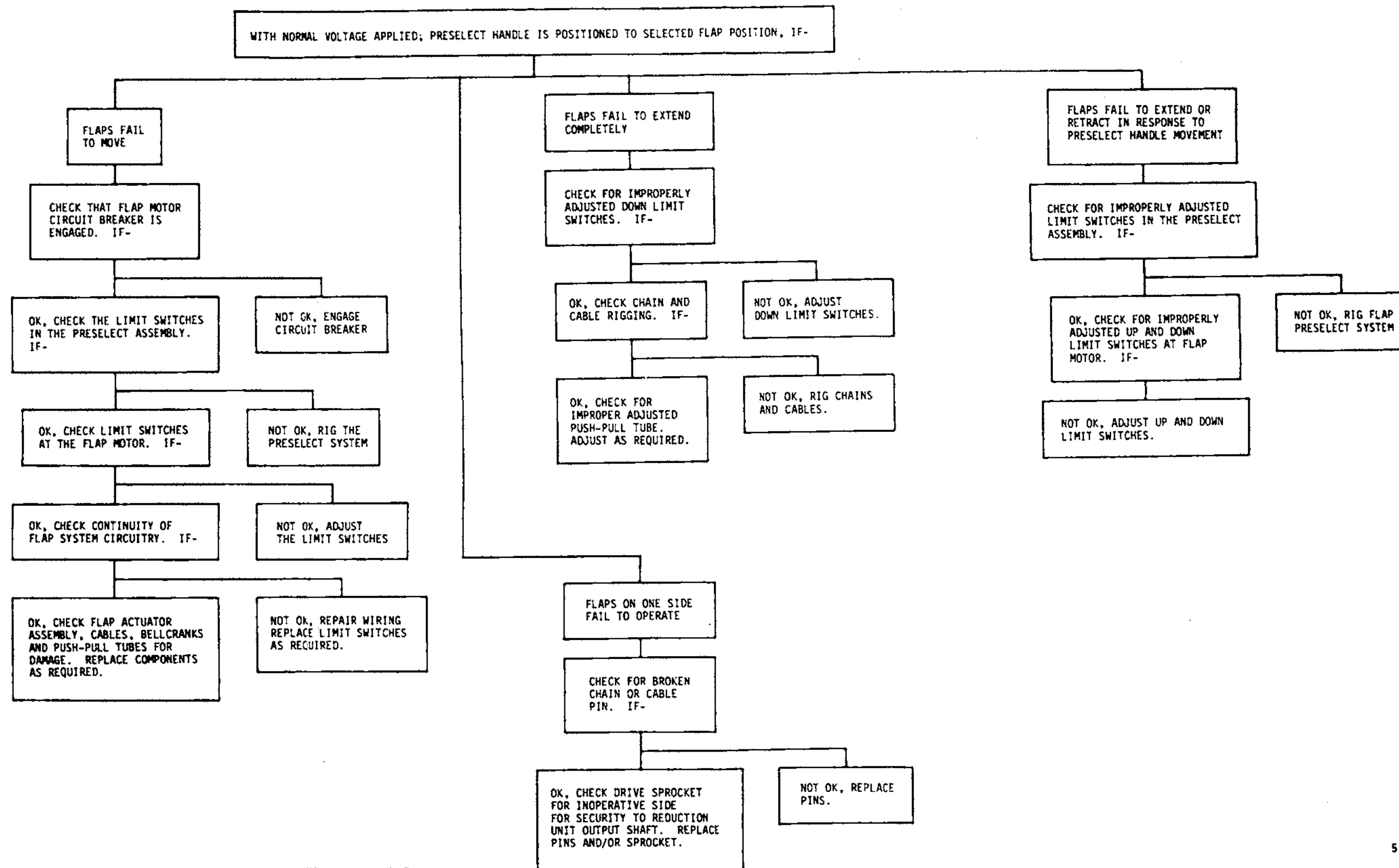
NOTE: Equivalent substitutes may be used instead of the following listed items:

Name	Number	Manufacturer	Use
Inclinometer	SE716	Cessna Aircraft Co. Wichita, Kansas	To measure travel of control surfaces.
Tensiometer	T5-2002-0101	Pacific Scientific Co. Los Angeles, Calif.	To measure flap extend cables.
Tensiometer	T60-100-1	Pacific Scientific Co. Los Angeles, Calif.	To measure flap return cables.
Multimeter	Model 260	Simpson	To measure voltage and resistance in electrical circuits.

NOTE: Inclinometer is available from Cessna Service Center.

3. Troubleshooting Flap Control System.

- A. For a guide to troubleshooting the flap control system, see Figure 1.



Troubleshooting Chart - Flap Control System
Figure 1

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Adjustment/Test

1. Tools and Equipment.

NOTE: Equivalent substitutes may be used instead of the following listed items:

Name	Number	Manufacturer	Use
Inclinometer (4 Required)	(See Note)	Commercially Available	To measure travel of control sur- faces.
Tensiometer	T5-2002-0101	Pacific Scientific Co. Los Angeles, Calif.	To measure flap extend cables.
Tensiometer	T60-100-1	Pacific Scientific Co.	To measure flap return cables.

NOTE: Inclinometer capable of measuring 0° to 50° (1/2° increment).

2. Rigging Flap Control System.

- A. Refer to Chapter 12. Remove cabin seats and carpet.
- B. Remove floor panel above flap actuator assembly and access covers at flap bell-cranks. Disconnect flap preselect cable from flap extend cable.
- C. Remove inspection plates forward of rear spar adjacent to wheel well.
- D. Connect a 24-volt external power source.

NOTE: To facilitate rigging of the flap system, a two-position momentary switch with suitable lengths of electrical wires can be connected to the flap actuator limit switches in such a manner that the flaps can be observed while being operated during rigging.

CAUTION: WHEN CONNECTING THE MOMENTARY SWITCH, MAKE SURE THE FLAP MOTOR LIMIT SWITCHES ARE NOT BY-PASSED TO AVOID DAMAGE TO THE FLAP SYSTEM. CONNECTING THE SWITCH TO WIRING BETWEEN THE FLAP PRESELECT AND THE FLAP MOTOR WILL INSURE THAT THE LIMIT SWITCHES HAVE NOT BEEN BY-PASSED. (DO NOT ATTACH DIRECTLY TO THE MOTOR TERMINALS).

- E. Extend the flaps and disconnect the push-pull rods from inboard and outboard flaps. Ensure push-pull rods are clear of moving parts.
- F. (See Figure 2A.) Adjust each inboard flap push-pull rod to 10.45 inches.

NOTE: Length of push-pull rods is measured between centerlines of rod end bolt holes. The inboard and outboard flaps cannot be adjusted simultaneously. Adhere to the rigging notes as flap rigging is performed.

- G. (See Figure 2A.) Adjust inboard and outboard interconnect push-pull tubes to 23.80 inches

NOTE: Use push-pull rod inspection holes to verify that there is sufficient thread engagement of the rod end to reach at least to the inspection hole.

- H. Tighten jam nuts on interconnect tubes finger-tight to maintain these dimensions. Install interconnect tubes between bellcranks.

NOTE: Do not safety any parts until rigging is completed, or necessary adjustments cannot be accomplished.

- I. Ensure that flap push-pull rods are free and straight; replace if bent. Do not attach to flaps.
- J. (See Figure 5.) Adjust up limit switch (10) to upper 1/4 range of adjustment. Ensure flap actuator cam (13) is tight on shaft.
- K. Operate flap actuator in up direction until up limit switch (10) is actuated.
- L. With the flap linkage in the FLAP UP position, check for correct position of the flap chains on sprockets and, if necessary, adjust as follows.
 - (1) Engage right bottom chain so that approximately 2-1/2 links extend around bottom of aft sprocket.

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- (2) Engage left top chain so that three links extend around top side of forward sprocket.
- (3) Connect cables to chain with turnbuckles. Be sure that top cables on each side are connected to top chains and that bottom cables are connected to bottom chains.
- (4) (Refer to Figure 2A.) Adjust cables to position inboard bellcranks at 45° relative to the rear spar per dimensions shown. Adjust all cables to 250 pounds tension.

CAUTION: CABLE TENSION SHOULD BE ADJUSTED WHEN AMBIENT TEMPERATURE IS BETWEEN 60°F AND 90°F. ALLOW AIRPLANE TO STABILIZE AT OR BETWEEN THESE TEMPERATURES FOR AT LEAST FOUR (4) HOURS. A MAXIMUM OF (3) THREADS ALLOWED TO EXTEND OUT OF TURNBUCKLES.

- M. (Refer to Figure 2A.) Adjust inboard interconnect push-pull tubes as necessary to obtain bellcrank angle of 45° or the specified dimensions for outboard bellcrank.
- N. Use momentary switch to rotate bellcranks so that flap push-pull rods may be attached. Only a small amount of bellcrank rotation is necessary. Watch cam on flap motor. Stop motor when cam has moved no more than halfway between the limit switch arms (Refer to Figure 5).

CAUTION: FLAP ACTUATOR DOWN SWITCH AND PRESELECT DOWN LIMIT SWITCH ARE INEFFECTIVE. DO NOT ALLOW BELLCRANKS TO MOVE ANYMORE THAN NECESSARY TO INSTALL FLAP RODS OR SYSTEM MAY BE DAMAGED. DO NOT ALLOW FLAP RODS TO PULL UP INTO WING OR TO BIND ON ANY PART OF THE AIRFRAME OR RODS MAY BE BENT.

- O. Install push-pull rods to inboard flaps only. Leave outboard flaps disconnected.
- P. Raise flaps. When initial contact is made between flap trailing edge and wing trailing edge, stop travel and adjust rods as necessary. Do not allow flaps to close completely against wing unless both wing and flap trailing edges are parallel and flaps will fit evenly.
- Q. Adjust right inboard flap and left inboard flap evenly. Do not attempt to set one side completely without setting the other side or damage to the system may result.
- R. Recheck up limit switch for activation after each adjustment.

CAUTION: DO NOT ALLOW FLAP PANELS TO TIGHTEN EXCESSIVELY AGAINST WING. AIM A FLASHLIGHT BEAM ACROSS FLAP PANEL SKIN. IF SKIN DEFLECTS UPWARDS AFTER FLAP PANEL CONTACTS WING TRAILING EDGE, FLAP PANEL IS TOO TIGHT. ADJUST PUSH ROD AS NECESSARY.

- S. Attach an inclinometer to each flap panel using tape or other means. Be sure base of inclinometer is flat against bottom of flap panel. Check inclinometer for free operation and zero degree indication.
- T. Lower flaps using momentary switch or with a technician in the cockpit and at each wing. Look and listen for any unusual tension buildup in the cables or binding or push-pull tubes, until flaps reach 45° +1°, -0°, as indicated by the inclinometers.
- U. Rig both extend cables to 85 pounds ±10 pounds tension.
- V. Adjust flap actuator down limit switch to provide correct down flap angle.
- W. Raise flaps to 0°. Check up limit switch for correct operation.
- X. Check flap return cables for 250 +25, -25 pounds tension.
- Y. All flap panels cannot be adjusted simultaneously. Use the following procedure.
 - (1) (Refer to Figure 4.) Adjust outboard flap push-pull rod so that 0.15 inch clearance exists between rod and torque tube.
 - (2) Extend inboard flaps to 45°.
 - (3) Connect outboard flaps.
 - (4) Adjust flap scissor rod ends to obtain 45° +1°, -0° on outboard panels.
 - (5) Raise flaps to 0° position. Check proper fairing of outboard flaps with trailing edge of wing.
 - (6) From this point on, flap travel adjustment should be accomplished by adjusting the flap scissor rod ends. If adjusting the flap scissor rod ends will not provide correct angular positions, adjust the push-pull rod as follows.
 - (a) Lower flaps.
 - (b) Disconnect flap.
 - (c) Adjust rod 1/2 turn.

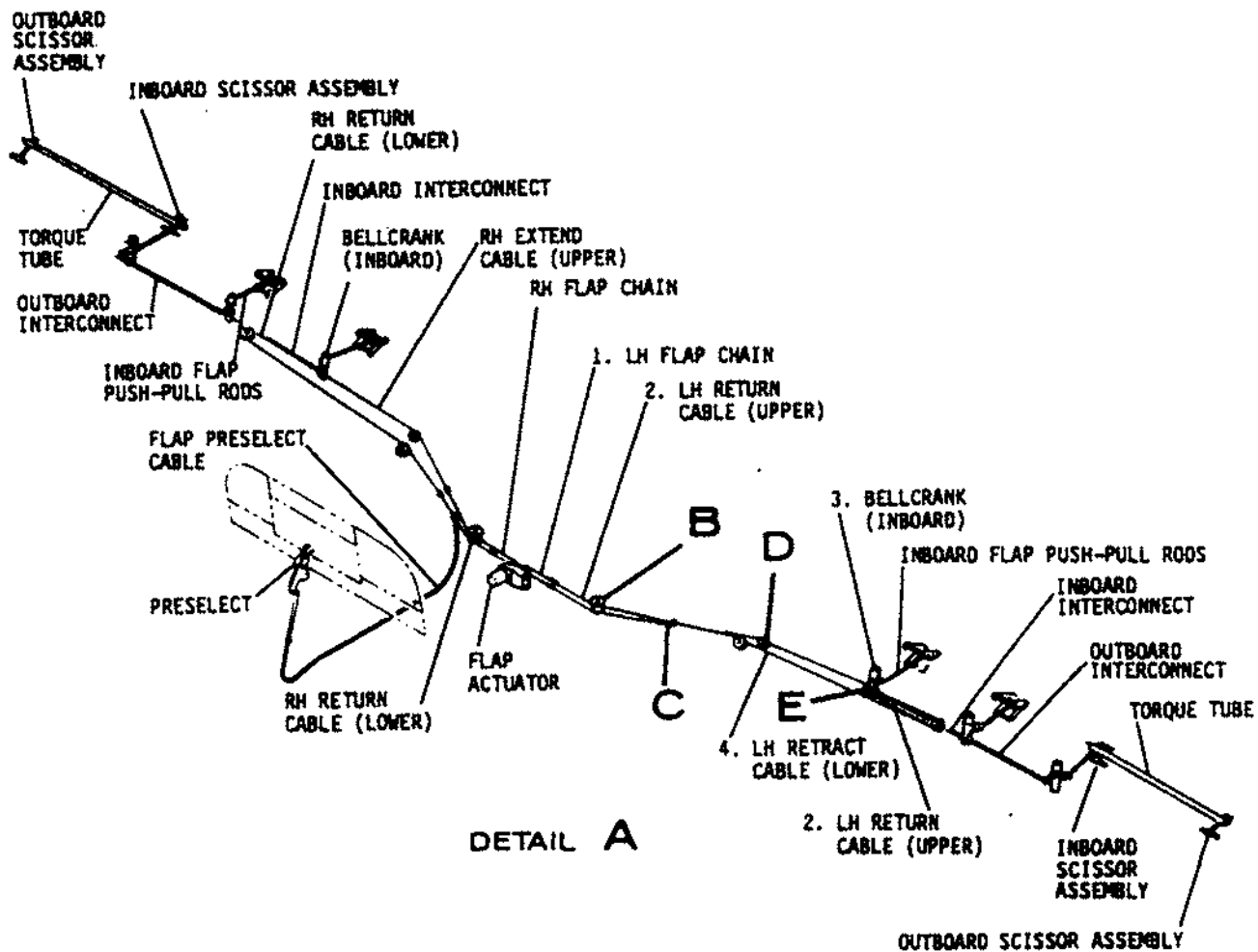
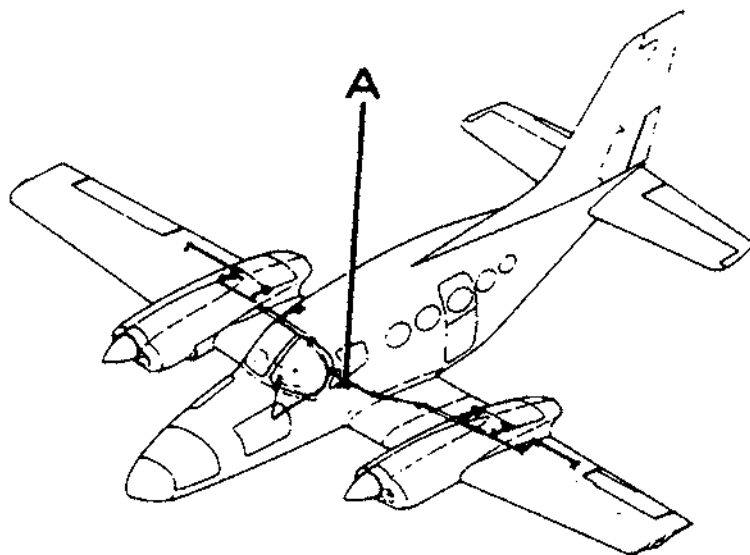
- (d) Retract flaps.
- (e) Check for 0.15 inch clearance (.03 inch minimum).
- (f) Lower flaps.
- (g) Attach flap panel.
- (h) Raise flaps. Check angle at each preselect point.
- (i) Repeat Steps (a) through (h) as often as necessary to obtain correct positions.

CAUTION: UNDER NO CIRCUMSTANCES ALLOW FORE-AFT ROD TO CONTACT TORQUE TUBE OR BINDING AND DAMAGE TO THE SYSTEM MAY RESULT.

- (7) Set tension of return cables to 280 $\pm$ 20 pounds tension.
- Z. Lower flaps. Check down limit switch for proper operation.
- AA. Set final tension on extend cables to 85 $\pm$ 10 pounds tension.
- BB. Raise flaps to 0° position. Check return cable tension. If tension must be reset, lower flaps and check extend cables for proper tension.
- CC. Tighten all linkage fasteners and install cotter pins.
- DD. Check flaps for proper operation and correct positions to verify that no change has taken place as a result of tightening linkage fasteners.
- EE. (See Figure 6.) Rig flaps preselect system as follows:
 - (1) Lower flaps to full down position.
 - (2) Attach preselect cable clamp block to flap cable, align with preselect cable end and approximately 0.50 + .25 inch from flap pulley, leave conduit nuts loose and attach cable end to clamp block. Adjust cable conduit to extend cable out of housing from full in position by .10 inch.
 - (3) Adjust conduit and/or cable end to position control arm parallel.
 - (4) Raise flaps to full up position.
 - (5) Adjust both limit switches at flap preselect control so that switch rollers are snug against cam (see Figure 6).
 - (6) Check for clearance between control arm and panel, .20 inch minimum.
 - (7) If necessary, adjust control cable in control arm slot to obtain clearance.
 - (8) Move flap lever to 15° detent. Loosen adjustment screw between flap preselect lever and cam.
 - (9) Check angle of flap panels. Move cam to obtain 15° + 5° down travel and 15° + 0 - 2° up travel on the inboard flap; 15° + 5° down travel and up travel on the outboard flap.
 - (10) Tighten cam adjusting screw with flaps at this angle.
 - (11) Adjust pointer to 15° mark by bending wire.
 - (12) Match pointer arc with indicator block and guard block by adjusting block vertically. Slotted holes are provided for this adjustment.
 - (13) Adjust flap preselect lever up stop bolt to limit travel to 0° with 225 $\pm$ 25 pounds return cable tension.
 - (14) Adjust lever down stop bolt to limit lever to full down travel at 45° + 1°, - 0°.
 - (15) Adjust flap/landing gear warning limit switch to activate alarm with flap handle 0.04 inch to 0.08 inch below 15° detent.
 - (16) Disconnect momentary switch (if used).
 - (17) Repeat check of flap travel, up and down.

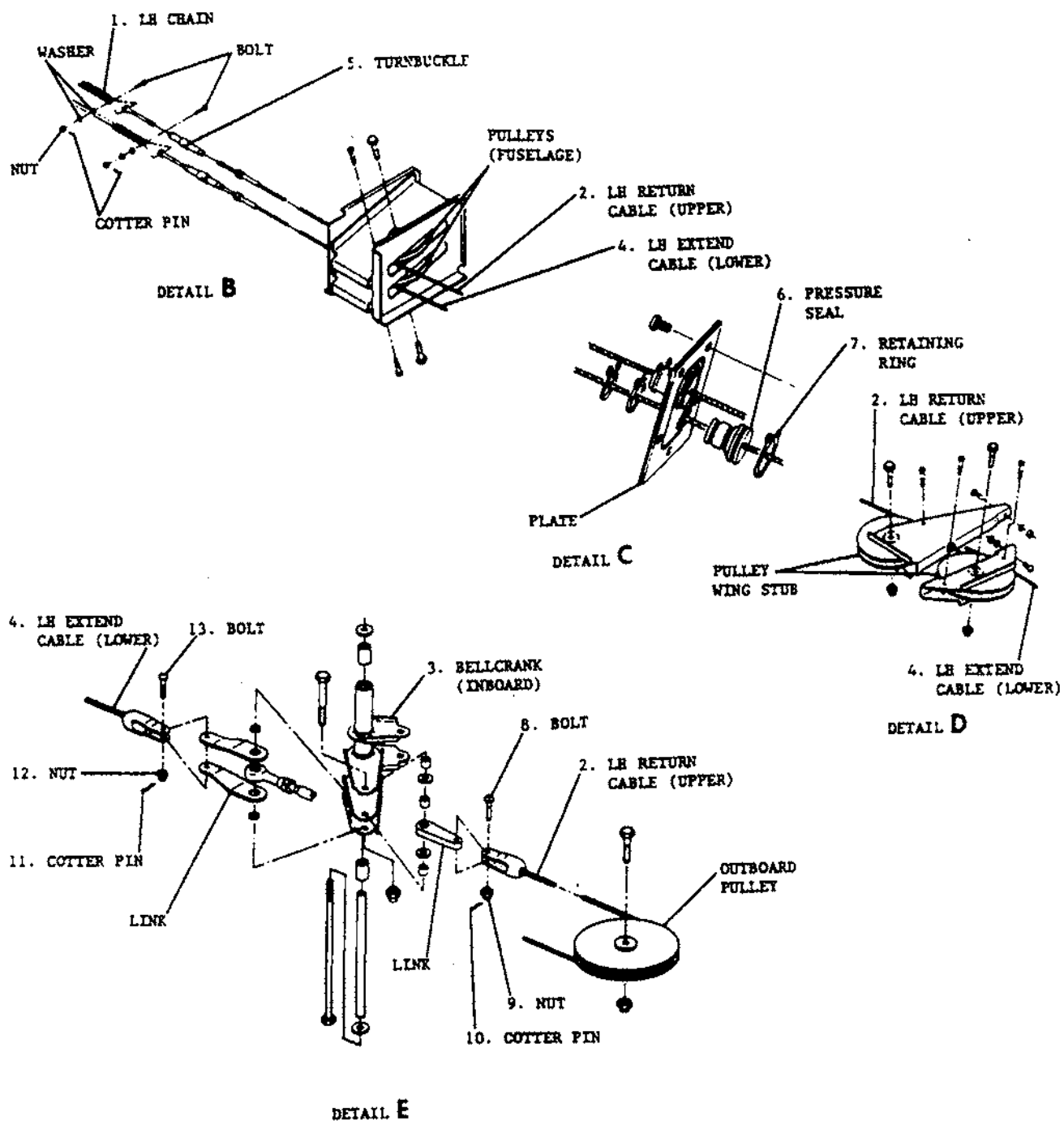
NOTE: Inboard flap panel must match within 2° and outboard flap panel must match within 2° at 15° and 30° positions.

- (18) Retract flaps. Place flap lever in full down position. Note the time required for flaps to extend. Time should be nine to fourteen seconds.
- (19) Place flap lever in full up position. Time for flap retraction should be six to ten seconds.
- (20) If flap operating time limits outlined in step (18) and (19) do not meet requirements perform operational check of flap motor.
- (21) Safety all turnbuckles.
- (22) Install access panels and floor panels.
- (23) Install carpets and seats. Refer to Chapter 12.
- (24) Remove inclinometers from flap panels.



Flap Control Cable Installation
Figure 2 (Sheet 1 of 2)

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Flap Control Cable Installation
Figure 2 (Sheet 2)

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3. Flap System Functional Test

NOTE: Airplane temperature must be stabilized between 60°F and 90°F for at least four hours.

- A. Tape an inclinometer to each flap panel.
- B. Operate flaps with preselect using airplane battery or A.P.U.
 - (1) Monitor flaps during travel for excessive binding or tensions.
- C. Flaps - up.
 - (1) Check return. Cable tension (225 + 25 pounds).
 - (2) Actuate the preselect up limit (aft) switch. The flap motor should momentarily rotate until actuator up limit switch is reached. Check return cable tension (280 + 20 pounds).
- D. Move preselect flap handle down to 15° detent. Check flap angle for 15° + 5°.
- E. Move preselect flap handle down to 30° detent - check flap angle for 30° ± 5°. Inboard and outboard flaps must have no more than 2° difference comparing inboard to inboard and outboard to outboard.
- F. Move preselect flap handle to full down. Check flap angle for 45° + 1°, -0°. Inboard and outboard flaps must have no more than 1° difference comparing inboard to inboard and outboard to outboard.
 - (1) Actuate the preselect down limit (fwd) switch. The flap motor should momentarily rotate until actuator down limit switch is reached.
- G. Check operation of pointer as viewed from pilot's normal eye location.
- H. Check extend (9-14 sec.) and retract (6-10 sec.) times.
- I. Remove inclinometers.

4. Flap System Rigging Notes

- A. Lengthening push rods will tend to increase return cable tension while decreasing down angle.
- B. Lengthening outboard panel flap rod will increase down angle without severely changing cable tension. Lengthening outboard flap push-pull rod will increase return cable tension without severely changing down angle.
- C. Increasing cable tension of any cable will tend to increase tension of both cables in the opposite wing while decreasing tension of the remaining cable in the same wing. This occurs due to a sideways force placed on the flap motor when any cable is tightened.
- D. Tightening any flap panel (up) tends to loosen all other panels.
- E. Adjusting inboard push rods will create more cable tension change than adjusting outboard push rods.
- F. If possible, adjust final cable tension by rigging outboard flap panels tighter (up) than inboard panels (lengthen outboard push rods).
- G. Set final return cable tensions as close as possible to 250 pounds. Set final extend cable tensions as close as possible to 85 pounds.

Inspection/Check

1. Tools and Equipment.

NOTE: See Adjustment/Test for tools and equipment.

2. Flap Control System Check.

NOTE: Angular dimensions for checking flaps are measured by placing inclinometer on flap surface. Flap is in zero degree position when the trailing edge is streamlined with bottom surface of the wing trailing edge.

3. Flap Deflection Check.

- A. Move flap preselect lever to zero degree position, measure angle of flap.
- B. Move flap preselect lever to 15° +0° down, measure angle of flap.
- C. Move flap preselect to 30° +2° down, measure angle of flap.
- D. Move flap preselect to 45° ±1°, -0° down, measure angle of flap.

4. Flap Cable Check.

- A. Refer to Chapter 12. Remove passenger seats and carpet.
- B. Refer to Chapter 1. Remove floor panels at flap actuator.
- C. Place tensiometer on the return cables and read cable tension.
- D. Extend flaps, place tensiometer on the extend cables and read cable tension. For cable temperature tension NOTE, refer to Adjustment/Test.
- E. Reinstall floor panels, passenger seats and carpet.

5. Flap Inspection.

A. Extend flaps.

Maintenance Practices

1. Removal/Installation Inboard Flap (See Figure 3).

NOTE: The following is a removal/installation procedure for the left inboard flap. Removal/installation of the right-hand inboard flap is similar.

A. Remove Inboard Flaps.

- (1) Extend flaps.
- (2) Remove aft wing gap cover, refer to Chapter 1.
- (3) Disconnect lower scissors link (37) from flap structure by removing cotter pin, nuts (40), washers (39), spacers (36 and 38) and bolts (35).
- (4) Remove safety wire from bent end of hinge pin (1), and detach inboard flap by removing hinge pin (1).

B. Install Inboard Flaps.

- (1) Attach inboard flap to wing with hinge pin (1). Safety bent end of hinge pin (1).

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

- (2) Connect lower scissor links (37) to flap by installing bolts (35), spacers (36 and 38), washers (39) and nuts (40) and cotter pins.
- (3) Replace aft wing gap cover.
- (4) Check flap for proper operation and correct travel. Refer to Adjustment/-Test.

2. Removal/Installation Outboard Flaps (See Figure 4).

NOTE: The following is a removal/installation procedure for the left outboard flap. Removal/installation of the right-hand outboard flap is similar.

A. Remove Outboard Flaps.

- (1) Extend flaps.
- (2) Disconnect flap scissors (27 and 42) from flap structure by removing cotter pins (29 and 43), nuts (30 and 44), washers (28 and 42), spacers (32 and 46) and bolts (31 and 45).
- (3) Remove safety wire from bent end of hinge pin (1), and detach flap by removing hinge pin (1).

NOTE: If difficulty is encountered in removing outboard flap hinge pin, it may be necessary to remove aileron to gain better access to hinge pin.

B. Install Outboard Flap.

- (1) Attach outboard flap to wing with hinge pin (1). Safety wire bent end of hinge pin.

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

- (2) Connect flap scissors (27 and 41) to flap structure by installing bolts (31 and 45), spacers (32 and 46), washers (28 and 42), nuts (30 and 44) and cotter pins (29 and 43).
- (3) Check flap for proper operation and correct travel. Refer to Adjustment/-Test.

3. Removal/Installation Inboard Flap Bellcrank (See Figure 3).

NOTE: The following is a removal/installation procedure for the left inboard bellcrank. Removal/installation of the right-hand inboard bellcrank is similar.

A. Remove Inboard Flap Bellcrank.

- (1) Remove passenger seats and carpet. Refer to Chapter 12.
- (2) Remove floor panel from above flap actuator and at inboard bellcrank.
- (3) Remove plug button and rear spar access cover adjacent to bellcrank (18).
- (4) Lower flaps several degrees to decrease tension on return cable (9), remove safety and loosen turnbuckles (5, Figure 2) to release tension on cables.
- (5) Disconnect extend cable (23) and return cable (9) from cable attachment links by removing cotter pins (11 and 21), nuts (10 and 22) and bolts (8 and 24).
- (6) Disconnect push-pull rod (2) from bellcrank (18) by removing cotter pin (6), nut (5), spacers (4) and bolt (3).
- (7) Disconnect interconnecting push-pull tube (20) from bellcrank (18) by removing cotter pin (13), nut (14), spacers (12), links, washers (7) and bolt (26).
- (8) Remove bellcrank (18) by removing safety wire from bolt (17); remove bolt (17) and washers (15 and 27), taking care that bushing (16) does not fall from bellcrank during removal.

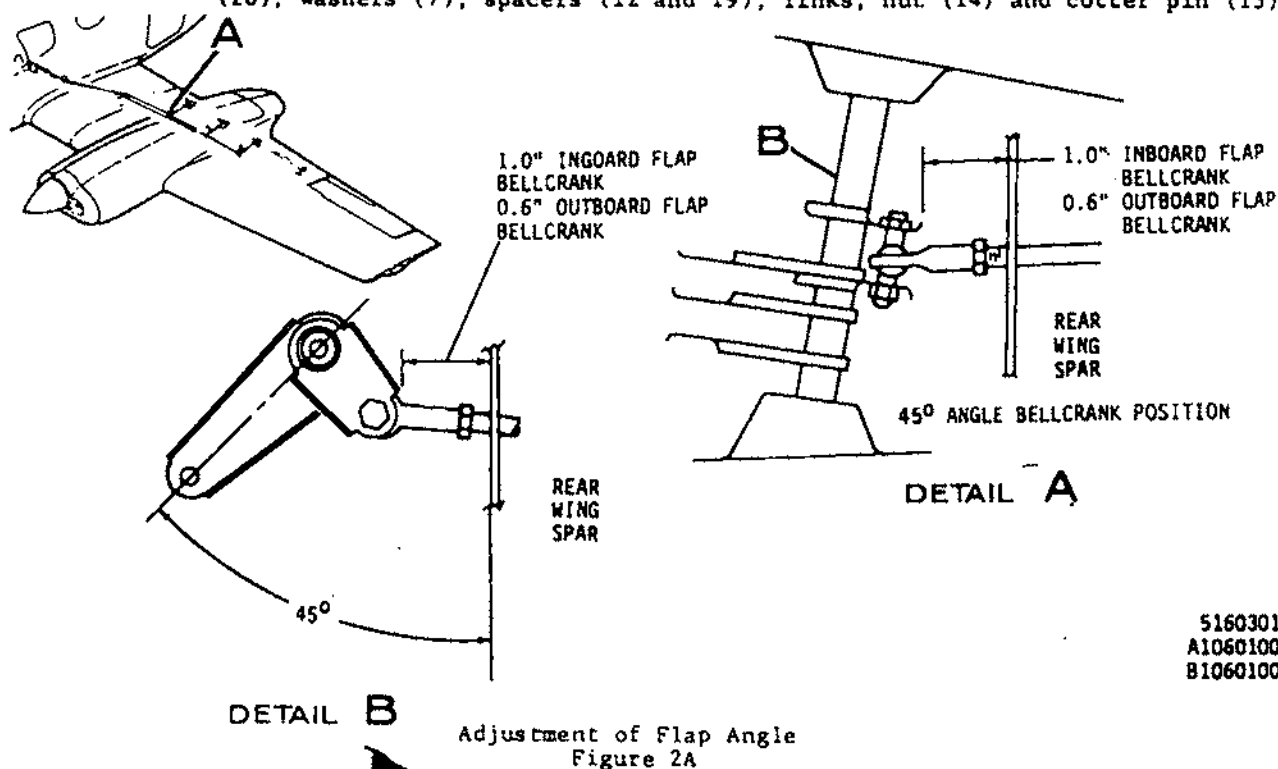
B. Install Inboard Flap Bellcrank.

- (1) Insert bellcrank (18) through access hole with bushing (16) installed. Install washers (15 and 27) and bolt (17). Safety bolt and install plug button on underside of wing beneath bolt.

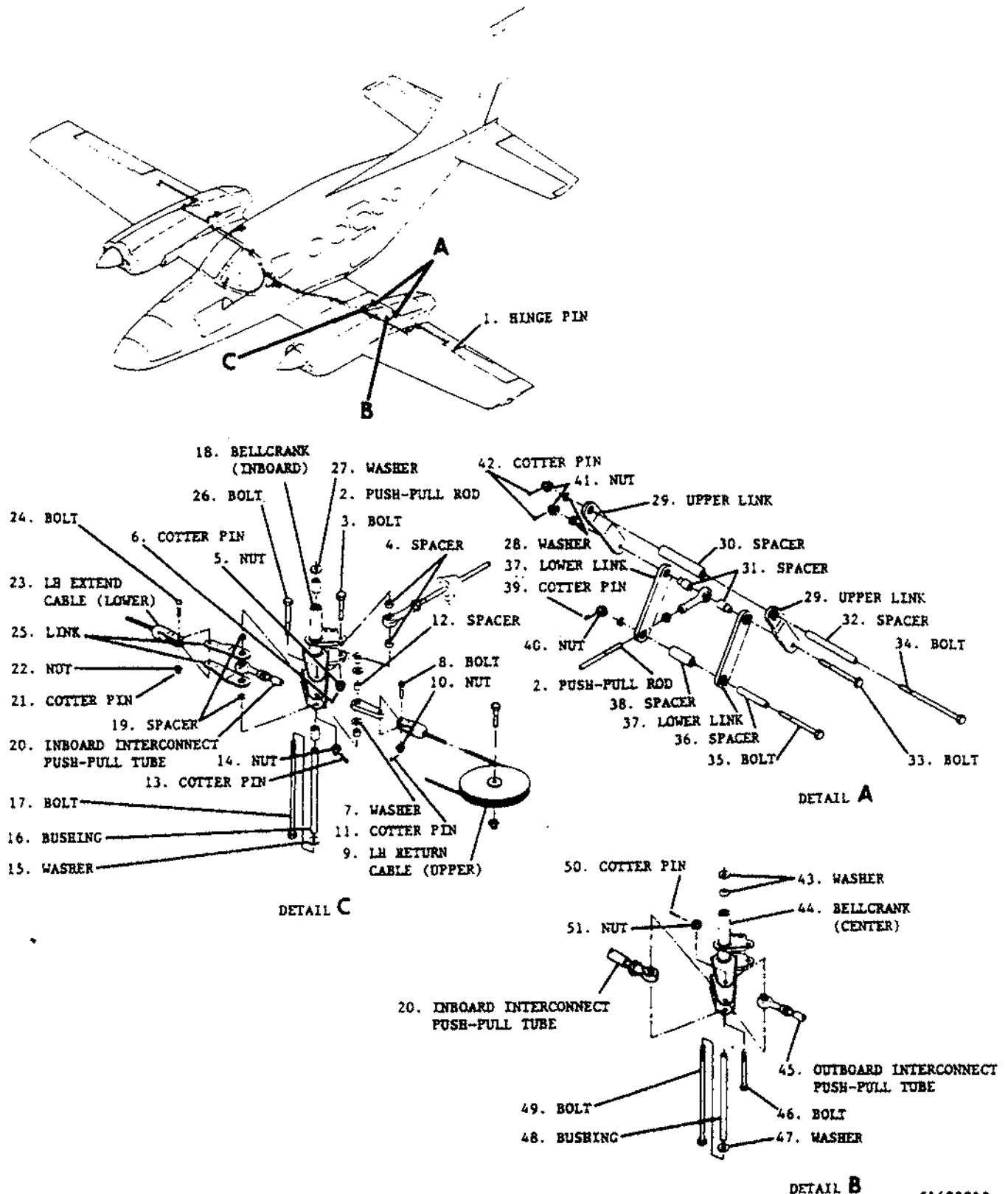
NOTE: Washers (15 and 27) and bushing (16) must be in place before installing bolt (17).

NOTE: Before safetying bolt (17) check bellcrank (18) for freedom to rotate without binding.

- (2) Attach interconnecting push-pull tube (20) to bellcrank (18), using bolt (26), washers (7), spacers (12 and 19), links, nut (14) and cotter pin (13).



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Inboard Flap and Bellcrank Installation
Figure 3

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- (3) Connect push-pull rod (2) to bellcrank (18) with bolt (3), spacers (4), nut (5) and cotter pin (6).
- (4) Connect flap extend cable (23) to links (25) with bolt (24), nut (22) and cotter pin (21).
- (5) Connect flap return cable (9) to link with bolt (8), nut (10) and cotter pin (11).
- (6) Rig flaps, refer to Adjustment/Test.
- (7) Reinstall access covers and floor panels.
- (8) Install carpet and seats. Refer to Chapter 12.

4. Removal/Installation Center Flap Bellcrank (See Figure 3).

NOTE: The following is a removal/installation procedure for the left center bellcrank. Removal/installation of the right-hand center bellcrank is similar.

A. Remove Center Flap Bellcrank.

- (1) Extend flaps.
- (2) Remove plug button and rear spar access cover adjacent to bellcrank (44).
- (3) Disconnect push-pull rod (2) from bellcrank (44) by removing cotter pin (6), nut (5), spacers (4) and bolts (3).
- (4) Disconnect interconnecting push-pull tubes (20 and 45) from bellcrank (44) by removing cotter pin (50), nut (51) and bolt (46).
- (5) Remove bellcrank (44) by removing safety wire from bolt (49); remove bolt (49) and washers (43 and 47), taking care that bushing (48) does not fall from bellcrank during removal.

B. Install Center Flap Bellcrank.

- (1) Insert bellcrank (44) through access hole with bushing (48) installed. Install washers (43 and 47) and bolt (49). Safety bolt and install plug button on underside of wing beneath bolt.

NOTE: Washers (43 and 47) and bushing (48) must be in place before installing bolt (49).

NOTE: Before safetying bolt (49) check bellcrank (44) for freedom to rotate without binding.

- (2) Connect interconnecting push-pull tubes (20 and 45) to bellcrank (44) with bolt (46), nut (51) and cotter pin (50).
- (3) Connect push-pull rod (2) to bellcrank (44) with bolt (3), spacers (4), nut (5) and cotter pin (6).
- (4) Rig flaps, refer to Adjustment/Test.
- (5) Reinstall access cover.

5. Removal/Installation Outboard Flap Bellcrank (See Figure 4).

NOTE: The following is a removal/installation procedure for the left outboard bellcrank. Removal/installation of the right-hand outboard bellcrank is similar.

A. Remove Outboard Flap Bellcrank.

- (1) Extend Flaps.
- (2) Remove plug button and access cover adjacent to bellcrank on lower surface of wing.
- (3) Disconnect push-pull rod (5) from bellcrank (2) by removing cotter pin (7), nut (8), bolt (3) and spacers (4).
- (4) Disconnect interconnect push-pull tube (13) from bellcrank (2) by removing cotter pin (9), nut (8) and bolt (14).
- (5) Remove bellcrank (2) by removing safety wire from bolt (12); remove bolt (12) and washers (11), taking care that bushing (10) does not fall from bellcrank during removal.

B. Install Outboard Flap Bellcrank.

- (1) Insert bellcrank (2) through access hole with bushing (10) installed. Install washers (11) and bolt (12). Safety bolt and install plug button on underside of wing beneath bolt.

NOTE: Washers (11) and bushing (10) must be in place before installing bolt (12).

NOTE: Before safetying bolt (12) check bellcrank (2) for freedom to rotate without binding.

- (2) Attach interconnect push-pull tube (13) to bellcrank (2) with bolt (14), nut (8) and cotter pin (9).
- (3) Connect push-pull rod (5) to bellcrank (2) with bolt (3), spacers (4), nut (6) and cotter pin (9).
- (4) Rig flaps, refer to Adjustment/Test.
- (5) Reinstall access cover.

6. Removal/Installation Inboard Flap Scissor Assemblies (See Figure 3).

NOTE: The following procedures are for the left inboard flap scissor assemblies. Removal/installation of the right-hand inboard flap scissor assemblies are similar.

A. Remove Inboard Flap Scissor Assembly.

- (1) Extend flaps.
- (2) Disconnect upper and lower scissor links (29 and 37), by removing cotter pin (39 and 42), nuts (40 and 41), washers (28), spacers (30, 32, 36 and 38) and bolts (34 and 35).
- (3) Disconnect upper and lower scissor links (29 and 37) by removing cotter pin (42), nut (41), washers (28), spacers (31), push-pull rod (2) and bolt (33).

B. Install Inboard Flap Scissor Assembly.

- (1) Assemble scissor links (29 and 37) to push-pull rod (2) using bolt (33), spacers (31), washers (28), nut (41) and cotter pin (42).
- (2) Connect upper and lower scissor links (29 and 37), using bolts (34 and 35), spacers (30, 32, 36 and 38), washers (28), nuts (40 and 41) and cotter pins (39 and 42).
- (3) Check flaps for proper operation and correct travel. Refer to Adjustment/Test.

7. Removal/Installation Outboard Flap Scissor Assemblies (See Figure 4).

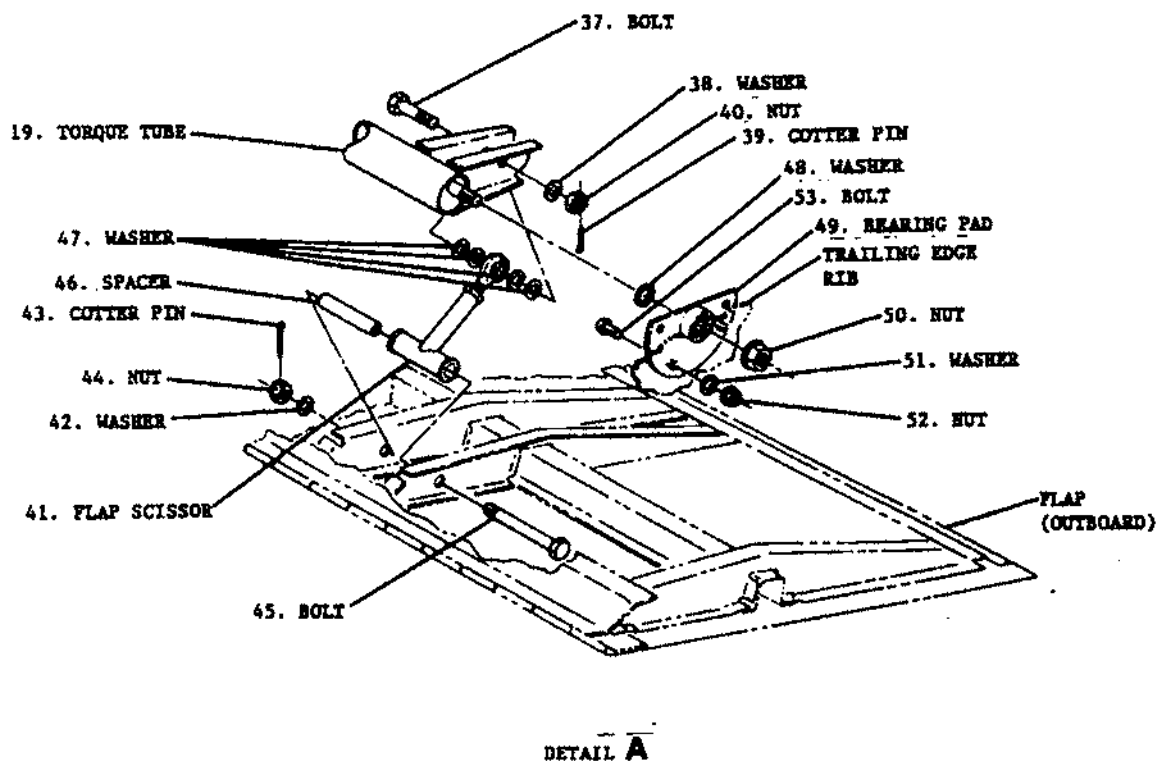
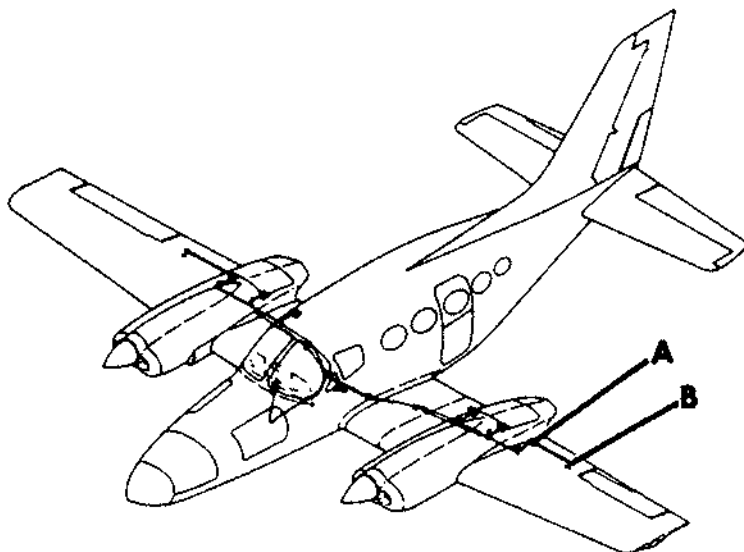
NOTE: The following procedures are for the left outboard flap scissors assemblies. Removal/installation of the right-hand outboard flap scissor assemblies are similar.

A. Remove Outboard Flap Scissor Assemblies.

- (1) Extend flaps.
- (2) Remove inboard flap scissor assembly as follows:
 - (a) Disconnect flap scissor (27) and push-pull rod (5) from torque tube (20) by removing cotter pin (25), nut (26), washer (24), bolt (34) and washers (22, 23 and 33).
 - (b) Disconnect flap scissor (27) from outboard flap by removing cotter pin (29), nut (30), washer (28), bolt (31) and spacer (32).
- (3) Remove outboard flap scissor assembly as follows:
 - (a) Disconnect flap scissors (41) from torque tube (20) by removing cotter pin (39), nut (40), washer (38), bolt (37) and washers (47).
 - (b) Disconnect flap scissor (41) from outboard flap by removing cotter pin (43), nut (44), washer (42), bolt (45) and spacer (46).

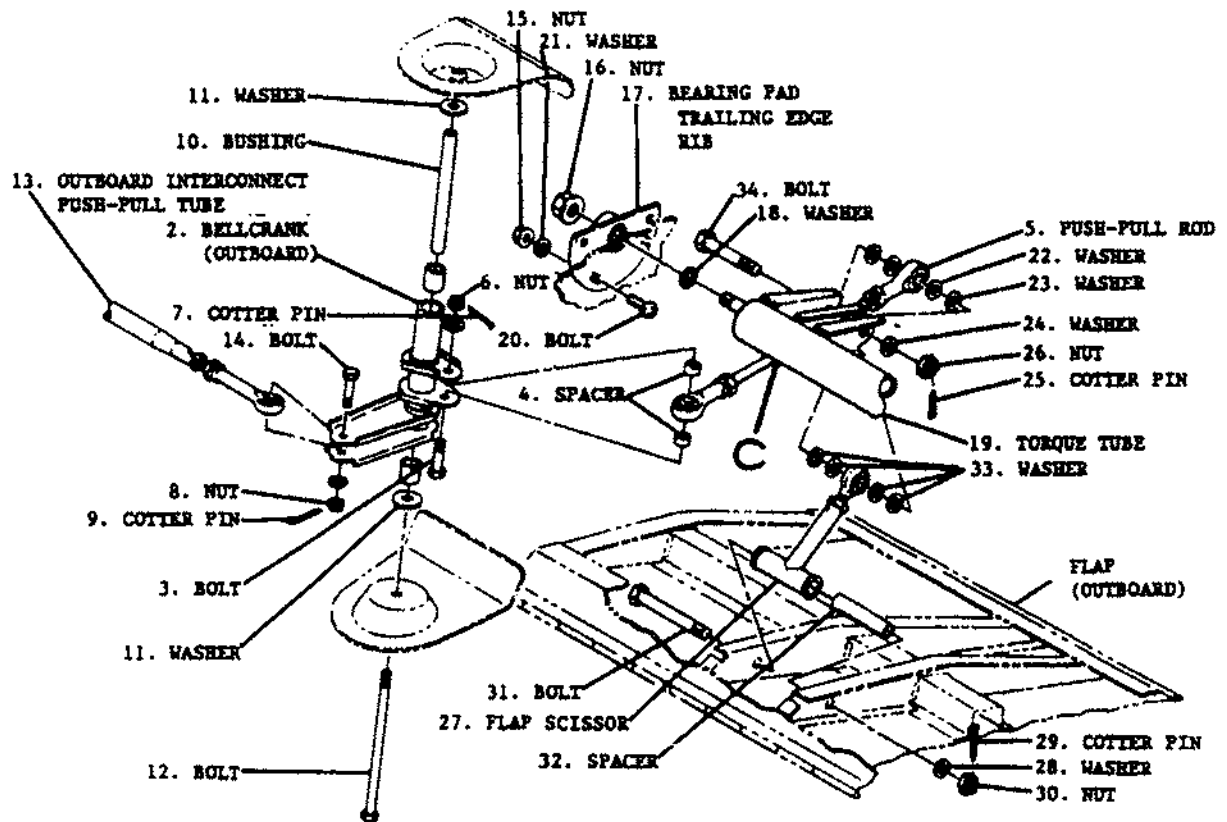
B. Install Outboard Flap Scissor Assemblies.

- (1) Install outboard flap scissor assembly as follows:
 - (a) Connect flap scissor (41) to outboard flap with bolt (45), spacer (46), washer (42), nut (44) and cotter pin (43).
 - (b) Connect flap scissor (41) to torque tube (20) with bolt (37), washers (47) (two each side of flap scissor), washer (38), nut (40) and cotter pin (39).
- (2) Install inboard flap scissor assembly as follows:
 - (a) Connect flap scissor (27) to outboard flap with bolt (31), spacer (32), washer (28), nut (30) and cotter pin (29).

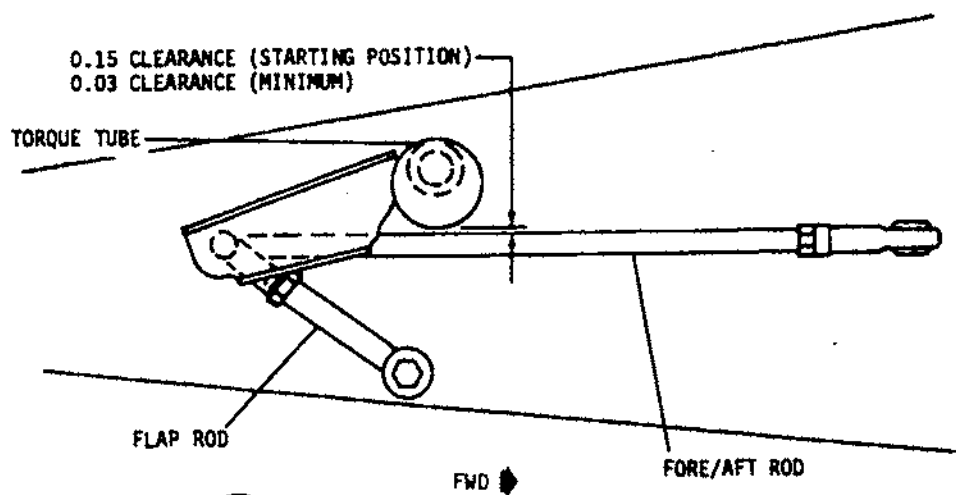


Outboard Flap and Bellcrank Installation
Figure 4 (Sheet 1 of 2)

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A51612014



DETAIL B



DETAIL C

Outboard Flap and Bellcrank Installation
Figure 4 (Sheet 2)B51612013
C10601001

- (b) Connect flap scissor (27) to torque tube (20) with bolt (34), washers (22 and 23), push-pull rod (5), washers (33), washers (24), nut (26) and cotter pin (25).

NOTE: Washers (22) are thin washers and shall be installed, one each next to push-pull rod (5). Thick washers (23) shall be installed, one each next to washers (22).

- (3) Check flaps for proper operation and correct travel. Refer to Adjustment/Test.

8. Removal/Installation Flap Control Cables (See Figure 2).

NOTE: Removal/installation procedures are for LH wing. Removal/installation of right cables is similar. Refer to Flight Control Maintenance Practices.

A. Remove Flap Control Cables.

- (1) Remove cabin seats and carpet, refer to Chapter 12.
- (2) Remove floor panels above and to each side of flap actuator.
- (3) Remove inspection plates on forward side of rear spar adjacent to wheel well.
- (4) Lower flaps several degrees to decrease tension on cables, remove turnbuckle clips and disconnect the turnbuckles.
- (5) Disengage chains from sprockets of flap actuator.
- (6) Disconnect flap extend cable (4) from attaching link by removing cotter pin (11), nut (12) and bolt (13).
- (7) Disconnect flap return cable (2) from attaching link by removing cotter pin (10), nut (9) and bolt (8).
- (8) Remove outboard pulley by removing nut and bolt.

NOTE: Outboard pulley cable guard pins are quite difficult to remove and install and should be removed only for replacement.

- (9) Remove pulley, located on wing stub by removing nuts and bolts.
- (10) Remove fuselage pulleys, located under the floorboard by removing bolt.
- (11) Remove pressure seals (6) through access holes.
- (12) Tie guide wires to flap cables and pull out through fuselage.
- (13) Untie guide wires and remove cables from aircraft. Leave guide wires in aircraft to aid in reinstallation.

B. Install Flap Control Cables.

- (1) Tie cables (2 and 4) to guide wire and route into position through the fuselage and wing to bellcrank (3).
- (2) Attach flap extend cable (4) to attaching link with bolt (13), nut (12) and cotter pin (11).
- (3) Attach flap return cable (2) to attaching link with bolt (8), nut (9) and cotter pin (10).
- (4) Place return cable (2) in position on pulley and install pulleys with bolts and nuts.
- (5) Place extend cable (4) in position on pulleys and install pulleys with bolts and nuts.
- (6) Engage LH chain (1) on flap actuator and connect cables with turnbuckles (5).
- (7) Install pressure seals (6) as follows:
 - (a) Ensure that cables are lubricated for the full length of its travel within the seals.
 - (b) Pack the pressure seals with MIL-G-81322A lubricant.
 - (c) Place pressure seals (6) on cables on non-pressurized side of bulkhead with small end toward bulkhead.
 - (d) Insert pressure seal (6) in the bulkhead hole so that bulkhead metal is seated within the retaining groove with the small end of seal in pressurized section.
 - (e) Install proper retaining rings (7) in the grooves of the seal (two on small end and one on large end).
- (8) Rig flap system, refer to Adjustment/Test.
- (9) Safety turnbuckles (5).
- (10) Install inspection plates, wing access panels, wing gap skin, floor panels.
- (11) Install carpet and seats. Refer to Chapter 12.

9. Removal/Installation Outboard Flap Torque Tube (See Figure 4).

A. Remove Outboard Flap Torque Tube.

- (1) Extend flaps.
- (2) Disconnect push rod (5) and flap scissor (27) from torque tube (19) by removing cotter pin (25), nut (26), washers and bolt (34).
- (3) Disconnect flap scissors (41) from torque tube (19) by removing cotter pin (39), nut (40), bolt (37) and washers.
- (4) At inboard portion of torque tube (19) remove nut (16) and bearing pad (17) by removing nuts (15), washers (21) and bolts (20).
- (5) At outboard portion of torque tube (19) remove nut (50) and bearing pad (49) by removing nuts (52), washers (51) and bolts (53).
- (6) Remove torque tube (19) and washers (21 and 48) from trailing edge rib.

B. Install Outboard Flap Torque Tube.

- (1) Install torque tube (19) and washers (21 and 48) on trailing edge ribs.
- (2) At outboard portion of torque tube (19) install bearing pad (49) and secure with bolts (53), washers (51) and nuts (52). Install nut (50) on torque tube (19).
- (3) At inboard portion of torque tube (19) install bearing pad (17) and secure with bolts (20), washers (21) and nuts (15). Install nut (16) on torque tube (19).
- (4) Connect push-pull rod (5) and flap scissor (27) with bolt (34), washers (22, 23, 33 and 24), nut (26) and cotter pin (25).

NOTE: Washers (22) are thin washers and shall be installed one each next to push-pull rod (5). Thick washers (23) shall be installed, one each next to washers (22).

- (5) Connect flap scissor (41) to torque tube (19) with bolt (37), washers (47 and 38), nut (40) and cotter pin (39).
- (6) Check flaps for proper operation and correct travel. Refer to Adjustment/Test.

10. Removal/Installation Flap Actuator Assembly (See Figure 5).

A. Remove Flap Actuator Assembly.

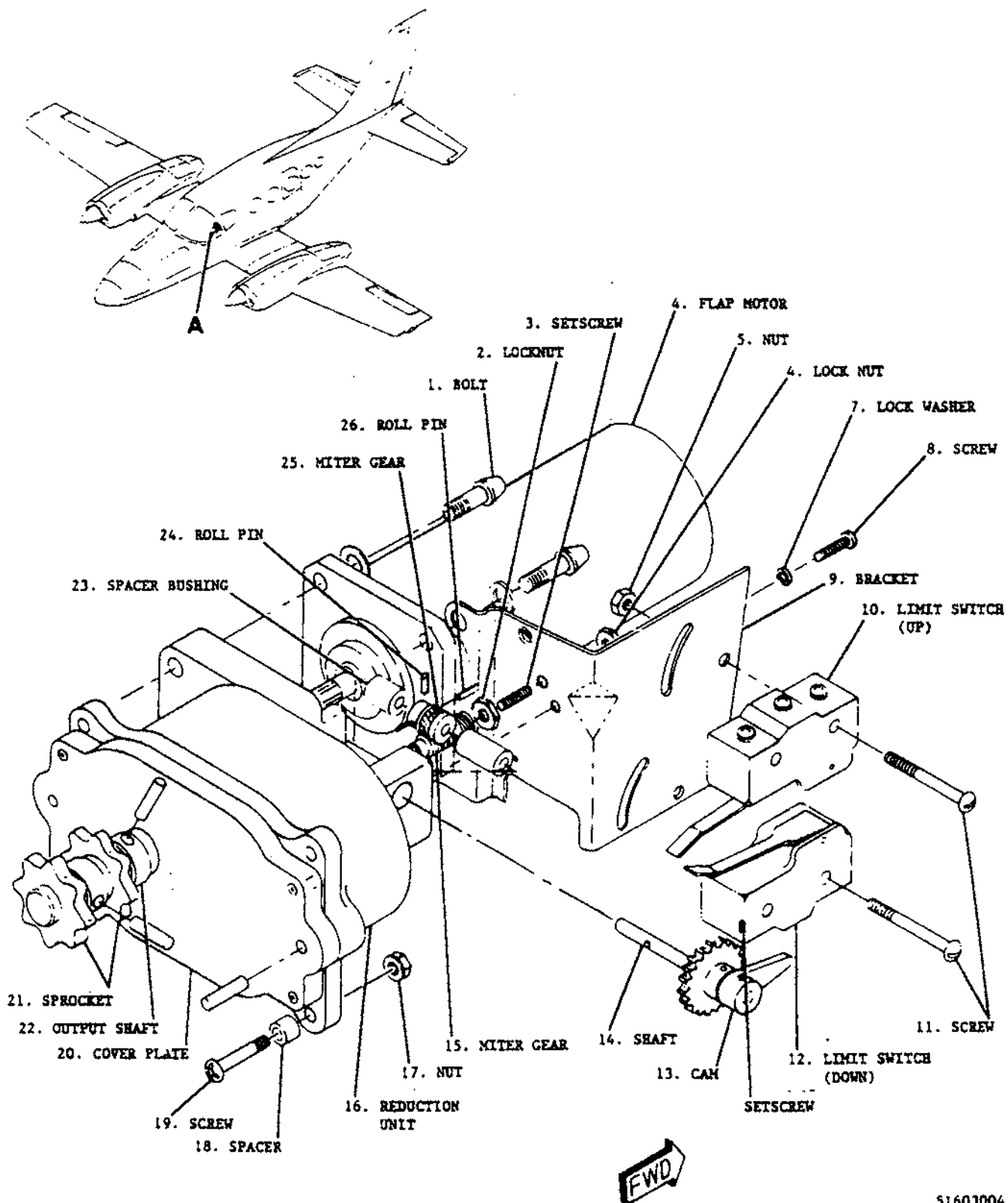
- (1) Disengage Flap Motor circuit breaker.
- (2) Refer to Chapter 12. Remove cabin seats and carpet.
- (3) Remove floor panel above flap actuator.
- (4) Lower flaps several degrees to release tension on return cables.
- (5) Remove safety from turnbuckles (5, Figure 2). Loosen the turnbuckles enough to disengage chains from sprockets (21).
- (6) Identify and disconnect electrical wires from limit switches (10 and 12).
- (7) Remove nuts (17), spacers (18) and screws (19) attaching reduction unit (16) to fuselage rear spar.
- (8) Move complete actuator assembly forward until it clears the rear spar, tilt assembly slightly and remove through floor access hole.

NOTE: Care should be exercised when working flap actuator assembly through control cables.

- (9) If limit switch bracket (5), removal is desired, proceed as follows:
 - (a) Identify and disconnect flap motor (4) electrical wires from limit switches (10 and 12).
 - (b) Remove safety wire from bolts (1).
 - (c) Remove screw (8) and lockwasher (7) and bolt (1).

NOTE: The lower bolt (1) attaching bracket (9) to flap motor only needs loosening. The bracket hole is slotted for removal.

- (d) Remove bracket (9) with limit switches (10 and 12) attached.
- (10) If further disassembly of flap actuator assembly is desired, refer to Landing Gear and Flap System Components Overhaul Parts Manual.



DETAIL A

Flap Actuator Assembly
Figure 551603004
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B. Install Flap Actuator Assembly.

- (1) If limit switch bracket (9) was removed, proceed as follows:
 - (a) Position bracket (9) with limit switches (10 and 12) attached to flap motor (4). Secure bracket with bolts (1), lockwasher (7) and screw (8). Safety wire bolts (1).
 - (b) Route flap motor electrical wires through grommet of bracket (9). Identify wires and connect wires to limit switches (10 and 12).
 - (c) Check that reduction unit output shaft (22) does not turn when 800 inch-pounds torque is applied.
 - (d) Adjust setscrew (3) to provide 0.005 maximum transfer shaft movement and secure with locknuts (2 and 4).

NOTE: Shaft movement measurement should be measured between miter gear (15) and miter gear (25).

- (e) Prior to flap actuator assembly installation, ensure that limit switches (10 and 12) operate properly.
- (2) Adjust limit switches (10 and 12) at the end of the adjusting slot on bracket (9). Which is farthest from cam (13) to allow for travel when rigging.
- (3) Identify wires to limit switches (10 and 12) and connect wires to limit switches. Connect flap motor ground.

NOTE: Ensure that terminals of the limit switches are covered with insulation sleeving and wiring is secure and clear of all control cables and moving parts.

- (4) Insert flap actuator assembly through access hole in underside of fuselage. Secure flap actuator assembly to rear spar, using screws (19), spacers (18) and nuts (14).
- (5) Engage chains with sprockets (21) and connect turnbuckles (5, Figure 2).
- (6) Rig flap control system, refer to Adjustment/Test.
- (7) Install floor panels.
- (8) Install carpet and cabin seats, refer to Chapter 12.

11. Removal/Installation Flap Preselect Control Cable (See Figure 6).

NOTE: Refer to Flight Control Maintenance Practices.

A. Remove Flap Preselect Control Cable.

- (1) Remove necessary seats, carpet and floor panels to gain access to flap preselect control cable.
- (2) Remove center carpet and floor panels to gain access to flap preselect control cable.
- (3) Remove nut, spacer and screw attaching control cable to flap preselect assembly.
- (4) Loosen nut and remove bolt and clamp from flap extend cable and control cable.
- (5) Remove clamps securing control cable to bulkheads and remove control cable from airplane.

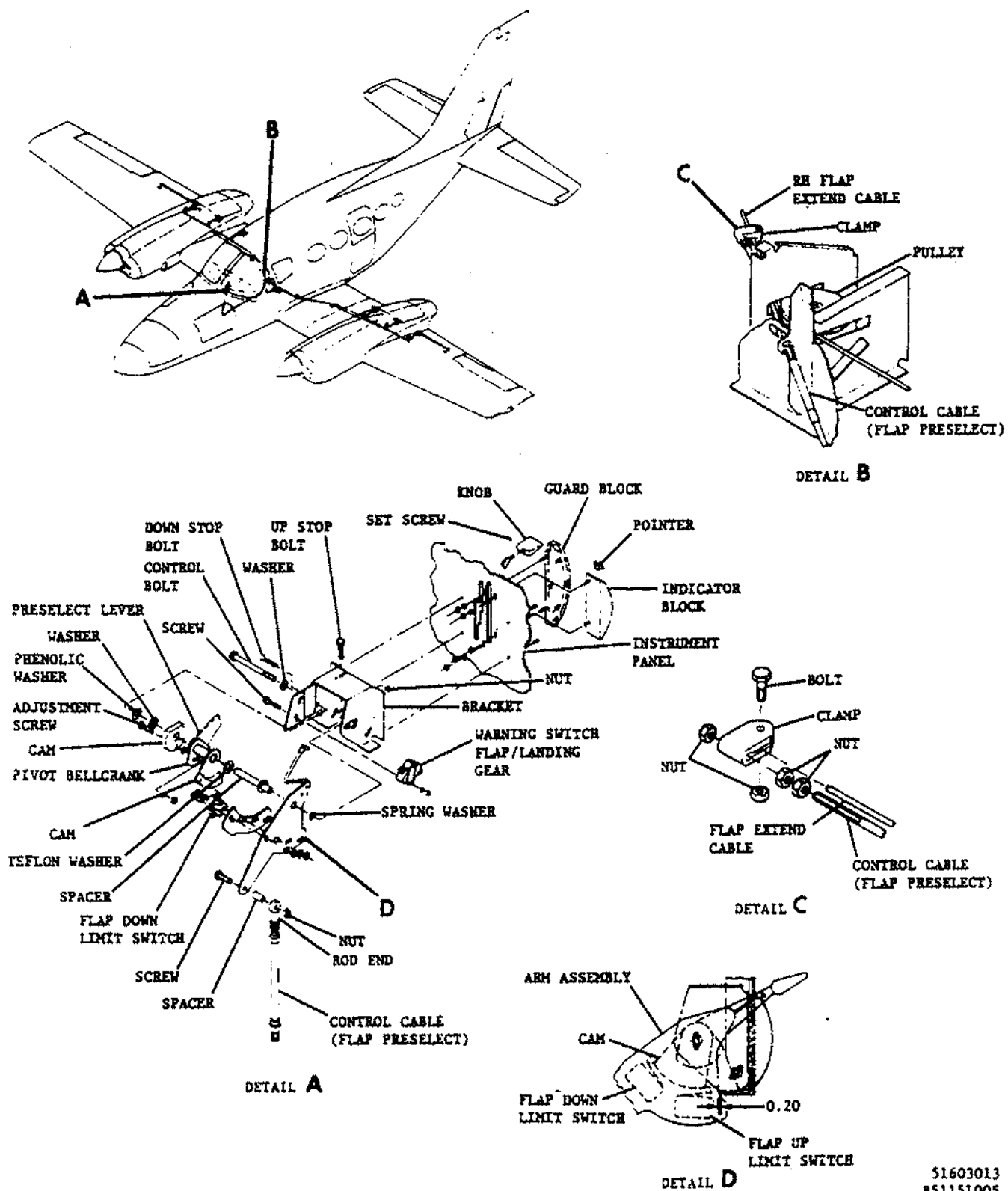
B. Install Flap Preselect Control Cable.

- (1) Route control cable in airplane and secure with clamps.
- (2) Clamp control cable to flap extend cable, using bolt, clamp and nuts.
- (3) Connect forward end of control cable to flap preselect, using screw, spacer and nut.
- (4) Rig flap preselect system, refer to Adjustment/Test.
- (5) Install floor panels, carpet and seats.

12. Operational Check Flap System

A. Flight Operational Check.

- (1) Check flap operation for proper operating times as follows:
 - (a) Flight check to verify that flaps fully extend in 9-14 seconds, and retract in 6-10 seconds. Check extension and retraction times at 140 KIAS.



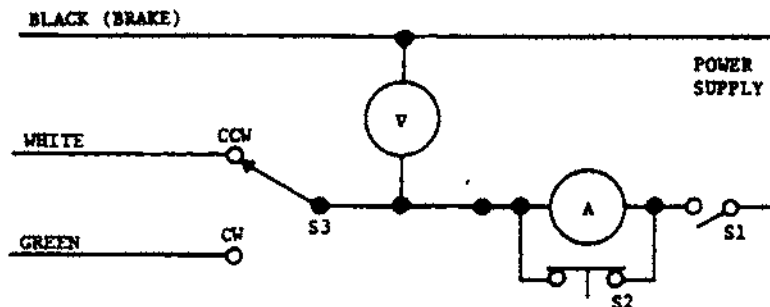
Flap Preselect Installation
Figure 6

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851151005
C51611032
D51611041
A51153015

- (b) If during flight check, the flaps will not extend and retract within the time limits described in step (a), remove the flap actuator motor and perform the following no load test:
 - 1) Mount motor securely in a horizontal position.
 - 2) Connect motor as shown in Figure 7 to a variable 30 volt DC power supply.
 - 3) Close switch S3 for either direction.
 - 4) Open switch S2 to read ammeter.
 - 5) Close switch S1 to start motor.
 - 6) Gradually increase voltage from zero until the brake releases.

NOTE: The brake releasing may be indicated either by sound or the armature starting to turn.

- 7) Read voltmeter when brake releases. Brake must release at or less than 18 volts.
- 8) Stop motor, close switch S3 for opposite rotation and repeat steps 3) thru 7).
- 9) Voltage must be within the same limits as previous rotation.
- 10) If the voltage is not within the same limits, refer to Troubleshooting.
- 11) Run motor in each direction as shown connected in Figure 7 with 24 volts DC applied.
- 12) Open switch S2 and read ammeter current. The ammeter should read approximately 3.5 amperes under no load, when the RPM is approximately 1100 RPM.
- 13) Stop motor, close switch S3 for opposite rotation and repeat step 12).
- 14) Motor should operate within limits as described in step 12).
- 15) If the motor does not operate within the limits as described in step 12), refer to Troubleshooting.



V - VOLTMETER, DC, 7.5/30/75, TYPE DP-11.

NO. 50-202011 RCPF

A = AMMETER, DC, 5/20/50, TYPE DP-11.

NO. 50-202111 RPS

S1 = SWITCH, SPST 30 AMPERE CAPACITY,

NO. 707

S2 - SWITCH - PUSH BUTTON NO. CR2940-UA202B

S3 - SWITCH, DPDT NO. 2565K5

10987011

Schematic Test Connection Diagram
Figure 7

- (c) If the motor will not meet operating requirements, after performing no load test, replace motor and repeat step (a).
- (d) If the flaps still will not meet flight check requirements, check system for binding or interference.
- (e) If no evidence of binding or interference is found, flap actuator must be replaced or overhauled in accordance with Cessna Landing Gear and Flap System Components Overhaul/Parts Manual.

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FLIGHT CONTROL MAINTENANCE PRACTICES

Control Cables

1. Description

- A. The chromium nickel steel wire is helically twisted into strands and the strands laid about other strands forming the flexible steel cable. The number of wires and the number of strands in the cable are determined by the diameter of the cable.

2. Tools and Equipment

NOTE: Equivalent substitutes may be used instead of the following listed items.

Name	Number	Manufacturer	Use
Hunter Spring Gage	Type L-30	Ametex Testing Equipment System Lansdale, PA	To measure friction force

3. Construction of Cables

- A. Cable diameter 1/32 inch, 3 by 7 construction - Cable of this construction shall consist of three strands of seven wires each. There shall be no core in this construction. The cable shall have a length of lay of not more than eight times nor less than five times the nominal cable diameter.
- B. Cable diameter 1/16 inch and 3/32 inch, 7 by 7 construction - Cable of this construction shall consist of six strands of seven wires each, laid around a core strand of seven wires. The cable shall have a length of lay of not more than eight times nor less than six times the nominal cable diameter.
- C. Cable diameter 1/8 inch through 3/8 inch, 7 by 19 construction - Cable of this construction shall consist of six strands laid around a core strand. The wire composing the seven individual strands shall be laid around a central wire in two layers. The single core strand shall consist of a layer of 6 wires laid around the central wire in a right-hand direction, and a layer of 12 wires laid around the 7 wire strand in a right-hand direction. The 6 outer strands of the cable shall consist of a layer of 6 wires laid around the central wire in a left-hand direction.
- (1) Lubrication - A pressure type friction-preventive compound is continuously applied to each strand as it is formed into a strand so that each wire is completely coated.
- (2) Friction-preventive compound is continuously applied to each strand as it is formed into a cable so that each strand is completely coated.
- E. Definitions - The following definitions pertain to flexible steel cable.
- (1) Wire - Each individual cylindrical steel rod or thread shall be designated as a wire.
- (2) Strand - Each group of wires helically twisted or laid together shall be designated as a strand.
- (3) Cable - A group of strands helically twisted or laid about a central core shall be designated as a cable. The strands and the core shall act as a unit.
- (4) Diameter - The diameter of cable is the diameter of the circumscribing circle.
- (5) Wire Center - The center of all strands shall be an individual wire and shall be designated as a wire center.
- (6) Strand Core - A strand core shall consist of a single straight strand made of preformed wires, similar to the other strands comprising the cable in arrangement and number of wires.

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- (7) Preformed Type - Cable consisting of wires and strands shaped, prior to fabrication of the cable, to conform to the form or curvature which they take in the finished cable, shall be designated as preformed types.
- (8) Lay or Twist - The helical form taken by the wires in the strand and by the strands in the cable is characterized as the lay or twist of the strand or cable respectively. In a right-hand lay, the wires or strands are in the same direction as the thread on a right-hand screw, and for a left-hand lay, they are in the opposite direction.
- (9) Pitch (or length of lay) - The distances, parallel to the axis of the strand or cable, in which a wire or strand makes one complete turn about the axis, is designated as the pitch (or length of lay) of the strand or cable respectively.

4. Control Cable Installation

A. When installing control cables the following precautions must be taken:

- (1) Keep cable assemblies clean. DO NOT allow shavings, dirt, grease, etc. to get on the cables and keep the cables off the floor.
- (2) Keep cables straight, or properly coiled and bagged during installation. or use pliers to pull cables.

Chain to Cable Connection

- 1. When replacing chain assemblies or cable assemblies, new chain connecting links are required. The connecting link assembly is not supplied with chain assemblies or cable assemblies and must be ordered separately.

2. Chain to Cable Installation.

- A. When replacing cables, remove old links from chain to maintain the original installation length.
- B. Install new connecting link by pressing the link plate on and peening pin ends.

Flight Control Friction Force

1. Aileron

- A. Aileron cables must be rigged to proper tension, refer to Aileron Rigging.
- B. Remove access plate (241E), refer to Access Plates/Panels Identification.
- C. Disconnect aileron/rudder spring, refer to Maintenance Practices.
- D. Connect a spring gage to the control wheel, refer to Tools and Equipment.
- E. Measure the amount of force required to move the aileron from the neutral position 45° on either side of neutral and from 45° to full travel. Refer to Table 1.
- F. Connect aileron/rudder spring, refer to Maintenance Practices.
- G. Install access plate (241E).

2. Aileron Trim Tab Control Wheel

- A. Aileron trim tab cables must be rigged to proper tension, refer to Aileron Rigging.
- B. Position spring gage on aileron trim tab control wheel; push on spring gage and measure the amount of pressure required to move the control wheel. Refer to Table 1.

3. Rudder

- A. Rudder cables must be rigged to the proper tension, refer to Rudder Rigging.
- B. Jack airplane, refer to Lifting and Shoring.
- C. Disconnect shimmy damper, refer to Chapter 4, Landing Gear and Brake System.
- D. Position rudder pedal to neutral. Using a spring gage apply pressure to the pilot's left rudder pedal. Record the pressure (breakout force) required to move rudder pedal. Repeat step for the copilot's left rudder pedal. Refer to Table 1.
- E. Position left rudder pedal half way between neutral and full forward position. Using the spring gage, measure the pressure (continuous force) required to move the rudder pedals through neutral position.

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- F. Position spring gage on rudder pedal and measure the amount of pressure required to move the rudder pedals through full travel, refer to Table 1.
 - G. Connect shimmy damper, refer to Chapter 4, Landing Gear and Brake System.
 - H. Remove jacks from airplane.
4. Rudder Trim Tab Control Wheel
- A. Rudder trim tab cables must be rigged to proper tension, refer to Rudder Rigging.
 - B. Position spring gage on rudder trim tab control wheel. Push on spring gage and measure the amount of pressure required to move the control wheel. Refer to Table 1.
5. Elevator
- A. Remove elevator bob weight, refer to Elevator Maintenance Practices.
 - B. Remove access plate (3128), refer to Chapter 1, Access Plates/Panels Identification.
 - C. Disconnect elevator down spring, refer to Elevator Maintenance Practices.
 - D. Connect spring gage to control wheel, measure pressure required to move the elevator through its full range of travel. Refer to Table 1.
 - E. Install bob weight, refer to Elevator Maintenance Practices.
 - F. Install access plate (3128).
6. Elevator Trim Tab Control Wheel
- A. Elevator trim tab cables must be rigged to proper tension, refer to Elevator Rigging.
 - B. Position spring gage on elevator trim tab control wheel. Push on spring gage and measure the amount of pressure required to move the control wheel. Refer to Table 1.

TABLE 1

FLIGHT CONTROLS	FRICTION FORCE (POUNDS)
Aileron - Neutral to 45° Travel	2.75
45° to Full Travel	3.50
Aileron Trim Tab Control Wheel	5.00
Rudder - Breakout Force	20.00
Continuous Force	18.00
Full Travel 85% to 98%	30.00
Rudder Trim Tab Control Wheel	5.00
Elevator	7.25
Elevator Trim Tab Control Wheel	5.00

CHAPTER

6

ENVIRONMENTAL SYSTEMS

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COMPONENTS LOCATION CHART
Environmental

<u>Components</u>	<u>Location</u>
Air Conditioning Switch	Instrument Panel
Cabin Pressure Safety Valve	Aft, Cabin Pressure Bulkhead
Altitude Sensor	Tailcone Equipment Rack
Barometer Safety Switch	Forward, Instrument Panel on Panel Brace
Combustion Air Flow Pressure Switch	Attached to Air Blower
Condensor Blower Motor	Forward and Lower Left Console
Heater Fuel Filter	Leading Edge, Right Wing
Heater Solenoid	Leading Edge, Right Wing
Heater Warning Light Relay	Inside Left Console
Pressurization Solenoid Valve	In Cabin, Forward of Aft Pressure Bulkhead
High Temperature Switch	Near Hydraulic Motor, Condensor and Compressor
Pressurization Outflow Valve	Aft Pressure Bulkhead
Oxygen Pressure Gage	Instrument Panel
Pitot Heat Switch	In Cabin, On Left Console
Pressurization Controls	On Instrument Panel
Heater Hour Meter	Nose, Right-Hand Baggage Retainer

ENVIRONMENTAL SYSTEMS

Description

1. The environmental systems are defined as the airplane systems that are necessary for the comfort and safety of the flight crew and passengers. In this manual, these systems consist of the pressurization system, heating, defrost and ventilating system, air conditioning system and the oxygen system.

PRESSURIZATION SYSTEMDescription

1. Two pressurization systems are provided for the airplane; the standard pressurization system or the optional cabin pressurization system.
2. The standard cabin pressurization system consists of: left and right-hand engine bleed air venturi, left and right-hand pressurized air dump valves, left and right-hand heat exchangers, outflow valve controller, outflow valve, solenoid valve, safety valve, cabin rate of change indicator, cabin altitude and differential pressure indicator, cabin altitude light, barometric pressure switch, pressurization system controls, ducting to air distribution system and necessary plumbing.
 - A. The standard pressurization system (421C0001 thru 421C1400) provides a constant 8000 foot cabin altitude from 8000 feet to 23,120 feet. Below 8000 feet, no pressurization is provided. Above 23,120 feet a nominal differential pressure of 5.0 $\pm$ 0.3 PSI is maintained. Automatic pressurization is controlled by the outflow valve controller connected by plumbing to the outflow valve. A cabin safety valve (dump valve) is utilized in the system as a backup for the outflow valve. The safety valve when actuated by the solenoid valve provides a means for the pilot to depressurize the cabin when the cabin pressurization switch is positioned to DEPRESSURIZE. Also, if the cabin outflow valve should malfunction, the safety valve will take over differential pressure setting and control.
3. The variable cabin pressurization system (optional 421C0001 thru 421C1401, standard 421C1401 and On) consists of the following: a variable rate cabin pressure outflow valve, a cabin air pressure controller, and volume tank. The air pressure controller controls the operation of the outflow valve.
 - A. The variable pressurization system provides the maximum for passenger comfort by allowing selection of any cabin pressure altitude above sea level on the air pressure controller. This selected cabin altitude is automatically maintained until the airplane reaches an altitude creating $\pm$ 0.10 PSI differential pressure. Also, the air pressure rate-of-change can be selected by the pilot providing maximum passenger comfort regardless of airplane rate of ascent or descent.
4. The pressurization controls are located on the instrument panel and include the following: Cabin Pressurization Switch, LH and RH Pressurized Air Dump Valve Controls and Cabin Pressurized Air Warm Controls. Also, a Cabin Altitude Warning Light is provided to warn the pilot of an oxygen requirement.
5. Cabin pressurized air is developed by the use of engine-driven turbocharger, which provides compressed air for engine induction air and for cabin pressurization. One compressor is mounted in each engine nacelle. Either compressor can supply adequate pressurized air in the event of a failure of one.
6. Pressurization Mode of Operation.
 - A. The pressurization air controls are in the following position when operating in the pressurized mode:

Cabin Pressurization Switch	At Pressurize
Ram Air Valve Control	Full "In"
Pressurized Air Dump Valve Controls	Full "In"
 - B. Ram air is taken in through a scoop on the side of the engine nacelle, compressed by the turbocharger and directed through a sonic venturi. Air from the venturi is routed through a duct and air pressure dump valve to a ram air heat exchanger in the stub wing. The pressurized air temperature is reduced to approximately 10°F of ambient at the heat exchanger. From the heat exchanger, pressurized air is routed through check valves which are provided to prevent back flow of air in the event of failure of either compressor or single engine operation, into the cabin air distribution. Pressurized air enters the cabin air distribution system through the overhead fresh air outlets and heater outlets at a controlled temperature.

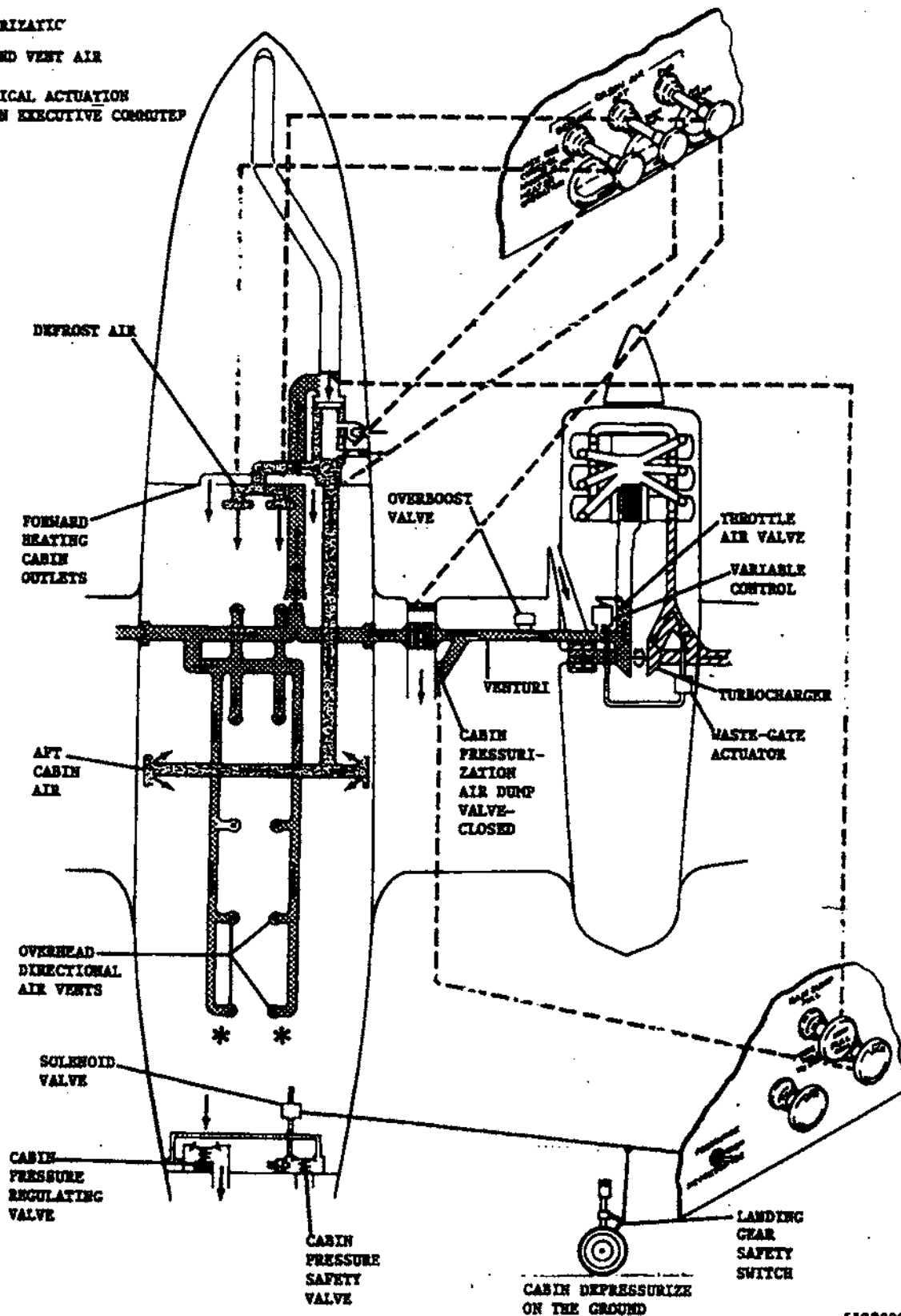
EXHAUST

PRESSURIZATIC

HEAT AND VENT AIR

ELECTRICAL ACTUATION

* USED ON EXECUTIVE COMBUST



Pressurization Schematic
Figure 1

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7. The pressurization system incorporates provisions for an emergency operation in the event of air contamination. When the system is operated under an emergency condition the pressurization air controls are in the following position.

Cabin Pressurization Switch	At Depressurize
Ram Air Valve Control	Full Out
Pressurized Air Dump Valve Controls	Full Out

- A. The cabin pressurization switch de-energizes the solenoid valve to the cabin pressure safety valve, causes the solenoid valve to open, applies airplane vacuum to open the safety valve and allows cabin air to be exhausted. The ram air valve manually opened, allows ram air to be delivered through the nose ram air scoop and forced through the heater to the pilot and copilot's outlets, passenger outlets and defrost system. The pressurized air dump valve manually opened, diverts turbocharger pressurized air overboard before it reaches the cabin.

8. Description of Pressurization Components.

- A. The outflow valve controller (Standard System 421C0001 thru 421C1400) is located on the left aft side of the forward pressure bulkhead. The controller is connected to the airplane's vacuum source and to the cabin pressure outflow valve. The controller automatically controls the cabin outflow valve.
- B. The air pressure controller (Optional System 421C0001 thru 421C1400, Standard 421C1401 and On) is located on the left side of the instrument panel. The controller is connected to the airplane's vacuum system, volume tank and cabin outflow valve and controls the outflow valve. The controller incorporates two selector knobs: cabin rate control and cabin altitude selector.
- C. A cabin outflow valve, mounted in the cabin aft pressure bulkhead under the floor, controls pressurized air outflow and is controlled by the outflow valve controller (Standard System) and the air pressure controller (Optional System). A nominal pressure differential of 5.0 $\pm$ 0.1 PSI is maintained above 23,120 feet. There is no adjustment of the outflow valve.
- D. A cabin safety valve, mounted in the cabin aft pressure bulkhead under the floor, provides a backup for the outflow valve and a means of depressurizing. The safety valve is set at 5.3 $\pm$ 0.1 PSI at the factory and should not be readjusted. Should the cabin outflow valve malfunction, the safety valve will take over the differential pressure control and exhaust cabin air. Another function of the safety valve is to depressurize the cabin when the Cabin Pressurization switch is positioned to Depressurize.
- E. A solenoid valve (electrically operated and controlled by the Cabin Pressurization switch) is incorporated in the vacuum line to the safety dump valve. When the Cabin Pressurization switch is positioned to Depressurize, the solenoid valve opens. This allows the airplane's vacuum to be applied to the safety valve, opening the valve and exhausting cabin air. When the Cabin Pressurization switch is positioned to Pressurize, the solenoid valve will close, removing vacuum from the safety valve and cabin repressurization will occur. At this point the safety valve will return to a safety valve function for the outflow valve. Also, the main gear safety switch incorporates an electrical circuit, connected to the solenoid valve to ensure decompression, when the airplane is on the ground.
- F. The pressurized air dump valves (left and right-hand) are located in each stub wing, just outboard of the heat exchanger. The dump valves are manually controlled by its respective control cable. When the controls are full "In", the dump valve butterfly is closed and pressurized air from the turbocharger is routed through the heat exchanger into the cabin. When the controls are in the full "Out" position, the dump valve butterfly is opened and pressurized air is dumped overboard through the heat exchanger cross flow outlets. In case of air contamination or emergency, the controls may be operated independently as either engine turbocharger will provide adequate air.
- G. A heat exchanger is located in each stub wing. The heat exchanger components consists of: the inlet scoop, heat exchanger and air outlet. The heat exchanger ram air intake incorporates a butterfly valve controlled by the Cabin Pressure Air Knobs (left and right-hand), located on the instrument panel at the heater controls. Pressurized air from the engine turbocharger passes through the heat exchanger. The pressurized air is cooled to within 10° degrees of ambient temperature by ram air entering the air intake and passing through the heat exchanger, when the Cabin

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Pressurize Knob is positioned to full Warm. The ram air inlet butterfly valve is closed and pressurized air is provided from the turbocharger.

9. Description of Pressurization Instrument Components.

- A. The cabin altitude rate-of-change indicator visually displays the rate in feet per minute at which the cabin altitude is changing. The indicator is calibrated in 100 feet per minute increments from 0 to 1000 feet and in 1000 feet per minute increments from 1000 to 6000 feet in both up and down directions. The indicator is located on the left-hand side of the instrument panel.
- B. The cabin altitude and differential pressure indicator is a dual purpose instrument which indicates cabin altitude to 35,000 feet and displays the differential pressure in PSIG between cabin and atmosphere. The indicator is located on the left-hand side of the instrument panel.

10. A CABIN ALT (cabin altitude) light, located on the annunciator panel is utilized to visually warn the pilot of an oxygen requirement when illuminated. Illumination of the annunciator light is associated with a barometric pressure switch. The barometric switch is set to illuminate the light between 9,650 to 10,350 feet on increasing altitude. Switch reactivation (CABIN ALT extinguished) will occur before reaching 8,450 feet. The barometric pressure switch is located behind the left instrument panel below the pressurization air controls.

Troubleshooting

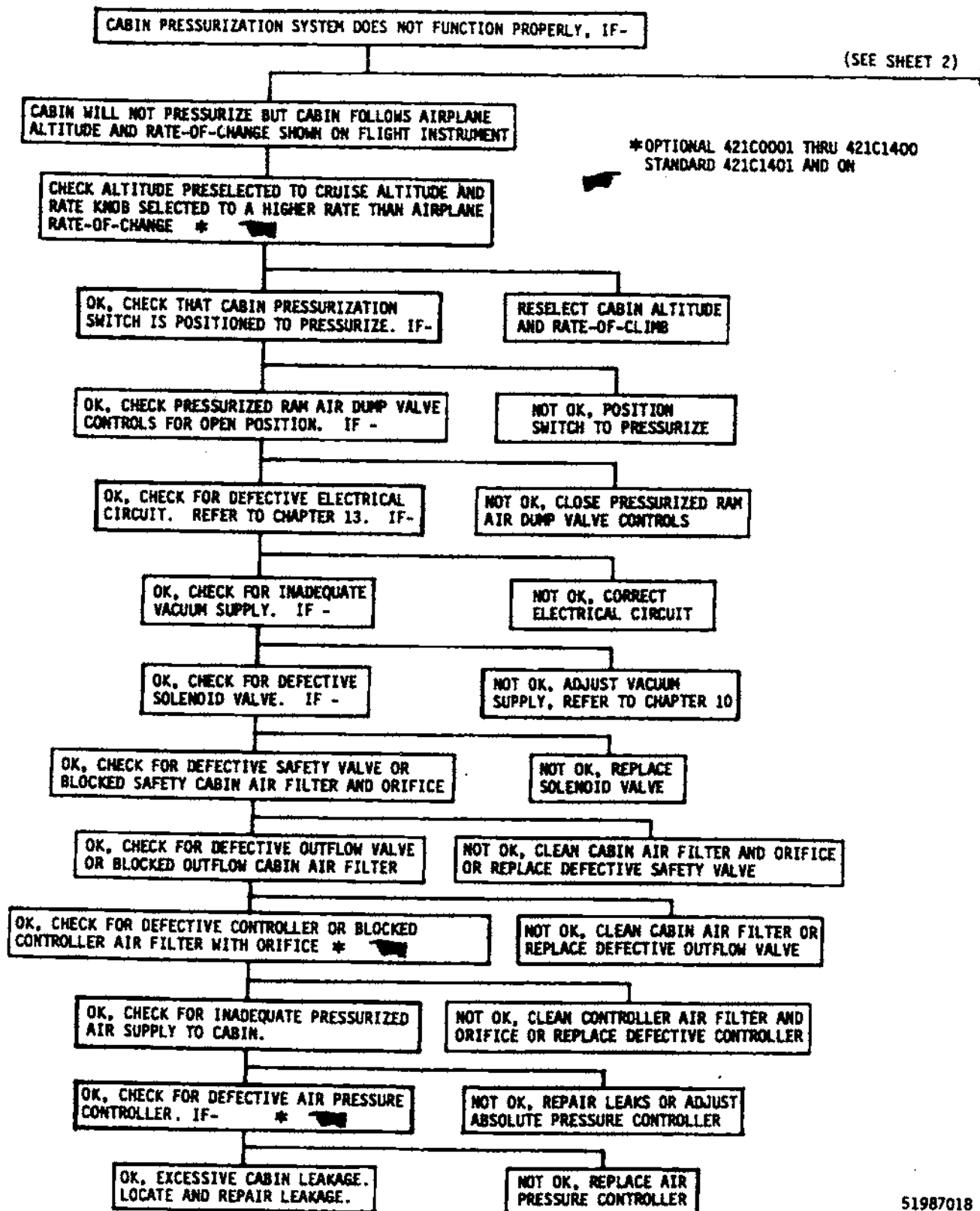
1. Troubleshooting Cabin Pressurization System.

- A. For troubleshooting cabin pressurization system. (Refer to Figure 2.)
- B. A pressurization troubleshooting checklist is provided to aid in locating possible leaks in the pressurized section of the fuselage, refer to Pressurization Troubleshooting Checklist.

LOCATION	PROBABLE CAUSE	CORRECTION
Entrance Door*	Faulty seals and/or Lock-O-Seals	Repair or replace seal. Refer to SK421-2
Emergency Exit*	Faulty seal	Replace seal
Foul Weather Windows	Faulty seal	Replace seal
Wire Bundles at FS 100.00 Bulkhead	Sealant broken	Reseal
Access Doors	Faulty seals	Replace seals
Windows	Sealant broken	Replace sealant
Controls at FS 100.00 Bulkhead	Sealant broken	Reseal controls
Controls at Stub Wing	Sealant Broken	Reseal controls
Safety Valve and Outflow Valve	Faulty sealant and/or Lock-O-Seals	Reseal or replace Lock-O-Seals.

*A small amount of leakage around these areas is normal.

Pressurization Troubleshooting Checklist

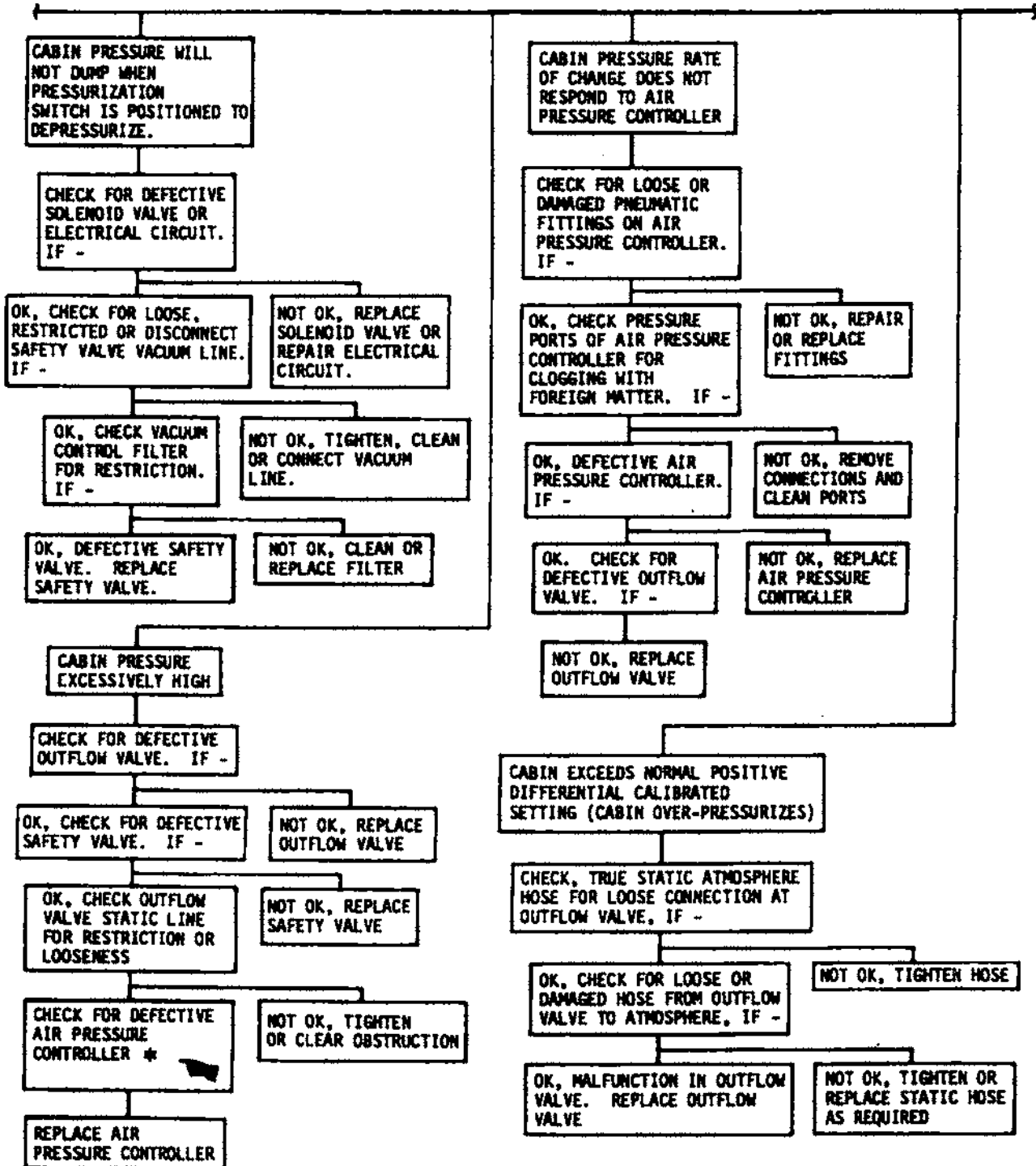


Troubleshooting Chart Pressurization System
Figure 2. (Sheet 1)

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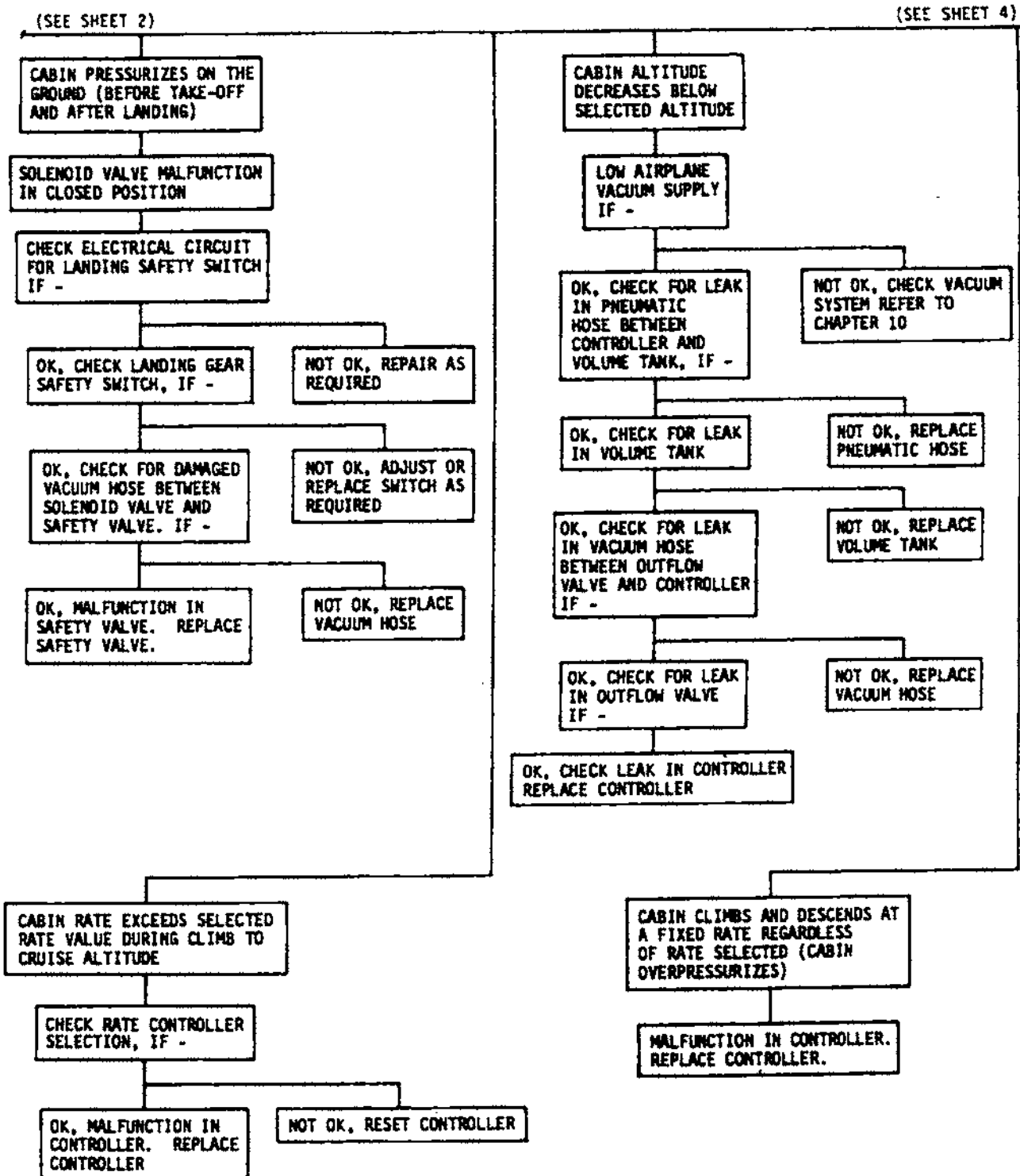
(SEE SHEET 1)

(SEE SHEET 3)



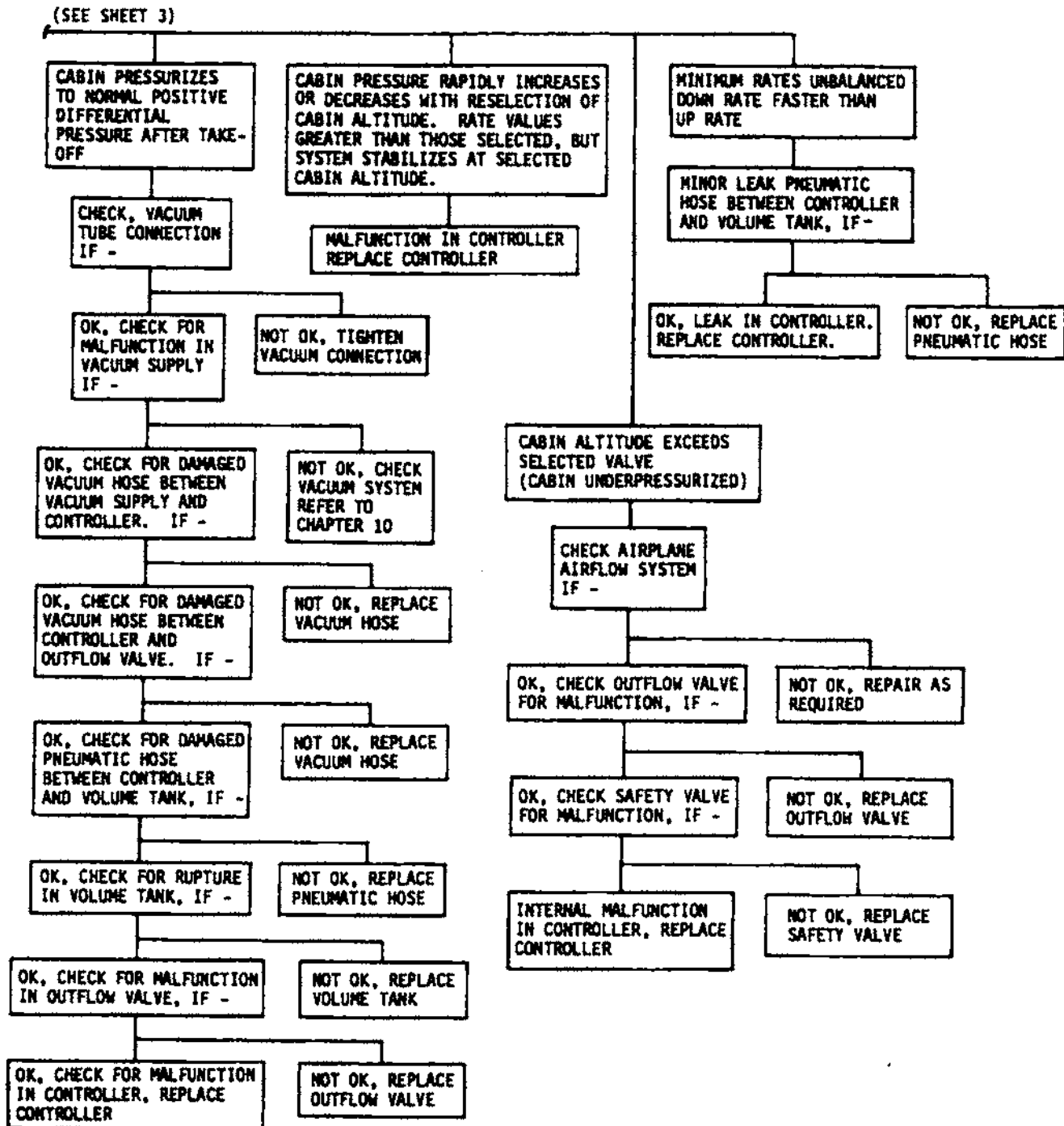
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Troubleshooting Chart Pressurization System
Figure 2. (Sheet 2)



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Troubleshooting Chart Pressurization System
Figure 2. (Sheet 3)



51987021

■ Troubleshooting Chart Pressurization System
Figure 2. (Sheet 4)

Adjustment/Test

1. Tools and Equipment.

NOTE: Equipment substitutes may be used instead of the following listed items.

Name	Number	Manufacturer	Use
Auxiliary Power 24-28 VDC		Commercially Available	Operational checks.
Vacuum Pump 3.75 Inches Hg.		Commercially Available	System leak test.
Air Supply 68 CFM at 7 PSI		Commercially Available	Cabin outflow valve and safety valve differential setting.
Pressurization Ground Test Cart		Commercially Available	Cabin outflow valve and safety valve differential setting.

2. Cabin Pressurization Check.

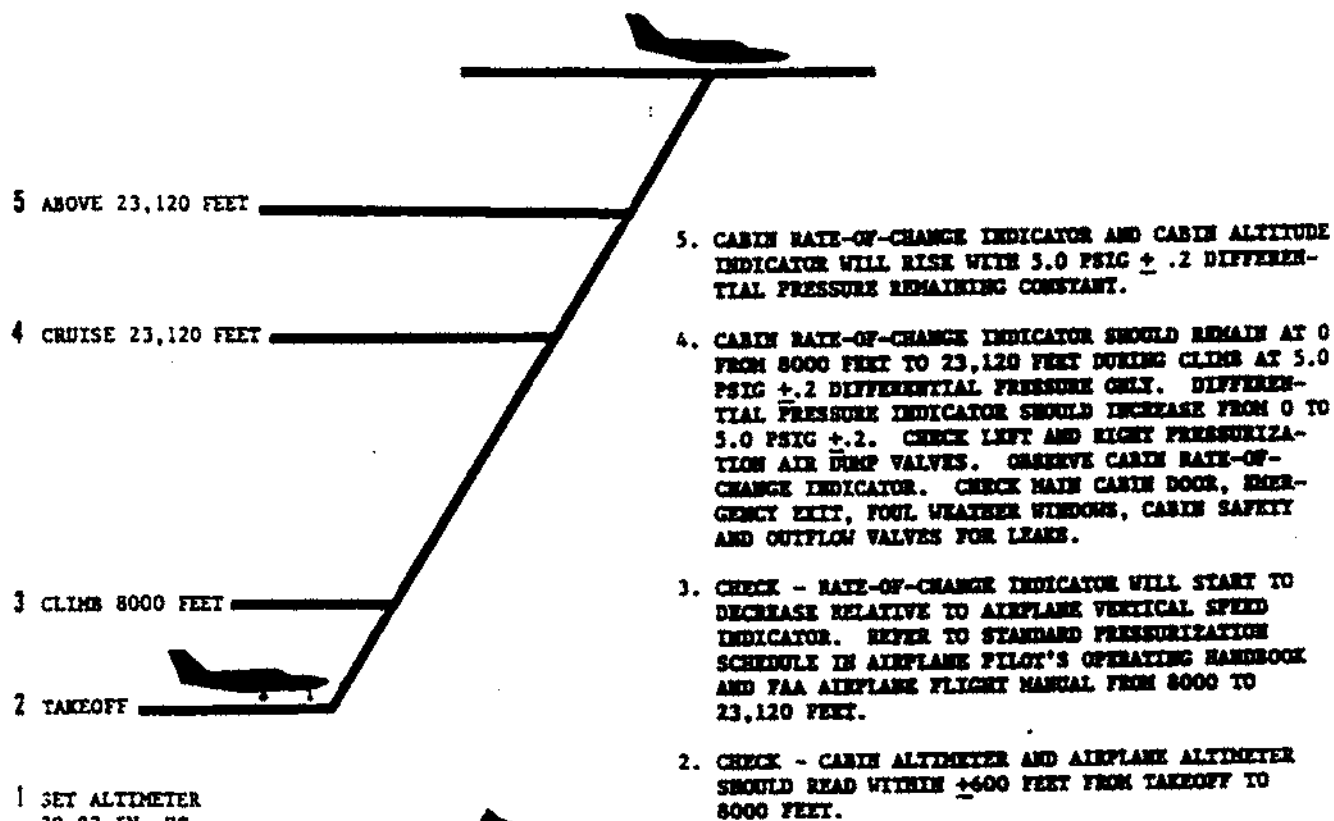
- A. The cabin pressurization check should be conducted anytime 5.0 $\pm$.2 PSIG cabin differential cannot be maintained and/or during every 500 hour inspection. The cabin pressurization flight check procedure may be utilized to recognize cabin pressurization leakage or equipment malfunction and requires no test equipment.
- B. If the pressurization system is not functioning properly, obtain all information available as to the nature of the malfunction such as; when it occurs, altitude, maximum differential obtained, engine power settings, cabin pressurization control settings, any recent repairs or major equipment installation affecting the pressurized cabin section.
- C. There are two principal areas to be considered in troubleshooting the cabin pressurization system.
 - (1) Engine and turbochargers.
 - (2) Pressurized cabin section and its regulating controls.
- D. To isolate the source of the trouble, a flight check is recommended, this will accomplish the following:
 - (1) Check the performance of the engines and turbocharger (refer to Chapter 7) for Turbocharger Operational Flight Check Procedures.
 - (2) Check the cabin pressurization system in accordance with the Cabin Pressurization System Flight Check.

3. Cabin Pressurization System Flight Check (Standard 421C0001 Thru 421C1400).

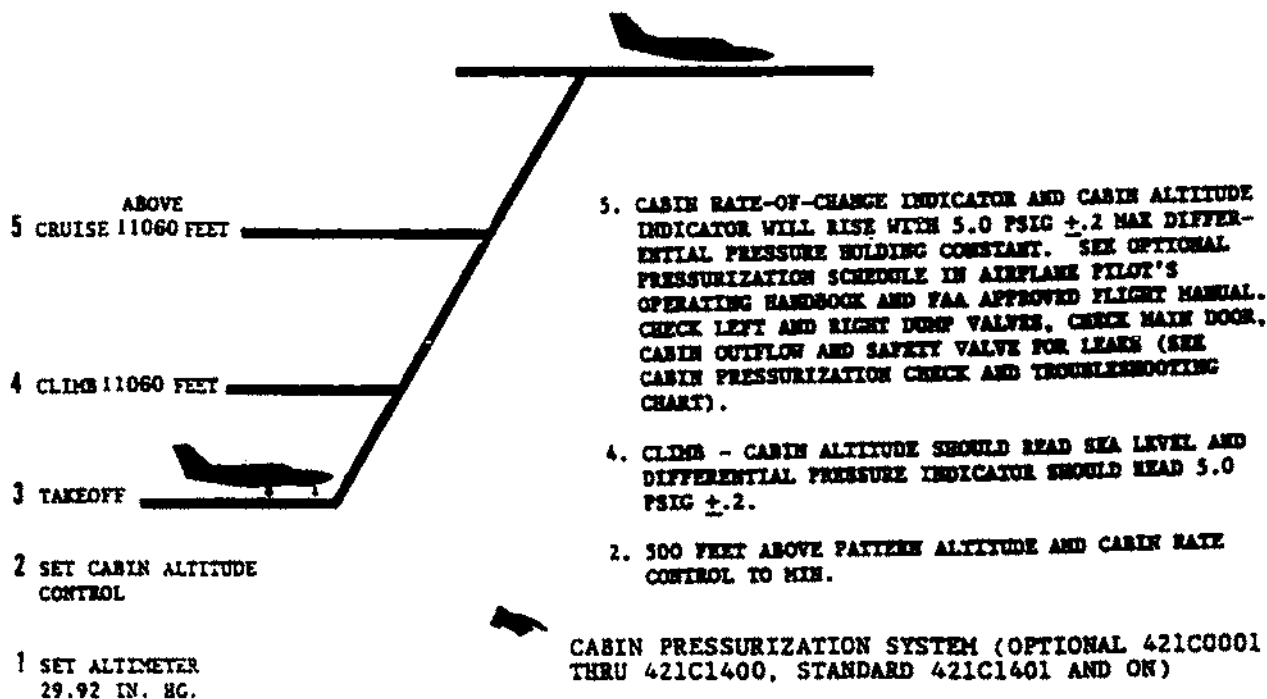
A. Cabin Pressurization System Flight Check.

- (1) Conduct a Turbocharger System Operational Flight Check, refer to Chapter 7.
- (2) During climb, pressurize the cabin and observe operation of the system, noting the differential and comparing cabin altitude with the cabin Pressurization Operational Flight Check Chart, see Figure 3. Maximum differential of 5.0 $\pm$.2 PSIG should be reached at 23,120 feet.
- (3) If the engines and turbochargers are functioning normally, according to the Turbocharger Operation Flight Check Procedure, Chapter 7, any malfunction of the cabin pressurization system should be isolated to the cabin area, its ducting seals and/or regulating equipment.

NOTE: If engines are not performing properly at altitude, the engine trouble should be corrected before proceeding further with this check.



CABIN PRESSURIZATION SYSTEM (STANDARD 421C0001 THRU 421C1400)



CABIN PRESSURIZATION SYSTEM (OPTIONAL 421C0001 THRU 421C1400, STANDARD 421C1401 AND ON)

Cabin Pressurization Operation Flight Check Chart
Figure 3

51106001

- (4) While at cruise power and maximum differential pressure, check the following for air leaks; around the main cabin door, emergency exit window, foul weather windows, etc. Refer to Pressurization Troubleshooting Checklist for additional areas to check.
- (5) Check cabin outflow valve and safety valve for escaping air pressure; both valves should be closed if 5.0 ± 2 PSIG differential is not being maintained at 23,120 feet or above.
- (6) Check the operation of each engine system and the pressurization air dump valves by dumping one valve at a time. A normal system will show a momentary rise in cabin altitude followed by a return to a stable condition on the cabin rate-of-change indicator. Close the dump valve returning the system to pressurization from both engines. Dump the opposite pressurization air dump valve and observe the cabin rate-of-change indicator for change. The rate should become stable after a momentary rise in cabin altitude.

CAUTION: SEVERE PERSONNEL DISCOMFORT WILL BE ENCOUNTERED IF BOTH PRESSURIZATION AIR DUMP VALVES ARE OPENED AT THE SAME TIME.

- (a) A continuing rate-of-change indication and a loss of differential pressure at a constant power setting, while pressurizing with one engine could indicate leaking in the pressurization air dump valves or ducting in that system.
- (7) If differential pressure 5.0 ± 2 PSIG was not maintained during the check flight, refer to the Pressurization Troubleshooting Checklist and perform inspection of Pressurization System Components, refer to Chapter 2.

4. Cabin Pressurization System Flight Check (Optional 421C0001 Thru 421C1400, Standard 421C1401 and On) (See Figure 3).

A. Cabin Pressurization System Flight Check.

- (1) Conduct a Turbocharger System Operational Flight Check, refer to Chapter 7.
- (2) During the climb to altitude, set cabin altitude control on air pressure controller for a sea level cabin. A properly functioning system should maintain a sea level cabin to 11060 feet altitude. A differential pressure of 5.0 ± 2 PSIG should be maintained throughout the remainder of the climb. Monitor cabin altitude during the climb and compare cabin pressurization schedule in the Pilots Operating Handbook and FAA Approved Airplane Flight Manual.
- (3) If the engines and turbochargers are functioning normally, according to the Turbocharger Operation Flight Check Procedures, Chapter 7, any malfunction of the cabin pressurization system should be isolated to the cabin area, its ducting seals and/or regulating equipment.

NOTE: If engines are not performing properly at altitude, the trouble should be corrected before proceeding further with this check.

- (4) While at cruise power and maximum differential pressure, check the following for air leaks; around the main cabin door, emergency exit window, foul weather windows, and etc., refer to Pressurization Troubleshooting Checklist for additional areas to check.
- (5) Check cabin outflow valve and safety valve for escaping air pressure, both valves should be closed if 5.0 ± 0.2 PSIG differential pressure is not being maintained.
- (6) Check operation of each engine and the pressurization air dump valves by dumping one valve at a time. A normal system will show a momentary rise in cabin altitude followed by a return to a stable condition on the cabin rate-of-change indicator. Close the dump valve, returning the system to pressurization from both engines. Dump the opposite pressurization air dump valve and observe the cabin rate-of-change indicator for change. The rate should become stable after a momentary rise in cabin altitude.

CAUTION: SEVERE PERSONNEL DISCOMFORT WILL BE ENCOUNTERED IF BOTH DUMP VALVES ARE OPENED AT THE SAME TIME.

- (a) A continuing rate-of-change indication and loss of differential pressure at a constant power setting, while pressurizing with one engine, could indicate leaking in the pressurization dump valves or ducting in that system.
- (7) If differential pressure 5.0 ± 2 PSIG was not maintained during the check flight, refer to the Pressurization Troubleshooting Checklist and perform inspection of Pressurization System Components, refer to Chapter 2.

5. Ground Checkout Procedure.

A. Perform cabin pressure control and rate control operational check as follows:

NOTE: These operational check procedures will verify that unpressurized operation, cabin altitude control, and cabin pressure rate-of-change control are operational.

- (1) Cabin door and windows closed, cabin pressurization dump controls forward, "Cabin Press" circuit breaker pulled out.
- (2) Start engines and run at 22 inches of manifold pressure. Confirm that airplane vacuum is in the green range.
- (3) Rotate cabin altitude selector knob until CABIN ALT indicates approximately sea level.
- (4) Rotate cabin rate control knob counterclockwise and note a reduction in rate-of-change of cabin pressurization.
- (5) Rotate cabin rate control selector knob clockwise and note an increase in cabin rate-of-change.
- (6) Allow cabin pressure to stabilize at the selected value.
- (7) Pull and reset cabin pressurization circuit breaker and visually observe safety valve open with circuit breaker in and closed with circuit breaker out.
- (8) Set cabin altitude selector on the controller full clockwise.
- (9) Rotate cabin rate control knob counterclockwise and note a reduction in cabin pressure rate-of-change.
- (10) Rotate cabin rate control knob clockwise and note an increase in cabin pressure rate-of-change; then allow cabin pressure to return to field altitude.
- (11) Close "Cabin Press" circuit breaker and note that the safety valve fully opens and the outflow valve moves to the open position.
- (12) Shut down both engines.

ALTITUDE X 1000 FT	DIFFERENTIAL PRESSURE PSI	ALTITUDE X 1000 FT	DIFFERENTIAL PRESSURE PSI	ALTITUDE X 1000 FT	DIFFERENTIAL PRESSURE PSI
1	.52	6	2.92	12	5.35
2	1.03	7	3.35	13	5.71
3	1.52	8	3.78	14	6.06
4	2.00	9	4.19	15	6.40
5	2.47	10	4.58	16	6.72
		11	4.97		

Pressure/Altitude Chart

6. Positive Differential Pressure Relief Operation Check of Safety Valve and Outflow Valve.

A. Preferred Method.

- (1) Set up test apparatus as shown in Figure 3A. Connections are provided in the nose gear wheel well on the forward pressure bulkhead.
- (2) Disconnect vacuum line at pressurization controller and plug line.
- (3) Push cabin pressurization dump controls forward to the instrument panel. Insure that all three valves are closed (ram air inlet and overboard dumps).
- (4) Disconnect vacuum control line at outflow valve.
- (5) Disconnect static sense line from the outflow valve and plug line air tight.
- (6) Disconnect auxiliary volume tank line at controller.
- (7) Turn cabin rate-of-change knob on controller full clockwise.
- (8) Pressurize cabin to 5.5 psi and watch flowmeter. If flowmeter shows a sudden increase in flow anywhere between 5.2 psi and 5.4 psi, safety valve is opening properly. If safety valve opens outside this range the valve must be replaced.

- (9) Depressurize cabin and reconnect static sense line to outflow valve.
- (10) Disconnect static sense line from safety valve and plug line (airtight).
- (11) Pressurize cabin to 5.2 psi and watch flowmeter. If flowmeter shows a sudden increase in flow between 4.9 psi and 5.1 psi the outflow valve is opening properly. If outflow valve opens outside this range the valve must be replaced.
- (12) Depressurize cabin and reconnect static sense line to safety valve.
- (13) Reconnect vacuum control line to outflow valve.
- (14) Reconnect auxiliary volume tank line to the controller.
- (15) Remove plug from vacuum line and reconnect vacuum line to controller.
- (16) Disconnect test cart.

B. Alternate Method.

NOTE: When performing ground pressurization check, the following test units or equivalent test unit may be used:

AAR Western Skyways WS600
AAR Western Skyways, Inc.
Portland-Troutdale Airport
Troutdale, OR 97060

Kitco Tool 1200/1300
Kitco Tool, Inc.
21 Water St.
Mill Hall, PA 17751

- (1) Disconnect the airplane vacuum line, at manifold tee fitting, and install a needle valve P/N 5126207-2 valve and P/N 5600108-51 line assembly or equivalent valve. Connect one side of the needle valve to the vacuum line and the other side to the tee fitting. Open needle valve to the full open position.
- (2) Close and secure cabin door.
- (3) Rotate cabin rate control selector knob to the full clockwise position. This will allow the pressure in the rate chamber to remain equalized with cabin pressure during the following checkout procedures.
- (4) Rotate cabin altitude selector knob until CABIN ALT indicates approximately 500 feet above field altitude.
- (5) Set brakes, start engines and establish a steady cabin air inflow.
- (6) Open landing gear circuit breaker to simulate flight condition. Note that the safety valve closes and the outflow valve moves toward the open position.
- (7) Slowly start to close needle valve in airplane vacuum line until cabin pressure starts to increase as indicated on cabin altimeter and rate-of-change indicator. Adjust needle valve to establish a comfortable cabin pressure rate-of-change. Increase the cabin pressure to positive differential pressure control operation.

NOTE: Opening needle valve in vacuum line will decrease cabin pressure rate-of-change. Closing needle valve will increase cabin pressure rate-of-change.

- (8) When the cabin pressure control system has reached positive differential pressure control operation, as shown on the cabin-to-atmosphere differential pressure gage and the cabin pressure rate-of-change decreases to zero, close needle valve to shut off airplane vacuum. The cabin pressure control system will control cabin pressure on normal positive differential pressure control operation.
- (9) Disconnect true static atmosphere line from port No. 1 of outflow valve. Cap the atmosphere line. Differential pressure control operation will transfer to the safety valve and the system will be controlled on maximum positive differential pressure control operation.

NOTE: This will verify the operation of the outflow valve and the safety valve.

- (10) Reconnect true static atmosphere line to port No. 1 to outflow valve and allow differential pressure control to transfer to outflow valve.
- (11) Slowly open needle valve in airplane vacuum line to establish a comfortable cabin pressure rate-of-change while ascending to field altitude.

NOTE: Closing needle valve in airplane vacuum line will decrease cabin pressure rate-of-change. Opening needle valve will increase cabin pressure rate-of-change.

- (12) When cabin pressure has returned to field altitude, shut down the engines.
- (13) Remove needle valve and reconnect airplane vacuum line to tee fitting.

7. Pressurization System Leak Check.

A. Leak Check Pressurization Components.

- (1) Disconnect controller vacuum supply line between controller and tee fitting and connect alternate vacuum supply.
- (2) Seal cabin air filter orifice on controller with pressure tape.

NOTE: Insure that air sense port on controller is open.

- (3) Turn altitude controller and rate control knobs full clockwise.
- (4) The following procedures check the controller, auxiliary volume tank, outflow valve and interconnecting plumbing.
 - (a) Apply 1 inch/Hg vacuum to the system (1000 feet on the altimeter). Do not exceed 2000 feet per minute rate-of-change, this allows the two internal chambers within the controller to equalize then close vacuum control valve.

NOTE: Apply vacuum slowly because the amount of vacuum will increase rapidly when the outflow valve opens fully.

- (b) Observe altimeter; altitude decrease shall not exceed 150 feet in one minute.
- (c) If leakage is greater than 150 feet in one minute, apply positive pressure to system (maximum 0.5 psi) to isolate leakage. Repair leakage as required.
- (5) Disconnect alternate source of vacuum and reconnect controller vacuum supply line to tee.
- (6) The following procedures check the safety valve, solenoid dump valve and plumbing.
 - (a) Open solenoid dump valve.
 - (b) Disconnect manifold vacuum supply line at tee and connect alternate source of vacuum.
 - (c) Apply 1 inch/Hg vacuum to the system (1000 feet on the altimeter). Do not exceed 2000 feet per minute rate-of-change, this allows the two internal chambers within the controller to equalize, then close vacuum control valve.

NOTE: Apply vacuum slowly because the amount of vacuum will increase rapidly when the outflow valve and safety valve open fully.

- (d) Observe altimeter; altitude decrease shall not exceed 250 feet in one minute.
- (e) If leakage is greater than 250 feet in one minute, apply positive pressure to system (maximum 0.5 psi). Isolate leakage. Repair leakage as required.
- (7) Disconnect alternate vacuum supply and reconnect manifold vacuum line to tee.
- (8) Remove pressure tape from orifice on controller and safety valve.

8. Cabin Altitude and Rate Controller Functional Test and Adjustment (Airplanes C0601 and On).

A. The following procedure for setting the pressurization controller cabin altitude select and cabin rate control knobs is recommended.

- (1) Prior to engine startup, rotate the cabin altitude select knob full counter-clockwise. Rotate the cabin rate control knob to maximum rate (full clockwise). Using the 3/64-inch Allen wrench (rate knob) and 1/16-inch Allen wrench (cabin altitude), verify that the set-screw to the left of the knob centerline is tight on both knobs. Loosen the set-screw to the right of the knob centerline on both knobs. Return the rate control knob and altitude select knobs to recommended takeoff positions.

- (2) Using recommended takeoff and climb pressurization procedures, climb to 12,000 feet, establish level flight and maximum recommended cruise power.
- (3) After the pressurization system has stabilized, using a hand-held calibrated altimeter, set to 29.92 inches of Mercury, rotate the cabin altitude select knob until a 5000-foot cabin is indicated on the hand-held altimeter.
- (4) If required, loosen the set-screw in the cabin altitude select knob (set-screw not loosened in Step 1) (do not remove knob). Insert a .020-inch feeler gage between the knob assembly and the controller face and rotate the knob until a 5000-foot cabin is indicated on the control head. Tighten both set-screws and remove feeler gage.
- (5) Rotate the cabin rate control knob to the vertical (12 o'clock) position.
- (6) Rotate the cabin altitude select knob to 7000 feet. Using a stopwatch and the hand-held altimeter, determine and note the cabin rate-of-change. Verify that the system stabilizes at 3000 ± 500 feet as indicated on the hand-held altimeter. Reselect 5000-foot cabin and allow the system to stabilize. If the rates-of-change, as determined in Steps (6) and (7) are not within 350 feet per minute to 650 feet per minute, continue to Step (8). If within, tighten set-screw loosened in Step (1) and proceed with descent procedures.
- (7) Select the larger rate-of-change as established in Steps (6) and (7) and repeating that step, rotate the cabin rate control knob until the rate is 600 feet per minute as determined by the hand-held altimeter and stop-watch.
- (8) Loosen the set-screw in the cabin rate control knob (set-screw not loosened in Step 1). (Do not remove the knob from the controller.) Insert a .020-inch feeler gage between the knob and the controller and rotate the knob pointer to the vertical (12 o'clock) position and tighten both set-screws and remove feeler gage.

Return the airplane pressurization system to a comfortable rate control and selected altitude. Initiate airplane descent procedures as outlined in the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

Required equipment:

- (1) 3/64 Allen Wrench
- (1) 1/16 Allen Wrench
- (1) Calibrated Hand-Held Altimeter
- (1) Stop-watch
- (1) .020-inch Feeler Gage - approximately 1 inch x 1 inch.

9. Internal Leak-Check of Volume Tank, Outflow Valve and Safety Valve.

A. Volume Tank.

- (1) Connect a vacuum source to volume tank. Supply volume tank with 6.0 inch of water vacuum, pressure increase must not exceed 0.10 inch of water in one minute.

B. Outflow Valve (Port 2).

- (1) Disconnect tube at Port "2" on outflow valve. Supply outflow valve with 6.0 inch of water vacuum. Pressure increase must not exceed 0.5 inch of water in one minute.

C. Outflow Valve (Port 1).

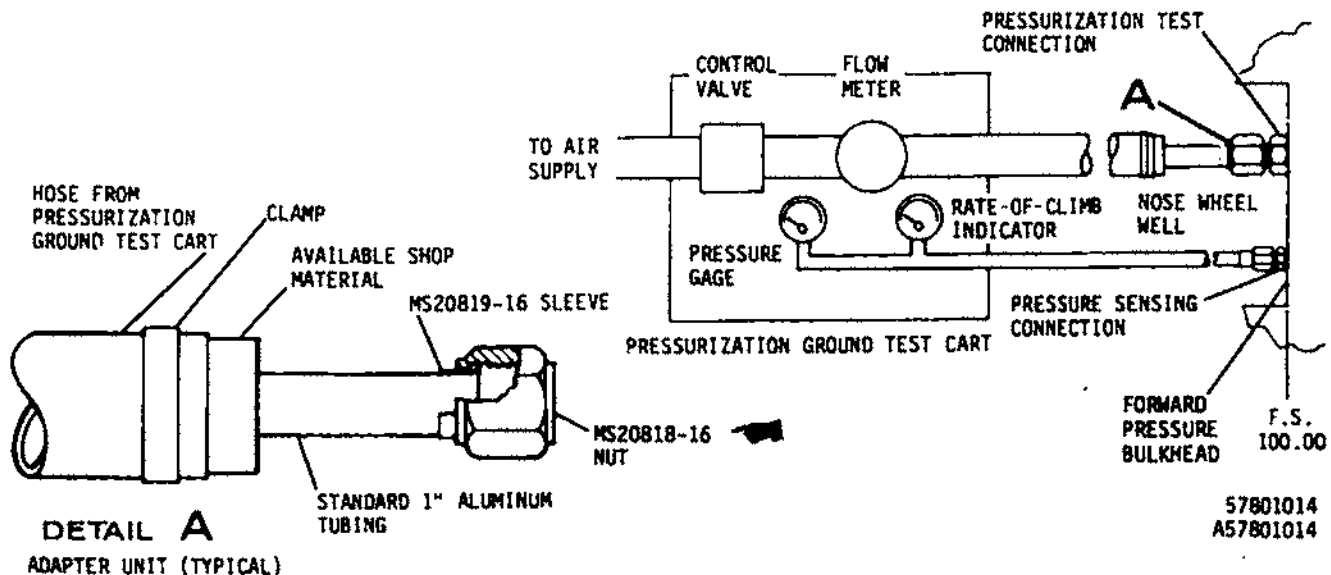
- (1) Disconnect tube at Port "1" on outflow valve. Supply outflow valve with 6.0 inch of water vacuum pressure. Pressure increase must not exceed 0.5 inch of water in one minute.

D. Safety Valve (Port 1).

- (1) Disconnect tube at solenoid valve and seal cabin air filter with tape. Supply tube and safety valve with 6.0 inch of water vacuum. Pressure increase must not exceed 0.5 inch of water in one minute.

E. Safety Valve (Port 2).

- (1) Disconnect tube at solenoid valve and seal cabin air filter with tape. Supply tube and safety valve with 6.0 inch of water vacuum. Pressure increase must not exceed 0.5 inch of water in one minute.



Cabin Outflow Valve and Safety Valve Differential Setting
Figure 501

CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL

10. Barometric Pressure Switch Removal/Installation.

A. Removal of barometric pressure switch.

1. Place battery switch in the OFF position.
2. Remove barometric pressure switch, located behind the left instrument panel below the pressurization air controls. (Refer to 6-11 Figure 2 for location).
3. Tag and disconnect barometric pressure switch wiring.
4. Remove two screws and nuts securing switch.

B. Installation of barometric pressure switch.

1. Position barometric pressure switch in left instrument panel below the pressurization air controls, and secure with screws.
2. Connect wiring to barometric pressure switch.

11. Barometric Pressure Switch Functional Test.

A. Functional Test Cabin Altitude Barometric Pressure Switch (Alternate Inflight Method).

NOTE : Functional test of the barometric pressure switch may be performed in flight or (alternate method) in a shop using a vacuum vessel.

1. Ensure crew oxygen is available.
2. Fly the airplane to 10,500 feet with cabin depressurized and observe the following:
 - a. As the cabin altitude climbs through 9650 to 10,350 feet, the annunciator light CABIN ALT 10,000 FT. and master warning lights illuminate.
3. Decrease altitude, observe that annunciator light CABIN ALT 10,000 FT. goes out before reaching 8450 feet.

B. Functional Test Cabin Altitude Barometric Pressure Switch.

NOTE : Testing the barometric pressure switch is accomplished in the shop using a vacuum vessel (bell jar) or locally fabricated vacuum container. Refer to Fabrication of Barometric Test Container Figure 502.

1. Remove barometric pressure switch. Refer to Barometric Pressure Switch Removal / Installation.
2. In shop, place the barometric pressure in a vacuum vessel (bell jar or test container) capable of simulating altitude changes, and connect a continuity tester to the two (2) switch wires.
3. Carefully apply vacuum equivalent to the altitude for actuation of the barometric switch, and observe the continuity tester for switch actuation. Do not exceed 14,500 feet altitude on the locally fabricated test container or damage to the test container may result.

NOTE : The barometric pressure switch should actuate CLOSE on INCREASING altitude (vacuum) 9650 to 10,350 feet, and should actuate OPEN on DECREASING altitude (vacuum) from 10,350 to 8450 feet.

4. Record the closed and open altitude actuation of the barometric pressure switch.
5. Compare the recorded actuation of the barometric pressure switch with the required closed and open altitude range.
 - a. No adjustment is permitted to the barometric pressure switch. A switch failing the test must be replaced.
6. Slowly decrease the vacuum in the vacuum vessel (bell jar or test container) to zero. Remove barometric pressure switch and disconnect continuity tester.
7. Install serviceable barometric pressure switch in the airplane. Refer to Barometric Pressure Switch Removal / Installation.

12. Fabrication of Barometric Switch Test Container.

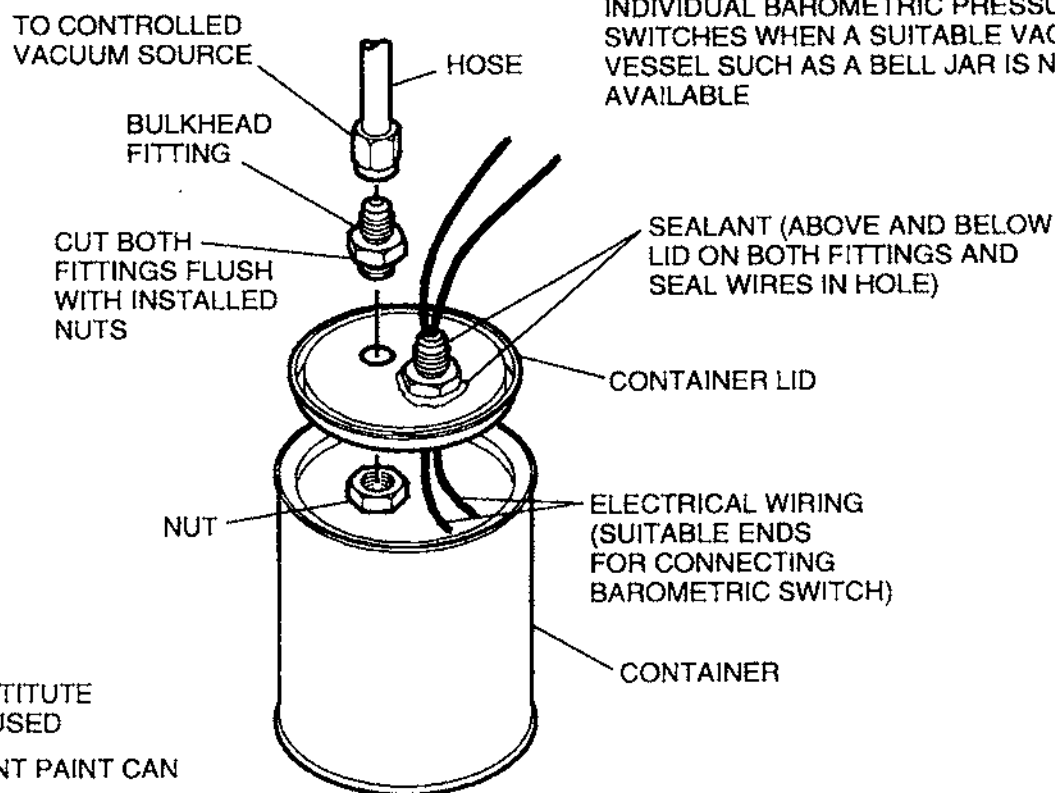
A. Test Container.

NOTE : Facilities not equipped with a suitable vacuum vessel such as a bell jar may locally fabricate a barometric test container using the following information and Figure 502 as a guide.

CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL

1. Obtain the necessary materials as listed in Figure 502. Suitable substitute items may be utilized. The container should be capable of being airtight such as a pint paint can with a removable lid.
2. Drill two holes (0.50 inch) in the lid.
3. With sealant (Type 1, Class B) applied on the bulkhead union fittings and lid mating surfaces, install the unions through the drilled holes and secure with jamnuts.
4. Cut off both union fittings flush with the bottom of the jamnuts to provide more room inside the container for the barometric pressure switch.
5. Thread two 10 inch electrical wires through one of the bulkhead union fittings, letting the wires extend equal lengths out of the union fitting.
6. Apply sealant (Type 1, Class B) around the electrical wires at each end of the union fitting and seal the fitting hole.
7. Allow sealant to cure, install lid on the container, and test the container for leakage by attaching a vacuum equal to 14,500 feet altitude. Shut off vacuum and hold for approximately five minutes to check for loss of vacuum.
8. Decrease vacuum to zero and disconnect vacuum source.

NOTE: LOCALLY FABRICATED TEST CONTAINER MAY BE USED TO TEST INDIVIDUAL BAROMETRIC PRESSURE SWITCHES WHEN A SUITABLE VACUUM VESSEL SUCH AS A BELL JAR IS NOT AVAILABLE



MATERIAL

SUITABLE SUBSTITUTE
ITEMS MAY BE USED

CONTAINER: PINT PAINT CAN
BULKHEAD

FITTINGS: AN832-4D (2)

NUTS: AN924-4D (2)

SEALANT: TYPE 1, CLASS B (AS REQUIRED)

WIRE: 20-GAUGE, 10-INCH (2 COLORS
FOR IDENTIFICATION)

Fabrication of Barometric Test Container
Figure 502

Maintenance Practices

1. Removal/Installation Heat Exchanger (See Figure 4).

NOTE: Removal/installation is given for left-hand side; right-hand side is similar.

A. Remove Heat Exchanger.

- (1) Remove heat exchanger access door for access to heat exchanger (5).
- (2) Remove clamps (4, 11 and 19) securing ducts (3, 12 and 18) and disconnect ducts.
- (3) Disconnect dump valve control cable from dump valve (8).
- (4) Remove nuts securing adapter (6) to rib and slide adapter outboard to disengage adapter (6) from heat exchanger.
- (5) Remove screws securing heat exchanger to structure at forward side and lower heat exchanger from stub wing.

B. Install Heat Exchanger.

- (1) Position heat exchanger (5) in stub wing and secure to structure at forward side with screws.
- (2) Slide adapter (6) into heat exchanger and secure adapter to rib with nuts.
- (3) Connect dump valve control cable to dump valve (8) using clamp (bolt), two washers and nut and ensure dump valve opens and closes properly.
- (4) Connect ducts (3, 12 and 18) and secure with clamps (4, 11 and 19).
- (5) Install door (20).

2. Removal/Installation Pressurized Air Dump Valve (See Figure 4).

A. Remove Dump Valve.

NOTE: Removal/installation is given for left-hand side; right-hand side is similar.

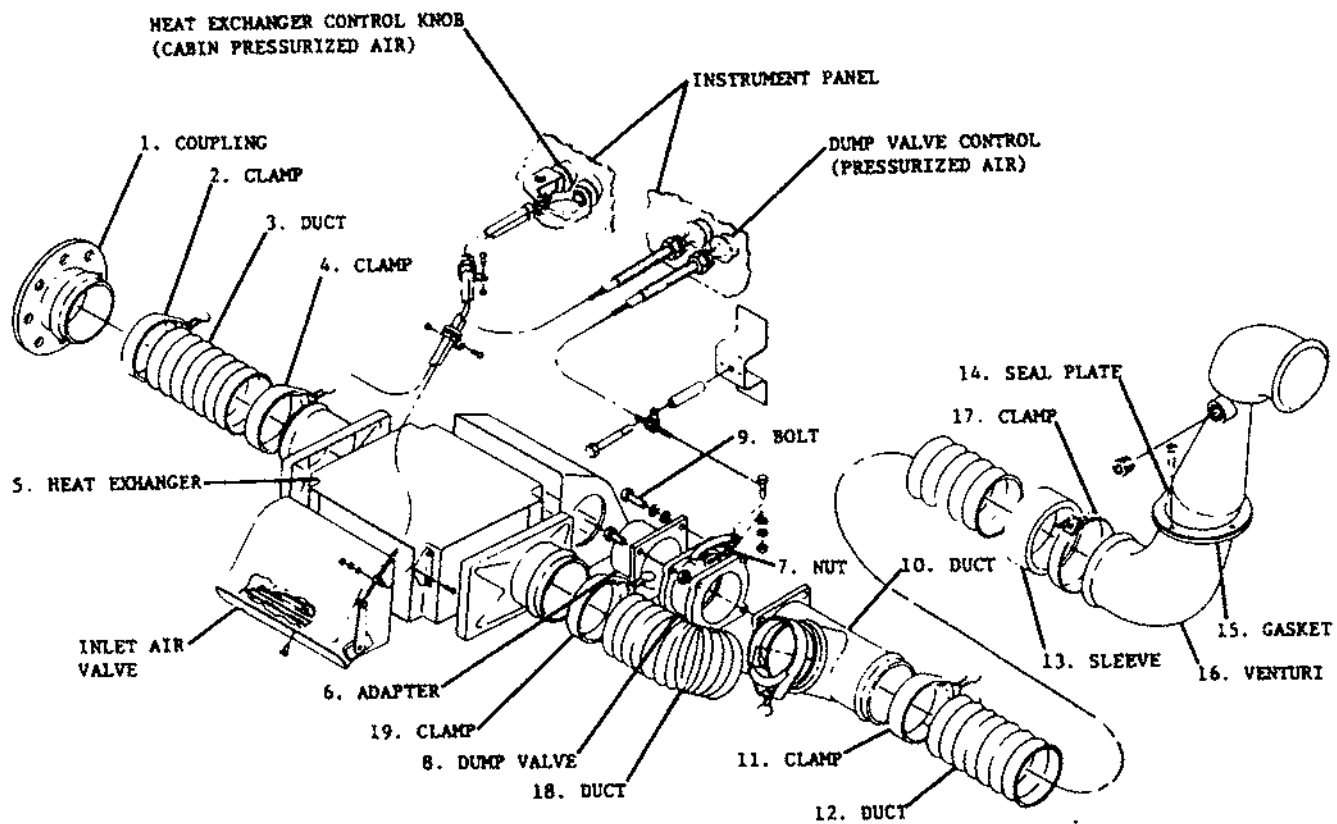
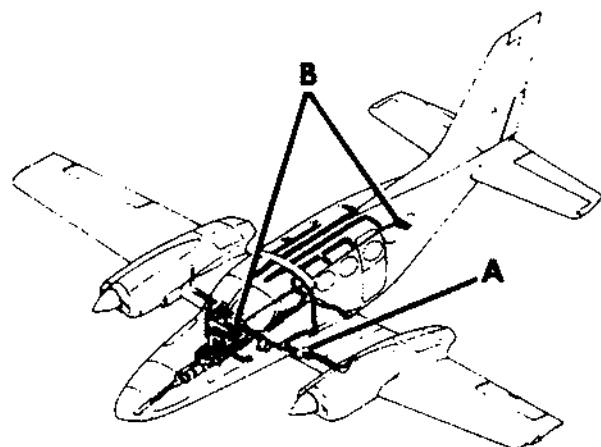
- (1) Remove door (20) access to dump valve (8).
- (2) Disconnect dump valve control cable from dump valve (8).
- (3) Remove nuts (7) and bolts (9) securing dump valve (8) to adapter (6) and rib and remove dump valve.

B. Install Dump Valve.

- (1) Position dump valve (8) between adapter (6) and duct (10) and secure with bolts (9) and nuts (7) to adapter and rib.

NOTE: Ensure o-ring is installed in groove of dump valve.

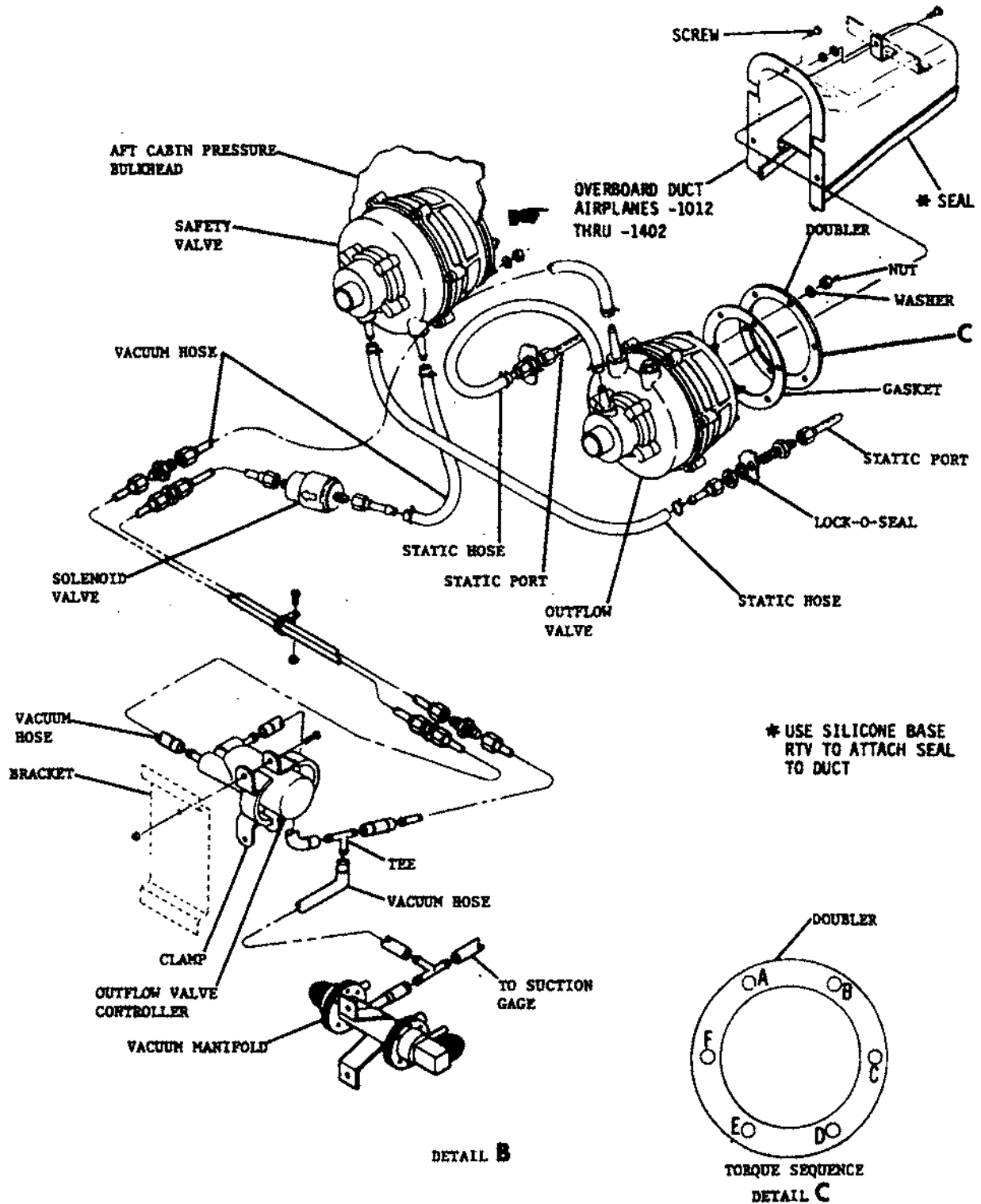
- (2) Connect dump valve control cable to dump valve (8) with clamp (bolt), two washers and nuts. Ensure dump valve opens and closes properly.
- (3) Install door (20).



DETAIL A

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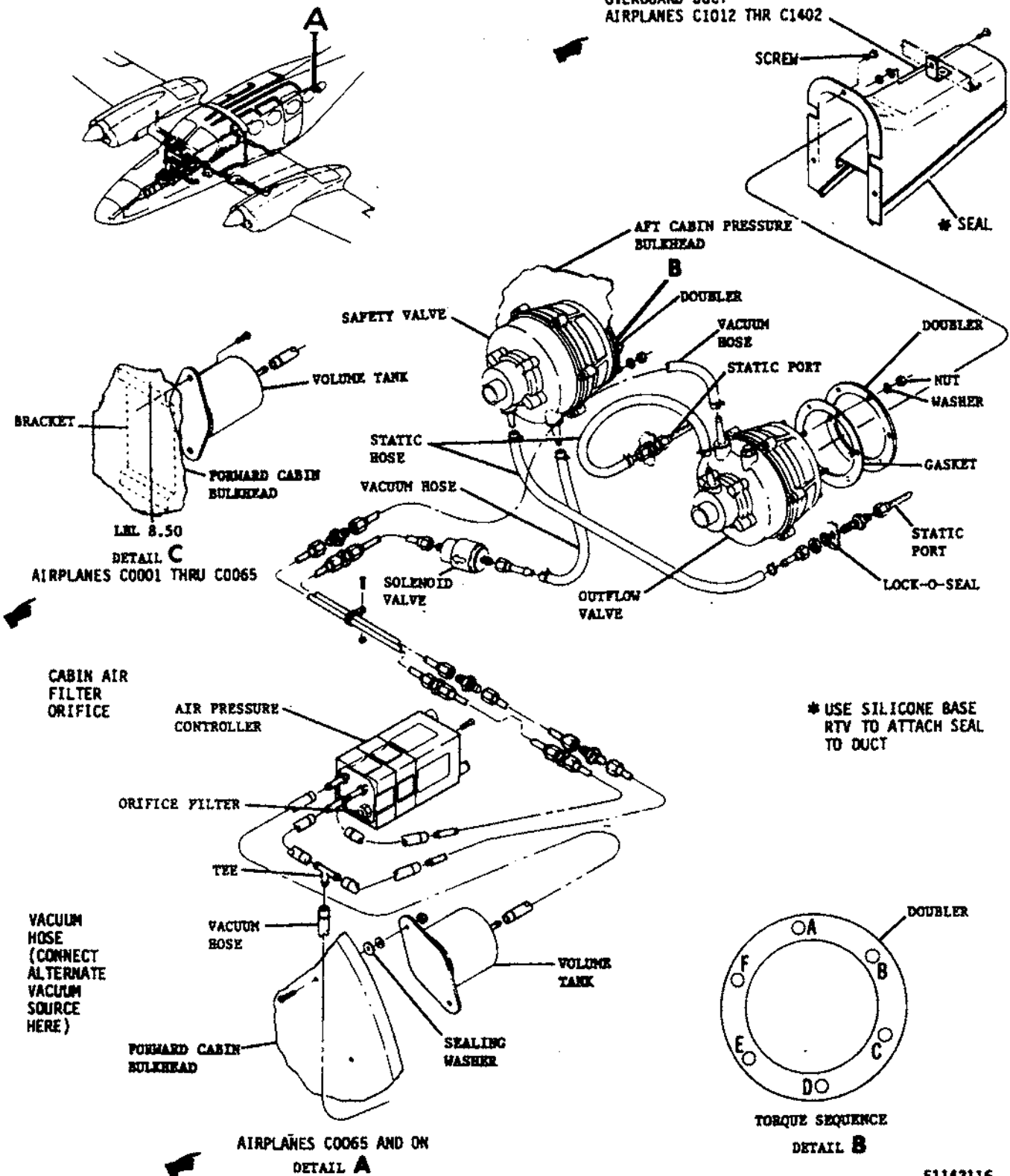
Cabin Pressurization Components Installation
Figure 4 (Sheet 1 of 2)

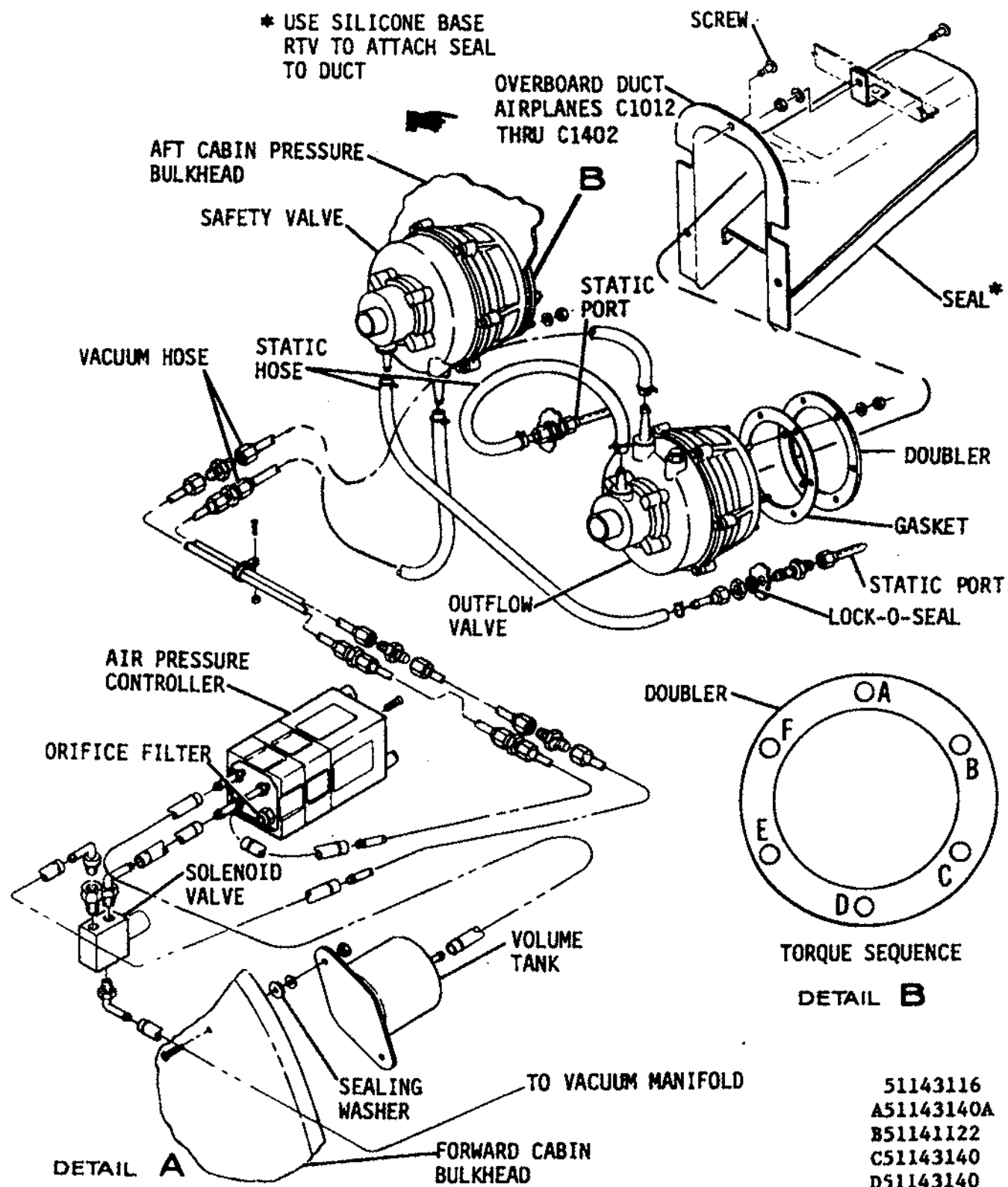


STANDARD PRESSURIZATION SYSTEM
AIRPLANES C0001 THRU C1400

Cabin Pressurization Components Installation
Figure 4 (Sheet 2)

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OVERBOARD DUCT
AIRPLANES C1012 THR C1402OPTIONAL PRESSURIZATION SYSTEM
AIRPLANES C0001 THRU C1400Variable Cabin Pressurization Components Installation
Figure 5 (Sheet 1)51143116
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STANDARD PRESSURIZATION AIRPLANES C1401 AND ON
Variable Cabin Pressurization Components Installation
Figure 5 (Sheet 2)

3. Removal/Installation Pressurization Air Venturi (See Figure 4).

NOTE: Removal/Installation is given for left-hand side; right-hand side is similar.

A. Remove Venturi.

- (1) Remove upper engine cowl, refer to Chapter 7.
- (2) Remove access plate for access to clamp (17), refer to Chapter 1.
- (3) Disconnect venturi (16) from duct (13) by loosening clamp (7).
- (4) Remove screws securing seal plate (14) and gasket (15).
- (5) Disconnect venturi (16) from engine throttle body and remove venturi.

B. Install Venturi.

- (1) Insert venturi (16) in hole and secure using gasket (15), seal plate (14) and screws.
- (2) Connect venturi (16) to engine throttle body.
- (3) Connect duct (13) to venturi (16), using sleeve (13) and clamp (17).
- (4) Install access plate.
- (5) Install upper engine cowl.

4. Removal/Installation Outflow Valve (See Figure 4 or Figure 5).

NOTE: These procedures are applicable to the Standard or Optional Pressurization System.

A. Remove Outflow Valve.

- (1) Remove tailcone access, refer to Chapter 3.
- (2) On 421C0868 and On, remove the duct on the aft side of the outflow valve to gain access to the nuts securing the valve to the bulkhead.
- (3) Remove floor panels at Station 289.94 as required for access to outflow valve, refer to Chapter 3.
- (4) Disconnect static and vacuum hoses from outflow valve.
- (5) From aft side of cabin bulkhead, remove nuts, washers and doubler, while holding outflow valve to prevent damage from falling.

B. Install Outflow Valve.

- (1) Install outflow valve on bulkhead, using gasket, doubler, washers and nuts.
- (2) Torque nuts A, C and E to 6 inch-pounds and nuts B, D and F finger tight per torque sequence shown in Figures 4 and 5.
- (3) Connect vacuum and static hoses to outflow valve.
- (4) Install floor panels.
- (5) On 421C0885 and On, install the duct on the aft side of the outflow valve to vent air overboards.
- (6) Install tailcone access, refer to Chapter 3.

5. Removal/Installation Safety Valve (See Figure 4 or Figure 5).

NOTE: These procedures are applicable to the Standard or Optional Pressurization System.

A. Remove Safety Wire.

- (1) Remove tailcone access, refer to Chapter 3.
- (2) Remove floor panels at Station 289.94 as required for access to safety valve, refer to Chapter 3.
- (3) Disconnect static and vacuum hoses from safety valve.
- (4) From aft side of cabin bulkhead, remove nut, washers and doubler, while holding safety valve to prevent damage from falling.

B. Install Safety Valve.

- (1) Install safety valve on doubler, using gasket, doubler, washers and screws.
- (2) Torque nuts A, C and E to 6 inch-pounds and nuts B, D and F finger tight per torque sequence shown in Figures 4 and 5.
- (4) Connect vacuum and static hoses to safety valve.
- (5) Install floor panels.
- (6) Install tailcone access, refer to Chapter 3.

6. Removal/Installation Outflow Valve Controller (See Figure 4).

A. Remove Outflow Valve Controller.

- (1) Disconnect vacuum hoses from outflow valve controller.
 - (2) Remove outflow valve controller by removing clamp, screws and nuts.
- B. Install Outflow Valve Controller.
- (1) Secure outflow valve controller to bracket with clamp, screws and nuts.
 - (2) Connect vacuum hoses to outflow valve controller.
7. Removal/Installation Air Pressure Controller (Optional) (See Figure 5).
- A. Remove Air Pressure Controller.
- (1) Disconnect hoses from air pressure controller.
 - (2) Remove screws securing controller to instrument panel and remove controller.
- B. Install Air Pressure Controller.
- (1) Secure air pressure controller to instrument panel with screws.
 - (2) Connect hoses to controller.
8. Removal/Installation Volume Tank (Optional) (See Figure 5).
- A. Remove Volume Tank.
- (1) Disconnect hose from volume tank.
 - (2) Remove volume tank by removing screws.
- B. Install Volume Tank.
- (1) Secure volume tank to bracket with screws.
 - (2) Connect hose to volume tank.

Inspection/Check

1. Inspection/Check Pressurization System.
 - A. Remove stub wing leading edge access panels to inspect ducting.
 - B. Remove floor panels as required to inspect plumbing, outflow valve and safety valve, refer to Chapter 3.

Cleaning/Painting

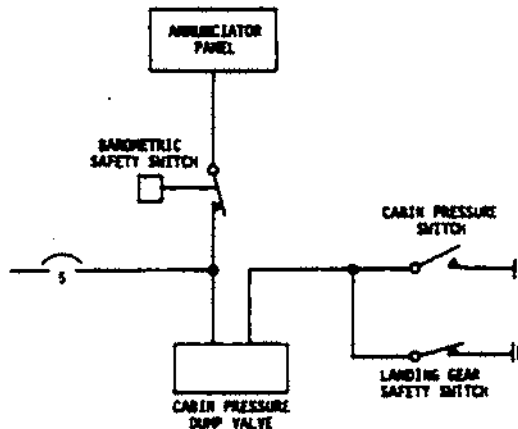
1. Cleaning Pressurization System Components.
 - A. Clean Pressurization Components.
 - (1) Cleaning of components of the cabin pressure control system is limited to cleaning of filters in the air pressure controller (optional system), safety valve and cleaning seats in the outflow and safety valves. Refer to Cabin Pressure Control System Operation Instructions P/N 4-266, available from Cessna Dealers' Organization.
 - (2) Refer to Maintenance Practices for Removal/Installation of air pressure controller, safety valve and outflow valve.
2. Cleaning Pressurized Air Dump Valves.
 - A. Clean Dump Valves.
 - (1) Cleaning the dump valves requires the removal of the valves, refer to Maintenance Practices, Removal/Installation Pressurized Air Dump Valves.
 - (2) Clean dump valves, refer to Pressurization Air Dump Valve Service/Parts Information P/N 43D57, available from Cessna Dealers' Organization.

PRESSURIZATION SYSTEM CONTROLSDescription

1. The pressurization system controls consist of the cabin pressurization switch, manual controls and indicators. The manual controls located on the left-hand instrument panel consists of: LH and RH pressurization air dump valve controls. The pressurization system indicators are located on the left-hand instrument panel and consist of: cabin altitude and differential pressure indicator, cabin rate-of-change indicator and cabin air pressurization controller (optional).

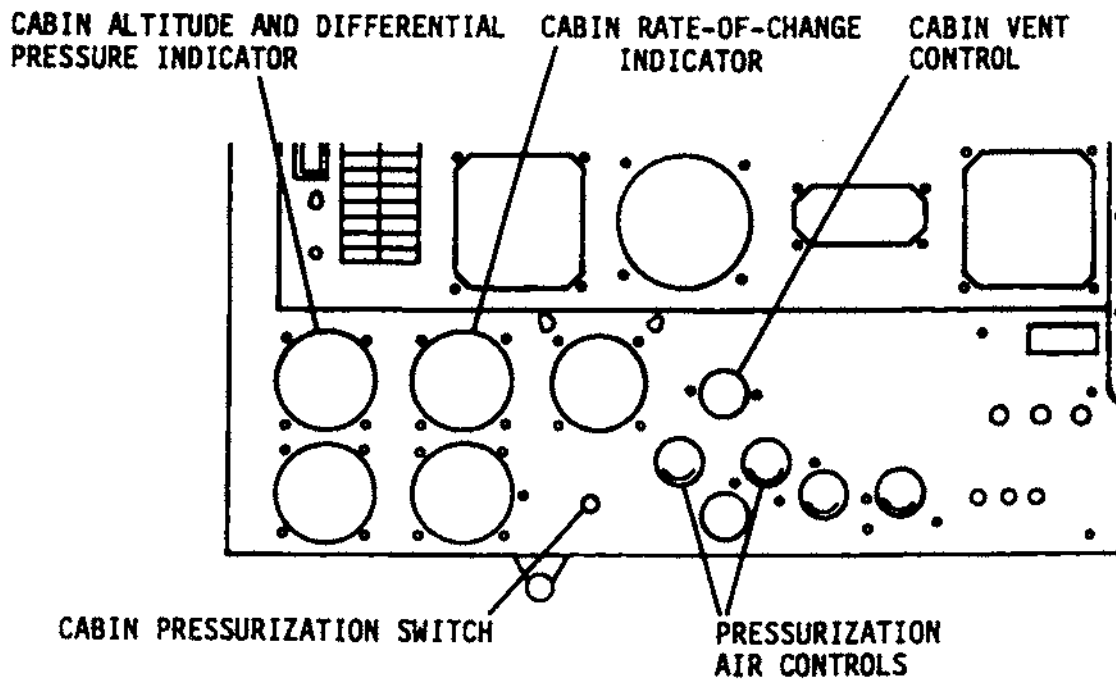
Maintenance Practices

1. Removal/Installation Pressurization System Indicators.
 - A. For removal/installation of indicators, refer to Chapter 10.
 - B. For removal/installation of air pressurization controller, refer to Removal/Installation Air Pressurization Controller, Chapter 6.

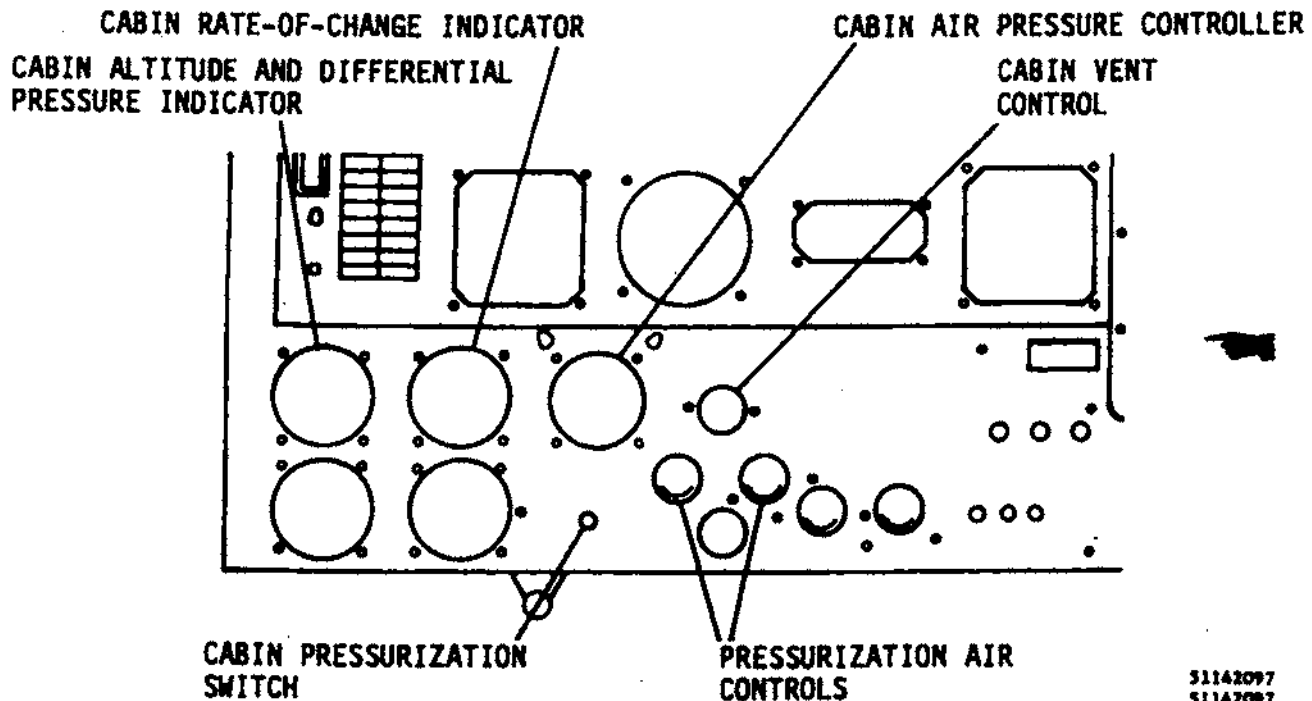


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Cabin Pressurization Simplified Schematic
Figure 1



STANDARD PRESSURIZATION SYSTEM



OPTIONAL PRESSURIZATION SYSTEM

Pressurization System Controls and Indicators
Figure 2

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CABIN HEATER, DEFROST AND VENTILATION SYSTEMDescription

1. The heating and ventilating system provides air for cabin heating, cooling, ventilation, defrosting and also provides an air distribution source for cabin pressurization. Air enters the cabin through controllable outlets. Two outlets are located at the base of the windshield for defrosting purposes, two are located on the forward cabin pressure bulkhead just forward of each set of rudder pedals and one is mounted on each side of the cabin. Also, there are overhead outlet valves.
2. During unpressurized ground operations, fresh air enters a ram air scoop, located in the nose of the aircraft. The air is forced through the cabin outlets by use of the cabin heater ventilating fan. The cabin heater controls the temperature of the ventilating air. The heater ventilating fan is operated by the use of either the Cabin Fan switch or the Cabin Heat switch. During unpressurized flight operations, air from the turbocharger enters the ventilation system through a ducting and is routed through ducts to individual adjustable overhead outlet valves.
3. During pressurized flight, ventilating air (pressurized) is ducted from the turbocharger compressor, through the heat exchanger. Which cools the air (provided heat exchanger ram air valve is open) into the cabin air ducting. In the cabin a portion of the pressurized air is routed to the overhead outlet valves. The remainder of pressurized air is routed through the ducting to the cabin heater. The cabin heater heats the pressurized air and the heater ventilating fan forces the air back into the cabin and out through the cabin outlets. Pressurized air continually enters the cabin and is exhausted through a cabin pressure outflow valve. For Pressurization System information, refer to Pressurization System.
4. An auxiliary cabin air ventilation system (optional) may be installed in the aircraft. This system circulates cabin air through ducting along both sides of the cabin area.

CABIN HEATER AND DEFROST SYSTEMDescription

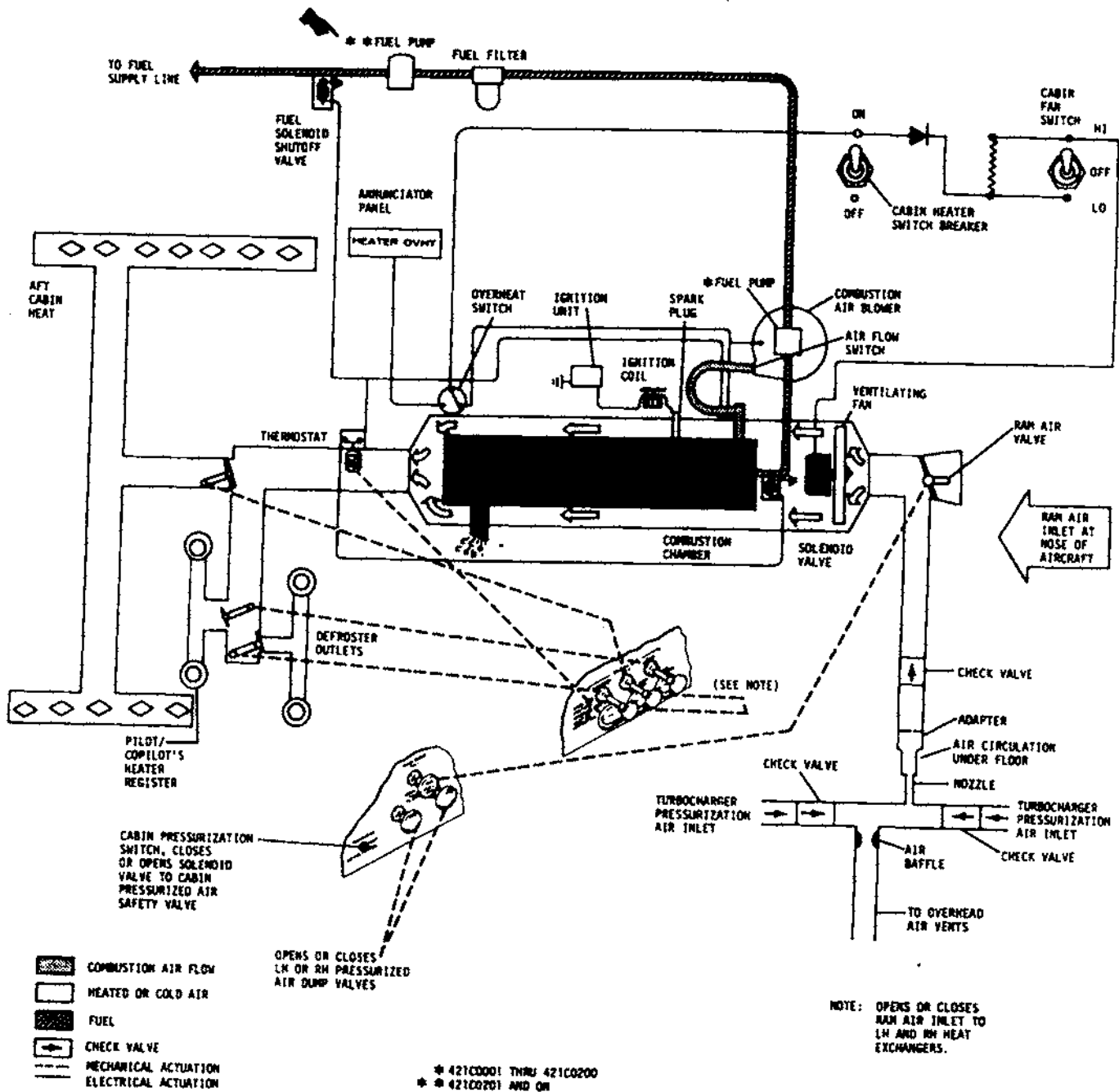
1. The cabin heater is mounted in the nose section, right-hand aft side. The heater is a gasoline combustion type, operation of the heater is controlled electrically.
2. Heater fuel is obtained from the airplane's main fuel system. The fuel is routed from a tee in the main fuel system crossfeed line through an electrically operated solenoid (shutoff) valve and a filter, located in the leading edge of the right stub wing and on to the cabin heater fuel pump. On airplanes C0201 and On, a fuel pump is mounted adjacent to the shutoff valve. On airplanes C0001 through C0200, the heater fuel pump assembly is enclosed in a metal housing and mounted on the combustion blower motor. The metal housing is vented and drained as a precaution against fire in event of a fitting leakage. Fuel from the heater fuel pump enters the heater solenoid (electrically operated) which allows fuel to pass through the combustion chamber spray nozzle.
3. Electrical current is supplied to the combustion air blower, combustion air pressure switch and ignition coil, solenoid valve and fuel pump when the Cabin Heater switch is positioned to ON. As the combustion air flow increases, the combustion air pressure switch closes and actuates the ignition coil and heater solenoid valve. Fuel then flows through the heater solenoid valve into the combustion chamber spray nozzle which injects a conical shaped spray cone of fuel into the combustion chamber where the spark plug is already sparking, thus combustion occurs. As the heated air forced from the heater by the ventilating fan exceeds the thermostat setting, the thermostat automatically closes the solenoid (shutoff) valve, stopping fuel flow into the heater. As the heater cools, the thermostat opens the solenoid valve, allowing fuel to flow and combustion takes place since the spark plug is continually sparking. By cycling on and off the heater maintains an even air temperature in the cabin.
4. The heater combustion chamber is completely separate from the ventilating system of the heater to prevent any exhausted gases from contaminating the cabin air. All exhausted gases are vented overboard through an exhaust tube directly beneath the heater.
5. The cabin heater utilizes an Overheat switch, mounted on the heater case to protect the heater and associated components from overheating. An electrical circuit is connected to the Overheat switch and then connected to the Heater Overheat light on the annunciator panel. If the air temperature exceeds 370°F the Overheat switch will open and shut off ignition, fuel and the combustion air blower. Simultaneously, the Overheat switch will illuminate the Heater Overheat light. The cabin heater will remain off and the Heater Overheat light will remain illuminated until the Overheat switch has been manually reset.
6. The defrost system ducting is connected to the upper plenum at the aft end of the heater and routed to the windshield. The defrost system air is controlled by a manually operated knob on the instrument panel.
7. The heater hour meter is installed in the right nose section on the baggage retainer. If the airplane is not equipped with a heater hour meter, a heater hour meter kit is available AK421-136A.

Troubleshooting

1. Troubleshooting Cabin Heater.
 - A. For a guide to troubleshooting the heater system, refer to Figure 2.
 - B. For troubleshooting the heater, refer to Cessna Heater and Components Overhaul/Parts Manual.

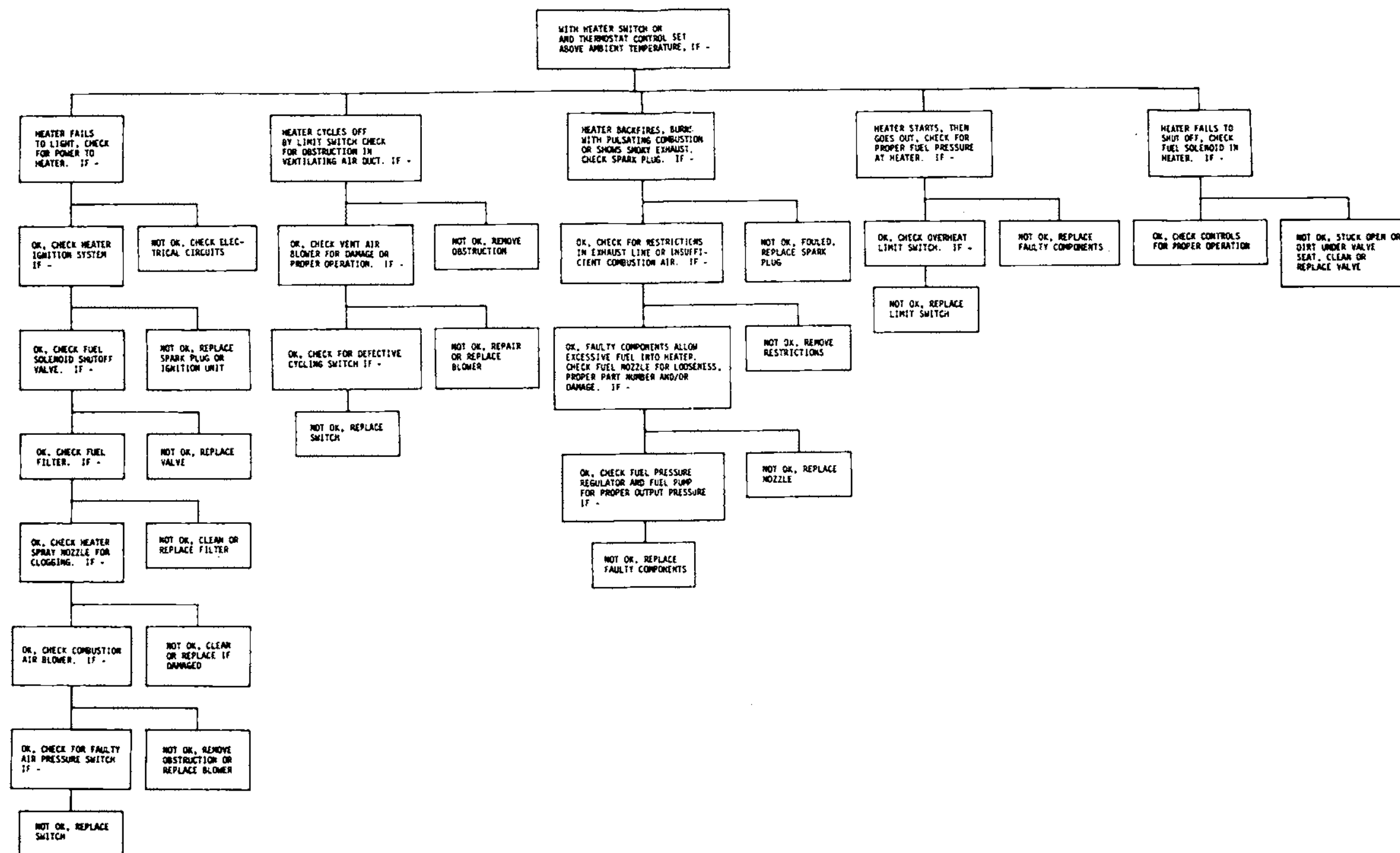
Maintenance Practices

1. Removal/Installation Heater Assembly (Refer to Figure 3).
 - A. Remove Heater Assembly.
 - (1) Remove RH nose shelves as necessary to gain access to heater. Refer to Chapter 3, Maintenance Practices.
 - (2) Tag and disconnect all electrical wiring to overheat switch (19), heater terminal strip and to combustion blower.
 - (3) Remove cover from fuel pump housing (8).



Heater and Air Ventilation Schematic
Figure 1

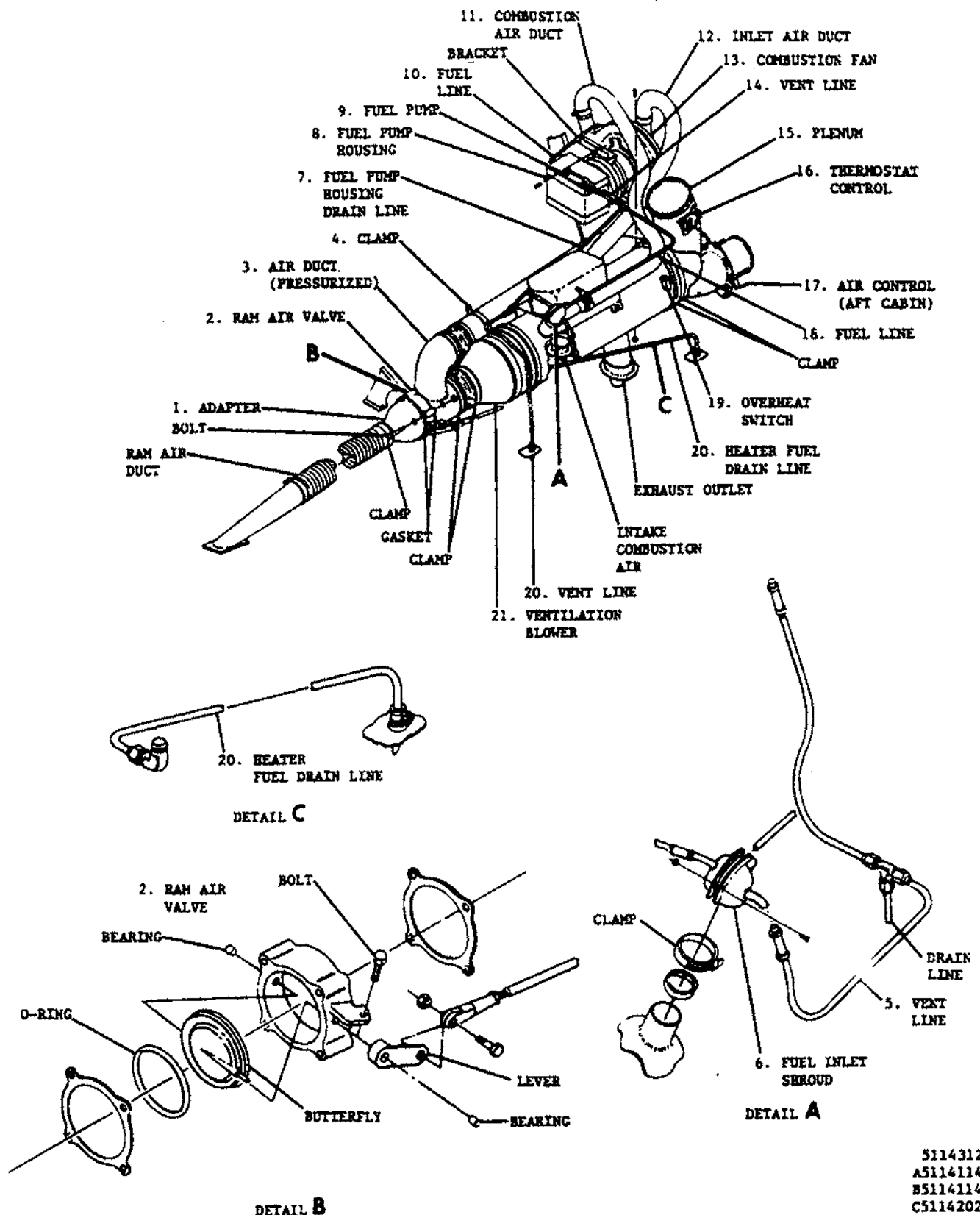
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Troubleshooting Chart - Cabin Heater
Figure 2

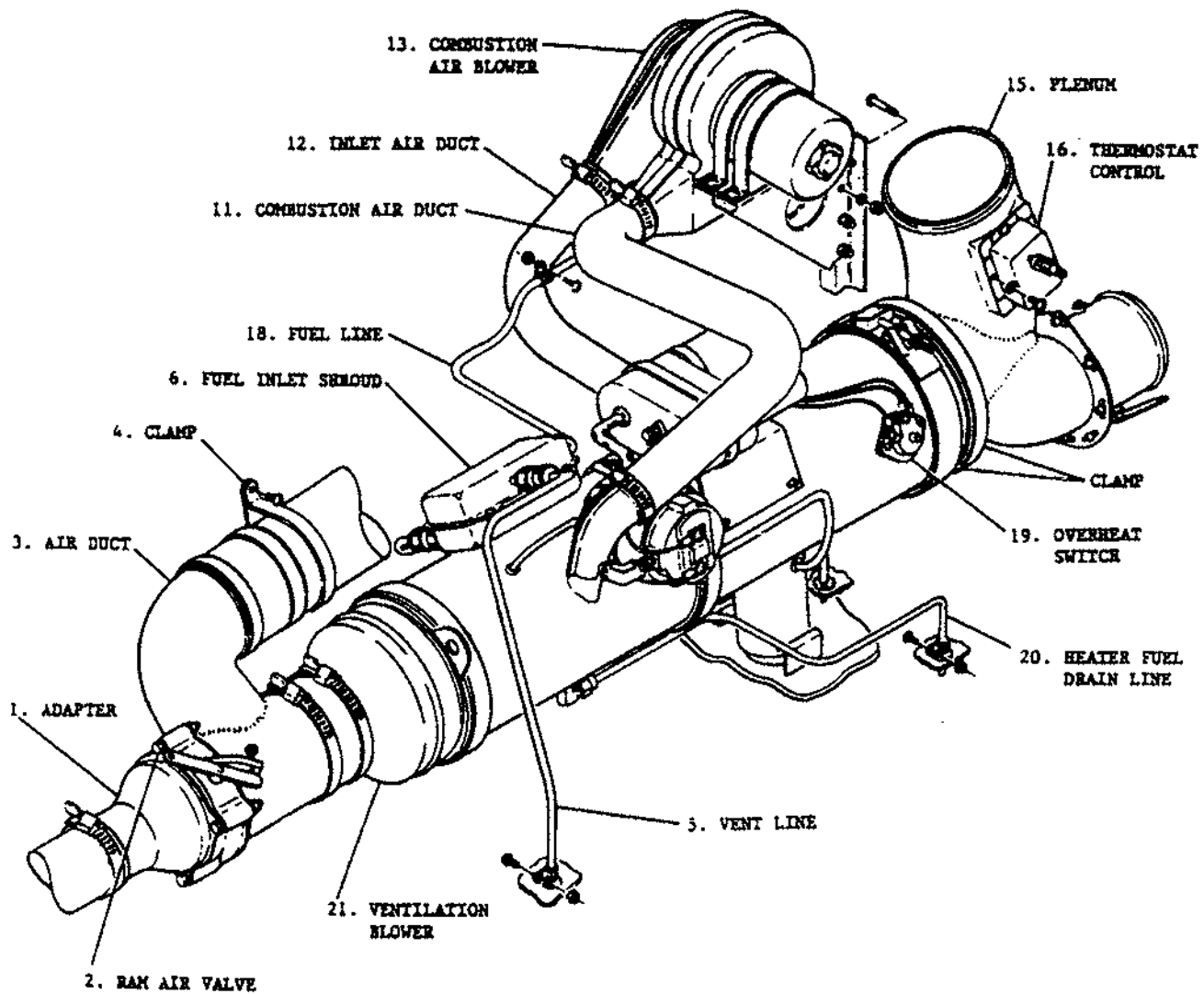
421

SERVICE MANUAL



Heater Installation
Figure 3 (Sheet 1 of 2)

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421C0201 AND ON

Heater Installation
Figure 3 (Sheet 2)

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- (4) Disconnect fuel line (18) from fuel pump (9).
- (5) Remove clamp and disconnect vent line (14) from fuel pump housing (8).
- (6) Remove clamps and disconnect vent line (5) and drain line (21) from fuel inlet shroud (6).
- (7) Disconnect combustion air duct (11) below fuel inlet shroud (6).
- (8) Remove clamp from heater at plenum (15).
- (9) Remove clamp from air duct (3) at forward end of heater and clamp (4).
- (10) Remove heater mounting clamps and lift heater out.

WARNING: FUEL ACCUMULATION IN THE NOSE IS A FIRE HAZARD. USE CAUTION WHEN REMOVING HEATER TO PREVENT RESIDUAL FUEL FROM DRAINING.

- (11) Cap all fuel lines.

B. Install Heater Assembly.

NOTE: On installation, ensure drain and vent lines are installed to provide a positive drain slope.

- (1) Remove caps from fuel lines.
- (2) Position heater in place on mounting brackets and secure clamps.
- (3) Install clamp at heater and plenum (15).
- (4) Install clamp from heater to air duct (3). Install clamp (4).
- (5) Connect combustion air duct (11) below fuel inlet shroud (6) with clamp.
- (6) Connect vent line (5) and drain line (21) to fuel inlet shroud (6) with clamps.
- (7) Connect vent line (14) to fuel pump housing (8) with clamp.
- (8) Connect fuel line (18) to fuel pump (9) and install cover on fuel pump housing (8).
- (9) Identify and connect electrical wiring to heater terminal strip, overheat switch (19) and combustion blower.
- (10) Install RH nose shelf. Refer to Chapter 3.

2. Removal/Installation Combustion Blower (See Figure 3).

A. Remove Combustion Blower.

NOTE: Heater fuel pump is part of the combustion blower assembly.

- (1) Remove RH nose shelves as necessary to gain access to combustion blower. Refer to Chapter 3.
- (2) Tag and disconnect electrical wire to combustion blower (13).
- (3) Disconnect inlet air duct (12) and combustion air duct (11) from combustion blower (13).
- (4) Remove cover from fuel pump housing (8).
- (5) Disconnect fuel lines (10 and 18) from fuel pump (9). Cap all fuel lines.

WARNING: FUEL ACCUMULATION IN THE NOSE IS A FIRE HAZARD. USE CAUTION WHEN REMOVING FUEL LINES TO PREVENT RESIDUAL FUEL FROM DRAINING.

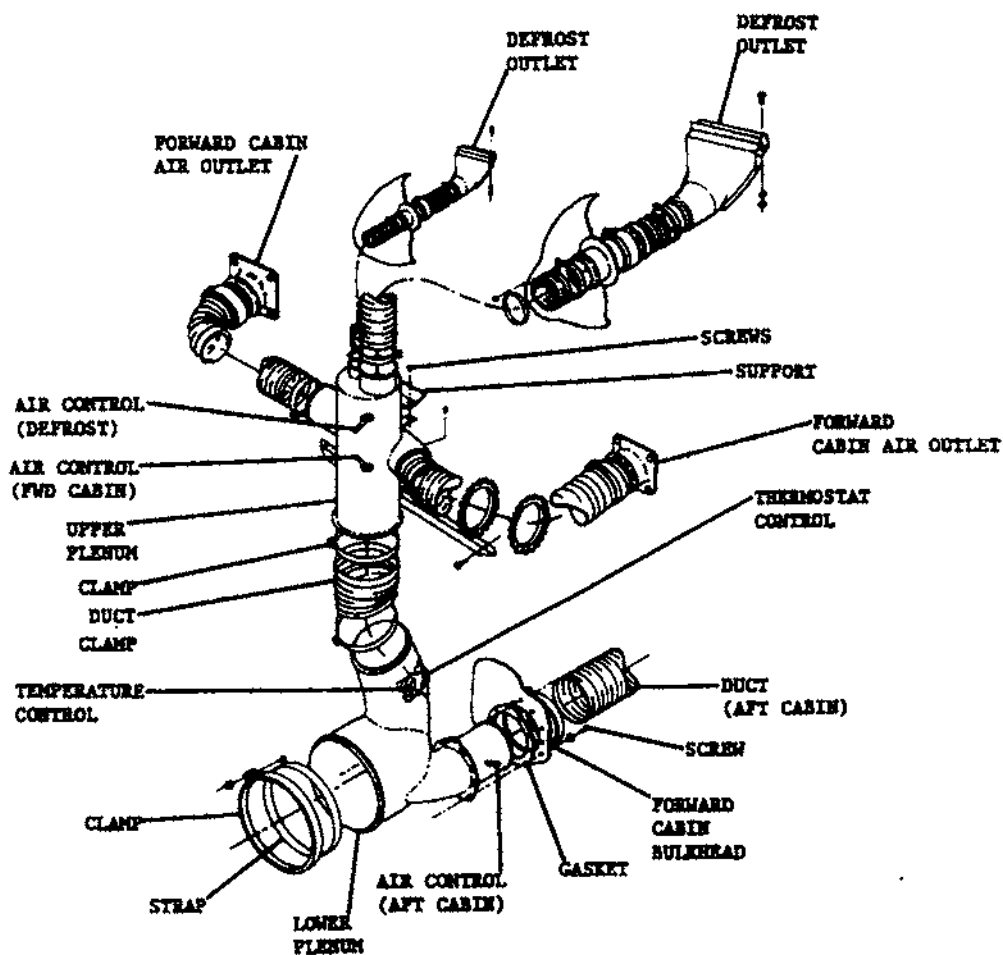
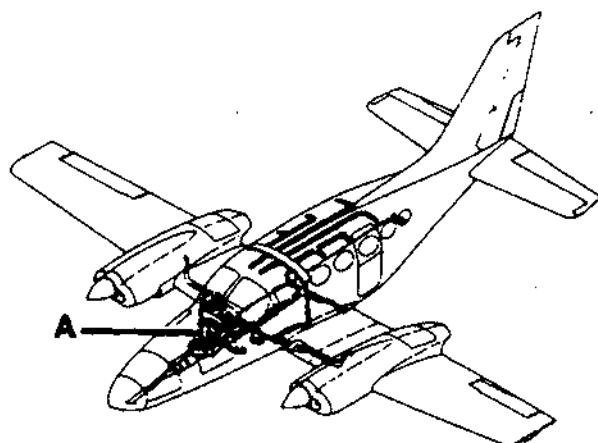
- (6) Disconnect drain line (7) and vent line (14) from fuel pump housing (8).
- (7) Remove mounting clamp securing combustion blower (13) to bracket and remove combustion blower.
- (8) For disassembly/assembly of combustion blower, refer to Cessna Heater and Components Overhaul/Parts Manual.

B. Install Combustion Blower.

- (1) Secure combustion blower (13) to bracket using mounting clamp.
- (2) Connect drain line (7) and vent line (14) to fuel pump housing (8) with clamps.
- (3) Remove cap and connect fuel lines (10 and 18).
- (4) Install cover on fuel pump housing (8).
- (5) Identify and connect electrical wire to combustion blower (13).
- (6) Connect inlet air duct (12) and combustion air duct (11) to combustion blower (13).
- (7) Install RH nose shelves, refer to Chapter 3.

3. Disassembly/Assembly Cabin Heater Components.

- A. For disassembly/assembly of heater components, see Cessna Heater and Components Overhaul/Parts Manual.**



DETAIL A

Heater Plenum and Defrost Installation
Figure 431143116
A51143124

4. Removal/Installation Ram Air Valve (See Figure 3).**A. Remove Ram Air Valve.**

- (1) Remove RH nose shelves as necessary to gain access to ram air valve (2). Refer to Chapter 3.
- (2) Disconnect ram air valve control from ram air valve (2) by removing bolt and nut.
- (3) Remove nuts, washers and bolts securing adapter (1) and ram air valve (2) to support and duct.
- (4) Remove ram air valve (2) and gaskets.

B. Install Ram Air Valve.

- (1) Position ram air valve (2) between adapter (1) and air duct (3). Ensure gaskets are installed.
- (2) Secure ram air valve (2) to adapter (1), support and air duct (3) with bolts, washers and nuts.
- (3) Connect control cable to ram air valve (2) with bolt and nut.
- (4) Install RH nose shelves. Refer to Chapter 3.

5. Removal/Installation Heater Plenum Ducts (See Figure 4).**A. Remove Heater Plenum Ducts.**

- (1) Remove RH aft nose shelf, refer to Chapter 3.
- (2) Remove lower plenum as follows:
 - (a) Remove heater, refer to Removal/Installation Heater Assembly.
 - (b) Remove temperature control from thermostat control.
 - (c) Remove aft cabin control cable from lower plenum.
 - (d) Remove clamps securing duct to upper plenum and remove duct.
 - (e) Remove clamp securing duct to support.
 - (f) Remove aft cabin duct from lower plenum.
 - (g) Remove screws securing lower plenum to forward cabin bulkhead.
 - (h) Remove lower plenum by pulling forward and up.
- (3) Remove upper plenum as follows:
 - (a) Disconnect forward cabin air control and defrost air control from upper plenum.
 - (b) Remove clamp securing defrost ducts to upper plenum and slide ducts off.
 - (c) Remove clamps securing forward cabin air ducts to upper plenum and slide ducts off.
 - (d) Remove screws securing upper plenum to supports and remove upper plenum.

B. Install Heater Plenum Ducts.

- (1) Install lower plenum as follows:
 - (a) Install lower plenum to forward cabin bulkhead using gasket and screws.
 - (b) Connect aft cabin duct to lower plenum with clamp.
 - (c) Secure lower plenum to support and install strap and clamp.
 - (d) Connect temperature control and aft cabin control to lower plenum.
 - (e) Install duct to lower plenum with clamp.
 - (f) Install heater, refer to Removal/Installation Heater Assembly.
- (2) Install upper plenum as follows:
 - (a) Slide upper plenum on duct from lower plenum and secure with clamp.
 - (b) Secure upper plenum to supports with screws.
 - (c) Connect defrost and forward cabin ducts to upper plenum with clamps.
 - (d) Connect defrost and forward cabin air control cable to upper plenum.
- (3) Install RH aft nose shelf, refer to Chapter 3.

6. Inspection/Check Heater Assembly.**A. Inspection Heater Assembly.**

- (1) Remove RH aft nose shelf.

B. Electrical Continuity Check Heater Assembly.

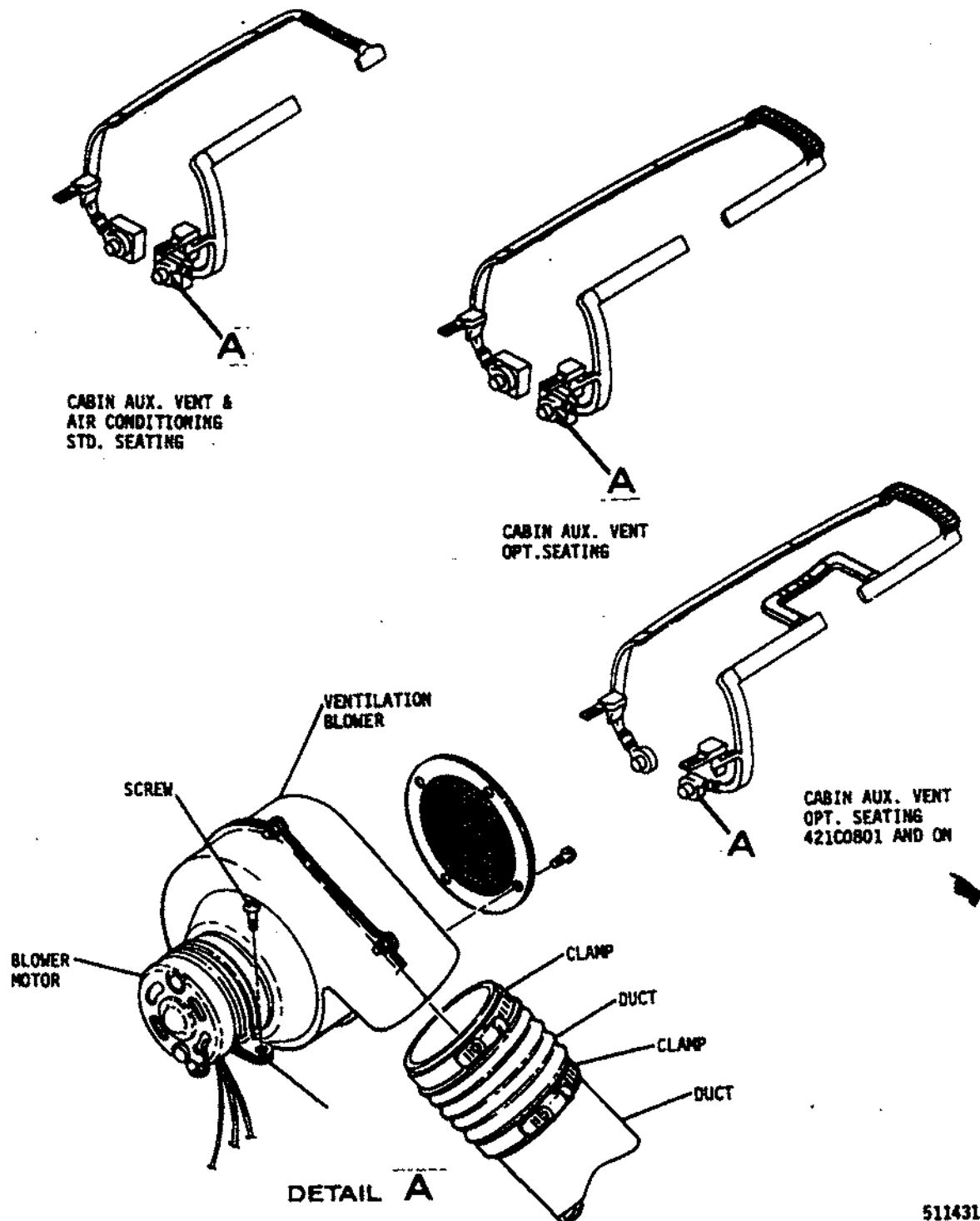
- (1) For electrical continuity checks, refer to Chapter 13 and to the Cessna Heater and Components Overhaul/Parts Manual.

VENTILATION SYSTEMDescription

1. The ventilation system consists of the cabin heater ventilation blower, which is part of the cabin heater and is a standard installation on the aircraft. An auxiliary cabin air ventilation system (optional) may be installed on the aircraft.
2. The cabin heater ventilating fan is electrically controlled by the cabin heater switch and Cabin Fan switch. The blower is mounted on the front portion of the cabin heater and circulates heated or cool air through the heater into the cabin air distribution system. For removal/installation procedures of the ventilating blower, refer to Cessna Heater and Components Overhaul/Parts Manual.
3. The auxiliary cabin air ventilation system (optional) consists of: two blower assemblies, ducting and control switch. The blower assemblies are mounted one on each side of the forward cabin just aft of the crew seats. When the blowers are turned on by the Aux Cabin Air switch. Air from the cabin is circulated by each blower through its individual ducting to the passengers.

Maintenance Practices

1. Removal/Installation Auxiliary Ventilation Blower (See Figure 1).
 - A. Remove Ventilation Blower.
 - (1) Ensure electrical power is OFF.
 - (2) Raise and slide pilot or copilot's seat forward.
 - (3) Remove cabin divider.
 - (4) Remove cover from above ventilation blower.
 - (5) Identify and disconnect blower electrical wiring.
 - (6) Loosen clamp from duct connecting ventilation blower.
 - (7) Remove screw securing clamp to blower motor.
 - (8) Slide duct of ventilation blower and remove blower from aircraft.
 - B. Install Ventilation Blower.
 - (1) Slide ventilation blower onto duct and secure with clamp.
 - (2) Secure blower motor to support with clamp and screw.
 - (3) Identify and connect electrical wiring.
 - (4) Install cover and secure to structure with screws.
 - (5) Install cabin divider.



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Auxiliary Ventilation Blower Installation
Figure 1

AIR DISTRIBUTION SYSTEMDescription

1. The air distribution consists of the pressurized air distribution system and the cabin heater air distribution system.
2. The pressurized air distribution system consists of ducting, check valves and outlets. Pressurized air enters the cabin from the heat exchangers; routed through check valves and ducting to the cabin heater and overhead air outlets. Pressurized air will enter the cabin heater, providing the ram air valve is closed. At the cabin heater the ventilation blower will force the air through the heater and out through the cabin heater air distribution system.
3. The cabin heater air distribution system consists of ducts which routes air (cooled or heated) into the cabin. Air for the cabin heater may be obtained from the ram air scoop in the nose of the aircraft, when the ram air valve is open or from the aircraft turbochargers when the ram air valve is closed.

Maintenance Practices

1. Removal/Installation Cabin Pressurized Air Ducting (See Figure 1).

A. Remove Pressurized Air Ducting.

- (1) Remove forward cabin carpet and forward cabin floor access plates as required to gain access to ducting, refer to Chapter 1.
- (2) Remove air distribution components as desired in accordance with Figure 1.

B. Remove Pressurized Air Ducting.

- (1) Install air distribution components, removed in accordance with Figure 1.

NOTE: Install all butterfly type check valves with the hinge line in a vertical plane. Be sure air will flow in the proper direction.

- (2) Install all removed access plates and forward cabin carpet.

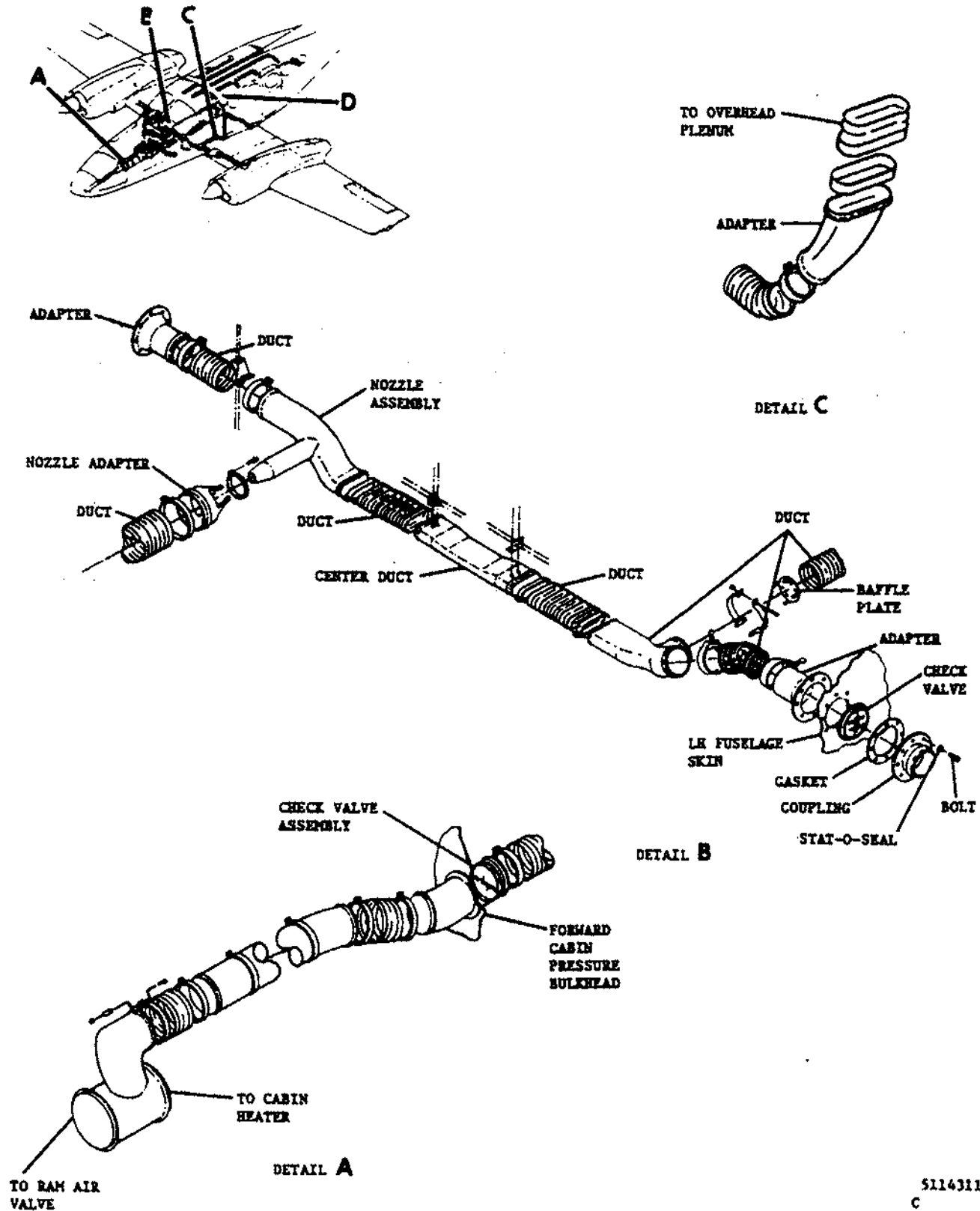
2. Removal/Installation Cabin Heater Air Ducting (See Figure 2).

A. Remove Cabin Heater Air Ducting.

- (1) Remove seats, carpeting access panels and floor panel as necessary for access to ducting. For access plate locations, refer to Chapter 1.
- (2) It will be necessary to remove lower upholstery panel to gain access to the adapter on right and left sides.
- (3) Remove ducting as required in accordance with Figure 2.

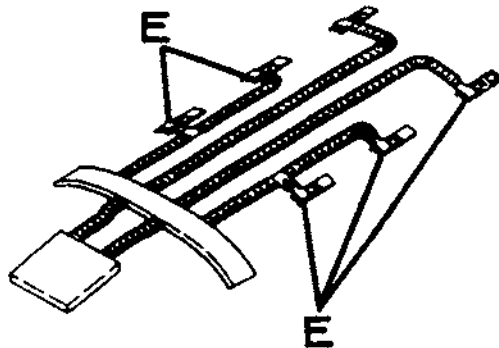
B. Install Cabin Heater Air Ducting.

- (1) Install ducting removed in accordance with Figure 2.
- (2) Install lower upholstery panels if removed.
- (3) Install floor panels, access plates, carpet and seats.

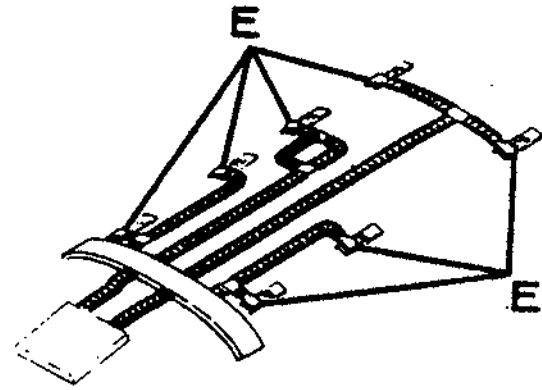


Pressurized Air Distribution System
Figure 1 (Sheet 1 of 3)

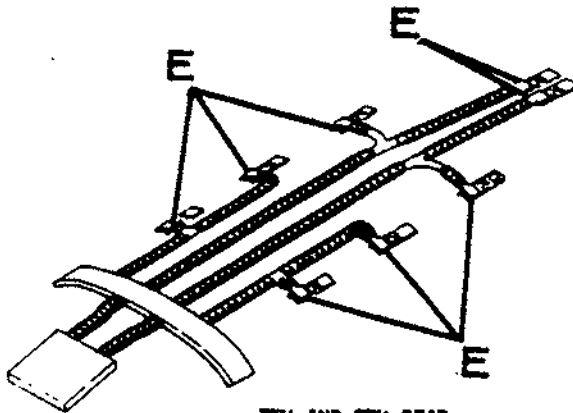
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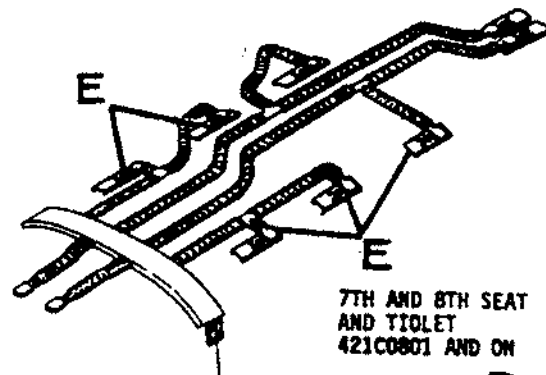
STANDARD
DETAIL D



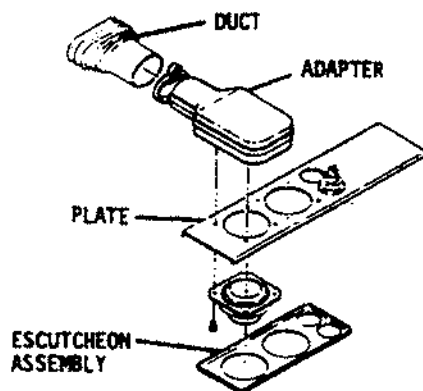
10 PLACE SEATING
DETAIL D



7TH AND 8TH SEAT
AND TOILET
421C001 THRU 421C0800
DETAIL D



7TH AND 8TH SEAT
AND TOILET
421C0801 AND ON
DETAIL D

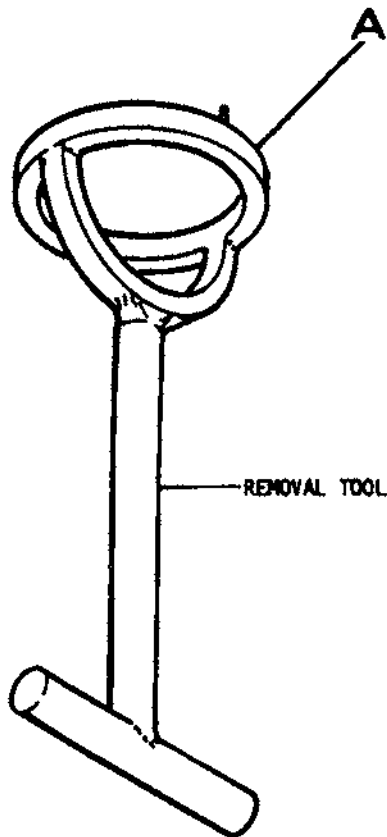
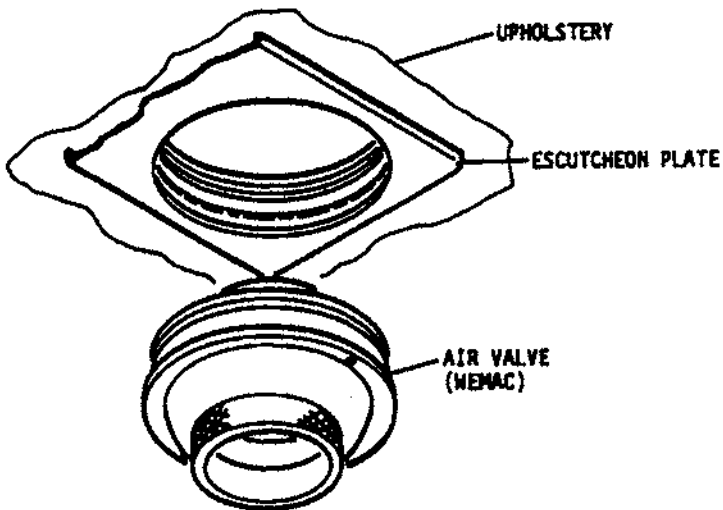


DETAIL E

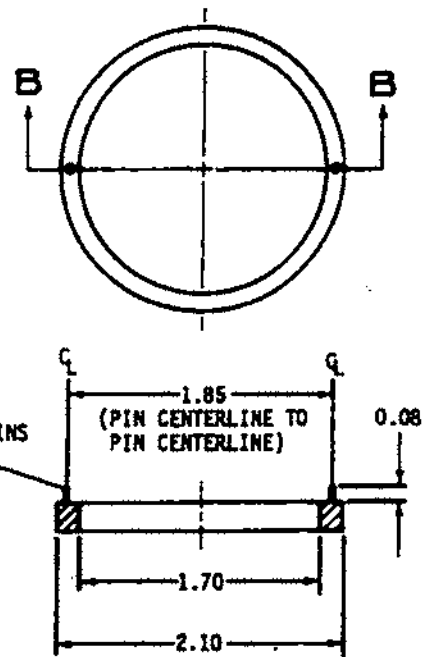
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Air Valve (Wemac) Removal Tool

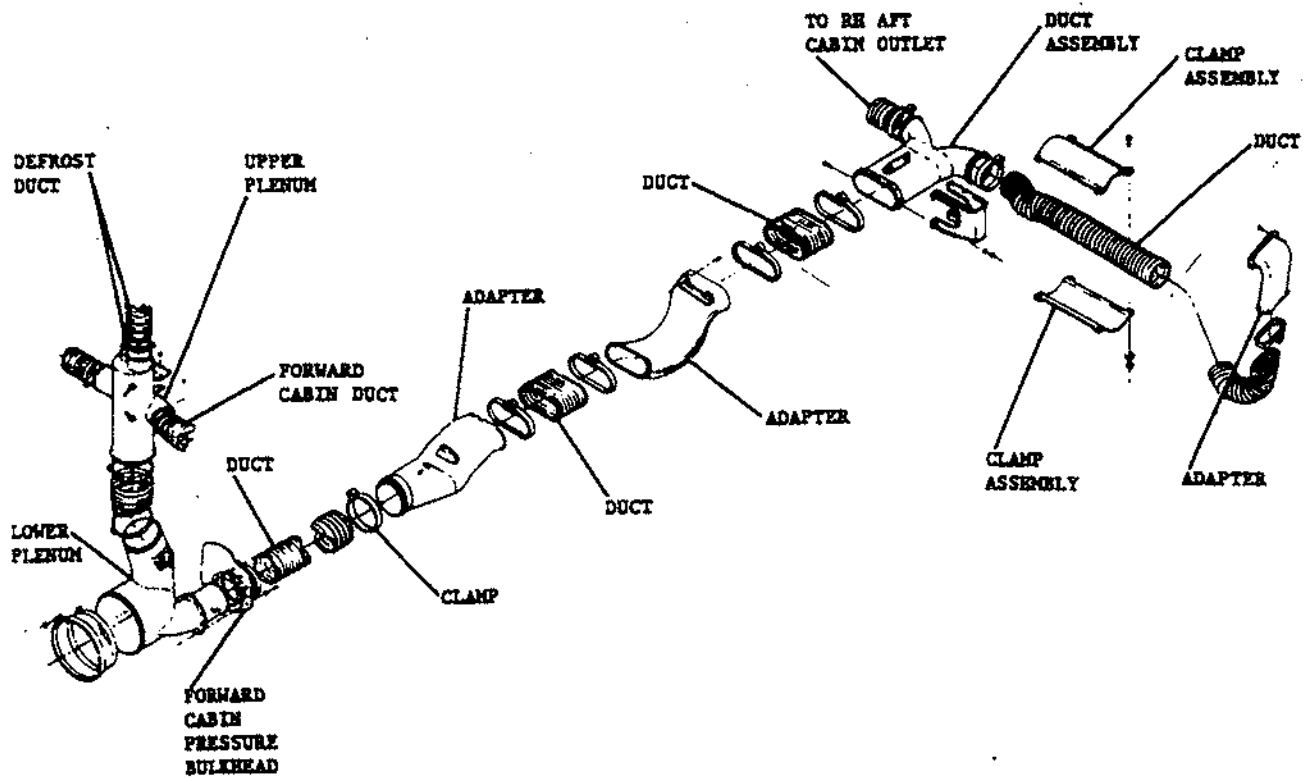
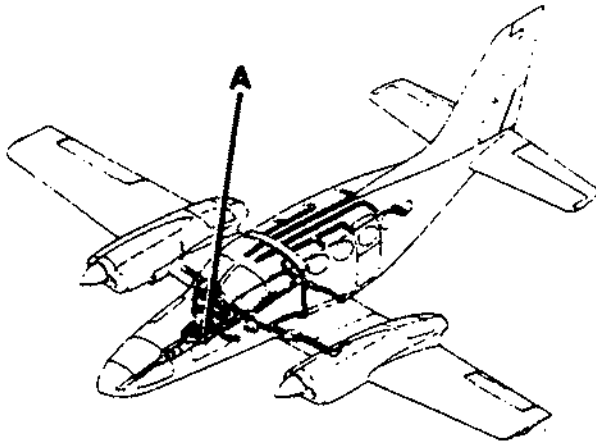
Use of the below described tool will aid in removal of an air valve without damage to the air valve or surrounding upholstery.



PINS TO BE:
.05 DIAMETER
AND PROTRUDE
.08 FROM TOOL
FACE
MATERIAL OF PINS
TO BE STEEL



VIEW B-B



DETAIL A

Cabin Heater Air Distribution
Figure 251143116
A51143123
A51143124

AIR CONDITIONING SYSTEMDescription

1. The air conditioning system (optional) is hydraulic powered and consists of three systems; the hydraulic drive system, compressor, condenser and evaporator system and the air distribution system. The air conditioning system is electrically controlled by a temperature selector rheostat, a mode switch and blower speed select switch. The air conditioning system utilizes the vapor cycle concept and Freon (R-12) as the refrigerant. The air conditioning system will deliver 14,500 BTU of cooling with an outside air temperature of 100° Fahrenheit.
2. System operation in the air conditioning mode, requires the right engine to be operating at a minimum tachometer reading of 950 RPM to drive the Freon compressor at its designed ground capacity.
3. In flight cooling for the condenser is provided by ram air entering the inlet scoop on the outboard side of the engine nacelle and being passed over the condenser and expelled through the nacelle outlet on the inboard side of the nacelle.
4. Ground cooling for the condenser is provided by the condenser blower fan. The fan is wired through the landing gear safety switch and operates during ground operation only; however, during flight in the event condenser temperature becomes excessively high, causing the output pressure temperature to increase, the fan will be turned on by the condenser high temperature switch, and remain on until temperature of the condenser is reduced, lowering output pressure temperature. When the output pressure temperature is reduced, the condenser high temperature switch will turn the fan off.
5. The drive system for the air conditioning compressor is hydraulically powered and electrically controlled. The drive system components are located in the right wing nacelle aft of the engine. The drive system consists of: a hydraulic fluid reservoir, engine-driven hydraulic pump, manifold and valve assembly (electrically operated), hydraulic motor, hydraulic fluid pressure switch, hydraulic fluid cooling tube and associated plumbing.
 - A. The drive system operation is controlled by the electrically operated manifold and valve assembly. The manifold and valve assembly is controlled by the air conditioning controls on the instrument panel. When cooling is selected, the manifold and valve assembly is energized and allows the hydraulic fluid under pressure from the engine-driven hydraulic pump to operate the motor, which in turn drives the air conditioning compressor. After the temperature demand is reached, the manifold and valve assembly will de-energize and compressor rotation ceases.
 - B. A pressure switch is installed in the hydraulic pressure line at the manifold valve assembly. The pressure switch will actuate and illuminate the A COND HYD light on the annunciator panel with the air conditioning system ON and right engine running. The pressure switch will deactivate and the light will go out when hydraulic fluid pressure falls below 400 PSI. A cover is provided for access to the right wing locker area, for servicing and maintenance.
6. The compressor, condenser and evaporator system constitutes the refrigerant (Freon) air portion of the air conditioning system. The right wing nacelle houses the compressor, condenser, receiver-dryer, condenser blower, low pressure switch, high temperature switch and associated plumbing. Two evaporators are located one on each side of the cabin just behind the pilot and copilot seats.
 - A. Whenever the air conditioning switch is positioned to COOL, the manifold and valve assembly of the drive system is closed and hydraulic fluid is supplied to the hydraulic motor, which drives the compressor. The compressor starts delivering a high pressure and temperature freon gas to the condenser. This freon gas is routed through the condenser where cool ram air removes heat from the freon gas and condenses the gas into a high pressure liquid. The liquid is routed to the receiver-dryer where it is filtered, dried and gas is separated from the liquid. From the receiver-dryer, the liquid flows through the low pressure switch to each evaporator module expansion valve. The expansion valve throttles the liquid into a sub-cooled gas before it enters the evaporator coil. Air from the cabin is pulled across the evaporator coil by the evaporator blower and cooled by the sub-cooled freon gas. The refrigerated air is then routed by the blower into the air conditioning air distribution system and exhausted into the cabin.



7. The air distribution system of the air conditioning system, consists of ducting routed from each evaporator, along each side of the cabin to the crew and passenger seats.

Troubleshooting

1. Troubleshooting Air Conditioning System.

- A. Troubleshooting the air conditioning system is accomplished initially by determining whether the trouble exists in the electrical operated components, hydraulic drive system or freon gas controlled components.
- B. For troubleshooting the air conditioning electrical system, refer to Chapter 13 Electrical Wiring Diagrams.
- C. For a guide to troubleshooting freon gas operated components of the air conditioning system, refer to Cessna Air Conditioning System Service Parts Manual.
- D. For a guide to troubleshooting the air conditioning system, hydraulic drive system, refer to Air Conditioning System Hydraulic Drive System and Cessna Air Conditioning System Service Parts Manual.

Adjustment/Test

1. Tools and Equipment.

NOTE: Equivalent substitutes may be used instead of the following item.

Name	Number	Manufacturer	Use
Hydraulic Test Stand	SE1300 or SE589 Modified to include SK421-68	Cessna Aircraft Company	Test air conditioning system.

A. Test Air Conditioning System (Using Hydraulic Test Cart).

- (1) Ensure fittings, clamps and lines are tight.
- (2) Service hydraulic reservoir with 2.75 quarts MIL-H-5606 hydraulic fluid (red).
- (3) Ensure air conditioner compressor is serviced with proper amount of freon (refer to Air Conditioning System Service Parts Manual).
- (4) Connect hydraulic test cart to inlet and outlet lines at the engine-driven hydraulic pump.
- (5) Connect 28 volts DC power source to airplane.
- (6) Adjust hydraulic test cart to 5 gpm.
- (7) Turn airplane air conditioner to COOL mode.
- (8) Check hydraulic system for leaks.

CAUTION: EXERCISE CARE IN THE AREA OF CONDENSER FAN.

- (9) Increase hydraulic pressure to 1000 psi.
- (10) Observe airplane air conditioner panel light ON.
- (11) Observe hydraulic motor rotation and compressor pressures. If rotation is not observed when pressure is applied to the system, the following steps should be accomplished:
 - (a) Bleed freon system pressure to approximately 50 pounds.
 - (b) Disconnect temperature control box from plug.
 - (c) Turn the air conditioner mode switch to cool, at this point the condenser fan should energize and the solenoid located on the hydraulic manifold should be actuated.

NOTE: A screwdriver blade held in the vicinity of an actuated solenoid will be attracted to it.

- (d) Energize the hydraulic test cart. A pressure of approximately 1000 should be observed, also, the air conditioner panel light should be on. If the assembly still fails to rotate, the following sequence should be accomplished - turn the hydraulic test cart on and off in rapid order. This will help to break loose a stiff motor compressor combination. If the rotation starts, allow the freon to be pulled in through the suction port of the compressor. The freon will have to be bled into the compressor at a slow rate. As the freon reaches a certain level in the system, the rotation of the compressor will slow down. Stop the flow of freon and allow the compressor to rotate until an increase in rotation is noted. These steps will have to be repeated until the system reaches a fully charged state.
- (12) With hydraulic test cart maintaining 1000 psi at 5 gpm, turn air conditioner mode switch OFF and observe air conditioner panel light OUT.
 - (13) Turn air conditioner mode switch to COOL and observe panel light ON and hydraulic motor rotation.
 - (14) Operate air conditioner in this configuration for a period of not less than twenty minutes. During this time, check for hydraulic leaks and comply with Air Conditioner Functional Test CES-FT-2314.
 - (15) Reread reservoir fluid level.
- B. Test Air Conditioning System (Engine Operation). (Hydraulic System not Previously Tested by Hydraulic Test Cart.)
- (1) Insure fittings, clamps and lines are tight.
 - (2) Service hydraulic reservoir with 2.75 quarts MIL-H-5606 hydraulic fluid (red) and prime engine driven pump by filling pump inlet line.
- CAUTION:** THE HYDRAULIC SYSTEM MUST BE COMPLETE AND SERVICED BEFORE STARTING RH ENGINE, OTHERWISE REMOVE ENGINE-DRIVEN HYDRAULIC PUMP FROM ENGINE ACCESSORY PAD.
- (3) Insure air conditioner compressor is serviced with the proper amount of freon, refer to Air Conditioning System Service Parts Manual.
 - (4) Start right-hand engine and operate at approximately 1000 rpm and check for hydraulic fluid leaks.
- CAUTION:** EXERCISE CAUTION IN THE AREA OF THE PROPELLER AND CONDENSER FAN.
- (5) Select COOL mode on the air conditioner switch and observe the air conditioner panel light ON hydraulic motor rotation and compressor pressures.
 - (6) If rotation is not observed when pressure is applied to the system the following steps should be accomplished:
 - (a) Bleed the freon system pressure to approximately 50 pounds.
 - (b) Disconnect the temperature control box.
 - (c) With engine at idle plus 200 rpm, turn air conditioner mode switch to COOL, at this point the condenser fan should energize and the solenoid located on the hydraulic manifold should be actuated.
- NOTE:** A screwdriver blade held in the vicinity of an actuated solenoid will be attracted to it.
- (d) The air conditioner panel light should be on and rotation observed. Should the assembly fail to rotate the following sequence should be accomplished:
 - 1) Turn the air conditioner mode switch on and off in rapid order. This will help to break loose a stiff motor compressor combination. If rotation starts, allow the freon to be pulled in through suction port of the compressor. The freon will have to be bled into the compressor at a slow rate. As freon reaches a certain level in the system, the rotation of the compressor will slow down. Stop the flow of freon and allow the compressor to rotate until an increase in rotation is noted. These steps will have to be repeated until the system reaches a fully charged state.

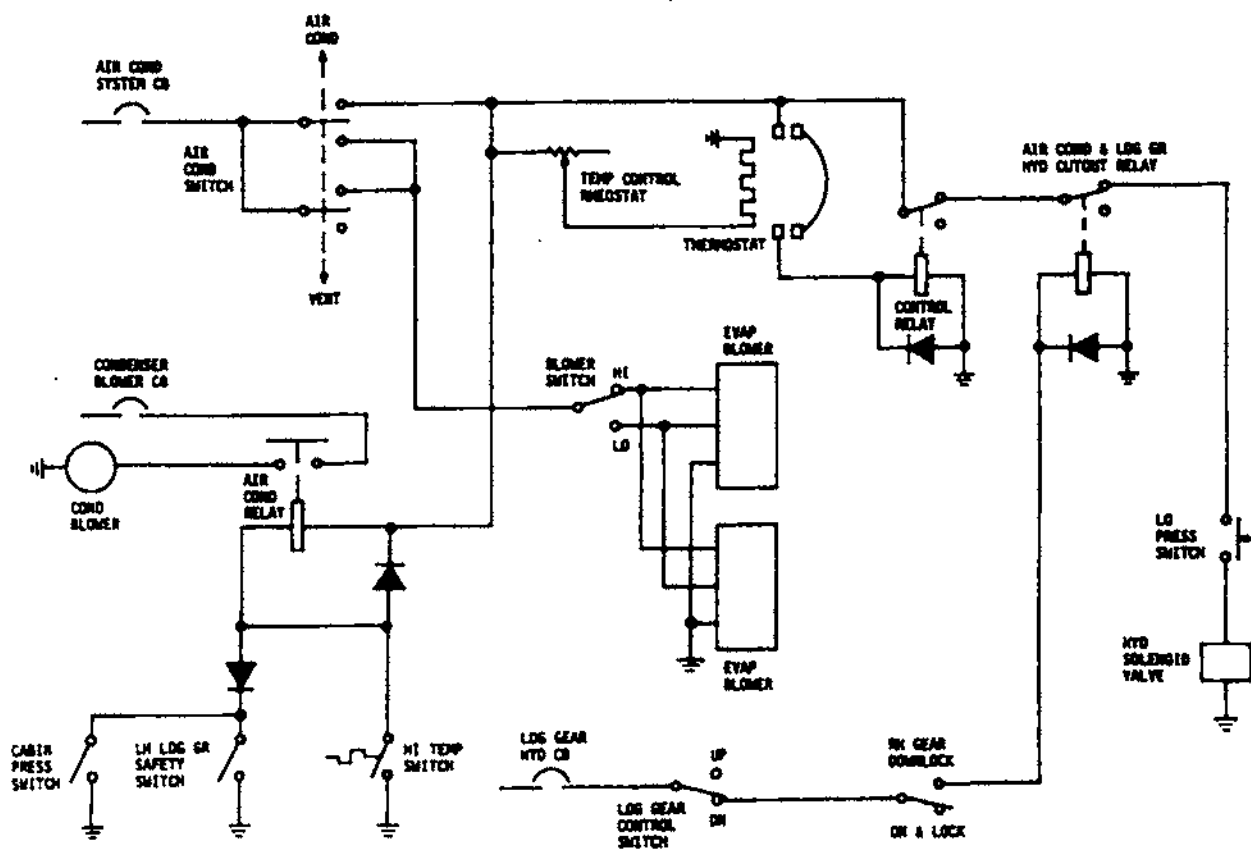
NOTE: If the motor-compressor rotation cannot be obtained by the refer to the troubleshooting section for the proper actions to be taken.

- (7) Increase rpm to 1600 rpm.
- (8) Turn air conditioner mode switch to OFF position and observe air conditioner panel light OFF.
- (9) Turn air conditioner mode switch to COOL and observe the air conditioner panel light ON, hydraulic motor rotation and compressor pressures.
- (10) Operate engine at various rpm, checking air conditioner hydraulic operation for a period of not less than twenty minutes for initial checkout.
- (11) Recheck reservoir fluid level.

Servicing

1. Servicing Air Conditioning System.

- A. For servicing air conditioning system with freon and compressor with oil, refer to Cessna Air Conditioning System Service Parts Manual.
- B. For servicing the hydraulic fluid reservoir, refer to Chapter 2.



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Air Conditioning Simplified Schematic
Figure 2

AIR CONDITIONING HYDRAULIC DRIVE SYSTEMDescription

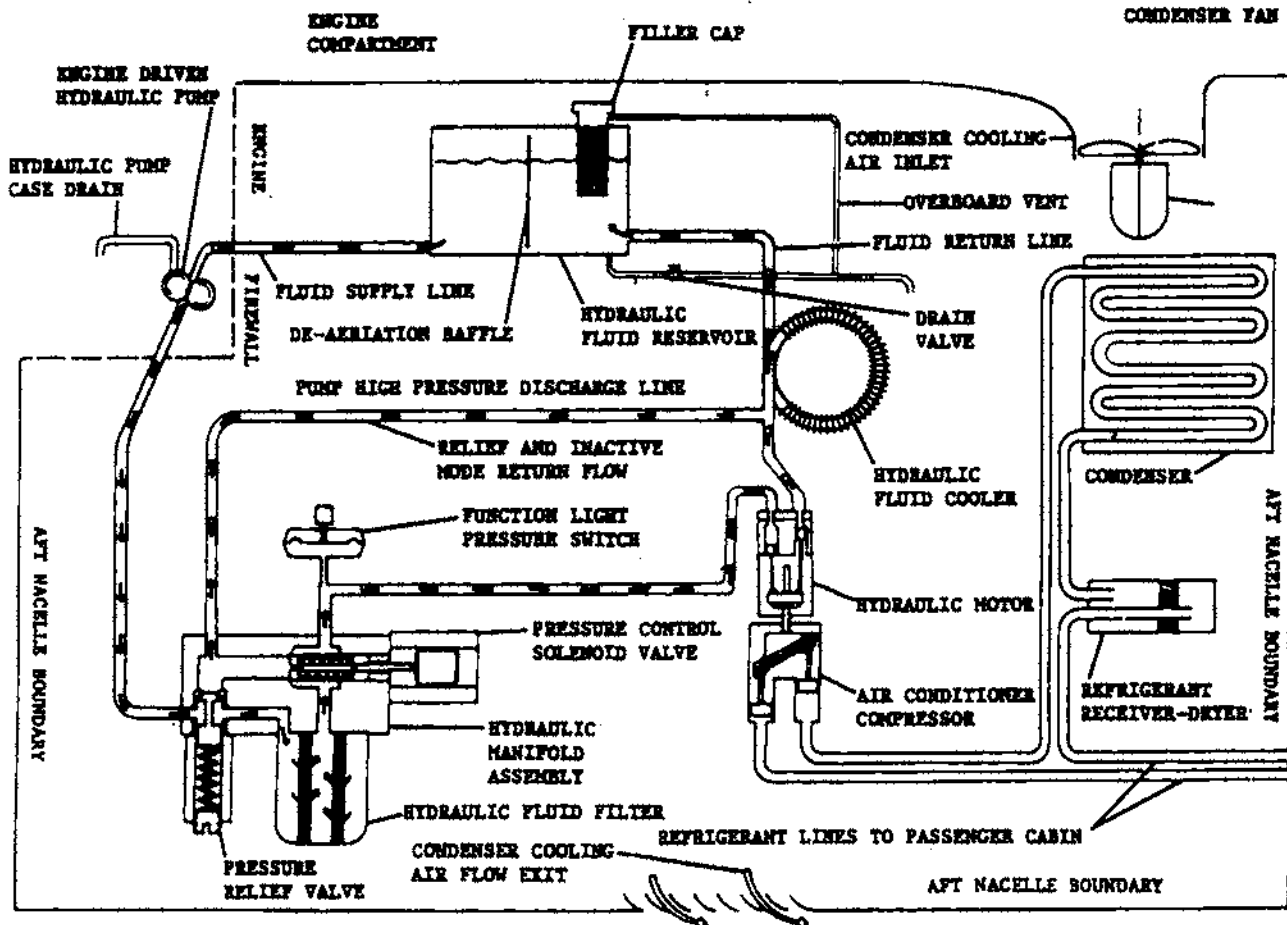
1. The hydraulic drive system powers the air conditioning compressor. Components and plumbing for the system is located in the right wing nacelle. The hydraulic drive system is electrically controlled and consists of hydraulic fluid reservoir, engine-driven hydraulic pump, manifold and valve assembly, hydraulic motor connected to the compressor, hydraulic fluid pressure switch, hydraulic fluid cooling tube, drain valve, automatic inlet scoop door (421C0201 and On) and associated plumbing.
2. The reservoir mounted on the side of the RH nacelle provides the hydraulic fluid to power the hydraulic drive system. A door is provided in the air conditioning compartment cover for access to the reservoir filling cap. The reservoir capacity is 2.75 quarts of MIL-H-5606 (red) hydraulic fluid.
3. The engine-driven hydraulic pump is mounted on the accessory pad of the right engine. The pump is mounted to the accessory pad by utilizing an adapter and the accessory pad mounting bolts. The pump is a gear type and pumps hydraulic fluid under pressure to drive the hydraulic motor connected to the compressor.
4. The manifold and valve assembly is installed in the hydraulic drive system between the engine-driven hydraulic pump and motor and provides a means for controlling the flow of hydraulic fluid to the motor, which drives the compressor. The manifold and valve assembly is electrically operated and consists of: a pressure relief valve, filter, solenoid valve and a pressure switch connected to the valve assembly. When the air conditioning system is operating the manifold and valve assembly allows hydraulic fluid to flow to the motor to operate the compressor. As the hydraulic fluid flows to the motor it passes through the pressure switch, which will illuminate the A COND HYD light on the annunciator panel. When the air conditioning system is OFF, the manifold and valve assembly routes hydraulic fluid from the engine-driven pump back to the reservoir bypassing the hydraulic motor, causing the compressor to idle and the A COND HYD light will be out during this condition.
5. The hydraulic motor is a piston type motor, connected to the compressor by an adapter assembly. Hydraulic fluid under pressure from the engine-driven pump drives the motor which turns the compressor when the air conditioning system is ON. Hydraulic fluid from the motor is returned to the reservoir through a cooling tube which cools the fluid before it enters the reservoir for recycle.
6. The inlet scoop door is automatically opened when the system is operating. Hydraulic pressure is tapped from the manifold and valve assembly and directed to a small cylinder on the inlet scoop door. The door is held open against spring tension and when the system is shut down, the door is held shut and streamlined.

Troubleshooting

1. Troubleshooting the air conditioning hydraulic drive system is accomplished initially by determining whether the trouble exists in the electrical system or the hydraulic components.
2. Troubleshooting Air Conditioning Hydraulic Drive System.
 - A. For a guide to troubleshooting the air conditioning hydraulic drive system, see Figure 2.
 - B. For detailed troubleshooting of hydraulic drive system components, refer to Air Conditioning System Service Parts Manual.

Maintenance Practices

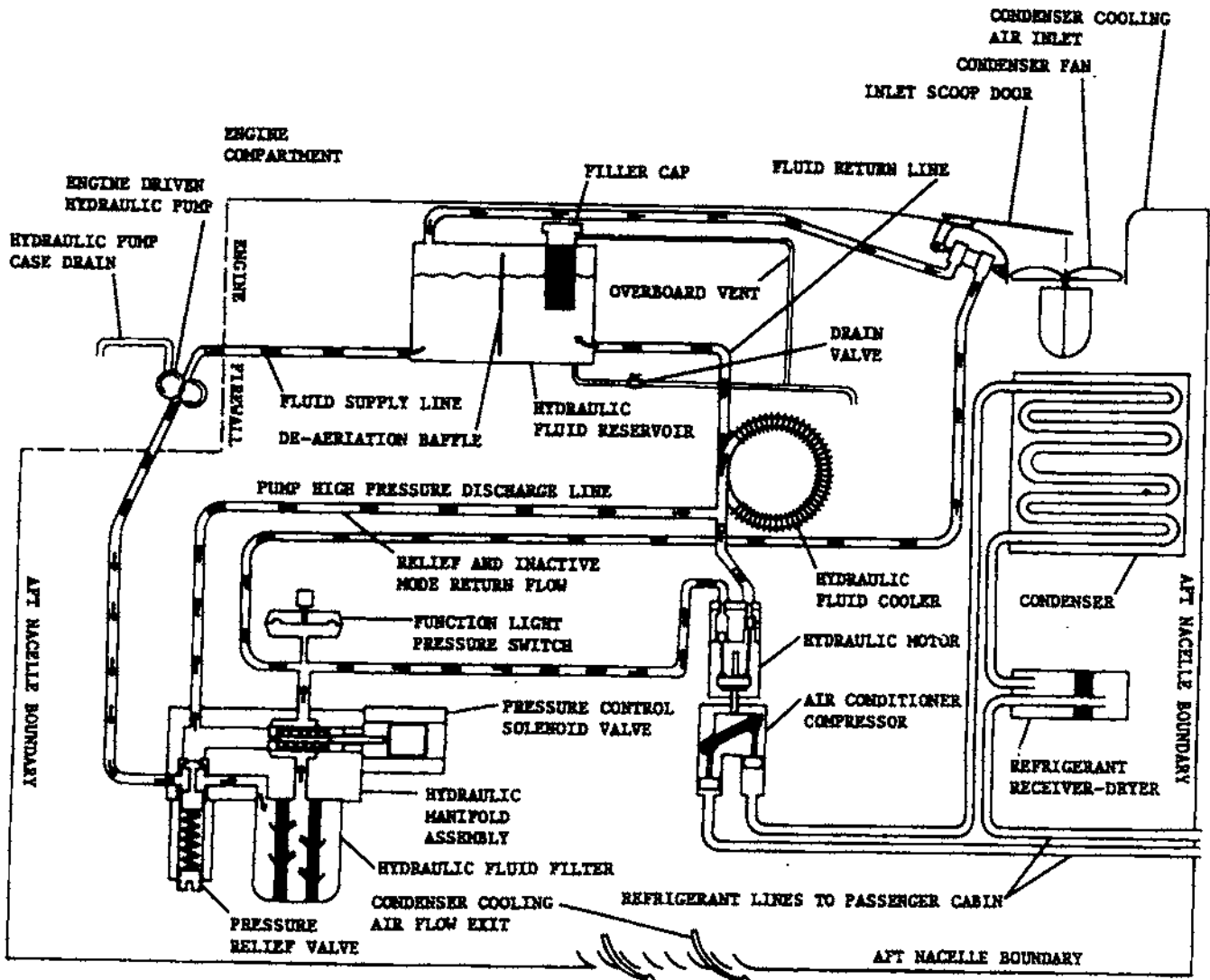
1. General Maintenance Practices.
 - A. Technical Precautions.
 - (1) Before any maintenance is performed on the hydraulic system, personnel should read and thoroughly understand the following precautions. Careful adherence to these instructions will aid in maintaining a functional and trouble-free system.



421C0001 TO 421C0200

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Air Conditioning Hydraulic System Schematic
Figure 1 (Sheet 1 of 2)

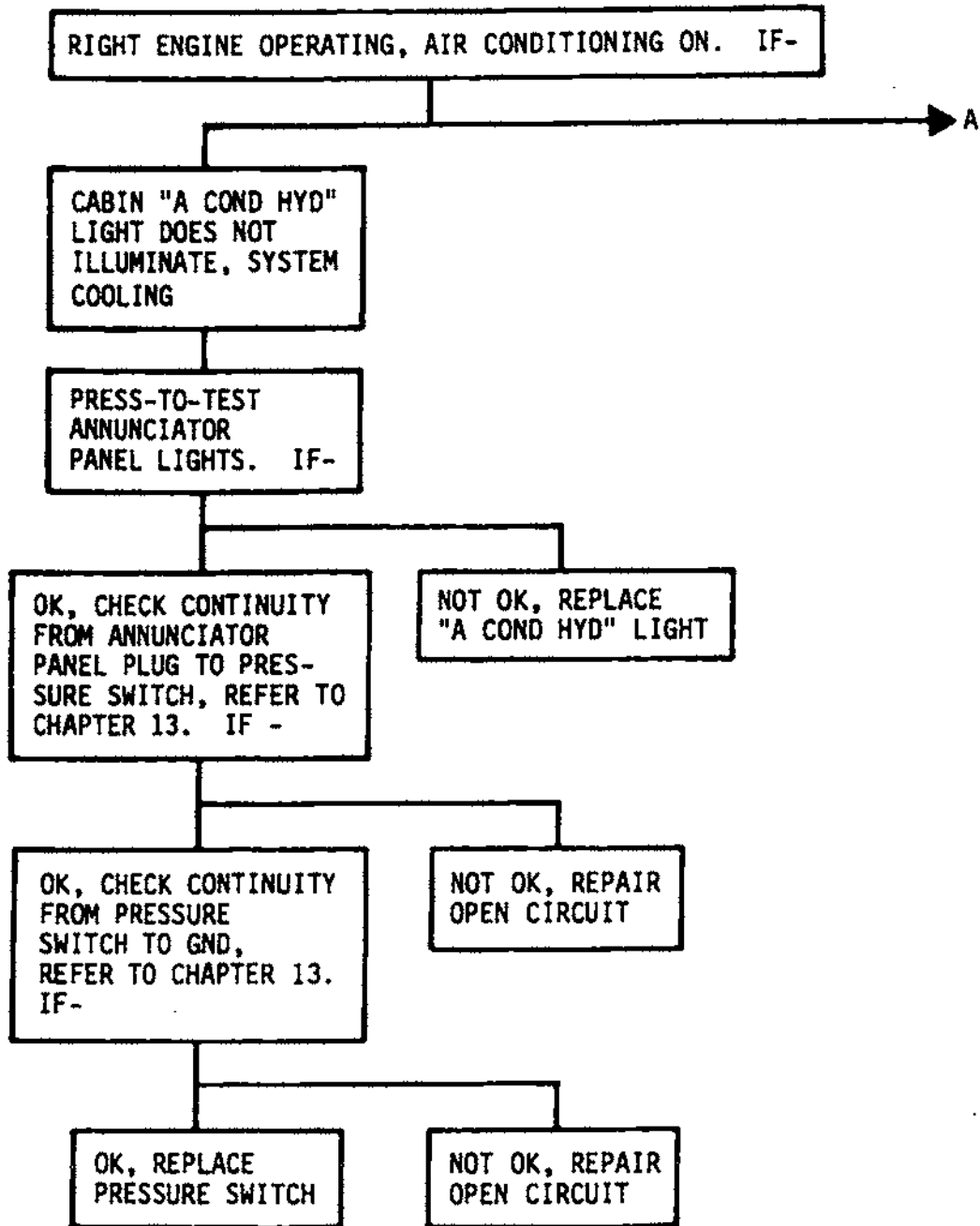


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Air Conditioning Hydraulic System Schematic
Figure 1 (Sheet 2)

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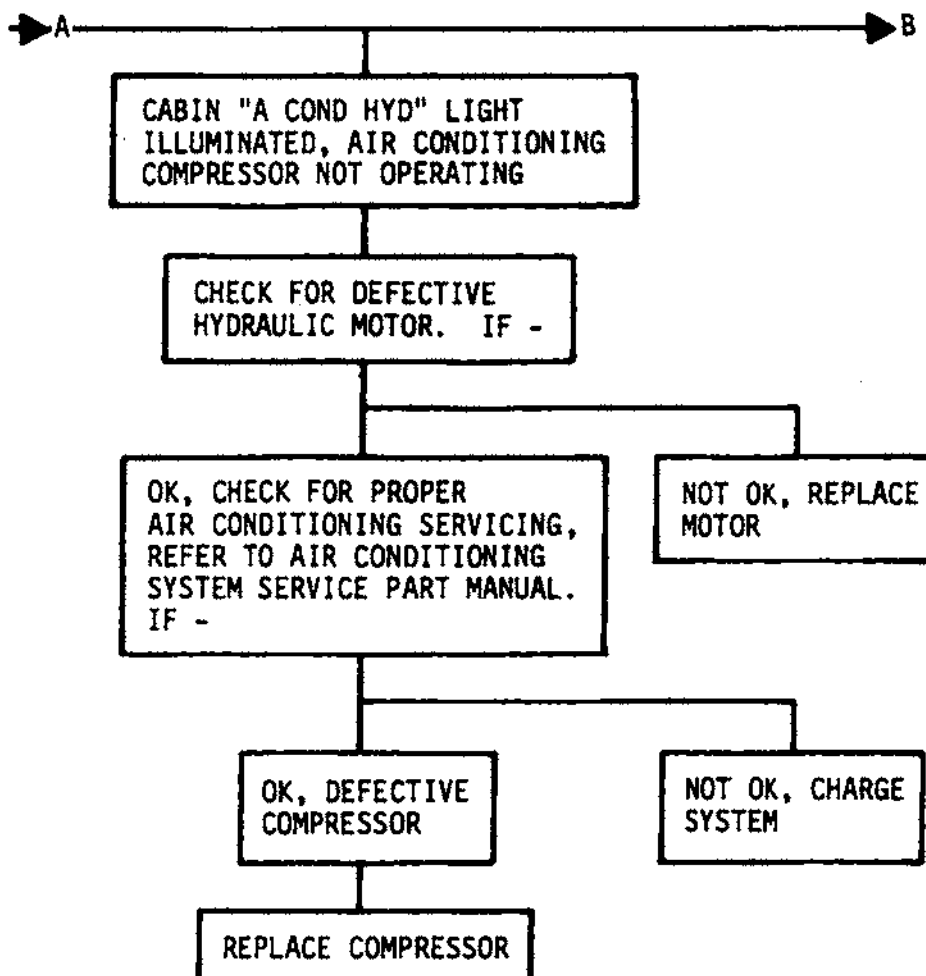
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MODEL 421
SERVICE MANUAL



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Air Conditioning Hydraulic Drive System Troubleshooting Chart
Figure 2 (Sheet 1)

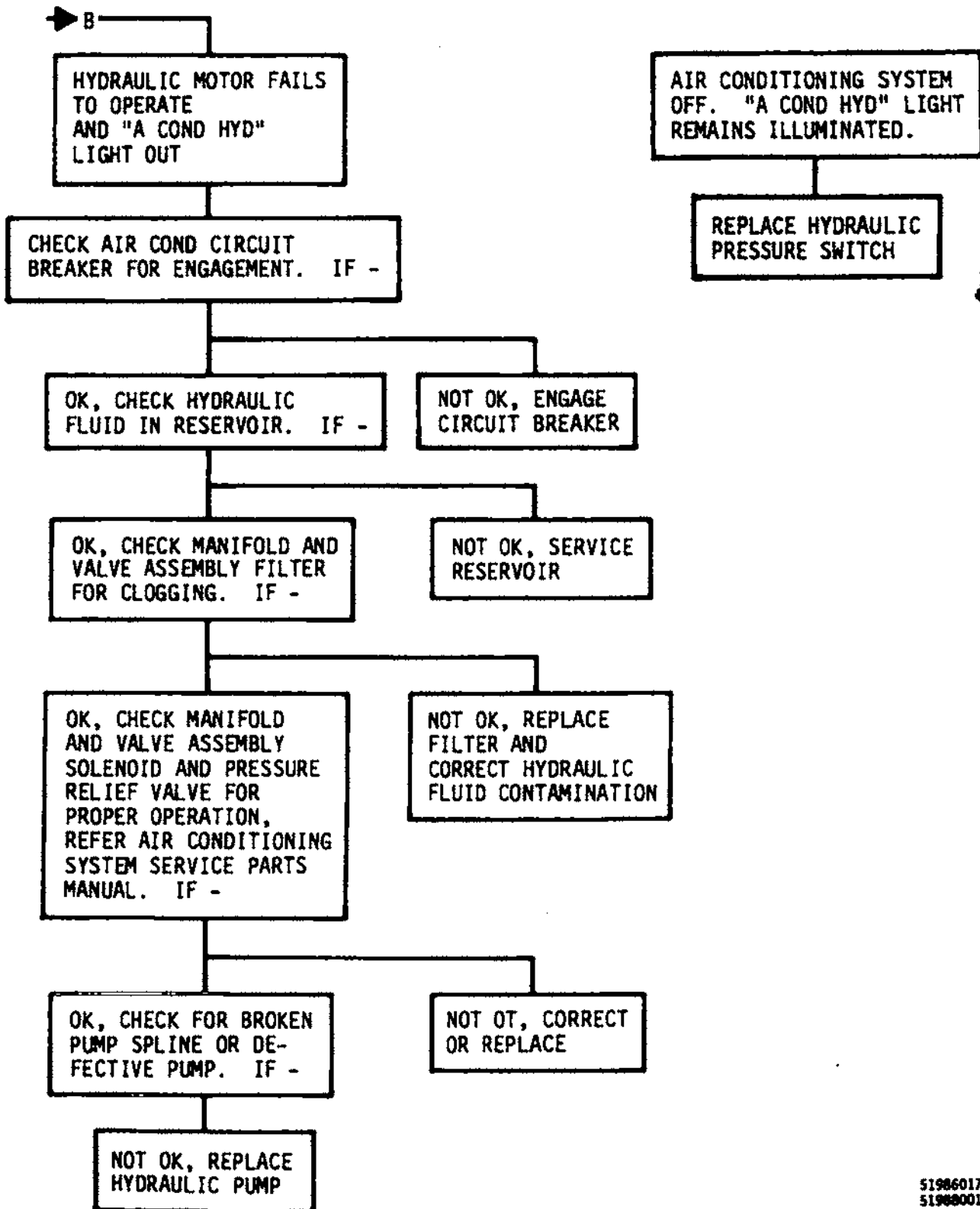
CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL



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Air Conditioning Hydraulic Drive System Troubleshooting Chart
Figure 2 (Sheet 2)

CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL



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Air Conditioning Hydraulic Drive System Troubleshooting Chart
Figure 2 (Sheet 3)

CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL

- (2) Keep spillage to an absolute minimum, place rags under fittings before disconnecting lines. Clean up spilled hydraulic fluid immediately to prevent entry into adjacent areas of the aircraft, and to prevent future false hydraulic leak reports.
- (3) Plug or cap all lines and openings when disconnecting lines and removing components.
- (4) Always check position and angle of all fittings removed from components to ensure placement and alignment on installation or replacement components.
- (5) When assembling hydraulic system packings, lubricate only with hydraulic fluid. Always lubricate packings immediately before installation. Thread fittings should be assembled without the use of lubricants whenever possible. If a lubricant is required to prevent galling or to otherwise ease installation, use system hydraulic fluid.

2. Removal/Installation Hydraulic Pump (See Figure 3).

A. Remove Hydraulic Pump.

- (1) Remove EH engine cowl.
- (2) Disconnect hoses (6 and 32) from pump (33) and drain hoses. Cap all openings.
- (3) Remove nuts (1), washers (2 and 4) and bolts (5) and remove pump (33) and gasket (3) from adapter (34).
- (4) Remove adapter from engine as follows:
 - (a) Disconnect drain line (35) from adapter (34).
 - (b) Remove nuts and washers and remove adapter (34) and gasket (36) from accessory pad.
 - (c) Cover engine accessory pad opening.

B. Install Hydraulic Pump.

- (1) Install adapter on engine accessory pad as follows:
 - (a) Install gasket (36) and adapter (34) on accessory pad and secure with washers and nuts.
 - (b) Connect drain hose (35) to adapter with nipple.
- (2) Install pump (33) on adapter (34) using gasket (3) bolts (5), washers (2 and 4) and nuts (1).
- (3) Connect hoses (6 and 32) to pump (33) with elbows.

CAUTION: HYDRAULIC PUMP INLET PORT MUST BE PRIMED BEFORE CRANKING ENGINE.

- (4) Service hydraulic reservoir.
- (5) Check air conditioning system operation and for hydraulic fluid leakage.
- (6) Install engine cowl.

3. Removal/Installation Hydraulic Motor (See Figure 3).

A. Remove Hydraulic Motor.

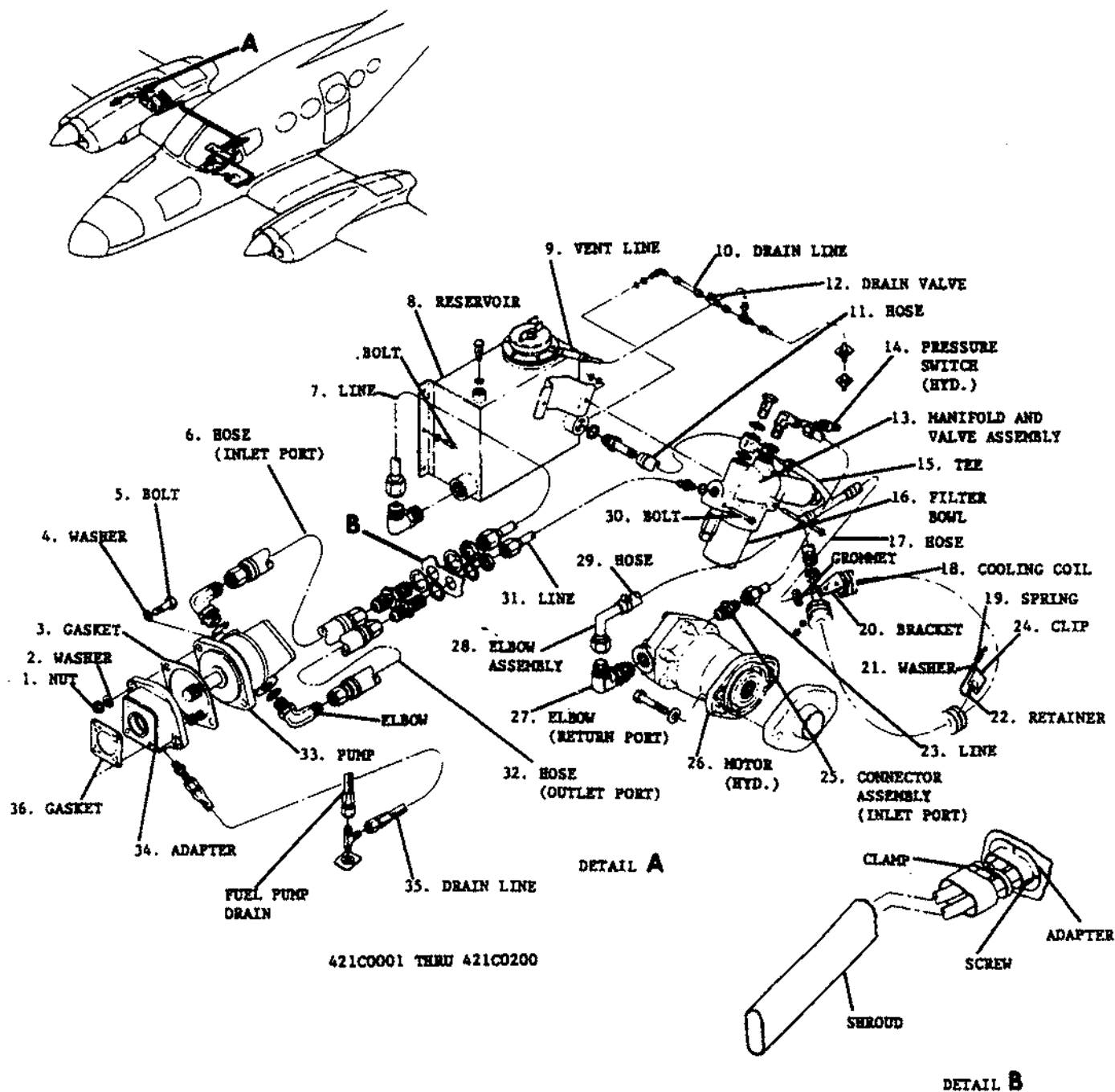
- (1) Remove EH wing nacelle air conditioning access cover.
- (2) Place container under reservoir drain.
- (3) Cut safety wire; open drain valve (12) and drain fluid from the reservoir.
- (4) Disconnect line (31) from manifold and valve assembly (13) and firewall fitting. Cap all openings.
- (5) Disconnect elbow assembly (28) and line (23) from hydraulic motor (26). Cap all openings.
- (6) Remove bolt and washers securing hydraulic motor (26) to adapter.
- (7) Pull hydraulic motor (26) outboard and remove motor from compartment.

B. Install Hydraulic Motor.

NOTE: Ensure adapter and retaining ring is assembled on shaft of compressor before installing motor.

- (1) Engage the hydraulic motor (26) with the compressor shaft. Ensure that the adapter and retaining ring are properly engaged.
- (2) Secure the hydraulic motor (26) to adapter and retaining ring with washers and bolts.

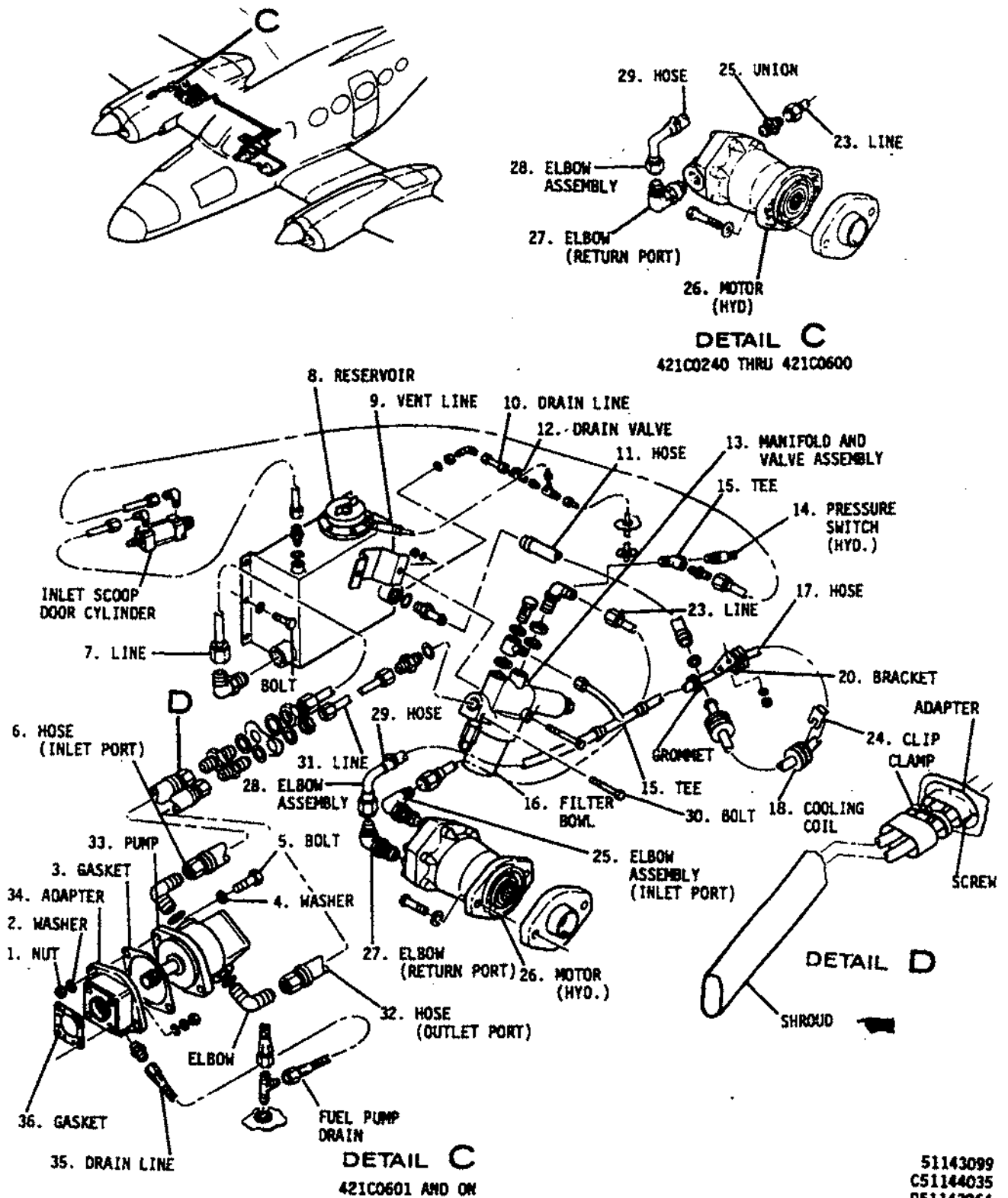
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Air Conditioning Drive Components Installation
Figure 3 (Sheet 1 of 2)

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Air Conditioning Drive Components Installation
Figure 3 (Sheet 2)

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- (3) Connect elbow assembly (28) and line (23) to hydraulic motor (26) with elbow (27) and connector assembly (25).
- (4) Close drain valve (12) and safety wire.
- (5) Service hydraulic reservoir; refer to Chapter 2.
- (6) Check system for operation and leakage.
- (7) Install RH nacelle air conditioning access cover.

4. Removal/Installation Hydraulic Reservoir (See Figure 3).

A. Remove Hydraulic Reservoir.

- (1) Remove RH nacelle air conditioning access cover.
- (2) Place container under reservoir drain.
- (3) Cut safety wire; open drain valve (17) and drain hydraulic fluid from reservoir.
- (4) Disconnect vent line (9), drain line (10), line (7) and hose (11) from reservoir (8). Remove fittings and cap all openings.
- (5) Remove nuts, washers and bolts (30), securing manifold and valve assembly (13) to reservoir (8).
- (6) Remove bolts and washers from reservoir (8) and remove reservoir.

B. Install Hydraulic Reservoir.

- (1) Install and secure reservoir (8) to nacelle structure with washers and bolts.
- (2) Install reservoir fittings and packings, then connect hose (11), drain line (10), vent line (9) and line (7) to reservoir fittings.
- (3) Secure manifold valve (13) to reservoir (8) with bolts (30), washer and nuts.
- (4) Close drain valve (12) and safety wire.
- (5) Service hydraulic reservoir, refer to Chapter 2.
- (6) Check system for operation and leakage.
- (7) Install RH nacelle air conditioning access cover.

5. Removal/Installation Manifold and Valve Assembly (See Figure 3).

A. Remove Manifold and Valve Assembly.

- (1) Verify electrical power to air conditioning system is turned OFF.
- (2) Remove RH nacelle air conditioning access cover.
- (3) Place container under reservoir drain.
- (4) Cut safety wire; open drain valve (12) and drain hydraulic fluid from reservoir (8).
- (5) Identify electrical wiring and disconnect.
- (6) Disconnect lines (23 and 31) and tee (15) from manifold and valve assembly (13). Cap all openings.
- (7) Remove nuts, washers and bolts (30); remove manifold and valve assembly (13).

B. Install Manifold and Valve Assembly.

- (1) Secure manifold and valve assembly to reservoir (8) with bolts (30), washers and nuts.
- (2) Connect lines (23 and 31) and tee (15) to manifold and valve assembly (13).
- (3) Identify and connect electrical wiring to manifold and valve assembly.
- (4) Close drain valve (12) and safety wire.
- (5) Service hydraulic reservoir, refer to Chapter 2.
- (6) Check system operation and leakage.
- (7) Install RH nacelle air conditioning access cover.

6. Removal/Installation Hydraulic Fluid Pressure Switch (See Figure 3).

A. Remove Pressure Switch.

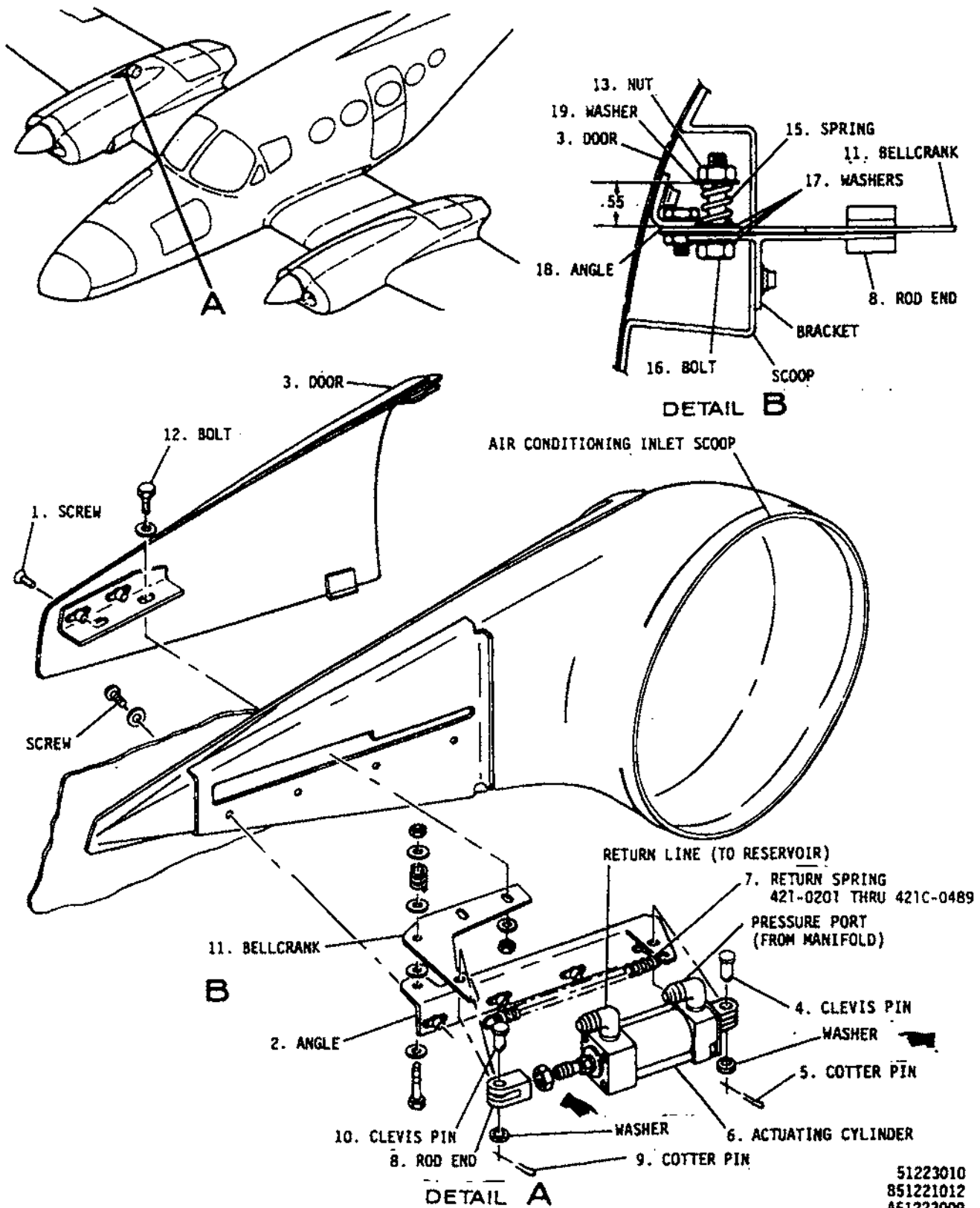
- (1) Remove RH nacelle air conditioning access cover.
- (2) Identify and disconnect electrical wire from pressure switch (14).
- (3) Remove pressure switch (14) from manifold and valve assembly (13) elbow.

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- B. Install Pressure Switch.
- (1) Install pressure switch (14) in elbow of manifold and valve assembly (13).
 - (2) Identify and connect electrical wires to pressure switch (14).
 - (3) Service hydraulic fluid reservoir, refer to Chapter 2, Servicing.
 - (4) Check system operation and for leakage.
 - (5) Install RH nacelle air conditioning access cover.
7. Removal/Installation of Inlet Scoop Door. (Refer to Figure 4.)
- A. Remove Inlet Scoop Door.
- (1) Remove screws (1) from door (3) and angle (2).
 - (2) Remove door (3) from aircraft.
- B. Install Inlet Scoop Door.
- (1) Check travel of door (3). Refer to Adjustment/Test.
 - (2) With door travel properly adjusted, install door (3) and secure with screws (1).
8. Removal/Installation of Bellcrank Assembly.
- A. Remove Bellcrank Assembly. (Refer to Figure 4.)
- (1) Remove inlet scoop door (1).
 - (2) Remove return spring (7) (Airplanes C0201 thru C0489).
 - (3) Remove cotter pin (9) and clevis bolt (10) from rod end (8) and disconnect actuating cylinder (6) from bellcrank (11).
 - (4) Remove nut (13), washer (19), spring (15), bolt (16) and washers (17) from bellcrank (11). Remove bellcrank (11) from aircraft.
- B. Install Bellcrank Assembly.
- (1) Install bellcrank (11) securing with bolt (16), washers (17), spring (15), washer (19) and nut (13). Upon installation, the spring (15) should be compressed to .55 inch.
 - (2) Install actuating cylinder (6) on bellcrank (11) and secure with clevis pin (10) and cotter pin (9).
 - (3) Install return spring (7) (Airplanes C0201 thru C0489).
 - (4) Install inlet scoop door (3). Refer to Adjustment/Check.
9. Removal/Installation of Actuating Cylinder. (Refer to Figure 4.)
- A. Remove Actuating Cylinder.
- (1) Disconnect and cap hydraulic lines from the actuating cylinder.
 - (2) Remove cotter pins (5 and 9) and clevis pins (4 and 10) from rod ends (8), and remove actuating cylinder (6) from aircraft.
- B. Install Actuating Cylinder.
- (1) Install actuating cylinder (6) on aircraft, and secure with cotter pins (5 and 9) and clevis pins (4 and 10).
 - (2) Rig door. Refer to Adjustment/Test.
 - (3) Remove caps and connect lines and operationally check.

Servicing

1. Remove Manifold and Valve Assembly Filter. (Refer to Figure 3.)
- (1) Remove RH nacelle air conditioning cover.
 - (2) Remove filter bowl (16) from manifold and valve assembly (14).
 - (3) Remove O-ring and filter element.



Air Conditioning Inlet Scoop Door Installation
Figure 4

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- B. Install Manifold and Valve Assembly Filter.
- (1) Install new O-ring and filter element and secure in manifold and valve assembly (13) with filter bowl (16).
 - (2) Check system operation and for leakage.
 - (3) Install RH nacelle air conditioning access cover.
2. Servicing Hydraulic Fluid Reservoir.
- A. Service Reservoir.
- (1) Access to the reservoir filling cap is gained through the door on the air conditioning access cover.
 - (2) For filling capacity, refer to Chapter 2, Servicing.

Adjustment/Test

1. Tools and Equipment.

NOTE: Equivalent substitutes may be used for the following listed items.

NAME	NUMBER	MANUFACTURER	USE
Hydro Test Unit	SE1300 or SE-589 Modified by SK421-68	Cessna Aircraft Company Wichita, KS 67277	Adjust hydraulic actuator for inlet scoop door.

2. Adjust Hydraulic Drive Components.
- A. For adjustment of hydraulic drive components, refer to Cessna Air Conditioning System Service Parts Manual.
3. Adjustment of Inlet Scoop Door. (Refer to Figure 4.)
- A. Remove nacelle access panel to air conditioner.
 - B. Adjust the forward actuator clevis and jamnut so as to obtain the shortest length possible.
 - C. Remove the inlet scoop door.
 - D. Loosen the screws securing the angle (18) to bellcrank (11).
 - E. Reinstall inlet door to angle.
 - F. Position door to fair in with the nacelle skin contour, by moving angle (18) on bellcrank (11) along the slotted holes.
 - G. Remove inlet scoop door.
 - H. Tighten screws securing angle (18) to bellcrank (11).
 - I. Install the inlet scoop door.
- WARNING: ENSURE HANDS ARE CLEAR OF THE AIR SCOOP WHEN PRESSURE IS APPLIED FOR TEST.
- J. Connect hydro test unit to actuating cylinder and apply 750, +25, -25 PSIG at one gallon per minute gradually to the actuator.
 - K. Verify the inlet scoop or inlet scoop door has not been damaged.
- NOTE: At this point, the door will be preloaded and is acceptable providing the door does not take a permanent set when pressure is relieved.
- L. Disconnect hydro test unit and install air conditioner access panel.

AIR CONDITIONING COMPRESSOR, CONDENSER AND EVAPORATOR SYSTEMDescription

1. The air conditioning compressor, condenser and evaporator system is the refrigerant (freon) portion of the air conditioning system. The compressor, condenser, receiver-dryer, low pressure switch, condenser fan and high temperature switch are, located in the right wing nacelle forward of the baggage compartment. Two evaporators are utilized in the air conditioning system. The evaporators are located one each just behind the pilot and copilot seats.
2. The compressor is connected to the hydraulic motor by an adapter, retaining ring and coupling. The coupling is screwed on the shaft of the compressor. The compressor is secured to the nacelle structure by a mount. The compressor driven by the hydraulic motor when the air conditioning system is ON circulates the freon through the condenser, receiver-dryer and evaporators to provide the refrigerated air.
3. The condenser is mounted just outboard of the compressor. The function of the condenser is to cool and condense the freon gas from the compressor into a high pressure liquid, which is routed through the receiver-dryer to each evaporator expansion valve. The condenser is mounted in a frame and baffles are installed around the condenser. The baffles control the air (ram) flow around the condenser to cool the condenser coils.
4. The receiver-dryer is mounted in the high pressure line to the evaporators. The receiver-dryer is mounted next to the condenser and secured to the mount bracket by a clamp. The function of the receiver-dryer is to store liquid refrigerant and remove moisture from the refrigerant liquid during the operation cycle.
5. The low pressure switch, located in the high pressure line aft of the receiver-dryer, provides system protection in the event of freon loss, or operation during extremely low outside ambient temperature. When low pressure exists in the high pressure line, the switch will close, applying electrical power to close the manifold and valve assembly, discontinuing the flow of hydraulic fluid to the hydraulic motor, causing the compressor to idle.
6. The condenser fan is mounted in the ram air flow stream outboard of the condenser. The fan is controlled electrically and automatic in operation. The function of the fan is to provide air to the condenser, when a high temperature condition exists in the high pressure line or when operating the air conditioning system on the ground. The electrical circuit for the condenser fan consists of: the circuit breaker, relay (located in the side console), fan motor and high temperature switch. When the air conditioning system is operated on the ground, the fan is operating and controlled by an electrical circuit from the landing gear safety switch. In flight, the air conditioning system ON, the fan is controlled by the high temperature switch and comes on only when a high temperature condition exists in the high pressure line from the condenser.
7. The evaporator modules each contain an evaporator coil, expansion valve, shroud, drain line and blower assembly. Each evaporator is mounted in a pan assembly just aft of the crew seats. Access to the evaporator module is obtained by removing the respective cover.
 - A. Special service fittings for diagnosis and charging the freon system are installed in the high pressure (liquid) line to the right-hand evaporator module expansion valve and in the suction line in the sight gage. These fittings contain a valve to prevent loss of freon during servicing. Service fittings are also located on the aft face of the compressor.
 - B. A condensate drain valve is located under the cabin floor and mounted to the front spar. The drain valve automatically drains the condensate from the evaporator modules. The drain valve provides a two-stage orifice which permits maximum drainage, during ground operation and limited drainage during cabin pressurized flight. The second stage orifice assures no significant loss in cabin pressurization.
 - C. On aircraft 421C0001 thru 421C0400, a temperature control switch and a heat temperature control are mounted to the right evaporator. On aircraft 421C0401 and on, there are two temperature probes and a temperature control. The control is mounted on the right evaporator and the probes are mounted, one on each evaporator.

- D. To keep seals lubricated, air conditioner system should be operated for approximately five minutes each week.

NOTE: In cool weather, air conditioner may not operate due to cold refrigerant (low pressure) even though the system is fully charged. Do not operate below 20°F OAT.

Troubleshooting

1. Troubleshooting Air Conditioning (Freon) System.

- A. For a guide to troubleshooting freon gas operated components, refer to Cessna Air Conditioning System Service Parts Manual.

Maintenance Practices

1. General Maintenance Practices.

NOTE: Before any maintenance is performed on the air conditioning system (Freon) components personnel should read and thoroughly understand the following precautions. Careful adherence to these instructions will aid in maintaining a functional and troublefree system.

A. Safety Precautions.

- (1) The refrigerant used in the system is R-12 Freon. This refrigerant is non-explosive, non-inflammable, non-corrosive, has practically no odor and is heavier than air. Although R-12 is classified as a safe refrigerant, certain precautions must be observed to protect parts involved and personnel working on the system.
- (2) Liquid R-12, at normal atmospheric pressure and temperature, evaporates so quickly that it tends to freeze anything it comes in contact with. Care must be taken to prevent any liquid refrigerant from coming in contact with skin and especially the eyes. R-12 is readily absorbed in most types of oil. Therefore, it is recommended a bottle of clean mineral oil and a weak solution of boric acid be kept nearby whenever performing maintenance and servicing the refrigerant system.
- (3) Always wear eye protection equipment when performing maintenance on any part of the refrigerant system.
- (4) Should any liquid refrigerant get into the eyes, use a few drops of mineral oil to wash out, then use a weak solution of boric acid to wash the eyes. Then seek the aid of a doctor immediately, even though the irritation has ceased.

B. Normal Maintenance Precautions.

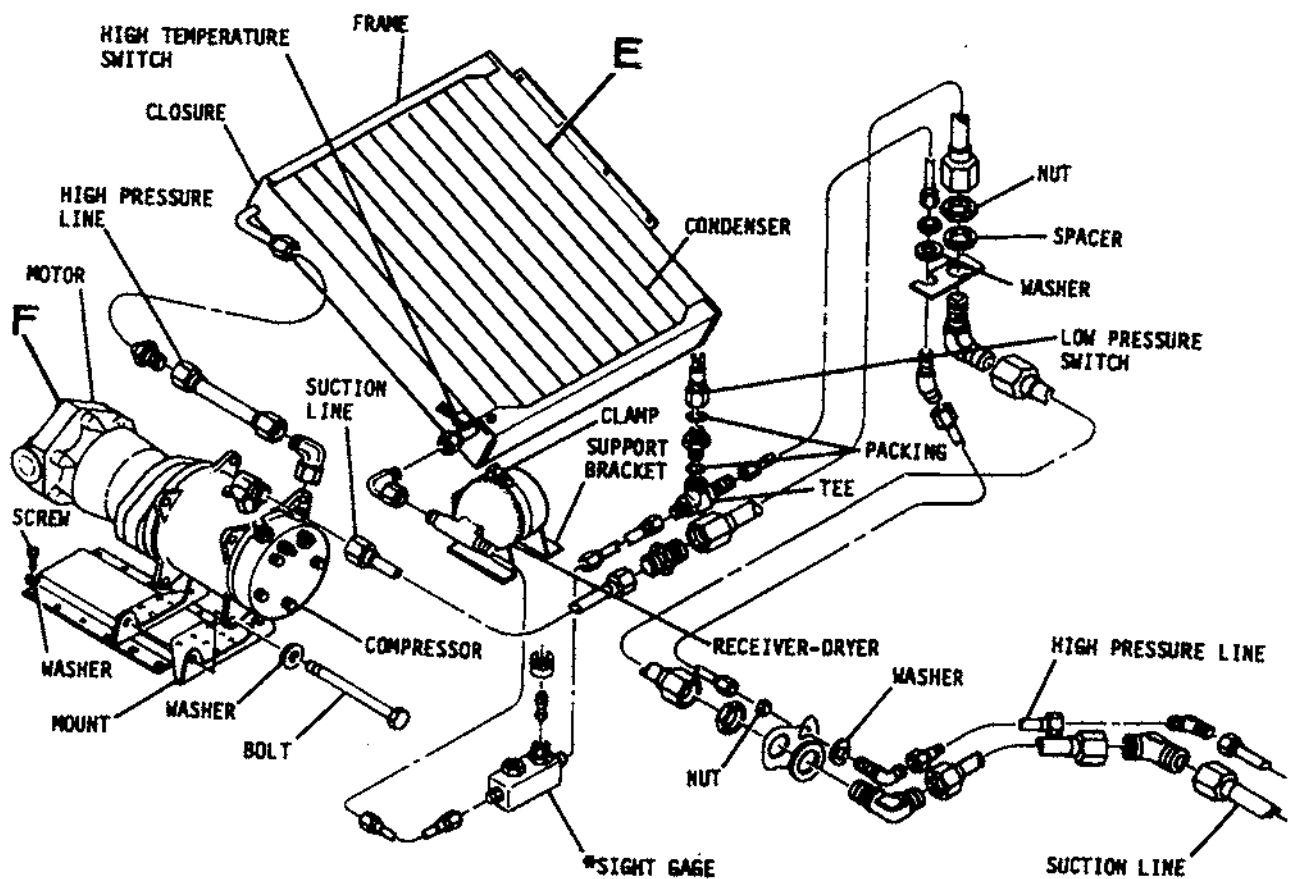
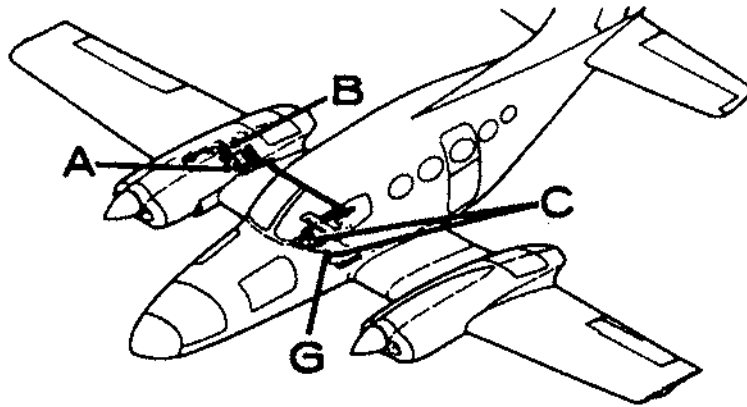
- (1) Cleanliness is of utmost importance to avoid system contamination, useless wear on the compressor and other equipment items causing possible short life or failure.
- (2) All plumbing hoses and components should be kept clean during normal maintenance. If components are removed for maintenance they shall be capped and precautions taken to prevent contamination.
- (3) Torquing of Plumbing Fittings - All plumbing fittings must be torqued to prevent potential Freon leakage and any removed or loosened fittings during maintenance shall be rechecked after high pressure leak check has been performed. For torquing of plumbing fittings, refer to Cessna Air Conditioning System Service Parts Manual.
- (4) When reinstalling fittings, it is recommended that all straight thread fittings and packings (o-rings) be lubricated with clean refrigerant oil and all taper (pipe) threads be serviced with Teflon tape; use care not to get Teflon taper closer than 2 (two) threads from the end of the fitting. Should a piece of tape get into system, the tape can cause blockage of several small orifices.

CAUTION: THE USE OF OTHER THREAD LUBRICANTS IS POSITIVELY PROHIBITED, INCLUDING "LOCTITE" OR OTHER COMMERCIAL REFRIGERANT LUBRICANTS SUCH AS "LEAK-LOCK."

2. Removal/Installation Compressor (See Figure 1).

A. Remove Compressor.

- (1) Discharge refrigerant system. Refer to Cessna Air Conditioning System Service Parts Manual.
- (2) Remove RH wing nacelle air conditioning access cover.
- (3) Disconnect suction and high pressure lines from compressor. Cap all openings.
- (4) Disconnect high pressure line through compressor baffle. Cap all openings.
- (5) Remove bolts and washers securing motor to compressor.
- (6) Remove bolts and washers securing compressor to mount.
- (7) Remove screws securing baffle to compressor.
- (8) If further disassembly of compressor is required, refer to Air Conditioning System Service Parts Manual.

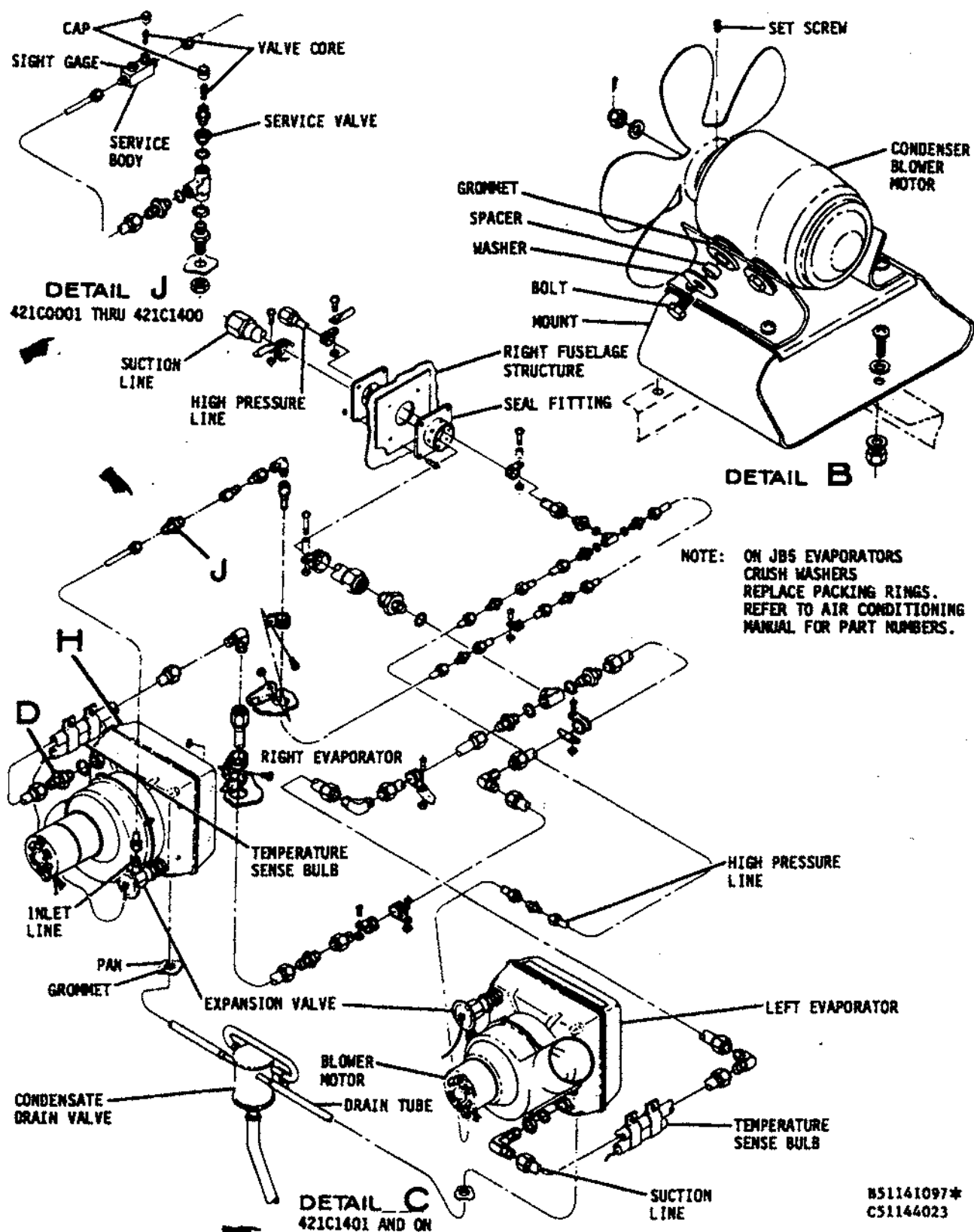


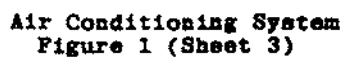
*421C1401 AND ON

DETAIL A

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Air Conditioning System
Figure 1 (Sheet 1)

Air Conditioning System
Figure 1 (Sheet 2)B51141097*
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B. Install Compressor.

- (1) Drain all oil from the compressor. Refer to Cessna Air Conditioning Service Parts Manual.
- (2) Refill the compressor with 4 ounces of Suniso No. 5 or Texaco Capella E Grade, 500 viscosity oil or equivalent.

NOTE: Special care shall be taken to assure that the system is not overcharged with oil. Since an overcharge of oil in the system will decrease system performance.

NOTE: All openings in compressor shall be capped off to assure that oil in the compressor does not drain out during installation.

- (3) Secure baffle to compressor with screws, before installation.
- (4) Position compressor in the compartment and assemble retaining ring, adapter and motor to the compressor.
- (5) Secure compressor to mount with bolts, washers and nuts.
- (6) Secure motor, adapter and retaining ring to the compressor with washers and bolts. Torque bolts to 125 inch-pounds.
- (7) Connect suction and high pressure lines to the compressor.
- (8) Evacuate, charge and leak check system. Refer to Cessna Air Conditioning System Service Parts Manual.
- (9) Install nacelle access cover.

3. Removal/Installation Condenser Blower Motor (See Figure 1).**A. Remove Condenser Blower Motor.**

- (1) Verify electrical power to air conditioning system is turned OFF.
- (2) Remove RH nacelle air conditioning access cover.
- (3) Disconnect electrical wiring and tag.
- (4) Remove bolts, washers and spacer and slide blower motor inboard and remove.
- (5) If removal of fan blade is required, refer to Removal/Installation Condenser Blower Fan Blade.

B. Install Condenser Blower Motor.

- (1) Install blower motor on mount and secure with bolts, washers and spacers. Torque bolts to 30-40 inch-pounds.

NOTE: Additional AN860-416L washers may be used as required to ensure that the bolts do not bear against the phenolic insulator of the motor.

- (2) Identify and connect electrical wiring to condenser blower.
- (3) Apply electrical power to system; position air conditioning switch to COOL and check blower operation.
- (4) Turn off electrical power and install access cover.

4. Removal/Installation Condenser Blower Fan Blade (See Figure 1).**A. Remove Fan Blade.**

- (1) Remove condenser blower, refer to Removal/Installation Condenser Blower Motor.
- (2) Remove cotter pin and retaining nut.
- (3) Remove allen head set screws and remove fan blade from motor shaft.

B. Install Fan Blade.

- (1) Install fan blade on the motor shaft with fan hub 1/8 inch from motor front face.
- (2) Tighten setscrews; install retaining nut and cotter pin.
- (3) Install condenser blower, refer to Removal/Installation Condenser Blower Motor.

5. Removal/Installation Condenser (See Figure 1).**A. Remove Condenser.**

- (1) Remove RH nacelle air conditioning access cover.
- (2) Discharge system. Refer to Cessna Air Conditioning System Service Parts Manual.

- (3) Disconnect high pressure lines at condenser.
 - (4) Remove baffles from around condenser as required for removal.
 - (5) See Figure 3, Chapter 6-31. Remove retainer, spring and washers securing cooling coil (18) to condenser.
 - (6) Remove screws and washers securing condenser frame to structure and remove condenser.
- B. Install Condenser.
- (1) Position condenser in the compartment and secure frame to structure with washers and screws.
 - (2) Refer to Figure 3, 6-31. Secure cooling coil (18) to condenser with retainer (22), washers (21), spring (19) and clip (24).
 - (3) Install baffles around condenser and secure with nuts, washers and screws as applicable.
 - (4) Connect high pressure lines to condenser.
 - (5) Evacuate, charge and leak check system. Refer to Air Conditioning System Service Parts Manual.
 - (6) Install access cover.
6. Removal/Installation Receiver-Dryer (See Figure 1).
- A. Remove Receiver-Dryer.
- (1) Discharge system. Refer to Air Conditioning System Service Parts Manual.
 - (2) Remove RH wing nacelle air conditioning access cover.
 - (3) Disconnect high pressure lines at receiver-dryer.
 - (4) Loosen clamp securing receiver-dryer to mount. Remove receiver-dryer.
- B. Install Receiver-Dryer.
- (1) Position receiver-dryer on mount and secure with clamp.

NOTE: The IN port of the receiver-dryer is connected to the plumbing from the condenser.
 - (2) Connect high pressure lines to receiver-dryer.
 - (3) Evacuate, charge and leak check system. Refer to Air Conditioning System Service Parts Manual.
 - (4) Install access cover.
7. Removal/Installation Low Pressure Switch (See Figure 1).
- A. Remove Low Pressure Switch.
- (1) Discharge system. Refer to Air Conditioning System Service Parts Manual.
 - (2) Remove RH wing nacelle air conditioning access cover.
 - (3) Disconnect electrical wires to low pressure switch.
 - (4) Remove low pressure switch from tee.
- B. Install Low Pressure Switch.
- (1) Install low pressure switch in tee, using new pack (o-ring).
 - (2) Connect electrical wires.
 - (3) Evacuate, charge and leak check system. Refer to Air Conditioning System Service Parts Manual.
 - (4) Install access cover.
8. Removal/Installation High Temperature Switch (See Figure 1).
- A. Remove High Temperature Switch.
- (1) Verify electrical power to system is turned OFF.
 - (2) Disconnect electrical wire to high temperature switch.
 - (3) Remove nut and bolt secure high temperature switch to high pressure line.
- B. Install High Temperature Switch.
- (1) Secure high temperature switch to high pressure line with screw and nut.
 - (2) Connect electrical wiring.
 - (3) Install access cover.

9. Removal/Installation Evaporator (See Figure 1).

NOTE: The removal/installation procedures given pertain to the LH evaporator unit; however, the procedures are the same for the RH evaporator. Where there is a specific difference, reference will be made to the individual evaporator unit.

A. Remove Evaporator.

- (1) Remove forward cabin divider, crew seat and carpet, refer to Chapter 12.
- (2) Remove cover from evaporator.
- (3) Discharge the system, refer to Air Conditioning Systems Service Parts Manual.
- (4) Remove expansion valve temperature sense bulb from suction line by removing nut and screw securing clamps.
- (5) Disconnect lines from evaporator.
- (6) Tag and disconnect electrical wiring.
- (7) Disconnect drain tube from bottom of evaporator unit.
- (8) Remove air duct from evaporator.
- (9) Remove screws and spacers securing evaporator to mounting and remove evaporator.

B. Install Evaporator.

- (1) Place evaporator in mounting and secure with spacers and screws.
- (2) Connect air duct with clamp.
- (3) Connect drain tube to bottom of evaporator unit.
- (4) Connect electrical wiring.
- (5) Connect lines to evaporator.
- (6) Fasten temperature sense bulb to the bottom horizontal or downward sloping run of suction line approximately between 5-7 o'clock position as near to the evaporator as possible (do not mount sense bulb on the bottom of a "U" shaped trap).
- (7) Insulate suction line (after temperature sense bulb is attached) with P-2, 2-inch wide x 0.19 thick foam tape. Vendor Wilshire Foam Products, Inc., 2665 Columbia St., Torrance, California 90503.
- (8) Evacuate, charge and leak check system. Refer to Air Condition System Service Parts Manual.
- (9) Install cover.
- (10) Install crew seat, carpet and cabin divider.

10. Removal/Installation Expansion Valve (See Figure 1).

NOTE: The removal/installation procedures are the same for the LH or RH evaporator expansion valve except for the valve being located in a different place on the evaporator.

A. Remove Expansion Valve.

- (1) Verify system power is OFF.
- (2) Remove evaporator, refer to Removal/Installation Evaporator.
- (3) Disconnect blower motor wiring and tag.
- (4) Remove screws and lock nuts from module housing and remove motor housing assembly from evaporator module.
- (5) Disconnect 1/4 inch inlet line from expansion valve.
- (6) Loosen jamb nut on expansion valve and unscrew valve.

CAUTION: WHILE LOOSENING JAMB NUT ON VALVE, USE BACKUP WRENCH ON EVAPORATOR BOSS.

- (7) Remove O-ring and jamb nut.

B. Install Expansion Valve.

NOTE: Preset expansion valve to 40 PSI upon reinstallation on airplanes 421C0858 and On.

- (1) Install jamb nut and new O-ring (NAS-1595-8) on the valve outlet fitting.
- (2) Screw expansion valve assembly into coil inlet fitting until O-ring touches the inlet fitting.
- (3) Position valve to mate with inlet line and screw on inlet line fitting until finger tight.
- (4) Tighten jamb nut while using backup wrench on evaporator boss.

CAUTION: DO NOT USE WRENCH ON EXPANSION VALVE OUTLET LINE.

- (5) Tighten fitting on 1/4 inch inlet line.

- (6) Clean motor housing and module housing mating surfaces; apply a small bead of silicone rubber (RTV102).
 - (7) Install motor housing assembly to module housing and align mounting holes.
 - (8) Install mounting screws and lock nuts and tighten at random.
 - (9) Connect motor electrical wiring and check out motor operation at both speeds. Listen for excessive noise or rubbing.
 - (10) Install evaporator, refer to Removal/Installation Evaporator.
11. Removal/Installation Evaporator Condensate Drain (See Figure 1).
- A. Remove Condensate Drain Valve.
 - (1) Remove floorboard as necessary to gain access to drain valve.
 - (2) Remove hose connections from evaporator condensate drain valve.
 - (3) Remove screws attaching condensate drain valve to front spar and remove valve.
 - B. Install Condensate Drain Valve.
 - (1) Secure condensate drain valve to front spar using screws.
 - (2) Connect drain hoses to condensate drain valve.

NOTE: If hose was removed from bottom surface of cabin, reseal using EC1126 sealant.
 - (3) Install floorboard.
12. Removal/Installation Air Conditioning (Freon) System Plumbing (See Figure 1).
- A. Remove Plumbing.
 - (1) Remove all RH passenger seats, crew seats, cabin divider and RH side of cabin carpet, refer to Chapter 12.
 - (2) Remove RH nacelle air conditioning access cover, lower flaps and remove all necessary access covers in RH floorboard area.
 - (3) Discharge system. Refer to Air Conditioning System Service Parts Manual.
 - (4) Remove plumbing as required; see Figure 1.
 - B. Install Plumbing.
 - (1) Install plumbing, refer to Figure 1.
 - (2) If plumbing was removed at cabin seal fitting, reseal seal fitting, refer to Chapter 1.
 - (3) Evacuate, charge and leak check system. Refer to Air Conditioning System Service Parts Manual.
 - (4) Install access cover and floorboards.
 - (5) Install carpet, seats and cabin divider.

Servicing

1. Service Air Conditioning Freon System.

A. Service Freon System.

- (1) For servicing the air conditioning Freon system, refer to Air Conditioning System Service Parts Manual.

Inspection/Check

1. Inspect Air Conditioning Freon System.

A. Inspect Freon System.

- (1) Remove RH nacelle access cover, covers from evaporators and floorboard as required to inspect component and plumbing.

AIR CONDITIONING AIR DISTRIBUTION SYSTEMDescription

1. The air conditioning air distribution system consists of: ducting, air outlets and two blower assembly (part of evaporator modules).
2. The blower motor operation is controlled by the Air Conditioning switch and motor speed is controlled by the Blower switch. The blower motor may be operated as a ventilating blower for recirculating cabin air without using the air conditioning system.

Troubleshooting

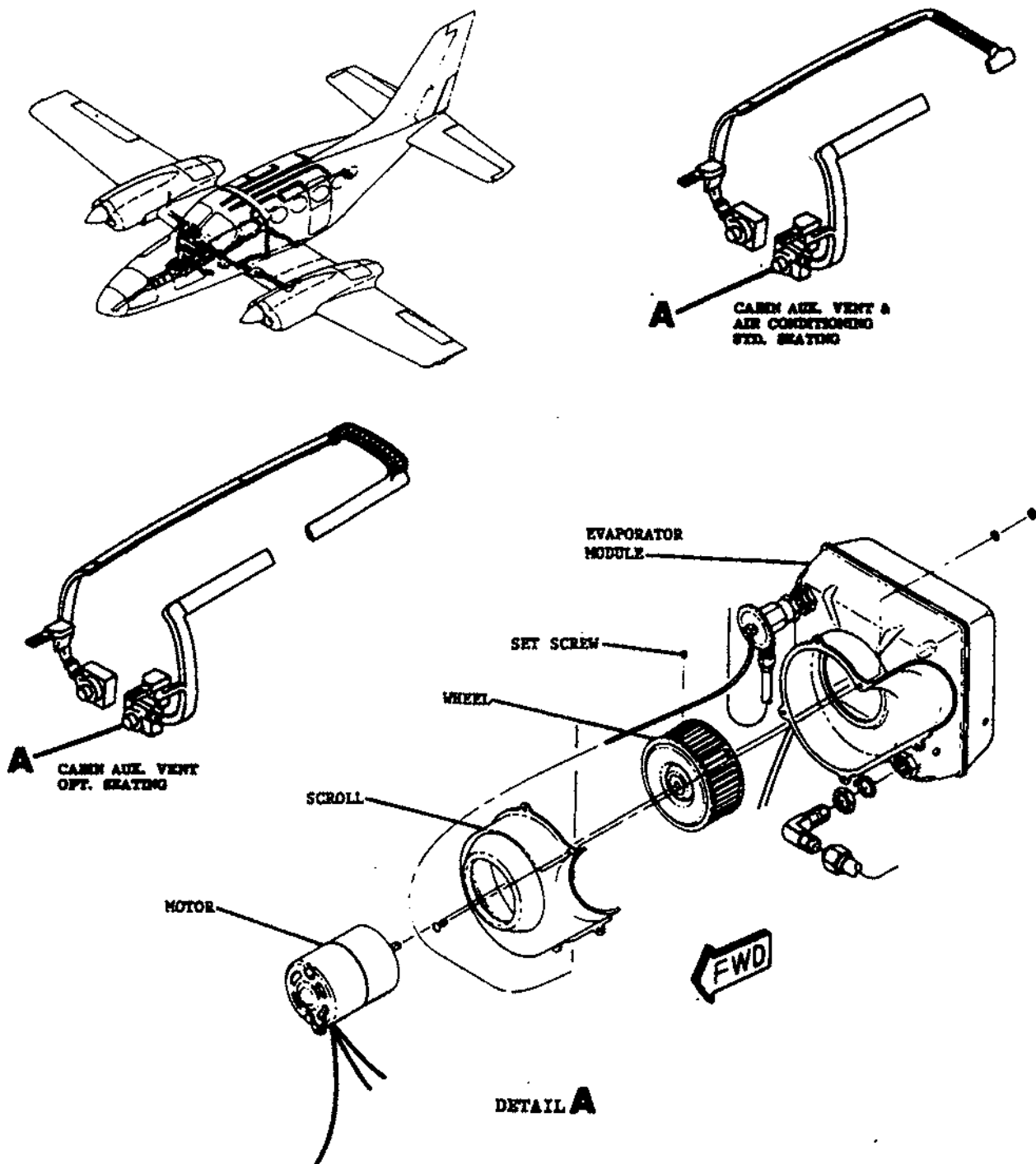
1. Troubleshooting Air Conditioning Blower Motor.
 - A. Troubleshooting the blower motor operation pertains to electrical wiring defects, such as, defective switches, open circuit or defective motor. Refer to Chapter 13 for wiring diagram.

Maintenance Practices

1. Removal/Installation Evaporator Blower Motor (See Figure 1).
 - A. Remove Blower Motor.
 - (1) Verify electrical power to system is turned OFF.
 - (2) Remove evaporator; refer to Removal/Installation Evaporator.
 - (3) Remove screws and locknuts from blower housing.
 - (4) Pull motor and front portion of scroll assembly away from evaporator module.
 - (5) Remove blower wheel setscrew and slide wheel off motor shaft.
 - (6) Remove two motor support nuts and lock washers. Pull motor away from scroll and motor support ring.
 - B. Install Blower Motor.
 - (1) Place motor in support ring, align mounting studs and press motor in place.
 - (2) Replace motor mount lock washers and nuts and tighten nuts.
 - (3) Slide wheel on motor shaft until it stops. Tighten setscrew.

NOTE: Verify that the back side of the wheel does not strike the motor mount studs.
 - (4) Clean off both scroll mating surfaces and apply small bead of silicone rubber (RTV102) on scroll mating surface.
 - (5) Install motor scroll assembly and align mounting screws holes and install screws.
 - (6) Place lock nuts on mounting screws and tighten in random pattern.
 - (7) Connect motor electrical wiring and check motor operation at both speeds.

NOTE: During motor operation, listen for any excessive noise or rubbing.
 - (8) Turn motor off and install evaporator; refer to Removal/Installation Evaporator.



Air Conditioning Air Distribution System
Figure 1

51143116
51143122
A54143018R
51143122

OXYGEN SYSTEMDescription

1. The oxygen system is an optional system. The aircraft owner has a choice of 11.0 cu. ft. or 114.9 cu. ft. capacity oxygen cylinder. The 114.9 cu. ft. oxygen system incorporates an automatic altitude compensating regulator in the system to reduce oxygen expenditures at lower altitudes and increases oxygen duration. All aircraft are equipped with standard oxygen plumbing from the forward cabin bulkhead to the sixth oxygen outlet coupling. Aft from the sixth oxygen outlet coupling the plumbing will vary with aircraft seating arrangement.
2. The cylinder-regulator (oxygen bottle) is located in the nose section of the aircraft. Cylinder-regulator location will vary with capacity of the oxygen cylinder. A control knob on the instrument panel when pulled to the ON position, provides a continuous flow of oxygen to the oxygen mask, when the mask hoses are engaged in the outlets. The mask hose contains a flow indicator for visual verification of oxygen flow. The passenger masks and hoses are stored in a bag in the cabin. Pilot and copilot masks are stored in the armrests.

CAUTION: PRIOR TO INITIAL USE THE OXYGEN SYSTEM SHALL BE PURGED WITH OXYGEN FOR A PERIOD OF TEN (10) MINUTES BY INSERTING MASK FITTINGS AT EACH OF THE OUTLETS AND ALLOWING THE OXYGEN TO FLOW THROUGH SLOWLY.

Troubleshooting

NOTE: Before attempting maintenance, personnel should adhere to General Maintenance Precautions and procedures described in Maintenance Practices.

1. Tools and Equipment

NOTE: Equivalent substitutes may be used instead of the following listed item.

Name	Number	Manufacturer	Use
Sherlock Leak Detector	Type CG (MIL-L-25567A Type 1)	Puritan-Zep El Segundo, Calif.	For leak test fluid.

2. Troubleshooting Oxygen System.

- A. For a guide to troubleshooting the oxygen system, see Figure 2.

Servicing

1. Servicing Oxygen System.

- A. Charging Oxygen System.

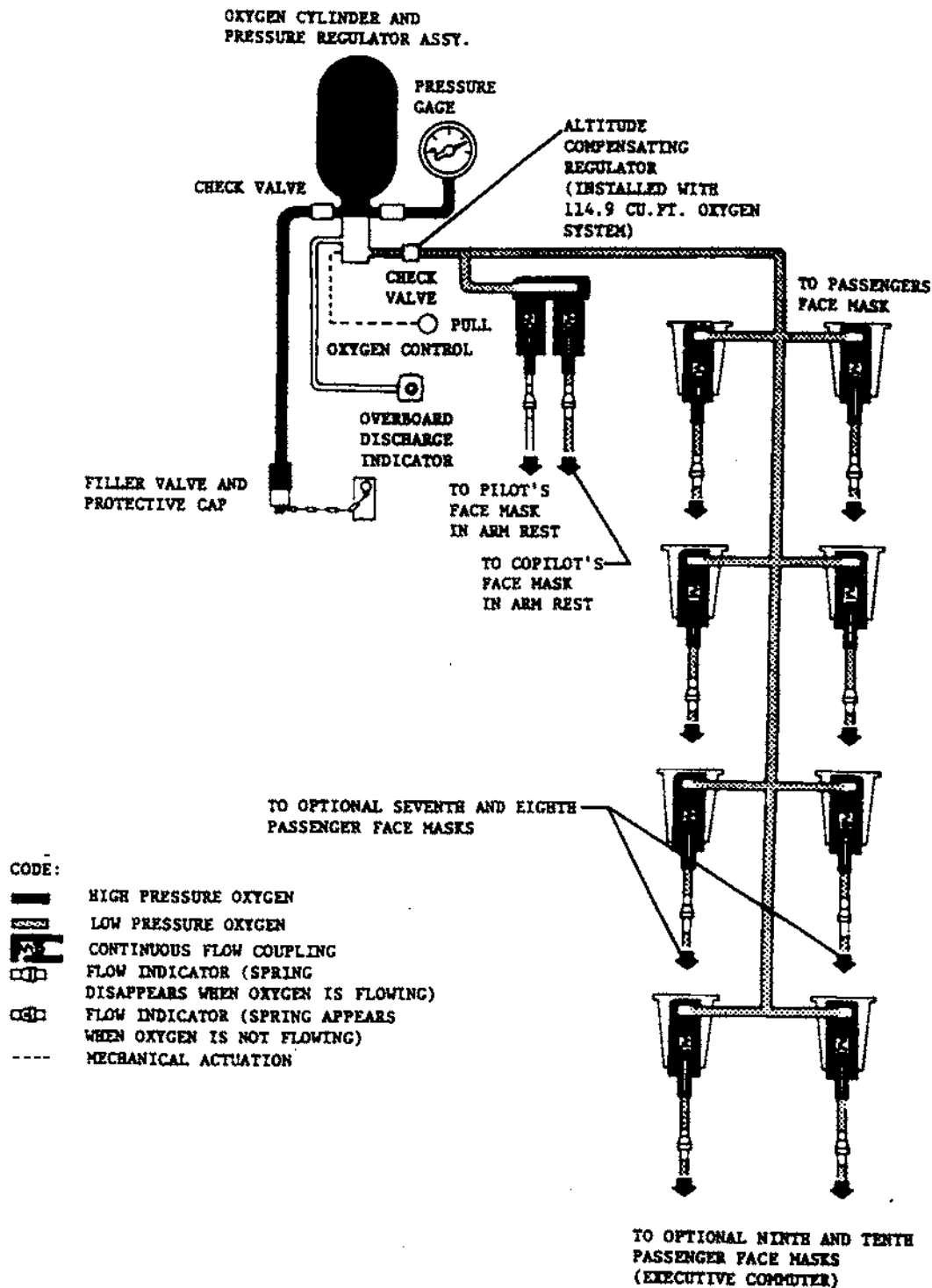
- (1) Refer to Chapter 2, for charging oxygen system.

- B. Discharge Oxygen System.

WARNING: THE DISCHARGE PROCEDURE SHOULD BE ACCOMPLISHED OUTDOORS. IF THE DISCHARGING IS DONE INDOORS, EXTREME CARE MUST BE EXERCISED TO PREVENT OXYGEN FLOW FROM OILS, GREASE, CONTAMINATES AND ELECTRICAL SPARKS. THE AREA SHOULD BE ROPE OFF AND NO SMOKING OR OPEN FLAME ALLOWED IN OR NEAR THE AREA.

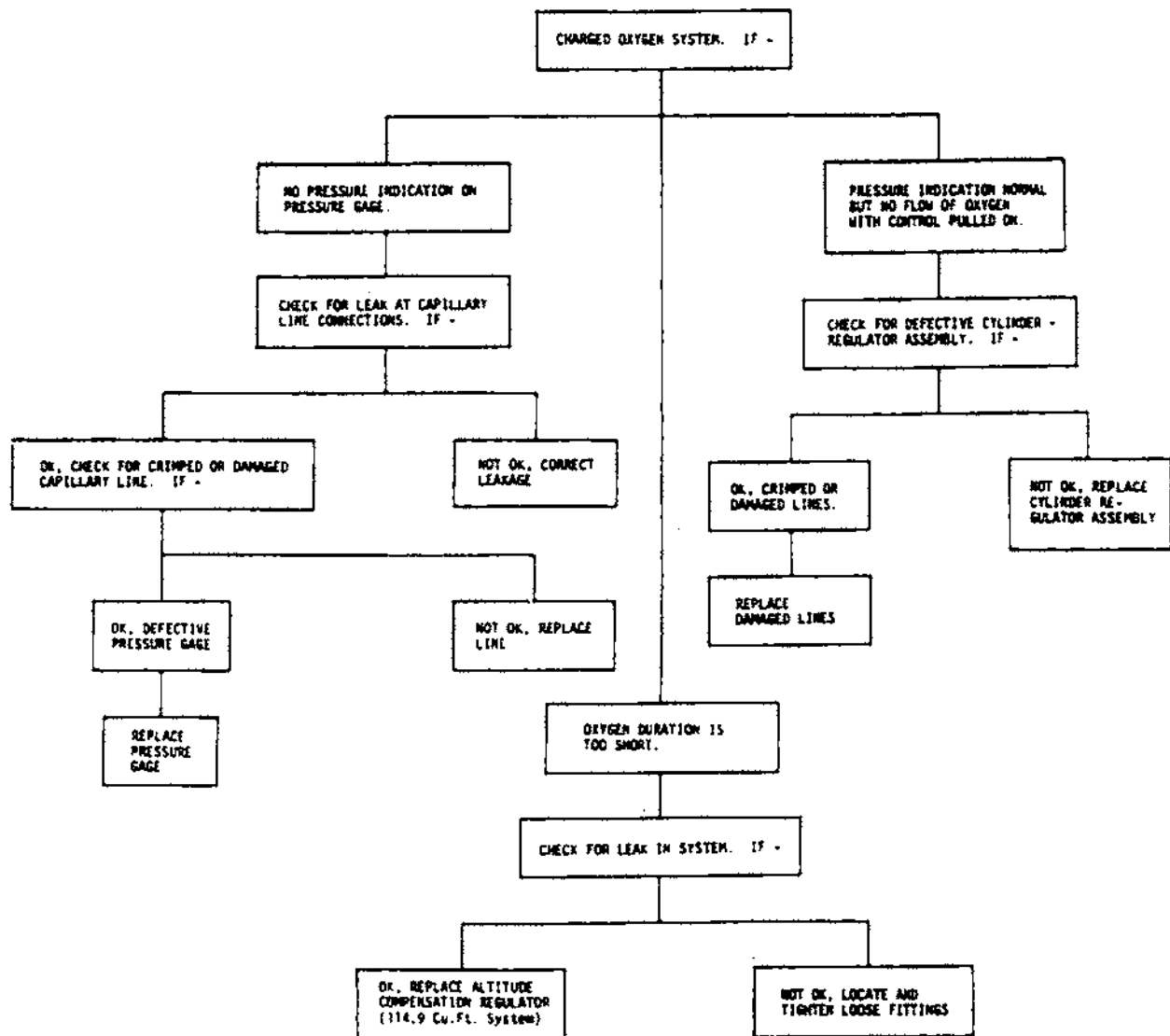
NOTE: Discharging the oxygen system into the cabin area is not recommended.

- (1) Pull oxygen control knob to ON position.



Oxygen Supply System Schematic
Figure 1

51983005



Troubleshooting Chart - Oxygen System
Figure 2

51988011

- (2) Remove hose from the mask end of one of the passengers' oxygen mask and insert hose into oxygen outlet port. Route the hose outside the cabin and through the foul weather window.

C. Purge Oxygen System.

WARNING: WHENEVER COMPONENTS HAVE BEEN REMOVED OR REPLACED OR OXYGEN SYSTEM HAS BEEN ALLOWED TO DEplete TO BELOW 50 PSI, THE SYSTEM MUST BE PURGED BEFORE CHARGING.

- (1) Charge the oxygen system. Refer to Chapter 2.
- (2) Move aircraft outdoors if possible. If unable to move aircraft outdoors make sure area is roped off, no smoking or open flame permitted in the area, no grease or lubricant near area, cabin door and foul weather windows open.
- (3) Plug all masks into outlets and purge system by allowing the oxygen to flow for at least 10 minutes. Smell the oxygen flowing from the outlets and continue to purge until the oxygen is odorless. Refill cylinder as required during and after purging; refer to Chapter 2.

Maintenance Practices

1. Tools and Equipment.

NOTE: Equivalent substitutes may be used instead of the following items.

Name	Number	Manufacturer	Use
Anti-seize Compound	MIL-T-5542	Commercially available	To lubricate threads and fittings.
Trichlorethylene	MIL-T-7003	Commercially available	To clean oxygen lines.
Naphtha	TT-N-95		Flush oxygen lines.
Anti-Icing	MIL-F-5566		Flush oxygen lines.

2. General Maintenance Precautions.

- A. Before any maintenance is performed on the oxygen system personnel should read and thoroughly understand the following. Careful adherence to these instructions will aid in maintaining a trouble-free system.
- B. If maintenance is performed on the aircraft oxygen system, or on any other system in the aircraft requiring removal of an oxygen system component, strict adherence to the following procedures and precautions is required.

WARNING: DO NOT PERMIT SMOKING OR OPEN FLAME NEAR AIRCRAFT WHILE MAINTENANCE IS BEING PERFORMED ON THE OXYGEN SYSTEM. ASSURE ALL ELECTRICAL POWER IS DISCONNECTED AND THAT THE AIRCRAFT IS PROPERLY GROUNDED. IN ADDITION, OILS, GREASE, AND SOLVENTS MAY BURN OR EXPLODE SPONTANEOUSLY WHEN CONTACTED BY OXYGEN UNDER PRESSURE.

- (1) Use extreme caution to assure every port on the system is kept thoroughly clean and free of water, oil, grease, and solvent contamination.
- (2) Cap all openings immediately upon removal of any component. Do not use tape or caps which will induce moisture.
- (3) Lines and fittings shall be clean and dry. One of the following methods may be used to clean lines.
 - (a) A vapor degreasing solution of stabilized trichlorethylene conforming to Specification MIL-T-7003, followed by blowing tubing clean and dry with a jet of nitrogen gas (BB-N411) Type 1, Class 1, Grade A or Technical Argon (MIL-A-18455).

CAUTION: MOST AIR COMPRESSORS ARE OIL LUBRICATED, AND A MINIMUM AMOUNT OF OIL MAY BE CARRIED BY THE AIR STREAM. A WATER LUBRICATED COMPRESSOR SHOULD BE USED TO BLOW TUBING CLEAN ONLY WHEN NITROGEN OR ARGON ARE NOT AVAILABLE. THE AIR MUST BE CLEAN, DRY AND FILTERED.

- (b) Flush with naphtha conforming to 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 a jet of nitrogen gas (BB-N-411) Type 1, Class 1, Grade A or Technical Argon (MIL-A-18455).
- (c) Flush with hot inhibited alkaline cleaner until free from oil and grease. Rinse with fresh water and dry with a jet of nitrogen gas (BB-N-411) Type 1, Class 1, Grade A or Technical Argon (MIL-A-18455).

NOTE: Cap all lines immediately after drying.

- (d) Fabrication of pressure lines is not recommended. Lines should be replaced from the factory by part number.
- (e) All compounds used on fittings must conform to MIL-T-5542. No compounds shall be used on aluminum alloy flared fittings. Compounds are used only on the first three threads of male fittings. No compound or tape is used on coupling sleeves, or outside of the flares. Use only Sl465 Teflon lubricating tape on threads.
- (f) Maintenance personnel must assure that their hands are free of dirt or grease prior to installation of oxygen tubing or fittings.
- (g) All tools used for installation of oxygen tubes or fittings must be free of dirt, grease, or oils.

WARNING: USE NON-SPARKING TOOLS.

CAUTION: WITH OXYGEN BOTTLE CHARGED, DO NOT MOVE CONTROL TO THE ON POSITION WITH OUTLET PORTS (LOW PRESSURE) OPEN TO ATMOSPHERE. DAMAGE TO REGULATOR METERING POPPET MAY OCCUR.

CAUTION: WHENEVER A COMPONENT OF THE OXYGEN SYSTEM HAS BEEN REMOVED, RE-INSTALLED, REPLACED OR SYSTEM HAS BEEN DISASSEMBLED IN ANY WAY, THE OXYGEN SYSTEM MUST BE LEAK CHECKED AND PURGED.

- C. Inspection of the cylinder is required before charging. Do not attempt to charge the cylinder if any of the following conditions exists:
 - (1) Contaminated or corroded fitting on servicing cylinder or filler valve.
 - (2) Cylinder out of hydrostatic test date.
 - (3) Cylinder bears no D.O.T. designation.
 - (4) Cylinder completely empty after shutoff valve has been turned off for a length of time. Must be completely disassembled and inspected in an FAA approved facility before charging.
- D. To assist in cylinder identification, the following information is reflected on each oxygen cylinder.
 - (1) Cylinder specification followed by service pressure such as "ICC-3AA1800 or ICC-3HT1850" will be stamped on the shoulder or neck of each cylinder.

NOTE: Effective January 1, 1970, all newly manufactured cylinders are stamped "DOT" (Department of Transportation) in lieu of "ICC" (Interstate Commerce Commission).

- (2) Cylinder serial number will be stamped below or directly following the cylinder specification.
- (3) Hydrostatic test date will be stamped directly below the original manufacture date and shall include the month and year of the hydrostatic test date.

Adjustment/Test

1. Tools and Equipment.

NOTE: Equivalent substitutes may be used instead of the following items:

Name	Number	Manufacturer	Use
Sherlock Leak Detector	Type CG (MIL-L-25567A)	Puritan-Zep El Segundo, Calif.	For leak test fluid.
Pressure Gage (0-100 PSIG)		Commercially available	To check oxygen flow pressure.

2. Leak Test Oxygen System.

- (1) Charge the oxygen system. Refer to Chapter 2.
- (2) Allow thirty minutes for cylinder pressure to stabilize between 1750 and 1800 PSIG, indicated on pressure gage.
- (3) Record the cylinder pressure and ambient temperature.
- (4) After 24 hours, record cylinder pressure and ambient temperature. Maximum allowable pressure drop is 50 PSIG (correcting for temperature change, using formula of $\pm 1^{\circ} = 3.4$ PSIG).
- (5) If the pressure drop derived from the formula in the preceding step exceeds 50 PSIG, test the oxygen system for leakage by applying detector fluid type CG-1 or equivalent to all fittings and connections and observe for formation of bubbles.
- (6) Remove all traces of solution and repair or replace leaky fitting and repeat the preceding procedures.

3. Functional Test Oxygen System.

NOTE: Whenever the oxygen system regulator (cylinder-regulator assembly) has been replaced or overhauled, perform a flow test to determine that system functions properly.

A. Functional Test Uncompensated Oxygen System.

- (1) Fully charge the oxygen system. Refer to Chapter 2.
- (2) Install an oxygen outlet adapter (P/N C66005-0506) into a pressure gage (calibrated in one pound increments from 0 to 100 PSIG) and insert adapter into pilot's oxygen outlet.
- (3) Pull oxygen control to ON position. Pressure should be 70 ± 10 PSIG. If not 70 ± 10 PSIG, replace cylinder-regulator and repeat test.
- (4) Recharge oxygen system as required. Refer to Chapter 2.

B. Functional Test Compensated Oxygen System.

- (1) Fully charge the oxygen system. Refer to Chapter 2.
- (2) Install an oxygen outlet adapter (P/N C166005-0506) into a pressure gage (calibrated in one pound increments from 0 to 100 PSIG) and insert adapter into pilot's oxygen outlet.
- (3) Pull oxygen control to ON position.
- (4) Insert adapters or mask line assemblies into all remaining outlets. With oxygen flowing from all outlets, the pressure should then conform to schedule below.

Altitude Above Sea Level	Gage Pressure
Sea Level	7.30 ± 2.5
1,330	8.00 ± 2.5
2,000	8.34 ± 2.5
3,000	8.83 ± 2.5
4,000	9.31 ± 2.5
5,000	9.77 ± 2.5
6,000	10.22 ± 2.5
8,000	11.08 ± 2.5
10,000	11.89 ± 2.5
14,000	17.57 ± 2.5
17,000	21.55 ± 2.5
20,000	24.45 ± 2.5

Discrepancies	Cylinder Classification					
	ICC-3AA 1800			ICC-3HT-1850		
Isolated pitting or corrosion (Depth)	.020	2	3	.010	2	3
Local pitting or corrosion or line corrosion (Depth)	.010	3	4	.005	3	4
General corrosion	Not allowed			Not allowed		
Cuts, Digs, Gouges (Depth)	.010	6		.005	6	
Dents (Depth)	.062	7		.031	7	
	.062	7		.031	7	
Fire damage	Not allowed			Not allowed		
Bulges	Not allowed			Not allowed		

- 2 Isolated pits of small cross section involving loss of wall thickness by corrosive media. Small isolated pits with a maximum depth as shown are acceptable.
- 3 If depth exceeds figure shown, cylinder must be returned to the manufacturer for disposition.
- 4 Local pitting or corrosion or line corrosion involving loss of wall thickness by corrosive media with a pattern of pits which are connected to others in a band or line. A small area with a minimum depth as shown is acceptable. Areas extending beyond 3 inches in diameter or 4 inches long shall be considered general corrosion.
- 5 General corrosion (sometimes accompanied by pitting) involving loss of wall thickness by corrosive media covering a considerable area. Cylinder must be returned to the manufacturer for hydrostatic testing.
- 6 Deformations caused by contact with a sharp object cutting or upsetting the material of the cylinder, decreasing the wall thickness. Maximum defect permissible without corrective action. If this depth is exceeded, the cylinder must be returned to the manufacturer for removal of defects and verification of cylinder strength by hydrostatic testing.
- 7 Deformations caused by contact with blunt objects in such manner that the thickness of the metal is not impaired. The major diameter of the dent must be equal to or greater than 32 times the depth of the dent. Sharper dents (or deeper dents) than this are considered too abrupt and must be returned to the cylinder manufacturer for disposition.
- 8 Fire damage is indicated by charring or burning or sintering of the metal, charring or burning of the paint, distortion of the cylinder, functioned safety relief devices, melting of valve parts, etc. Cylinders must be returned to the cylinder manufacturer for disposition.
- 9 Bulged cylinders are not acceptable. Cylinders must be returned to the cylinder manufacturer for disposition.

NOTE: The above data may be used to determine that oxygen cylinders are acceptable for service. This criteria should be used prior to charging cylinders.

Inspection Criteria for Acceptance of Oxygen Cylinder
Figure 3

CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL

NOTE : If pressure at given altitude is different than shown above, check oxygen pressure on inlet to altitude compensating regulator; it should be 70 ± 10 PSIG.

- (5) If pressure cannot be obtained in the schedule and pressure is 70 ± 10 PSIG at line to inlet port of compensating regulator; replace compensating regulator. If pressure (70 ± 10 PSIG) cannot be obtained at compensating regulator; replace cylinder-regulator. Repeat test procedures.
- (6) Position control to OFF and return all masks to mask case.
- (7) Recharge oxygen system as required. Refer to Chapter 2.

C. Hydrostatic Test Oxygen System Cylinder.

- (1) Standard weight (ICC or DOT-3AA 1800) cylinder must be hydrostatically tested to 5/3 their working pressure every five years starting with the date of the last hydrostatic test.

NOTE : These test requirements are established by the Interstate Commerce Commission Code of Federal Regulations, Title 49, Chapter 1, Paragraph 173.34.

- (2) Standard weight (ICC or DOT-3AA 1800) cylinders have no life limitations and may be used until they fail hydrostatic testing.
- (3) Light weight (ICC or DOT-3HT 1850) cylinders must be hydrostatically tested to 5/3 their working pressure every three years starting with the date of the last hydrostatic test.
- (4) Light weight (ICC or DOT-3HT 1850) cylinders must be retired from service after twenty four years or 4380 filling cycles after date of manufacture, whichever occurs first.

Inspection/Check

1. Inspect Oxygen System.

A. Inspect Oxygen System Components.

- (1) A careful visual inspection of the oxygen cylinder should be performed during routine maintenance and periodic inspections. If any bad dents, scratches or areas of corrosion are found, the cylinders, refer to Manual CG6-CA (Visual Inspection of Cylinders) for inspection requirements.

NOTE : If the acceptability of the cylinder is questionable do not hesitate to return cylinder to manufacturer.

- (2) High pressure lines should be inspected for scratches, dents, cracks, deep gouges if a leak is indicated. Lines should be tested to not less than 3000 PSIG if trouble is indicated.

WARNING : WHENEVER COMPONENTS HAVE BEEN REMOVED AND REPLACED OR OXYGEN SYSTEM HAS BEEN ALLOWED TO DEplete TO BELOW 50 PSIG, THE SYSTEM MUST BE PURGED IN ACCORDANCE WITH PURGING PROCEDURES BEFORE CHARGING THE SYSTEM.

Cleaning/Painting

1. Cleaning Oxygen System Components.

A. Cleaning Filler Valve.

- (1) The filler valve should be cleaned with trichloroethylene MIL-T-7003.
- (2) Clean Freon MIL-C-8638 or alcohol may be used as an alternate.

B. Cleaning Regulator and Cylinder.

- (1) Clean regulator and cylinder with a clean cloth.

C. Cleaning Oxygen Masks and Hoses.

- (1) Clean the mask and hoses with a mild solution of soap and water. Rinse thoroughly with clean water and allow to dry.

NOTE: Ensure all soap is removed by rinsing. Masks may be disinfected with a hospital type antiseptic spray or Zep Aero SBT-12.

CAUTION: REMOVE MICROPHONE FROM PILOT'S MASK BEFORE CLEANING.

OXYGEN SYSTEM PLUMBING AND CYLINDER (11.0 CU. FT.)Description

1. The oxygen system (11.0 cu. ft.) consists of: a cylinder-regulator, filler valve, overboard discharge indicator, control cable and knob, cylinder pressure gage, outlets, oxygen masks and associated plumbing.
 - A. The cylinder-regulator (oxygen bottle) is located in the nose baggage compartment on the aft left-hand side. Access to the cylinder is gained by removing the left-hand baggage shelf. The cylinder-regulator is secured in position on supports with clamps. A supply regulator is attached to the cylinder to reduce high cylinder pressure to a lower constant pressure. The regulator incorporates a manual shutoff valve (cable operated); ports for a filling line, pressure gage line (capillary), outlet line (supply) and overboard discharge indicator line.
 - B. A control knob on the instrument panel when pulled to the ON position, provides a continuous flow of oxygen to the oxygen mask, when the mask hoses are engaged in the outlets. The mask hose contains a flow indicator for visual verification of oxygen flow.
 - C. The oxygen outlets are installed in the pilot and copilot arm rests and above the passenger seats. Each outlet contains a spring-loaded valve, which prevents oxygen flow until the mask hose is engaged with the outlet.
 - D. The oxygen filler valve is located inside the LH aft nose baggage compartment. The filler valve is secured to the structure with rivets and consists of the valve incorporating a filter and valve cap. A check valve is installed in the high pressure line (filler line) at the regulator to prevent the escape of oxygen from the cylinder at the filler line port.
 - E. The overboard discharge indicator is located on the bottom surface of the nose skin below the oxygen cylinder. A low pressure (60 $\pm$ 20 psi) green disc is provided to prevent dust and contamination from entering the line. The indicator line is connected to the high pressure rupture fitting of the regulator. A disc disappearance in the indicator, indicates oxygen cylinder overpressure existed and oxygen was routed overboard.
 - F. The oxygen pressure gage is located on the left-hand side of the instrument panel. The gage is electrically illuminated by a post light and the range markings are: yellow arc 0-300, green arc 1550 to 1850, and red line 2000 psi.

Maintenance Practices

NOTE: Before any maintenance is performed on the oxygen system, personnel should read and thoroughly understand General Maintenance Precautions, refer to Oxygen System, Maintenance Practices.

1. Removal/Installation Oxygen Cylinder - Regulator Assembly (See Figure 1).

- A. Remove Oxygen Cylinder - Regulator Assembly.

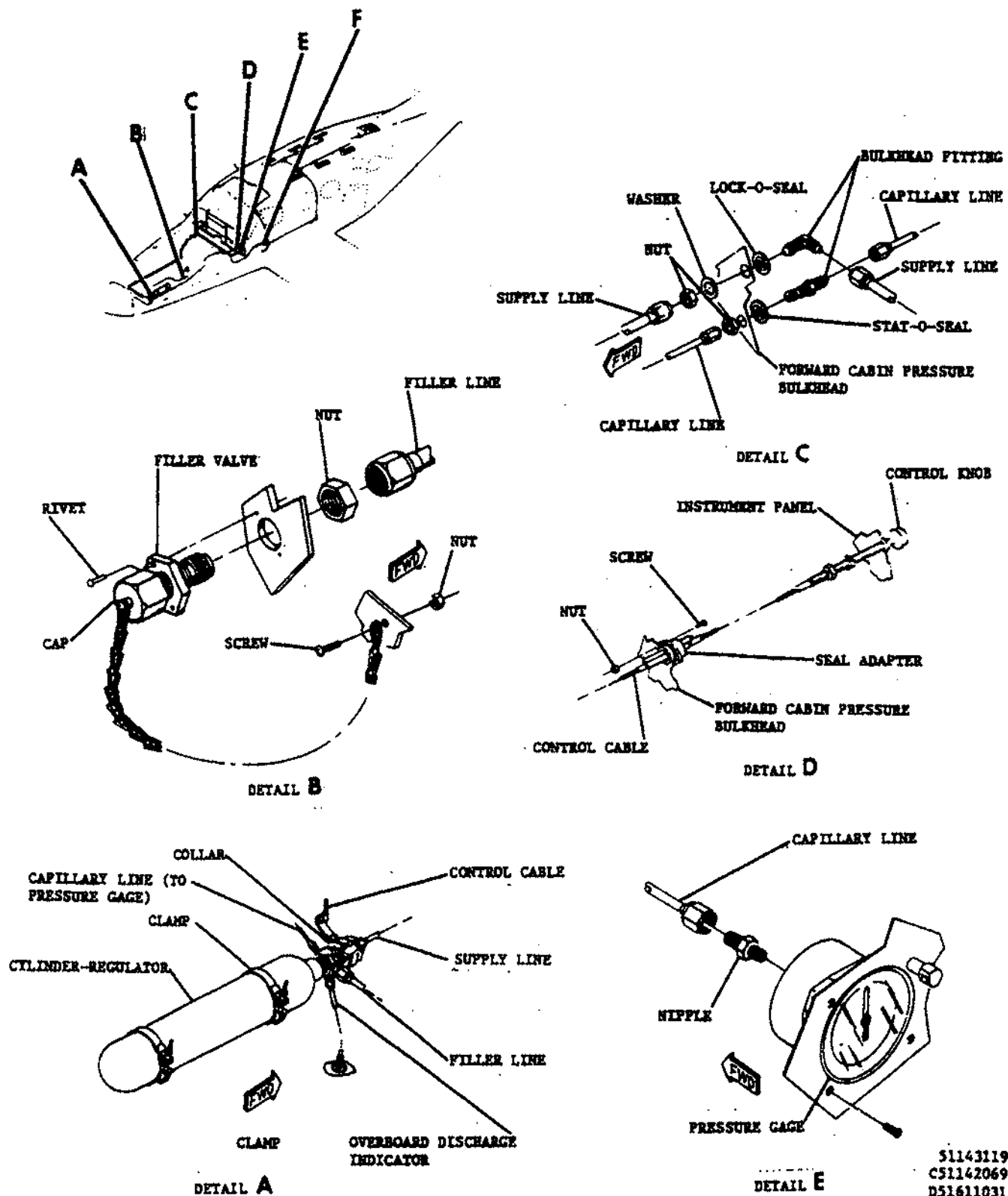
- (1) Position control knob to OFF.

WARNING: THE OXYGEN CYLINDER-REGULATOR MAY BE REMOVED WITH THE CYLINDER CHARGED; HOWEVER, EXTREME CARE MUST BE TAKEN WHEN INSTALLING OR WORKING NEAR THE CYLINDER-REGULATOR TO PREVENT DAMAGING THE CYLINDER.

- (2) Remove LH nose baggage shelf to gain access to oxygen cylinder-regulator, refer to Chapter 3.
- (3) Disconnect supply line, capillary line, filler line and overboard discharge line from cylinder-regulator. Cap all openings.

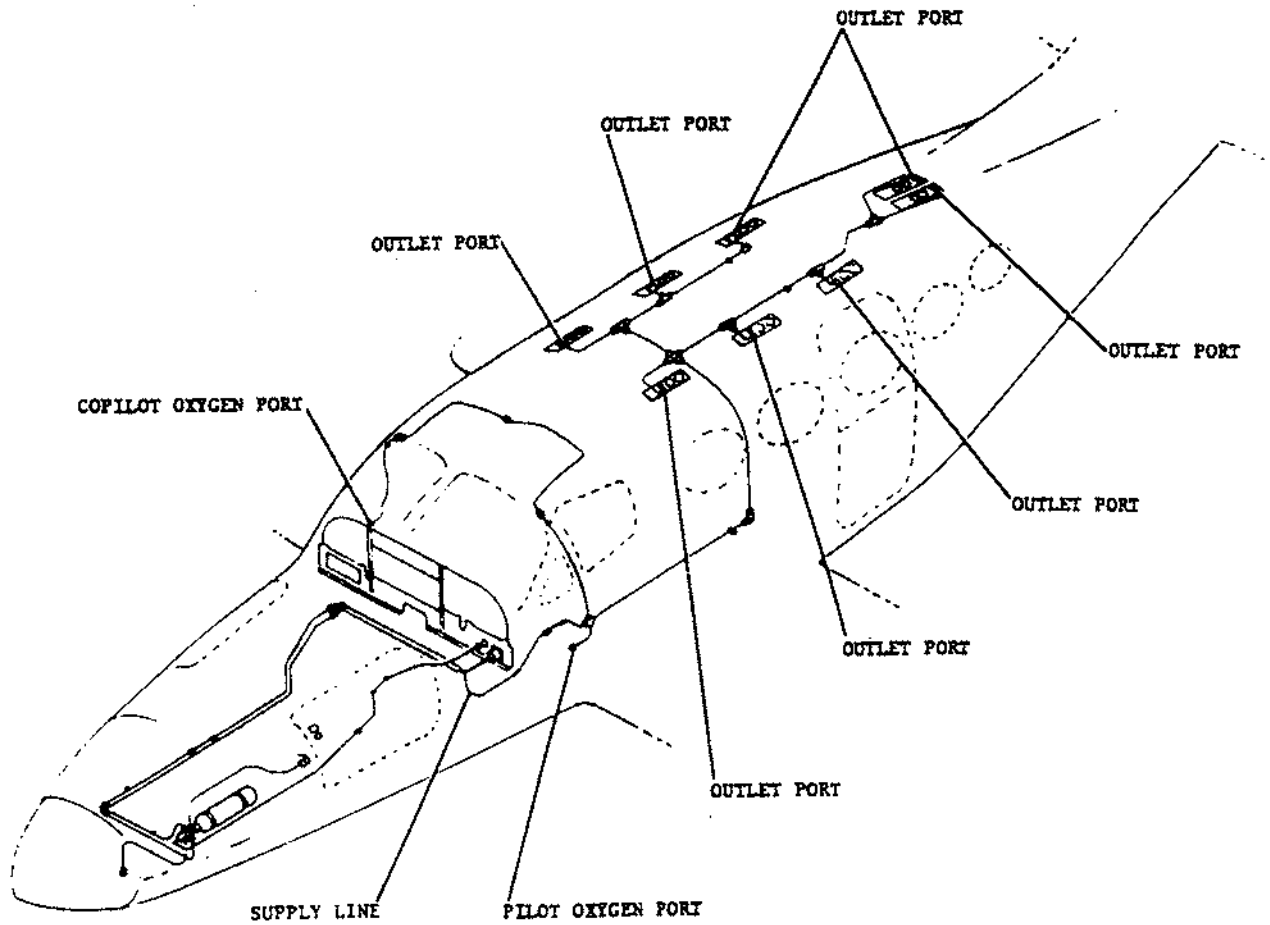
CAUTION: DO NOT MOVE CONTROL TO ON POSITION WITH OUTLET PORTS (LOW PRESSURE) OPEN TO ATMOSPHERE. DAMAGE TO REGULATOR METERING POPPET MAY OCCUR.

- (4) Disconnect control cable from oxygen cylinder-regulator.
- (5) Remove clamps securing cylinder-regulator to support and remove cylinder-regulator.



Oxygen (11.0 Cu. Ft.) System Installation
Figure 1 (Sheet 1 of 3)

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CS1142069
DS1611031
ES1141139
AS1142068
BS1142063

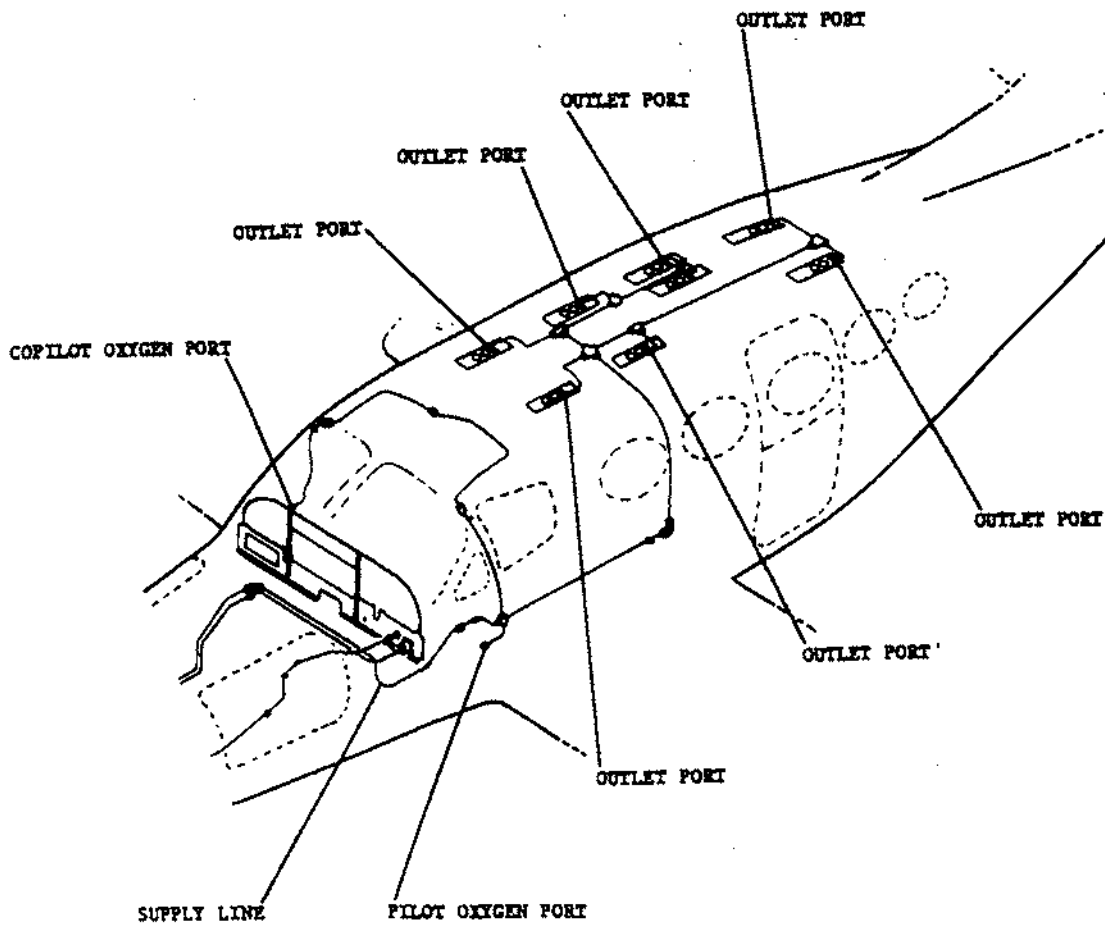


DETAIL F

(SHOWN WITH 7TH & 8TH
SEAT INSTALLATION)

Oxygen (11.0 Cu. Ft.) System Installation
Figure 1 (Sheet 2)

F51143119



DETAIL F

10 PLACE SEATING
(EXECUTIVE COMMUTER)

Oxygen (11.0 Cu. Ft.) System Installation
Figure 1 (Sheet 3)

F51143120

B. Install Oxygen Cylinder-Regulator Assembly.

WARNING: EXTREME CARE MUST BE TAKEN WHEN INSTALLING OR WORKING NEAR THE CYLINDER-REGULATOR TO PREVENT DAMAGING THE CYLINDER. THE SLIGHTEST SCRATCH, NICK OR DENT IS CAUSE FOR IMMEDIATE CONDEMNATION OF THE CYLINDER.

- (1) Position cylinder-regulator in the nose compartment and secure to supports with clamps. Do not tighten clamps.
- (2) Remove caps and connect supply line, overboard discharge line, capillary line and filler line to cylinder-regulator.
- (3) Connect control cable to cylinder-regulator.
- (4) Tighten clamps securing cylinder-regulator.
- (5) Install LH nose baggage shelf.

2. Removal/Installation Oxygen Pressure Gage (See Figure 1).

A. Remove Oxygen Pressure Gage.

NOTE: The oxygen pressure gage may be removed without discharging the oxygen system. A check valve is installed in the pressure gage outlet of the regulator to shut off the flow of oxygen from the cylinder when the capillary line is disconnected at the oxygen cylinder-regulator.

- (1) Remove LH nose baggage shelf, refer to Chapter 3.
- (2) Disconnect capillary line at cylinder-regulator. The check valve should close as the line is loosened.

CAUTION: IF OXYGEN CONTINUES TO FLOW WHEN CAPILLARY LINE IS LOOSENED, RETIGHTEN LINE AND DISCHARGE SYSTEM IN ACCORDANCE WITH DISCHARGING PROCEDURES. REPLACE CHECK VALVE.

- (3) Disconnect capillary line at pressure gage.
- (4) Check valve may be removed from cylinder-regulator, if desired or if faulty by removing valve from regulator.
- (5) Remove light assembly, refer to Chapter 13. Remove screws from oxygen gage and remove gage.

B. Install Oxygen Pressure Gage

- (1) Install oxygen pressure gage with screws and light assembly.
- (2) If removed, install check valve in regulator.
- (3) Connect capillary line to regulator and pressure gage.
- (4) Install LH nose baggage shelf.
- (5) If system pressure was depleted, purge oxygen system and service system.

3. Removal/Installation Oxygen Filler Valve (See Figure 1).

A. Remove Oxygen Filler Valve.

NOTE: The oxygen filler valve may be removed without discharging the oxygen system. A check valve is installed in the high pressure side of the oxygen regulator to shut off the flow of oxygen from the cylinder.

- (1) Disconnect filler valve line from filler valve.

CAUTION: IF OXYGEN CONTINUES TO FLOW WHEN LINE IS LOOSENED, RECONNECT THE LINE AND DISCHARGE SYSTEM IN ACCORDANCE WITH DISCHARGING PROCEDURES. REPLACE CHECK VALVE.

- (2) Remove filler valve protective cap and remove retaining nut from filler valve.
- (3) Remove filler valve from bulkhead by removing attaching rivets.
- (4) Check valve may be removed if desired or if faulty by disconnecting filler line from check valve, then remove check valve from regulator.

B. Install Oxygen Filler Valve.

- (1) If removed, ascertain that check valve is installed and filler line is connected.
- (2) Attach filler valve to structure with attaching rivets and retaining nut.
- (3) Connect filler line to filler valve.
- (4) Install protective cap.

4. Removal/Installation Oxygen Control Cable (See Figure 1).

A. Remove Control Cable.

- (1) Remove LH nose baggage shelf and retainer, refer to Chapter 3.
- (2) Loosen setscrew in collar and setscrew in clamp.
- (3) Remove all clamps supporting cable to structure.
- (4) Remove screws and nuts, securing seal adapter to bulkhead.
- (5) Remove nut on forward side of instrument panel and remove cable.

B. Install Control Cable.

- (1) Route control cable to cylinder-regulator and secure with clamps and collar.
- (2) Secure control cable at instrument panel with nut.
- (3) Install seal adapter with screws and nuts and seal, refer to Chapter 1.
- (4) Install retainer and baggage shelf.

OXYGEN SYSTEM PLUMBING AND CYLINDER (114.9 CU. FT.)Description

1. The oxygen system (114.9 cu. ft.) consists of: a cylinder-regulator, filler valve, overboard discharge indicator, control cable and knob, cylinder pressure gage, outlets, oxygen mask, altitude compensating regulator and associated plumbing.
 - A. The cylinder-regulator (oxygen bottle) is located in the nose section forward of the nose wheel well. Access to the cylinder is gained by removing the forward baggage shelf. The cylinder-regulator is secured in position on supports with quick-disconnect clamps. A supply regulator is attached to the cylinder to reduce high cylinder pressure to a lower constant pressure. The regulator incorporates a manual shutoff valve (cable operated); ports for a filling line, pressure gage line (capillary), outlet line (supply) and overboard discharge indicator line.
 - B. A control knob on the instrument panel when pulled to the ON position, provides a continuous flow of oxygen to the oxygen mask, when the mask hoses are engaged in the outlets. The mask hose contains a flow indicator for visual verification of oxygen flow.
 - C. The oxygen outlets are installed in the pilot and copilot arm rest and above the passenger seats. Each outlet contains a spring-loaded valve, which prevents oxygen flow until the mask hose is engaged with the outlet. For cabin oxygen outlet valve plumbing, refer to Oxygen System Plumbing and Cylinder (11.0 Cu. Ft.).
 - D. The oxygen filler valve is located inside the RH aft nose baggage compartment. The filler valve is secured to the structure with rivets and consists of the valve incorporating a filter and valve cap. A check valve is installed in the high pressure line (filler line) at the regulator to prevent the escape of oxygen from the cylinder at the filler line port.
 - E. The overboard discharge indicator is located on the bottom surface of the nose skin below the oxygen cylinder. A low pressure (60 $\pm$ 20 psi) green disc is provided to prevent dust and contamination from entering the line. The indicator line is connected to the high pressure rupture fitting of the regulator. A disc disappearance in the indicator, indicates oxygen cylinder overpressure existed and oxygen was routed overboard.
 - F. The altitude compensating regulator, located in the cabin on the left-hand side forward of the instrument panel, reduces oxygen expenditures at lower altitudes and increases oxygen duration.
 - G. The oxygen pressure gage is located on the left-hand side of the instrument panel. The gage is electrically illuminated by a post light. The range markings are: yellow arc 0-300, green arc 1550 to 1850, and red line 2000 psi.

Maintenance Practices

NOTE: Before any maintenance is performed on the oxygen system, personnel should read and thoroughly understand General Maintenance Precautions, refer to Oxygen System, Maintenance Practices.

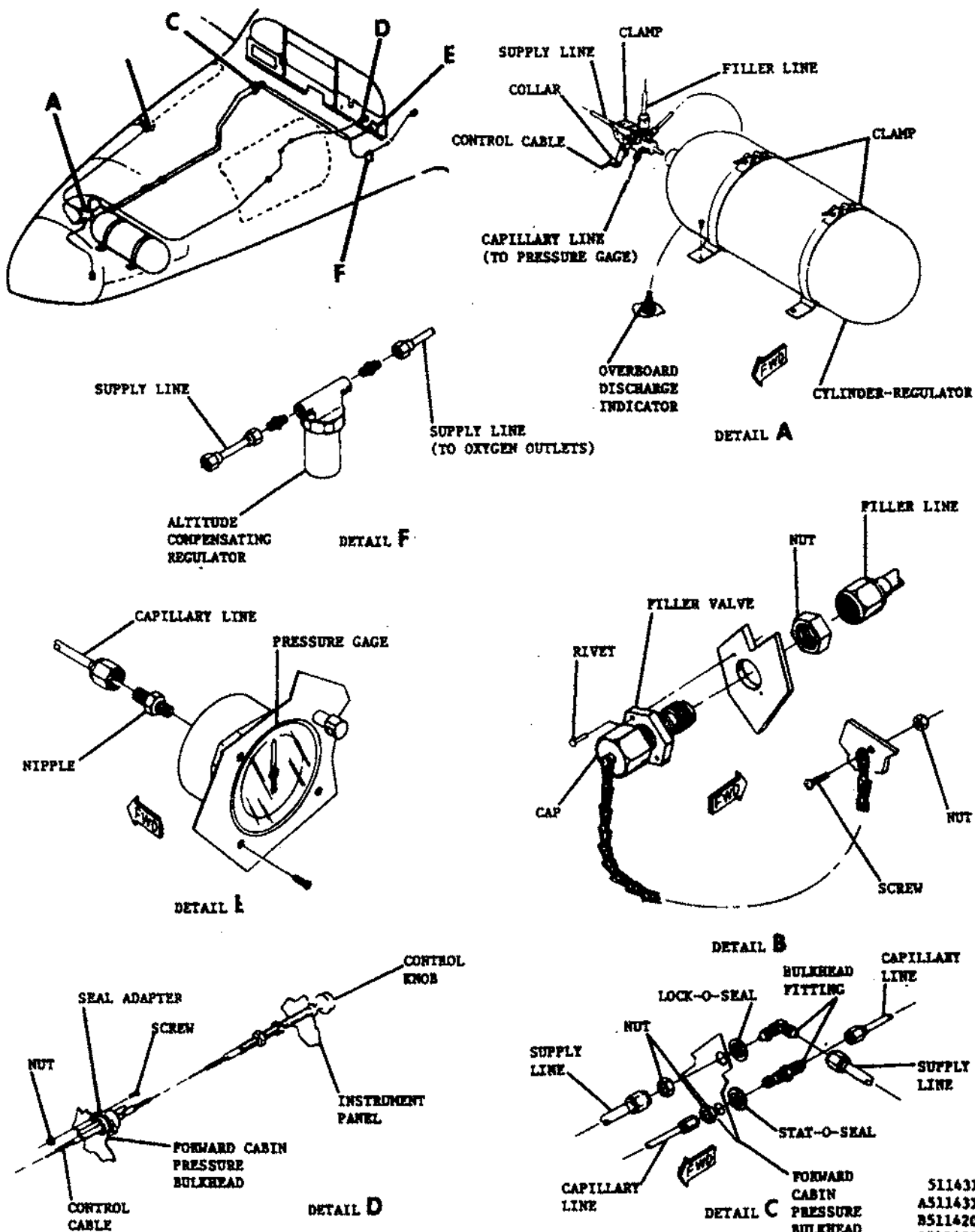
1. Removal/Installation Oxygen Cylinder-Regulator Assembly (See Figure 1).

- A. Remove Oxygen Cylinder-Regulator Assembly.

- (1) Position control to OFF.

WARNING: THE OXYGEN CYLINDER-REGULATOR MAY BE REMOVED WITH THE CYLINDER CHARGED; HOWEVER, EXTREME CARE MUST BE TAKEN WHEN INSTALLING OR WORKING NEAR THE CYLINDER-REGULATOR TO PREVENT DAMAGING THE CYLINDER.

- (2) Remove forward baggage shelf to gain access to oxygen cylinder-regulator, refer to Chapter 3.



Oxygen (114.9 Cu. Ft.) System Installation
Figure 1

51143120
A51143117
B51142063
C51142069
D51611031
E51141139
F14143035

- (3) Disconnect supply line, capillary line, filler line and overboard discharge line from cylinder-regulator. Cap all openings.

CAUTION: DO NOT MOVE CONTROL TO ON POSITION WITH OUTLET PORTS (LOW PRESSURE) OPEN TO ATMOSPHERE. DAMAGE TO REGULATOR METERING POPPET MAY OCCUR.

- (4) Disconnect control cable from oxygen cylinder-regulator.
- (5) Disconnect clamps securing cylinder-regulator to support and remove cylinder-regulator.

B. Install Oxygen Cylinder-Regulator Assembly.

WARNING: EXTREME CARE MUST BE TAKEN WHEN INSTALLING OR WORKING NEAR THE CYLINDER-REGULATOR TO PREVENT DAMAGING THE CYLINDER. THE SLIGHTEST SCRATCH, NICK OR DENT IS CAUSE FOR IMMEDIATE CONDEMNATION OF THE CYLINDER.

- (1) Position cylinder-regulator in the forward nose compartment and secure to supports with clamps. Do not tighten clamps.
- (2) Remove caps and connect supply line, overboard discharge line, capillary line and filler line to cylinder-regulator.
- (3) Connect control cable to cylinder-regulator.
- (4) Tighten clamps, securing cylinder-regulator.
- (5) Install forward baggage shelf.

2. Removal/Installation Oxygen Pressure Gage (See Figure 1).

A. Remove Oxygen Pressure Gage.

NOTE: The oxygen pressure gage may be removed without discharging the oxygen system. A check valve is installed in the pressure gage outlet of the regulator to shut off the flow of oxygen from the cylinder, when the capillary line is disconnected at the oxygen cylinder-regulator.

- (1) Remove forward nose baggage shelf, refer to Chapter 3.
- (2) Disconnect capillary line at cylinder-regulator. The check valve should close as the line is loosened.

CAUTION: IF OXYGEN CONTINUES TO FLOW WHEN CAPILLARY LINE IS LOOSENED, RETIGHTEN LINE AND DISCHARGE SYSTEM IN ACCORDANCE WITH DISCHARGING PROCEDURES. REPLACE CHECK VALVE.

- (3) Disconnect capillary line at pressure gage.
- (4) Check valve may be removed from cylinder-regulator, if desired or if faulty by screwing valve from regulator.
- (5) Remove light assembly, refer to Chapter 13. Remove screws from oxygen gage and remove gage.

B. Install Oxygen Pressure Gage.

- (1) Install oxygen pressure gage with screws and light assembly.
- (2) If removed, install check valve in regulator.
- (3) Connect capillary line to regulator and pressure gage.
- (4) Install forward nose baggage shelf.
- (5) If system pressure was depleted purge oxygen system and service system.

3. Removal/Installation Oxygen Filler Valve (See Figure 1).

A. Remove Oxygen Filler Valve.

NOTE: The oxygen filler valve may be removed without discharging the oxygen system. A check valve is installed in the high pressure side of the oxygen regulator to shut off the flow of oxygen from the cylinder.

- (1) Disconnect filler valve line from filler valve.

CAUTION: IF OXYGEN CONTINUES TO FLOW WHEN LINE IS LOOSENED, RECONNECT THE LINE AND DISCHARGE SYSTEM IN ACCORDANCE WITH DISCHARGING PROCEDURES. REPLACE CHECK VALVE.

- (2) Remove filler valve protective cap and remove retaining nut from filler valve.
- (3) Remove filler valve from bulkhead by removing attaching rivets.
- (4) Check valve may be removed if desired or if faulty by disconnecting filler line from check valve, then remove check valve from regulator.

B. Install Oxygen Filler Valve.

- (1) If removed, assure that check valve is installed and filler line is connected.
- (2) Attach filler valve to structure with attaching rivets and retaining nut.
- (3) Connect filler line to filler valve.
- (4) Install protective cap.

4. Removal/Installation Altitude Compensating Regulator (See Figure 1).

A. Remove Altitude Compensating Regulator.

- (1) Move oxygen control knob to the OFF position.

NOTE: Repair or maintenance of this unit is not recommended. If malfunction should occur, replace unit.

- (2) Disconnect supply lines from altitude compensating regulator. Cap all openings.
- (3) Remove altitude compensating regulator from aircraft.

B. Install Altitude Compensating Regulator.

- (1) Remove caps and connect supply lines to altitude compensating regulator.

NOTE: Ensure outlet port is connected supply line to oxygen outlets.

5. Removal/Installation Oxygen Control Cable (See Figure 1).

A. Remove Control Cable.

- (1) Remove forward baggage shelf and retainer, refer to Chapter 3.
- (2) Loosen setscrew in collar and setscrew in clamp.
- (3) Remove all clamps supporting cable to structure.
- (4) Remove screws and nuts, securing seal adapter to bulkhead.
- (5) Remove nut on forward side of instrument panel and remove cable.

B. Install Control Cable.

- (1) Route control cable to cylinder-regulator and secure with clamps and collar.
- (2) Secure control cable at instrument panel with nut.
- (3) Install seal adapter with screws and nuts and seal, refer to Chapter 1.
- (4) Install retainer and baggage shelf.

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CHAPTER

7

ENGINE

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COMPONENTS LOCATION CHART
Engine

<u>Component</u>	<u>Location</u>
Air Inlet Canister	Aft of Engine In Nacelles
Cooling Modulation (Cowl Flaps) Control	In Cabin, Below Control Quadrant
Cylinder Head Temperature	Left Engine , Lower Side Number 2 Cylinder Right Engine, Lower Side Number 1 Cylinder
EGT Probe	Exhaust Stack, Aft End of Engine
Fuel Injection Pump	Aft End of Engine
Fuel Flow Transducer	Aft End of Engine
Oil Temperature Bulb	Oil Cooler, Aft End of Engine
Starter Relay	Left Stub Wings
Starting Solenoid	Outboard, Stub Wing
Starting Vibrator	Inside Left Console, In Cabin
Tachometer Generator	Accessory Drive, Aft Side of Engine
Vernatherm	Bottom of Oil Cooler
Exhaust Bypass Valve Assembly	Below Turbocharger

ENGINEDescription

1. The 421C Golden Eagle and 421C Executive Commuter Airplane incorporate two Continental six-cylinder horizontally-opposed GTSIO-520-L engines on airplanes 421C0001 thru 421C1000 and GTSIO-520-N engines on 421C1001 and On.
2. Each engine is equipped with magnetos, spark plugs, ignition harness, oil pump, oil cooler, fuel pump, fuel distribution lines, starter and alternator.
3. Detail Engine Specifications.

Propeller Drive Ratio	0.667:1
Propeller Rotation (Looking Forward)	Clockwise*
Bore, Inches	5.25"
Stroke, Inches	4.00"
Displacement, Cubic Inches	520 Cu. In.
Compression Ratio	7.5:1
Oil SAE Number Above 40°F	SAE #50
Below 40°F	SAE #30
Unrestricted	20 W50
Oil Sump Capacity	13 Quarts
Fuel, Aviation Grade, Octane (Minimum) (Low Lead Fuels are approved for use)	100/130
Fuel System	Continental Fuel Injection
Fuel Injector	Continental Fuel Injection
Magneto Drive, Ratio to Crankshaft	1.5:1
Magneto Drive, Direction	Clockwise*
Tachometer Drive, Ratio To Crankshaft Rotation	.5:1 Clockwise*
Starter Drive, Ratio to Crankshaft Rotation	32:1 Counterclockwise*
Alternator Drive, Ratio to Crankshaft Rotation	3:1 Counterclockwise*
Vacuum Pump Drive (Deice) Rotation	1.14:1 Counterclockwise*
Vacuum Pump Drive (Autopilot) Rotation	1.14:1 Counterclockwise*
Propeller Governor Drive, Ratio to Crankshaft Rotation	.809:1 Clockwise*
Breaker Point Setting (Both Magnetos)	Refer to Chapter 1-00, General Information
Spark Plug Gap	Refer to Chapter 1-00, General Information
Firing Order	1-4-5-2-3-6
Fuel Pressure	Refer to Chapter 1-00, General Information

Oil Pressure (PSI)	
Normal	30-60 PSI
Maximum	100 PSI
Idling (Minimum)	10 PSI
Oil Temperature (°F)	
Normal	170°
Maximum	240°
Cylinder Head Temperature (°F)	
Maximum	480°
Minimum (Takeoff)	200°
Standard Engine Dry Weight	550.5 Lbs.

*Direction of Rotation Facing Engine Drive Pad.

Troubleshooting

1. Troubleshooting Engine Operation.

A. For troubleshooting engine operation, see Figure 1.

Maintenance Practices

1. Tools and Equipment.

Name	Number	Manufacturer	Use
Maintenance Stand		Fabricate Locally	Engine build up and/or maintenance.
Engine Mount Wrench	SE608	Cessna Aircraft Co.	Crimping lockwasher.
Multimeter		Commercially Available	Checking electrical bonds and electrical circuits.

2. Removal/Installation Engine (See Figure 2).

CAUTION: PLACE A SUITABLE PADDED SUPPORT UNDER TAILCONE BUMPER BEFORE ENGINE REMOVAL TO PREVENT AIRPLANE FROM TIPPING BACKWARDS.

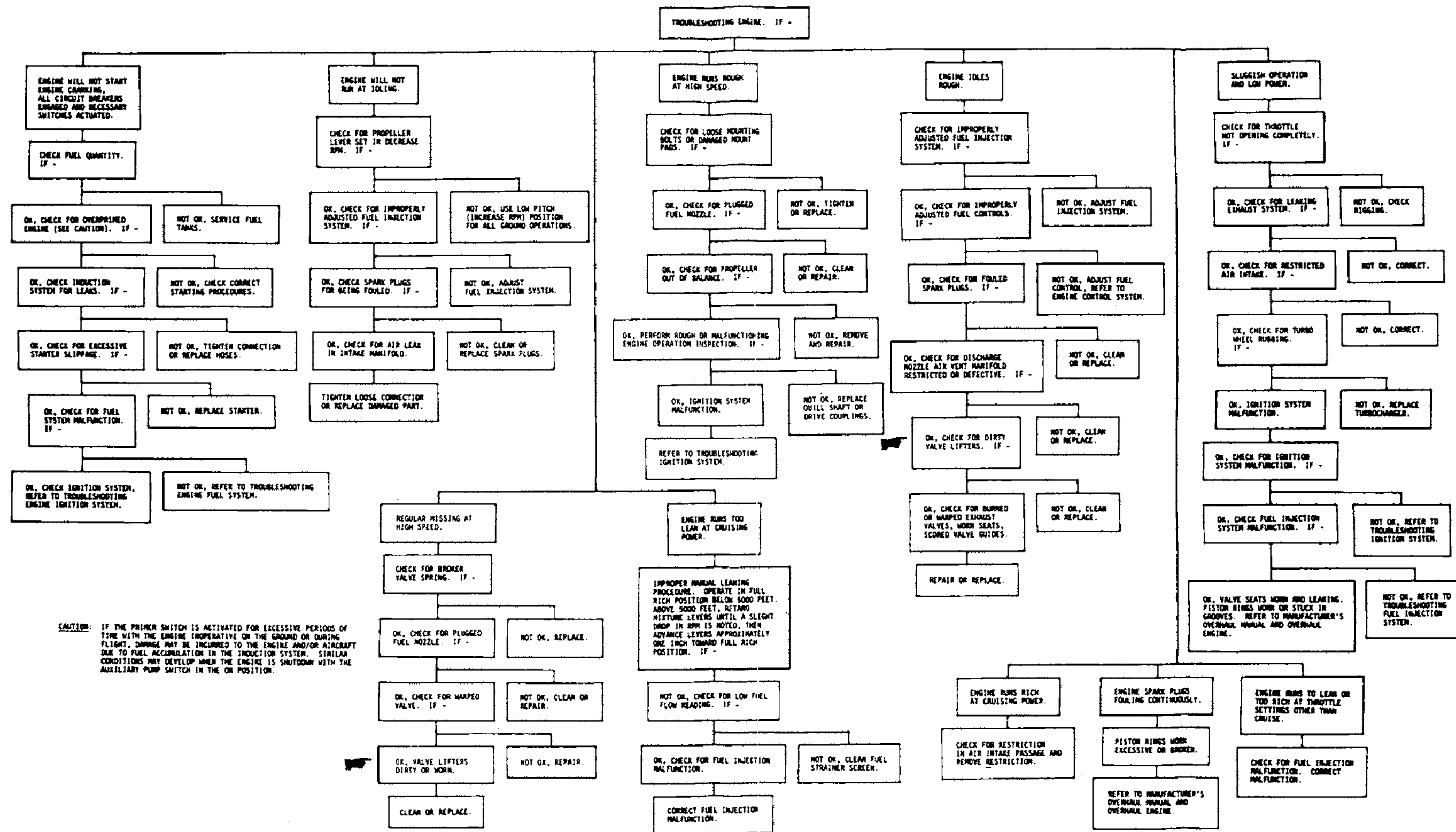
NOTE: If engine is being removed to be placed in storage, proper preparatory steps as outlined in Chapter 1 "Extended Storage" must be observed. In addition to the above mentioned procedures, cover all engine and accessory vents and other openings, including the crankcase breather, with vapor-proof material.

A. Remove Engine.

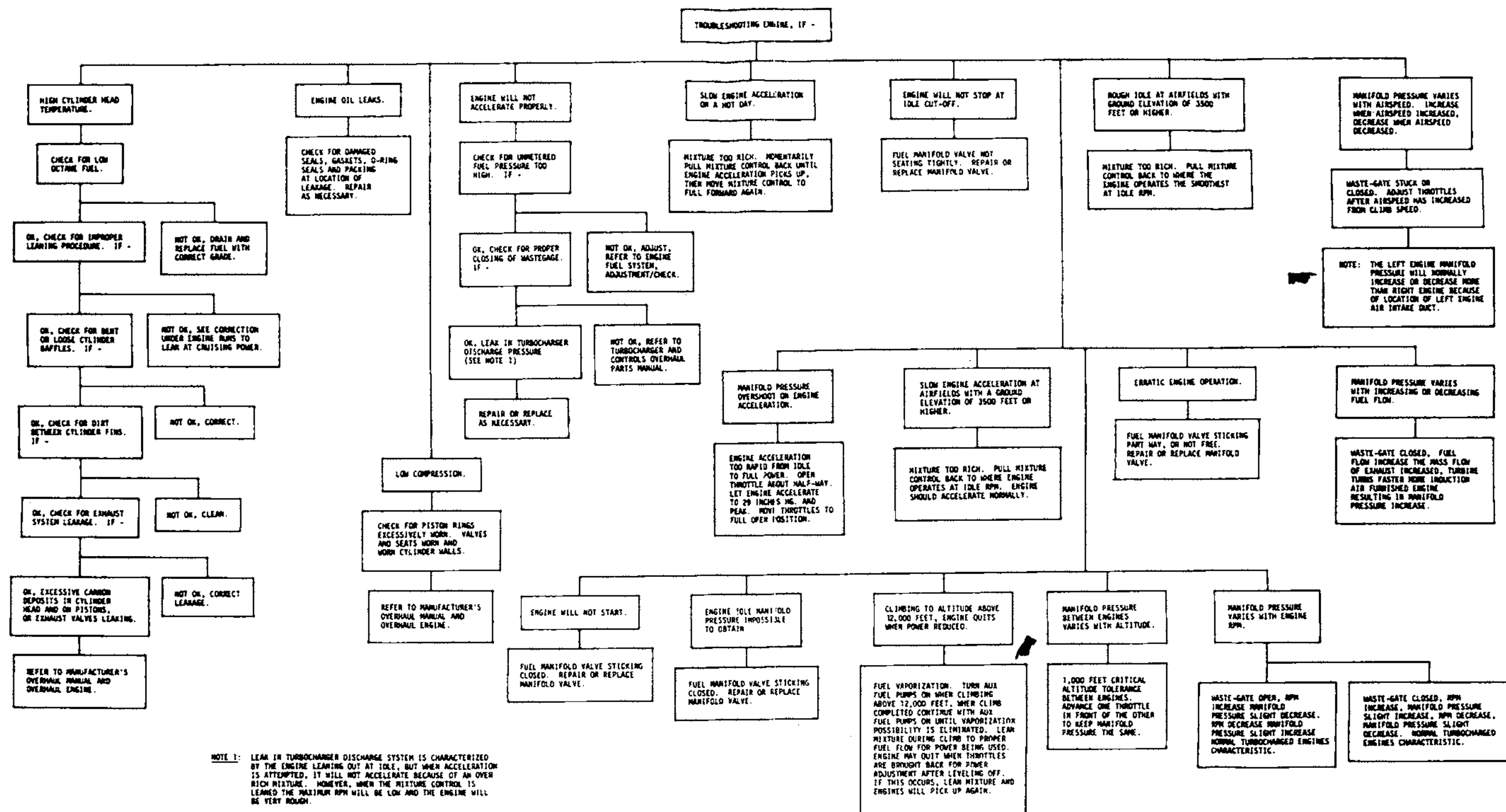
NOTE: Removal procedures are the same for either engine.

- (1) Turn all electrical power OFF.
- (2) Open the battery circuit by disconnecting the battery ground cable.
- (3) Remove engine cowl.
- (4) Disconnect magneto ground wire at the magnetos and withdraw them aft through the rear engine baffle.

WARNING: THESE MAGNETOS DO NOT HAVE INTERNAL GROUNDING SPRINGS. GROUND THE MAGNETOS TO THE CRANKCASE TO PREVENT ACCIDENTAL FIRING.

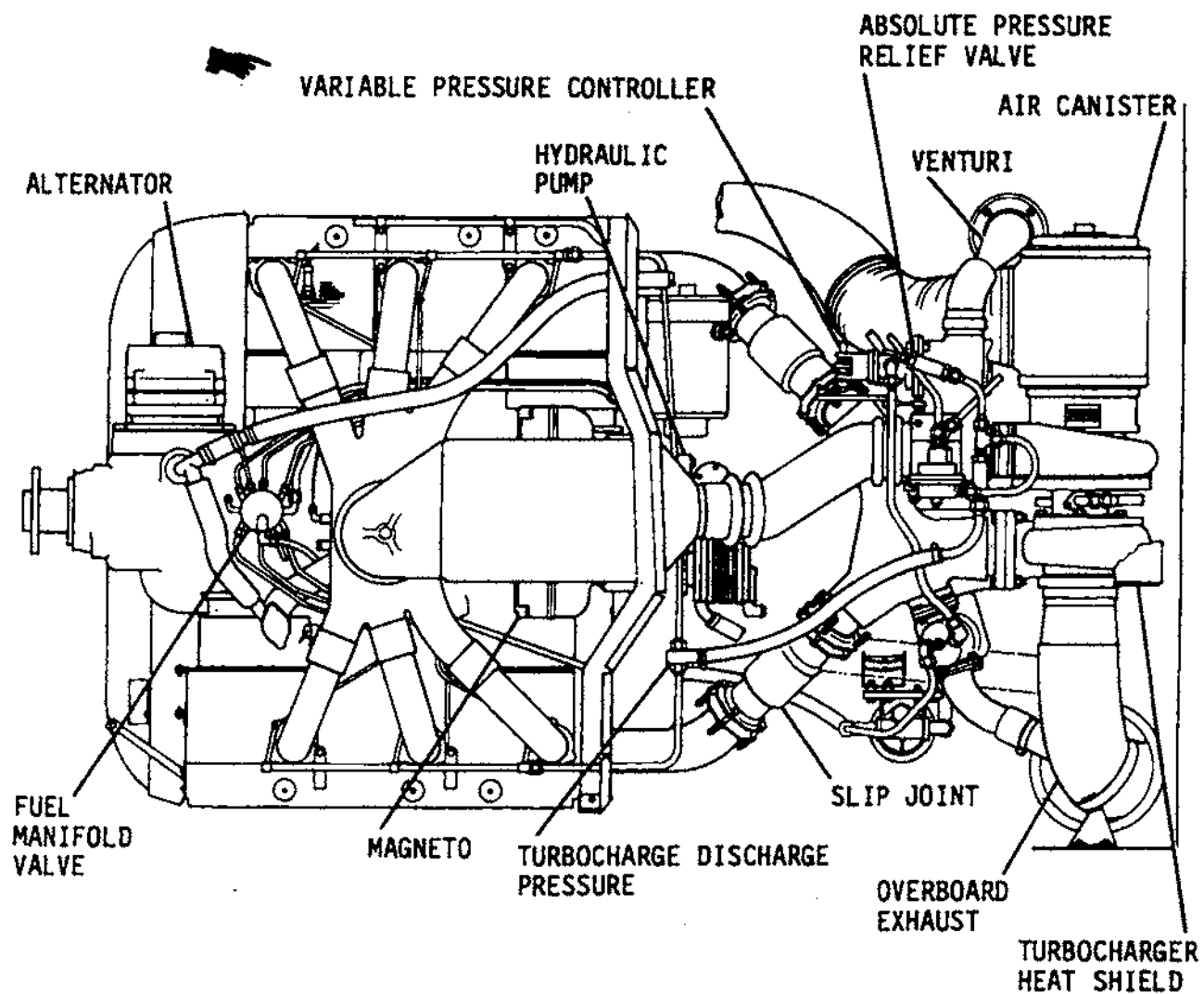


Troubleshooting Chart - Engines
Figure 1 (Sheet 1 of 2)



Troubleshooting Chart - Engines
Figure 1 (Sheet 2)

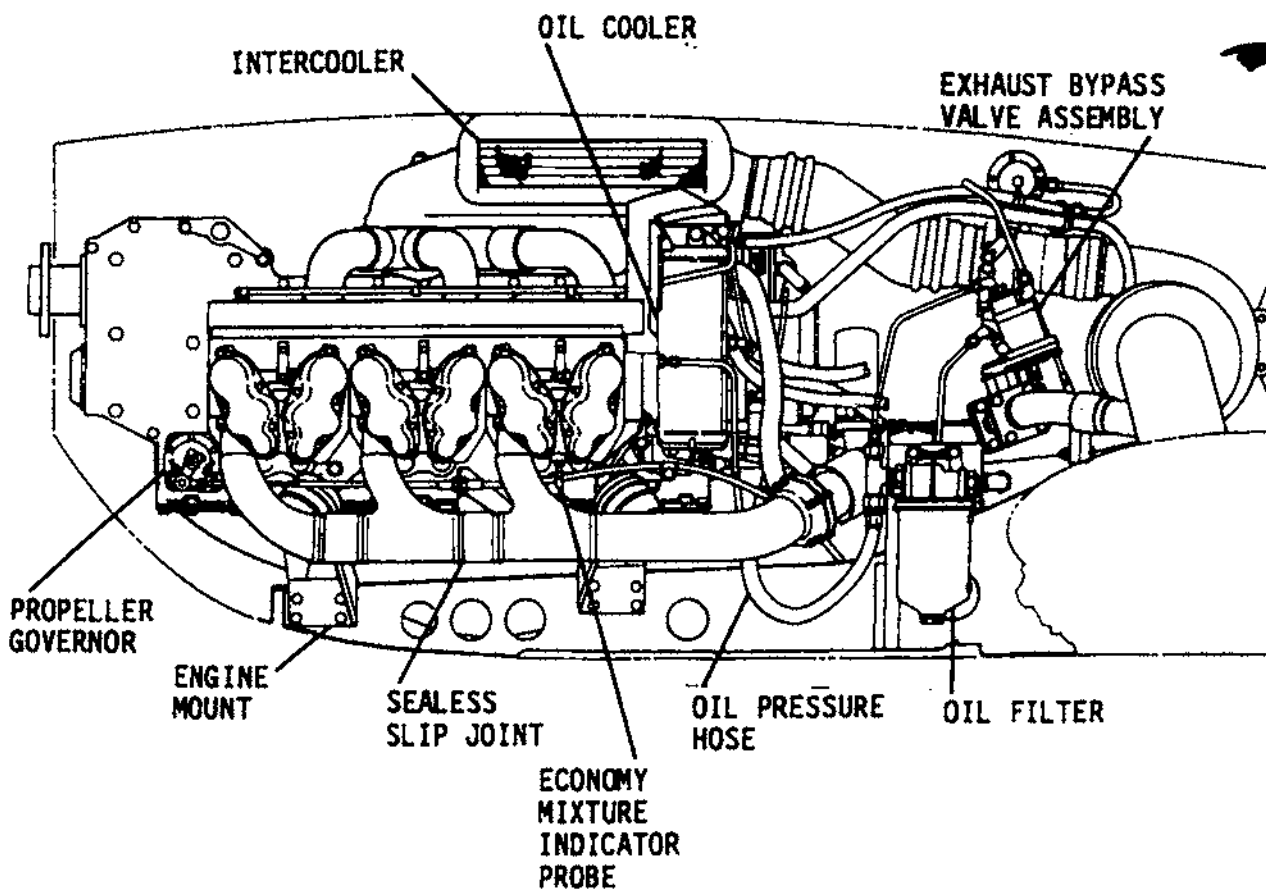
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51504003

Engine Installation
Figure 2 (Sheet 1)

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Engine Installation
Figure 2 (Sheet 2)

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- (5) Drain the oil in accordance with Chapter 2. Replace the drain plug.
- (6) Remove the propeller in accordance with Chapter 8.
- (7) Disconnect the engine controls as follows:
 - (a) Disconnect the induction air control, mixture control, and throttle control.
 - (b) Disconnect the propeller control at the governor. Remove propeller control bracket from the engine sump by removing the two bolts and washers.
- (8) Disconnect wires and cables as follows:
 - (a) Disconnect starter cable at starter.
 - (b) Disconnect electrical connector at tachometer.
 - (c) Disconnect the electrical leads from the cylinder head temperature bulb.
 - (d) Disconnect alternator cables and cable shielding ground.
 - (e) Tag and disconnect fuel pressure switch wires.
 - (f) Disconnect wires at radio noise filter.
 - (g) Remove all clamps attaching wires or cables to the engine. Pull all wires and cables aft to clear the engine assembly.
- (9) Remove engine ground strap from engine mount beam assembly by removing existing bolt.
- (10) Disconnect lines and hoses as follows:
 - (a) Disconnect oil separator overboard drain hose from oil separator.

WARNING: FUEL AND OIL DRAINING FROM LINES AND HOSES IS A FIRE HAZARD. PREVENT FUEL AND OIL FROM COLLECTING IN ENGINE NACELLE.

- (b) Disconnect vacuum pump to firewall hose from vacuum pump.

NOTE: If surface deice system is installed, a second oil separator is installed and additional hoses must be disconnected.

- (c) Disconnect hoses from hydraulic pump.
 - (d) Disconnect the fuel flow gage line at the aft side of the engine rear baffle.
 - (e) Disconnect the variable pressure controller to fuel injection pump hose.
 - (f) Disconnect the ram air tubes at the engine rear baffle.
 - (g) Disconnect manifold pressure gage hose at the aft side of engine baffle.
 - (h) Disconnect the variable pressure controller oil return hose from the aft end of engine crankcase.
 - (i) Disconnect fuel supply hose from fuel injection pump.
 - (j) Disconnect vapor return hose from the fuel injection pump.
 - (k) Disconnect fuel bypass to fuel injection pump hose at the fuel injection pump.
 - (l) Disconnect unmetered fuel to mixture control hose, at the fuel injection pump.
 - (m) Disconnect metered fuel hose from aft side of rear engine baffle.
 - (n) Disconnect oil filter to oil pump hose at the engine connection fitting.
 - (o) Disconnect turbocharger oil return hose from scavenger oil pump.
 - (p) Disconnect oil filter to oil cooler hose.
 - (q) Disconnect fuel pump drain hose from fuel pump.
 - (r) Disconnect oil pressure hose and turbocharger oil supply hose at tee fitting.
 - (s) Disconnect propeller unfeathering system accumulator hose at governor.
 - (t) Disconnect cylinder head drain cross to overboard outlet hoses at the overboard outlet cross.
- (11) Loosen clamps and remove hose which connects intake air duct to the throttle body.
 - (12) Disconnect exhaust stack balljoints at the forward end of slip joint.
 - (13) Attach a hoist to the lifting eyes of the engine crankcase. Lift engine just enough to relieve the weight from the engine mounts.

CAUTION: PLACE A STAND UNDER THE AIRCRAFT TAILCONE BUMPER BEFORE REMOVING ENGINE. THE LOSS OF ENGINE WEIGHT MAY ALLOW THE TAIL TO DROP.

(14) Refer to Figure 3 and remove the engine as follows:

(a) Remove engine mount bolts from the four engine mounts.

NOTE: Determine location and number of spacers and bolt lengths used on each forward engine mount so that proper reinstallation may be attained.

(b) Hoist engine slowly, assure all wires, lines and hoses are disconnected and remove engine clear of the aircraft.

(c) Remove upper and lower engine mounts (1) and (3) and spacers (2) from engine mount bracket.

B. Disassemble Engine.

NOTE: The disassembly procedure is the same for either engine and is intended to cover only those items which could normally be expected to require removal or are not covered by Continental Motor Corporation "Engine Overhaul" manual for the specific engine.

(1) Hoist engine assembly to a convenient working height.

(2) Spray engine assembly with suitable solvent to clean off any dirt accumulation and allow to drain. Remove residual dirt with a jet of compressed air.

CAUTION: PARTICULAR CARE SHOULD BE GIVEN TO ELECTRICAL COMPONENTS AND BEARINGS BEFORE CLEANING. SOLVENTS SHOULD NOT BE ALLOWED TO ENTER MAGNETOS, STARTERS, ALTERNATORS, ACTUATORS OR ANY LUBRICATED CONTROL. THESE ITEMS MUST BE PROTECTED WITH A COVER BEFORE SATURATING THE ENGINE WITH SOLVENT. ANY OIL, FUEL, OR AIR OPENING SHOULD BE COVERED CAUSTIC CLEANING SOLUTIONS SHOULD BE USED CAUTIOUSLY AND PROPERLY NEUTRALIZED AFTER USE.

NOTE: As each item is removed from the engine, place a temporary cover over the hole left by removal of components. This will prevent accidental entry of foreign material which could cause engine damage or lead to engine malfunction.

OPERATING PROCEDURE (SE608)

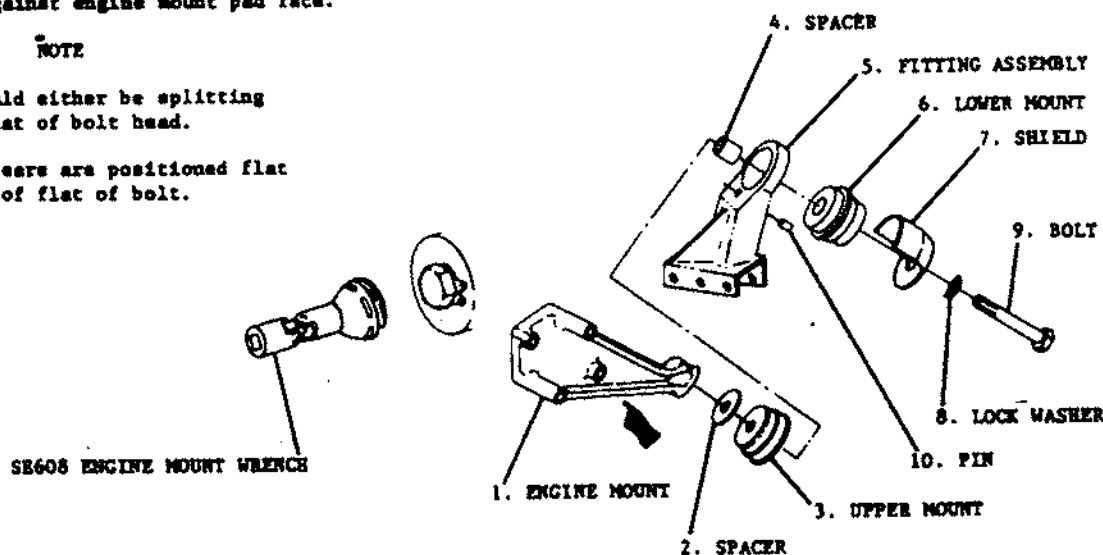
This tool is used when locking the washers on engine mount bolts.

1. Install tool on ratchet wrench or other suitable tool.
2. Position tool over head making sure it seats flat against engine mount pad face.

NOTE

Washer ears should either be splitting corners or on flat of bolt head.

3. Turn tool until ears are positioned flat against corners of flat of bolt.



Engine Mount Installation
Figure 3

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- (3) Remove engine exhaust system. Refer to engine exhaust system removal procedures.
- (4) Remove cylinder head drain lines by disconnecting at cylinder heads and removing clamp at cross.
- (5) Remove vacuum pump. Refer to Chapter 10.
- (6) Remove hydraulic pump. Refer to Chapter 11.
- (7) Remove the tachometer generator by removing four nuts and pulling it free of the tachometer generator drive adapter.
- (8) Remove propeller deice brush block assembly by removing engine crankcase through bolts securing brush block bracket.
- (9) Disconnect (optional) propeller unfeathering line and remove four nuts and washers securing propeller governor to engine and remove propeller governor. Cap fittings and lines.
- (10) Remove engine baffles. Refer to engine baffle removal procedures.
- (11) Remove all other fittings, hoses, lines and attaching parts necessary to facilitate maintenance of engine.

C. Assemble Engine.

- (1) Remove temporary protective covers and caps as assembly progresses.
- (2) Install all fittings, hoses, lines and attaching parts that were removed to facilitate disassembly.
- (3) Install engine baffles. Refer to engine baffle installation procedures.
- (4) Install (optional) unfeathering line to propeller governor and install propeller governor to engine.
- (5) Install propeller deice brush block assembly to brush block bracket using engine crankcase through bolts.
- (6) Remove cover plate and install tachometer generator. Align drive adapter to tachometer generator shaft, to assist installation.
- (7) Install vacuum pump. Refer to Chapter 10.
- (8) Install cylinder head drain lines, connect lines at cylinder heads and clamp at the cross fitting.
- (9) Install engine exhaust system. Refer to engine exhaust system installation procedures.

NOTE: Make sure all nuts and bolts are torqued and all cotter pins and/or safety wire are installed prior to installing engine.

D. Install Engine.

- (1) Attach a hoist to the lifting eye on top center of the engine and hoist engine a sufficient height just above the engine nacelle.

NOTE: The installation procedure is the same for either engine. Although there is some difference in the routing of wire bundles, lines, hoses and conduits. The following procedures are typical.

- (2) Install engine mounts: See Figure 3.
 - (a) Temporarily install upper mount (3), lower mount (6), spacer (4) and shield (7) to all four engine mounts, using lockwasher (8) and bolt (9). Make sure lower mount (6) will locate over pin (10) in the lower surface of fitting assembly (5) and lockwasher (8) fits in hole in shield (7) and lower mount (6). Remove bolt (9), lockwasher (8), shield (7) and lower mount (6).
- (3) Make sure the propeller control conduit and bracket is outside of engine mounts.

CAUTION: THE PROPELLER UNFEATHERING ACCUMULATOR IS NORMALLY PRESSURIZED. RELEASE PRESSURE BEFORE ATTEMPTING TO DISCONNECT HOSE FROM GOVERNOR. REFER TO CHAPTER 8.

NOTE: Locate spacers (2) between upper mount (3) and engine mount (1) on the forward mounts only as required to align propeller spinner with cowling. Be sure proper length bolts are used on each mount.

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- (4) With upper mount (3) in place, lower engine onto upper mount (3) and install lower mount (6) by locating hole in lower mount (6) over pin (10) and then shield (7). Be sure lockwasher (8) extends through retainer into hole in lower mount (6).
- (5) Install bolts (9) and torque to 300 +5 -00 inch-pounds.
- (6) Bend tab on lockwashers (8) over bolt head.
- (7) Connect exhaust system ball joint. Refer to exhaust system.
- (8) Install lines and hoses as follows:
 - (a) Install hose and clamps which connect the intake air duct to throttle body.
 - (b) Connect cylinder head drain hose to cross.
 - (c) If installed, connect propeller unfeathering accumulator hose to governor.
 - (d) Connect oil pressure hose and turbocharger oil supply hose at tee fitting on turbocharger.
 - (e) Connect fuel pump drain hose at fuel pump.
 - (f) Connect oil filter hose to oil cooler.
 - (g) Connect turbocharger oil return hose to scavenger pump.
 - (h) Connect oil filter hose to oil pump fitting at engine.
 - (i) Connect fuel injection pump to mixture control hose to the fuel injection pump.
 - (j) Connect fuel bypass to fuel injection pump hose to fuel injection pump.
 - (k) Connect fuel supply hose to fuel injection pump.
 - (l) Connect vapor return hose to the fuel injection pump.
 - (m) Connect metered fuel hose to aft side of rear baffle.
 - (n) Connect the variable pressure controller oil return line to engine fitting.
 - (o) Connect manifold pressure gage hose at the aft side of the rear engine baffle.
 - (p) Connect the ram air tubes at the engine rear baffle.
 - (q) Connect the variable pressure controller to fuel injection pump hose.
 - (r) Connect the fuel flow gage line at the aft side of rear engine baffle.
 - (s) If installed, connect surface deice oil separator hoses.
 - (t) Connect hose from vacuum pump to firewall.
 - (u) Connect hoses to hydraulic pump.
 - (v) Connect engine oil separator overboard drain hose at the oil separator.
- (9) Connect engine ground strap to engine mount beam.

NOTE: Use multimeter to assure proper bond between engine and engine mount beam. Resistance should be 0.00 ohms.
- (10) Connect engine wire bundle to the following components and remove tags.
 - (a) Wires at radio noise filter.
 - (b) Fuel pressure switch.
 - (c) Alternator cables.
 - (d) Alternator shielding to ground cable.
 - (e) Electrical leads to cylinder head temperature bulb.
 - (f) Tachometer generator wires.
 - (g) Propeller deice brush holder assembly.
 - (h) Oil temperature bulb.
 - (i) Magneto.
- (11) Connect starter cable to starter.
- (12) Connect propeller control and rig.
- (13) Connect mixture control and rig.
- (14) Connect throttle control and rig.
- (15) Connect induction air control and rig.
- (16) Install propeller in accordance with Chapter 8.
- (17) Make a magneto ground-out and continuity check and reconnect magneto wire.
- (18) Service the engine with oil in accordance with Servicing Procedures, Chapter 2.
- (19) Close battery circuit by connecting battery ground cable.
- (20) Install engine cowling.
- (21) Perform operational check.

2. Engine Operation Check.

CAUTION: GROUND OPERATION TIME SHOULD BE HELD TO A MINIMUM TO PREVENT OVERHEATING THE ENGINE. AT NO TIME SHOULD THE ENGINE TEMPERATURES BE ALLOWED TO EXCEED THEIR MAXIMUM LIMITS. DO NOT OPERATE THE ENGINE WITH COWLING REMOVED.

- A. Park aircraft with nose headed into prevailing wind and clear an area directly in front and to the rear of all objects that may be affected by the propeller and propeller slipstream.

CAUTION: AVOID ENGINE RUN-UP WITH AIRCRAFT PARKED IN AN AREA WHERE THERE IS LOOSE GRAVEL. THE PROPELLER WILL PICK UP SMALL STONES WHICH CAN DAMAGE PROPELLER BLADES.

- B. Install wheel chocks and position a fire extinguisher for easy access in the event of engine fire.
- C. Release parking brake, if previously set, and test-operate brakes. Take note of any sponginess or excessive brake pedal travel. Reset parking brake after completion of test.

CAUTION: IF PARKING BRAKE ACTION IS NOT NORMAL, DO NOT PERFORM ENGINE RUN UP UNTIL CORRECTIVE ACTION IS ACCOMPLISHED ON THE BRAKE SYSTEM.

- D. Refer to Pilot's Operating Handbook and perform "Before Starting Engine" and "Starting Engine" procedures.
- E. Warm-up Engines as follows:

- (1) Throttles - 750 to 900 RPM.
- (2) Fuel Flow Gage - +0.25 inch from minimum fuel press red line.
- (3) Oil pressure 10 PSI minimum in 30 seconds in normal weather or 60 seconds in cold weather.
- (4) Vacuum system 5.00 $\pm$ 0.25 inches Hg.
- (5) Cowl flaps - OPEN.
- (6) After the engine has reached normal operating cylinder head temperature and oil temperature, perform magneto ground-out check as follows:
 - (a) Throttle engine back to idle RPM.
 - (b) Momentarily switch both magnetos to OFF.

Result: The tachometer will indicate a sudden RPM drop when magnetos cease firing.

CAUTION: IF MAGNETO SWITCHES ARE LEFT OFF FOR A PROLONGED PERIOD, AFTER FIRING MAY OCCUR WHEN THEY ARE SWITCHED BACK ON. IF THE ENGINE CONTINUES TO RUN WITH SWITCHES OFF, STOP ENGINE BY PLACING MIXTURE CONTROL IN IDLE CUT-OFF AND CHECK MAGNETO GROUND.

- F. Advance throttle to 1500 RPM and perform a magneto check as follows:

- (1) Place right magneto switch to OFF position and note RPM drop. Return switch to ON position. Repeat check with left magneto switch.

Result: Engine speed should drop no more than a maximum differential between right and left magnetos of 50 RPM with no appreciable roughness.

- G. With Engine operating at 1700 RPM, exercise propeller.

- (1) Retard the propeller pitch lever to obtain a 1000 RPM tachometer indication.

Result: Exercise propeller and watch for any indication of sluggish or erratic operation.

- H. Make a mixture control check by slowly moving the mixture lever toward IDLE CUT-OFF.

Result: When a slight drop in RPM is noted, immediately return mixture lever to FULL RICH position.

F. Advance throttle to 1500 RPM and perform a magneto check as follows:

- (1) Place right magneto switch to OFF position and note RPM drop. Return switch to ON position. Repeat check with left magneto switch.

Result: Engine speed should drop no more than a maximum differential between right and left magnetos of 50 RPM with no appreciable roughness.

G. With Engine operating at 1500 RPM, exercise propeller.

- (1) At 1500 RPM, move propeller control to "FTH" position for a drop of 500 RPM.

CAUTION: DO NOT ALLOW PROPELLER SPEED TO FALL BELOW 800 RPM.

When RPM drops off to no less than 1000 RPM, quickly set propeller control to "INC" position and check for increase in propeller speed back to 1500 RPM.

Result: Exercise propeller and watch for any indication of sluggish or erratic operation.

H. Make a mixture control check by slowly moving the mixture lever toward IDLE CUT-OFF.

Result: When a slight drop in RPM is noted, immediately return mixture lever to FULL RICH position.

I. Stop engine by placing the mixture lever in IDLE CUT-OFF. As soon as propeller has stopped turning, place ignition switches OFF. Turn all switches OFF.

CAUTION: AFTER EXTENDED PERIODS OF GROUND ENGINE OPERATION ABOVE 1600 RPM OR WHEN THE CYLINDER HEAD TEMPERATURE INDICATOR SHOWS VALUES WITHIN THE UPPER HALF OF THE GREEN OPERATING ARC, REDUCE POWER TO SPEEDS BETWEEN 600 AND 800 RPM FOR A PERIOD NOT LESS THAN 2 TO 3 MINUTES PRIOR TO ENGINE SHUT DOWN. THIS EXPEDIENT IS INTENDED TO REDUCE INTERNAL TURBOCHARGER TEMPERATURES AND PRECLUDE THE POSSIBILITY OF PREMATURE ACCUMULATION OF CARBON DEPOSITS ON THE TURBINE SHAFT SEALS.

J. Reinspect engines for leaks, etc.

Inspection/Check

1. Engine Inspection/Check.

- A. Remove cowling in accordance with removal procedures.
- B. Remove lower nacelle access covers.

Cleaning/Painting

A. Cleaning Engine.

(1) Requirements.

- (a) Engine and accessories washdown for inspection and for maintaining safe operating conditions.

NOTE: External engine cleaning effective in preventive maintenance, early detection of leaks, parts chafing, etc.

(2) Washdown method.

- (a) It is recommended that a low pressure (20 PSI) spray gun be used to distribute cleaning agents over engine and components.
- (b) A stiff bristle fiber brush is recommended if cleaning agents do not remove excess grease and grime during spraying.

NOTE: Do not use steel brushes for cleaning operations.

(3) Procedure.

(a) Remove engine cowling.

CAUTION: DO NOT ATTEMPT TO WASH AN ENGINE WHICH IS STILL HOT OR RUNNING. ALLOW ENGINE TO COOL FOR A MINIMUM OF 60 MINUTES BEFORE CLEANING.

CAUTION: DO NOT PROCEED TO WASH ENGINE DOWN UNTIL PRECAUTIONS ARE TAKEN TO CLOSE OR SEAL ALL OPENINGS OR AREAS WHICH MAY BE AFFECTED BY CLEANING SOLUTIONS OR WATER.

- (b) Enclose the starter, magnetos, overboost valve, alternator and turbo controller with plastic bags and seal, liquid tight, with tape or rubber bands.
- (c) For removal of oil or grime use a cleaning agent described in Tools and Equipment.

NOTE: The cleaning agent should never be left on engine components for an extended period of time. Failure to remove cleaning agents may cause damage to neoprene seals, silicone fire sleeves, etc.

- (d) Thoroughly rinse with clean, warm water to remove all traces of cleaning agents.
- (e) For washdown when no oil or grime is present and engine is contaminated with salt or corrosive chemicals, fresh water only is recommended.
- (f) Remove plastic bags. Using a clean cloth dampened with cleaning agent, remove oil, grease, salt corrosion or corrosive chemicals from external surfaces of the starter, magnetos, overboost valve, alternator and turbo controller.
- (g) Completely dry engine and components using clean, dry compressed air regulated to a pressure not to exceed 20 PSI.
- (h) Engine cowling may be washed with same cleaning agents. After rinsing thoroughly, wipe dry with clean cloth.
- (i) Reinstall engine cowling.

WARNING: STAND CLEAR OF THE PLANE OF PROPELLER ROTATION WHILE ROTATING ENGINE. BEFORE STARTING ENGINE, ENSURE MAGNETO SWITCH IS OFF AND ROTATE ENGINE OPPOSITE DIRECTION OF ROTATION BY HAND NO LESS THAN 4 COMPLETE REVOLUTIONS.

Recommended Tools and Equipment.

Name	Number	Manufacturer	Use
CLEANING SOLVENTS			
Heavy Emulsion Cleaner (Solvent Base) (1 part cleaner and 3 parts solvent)			
5397	MIL-C-43616	BASF Wyandotte Corp. Chemical Specialties Div. 1609 Biddle Ave. Wyandotte, MI 48192	Clean engine.
		PLANTS IN: E. Stroudsburg, PA Santa Fe Springs, CA Tucker, GA	
B & B 2020 or B & B 4201	MIL-C-43616	B & B Chemical Company 875 West 20th St. Hialeah, FL 33010	Clean engine.
		PLANTS IN: Mt. Royal, NJ Union City, GA	

Name	Number	Manufacturer	Use
<u>CLEANING SOLVENTS (Continued)</u>			
Brulin 1-4-77N	MIL-C-43616	Brulin & Co., Inc. P.O. Box 270B Indianapolis, IN 46206 PLANTS IN: Richmond, CA Westwood, NJ	Clean engine.
C-1-79	MIL-C-43616	Bulk Chemical Dist. Inc. 80 First Street Gretna, LA 70053	Clean engine.
ED-366	MIL-C-43616	Eldorado Chem. Co. 6700 Lookout Road San Antonio, TX 78216 PLANTS IN: Stockton, CA	Clean engine.
Alkaline Detergent Cleaner (Water Base) (1 part cleaner, 2 to 3 parts water and 8 to 12 parts solvent)			
Oakite Fleetline JC-5 or JC-6	MIL-C-25769	Oakite Products, Inc. 50 Valley Road Berkely Heights, NJ 07922 PLANTS IN: Metuchen, NJ Houston, TX City of Industry, CA Romulus, MI	Clean engine.
Octagon 3726D	MIL-C-25769	Octagon Process, Inc. 596 River Road Edgewater, NJ 07020	Clean engine.
Formula-Y-1547	MIL-C-25769	West Chemical Prod., Inc. 4425 Sandini Boulevard Los Angeles, CA 90023	Clean engine.
AIR TEC 19 or AIR TEC 20	MIL-C-95769	Turco Products, Div. of Purex Corp. Ltd. 24600 South Main St. Wilmington/Carson, CA 90744 PLANTS IN: Houston, TX Rockdale, IL Philadelphia, PA	Clean engine
B & B 713G	MIL-C-25769	B & B Chemical Co., Inc. P.O. Box 796 Miami, FL 33166 PLANTS IN: Hialeah, FL	Clean engine.

ENGINE BAFFLESDescription

1. The sheet metal baffles installed on each engine direct the flow of air around the cylinders and other engine components. These baffles incorporate rubber-asbestos composition seals at points of contact with the engine nacelle and upper cowl to help confine and direct the air flow to the desired area. It is very important to the engine cooling to install the baffles properly.

Maintenance Practices

1. Removal/Installation of Engine Baffles (See Figure 1)

- A. Remove Engine Baffles.

- (1) Remove upper engine cowl.
 - (2) Remove lower engine cowl by removing attaching screws.
 - (3) Remove right and left baffles (1) and (11) by removing rocker box cover screws attaching baffles.
 - (4) Remove bolts (3) from right and left supports (2) and remove right and left outboard inter-cylinder baffles (16) and (12) and right and left inboard inter-cylinder baffles (17) and (13).
 - (5) Remove left forward cylinder baffle (14) by removing attaching screws.
 - (6) Remove left forward baffle (15) and right forward baffle (18) after removing attaching screws.

NOTE: To gain access to baffle (18) remove alternator and route wiring to aft nacelle section.

- (7) Disconnect fuel lines, oil lines, shroud lines, turbocharger discharge pressure lines, necessary fittings and remove right rear baffle (4) left aft baffle (8), aft center upper baffle (5) aft center lower baffle (6), and aft center baffle (7) by removing attaching screws and nuts.
 - (8) Remove left upper aft baffle (8) by removing attaching screws.
 - (9) Remove left rear cylinder baffle (10) by removing attaching screws to oil cooler and rocker box cover mounting screws.

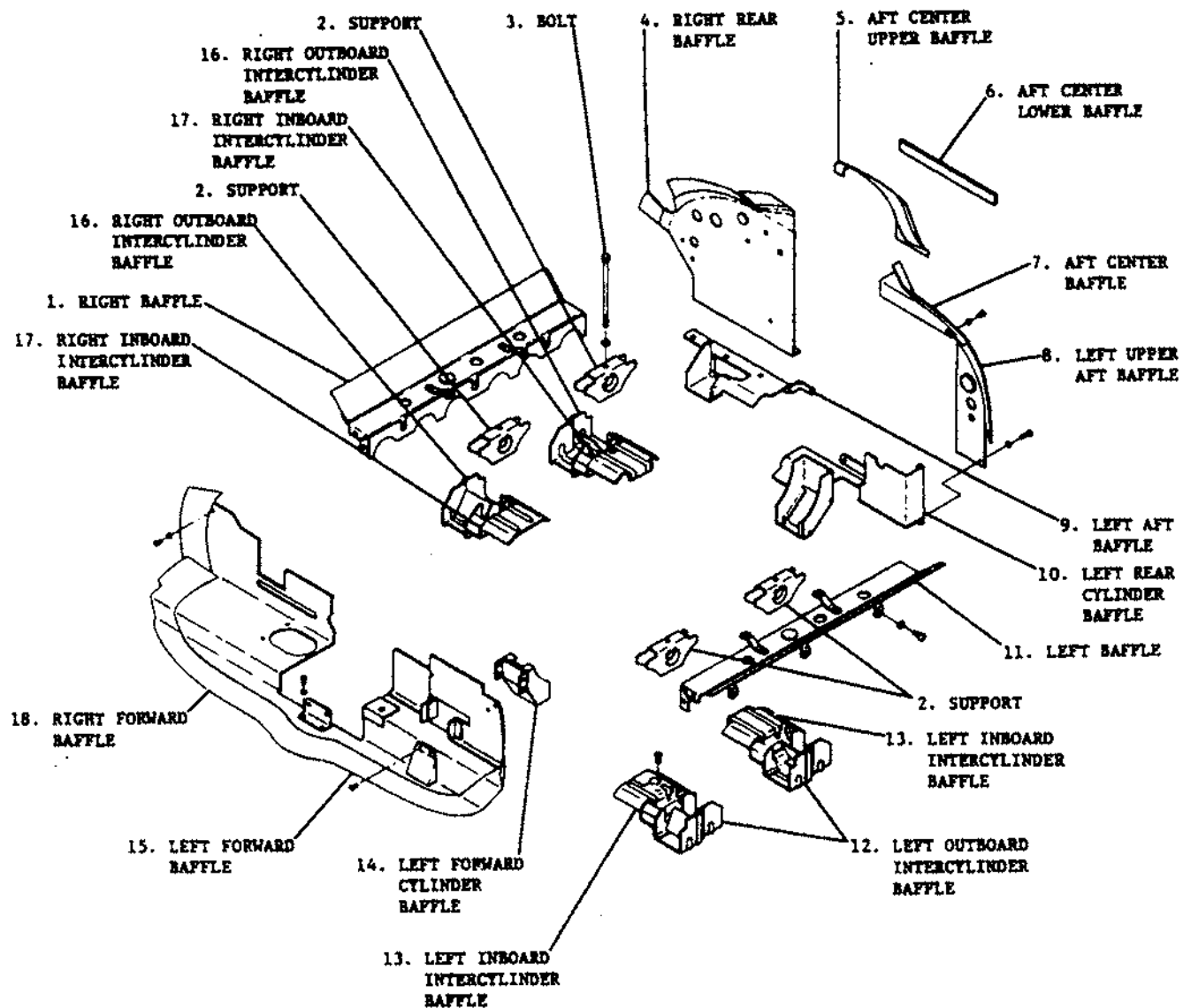
- B. Install Engine Baffles.

- (1) Install left rear cylinder baffle (10) using attaching screws in addition to oil cooler and rocker box cover mounting screws.
 - (2) Install left upper aft baffle (8) using attachment screws.
 - (3) Install right rear baffle (4), left aft baffle (8), aft center upper baffle (5), aft center lower baffle (6), and aft center baffle (7). Secure with attaching screws.
 - (4) Connect fuel lines, oil lines, shroud lines, turbocharger discharge pressure lines, and necessary fittings.
 - (5) Install left forward baffle (15) and right forward baffle (18) with screws.
 - (6) Install left forward cylinder baffle (14) using attaching screws.
 - (7) Install alternator and route wires through aft baffles and connect to alternator.
 - (8) Install left and right inboard inter-cylinder baffles (17) and (13), left and right outboard inter-cylinder baffles (12 and 16), supports (2) and bolts (3).
 - (9) Install right and left baffles (1) and (11) under rocker box cover mounting screws.
 - (10) Install lower engine cowl with attaching screws.
 - (11) Install upper engine cowl.

Inspection/Check

1. Inspection/Check of Engine Baffles.

- A. Remove engine cowl.



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Engine Baffle Installation
Figure 1

ENGINE MOUNTDescription

- Each engine is mounted to the engine mount beams by four engine mounts. Each mount incorporates two rubber pads, one washer, one spacer, one shield, one lockwasher and one bolt.

Maintenance Practices

1. Tools and Equipment.

Name	Number	Manufacturer	Use
Hoist	4180350	Cessna Aircraft Co.	Hoist Engine
Engine Mount Wrench	SE608	Cessna Aircraft Co.	Crimping lockwasher
Spacer	5056010-1 - 0.125 inches	Cessna Aircraft Co.	Shimming engine mount.
Spacer	5056010-2 - 0.188 inches	Cessna Aircraft Co.	
Spacer	5056010-3 - 0.250 inches	Cessna Aircraft Co.	
Spacer	5056010-4 - 0.312 inches	Cessna Aircraft Co.	

2. Removal/Installation of Engine Mounts (Refer to Section 7-00)

A. Remove Engine Mount.

- Remove engine cowl.

NOTE: The engine must be supported with an engine hoist before attempting removal of engine mount. If engine is being removed, refer to Engine Removal Procedures for components to be disconnected.

- Place a suitable support under tailcone.
- Bend ears down on lockwasher (8) and remove bolt (9), lockwasher (8), shield (7), lower mount (6) and spacer (4).
- Hoist engine slowly to a height of 2 to 3 inches above normal mounting position.

NOTE: Care should be taken not to induce adverse stresses on other items attached to engine, while hoisting.

- Remove upper mount (3) and spacer (2) from engine mount (1).

B. Install Engine Mount.

- Install upper mount (3) and spacer (2) in position on engine mount (1).
- Lower engine slowly into position on upper mount (3) and spacer (2) forward engine mount only.
- Install spacer (4) on lower mount (6) with hole located over pin (6) in fitting assembly (5).
- Install shield (7), lockwasher (8) and bolt (9).
- Torque bolts (9) to 300, +50, -00 pound-inches.
- Safety bolt (9) by using tool SE608 making sure the ears of lockwashers, lock over the flat surfaces on the bolt head.
- Install engine cowl.

3. Shimming Engine Mounts (Refer to Chapter 7-00)

- Although engine mount sag is normal and occurs over a period of time in-service, it can be corrected by shimming the mount back to its original position with spacers. Engine mount sag which has resulted in a loss of clearance between the engine mount and/or cowl components should be corrected by shimming.

- B. If the area between the exhaust riser of number six cylinder and the lower cowl panel does not have sufficient clearance, 0.40 inch minimum, shim engine mounts as follows:

- (1) Remove engine cowl.
- (2) Hoist engine and support as required to insert spacers.

NOTE: Spacers may be obtained from the Cessna Dealer's Organization. Refer to Tools and Equipment for part number and thickness desired. If the total thickness of spacers installed on any mount exceeds 0.312 inch, the mount must be removed and inspected in accordance with Chapter 2.

- (3) Insert spacers between the engine fitting assembly and upper mount (1) as required to obtain 0.40 inch minimum clearance.

NOTE: Align propeller spinner with cowl nose cap contours, to assist in determining correct engine mount position.

CAUTION: FOR EACH 0.125 INCH SPACER THICKNESS ADDED, IT WILL BE NECESSARY TO ADD THE NEXT LENGTH LONGER BOLT IN THE ENGINE MOUNT.

- (4) Secure engine mount in place and safety in accordance with engine mount installation procedures.
- (5) Remove engine hoist and recheck all clearances, especially in the exhaust stack area.
- (6) Safety bolts (4) with lockwashers, using engine mount wrench SE608.

Cleaning/Painting

1. Cleaning Engine Mounts

- A. Clean engine mounts with a suitable solvent.

NOTE: Never use a wire brush or sandpaper to clean engine mounts.

ENGINE FUEL SYSTEMDescription

1. The engine fuel injection system is a simple, low pressure system for injecting fuel into the intake valve port in the cylinder head. It is a multi-nozzle, continuous flow type system which controls fuel flow to match engine airflow. Any change in throttle position, engine speed, or combination of both, causes changes in fuel flow in the correct relation to engine airflow. On airplanes 421C1001 and On, a fuel primer injection nozzle is fitted into the air induction manifold allowing priming fuel to be injected directly into the manifold, bypassing the metering control and fuel manifold valve. Fuel directed through the primer nozzle is regulated by a solenoid valve which is activated by a combination of positioning the mixture control and operation of the primer switch. Refer to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual for starting procedures.
2. For proper installation of fuel primer injection nozzle, refer to Teledine Continental Maintenance and Overhaul Manual.
3. A manual mixture control and a flow gage, which indicates metered fuel pressure, provides for precise leaning at any combination of altitude and power setting.

Troubleshooting

1. For troubleshooting the fuel injection system, refer to Figure 1.

NOTE: When low fuel pressure exists, before performing troubleshooting check pressure hose between fuel pump and metering valve for restriction.

Adjustment/Check

1. Tools and Equipment.

NOTE: Equivalent substitutes may be used for the following listed items.

Name	Number	Manufacturer	Use
Fuel Pressure Test Kit	SK320-2	Cessna Aircraft Co.	Fuel pressure adjustment.
Screw Driver Flat Blade		Commercially Available	Adjust fuel/air control unit.

2. Fuel Mixture Check.

- A. Warm-up engine in accordance with Pilot's Operating Handbook and move throttles back to 475 +25 RPM).
- B. Place mixture control to full rich and propeller control full forward.
- C. Position auxiliary fuel pump to LOW, advance throttle to 600 RPM and slowly reduce mixture control, if both the fuel mixture control and fuel injection pumps are set properly, a 10 to 30 RPM rise will occur when the mixture control is gradually moved toward IDLE CUT-OFF.
- D. Using the above procedure set throttle to 1300 RPM and reduce mixture control slowly. If mixture control and fuel injection pumps are properly set, the RPM should increase 10 RPM when mixture control is gradually moved towards IDLE CUT-OFF.

NOTE: If RPM increases when mixture is reduced, fuel mixture is too rich; conversely, if RPM diminishes rapidly when mixture is reduced, fuel mixture is too lean.

- E. If fuel mixture check indicates a too rich or too lean idle condition refer to Fuel-Air Control Unit Adjustment/Check and Adjust Fuel Air-Control.
3. Unmetered Fuel Test, Hook-Up, Check and Adjustment (Airplanes C0001 Thru C0019 and C0021 thru C0025) (Refer to Figure 3).

The following procedures for adjusting and checking the unmetered fuel pressure are factory recommended and must be followed to insure proper adjustment.

NOTE: Excessive leaning is difficult to detect unless these procedures are followed.

A. Connect test gage to fuel pump as follows:

- (1) Place fuel selector valves in the OFF position.
- (2) Install fitting in pressure port of test gage (1) and connect hose (2). The vent hole in test gage is left open to atmosphere.
- (3) Install reducer (4) and nipples (3) to tee (6).
- (4) Attach test hose (5) to nipple (3) in tee (6).
- (5) Disconnect unmetered fuel pressure hose (11) from fuel injection pump fitting located on the underside and to the rear of fuel injection pump.
- (6) Reconnect the unmetered fuel pressure hose (11) to opposite end of tee (6).
- (7) Connect test hose (5) to fuel injection pump fitting where hose (11) was previously disconnected.

B. Adjust low unmetered fuel pressure as follows:

- (1) Start engine.
- (2) Allow engine to warm-up, then set idle RPM to 450-500 and check unmetered fuel pressure. Pressure should indicate 5.5 to 6.5 PSI on test gage.

NOTE: The test gage should be placed as near the same level of the fuel pump as possible or erroneous readings could result.

- (3) If unmetered fuel pressure does not indicate 5.5 to 6.5 PSI, the low unmetered fuel adjustment screw (10) must be adjusted. Turn low unmetered fuel adjustment screw (10) in (CW) to increase fuel pressure and out (CCW) to decrease fuel pressure. After correct unmetered fuel pressure is obtained, position auxiliary fuel pump to LOW and observe that unmetered fuel pressure does not exceed 6.5 PSI.

NOTE: Adjustments made to either the low unmetered adjustment screw (10) or the high setting adjustment screw (12) will affect the pressure setting of the other; therefore, recheck low and high RPM indications and readjust each pressure setting until the proper balance and pressure settings are achieved.

C. Adjust maximum fuel flow as follows:

NOTE: Propeller and manifold pressure adjustments must be accomplished before fuel flow adjustment. Refer to Chapter 8, Adjustment/Test.

- (1) Allow engine oil to reach a temperature indication in the upper 1/3 of the green arc on oil temperature gage.
- (2) With throttle full open, mixture full rich, auxiliary fuel pump on LOW, propeller control retarded to maintain 2100 RPM, set high setting adjustment screw (12) to obtain a fuel flow gage reading of 255 pounds per hour, as indicated on airplane's fuel flow gage. Loosen locknut on adjusting screw and turning screw OUT (CCW) to increase pressure or turn screw IN (CW) to decrease pressure. After adjustments are completed, tighten adjustment screw lock nut.
- (3) Readjust relief valve adjusting screw (14) OUT (CCW) to obtain a fuel flow gage reading of 255 to 265 pounds per hour with throttle full open, mixture full rich, auxiliary pump on LOW and maximum static RPM setting. Tighten locknut.

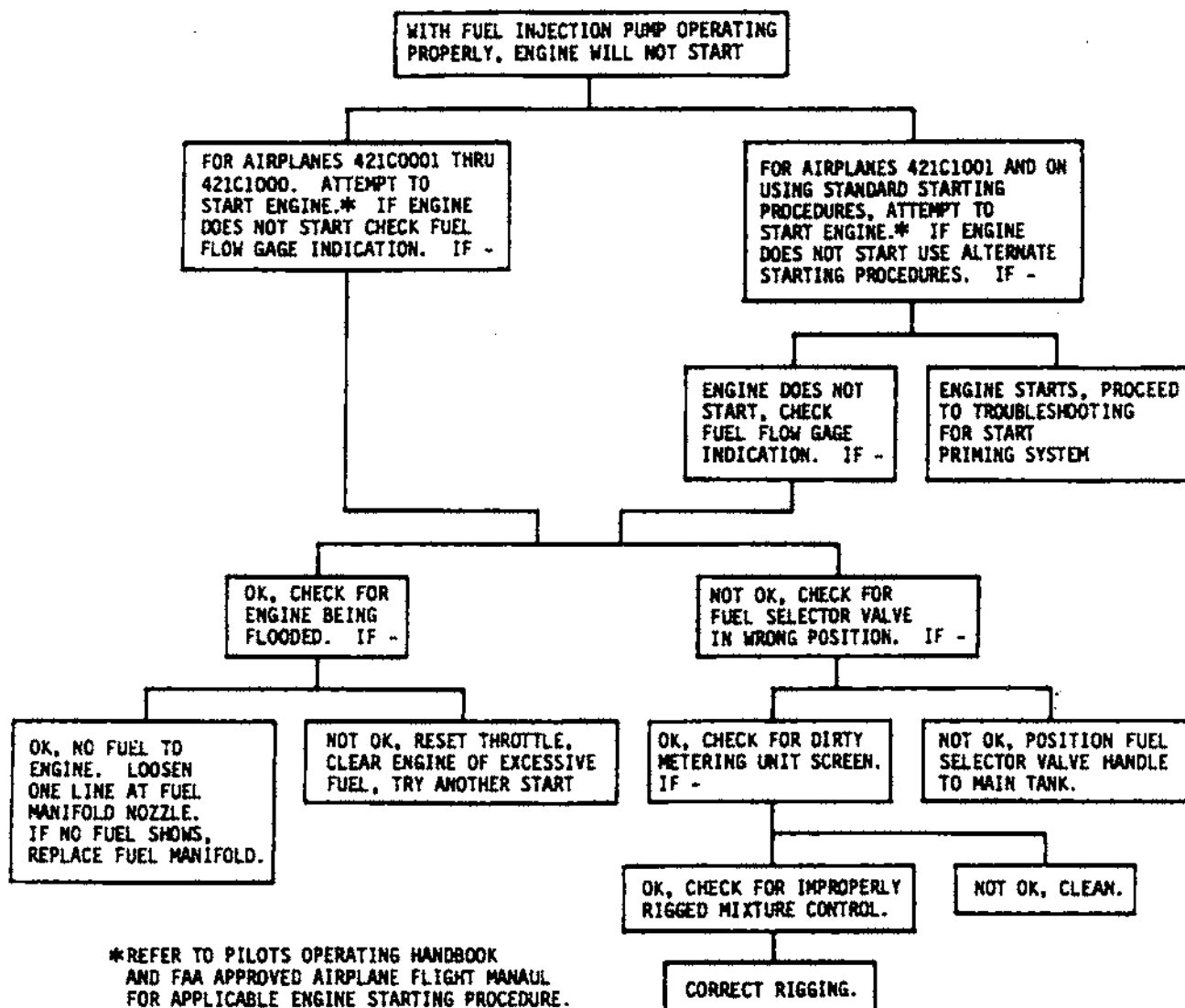
NOTE: If maximum static RPM cannot be obtained but RPM is above 2110, adjust fuel flow to 225 pounds per hour.

4. Unmetered Fuel Injection Pump, Test Setup, Check and Adjustment (Airplanes C0020 and C0026 thru C1000 incorporating SK421-70) (See Figure 3).

Test procedures are the same for the LH and RH engine fuel pumps. Make test set as shown and called out.

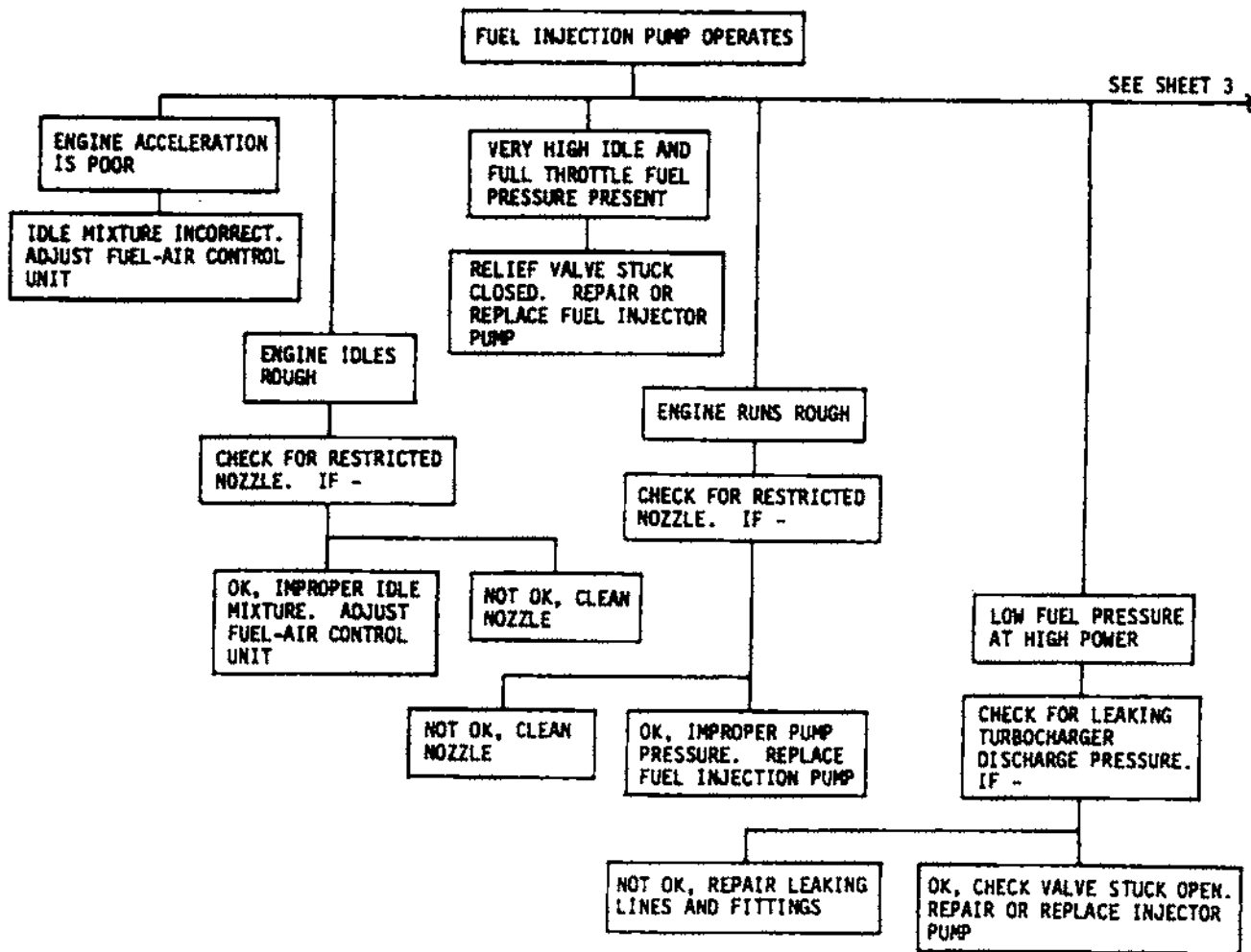
NOTE: The following procedures for adjusting and checking the unmetered fuel pressure are factory recommended and must be followed to insure proper adjustment. Excessive leaning is difficult to detect unless these procedures are followed.

Before performing unmetered fuel test, check fuel injection nozzles and fuel metering unit screen for contamination.



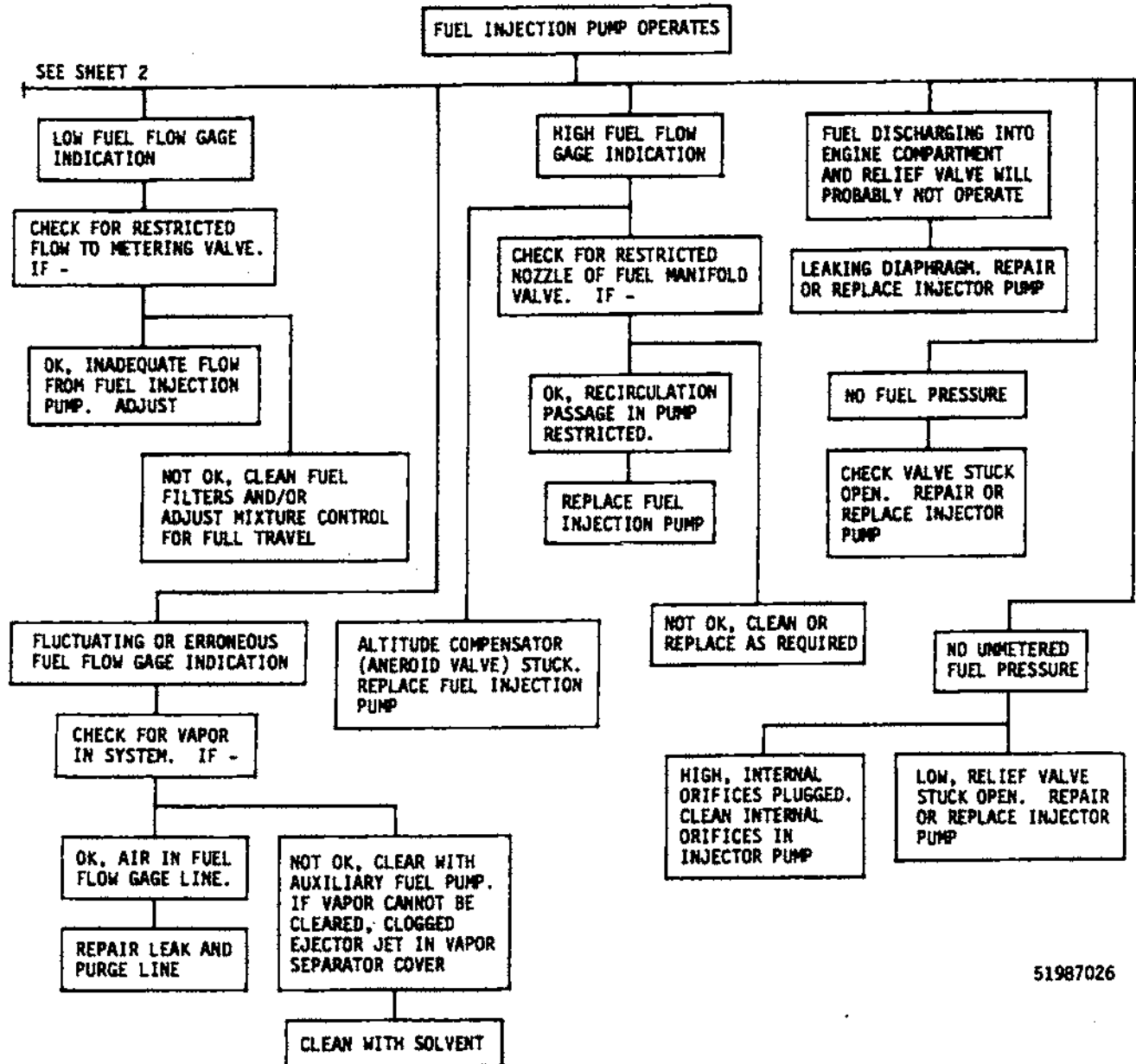
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Troubleshooting Chart - Fuel Injection System
Figure 1 (Sheet 1 of 3)



51987025

Troubleshooting Chart - Fuel Injection System
Figure 1 (Sheet 2)

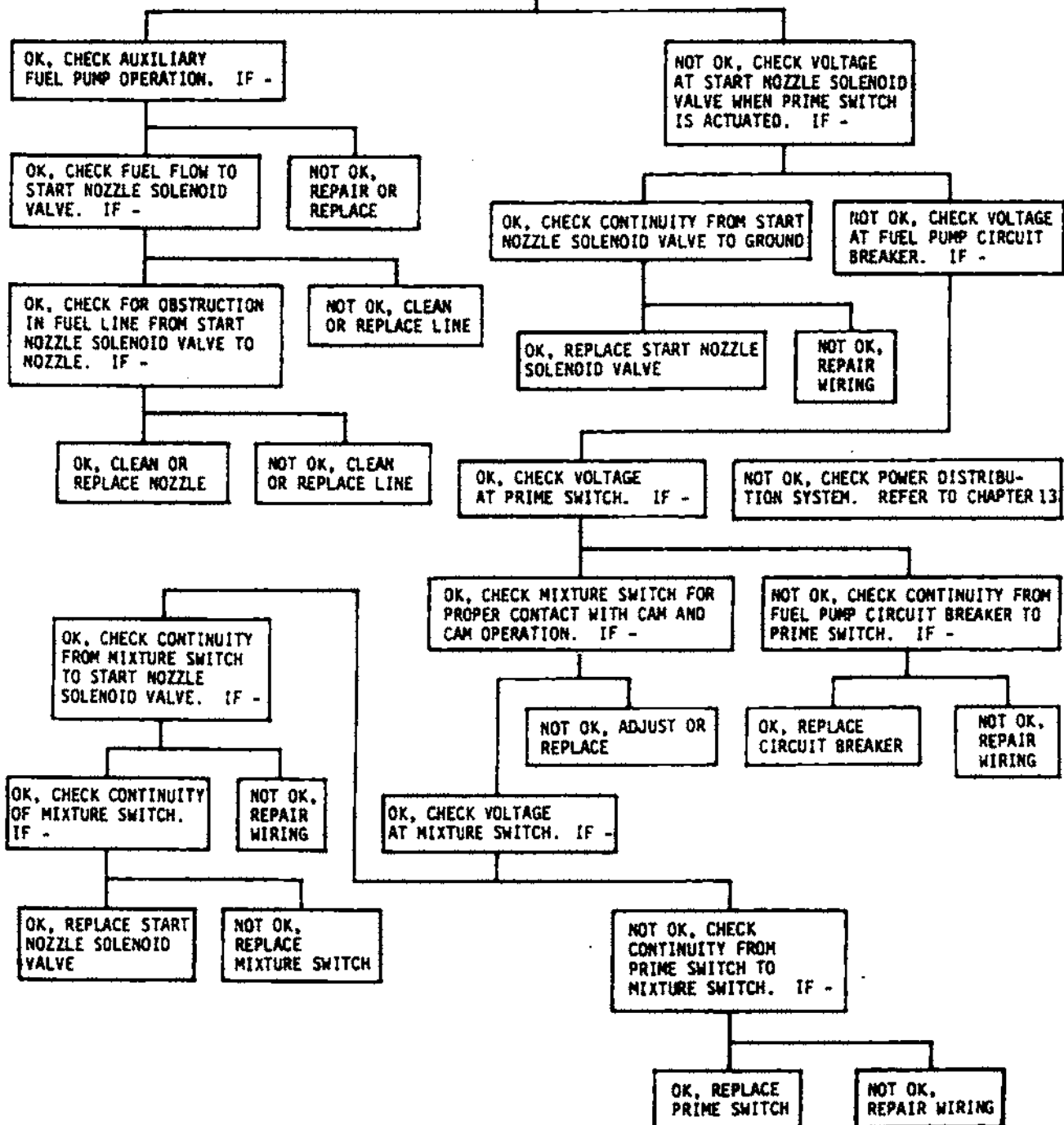


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Troubleshooting Chart - Fuel Injection System
Figure 1 (Sheet 3)

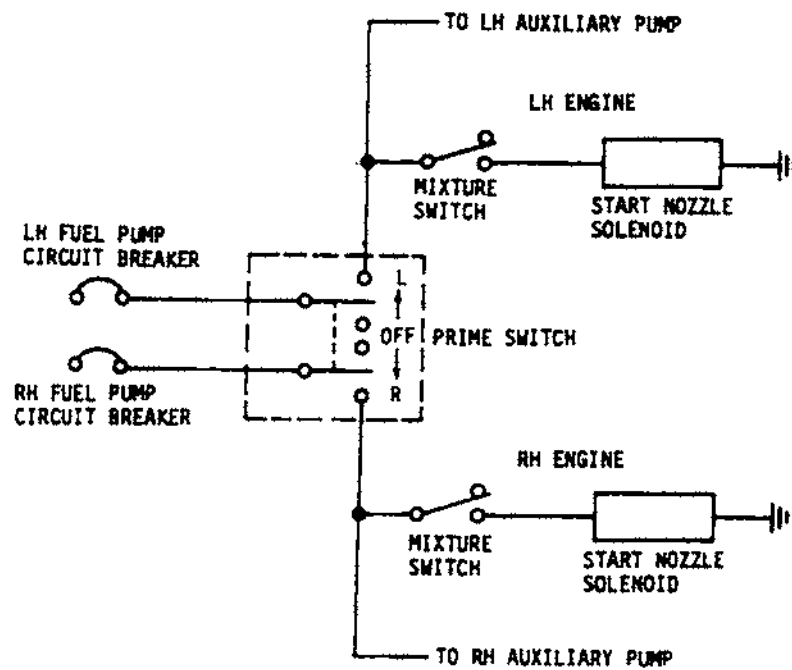
NO FUEL SPRAY AT START NOZZLE

WITH NORMAL VOLTAGE APPLIED, FUEL TO AUXILIARY FUEL BOOST PUMP AND ALL SWITCHES, CIRCUIT BREAKERS AND CONTROLS SET PER PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL FOR STARTING PROCEDURES, MOMENTARILY ACTUATE PRIME SWITCH BUT DO NOT PUSH START BUTTON AND LISTEN FOR CLICK OR FEEL START NOZZLE SOLENOID VALVE OPERATION. IF -

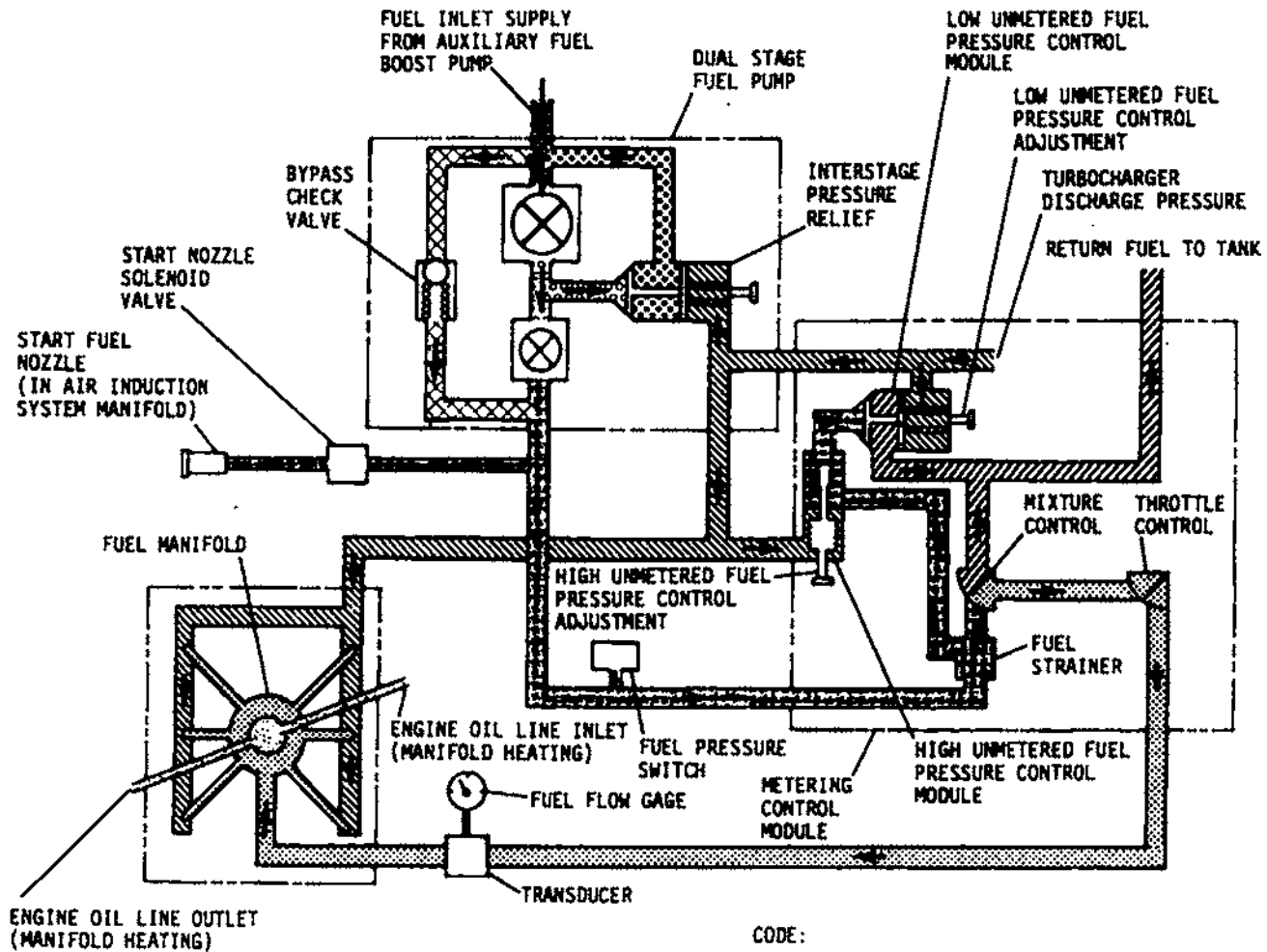


Troubleshooting - Start Priming System
Figure 1A

51987022

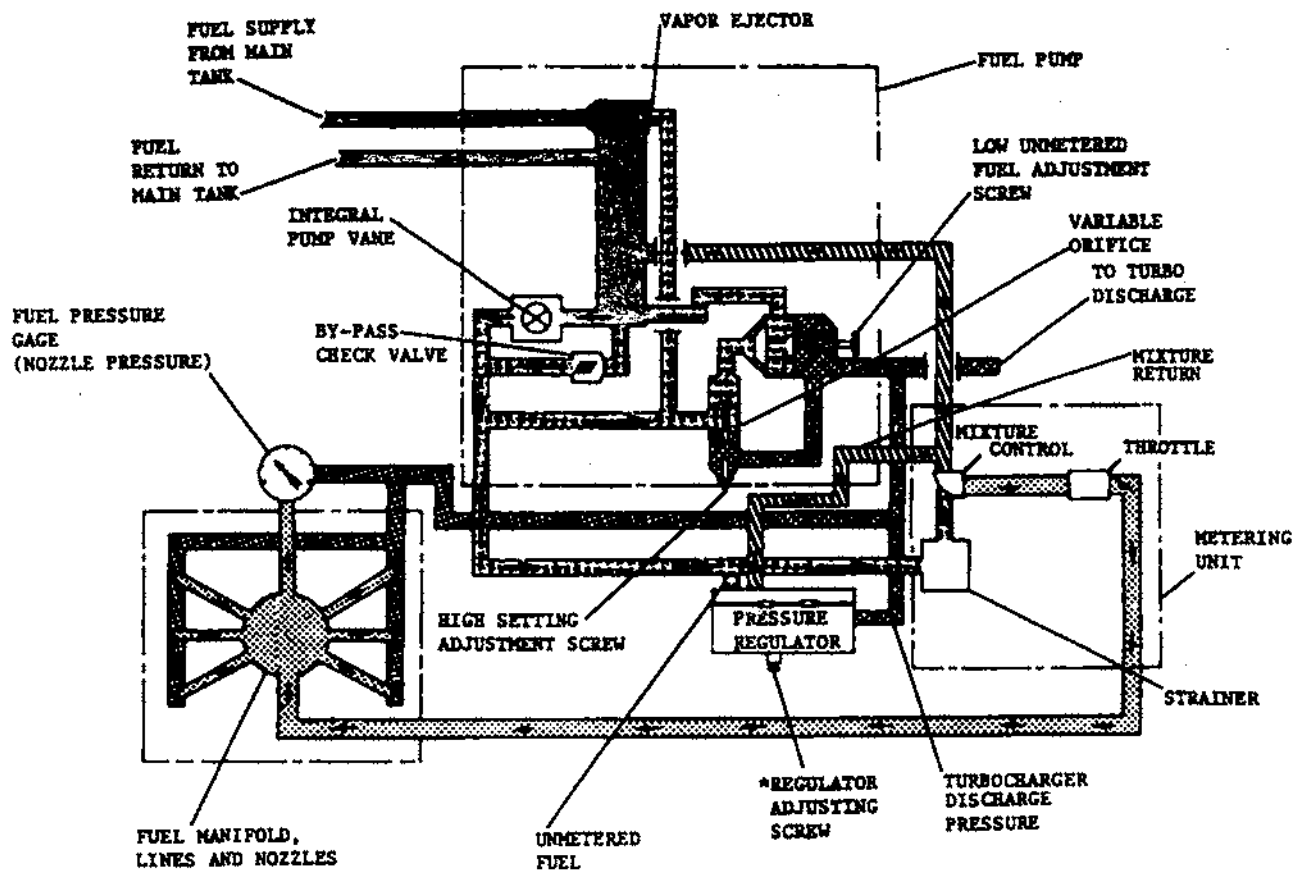


Priming System Electrical System (421C1001 and On)
Figure 1B



51701001

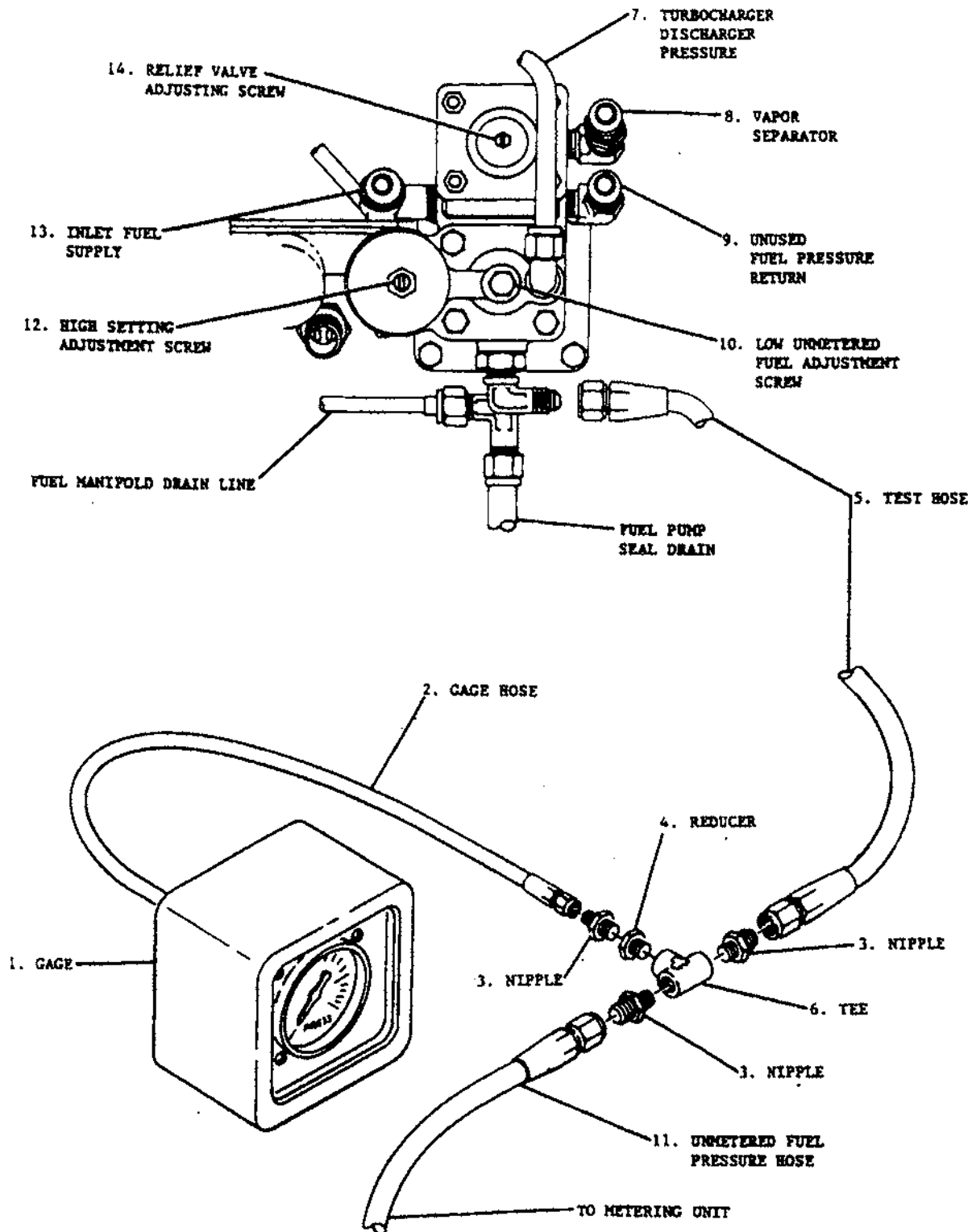
Fuel Injection System Schematic (421C1001 and On)
Figure 2 (Sheet 1 of 2)



*AIRPLANES 421C0025 THRU
421C1000 AND AIRPLANES
INCORPORATING SK421-70

58981001

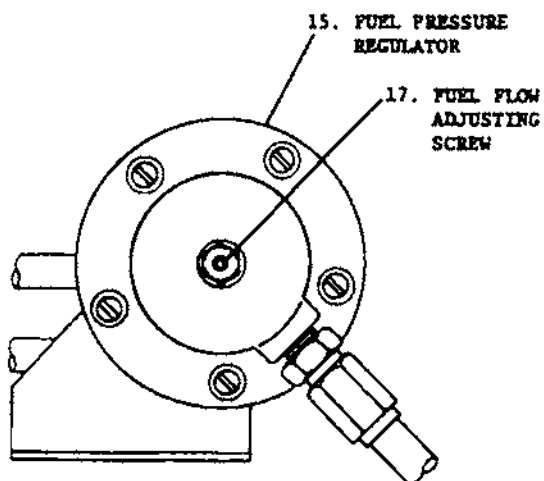
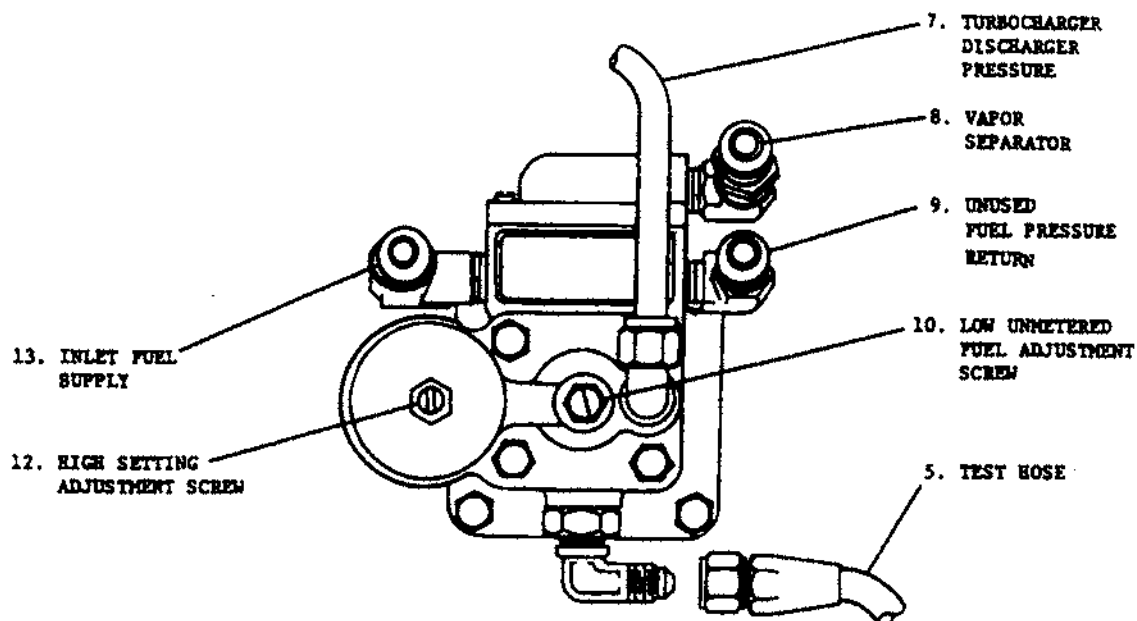
Fuel Injection System Schematic
Figure 2 (Sheet 2)



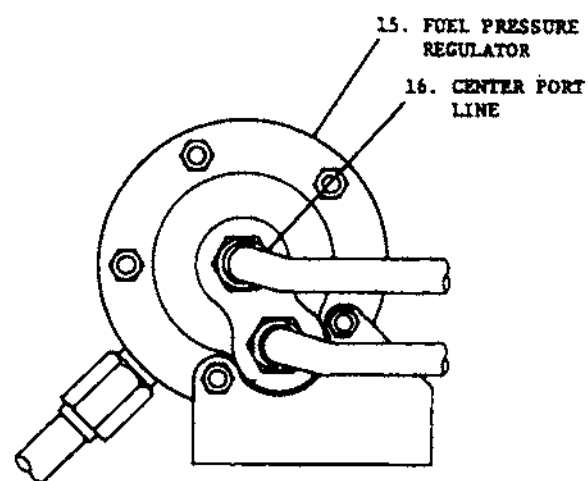
421C0001 THRU 421C0019 AND 421C0021 THRU 421C0025
NOT EQUIPPED WITH SE421-70

Fuel Injection Pump Test Hook-Up
Figure 3 (Sheet 1 of 2)

51561014
10562004R



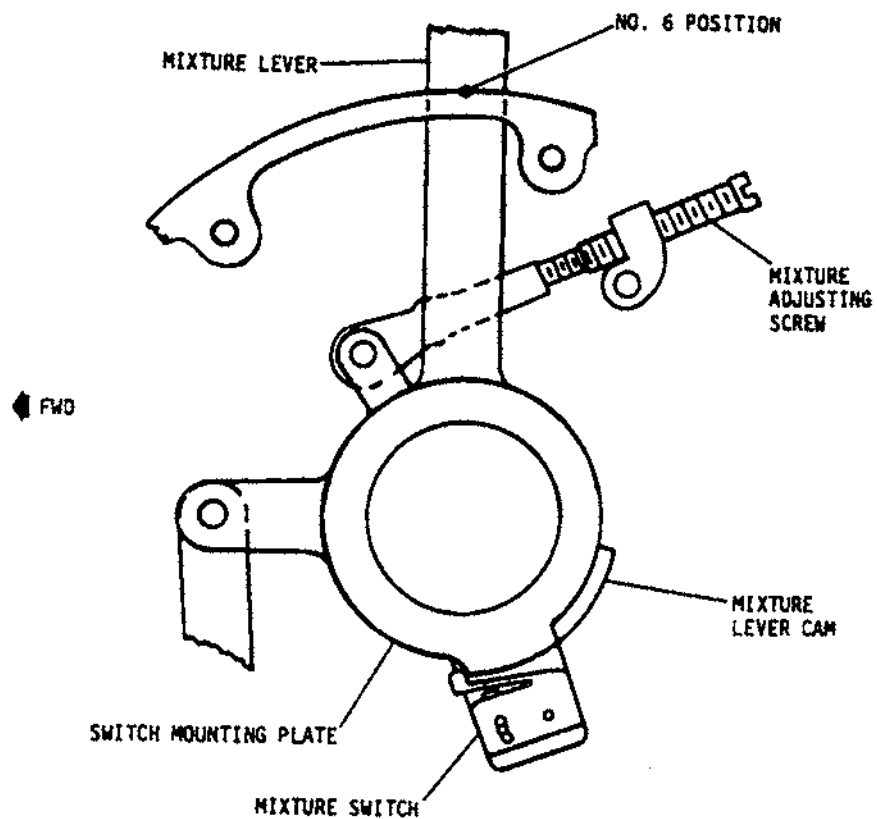
TOP VIEW



BOTTOM VIEW

421C0020 AND 421C0026 THRU 421C1000

Fuel Injection Pump Test Hook-Up
Figure 3 (Sheet 2)58561001
58562001



51181037

Fuel Primer Switch Adjustment
Figure 4

CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL

A. Connect test gage to pump as follows :

- (1) Place fuel selector valves in the OFF position.
- (2) Install fitting in pressure port of test gage (1) and connect hose (2). The vent hole in test gage is left open to atmosphere.
- (3) Install reducer (4) and nipples (3) to tee (6).
- (4) Attach test hose (5) to nipple (3) in tee (6).
- (5) Disconnect unmetered fuel pressure hose (11) from fuel injection pump fitting located on the underside and to the rear of the rear of fuel injection pump.
- (6) Reconnect the unmetered fuel pressure hose (11) to opposite end of tee (6).
- (7) Connect test hose (5) to fuel injection pump fitting where hose (11) was previously disconnected.

B. Adjust low unmetered fuel pressure as follows :

- (1) Start engine.
- (2) Allow engine to warm up, then set idle RPM to 450-500 and check unmetered fuel pressure. Pressure should indicate 5.5 to 6.5 PSI on test gage.

NOTE : THE TEST GAGE SHOULD BE PLACED AS NEAR THE SAME LEVEL OF THE FUEL PUMP AS POSSIBLE OR ERRONEOUS READINGS COULD RESULT.

- (3) If unmetered fuel pressure does not indicate 5.5 to 6.5 PSI, the low unmetered fuel adjustment screw (10) must be adjusted. Turn low unmetered fuel adjustment screw (10) in (CW) to increase fuel pressure and out (CCW) to decrease fuel pressure. After correct unmetered fuel pressure is obtained, position auxiliary fuel pump to LOW and observe that unmetered fuel pressure does not exceed 6.5 PSI.

NOTE : ADJUSTMENTS MADE TO EITHER THE LOW UNMETERED ADJUSTMENT SCREW (10) OR THE HIGH SETTING ADJUSTMENT SCREW (12) WILL AFFECT THE PRESSURE SETTING OF THE OTHER. THEREFORE, RECHECK LOW AND HIGH RPM INDICATIONS AND READJUST EACH PRESSURE SETTING UNTIL THE PROPER BALANCE AND PRESSURE SETTINGS ARE AVAILABLE.

C. Adjust maximum fuel flow as follows :

NOTE : THE PROPELLER AND MANIFOLD PRESSURE ADJUSTMENTS MUST BE ACCOMPLISHED BEFORE FUEL FLOW ADJUSTMENT. REFER TO CHAPTER 8, ADJUSTMENT/TEST.

- (1) Disconnect line (16) from return (center port of pressure regulator (15) and plug the end of detached line and cap center port on regulator.
- (2) Allow engine oil to reach a temperature indication in the upper 1/3 of green arc on temperature indicator.

CAUTION : DO NOT DISCONNECT OR PLUG LINE CONNECTED TO INLET (OFFSET) PORT OF PRESSURE REGULATOR. COMPLETE FAILURE OF PRESSURE REGULATOR COULD OCCUR.

- (3) With throttle full open, mixture full rich, low boost and propeller control retarded to maintain 2100 RPM reading airplanes fuel flow gage, set high pressure adjustment to obtain a fuel flow gage reading of 260 pounds per hour.

NOTE : THE ABOVE ADJUSTMENT IS ACCOMPLISHED BY LOOSENING LOCKNUT AND TURNING ADJUSTMENT SCREW (12) IN TO INCREASE OR TURN OUT TO DECREASE PRESSURE.

- (4) Shut down engine, remove plug and connect line to return (center) port (16) of pressure regulator.
- (5) Start engine and allow to warm up.
- (6) Adjust fuel flow adjustment screw (17) of regulator to obtain airplane fuel flow gage reading of 255 to 265 pounds per hour with throttle full open, mixture full rich, auxiliary boost pumps on low, manifold pressure at 40.0 inches Hg and maximum static RPM setting.

NOTE : IF MAXIMUM STATIC RPM CANNOT BE OBTAINED, BUT RPM IS ABOVE 2110, ADJUST FUEL FLOW TO 255 POUNDS PER HOUR.

NOTE: THIS SETTING WILL OVERRIDE THE SETTING MADE AT THE ENGINE-DRIVEN FUEL PUMP. THEREFORE, IT IS IMPORTANT TO FOLLOW THESE PROCEDURES CORRECTLY TO ASSURE PROPER FUEL FLOW.

CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL

NOTE : ADJUSTMENT MADE TO EITHER THE LOW UNMETERED ADJUSTMENT SCREW (10) OR THE HIGH SETTING ADJUSTMENT SCREW (12) WILL AFFECT THE PRESSURE SETTING OF THE OTHER. THEREFORE, RECHECK LOW AND HIGH RPM INDICATIONS AND READJUST EACH PRESSURE SETTING UNTIL THE PROPER BALANCE AND PRESSURE SETTINGS ARE ACHIEVED.

- (7) After adjusting the low unmetered fuel pressure and the maximum fuel flow, check idle RPM and idle mixture in accordance with the FUEL MIXTURE CHECK.
- (8) Remove test hook-up.
- (9) After completion of unmetered fuel adjustments with test equipment removed and fuel lines connected in normal position, it may be necessary to purge air from the fuel lines to prevent indicator needle fluctuations or erroneous readings.
- (10) Reinstall cowl.

D. Idle and Mixture Settings (Airplanes C1001 and ON).

- (1) Adjust idle to 475 RPM with boost pumps off (Refer to Figure 5).
- (2) Adjust low unmetered fuel pressure, with boost pumps off, to 6.0 to 7.0 psig (Refer to Figure 5).
- (3) Advance throttle to 600 RPM, boost pump off. Move mixture control toward idle cutoff. Check for an RPM increase of 10 to 30 RPM. An increase above 30 RPM indicates a rich condition.
- (4) If a rich condition is indicated adjust the mixture control on the throttle body to correct condition.

NOTE : ENGINE FUEL STARVATION CAN RESULT IF THE MIXTURE CONTROL IS CONTINUED TO BE MOVED TOWARD IDLE CUTOFF AFTER THE PEAK RPM IS REACHED DURING MIXTURE CHECKS.

- (5) If mixture control adjustment is made, turn the boost pump to low position and adjust power to 600 RPM. Recheck mixture per step (3) for correct RPM increase. If a rich condition exists, the low unmetered fuel pressure control must be adjusted to its higher limit and the idle mixture adjusted to obtain 10 to 30 RPM rise during mixture check.

NOTE : ADJUST LOW UNMETERED FUEL PRESSURE CONTROL WITH BOOST PUMPS OFF.

E. High Metered Fuel Flow Adjustment (Airplanes C1001 and ON).

- (1) Adjustment is performed with boost pump off, throttle full open, mixture full rich and propeller control adjusted to maintain 2235 RPM.
- (2) Adjust the high pressure control on the metering unit to obtain a fuel flow of 255 to 265 (PPH) pounds per hour. (Refer to Figure 5). Make adjustment by loosening the lock nut and turning the adjusting screw. (Turn OUT to increase, IN to decrease Flow).

NOTE : HIGH PRESSURE ADJUSTMENTS MUST BE PERFORMED WITH STABILIZED ENGINE MANIFOLD AND SPEED CONDITIONS.

IT MAY BE NECESSARY TO VERIFY FUEL FLOW AT 2235 RPM BY AIRPLANE FLIGHT AS VALUES FOR CHECKING MAY NOT BE OBTAINABLE UNDER STATIC CONDITIONS.

- (3) Adjust power to obtain 32.5 In. Hg. manifold pressure and 1900 RPM. Verify that both engines indicate a fuel flow of not less than 176 PPH and not more than 186 PPH. If fuel flow is not in limit, readjust low unmetered and high pressure settings.

5. Fuel-Air Control Unit Adjustments (Refer to Figure 1, Chapter 7-13, Adjustment/Text)

- A. The idle speed adjustment is a conventional spring-loaded screw located in the air throttle lever. Adjust idle speed adjustment screw to obtain 450 to 500 RPM. The idle mixture adjustment is the locknut at the metering unit end of the linkage. Tightening the nut, to shorten the linkage provides a leaner mixture. A richer mixture is obtained by backing off the nut to lengthen the linkage. Adjust the Fuel-Air Control to obtain a slight and momentary gain in idle speed as the mixture control is slowly moved toward IDLE CUT - OFF. If set too lean, idle speed will drop under same conditions.

6. Adjustment of Primer Solenoid Mixture Switches (Airplanes C1001 and On) (Refer to Figure 4).

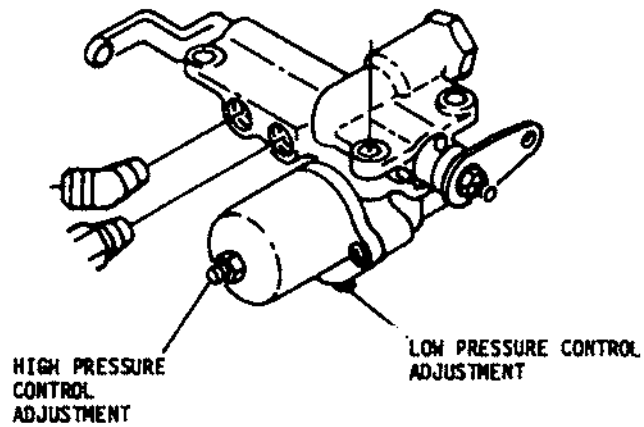
- A. Adjust screws to actuate switch to close solenoid valve when mixture lever is advanced to 6 on console markings.

NOTE: Number should align with center of mixture lever.

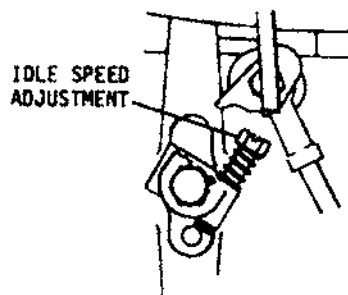
Inspection/Check

1. Engine Fuel System Inspection/Check

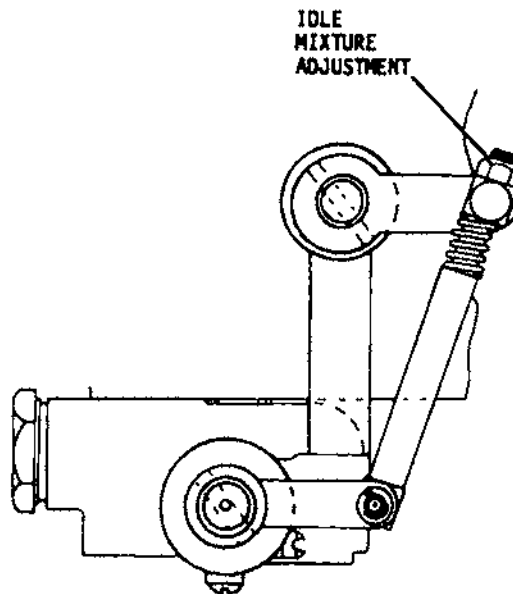
- A. Remove engine cowlings.
B. Remove lower nacelle access plates.



METERING UNIT



THROTTLE BODY
LH ENGINE
VIEWED FROM LEFT SIDE



THROTTLE BODY
LH ENGINE
VIEWED FROM RIGHT SIDE

AIRPLANES C1001 AND ON

Fuel Mixture Adjustment
Figure 5

51564007
51561013
51562002

FUEL INJECTION PUMPDescription

1. On airplanes 421C0001 thru 421C1000, the fuel injection pump is a positive displacement, rotating vane type incorporating a splined shaft for connection to the accessory drive. Since the pump is engine-driven, engine speed will affect total pump flow proportionally. The pump supplies more fuel than is required by the engine, therefore, a bypass is provided to maintain constant fuel pump pressure. An internal check valve is provided to return excess fuel and vapor to the main fuel tanks so that auxiliary fuel pump pressure can bypass the engine-driven fuel injection pump for starting the engine. The fuel injection pump incorporates a variable orifice controlled by an aneroid on the pump. The aneroid is controlled by the turbocharger discharge pressure. In the event of engine-driven fuel injection pump failure, the auxiliary fuel pump will operate automatically when the auxiliary fuel pump switch is ON.
2. On airplanes 421C1001 and On, the fuel injection pump is a two stage positive displacement, rotating valve type incorporating a splined shaft for connection to the accessory drive. The pump is engine-driven. Engine speed will affect total pump flow proportionally. The pump supplies more fuel than is required by the engine, therefore, a bypass is provided on the metering unit to maintain a constant fuel pump pressure. An internal bypass valve between the two stages returns fuel to the inlet side of the pump. The internal bypass is controlled by an aneroid and turbocharger discharge pressure. There are no adjustments to be made on the pump. When the auxiliary fuel pump switch is on, in event of engine-driven fuel pump failure, the auxiliary pump will operate automatically.

Maintenance Practices

1. Removal/Installation of Fuel Injection Pump (See Figure 1)

A. Remove Fuel Injection Pump.

- (1) Place fuel selector valve handles OFF.
- (2) Remove engine cowling.
- (3) Tag and disconnect all lines and fittings at fuel injection pump.

NOTE: Plug or cap all disconnected hoses, lines and fittings.

WARNING: RESIDUAL FUEL DRAINING FROM LINES AND HOSES IS A FIRE HAZARD. USE CARE TO PREVENT THE ACCUMULATION OF SUCH FUEL WHEN LINES OR HOSES ARE DISCONNECTED.

- (4) Remove the two nuts and washers attaching fuel injection pump to engine.
- (5) Remove fuel injection pump and gasket. Discard gasket.
- (6) If a replacement fuel injection pump is not being installed immediately, a temporary cover should be installed on the mount pad to prevent entry of foreign material.
- (7) Remove fittings and retain if a new fuel injection pump is being installed.

B. Install Fuel Injection Pump.

- (1) If removed, install fittings and clock in proper direction.
- (2) Place new gasket on the mounting pad on the engine and install pump with two flat washers, four internal tooth lockwashers and nuts.

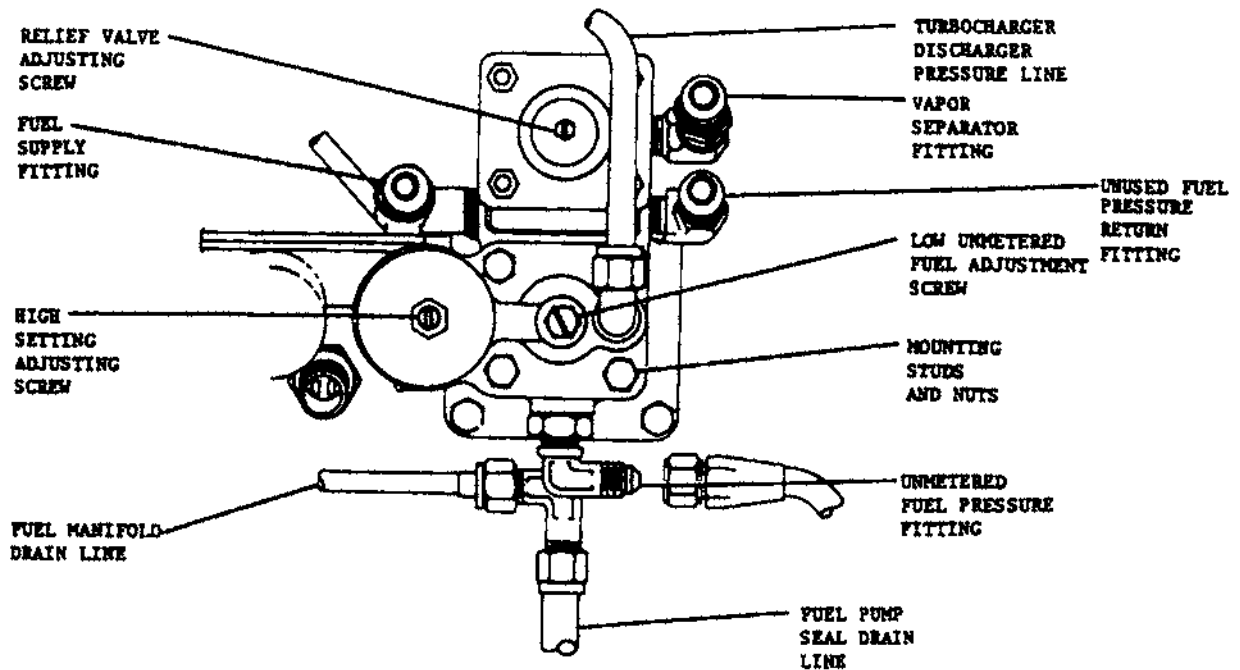
NOTE: When connecting fuel lines, use only a fuel soluble lubricant (such as engine oil) on the fitting threads. DO NOT USE ANY OTHER FORM OF THREAD COMPOUND.

- (3) Connect lines and hoses to respective fittings and remove tags.
- (4) Install engine cowling.
- (5) Perform engine operational check.

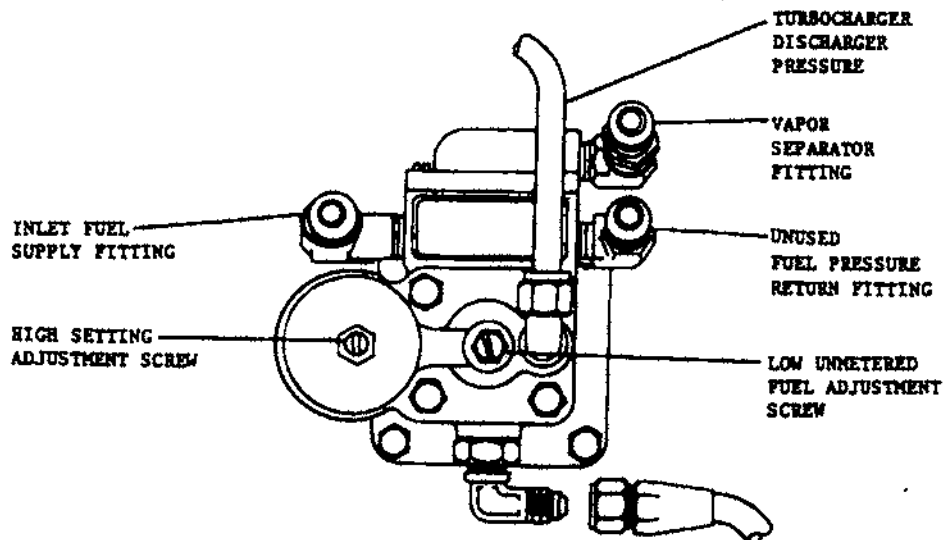
Inspection/Check

1. Injection Pump Inspection/Check.

A. Remove engine cowling.



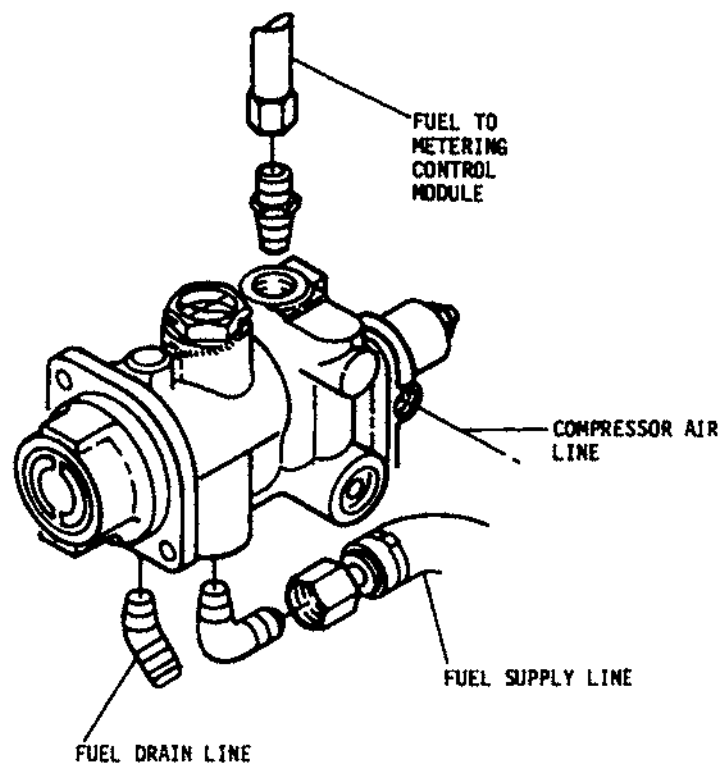
421C0001 THRU 421C0019
AND 421C0021 THRU 421C0025
EXCEPT AIRCRAFT INCORPORATING
SK421-70



421C0020 AND 421C0026 THRU 421C1000
AND AIRPLANES INCORPORATING SK421-70

Fuel Injection Pump
Figure 1

51561014
58561001



421C10001 AND ON

51564007

Fuel Injection Pump
Figure 1

FUEL MANIFOLD AND INJECTOR ASSEMBLYDescription

1. The fuel manifold provides a central point for distribution of fuel to individual cylinders. In the fuel manifold, a diaphragm and plunger valve raises and lowers by fuel pressure, to open or close the individual cylinder fuel supply port simultaneously. A fine mesh screen is provided in the manifold for protection against dirt and foreign matter entering the injector assembly. The fuel manifold is calibrated to operate at 4 PSI.
2. The fuel injector assembly consists of a nozzle and pressurization manifold. The fuel injector assembly is installed in each cylinder head outside each intake valve. An air bleed and injector pressurization arrangement supplies pressurized air to the injector. The air bleed arrangement aids in vaporization of fuel and by breaking the high vacuum at idle, maintains the fuel lines solidly filled and ready for instant acceleration of the engine. Nozzles are stamped with a letter on the hex of the nozzle body. Replacement nozzles must match and be of the same letter as those removed.

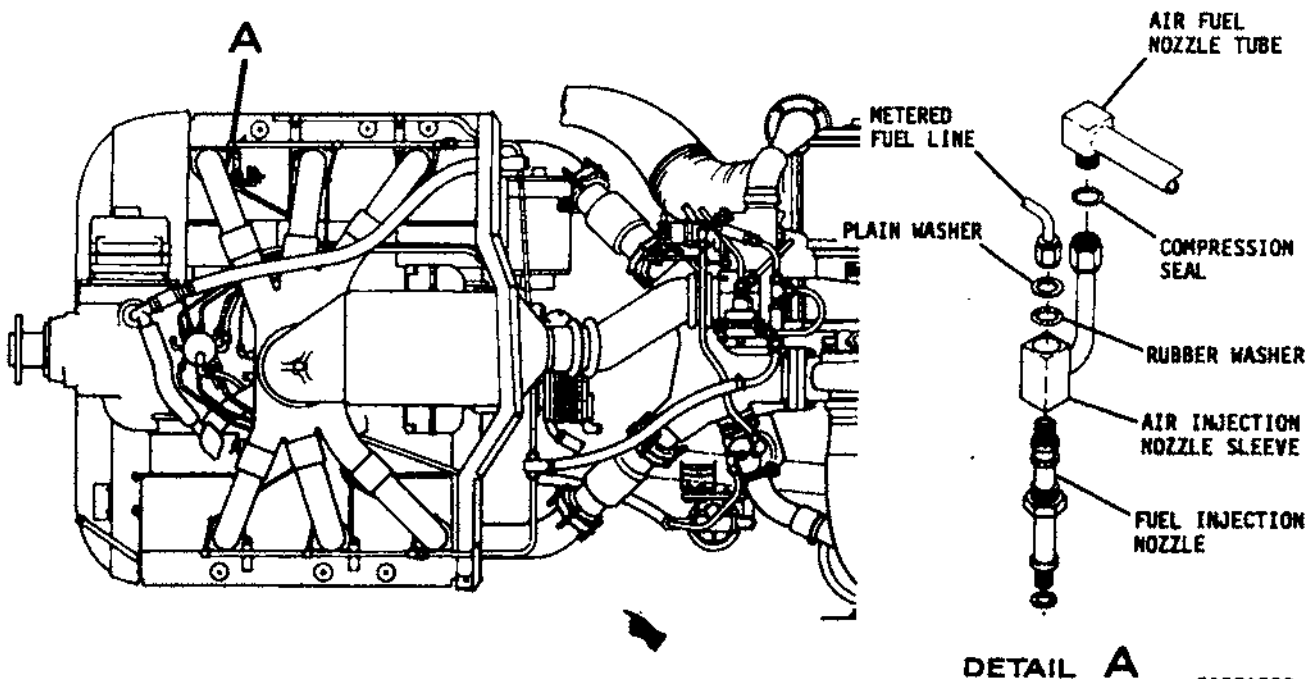
Maintenance Practices

1. Removal/Installation of Fuel Manifold (See Figure 1)

- A. Remove Fuel Manifold.

NOTE: Plug or cap all disconnected lines, hoses and fittings. Procedures are for either engine.

- (1) Remove engine cowlings.
 - (2) Tag and disconnect the six fuel injector assembly lines routing to each individual cylinder.



Fuel Manifold and Injector Assembly Installation
Figure 1

51504003
A51561010

- (3) Tag and disconnect the metered fuel line, fuel pressure line, and vent drain line at the manifold.
- (4) On Airplanes C1001 and On and Airplanes C0001 thru C1000 incorporating SK421-115, disconnect oil line to and from the manifold.
- (5) Remove fuel manifold mounting bolts from crankcase and remove fuel manifold.

B. Install Fuel Manifold.

CAUTION: FOR THE HEATED FUEL FEATURE TO BE EFFECTIVE, THE INSULATION ON THE TUBING MUST BE INTACT AND PROPERLY INSTALLED.

- (1) Position fuel manifold in place on engine and install mounting bolts.
- (2) Remove plugs, caps, connect lines and hoses from metered fuel, fuel pressure, and vent to their respective ports.

NOTE: When connecting fuel lines, use only a fuel soluble lubricant (such as engine oil) on fitting threads. DO NOT USE ANY OTHER FORM OF THREAD COMPOUND.

- (3) Remove plugs and caps and connect lines at fuel manifold from the six fuel injector assemblies and remove tags.
- (4) On Airplanes C1001 and On and Airplanes C0001 thru C1000 incorporating SK421-115, connect oil line to and from the manifold.
- (5) Install engine cowl.
- (6) Perform engine operational check.

C. Remove Injector Assembly.

NOTE: Removal procedures are for either engine and/or either right or left bank of cylinders on each engine. The pressurization lines to the injector assemblies is one assembly on each right or left bank of cylinders and must be removed as an assembly.

- (1) Disconnect fuel injection lines at the three cylinder injector assemblies.

NOTE: Plug or cap all disconnected lines and fittings.

- (2) Remove pressurization line assembly by lifting straight up off injectors.
- (3) Remove injector by unthreading from cylinder head.

D. Install Injector Assembly.

- (1) Install injector into cylinder head and tighten.

NOTE: Refer to Teledyne Continental motors overhaul manual for torque requirements.

- (2) Install pressurization line assembly.
- (3) Connect fuel injection lines at the injector assemblies.

NOTE: When connecting fuel lines, use only a fuel soluble lubricant (such as engine oil) on the fitting threads. DO NOT USE ANY OTHER FORM OF THREAD COMPOUND.

Inspection/Check

1. Fuel Manifold Inspection/Check

- A. Remove engine cowl.

2. Injector Assembly Inspection/Check

- A. Remove engine cowl.
- B. Disconnect lines at fuel injector assembly and remove fuel injector assembly.

Cleaning/Painting

1. Cleaning Fuel Manifold

CAUTION: DO NOT ATTEMPT TO REMOVE NEEDLE OR SPRING FROM INSIDE VALVE. REMOVAL OF THESE ITEMS FROM THE VALVE WILL DISTURB THE 4 PSI FACTORY CALIBRATION.

- A. Hold the top cover down against internal spring until all four attaching screws have been removed, then gently lift off the cover. Use care not to damage the spring-loaded diaphragm below it.
 - B. Remove the flushing plug located opposite the inlet fitting.

CAUTION: THE FILTER SCREEN IS A TIGHT FIT AND MAY BE DAMAGED IF REMOVAL IS ATTEMPTED. IT SHOULD BE REMOVED ONLY IF A NEW SCREEN IS TO BE INSTALLED.
 - C. Using clean gasoline, flush out the chamber below the screen.
 - D. 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.
 - E. Replace flushing plug.
 - F. Clean the diaphragm valve, top cover and springs in the same manner.
 - G. Carefully replace diaphragm and valve in manifold body. Check that valve works freely.
 - H. Place upper spring in position.
 - I. Align mounting holes in body, diaphragm and top cover locating the small vent hole in the cover to the side. Hold the cover down against the spring while installing and tighten all four screws. Safety the screws.
2. Cleaning Injector Assembly.
- A. To clean injector assemblies, immerse in fresh cleaning solvent.

CAUTION: DO NOT USE A WIRE BRUSH OR OTHER SHARP METAL OBJECTS TO CLEAN ORIFICES. THIS WILL DAMAGE ORIFICE.

FUEL-AIR CONTROL UNITDescription

1. The fuel-air control unit consists of the throttle body and metering unit. The metering unit bolts to the throttle body and is connected by linkage for simultaneous operation. 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. The two being used for fuel consist of one used for fuel mixture and the other for fuel metering. A linkage connecting the metering valve to the air throttle, proportions air flow versus fuel flow. Main fuel enters the control unit through a strainer and passes to the metering valve. The position of the metering valve controls the fuel passed to the manifold valve and nozzles. The position of the mixture valve determines the amount of fuel returned to the fuel injection pump. A fuel pressure switch, connected to the fuel control unit, actuates the auxiliary fuel pump to operate at high speed in the event the fuel injection pump pressure falls below 4.5 PSI. The auxiliary fuel pump switch must be ON for the fuel pressure switch to operate.

Maintenance Practices

1. Removal/Installation of Fuel-Air Control Unit (See Figure 1)

- A. Remove Fuel-Air Control Unit.

- (1) Place the fuel selector valve handles to OFF.
- (2) Remove engine cowling.

NOTE: Plug or cap all open lines, hoses and fittings.

- (3) Disconnect lines and hoses at metering unit.
- (4) Loosen clamps on ram air duct at the throttle body flex duct connections and slide back to allow removal.
- (5) Remove bolts securing fuel-air control to bracket and remove from nacelle.
- (6) If metering unit and throttle body are to be separated, remove bolts securing metering unit and disconnect linkage.

- B. Install Fuel-Air Control Unit.

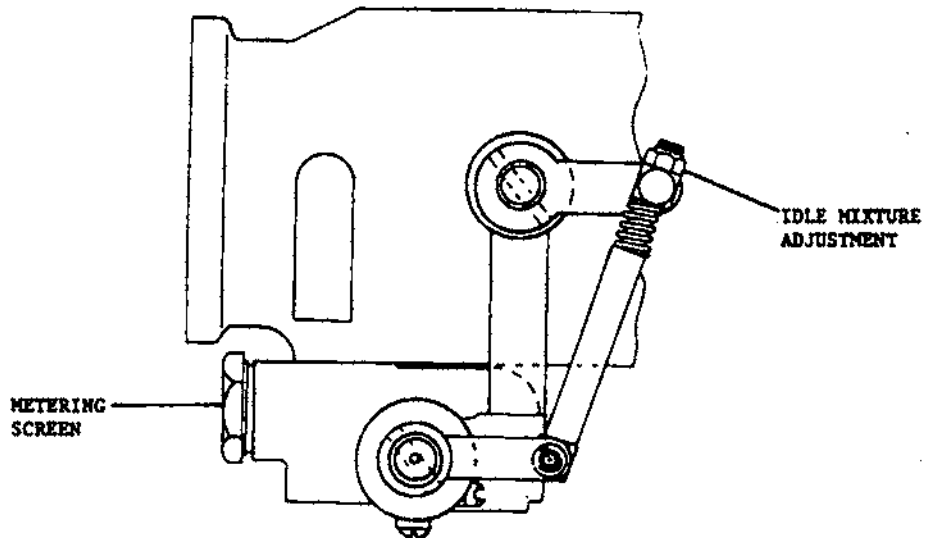
- (1) If metering unit and throttle body are separated, install metering unit to throttle body with bolts and connect linkage.
- (2) Position fuel-air control unit in place and install bolts in bracket.
- (3) Slide flex ducts in place on throttle body and install clamps.
- (4) Remove plugs and caps and connect lines and hoses at metering unit.
- (5) Refer to Chapter 7-10 and perform fuel-air control adjustment.
- (6) Install engine cowling.

Inspection/Check

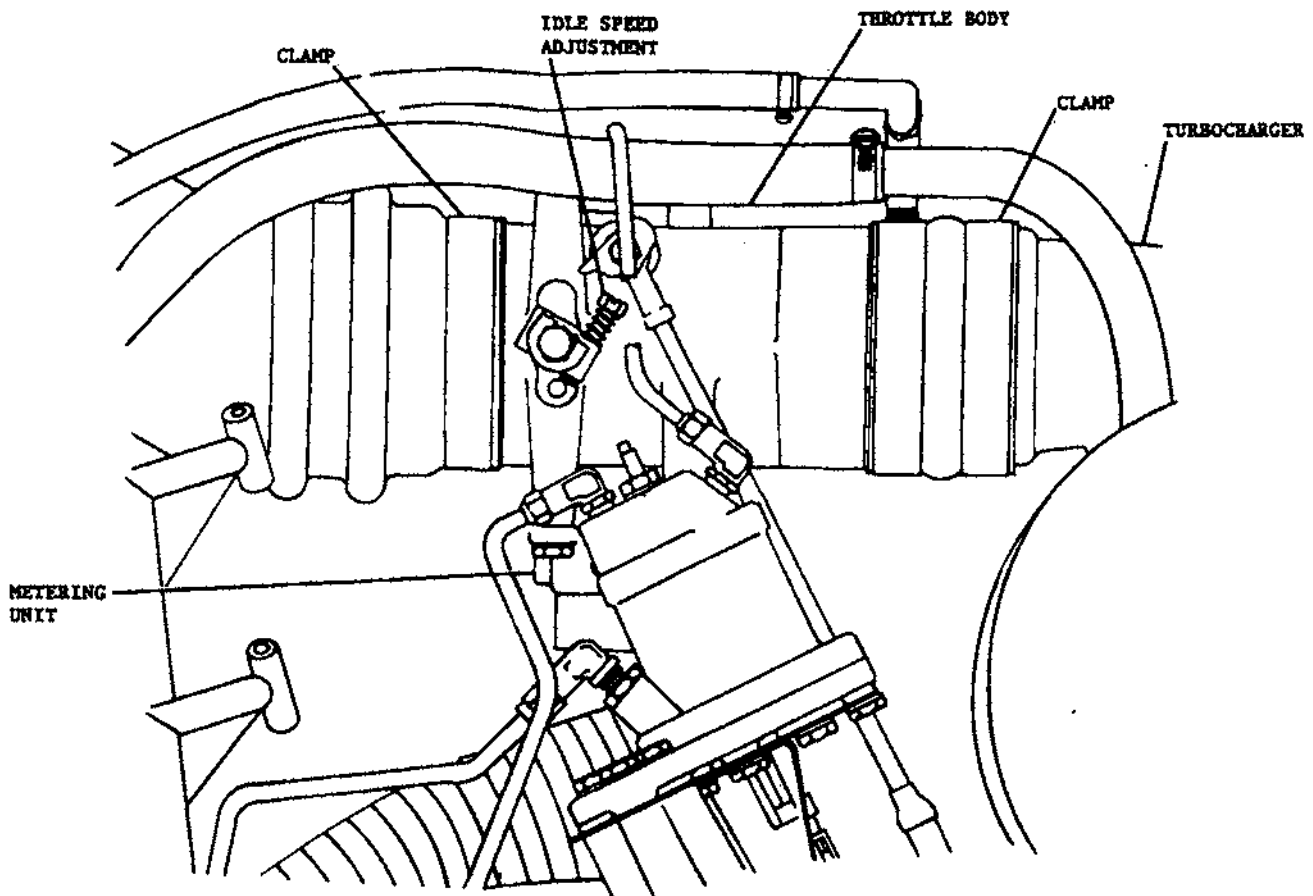
1. Fuel-Air Control Inspection/Check

- A. Remove engine cowling.

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L.H. ENGINE SHOWN
VIEW FROM RIGHT SIDE



L.H. ENGINE SHOWN
VIEW FROM LEFT SIDE

Fuel Air Control Unit
Figure 1

51561013
51562002

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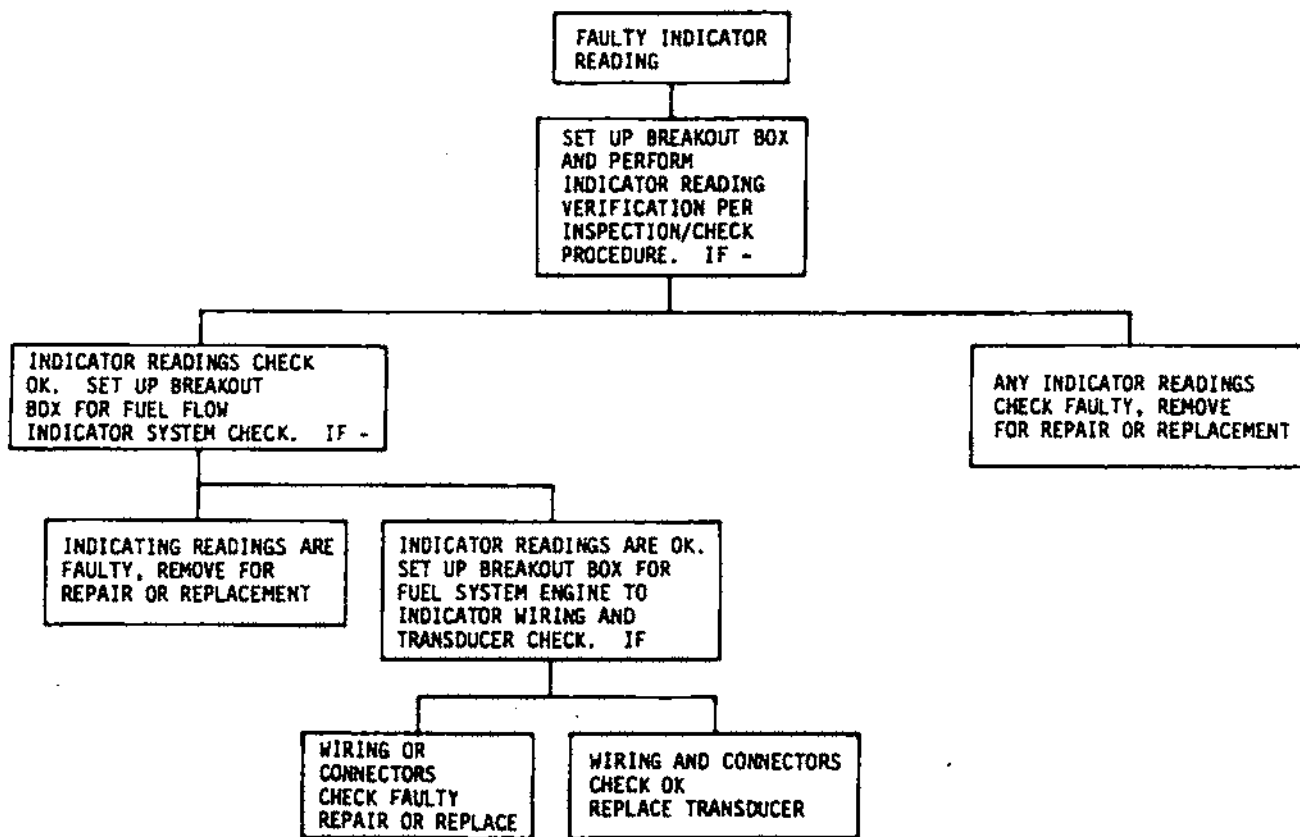
FUEL INDICATING SYSTEM

Description

1. The standard indicating system consists of a dual fuel flow gage calibrated in pounds per hour and gallons per hour. The dual flow gage senses the pressure as delivered to the fuel injector assemblies.
2. The optional indicating system consists of dual indicator and a fuel flow transducer for each engine. The fuel flow transducer generates electrical pulses, which represents a measure of fuel flow rate and transmits these pulses to the indicator as input frequency. The indicator then converts the frequency signals into an analog output which is displayed by the indicator as fuel flow in pounds per hour. In addition, these pulses provide information which drives a totalizer within the indicator. The indicator has a memory circuit that stores the quantity of fuel remaining or consumed, even if power is removed from the normal power input circuit.

Troubleshooting

1. For Troubleshooting Electrical System (Optional). (Refer to Figure 1.) Refer to Inspection/Check for Testing Equipment. For additional troubleshooting, refer to paragraph 2. below.



10987017

Troubleshooting Chart - Electrical Fuel Flow Indicating System
Figure 1

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2. The following is troubleshooting procedure for the fuel flow and totalizer system, including the flow transducer. This procedure should isolate the problem and ensure that the right component is removed/replaced.
 - A. Ensure 28 volts direct current (VDC) (22 to 30 VDC):
 - (1) Between pins A-POSITIVE and B-NEGATIVE (airplane ground).
 - (2) Between pins P-POSITIVE and L-NEGATIVE (airplane ground).
 - B. With master switch ON and 28 VDC present between pins A-POSITIVE AND B-NEGATIVE, and between pins P-POSITIVE and L-NEGATIVE:
 - (1) Check for 12 VDC between pins E-POSITIVE and C-NEGATIVE.
 - (2) Check for 12 VDC between pins F-POSITIVE and D-NEGATIVE of the connector (or between the RED and BLACK leads of the transducers).
 - C. Ensure there is 28 VDC present between pins K-POSITIVE and airplane ground.
 - D. If the totalizer is operating properly and the pointer is not, the problem is in the indicator.
 - E. If the totalizer and pointer are not operating properly, the problem is the transducer.
 - (1) Check for shorts:
 - (a) Between pin G and airplane ground of the connector.
 - (b) Between pin H and airplane ground of the connector.
 - (2) Check for 12 VDC on pins M-POSITIVE, T-NEGATIVE, N-POSITIVE and S-NEGATIVE of the connector (or between the GREEN and ORANGE leads of the transducers).

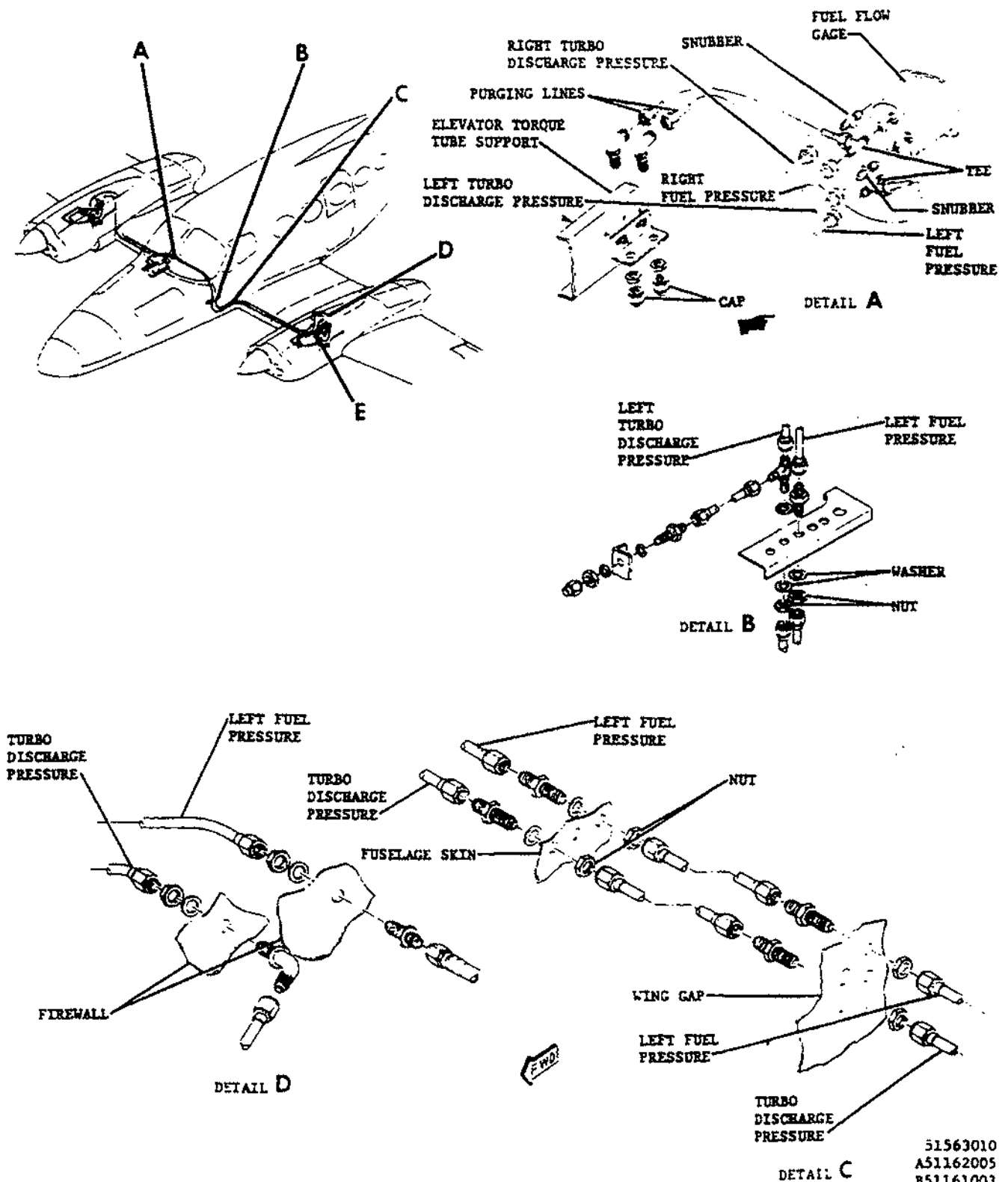
Maintenance Practices

1. Removal/Installation of Fuel Indicating System, Standard and Optional (Refer to Figures 7 and 8).
 - A. Remove Standard Fuel Indicating System.

NOTE: Plug or cap all disconnected lines and fittings.

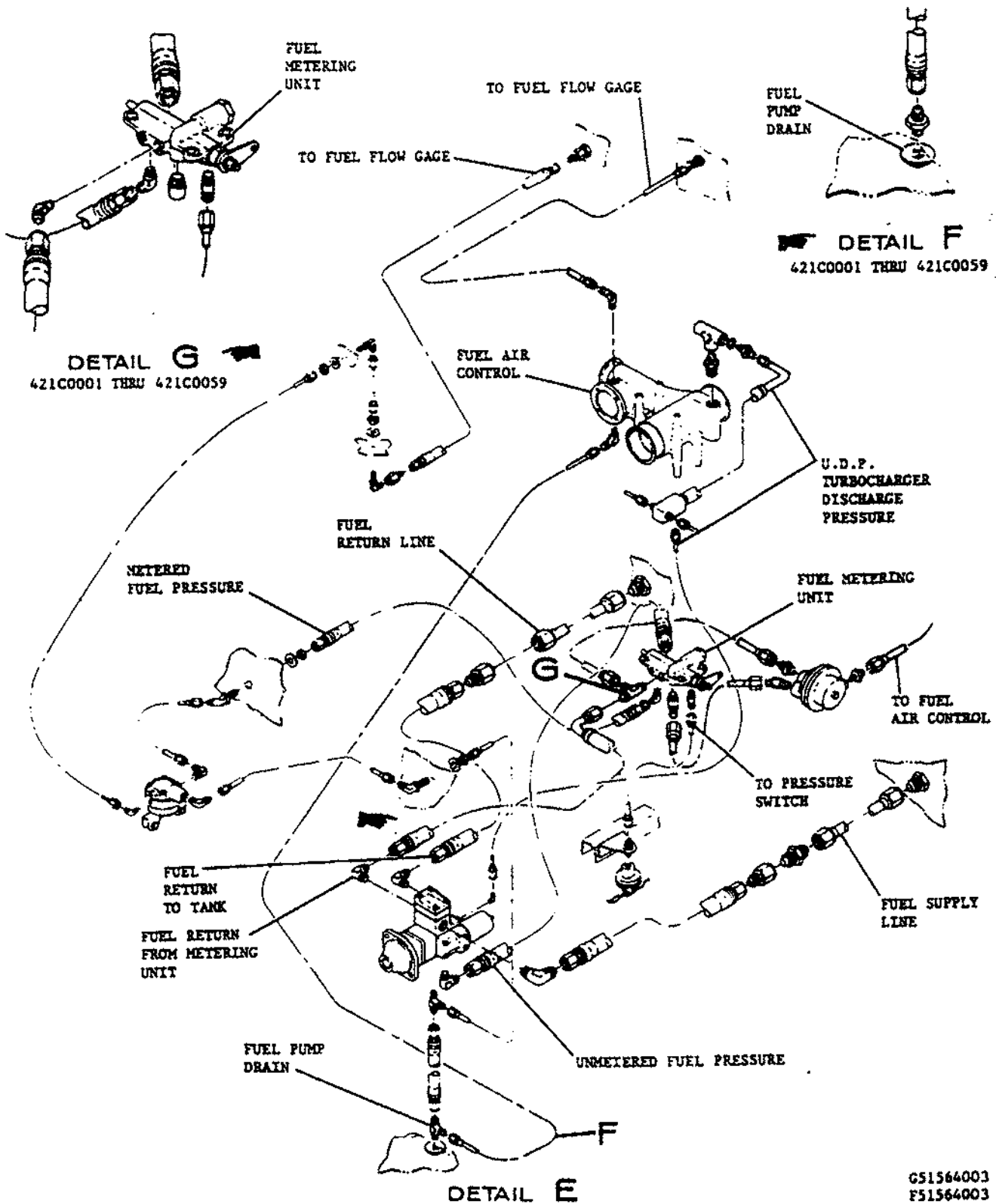
 - (1) Tag and disconnect lines at fuel flow gage and remove gage in accordance with typical instrument removal, Chapter 10, Maintenance Practices.
 - B. Install Standard Fuel Indicating System.
 - (1) Install gage in accordance with typical instrument installation, Chapter 10, Maintenance Practices.
 - (2) Connect lines at fuel flow gage and remove tags.
 - (3) Purge fuel indicating system in accordance with purging procedures and perform engine operational check.
 - C. Remove Optional Fuel Indicating System.
 - (1) Turn electrical power OFF.
 - (2) Remove engine cowling to gain access to fuel flow transducer.
 - (3) Disconnect electrical connector at fuel flow transducer.
 - (4) Disconnect cap fuel line and fuel hose at fuel flow transducer.
 - (5) Remove fuel flow transducer from union.
 - (6) Disconnect electrical connector at fuel flow indicator and remove fuel flow indicator of instrument panel in accordance with typical instrument removal. Refer to Chapter 10, Maintenance Practices.
 - D. Install Optional Fuel Indicating System.
 - (1) Install fuel flow indicator in accordance with typical instrument installation. Refer to Chapter 10, Maintenance Practices. Connect electrical connector to fuel flow indicator.
 - (2) Install fuel flow transducer from union.
 - (3) Remove caps and connect fuel line and fuel hose to fuel flow transducer.
 - (4) Connect electrical connector to fuel flow transducer. Reinstall engine cowling.

Pages 3, 4, 5 and 6 have been deleted.



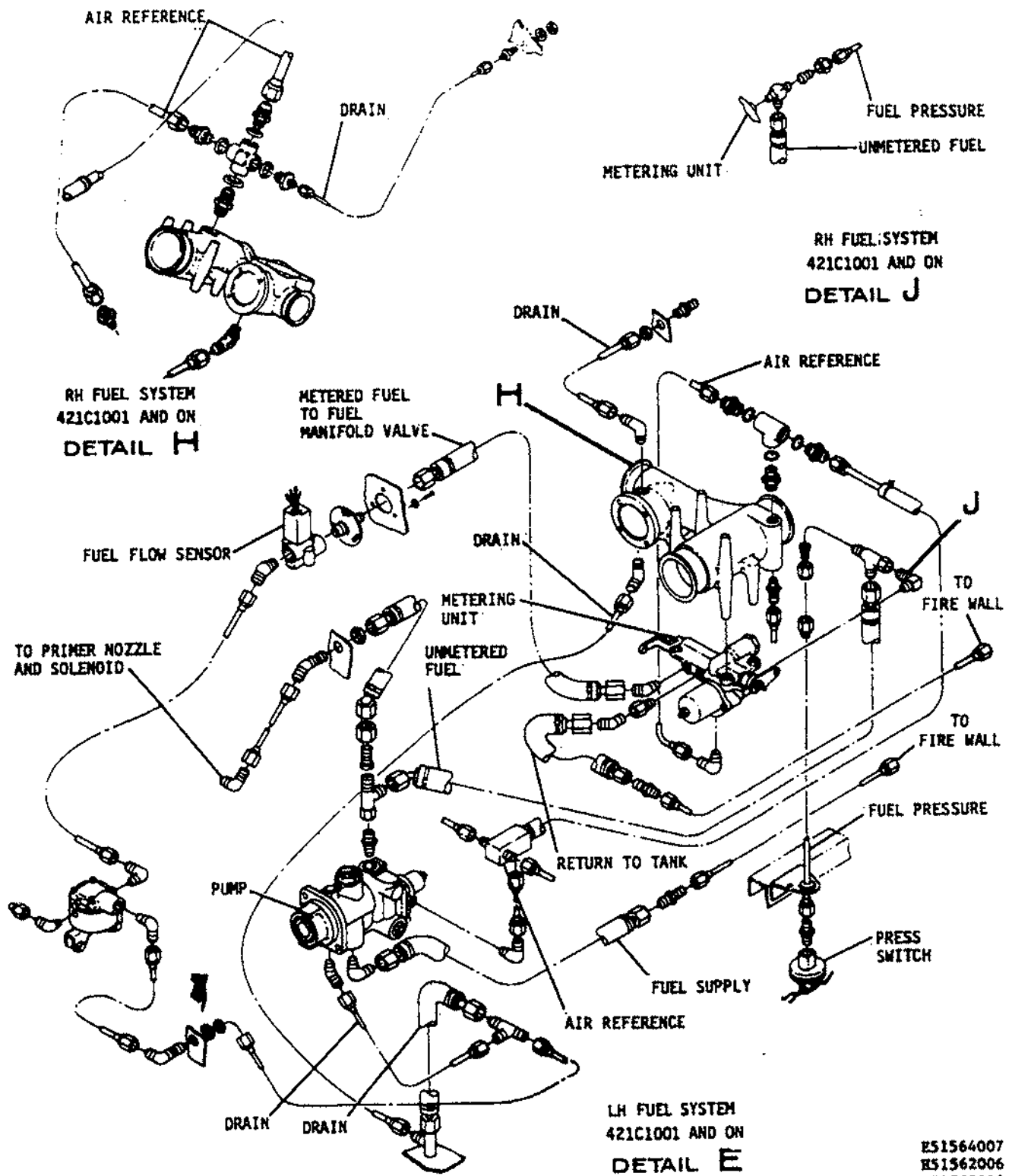
Engine Fuel System and Plumbing
Figure 7 (Sheet 1 of 3)

51563010
A51162005
B51161003
C51563011R
D51563011R



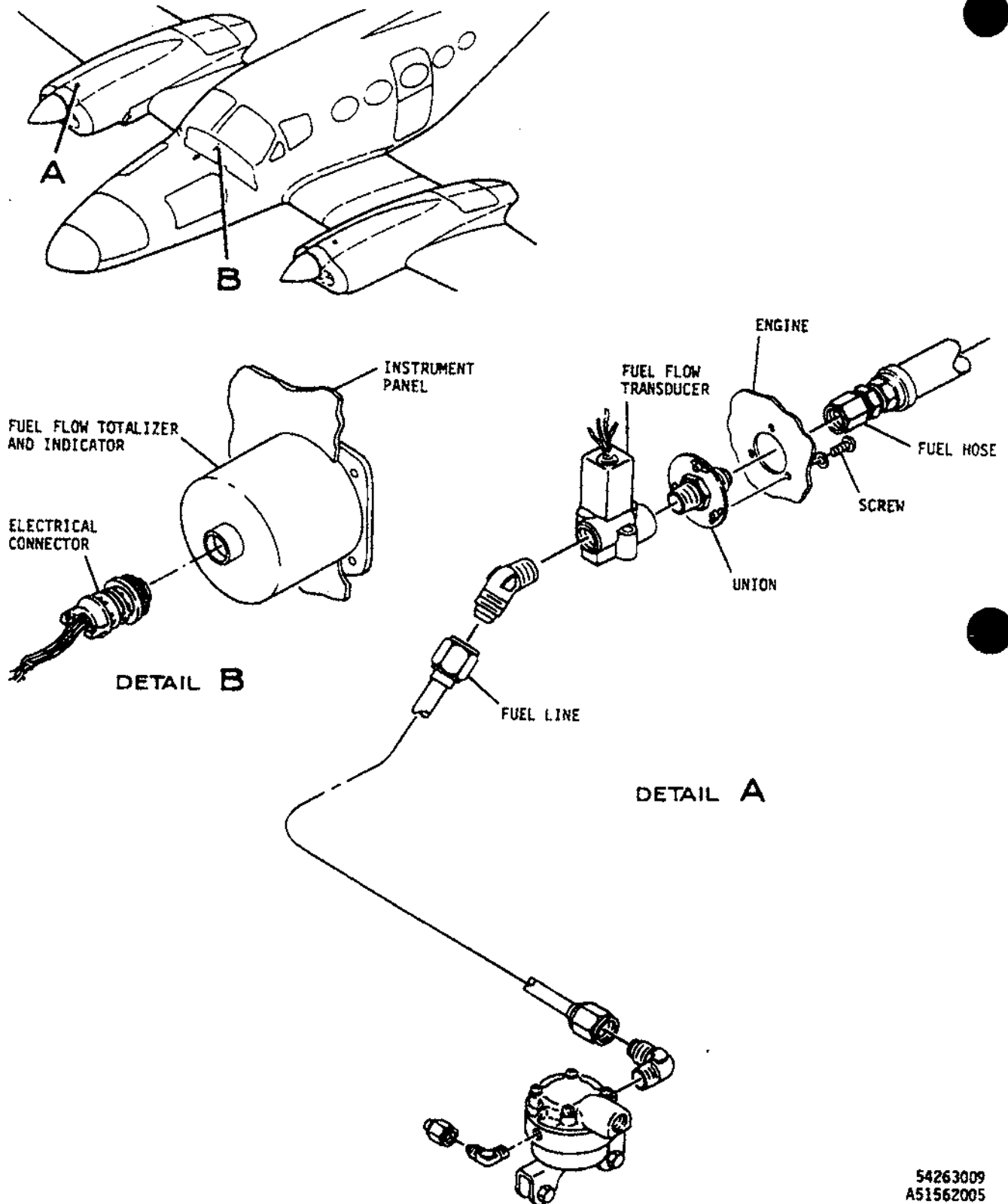
Engine Fuel System and Plumbing
Figure 7 (Sheet 2)

G51564003
F51564003
E51563019



Engine Fuel System and Plumbing
Figure 7 (sheet 3)

E51564007
E51562006
J51562006



Fuel Flow Totalizer and Indicator Installation
Figure 8

54263009
A51562005
B14161002

G. Purging Fuel Indicating System.

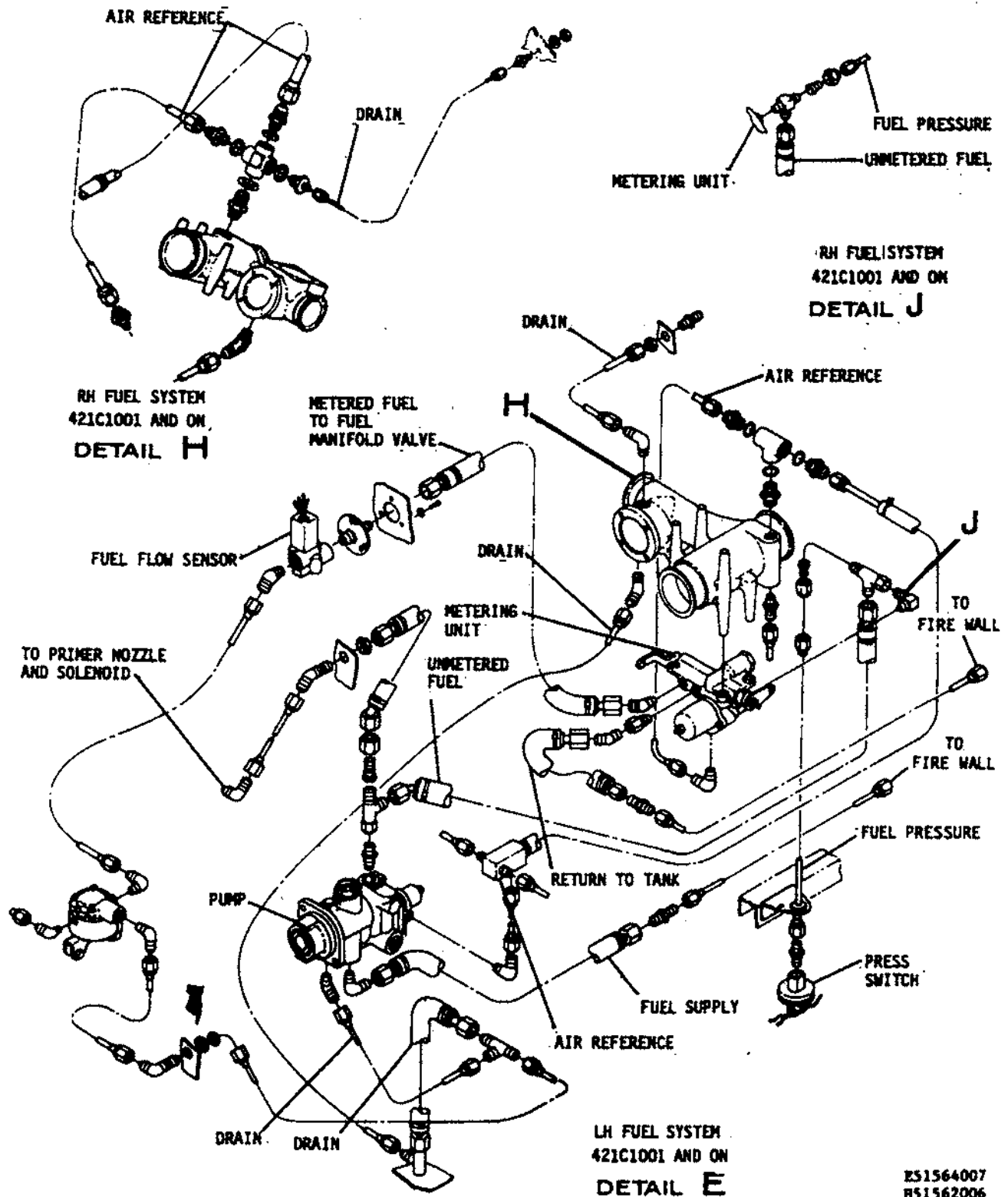
NOTE: Fuel pressure lines need to be bled any time the system is opened or if vapor lock occurs. The bleed lines are located on support next to glove box.

WARNING: CONSIDERABLE FUEL WILL RUN FROM THE CYLINDER HEAD DRAIN VALVES UNDER EACH NACELLE DURING PURGING PROCEDURES. AN APPROPRIATE CONTAINER MUST BE USED.

- (1) Place throttle levers full open and mixture levers full rich.
- (2) Remove caps from purging lines and operate auxiliary fuel pump until at least one pint of fuel has discharged from each purging line.
- (3) Install caps; tighten finger tight and back off one half turn.
- (4) Operate auxiliary fuel pump until all air has been dislodged from cap connection. Tighten cap with auxiliary fuel pump operating.
- (5) Turn auxiliary fuel pump OFF.

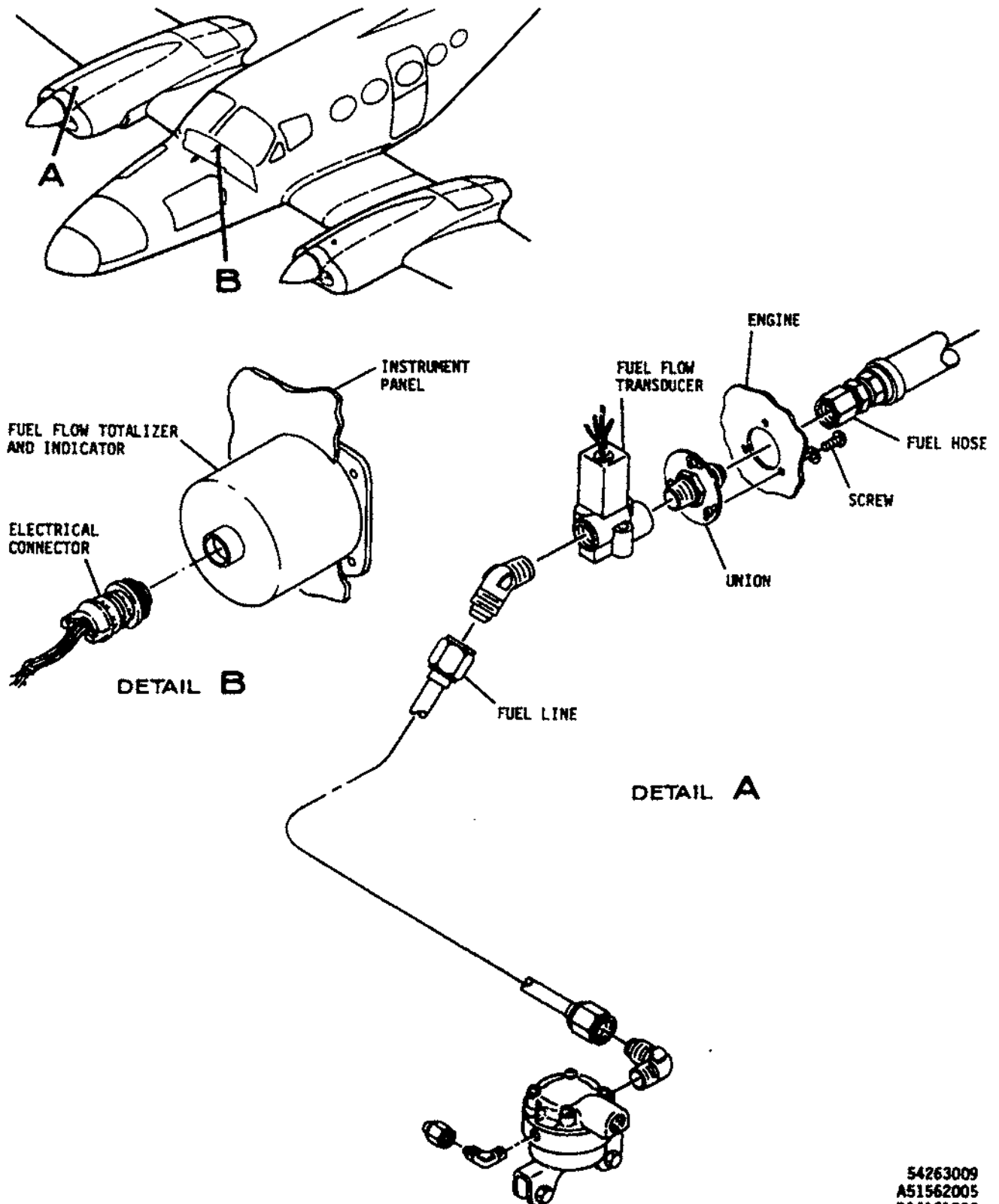
WARNING: DO NOT ATTEMPT TO START ENGINE UNTIL FUEL HAS COMPLETELY DRAINED FROM ENGINE CYLINDERS.

NOTE: If excessive fuel flow fluctuations are present, verify proper installation of snubbers.



Engine Fuel System and Plumbing
Figure 7 (sheet 3)

B51564007
B51562006
J51562006



Fuel Flow Totalizer and Indicator Installation
Figure 8

54263009
A51562005
B14161002

G. Purging Fuel Indicating System.

NOTE: Fuel pressure lines need to be bled any time the system is opened or if vapor lock occurs. The bleed lines are located on support next to glove box.

WARNING: CONSIDERABLE FUEL WILL RUN FROM THE CYLINDER HEAD DRAIN VALVES UNDER EACH NACELLE DURING PURGING PROCEDURES. AN APPROPRIATE CONTAINER MUST BE USED.

- (1) Place throttle levers full open and mixture levers full rich.
- (2) Remove caps from purging lines and operate auxiliary fuel pump until at least one pint of fuel has discharged from each purging line.
- (3) Install caps; tighten finger tight and back off one half turn.
- (4) Operate auxiliary fuel pump until all air has been dislodged from cap connection. Tighten cap with auxiliary fuel pump operating.
- (5) Turn auxiliary fuel pump OFF.

WARNING: DO NOT ATTEMPT TO START ENGINE UNTIL FUEL HAS COMPLETELY DRAINED FROM ENGINE CYLINDERS.

NOTE: If excessive fuel flow fluctuations are present, verify proper installation of snubbers.

ENGINE IGNITION SYSTEMDescription

1. The engine ignition system consists of the magneto, starting vibrator, ignition cables, and spark plugs. Ignition for the engine is provided by two Bendix Scintilla magnetos mounted on each engine.
2. A starting vibrator providing retarded ignition is used with the magneto for starting. The vibrator is electrically actuated by the starter switch during starting procedures.
3. Routed from the left magneto are six shielded, high-tension cables, with three to the upper spark plugs on the left bank of cylinders and three routed to the lower spark plugs on the right bank of cylinders. The right magneto and shielded, high-tension cables fire the lower spark plugs on the left bank of cylinders and the upper spark plugs on the right bank of cylinders.

Troubleshooting

1. For troubleshooting the engine ignition system, see Figure 1.

Adjustment/Test

1. Tools and Equipment

NOTE: Equivalent substitutes may be used for the following listed items:

Name	Number	Manufacturer	Use
Timing Light	11851	Bendix Electrical Components Div. Sidney, N.Y.	Point Gap Setting
Timing Kit	118501	Bendix Electrical Components Div. Sidney, N.Y.	Magneto Timing
Tester	118950	Bendix Electrical Components Div. Sidney, N.Y.	Testing High Tension Leads

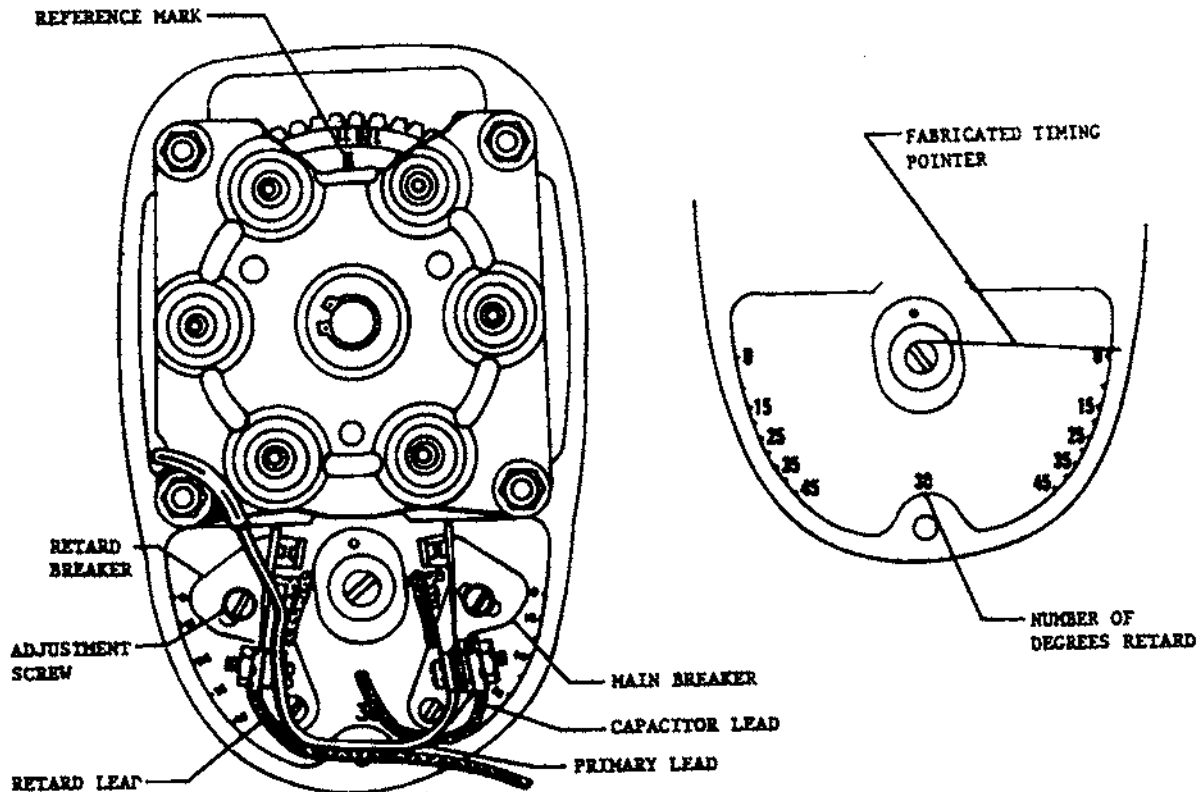
2. Internal Timing (See Figure 2)

- A. On each side of the breaker compartment there are timing marks. The marks on the left-hand side, viewed from the breaker compartment, are for clockwise rotation viewed from the drive end. The marks on the right-hand side are for counterclockwise rotation. The timing marks indicate "O" position, "E" gap, and various degrees of magneto retard. In addition to these marks, the cam has an indented line across its end for locating neutral position. The number of degrees retard for a particular magneto is stamped at the bottom of the breaker compartment.
- B. Turn rotor in direction of rotation until painted chamfered tooth of distributor gear is just becoming visible in timing window. Continue turning rotor of magneto until line on end of cam is aligned with neutral mark in housing.
- C. Fabricate a timing pointer from a piece of wire (approximately 2-1/2 inches) as follows:
 - (1) Remove the cam screw and flat washer from cam.
 - (2) Bend one end of wire around the threads of the screw, loose enough to allow wire to be rotated.
 - (3) At the outside diameter of the large washer, bend wire straight up parallel to the screw.

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Nov/75



Magneto Timing Adjustment
Figure 2

- (4) Install assembly on cam shaft and tighten screw just enough to hold wire in position and yet allowing it to be rotated.
- (5) At a height sufficient to clear breaker housing, make a right angle bend in the wire.

NOTE: Pointer should be over timing marks, but not touching the housing.

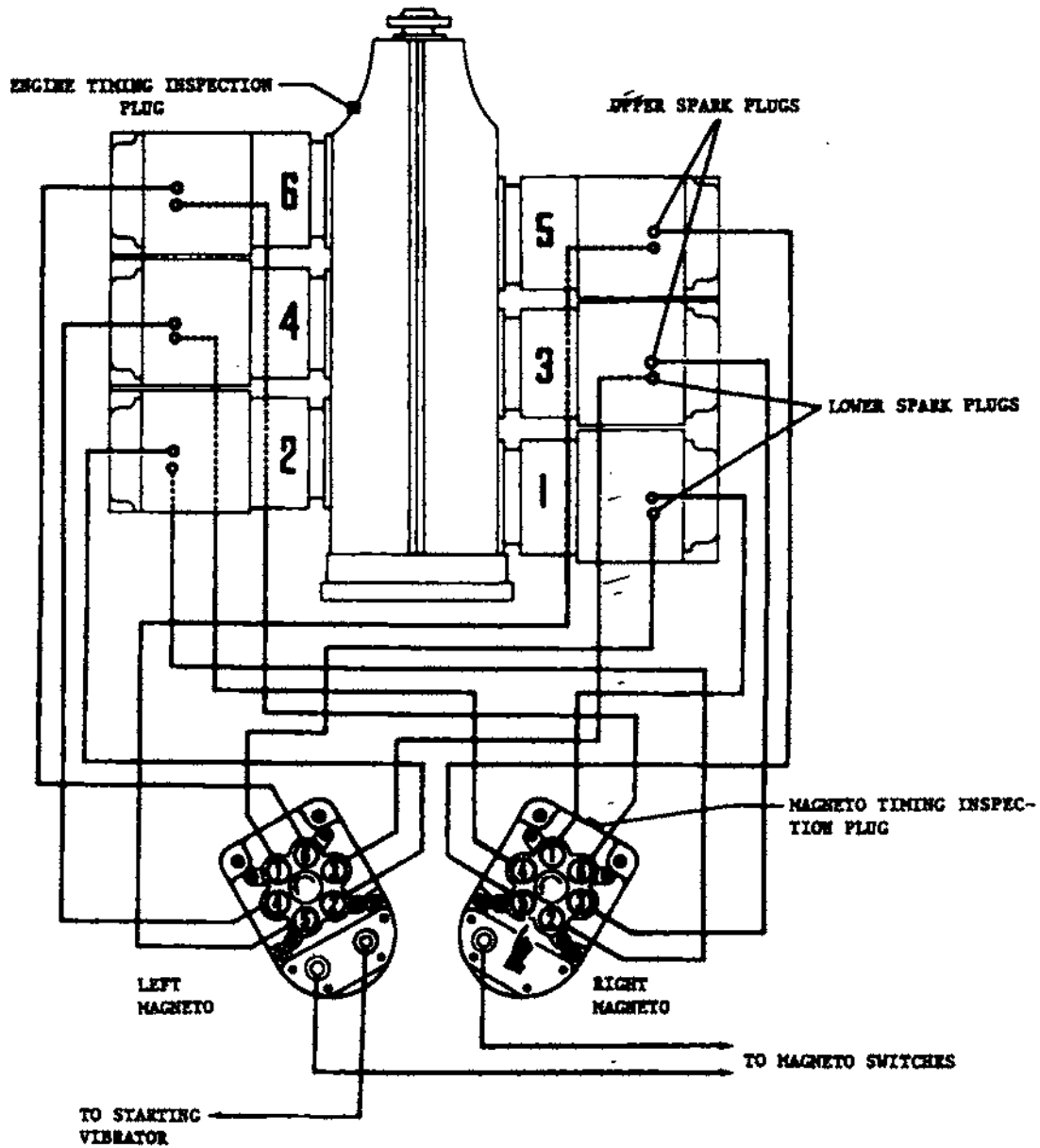
- D. On the retard breaker magnetos, it is necessary to set the retard breaker to open a predetermined number of degrees after the main breaker opens within $+2^\circ$, -0° . The number of degrees retard for a particular magneto is stamped at the bottom of the breaker compartment. After main breaker has been set to open a "E" gap $15^\circ \pm 2^\circ$ move pointer back until it is over the zero mark without moving rotor from its position where main breaker just opened.

NOTE: Extreme care must be taken not to move the rotor from the main breaker opening position when returning the pointer back to the zero mark.

- E. Turn rotor until pointer is over correct retard mark.

NOTE: When 24° retard is required on magnetos with cast in timing marks, advance pointer until it is over the 20° mark. Then rotate engine crankshaft until pointer is over the 45° mark. This will give a total of 24° retard.

- F. Using a timing light, adjust retard breaker contacts to open at this point. A tolerance of $1/16$ inch past the point can be used to get proper contact clearance. Continue rotating rotor until cam follower is on the high point of the lobe. Measure contact clearance. It should be 0.016 ± 0.003 . 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.



NOTE

NUMBER 1 CYLINDER
LEAD IS MARKED ON
MAGNETO CASE.

Ignition Cable Numbering
Figure 3

10581003

NOTE: Magneto timing to the engine must be rechecked after any replacement of contact breakers or gap adjustments.

Magneto timing should never be advanced beyond engine timing specifications.

- G. Certain magnetos may not incorporate timing marks in the breaker compartment. To check internal timing of these magnetos, install timing kit to breaker compartment and follow the procedure outlined in steps "C" through "F".

CAUTION: IF CAM SCREW WAS REMOVED FOR INSTALLATION OF POINTER, REPLACE FLAT WASHER, LOCKWASHER AND SCREW WITH NYLON PATCH SCREW. TORQUE TO 21-25 INCH-POUNDS. IF NYLON PATCH SCREW IS REMOVED AT ANY TIME ALWAYS REPLACE WITH A NEW SCREW AND TORQUE TO SPECIFIED VALUE.

Inspection/Check

1. Engine Ignition System Inspection/Check

- A. Remove engine cowling.
- B. Remove console side cover.

MAGNETOSDescription

1. The magneto installation on each engine consists of two magnetos, twelve ignition cables, two grounding leads and the associated starting vibrator wiring. The magneto is a completely self-contained unit.
2. Each magneto contains a rotating magnet turning on two ball bearings. One bearing is located on the drive end and the other is located on the breaker end. Dual breakers are actuated by one cam to allow the retard breaker contacts to open a predetermined number of degrees after the main breaker contacts open.

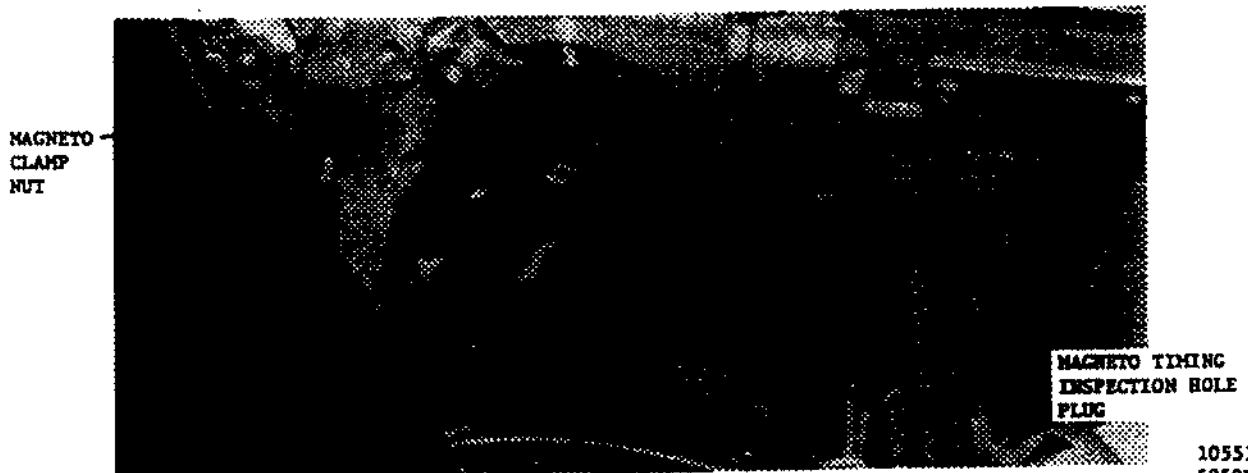
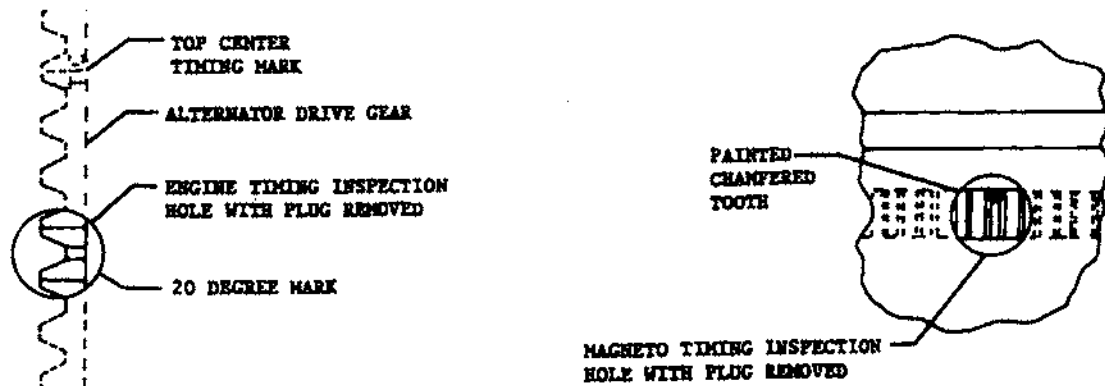
Maintenance Practices

1. Removal/Installation of Magnetos (See Figure 1)

NOTE: Procedures are the same for either magneto from either engine.

A. Remove Magneto.

- (1) Remove the engine cowl.
- (2) Remove induction air intercooler as follows:
 - (a) Remove clamp from induction air coupling at aft end of intercooler.
 - (b) Remove clamp from coupling at forward end of cooling air plenum.
 - (c) Disconnect manifold pressure line.
 - (d) Loosen clamps and slide hoses on the intake manifold tubes off the intake air plenum.
 - (e) Remove intercooler assembly.



Magneto Installation
Figure 1

10551008R
5850P6018

- (3) Remove magneto ground wire from magneto.

WARNING: THE MAGNETO IS IN A SWITCH ON POSITION WHEN THE SWITCH GROUND WIRE IS DISCONNECTED.

NOTE: When both magnetos are being removed, tag each ground wire for identification.

- (4) Detach the high tension outlet plate from the magneto to be removed.
 (5) Remove the two magneto flange clamp nuts, washers and clamps. Pull the magneto forward from the crankcase mounting pad.

NOTE: As the magneto flange clears the crankcase accessory hole, watch the rubber drive bushing and steel retainer in the gear hub to make sure they will not drop out.

B. Install Magneto.

NOTE: Check magneto and assure it is internally timed for left-hand drive rotation as viewed from the drive end.

- (1) Remove the timing inspection plug located on the side of the crankcase forward of number six cylinder.
- (2) Remove spark plug from number one cylinder.
- (3) Rotate the propeller by hand until the number one cylinder is on the compression stroke and the timing mark on the ring gear is visible through the crankcase timing inspection hole.
- (4) Turn magneto coupling until the painted chamfered tooth on the distributor gear is centered in the inspection hole and hold magneto in its approximate position during installation.
- (5) Set the magneto in place on the crankcase accessory pad.
- (6) Attach a timing light to magneto in accordance with internal timing procedures.
- (7) If timing light is extinguished, rotate magneto housing in direction of its magneto rotation a few degrees beyond point where light illuminates. Slowly rotate magneto in opposite direction until light is extinguished.
- (8) Tighten magneto clamp nuts, securing magneto to engine accessory case.

CAUTION: DO NOT ADJUST BREAKER POINTS TO COMPENSATE FOR IGNITION TIMING. BREAKER POINT ADJUSTMENT IS FOR INTERNAL MAGNETO TIMING ONLY.

- (9) Rotate propeller in opposite direction of normal rotation for a few degrees after light illuminates.
- (10) Rotate propeller in direction of normal rotation until light extinguishes. If timing mark is visible, through the crankcase timing inspection hole, when the light extinguishes the magneto is properly timed to the engines.
- (11) Repeat procedure for opposite magneto.
- (12) When ignition timing has been checked, assure magneto mounting clamps are tight.
- (13) Remove timing light from the magneto.
- (14) Install timing inspection hole plug and install high tension outlet plate on each magneto.

WARNING: MAGNETO IS IN A SWITCH ON POSITION WHEN THE SWITCH WIRE IS DISCONNECTED.

- (15) Install timing inspection hole plug on engine forward of number six cylinder.
- (16) Attach the magneto ground wire to magneto.

NOTE: Replace shield over vent opening if installed as recommended by engine manufacturer.

- (17) Install spark plug, previously removed from number one cylinder.
- (18) Install intercooler.
- (19) Connect manifold pressure line.
- (20) Install hoses on intake manifold and secure clamps.

- (21) Install clamp on coupling at forward end of plenum.
- (22) Install clamp at the aft end of plenum.
- (23) Install engine cowling.

NOTE: Refer to Magneto Overhaul Instruction Manual for repair information.

Inspection/Check

1. Magneto Inspection/Check

- A. Remove engine cowling.
- B. Remove high-tension outlet plate.

2. Inspection of Magnetos

NOTE: Any time the engine and propellers have been subjected to excessive roughness the magnetos should be removed for a drive coupling inspection.

- (1) Inspect the rubber drive bushings in drive gear hub for deformation and damage.

NOTE: If the magneto rubber in the drive bushings show signs of severe stress, inspect the quill shaft, alternator couplings, starter adapter drive gear and tachometer drive for galling, pitting or heavy wear distress. If parts are worn or fit couplings loosely, replace with new parts.

- (2) Remove the high-tension outlet plate and inspect contact points. The points should have a gray, frosty appearance. If burning or pitting is apparent, determine the cause and correct it before replacing the contact points. If the breaker contact points are oily, they can be cleaned with clean unleaded gasoline.

NOTE: Avoid getting any gasoline on the breaker felt as this will wash away the lubricant.

- (3) Check breaker contact point gap. Refer to Chapter 1-00, General Information.

Cleaning/Painting

1. Clean Magnetos

- A. Clean magnetos per Bendix Service Bulletin Number 612.

IGNITION CABLESDescription

1. The ignition harness for each engine consists of twelve shielded, high tension cable assemblies with attaching brackets. Six cables are routed from the left magneto, three routing to the upper spark plugs on the left bank of cylinders, three routing between number one and number three cylinders to the lower spark plugs on the right bank of cylinders. The remaining six cables are similarly routed from the right magneto, with three cables going to the upper spark plugs on the right bank of cylinders and the remaining three being routed between number two and number four cylinders to the lower left spark plugs.

Maintenance Practices

1. Removal/Installation Ignition Cables.

A. Remove Ignition Cables.

- (1) Remove engine cowlings.
- (2) Remove the cables from spark plug and withdraw the contactor from the spark plug barrel.
- (3) Loosen attaching clamps.
- (4) Remove screws which secure high tension plate to magnetos.
- (5) Remove the slotted-head screw and brass washer from plate grommet base which is in line with cable to be detached.
- (6) Withdraw cable.

B. Install Ignition Cable.

- (1) All cables can be installed in the same manner. If a new cable is being installed, check it for correct length by comparing it with the cable which is being replaced.

NOTE: Whenever spark plug cable terminal ends are withdrawn from plugs, inspect, clean and lubricate per Continental Engine Service Bulletin M80-4.

- (2) By using good ignition maintenance practices in addition to the Do's and Don'ts listed herein, the normal life expectancy of the harness can be reached. Avoid sloppy installation and maintenance to gain full harness service life. Don't let poor practices reduce reliability.

Do - Use the Bendix 11-8950 High-Tension Lead Tester to avoid unnecessary handling and replacement of leads.

Do - Route leads to avoid all contact with engine, engine components, oil lines, airframes, etc.

Don't - Allow leads to chafe on engine, engine components, oil lines, airframe, etc.

Do - Make necessary bends as gradual as possible. Keep leads straight wherever possible. Use an elbow clamp, screw and nut where a bend at the spark plug is required.

Don't - Make sharp bends or stretch leads.

Do - Torque spark plug coupling nuts accurately: 90-95 inch-pounds for 5/8" -24 nut and 110-120 inch-pounds for the 3/4" -20 coupling nut.

CAUTION: DON'T OVERTORQUE OR UNDERTORQUE SPARK PLUG COUPLING NUTS. ALWAYS USE A TORQUE WRENCH.

Do - Hold the hex-shaped crimped portion of the spark plug terminal ferrule with a open end wrench. This will prevent the ferrule from turning and twisting the lead while tightening or loosening the coupling nut. A four-inch open end type wrench is about the right size.

Don't - Allow the leads to twist while coupling. Twisting leads may rupture the insulating material.

Do - Use as many clamps and wire bundle ties as necessary. When in doubt, use another clamp or tie.

Do - Redress harnesses when engines are mounted in their nacelles to prevent chafing against airframe components, etc. Change nylon ties or clamps if they will hold better in a new position. Check harnesses, ties and clamps when other checks are being made on the engine.

Don't - Allow leads and wire bundles to hang loosely from their clamps. Don't allow leads to come near the exhaust manifold - keep them as far away as possible. Retighten or reposition clamps or ties if they are loosened for any reason.

Do - Check lead terminals, especially bottom cylinder plug terminals (which seem to run the hottest). The heat may cause the insulating sleeve of the plug terminal to stick in the barrel of the spark plug. If stuck, the insulating sleeve should be removed from the spark plug in such a manner as to protect the silicone insulation on the lead as much as possible. The insulating sleeve, which is readily replaceable, will receive most of any damage incurred during removal.

Don't - Bend and twist the spark plug lead until the insulation is damaged or cut by the edge of the terminal ferrule. Do not damage the 5mm high-tension wire by allowing a screwdriver blade or other sharp tool to pierce it.

Do - Remember to clean the spark plug well ceramic and terminal insulating sleeve. Clean with a cloth dampened in alcohol.

Don't - Touch the terminal insulating sleeve after washing.

Do - Use a high-temperature mold (MS-122 Fluorocarbon Spray, Miller-Stepenson Chemical Co., Inc., 16 Sugar Hollow Rd., Danbury, Connecticut), release on terminal sleeves and on grommets at the magneto cable outlet plates. This will help prevent the hotter running plug insulating sleeves from sticking.

Don't - Apply mold release to dirty plugs or insulating sleeves.

NOTE: During maintenance check, carefully inspect the silicone lead insulating between the braided conduit and insulating sleeve. Remove the elbow clamp, if installed, to facilitate this inspection. Any lead that is torn or cut must be replaced. A longitudinal or cross-shaped tear may be caused by spark plug leakage. This leakage usually causes a gray or black discoloration of the lead at the torn area.

- (3) Connect cable to high tension outlet by inserting cable end, with ferrule and coupling nut in place, through high tension cable outlet plate and into proper hole in outlet plate grommet.
- (4) Fasten cable in place with cable piercing screw and brass washer.

CAUTION: DO NOT OVERTIGHTEN SCREWS. AVOID BENDING THE LEAD OVER THE EDGE OF THE HARNESS FERRULE; THIS MAY RESULT IN CUTTING THE LEAD.

NOTE: Whenever a 3/4-20 spark plug is used, insure that the compression spring is fully seated in the ferrule counterbore. If this precaution is not observed, a "Z" or "S" shaped bend can occur in the lead when assembled to plug.

- (5) Attach high tension outlet plate, with cables in place, to magneto with four attaching screws.
- (6) Replace cable on proper spark plug.
- (7) Install the engine cowling removed.

Inspection/Check

1. Ignition Cable Inspection/Check

- A. Remove engine cowling.

Cleaning/Painting

1. Clean Ignition Cables

- A. The ignition cables should be wiped clean using a clean cloth and DC4 Silicone grease.

SPARK PLUGSDescription

1. There are two spark plugs in each cylinder. The spark plugs are 18mm short reach type and screw into heli-coil inserts in the cylinders. The spark plugs are shielded to prevent radio interference and have an internal resistor to provide longer gap life. An average life of 200 hours can be expected, however, this time will vary with operating conditions. The proper gap setting is .015 to .018 inches.

Maintenance Practices

1. Removal/Installation of Spark Plugs

- A. Remove Spark Plugs.

- (1) Remove engine cowling.
 - (2) Loosen coupling nut on spark plug ignition harness.
 - (3) Lift terminal sleeve out of spark plug shielding barrel well.

CAUTION: WHEN REMOVING TERMINAL SLEEVE FROM SPARK PLUG, USE EXTREME CARE TO KEEP THE CABLE TERMINAL SLEEVE STRAIGHT IN THE SHIELDING BARREL. ANY MISALIGNMENT COULD SCRATCH OR BREAK THE SLEEVE OR THE CERAMIC INSULATION IN THE SPARK PLUG, NECESSITATING REPLACEMENT OF EITHER OR BOTH.

- (4) Unscrew the spark plug from the cylinder using a deep socket wrench of suitable size. Make certain that the copper gasket is removed with the spark plug.

- B. Install Spark Plug as Follows:

- (1) To install a spark plug, first make certain the heli-coil insert in the cylinder is undamaged and that the old copper gasket was removed along with the spark plug.

NOTE: If there is any damage to the heli-coil insert, it should be replaced before installing a spark plug.

- (2) Apply anti-seize compound sparingly to spark plug threads, being careful not to allow any compound to get on the ground electrodes. A good practice is to leave the bottom two threads of the spark plug uncoated. The anti-seize compound is electrically conductive and any of this material on the electrodes would short out the spark plug.
 - (3) Install a new copper gasket and screw the spark plug into the cylinder. The plugs should be tightened to the specified torque, 330 $\pm$ 30 inch-pounds using a deep socket wrench with a torque indicating handle.

CAUTION: MAKE CERTAIN THAT THE SOCKET IS PROPERLY SEATED ON THE SPARK PLUG HEXAGON AS DAMAGE TO THE PLUG COULD RESULT IF THE WRENCH IS COCKED TO ONE SIDE WHEN PRESSURE IS APPLIED.

- (4) Install engine cowling.

Cleaning/Painting

1. Clean Spark Plugs

- A. Clean the spark plugs with an abrasive type cleaner. Refer to operating instructions furnished with cleaning unit.

Inspection/Check

1. Spark Plug Inspection/Check.

- A. Remove engine cowling.

CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL

ENGINE OIL SYSTEM

Description

1. The oil pressure system consists of a wet sump pressure lubricating system. Oil temperature in each engine is controlled by a thermally operated valve which either bypasses the oil around the external mounted cooler or routes it through the cooler passages for cooling. Drilled and bored internal passages route oil to all moving parts which require lubrication. Oil furnished to the propeller governor for propeller operation is also routed through internal passages. Engine oil is used externally for lubrication purposes on the engine turbocharger and for controlling the exhaust bypass valve. On 421C1001 and On, oil is routed through the fuel manifold valve to heat the fuel. Engine oil is filtered through an internally mounted sump screen and an externally mounted oil filter. A bypass valve will route the oil around the oil filter should it become clogged. Oil pressure is maintained by a spring-loaded pressure relief valve. The oil temperature bulb is located directly below the oil cooler. The bulb is heat variable and is attached to the oil temperature gage by electrical wiring.

Troubleshooting

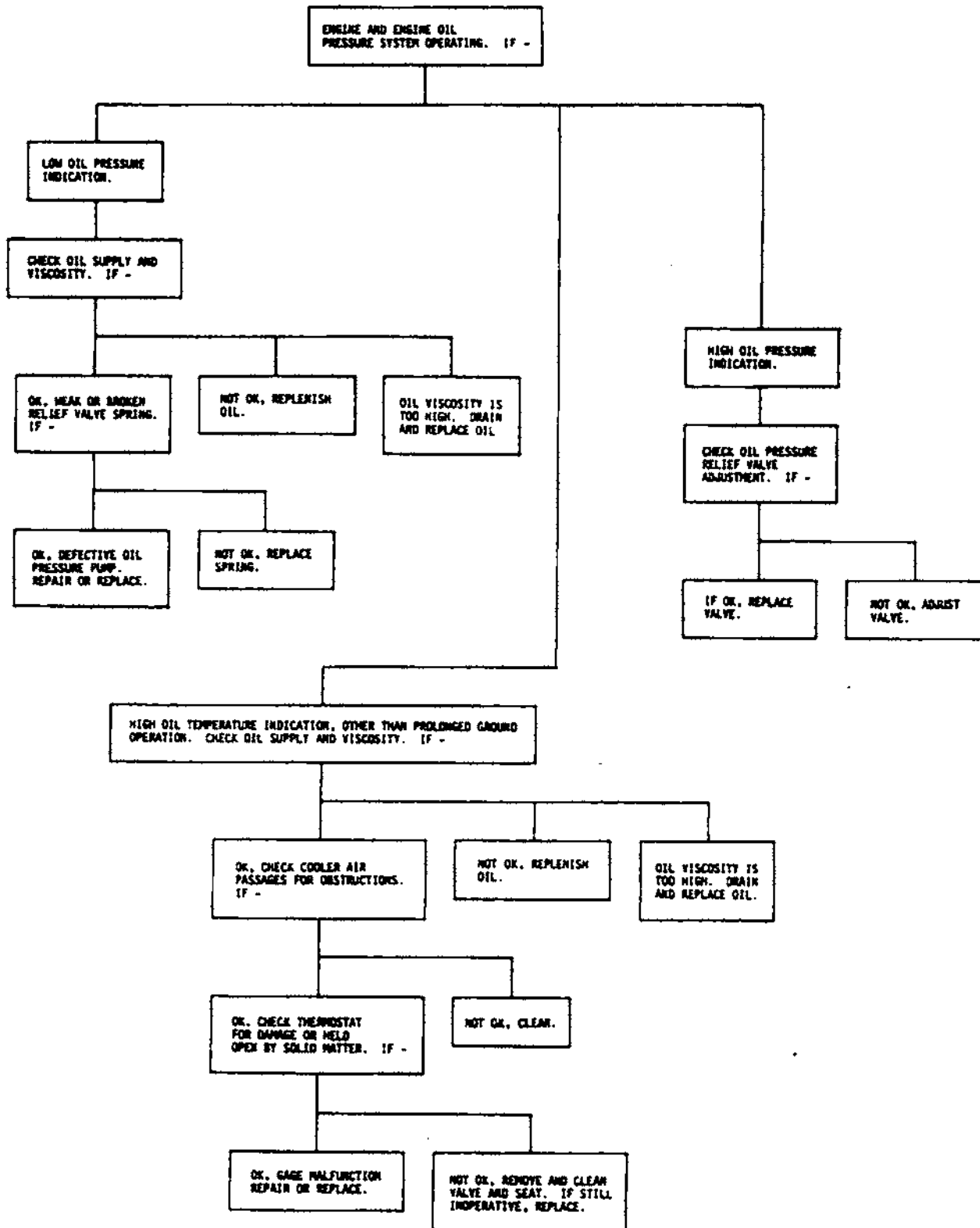
1. For troubleshooting the engine oil system, refer to Figure 1.

Adjustment/Test

1. Oil pressure relief valve adjustment (refer to Figure 2).
 - A. Adjust Oil Pressure.
 - (1) Start engines and allow engine to warm up. Refer to Pilot's Operating Handbook.
 - (2) Check oil pressure with engine operating 1700 RPM reading the engine gage on the instrument panel.
 - (3) If oil pressure is not 30 to 60 PSI, turn adjusting screw to obtain correct pressure. Turn in (CW) to increase pressure, turn out (CCW) to decrease pressure.

Inspection/Check

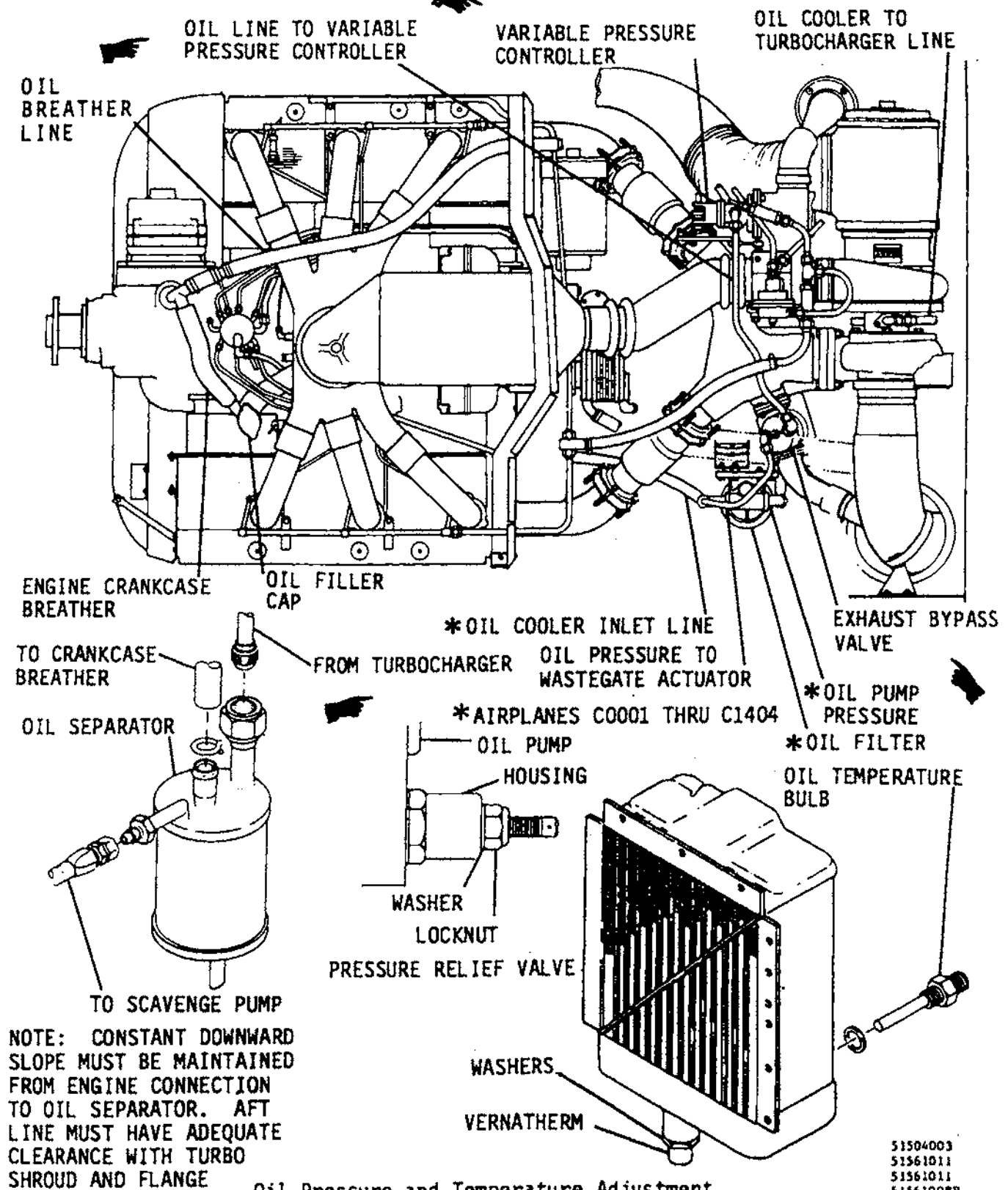
1. Inspection/Check of Engine Oil System.
 - A. Remove upper engine cowling.



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Troubleshooting Chart - Engine Oil System
Figure 1

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Oil Pressure and Temperature Adjustment
Figure 2

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51561011
51561008R

ENGINE OIL FILTERDescription

1. The engine oil filter is a full flow element type filter. A bypass valve will open should the element become clogged. Oil pressure opens the bypass valve, which is set at a predetermined pressure, so unfiltered oil will lubricate the engine and prevent oil starvation in the event the filter becomes clogged.

Maintenance Practices

1. Removal/Installation of Oil Filter (See Figure 1)

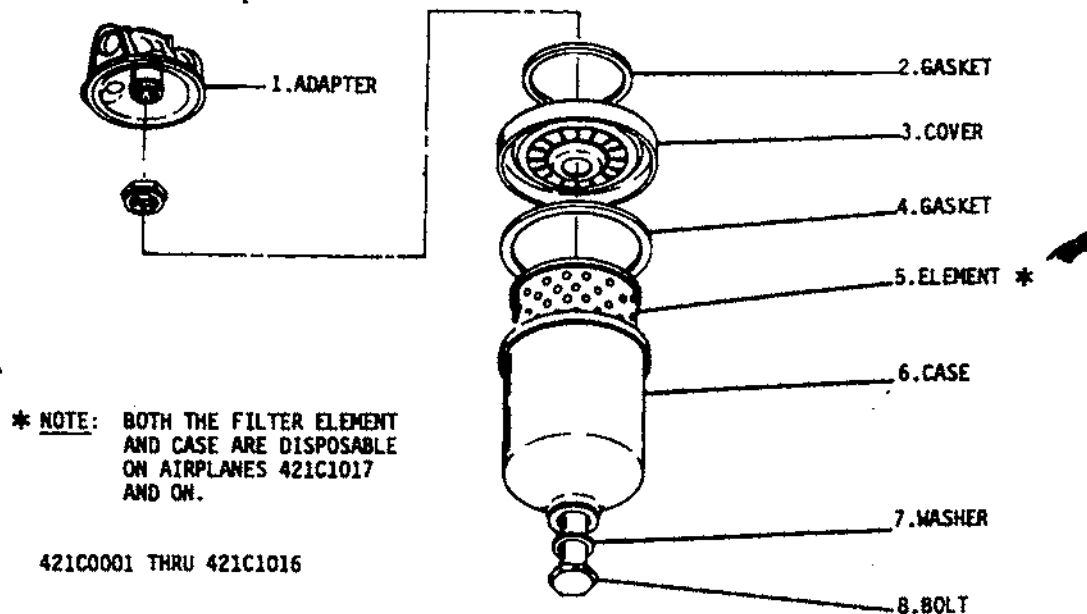
NOTE: Inspect and clean oil screen, if applicable, at each oil change. This fine mesh screen filters out carbon and other particles from the lubricating system. Oil filter should be opened and inspected for contaminants at each filter change by using a standard oil filter cutting tool which may be obtained locally. New engines frequently show widely dispersed metal flakes and lint on the first few oil changes. This should disappear after a few changes, but if large amounts of metal are apparent on any oil change, it is an indication of possible malfunction and should be investigated thoroughly.

A. Remove Oil Filter.

- (1) Remove upper engine cowl.
- (2) Cut safety wire on bolt (8).
- (3) Loosen bolt (8) and remove filter from adapter (1).
- (4) Remove and discard gasket (2).
- (5) Disassemble oil filter assembly as required.

B. Install Oil Filter.

- (1) Assemble bolt (8), washer (7), case (6), element (5), gasket (4) and cover (3) onto bolt (8).
- (2) Assemble new gasket (2) on cover (3), turn cover (3) so that it is facing downwards. If gasket (2) falls off, replace the gasket and repeat the test. If new gasket falls from cover (3), replace the cover.
- (3) Inspect the adapter gasket seat for possible gouges, excessive scratches, wrench marks or other types of mutilation. If defects are found, replace the adapter.



Oil Filter Installation
Figure 1

51561001

- (4) Inspect the threaded hole in the center of the adapter gasket seat. If the hole is off center more than .030 inch, replace the adapter.
- (5) Install the assembled oil filter on the adapter (1) but DO NOT allow the gasket (2) to make contact with gasket seat. Hold the oil filter assembly to prevent it from turning, torque the filter bolt (8) 15 to 18 foot-pounds (180 to 216 inch-pounds).

NOTE: If torque wrench is not available, tighten bolt 1-3/4 turns after gasket (2) snugs against the gasket seat.

- (6) Refill engine with proper grade and quantity of oil. Start engine and run for 5 minutes at 1000 RPM and check for leaks. After the engine has warmed properly, cycle through at least one high power setting.
- (7) If gasket (2) protrudes more than twice as much on one side as on the other, the gasket has become unseated during assembly. This condition indicates that either the cover or adapter are faulty and should be replaced.
- (8) Recheck filter bolt torque and safety wire the filter assembly.
- (9) Install upper engine cowl.

Inspection/Check

- 1. Oil Filter Inspection/Check.
 - A. Remove upper engine cowl.

ENGINE OIL INDICATING AND CYLINDER HEAD TEMPERATURE SYSTEMDescription

1. The engine oil and cylinder head temperature indicating system consists of the engine combination gage, oil temperature bulb, the cylinder head temperature thermocouple along with their associated lines and wiring. The oil temperature indicator is electrically operated, connected to a temperature bulb located in the bottom of the engine oil cooler. The cylinder head temperature indicator is operated from a thermocouple inserted in the bottom of number two cylinder of the respective engine. The engine oil pressure indicator is a direct reading PSI gage connected to the engine oil pressure system.

Maintenance Practices

1. Removal/Installation of Oil Pressure Indicating System (See Figure 1)

- A. Remove Oil Pressure Indicating System.

NOTE: Cap all openings and lines on removal.

- (1) Remove engine cowling.
 - (2) Disconnect oil pressure hose (2) from indicator (1) and fitting in support bracket (3).
 - (3) Disconnect cabin oil pressure line (4) at support bracket (3) and fuselage skin fitting.
 - (4) Disconnect stub wing oil pressure line (5) at fuselage skin fitting and wing gap fitting.
 - (5) Disconnect wing oil pressure line (6) and nacelle oil pressure line (7).
 - (6) Remove indicator in accordance with typical instrument removal, Chapter 10.

- B. Install Oil Pressure Indicating System.

- (1) Connect nacelle oil pressure line (7) and wing oil pressure line (6).
 - (2) Connect stub wing oil pressure line (5) at wing gap fitting and fuselage skin fitting.
 - (3) Connect cabin oil pressure line (4) at support bracket (3) and fuselage skin fitting.
 - (4) Connect oil pressure hose (2) at fitting in support bracket (3).
 - (5) Install indicator (1) in accordance with installation procedures Chapter 10.
 - (6) Connect oil pressure hose (2) to indicator (1).
 - (7) Install engine cowling.
 - (8) Anytime the oil pressure indicating system has been removed or repairs have been made, the oil pressure indication system should be bled as follows:
 - (a) With all connections tight, start engine and allow time for the engine oil pump to fill the oil pressure lines.
 - (b) After a positive indication has been noted, loosen the hose fitting on the rear of indicator (1) and allow a few drops of oil to leak from the fitting into a clean rag. This will bleed the trapped air from the lines and provide an accurate oil pressure indication.

2. Removal/Installation of Oil Temperature Indicating System (See Figure 1)

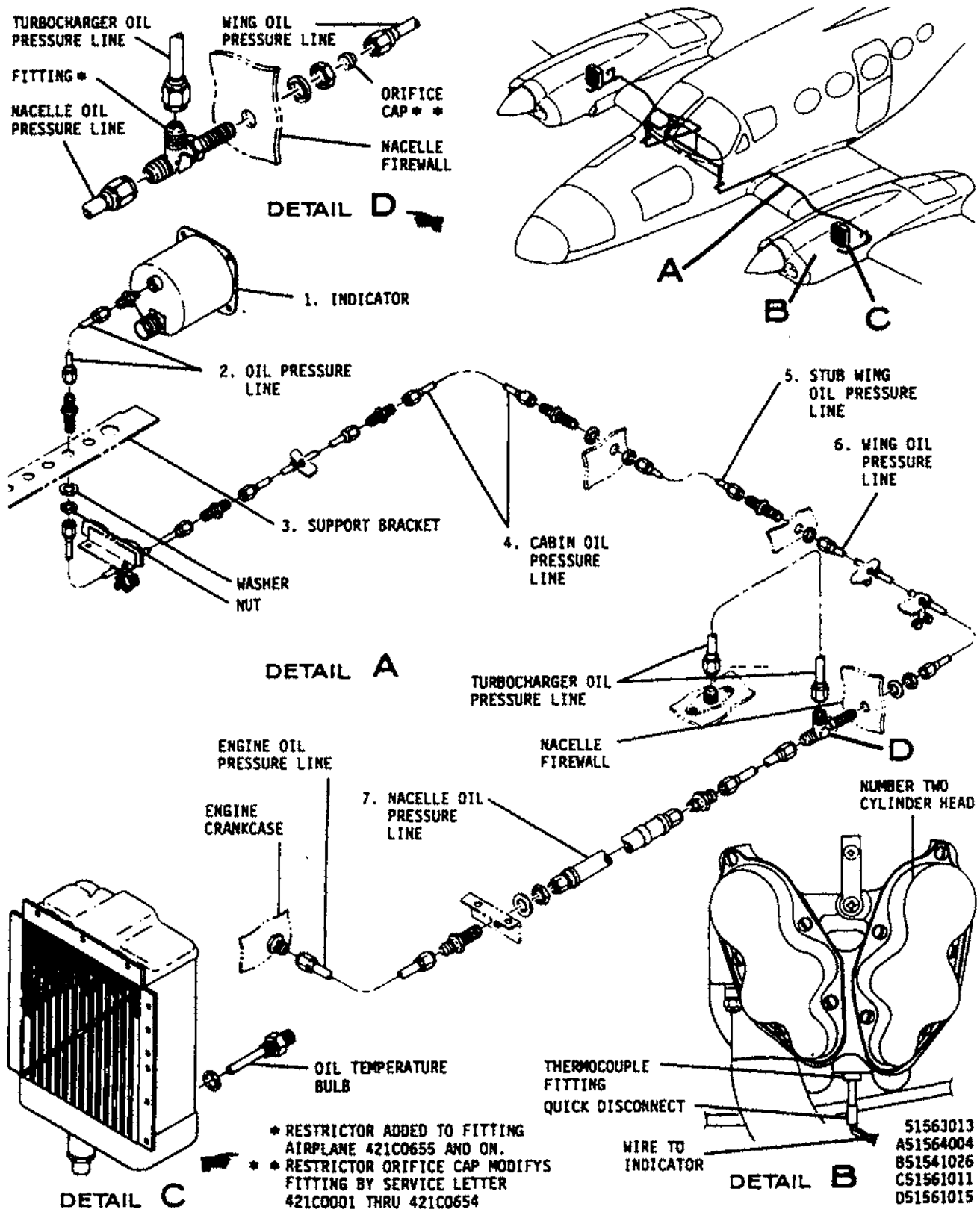
- A. Remove Oil Temperature Indicating System.

NOTE: Cap all openings and lines on removal.

- (1) Remove engine cowling.
 - (2) Disconnect electrical connector from temperature bulb located on underside of oil cooler.

CAUTION: PLACE CONTAINER OR RAGS UNDER OIL COOLER TO PREVENT OIL DRIPPING IN ENGINE NACELLE.

- (3) Loosen oil temperature bulb and remove from oil cooler.
 - (4) Remove wiring from engine wire bundle.
 - (5) Remove indicator in accordance with typical instrument removal, Chapter 10.



Engine Oil Indicating and Cylinder Head Temperature System
Figure 1

B. Install Oil Temperature Indicating System.

- (1) Install indicator in accordance with typical instrument installation procedures, Chapter 10.
- (2) Route wires from indicator to engine nacelle and secure to engine wire bundle.
- (3) Seal wire bundle at fuselage skin in accordance with electrical sealing procedures, Chapter 1.
- (4) Remove plug and install oil temperature bulb in oil cooler.
- (5) Connect electrical connector to oil temperature bulb.
- (6) Install engine cowling.
- (7) Perform engine operational check.

3. Removal/Installation of Cylinder Head Temperature Indicating System (See Figure 1)

A. Remove Cylinder Head Temperature Indicating System.

- (1) Remove engine cowling.
- (2) Disconnect quick-disconnect on the lower side of number two cylinder on the engine.

NOTE: Cap all fitting openings on removal of fittings.

- (3) Loosen thermocouple fitting from lower side of number two cylinder and remove.
- (4) Remove thermocouple wire from engine wire bundle.
- (5) Remove indicator in accordance with typical instrument removal, Chapter 10.

B. Install Cylinder Head Temperature Indicating System.

- (1) Install indicator in accordance with typical instrument installation procedures, Chapter 10.
- (2) Route wires from indicator to engine nacelle and secure to engine wire bundle.
- (3) Seal wire bundle at fuselage skin in accordance with electrical sealing procedure, Chapter 1.
- (4) Remove cap and install thermocouple fitting in lower side of number two cylinder head.
- (5) Connect quick-disconnect.
- (6) Install engine cowling.
- (7) Perform engine operational check.

Inspection/Check

1. Inspection/Check of Oil Indicating and Cylinder Head Temperature Indicating System.

- A. Remove Upholstery side panel.
- B. Remove necessary access plates and wing gap cover.
- C. Remove upper engine cowling.

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INDUCTION AIR SYSTEM

Description

1. The engine air induction system consists of the ram air duct located on the inboard side of the nacelles, the air canister and filter assembly and turbocharger compressor portion. The air canister and filter is connected to the ram air duct on the inlet side and the turbocharger inlet on the outlet side. A magnetically controlled alternate air incorporated in the air canister and filter assembly permits the turbocharger compressor suction to open and admit alternate air if the air induction system becomes obstructed. A manually controlled alternate air valve permits the pilot to select alternate (heated engine compartment) air should the induction air system become obstructed and the automatic system fails to operate. The turbocharger is exhaust driven and automatically controlled by the variable pressure controller. Each bank of cylinders is connected to an overboard drain valve located on the lower forward nacelle skin. The drain valve allows raw fuel to drain from the cylinder heads during periods of engine shut-down, yet prevents induction leaks during engine operation.

Troubleshooting

1. For troubleshooting the engine induction air system, refer to Figure 1.

Adjustment/Check

1. Alternate Air Control Valve Adjustment
 - A. Rig alternate air control valve as follows:
 - (1) Position alternate air control valve to CLOSE.
 - (2) Adjust travel of alternate air control valve by loosening jam nut and increasing or decreasing length of cable.
 - (3) Position door to OPEN.
 - (4) Check the extension of alternate air control handle for not more than 3.00 inches of travel from control pedestal.
 2. Variable Pressure Controller Adjustment. Refer to Figure 3.
 - A. The variable absolute pressure controller may be adjusted as much as 2" Hg. increase or decrease in the high pressure setting by the following procedure and not change the low stop setting more than 1 Hg. from its nominal setting while maintaining the 30, +2, -2 degrees alpha angle.

NOTE: The alpha angle is the degree of travel of the cam starting with the cam arm against the high setting stop pin to where cam disengages the cam follower.
 - B. Adjust linkage as follows:
 - (1) Remove engine cowl in accordance with removal procedures.
 - (2) Make sure controller mounting screws, fittings and lines are torqued properly.
 - (3) With the corresponding throttle lever against the full open cushion force, verify that the throttle valve shaft stop rests solidly against the pin on the throttle body.
 - (4) The throttle linkage adjustment nut must be adjusted to provide a clearance of 0.015 to 0.025 inch between the nut and the link rod end with the cam arm in solid contact against the high setting controller stop.

NOTE: The above settings must be carried out with the throttle lever in contact with the quadrant full open stop against the cushion force.
 - B. High Pressure Settings.
 - (1) After adequate engine warm up with oil temperature at upper third of green arc, accelerate the engine gradually to maximum RPM. Manifold pressure at maximum RPM should be 39.0, +0.5, -0.5 in. Hg.

CAUTION: DISCONTINUE ACCELERATION IF MANIFOLD PRESSURE EXCEEDS 40.0 HG.

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- (2) If a maximum manifold pressure does not conform with the limits defined above, reduce power to idle and loosen the high setting screw lock nut. Hold the screw while loosening the lock nut to prevent change of setting.
- (3) When adjusting, the fork and pin arrangement should be turned in the direction of the markings stamped at the edge of the cam arm, UP to increase manifold pressure and DN to decrease manifold pressure. Approximately one turn of the adjusting screw should provide a 1-inch Hg. variation of manifold pressure.
- (4) Repeat adjustments as required to obtain a setting within the limits specified in step (3) with the high setting screw lock nut properly tightened. Shut down engine.

C. Low Pressure Setting.

- (1) Align the index marks on the side of the cam arm and edge of cast bearing support by moving the engine throttle lever. Tighten the control quadrant friction knob to prevent control movement.
- (2) Loosen the low pressure setting screw lock nut and adjust the screw so that the cam needle bearing just starts to contact the cam follower. This can best be determined by rotating the needle bearing with the fingers to detect the point of initial drag. Tighten the low setting screw lock nut.

D. Low Pressure Setting and Cam Angle Verification Procedure.

In order to establish an adequate low pressure adjustment, the following ground and flight tests must be conducted.

- (1) Ground Test.
After completion of the adjustment defined by the high pressure setting and low pressure setting, connect a standard dual manifold pressure gauge to the test ports provided at the corresponding compressor discharge connections of the fuel flow gauge. This test gauge provides compressor discharge pressure readings required on the following verification tests:
 - (a) Start the engine and after adequate warm up, adjust the propeller control to maintain a constant 1800 RPM during the following verification.
 - (b) With the manifold pressure setting at 29.0 inches Hg. the compressor discharge pressure should read 32.4, +0.5, -0.5 inches Hg.
 - (c) With the manifold pressure setting at 26.0 inches Hg. the compressor discharge pressure should read 31.9, +0.5, -0.5 inches Hg.

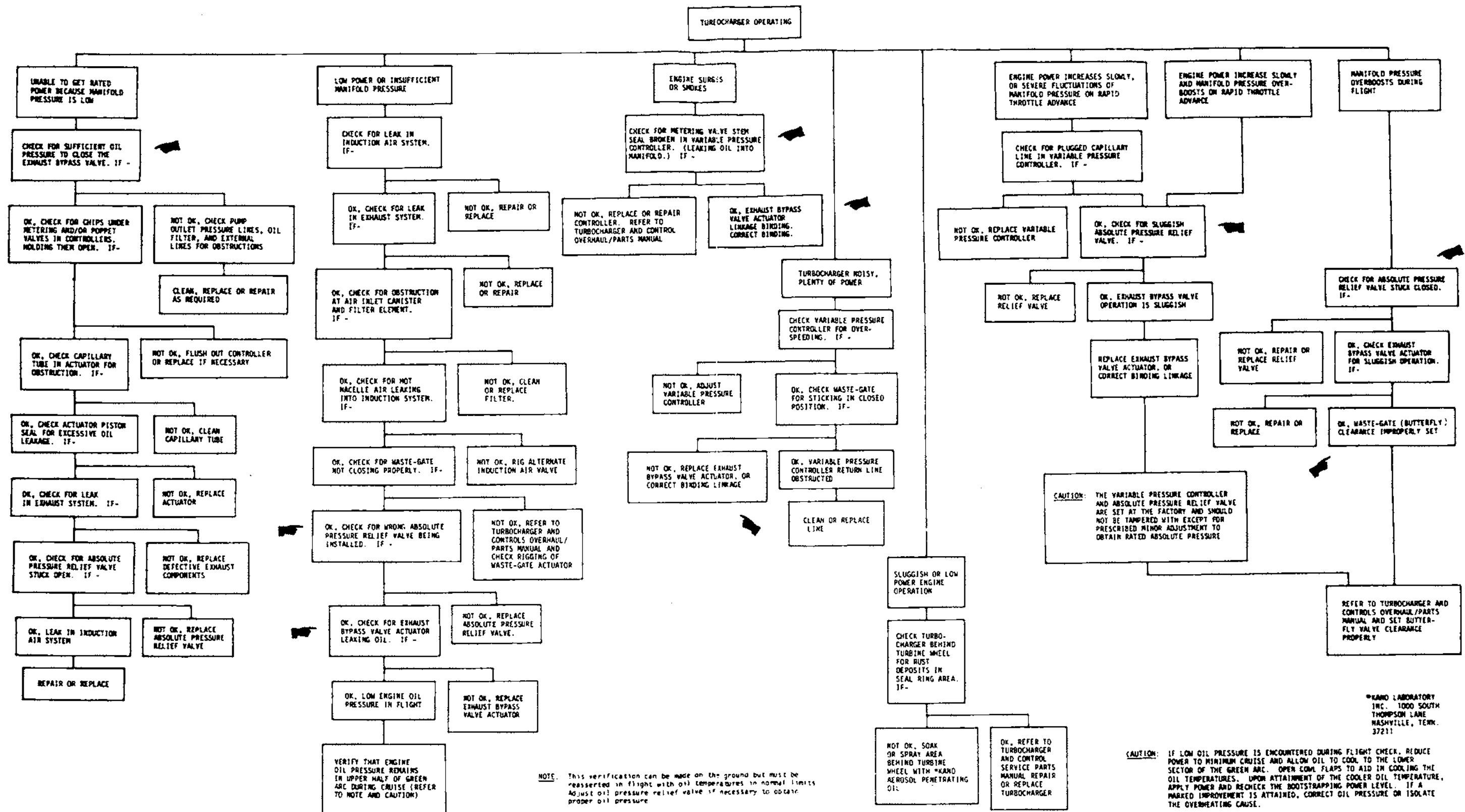
NOTE: To attain the above manifold pressure settings it will be necessary to adjust the throttle control along with the propeller control.

 - (d) (Refer to Figure 3.) To increase compressor discharge pressure, loosen the low pressure setting screw lock nut and turn screw clockwise as shown. To decrease compressor discharge pressure, turn counterclockwise. Tighten lock nut holding adjusting screw stationary after adjustment.
- (2) Flight Check.
 - (a) The dual pressure test gauge must be connected to the right-hand and left-hand compressor discharge pressure connections at the fuel flow gauge test ports during the flight tests.
 - (b) Flight verification for the low pressure adjustment to be conducted at a pressure altitude of 11,000 feet and at 1900 RPM. Adjust the throttle to a manifold pressure of 23.0 inches Hg. and the corresponding compressor discharge pressure should be 31.8, +0.3, -0.3 inches Hg. Readjust throttle to obtain a manifold pressure of 26.0 inches Hg. and the corresponding compressor discharge pressure should be 32.3, +0.3, -0.3 inches Hg.
 - (c) After low setting flight verification is complete, remove compressor discharge pressure test gauge and reinstall caps.

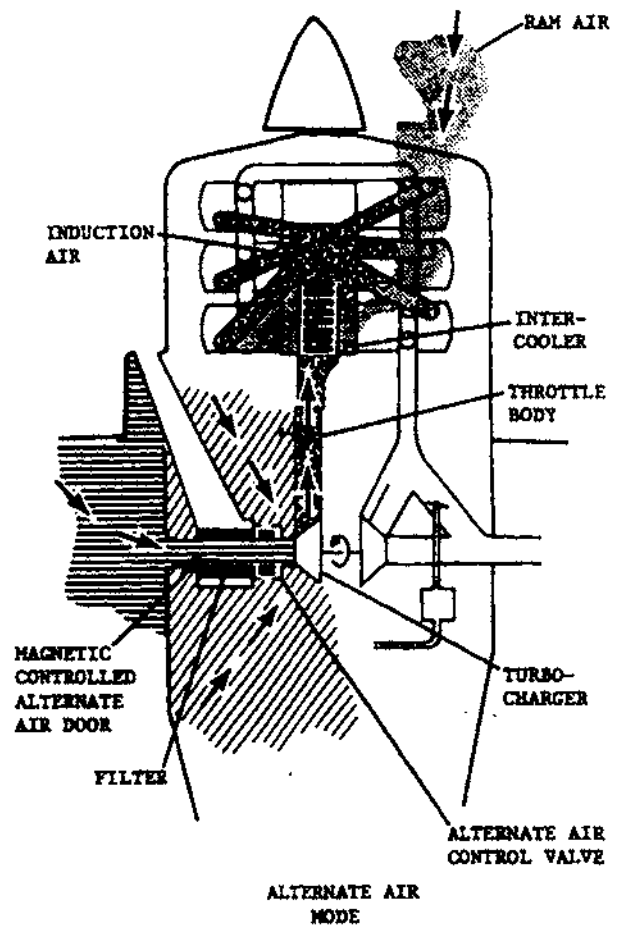
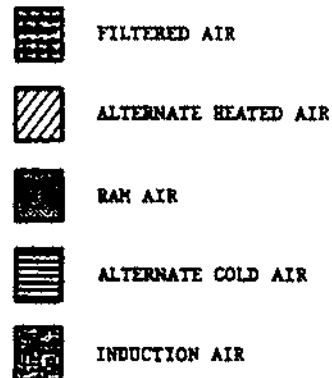
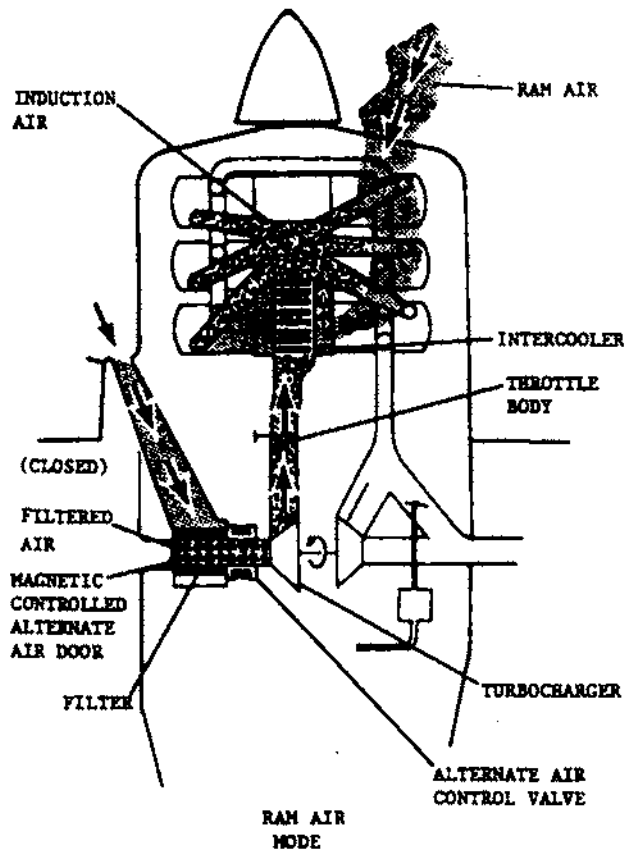
3. Exhaust Bypass Valve Assembly Adjustment

- A. Refer to Garrett Turbocharger and Control Overhaul/Parts Manual for adjustment of exhaust bypass valve assembly.

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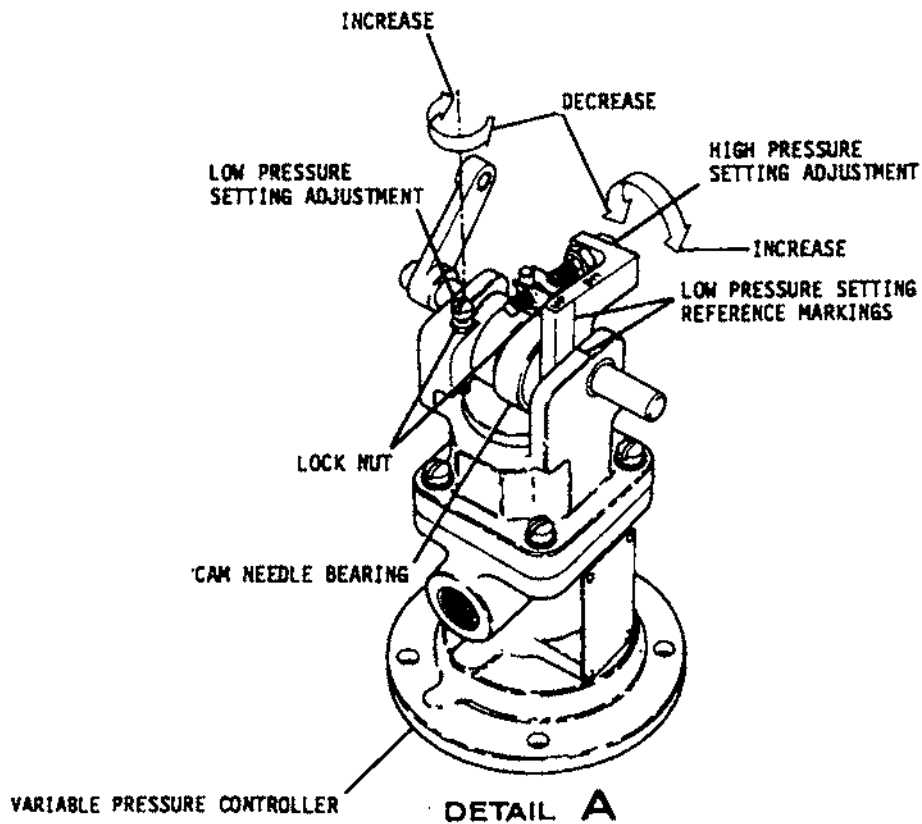
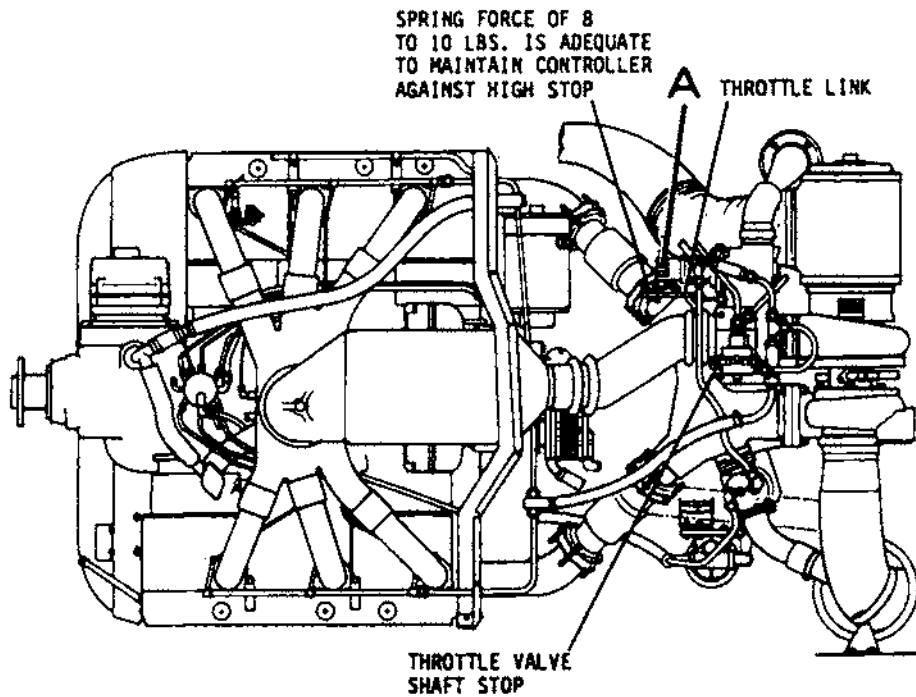
Engine Induction Air System Troubleshooting Chart
Figure 1



Induction Air Schematic
Figure 2

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Variable Pressure Controller Adjustment
Figure 3

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4. Checking Turbine Shaft Drag.

- A. Excessive turbine shaft drag can be verified by manually rotating the compressor wheel through the air filter opening. This shaft drag is caused by the formation of rust deposits in the area of the turbine shaft piston ring area as a result of water vapor accumulation. Though not detrimental to the integrity of the turbocharger, these deposits may momentarily restrict or impede rotation of the turbine assembly, resulting in sluggish or low-power engine operation. Where this condition exists, the turbine shaft can be freed by the method described as follows:

- (1) Remove the overboard exhaust stack and liberally spray the area behind the turbine wheel with the following approved or equivalent penetrating oil: Kano Aerokroi (Kano Laboratories, 1000 S. Thompson Lane, Nashville, Tennessee 37211).
- (2) After a soaking period of not less than 10 minutes, turn the turbine by hand. Lightly tapping the shaft end with a soft mallet may be required to free the shaft in the most severe cases.
- (3) Once the shaft is free, reinstall the overboard exhaust stack and conduct an engine power check to confirm proper turbocharger output.

NOTE: The above turbine shaft drag problem concerns only formation of rust deposits in new or low-time turbochargers, those in which combustion products have not yet formed a protective coating on seal surfaces. This problem should not be confused with turbine shaft binding caused by excessive internal coking, which can occur on high-time turbochargers. Units which are binding after a long time in-service must be removed for cleaning or replacement. Turbocharger coke removal procedures are given in the Cessna Turbocharger and Controls Overhaul/Parts Manual.

5. Turbocharger and Variable Pressure Controller Flight Check.

- A. The flight check procedure details the method of checking the turbocharger and variable pressure controller. This procedure is to be used for aircraft suspected of improper turbocharger operation as an aid to properly diagnose the discrepancy. To aid in recording the necessary flight readings, a sample form, as shown in Figure 5 is provided. This sample form or one with similar content, should be used in conjunction with the operational flight check procedures. To determine at which condition bootstrapping is most likely to occur, refer to Bootstrapping Tolerance Chart in Figure 4.

- (1) Takeoff - Variable Pressure Controller.
 - (a) Cowl Flaps - OPEN.
 - (b) Airspeed - 104 KIAS.
 - (c) Oil Temperature Upper 1/3 of green arc.
 - (d) RPM 2220 to 2235.
 - (e) Fuel Flow - Full Rich.
 - (f) Full Throttle M.P. (manifold pressure) - 39.0, +0.5, -0.5 Hg.
- (2) Climb - Variable Pressure Controller.
 - (a) Cowl Flaps - OPEN.
 - (b) Airspeed - 104 KIAS.
 - (c) Pressure Altitude - 16,000 Feet.
 - (d) RPM - 2220 to 2235.
 - (e) Fuel Flow - Full Rich.
 - (f) Full Throttle M.P. - 39.0, +0.5, -0.5 Hg.
- (3) Climb - Absolute Pressure Relief Valve.
 - (a) Cowl Flaps - OPEN.
 - (b) Airspeed - 104 KIAS.
 - (c) Pressure Altitude - 16,000 Feet.
 - (d) RPM - 2220 to 2235.
 - (e) Fuel Flow - Full Rich.
 - (f) Throttle - (One Engine at a Time).
 - (g) Idle until M.P. stabilizes.
 - (h) Rapidly advance to full throttle.
 - (i) Engine should not overboost by more than 4 Hg.

- (4) Cruise - Bootstrapping Determination.
- (a) Cowl Flaps - CLOSED.
 - (b) Airspeed - Level Flight.
 - (c) Pressure Altitude - 23,000 Feet.
 - (d) RPM - 2200 RPM.
 - (e) Fuel Flow - Lean.
 - (f) Throttle - 30 In. Hg.
 - (g) Prop Control - (One Engine at a Time).
 - 1) Slowly decrease RPM until M.P. drop indicates waste-gate is closed.
 - 2) The M.P., RPM, OAT at the instant of waste-gate closing should be recorded.
 - 3) The actual power being developed should be less than 60% power.
 - 4) RPM - Increase 50 RPM.
 - 5) Mixture - Normal Lean.
 - 6) Engine should not bootstrap.

Inspection/Check

1. Inspection/Check of Induction Air System

- A. Remove upper engine cowl.
- B. Remove induction air filter element.

Cleaning

1. Cleaning Induction Air Filter

- A. Tools/Equipment.

NOTE: An equivalent substitute may be used in place of the following listed item:

Name	Number	Manufacturer	Use
Filter Cleaner	DI400	Donaldson Company, Inc. Minneapolis, MN	Clean air filters.

NOTE: Under extremely dusty conditions, daily maintenance of the filters is recommended.

CAUTION: AIRPLANE ENGINE FILTERS ARE A DRY FILTER - DO NOT USE OIL.

B. Clean the filter as follows:

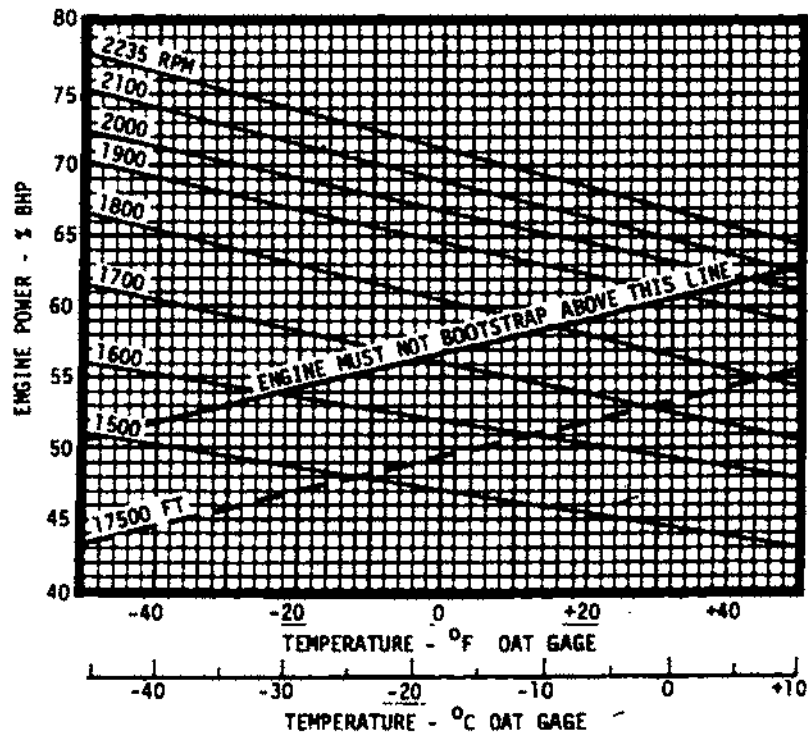
- (1) METHOD #1 - Direct dry compressed air up and down the pleats of the panel filter the opposite direction of the normal airflow until clean.

CAUTION: AIR PRESSURE AT NOZZLE MUST NOT EXCEED 100 PSI. MAINTAIN REASONABLE DISTANCE BETWEEN NOZZLE AND PANEL FILTER.

- (2) METHOD #2 - Wash in Donaldson DI400 filter cleaner or equivalent detergent. First follow procedure in Step 1 then soak panel filter in solution following directions on carton. Rinse and dry. DI400 is especially compounded to remove dust, carbon and oil particles from filter elements.

CAUTION: FILTER SHOULD BE REPLACED IF, WHEN HOLDING A LIGHT BEHIND IT, HOLES IN THE MEDIA ARE APPARENT.

BOOTSTRAP LIMIT
23000 FEET
30 IN. HG. MANIFOLD PRESSURE
AIRSPEED - 140 KIAS



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Bootstrapping Tolerance Chart
Figure 4

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6 LEVEL OFF 23,000 FT

COWL FLAPS - OPEN

1. Perform Controller Operation Flight Check Procedure Step 4.

5 CLIMB 20,000 FT

SET THROTTLE MAX RPM
MIXTURE - RICH (USE
PLACARD FUEL FLOW,
BLUE ARC)
COWL FLAPS - OPEN
CLIMB SPEED - 104 KIAS
CAUTION
SEE M.P. OPERATIONS
LIMITATIONS PLACARD
ABOVE 20,000 FT.

READINGS AT 23,000 FT.

OAT _____

M.P. Number 1 _____ In. RPM Number 1 _____ Fuel Flow _____ Lbs/Hr
M.P. Number 2 _____ In. RPM Number 2 _____ Fuel Flow _____ Lbs/Hr

4 CLIMB 16,000 FT

M.P. 39.0 IN. HG.
FULL RPM
MIXTURE - RICH
COWL FLAPS - OPEN
CLIMB SPEED - 104 KIAS

1. Observe manifold pressure at 16,000 ft. If 39.0 in. Hg. is available, variable pressure controller is functioning properly.
2. If 39.0 in. Hg. is not available, the absolute pressure relief valve is popping open too soon.

READINGS AT 16,000 FT.

OAT _____

M.P. Number 1 _____ In. RPM Number 1 _____ Fuel Flow _____ Lbs/Hr
M.P. Number 2 _____ In. RPM Number 2 _____ Fuel Flow _____ Lbs/Hr

3 CLIMB 14,000 FT

M.P. 32.5 ± .5 IN. HG.
RPM 2100
MIXTURE - RICH
COWL FLAPS - OPEN
CLIMB SPEED - 104 KIAS

READINGS AT 14,000 FT.

OAT _____

M.P. Number 1 _____ In. RPM Number 1 _____ Fuel Flow _____ Lbs/Hr
M.P. Number 2 _____ In. RPM Number 2 _____ Fuel Flow _____ Lbs/Hr

1. Observe and record altitude where manifold pressure (M.P.) falls off. If altitude is unusually low (below 8000 or 9000 ft. on a hot day) suspect exhaust system leak.

ALTITUDE READINGS AT
M.P. FALL OFF

Altitude Number 1 _____ Ft
Altitude Number 2 _____ Ft

2 TAKEOFF

M.P. 39.0 IN. HG.
FULL RPM
MIXTURE - RICH
OIL TEMPERATURE - UPPER 1/3 GREEN ARC

READINGS AT TAKEOFF

OAT _____

M.P. Number 1 _____ In. RPM Number 1 _____ Fuel Flow _____ Lbs/Hr
M.P. Number 2 _____ In. RPM Number 2 _____ Fuel Flow _____ Lbs/Hr

1 SET ALTIMETER

29.92 IN. HG.

Figure 5. Turbocharger and Variable Pressure Controller Operational Check Chart

TURBOCHARGER, AIR CANISTER AND FILTERDescription

1. Induction air is provided by the turbocharger which is driven by engine exhaust gases. The waste gate controls the speed of the turbocharger by allowing exhaust gases to bypass when less pressure is required as determined by the controller. Intake air to the turbocharger is filtered by the air canister and filter, mounted directly to the inlet side of the turbocharger.
2. The turbocharger shield is a two-piece shield, hinged together around the turbocharger turbine and held in place with Monel wire.

Maintenance Practices

1. Removal/Installation of Air Canister (See Figure 1)

NOTE: Procedures are typical for left and right engine.

A. Remove Air Canister as follows:

- (1) Remove upper engine cowl.
- (2) Loosen clamp securing canister (4) to turbocharger.
- (3) Disconnect alternate air control (3) at alternate air control valve (2).
- (4) Loosen duct clamp (8) from canister and remove from nacelle.

NOTE: If canister is not being reinstalled for a length of time, covers should be installed on all openings.

B. Install Air Canister.

CAUTION: ENSURE THAT HINGE PIN ON END CAP (1) IS PROPERLY STAKED IN POSITION.

- (1) Remove covers from openings.
- (2) Position air canister (4) in place and install inlet air ducts and secure with clamp (8).
- (3) Connect alternate air control (3) at alternate air control valve (2).
- (4) Place air canister (4) on turbocharger and secure with clamp.
- (5) Check alternate air control valve for operation.

NOTE: It may be necessary to adjust alternate air control valve after installation.

- (6) Install upper engine cowl.

C. Remove Air Canister Filter Element.

- (1) Remove upper engine cowl.
- (2) Release latches (9), slide end cap (1) from air canister (4) and remove filter element (10).

D. Install Air Canister Filter Element.

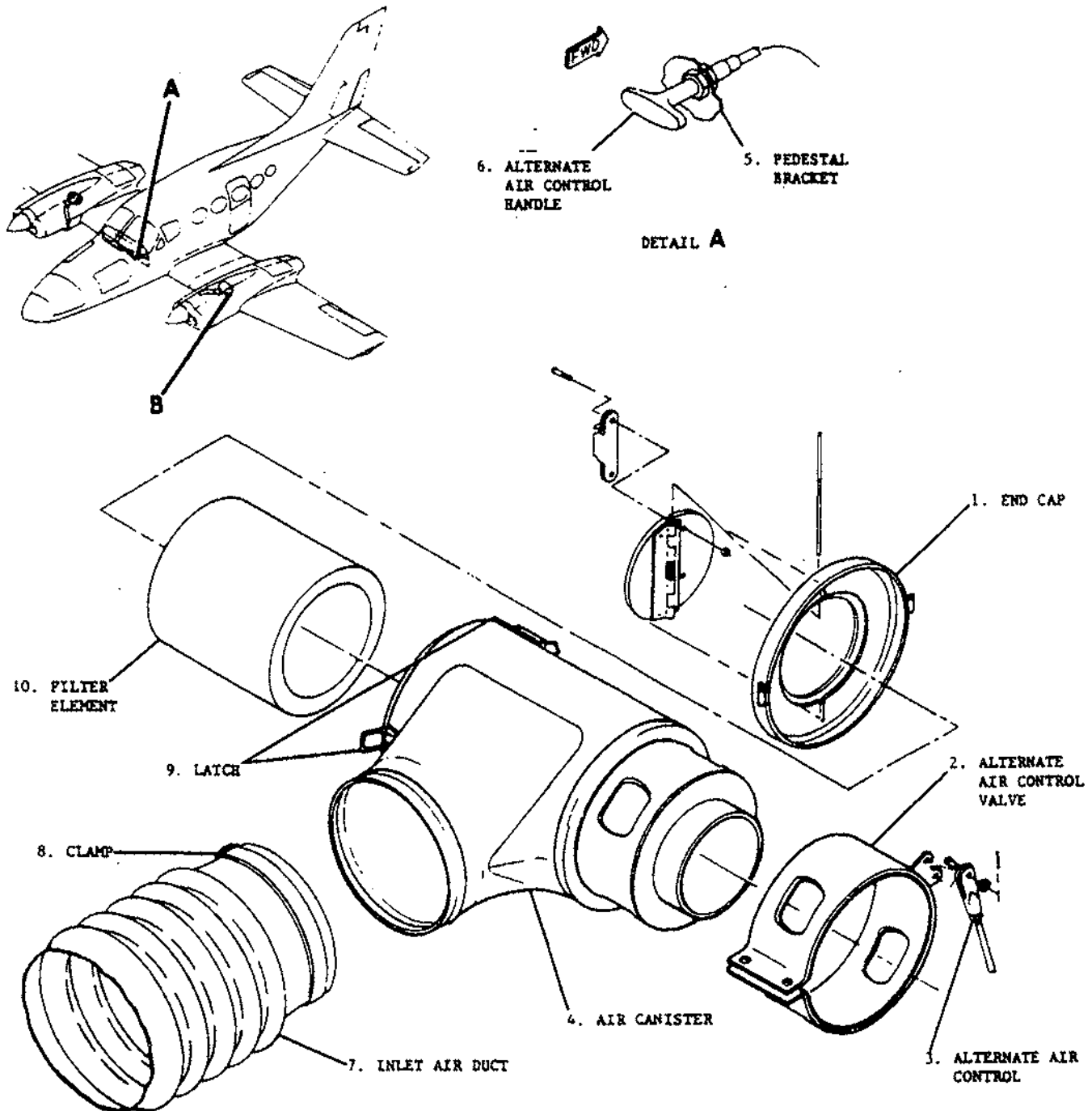
NOTE: Assure inside of air canister is clean before installing filter element.

- (1) Place air canister filter element (10) into air canister (4) and install end cap (1).
- (2) Lock latches (9) to end cap (1).
- (3) Install upper engine cowl.

2. Removal/Installation of Turbocharger (See Figure 2)

A. Remove turbocharger as follows:

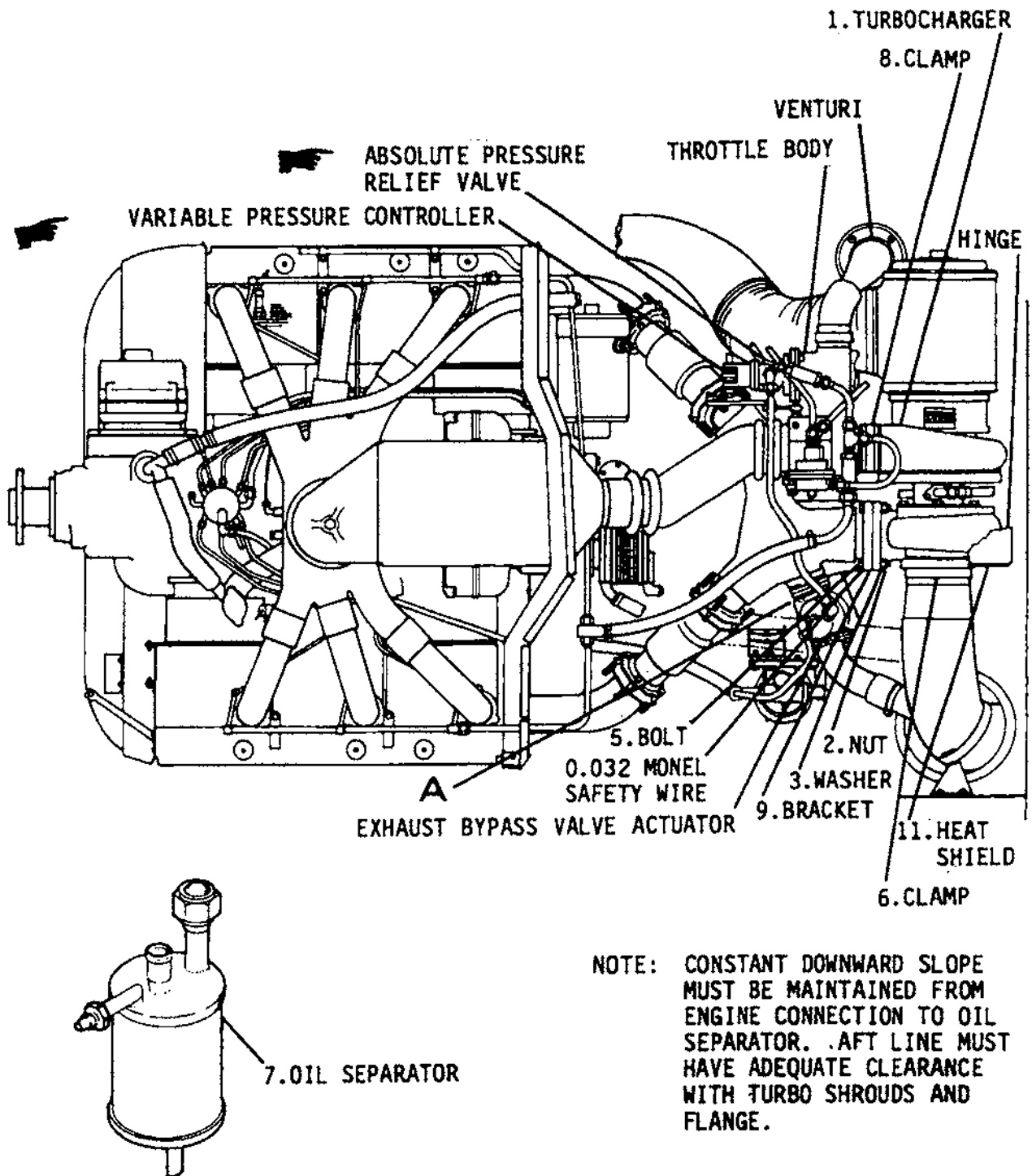
- (1) Remove engine cowl.
- (2) Remove air canister and filter assembly from turbocharger in accordance with removal procedures.
- (3) Loosen clamps (8) and slide hose to throttle body forward from turbocharger.
- (4) Remove nut (2), washers (3) and bolt (5) connecting collector assembly and turbocharger to bracket (9), discard gasket.



Induction Air Canister and Filter Installation
Figure 1

51503010
A
851504002

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MODEL 421
SERVICE MANUAL



NOTE: CONSTANT DOWNWARD SLOPE MUST BE MAINTAINED FROM ENGINE CONNECTION TO OIL SEPARATOR. AFT LINE MUST HAVE ADEQUATE CLEARANCE WITH TURBO SHROUDS AND FLANGE.

LEFT-HAND ENGINE.
Turbocharger Installation
Figure 2

51504003
A51561008

- (5) Cut safety wire and remove turbocharger heat shield.
- (6) Loosen clamp (6) from overboard exhaust tube and remove.
- (7) Disconnect oil separator (7) at drain connections.
- (8) Remove nuts (2), washers (3) and bolts (5) from bracket (4) and remove turbocharger up and out of engine nacelle.

NOTE: Cap and plug oil lines and seal turbine and compressor air openings to prevent the entry of foreign material.

B. Install Turbocharger as follows:

- (1) Remove caps, plugs and seals installed at turbine and compressor inlet and at the oil drain connections.
- (2) Set turbocharger in place in engine nacelle.
- (3) Install bolts (5), washers (3) and nuts (2) securing turbocharger to bracket (4).
- (4) Connect oil separator drain lines.
- (5) Position overboard exhaust tube in place on turbine and install clamp. Torque clamp to 40 inch-pounds.
- (6) Install heat shield in place on turbine and double safety in place with 0.032 Monel wire.
- (7) Using new gasket between turbocharger, bracket (9) and collector assembly. Install four bolts (5), washers (3) and nuts (2) to collector assembly.
- (8) Slide hose to throttle body onto turbocharger (1) and clamp in place with clamps (8).
- (9) Install air canister and filter assembly to inlet side of turbocharger compressor. Refer to installation procedures. Torque on clamp is 70 to 75 inch-pounds.
- (10) Install upper engine cowl.
- (11) Perform engine operational check and turbocharger operational flight check.

C. Remove Turbocharger Heat Shield.

- (1) Remove upper engine cowl.
- (2) Cut safety wire securing the turbocharger heat shield in place on turbine.
- (3) Open heat shield assembly and remove from turbocharger.

D. Install Turbocharger Heat Shield.

- (1) Position heat shield in place on turbine.
- (2) Install safety wire using a double tie as shown in Figure 2.

Inspection/Check

1. Inspection/Check of Air Canister.

- A. Remove upper engine cowl.
- B. Remove air canister filter element.

2. Inspection/Check of Turbocharger

- A. Remove upper engine cowl.
- B. Remove turbocharger heat shield.

Cleaning/Painting

1. Cleaning Air Canister Filter.

NOTE: Under extremely dusty conditions, daily maintenance of the filters are recommended. One method is to use dry compressed air at 100 PSI or less and blow through the filter. Blow dust from inside to the outside to remove dirt and dust.

A. Clean the filter as follows:

- (1) Remove the filter from the canister.
- (2) Slightly rap the filter to remove heavy dirt accumulations.
- (3) Wash thoroughly, using a mild detergent, non-sudsing soap and water solution.
- (4) Rinse filter with a stream of water until water is clear.
- (5) Dry thoroughly using dry compressed air. Air pressure must not exceed 100 PSI.

VARIABLE PRESSURE CONTROLLER AND EXHAUST BYPASS VALVE ASSEMBLY

Description

1. The variable pressure controller is mounted integrally with the throttle body and its sensing head is exposed to the pressurization air flow. Refer to Figure 1. The variable pressure controller automatically maintains a preselected compressor discharge pressure at levels that exceed the engine manifold pressure, determined by the position of the throttle lever. The exhaust bypass valve actuator is spring-loaded to position the waste-gate to the normally open position when there is not adequate oil pressure in the actuator power cylinder during engine shut down. When the engine is started, oil pressure is fed into the actuator power cylinder through a capillary tube which restricts the flow and dampens any sudden changes of the position of the waste-gate. As the actuator cylinder and lines leading to the controller are filled, the controller will block the flow of oil by normally closed metering and/or poppet valves. As the oil pressure builds up in the actuator cylinder, it overcomes the force of the actuator open spring, closing the waste-gate. When the waste-gate begins to close, the exhaust gases are routed through the turbocharger turbine. As the engine increases its power and speed, the increase of temperature and pressure of the exhaust causes the turbocharger to rotate faster, raising the turbocharger compressor outlet pressure. As the compressor outlet pressure rises, the aneroid bellows in the variable pressure controller senses the increase in pressure. When at high engine speed and load and the proper pressure is reached as determined by the throttle position, the force on the aneroid bellows opens the normally closed metering valve in the controller. When the oil pressure in the actuator is lowered sufficiently, the actuator open spring forces the mechanical linkage to open the waste-gate. A portion of the exhaust gases then bypasses the turbocharger turbine, thus preventing further increase of turbocharger speed and holding the compressor discharge pressure to the desired value. Conversely at engine idle, the turbocharger runs slowly with low compressor pressure output; therefore, low pressure applied to aneroid bellows is not sufficient to affect the unseating of the normally closed metering valve. Consequently, engine oil pressure keeps the waste-gate closed.

Maintenance Practices

1. Removal/Installation of Variable Pressure Controller and Exhaust Bypass Valve Assembly. (Refer to Figure 2)

A. Remove Variable Pressure Controller.

- (1) Remove engine cowlings.
- (2) Disconnect oil lines from controller.

NOTE: Plug and cap all lines and openings to prevent entry of foreign material.

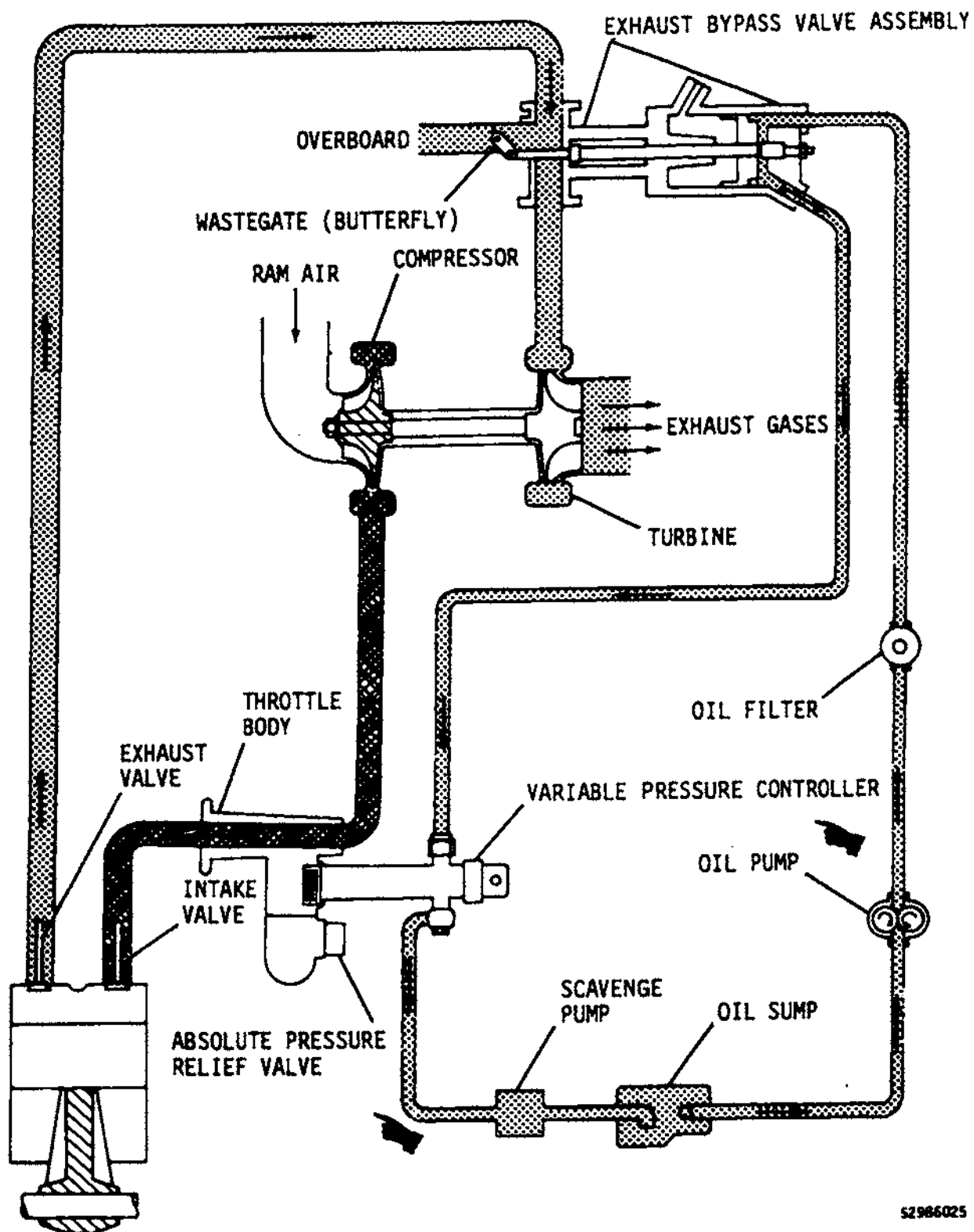
- (3) Disconnect throttle linkage at throttle lever.
- (4) Remove screws securing variable pressure controller and lift out.
- (5) If variable pressure controller is being replaced, the existing fittings must be removed, and the packings discarded.

B. Install Variable Pressure Controller.

NOTE: If a new variable pressure controller is being installed, the existing fittings with new packings should be installed and clocked in proper direction prior to installation.

- (1) Position variable pressure controller in place and install screws.
- (2) Remove caps and connect oil lines to controller.
- (3) Connect throttle linkage at throttle lever.
- (4) Install engine cowlings.
- (5) Perform operational check.

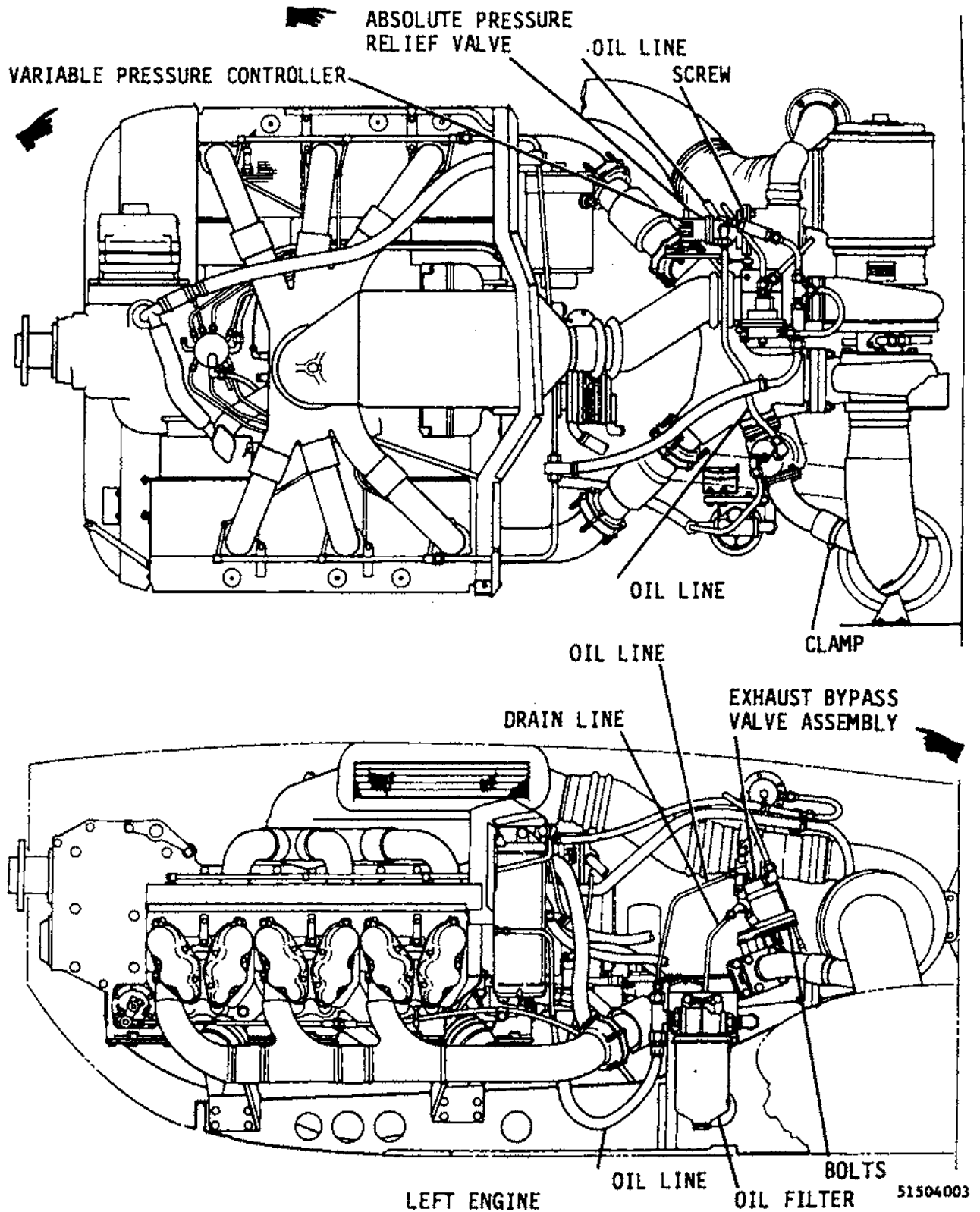
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Engine Turbocharger System Schematic
Figure 1

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Variable Pressure Controller and Exhaust Bypass Valve Installation
Figure 2

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C. Remove Exhaust Bypass Valve Assembly (refer to Figure 3).

NOTE: The exhaust bypass valve assembly consist of a valve and actuator which are considered as a matched set and must be replaced as a complete assembly.

- (1) Remove upper engine cowl.
- (2) Disconnect actuator drain line.
- (3) Disconnect oil lines at actuator.
- (4) Remove nuts, washers and bolts securing exhaust bypass valve assembly onto exhaust tube.
- (5) Remove exhaust bypass valve assembly from exhaust tube.

D. Install Exhaust Bypass Valve Assembly.

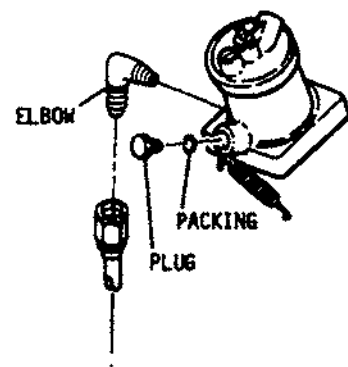
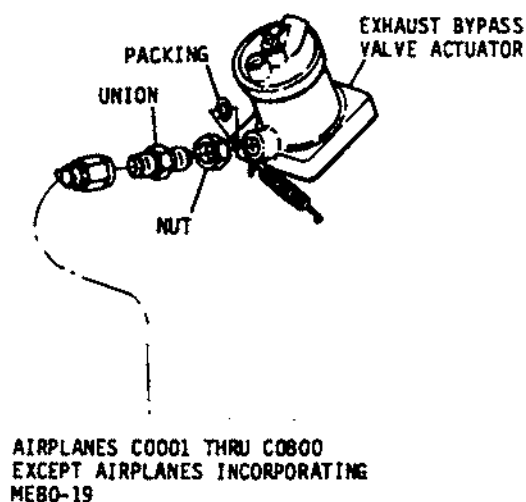
NOTE: Before installation of exhaust bypass valve assembly check adjustment in accordance with Exhaust Bypass Valve Assembly Adjustment procedures.

- (1) Position exhaust bypass valve assembly into position in the exhaust tube.

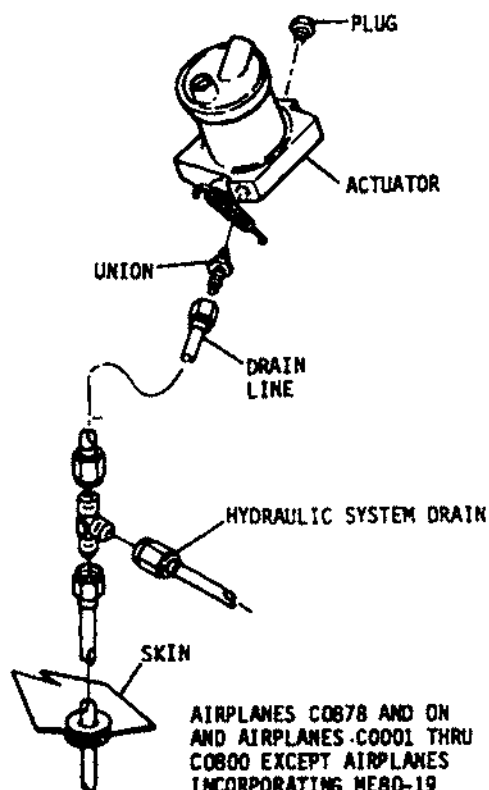
NOTE: Apply Fel-Pro C-5 or equivalent on all bolts in extreme high heat area.

- (2) Install bolts, washers and nuts securing exhaust bypass valve assembly to exhaust tube.
- (3) Connect oil lines to actuator.
- (4) Connect actuator drain line.
- (5) Install upper engine cowl.
- (6) Perform operational check.

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ORIGINAL EQUIPMENT
ONLY FOR AIRPLANES
C0801 THRU C0877



AIRPLANES C0878 AND ON
AND AIRPLANES C0001 THRU
C0800 EXCEPT AIRPLANES
INCORPORATING ME80-19
AND SPARES FOR AIRPLANES
C0801 THRU C0877

NOTE: THESE INSTALLATIONS
SHOW LH INSTALLATION.

CAUTION: IF ACTUATOR CONTAINS MORE
THAN ONE DRAIN HOLE - INSTALL
PLUG IN UNUSED HOLE.

NOTE: USE INSTALLATION REQUIRED BY ACTUATOR CONFIGURATION.

Exhaust Bypass Valve Actuator Drain Installation
Figure 3

51174013R
51174013
51174014

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MODEL 421
MAINTENANCE MANUAL

ABSOLUTE PRESSURE RELIEF VALVE

Description

1. The absolute pressure relief valve mounted on the throttle body is provided to prevent engine damage from excessive intake manifold pressure. The valve will actuate if the compressor discharge pressure exceeds 43.5 inches Hg.

Maintenance Practices

1. Removal/Installation of Absolute Pressure Relief Valve (Refer to Figure 1)

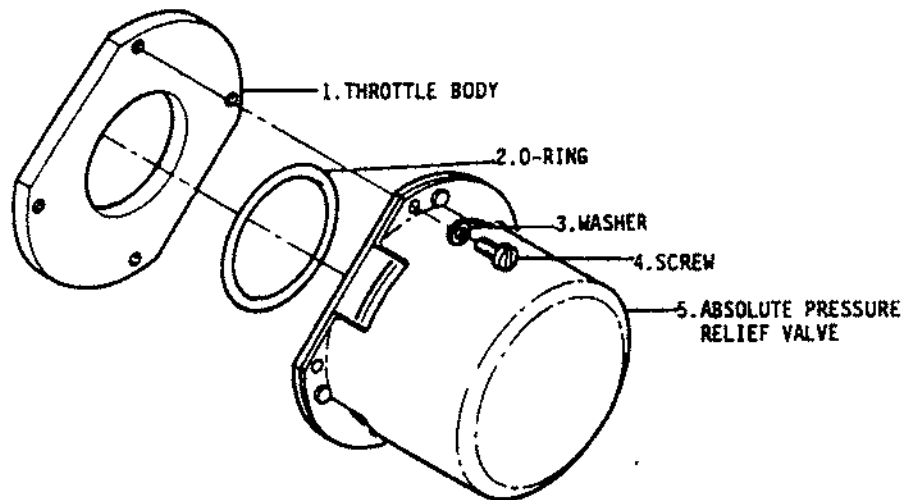
A. Remove Absolute Pressure Relief Valve.

- (1) Remove engine cowling.
- (2) Remove screws (4), washers (3) securing absolute pressure relief valve (5) to throttle body (1).
- (3) Lift absolute pressure relief valve from nacelle. Discard o-ring (2).

NOTE: If absolute pressure relief valve is not being replaced or immediately reinstalled, protective covers must be installed to prevent entry of foreign material.

B. Install Absolute Pressure Relief Valve.

- (1) Position new o-ring (2) in groove on the absolute pressure relief valve (5).
- (2) Install absolute pressure relief valve in place on throttle body (1) and secure with washers (3) and screws (4).
- (3) Safety wire screws (4).
- (4) Install engine cowling.
- (5) Perform engine operational check.



51541024R

Absolute Pressure Relief Valve
Figure 1

MANIFOLD PRESSURE INDICATING SYSTEMDescription

1. The manifold pressure indicating system consists of a dual manifold pressure gage mounted on the instrument panel. Manifold pressure lines are routed from the intake manifold of each engine to their respective connection on the back of the manifold pressure gage. The manifold pressure gage indicates in inches of mercury the absolute pressure inside the intake manifold of each engine.

Maintenance Practices

1. Removal/Installation of Manifold Pressure Indicating System (See Figure 1).

- A. Remove Manifold Pressure Indicating System.

- (1) Remove indicator in accordance with Chapter 10.
- (2) Remove engine cowling.
- (3) Remove necessary upholstery and access plates.
- (4) Remove indicator line (1), fuselage line (2), wing line (3), wing line (4) from fittings in wing and fuselage.
- (5) Remove nacelle hose (5), nacelle line (6) and engine line (7).

NOTE: Plug and cap all lines and hoses to prevent entry of foreign material.

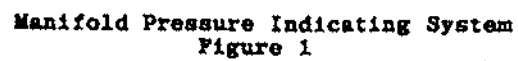
- B. Install manifold pressure indicating system.

- (1) Remove all caps and plugs from lines and fittings.
- (2) Install engine line (7), nacelle line (6) and nacelle hose (5).
- (3) Install wing line (4), wing line (3), fuselage line (2) and indicator line (1).
- (4) Install access plates and upholstery panels.
- (5) Install indicator and connect indicator line (1).
- (6) Install engine cowling.
- (7) Perform engine operational check.

Inspection/Check

1. Inspection/Check of Manifold Pressure Indicating System.

- A. Remove upholstery side panel.
- B. Remove necessary wing access plates.
- C. Remove engine cowling.



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MODEL 421
SERVICE MANUAL

ENGINE CONTROL SYSTEM

Description

1. The engine control system consists of the control quadrant, propeller controls, mixture controls, cooling modulator (cowl flap controls), alternate air controls, their cables, mounting, routing and connection to respective components. The alternate air control cables are routed from the stationary instrument panel to the nacelle area.

Maintenance Practices

1. Removal/Installation of Engine Controls (Refer to Figure 1)

A. Remove Engine Controls (Refer to Figure 1).

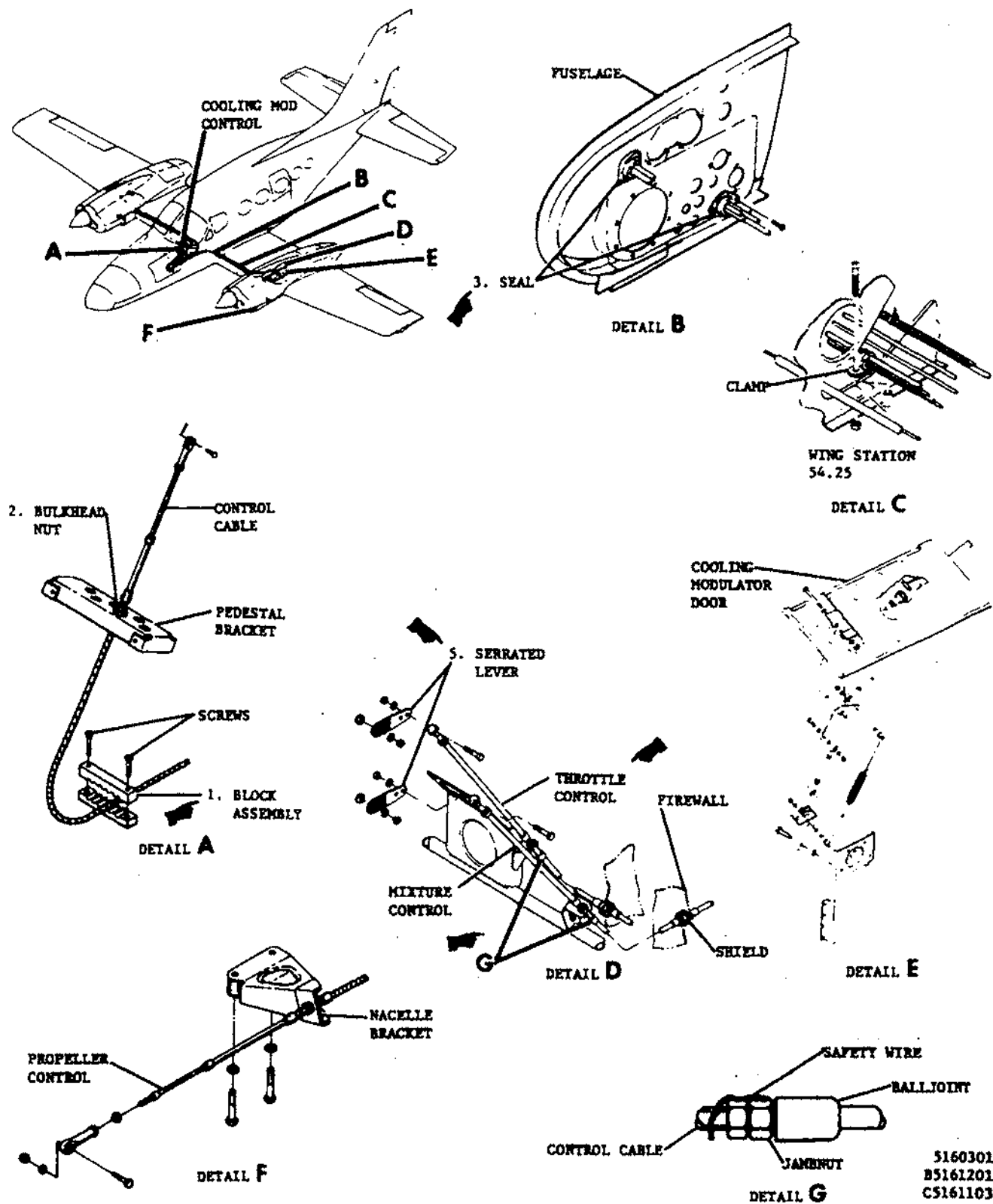
NOTE: The pressure seals on the engine control cables can be replaced using Kit Number 500-100-003, refer to 421C Parts Catalog.

- (1) Remove pilot and copilot seats, cabin divider, carpet, center pedestal access covers, floorboards, fuselage and wing access covers necessary for removal of controls and the engine cowlings.
- (2) Disconnect throttle, propeller and mixture control cables from control quadrant levers by removing attaching clevis pins.
NOTE: Note the direction that each clevis pin is installed and the position of the cable housing in the mounting bracket so they may be reinstalled in the same direction.
- (3) Disconnect each control from its respective engine component and remove rod ends and jam nuts from each end of control.
- (4) Remove locknuts from control cables at the pedestal mounting bracket and at the nacelle area.
- (5) If the cooling modulator (cowl flap) control cable is being removed, remove the handle and jam nut from aft side of bracket under pedestal.
- (6) Push control cable forward out of bracket and remove forward jam nut.
- (7) Loosen clamps securing cooling modulator (cowl flap) control cable just aft of block assembly (1).
- (8) If alternate air control cable and/or heat exchanger control cable are being removed, repeat steps (6) and (7) and disconnect from respective components in nacelle.
- (9) Remove block assembly (1) by removing screws and separating block halves.
- (10) Remove bulkhead nut (2) at the firewall through which the engine controls are routed.
- (11) Remove seal (3) at fuselage skin as follows:
 - (a) Remove nuts and screws securing seal to fuselage skin.
 - (b) Carefully separate seal (3) halves to remove seal from control cables.
- (12) Remove clamps securing controls in wing and under floorboard in cabin area.
- (13) Attach a guide wire to control cables at the nacelle.
- (14) Pull control cables back out of control pedestal and into cabin area through floorboard access.
- (15) Pull control cables from engine nacelle into cabin area with guide wire attached.
- (16) Disconnect attached guide wire and remove control cables from the airplane.
NOTE: To facilitate installation, leave guide wire routed in the airplane.

B. Install Engine Controls.

- (1) Attach guide wire to control cable ends.
- (2) Route the propeller, throttle, mixture cables to their proper locations in the engine nacelle and the control pedestal.

NOTE: When installing control cables, ensure that they are properly protected with a firesleeve in areas subject to intense heat (near exhaust and turbo charger components). Wrap cables with a 1.0 inch continuous overlap, double wrap protection, to extend 3.0 inches beyond either side of heat exposure area. Use 3M brand, number 365 aluminum tape. Refer to ME80-45 for cable replacement and routing instructions.



Engine Control System
Figure 1

51603016
B51612011
C51611038
E51523001
G51611007
D51153018
F14611002
A14611003

- (3) Remove guide wires from control cables.
- (4) Route cables through their respective mounting brackets at nacelle end of control cables.
- (5) Install bulkhead mounting nuts, jam nuts on cable ends, and rod ends.

NOTE: Do not connect rod ends to components or serrated levers at this time.

- (6) Install control cables in block assembly (1) and secure with screws.
- (7) Clamp control cables in wing, under floorboard.
- (8) Install seal (3) halves to control cable at fuselage skin.
- (9) Install bulkhead nut (2) at firewall.
- (10) If removed, route cooling modulator (cowl flaps) alternate air control or heat exchanger control cables and repeat steps (7) through (9).
- (11) Connect rod ends to their respective components on engine.
- (12) Route control cables through center pedestal bracket. Install bulkhead nuts, jam nuts and cable ends.
- (13) Connect cable ends to their respective control on center pedestal by inserting clevis pins and safety with cotter pins.
- (14) Route cooling modulator control cable through and on lower side of the center pedestal. Install bulkhead nut and route through control bracket.
- (15) Install jam nut and tee handle.
- (16) Rig control cables in accordance with rigging procedures. Refer to Chapter 8 for rigging propeller control.
- (17) Install center pedestal access covers, floorboards, fuselage and wing access covers and engine cowling.
- (18) Install carpets, seats and cabin divider.
- (19) Perform engine operational check.

NOTE: Wrap propeller and other control cables with aluminum heat reflective tape (3M #363 or equivalent) where cables pass within three inches of engine exhaust duct or turbochargers. Tape must extend three inches from each exposed point, and overlap one inch on each consecutive turn to insure double wrap protection.

Adjustment/Test

1. Rigging Mixture and Throttle Controls (See Figure 1)

- A. Adjustment of the idle mixture is accomplished by the use of a locknut attached to the mixture control lever. Tightening the locknut to shorten the interconnecting linkage provides a leaner mixture.
- B. Adjust control to obtain a slight and momentary gain in idle speed as the mixture control is slowly moved toward IDLE CUT-OFF. If the adjustment is set too lean, idle speed will drop under the same condition.

NOTE: Mixture controls on the control quadrant should reach the end of travel approximately 1/4 inch before reaching the quadrant stops.

- C. Mixture levers should be uniform within 1/2 of a knob of each other through the entire travel range. The rigging procedure chart provides corrective instructions to obtain proper adjustment.
- D. Rig control cables on throttle valve and metering unit as follows:
 - (1) Find the neutral position on shafts by rotating the throttle shaft clockwise and then counterclockwise until shaft rests on internal stops.
 - (2) Scribe an index mark on shaft and throttle body at these positions.
 - (3) Rotate throttle shaft to the mid point between marks and scribe a neutral position mark.

NOTE: The neutral position on the metering unit can be determined by visually positioning the pin on the metering unit shaft at the midpoint between the two stop pins.

- (4) Position both throttle and metering unit shafts to neutral.
- (5) Align serrated spacers on throttle and metering unit shafts so that serration lines on the face of the spacer are perpendicular to the neutral position of the shafts.
- (6) Install levers (5) on spacers aligning the serrations.
- (7) Secure levers and spacers to throttle and metering unit shafts with washers and nuts.
- (8) At the control quadrant, place throttle and mixture control levers at the midpoint between stops.
- (9) With the throttle and metering unit shafts in the NEUTRAL position and the throttle and mixture control levers on the quadrant set at the midpoint, adjust control cable rod ends so that when attached to levers (5), a 90-degree angle is formed between centerline of levers (5) and centerline of the control cables.

NOTE: If throttle and mixture controls on the quadrant were not set at a true midpoint as described in Step 8 above, the 1/4 inch tolerance as noted in steps "A thru D" will not be available. Readjustment for 1/4 inch travel (cushion) will be necessary and should be made as specified in Rigging Procedures Chart.

<u>CONDITION</u>	<u>PROBABLE CAUSE</u>	<u>CORRECTION</u>
MIXTURE CONTROL LEVER STOPS SHORT AT BOTH OF QUADRANT	Insufficient control travel.	Shorten travel of serrated lever (5) by resetting lever higher on serrated spacer.
MIXTURE CONTROL LEVER REACHES QUADRANT BEFORE COVERING FULL TRAVEL	Excessive control travel.	Lengthen travel of serrated lever (5) by resetting lever lower on serrated spacer.
MIXTURE CONTROL LEVER STOPS SHORT AT ONE END OF TRAVEL AND STRIKES THE QUADRANT STOP AT THE OTHER END	Uneven control travel adjustment.	Disconnect rod end from lever (5) and turn rod end until desired adjustment is achieved. Connect rod end to lever.
UNEVEN MIXTURE RESPONSE BETWEEN ENGINES (MORE THAN HALF KNOB DIFFERENCE AT BALANCED FLOW METER READINGS, RPM AND MANIFOLD PRESSURE)	Different mixture control sensitivities.	Refer to Rigging Mixture and Throttle Controls.
THROTTLE CONTROL LEVER STOPS SHORT AT BOTH ENDS OF QUADRANT	Insufficient control travel.	Shorten travel of serrated lever (5) by resetting lever higher on serrated spacer.
THROTTLE CONTROL LEVER REACHES QUADRANT STOPS BEFORE COVERING FULL TRAVEL	Excessive control travel.	Lengthen travel of serrated lever (5) by resetting lever lower on serrated spacer.
THROTTLE CONTROL LEVER STOPS SHORT AT ONE END OF TRAVEL AND STRIKES THE QUADRANT STOP AT THE OTHER END	Uneven control travel adjustment.	Disconnect rod end from lever (5) and turn rod end until desired adjustment is achieved. Connect rod end to lever.
UNEVEN THROTTLE SETTING RESPONSE BETWEEN ENGINES. MORE THAN 1/8 INCH DIFFERENCE BETWEEN KNOBS (AT SAME FLOW METER MANIFOLD PRESSURE AND RPM READINGS)	Different throttle control sensitivities.	Refer to Rigging Mixture and Throttle Controls.

NOTE: If described corrective measures do not provide adequate throttle control operation, check throttle body, control valve operation and air intake system for leaks.

Rigging Procedures Chart for Mixture and Throttle Controls

Inspection/Check

1. Inspection/Check of Engine Control System.
 - A. Remove pedestal left and right side panels.
 - B. Remove front carpet.
 - C. Remove upholstery side panel.
 - D. Remove wing gap fairing.
 - E. Remove necessary access plates on underside of wing.
 - F. Remove upper engine cowling.

ENGINE CONTROL QUADRANTDescription

1. The engine control quadrant mounted in the center pedestal contains throttle levers, propeller pitch levers, and mixture levers. The components are fastened together in a manner which allows a friction control knob at the right side of the control quadrant to vary the amount of friction on the various control levers. This provides a means of locking the control levers in the desired position.

Maintenance Practices

1. Removal/Installation of Engine Control Quadrant (See Figure 1)

- A. Remove Engine Control Quadrant as follows:

- (1) Remove LH and RH side panels, and friction knob.
 - (2) Refer to Chapter 5 and remove elevator trim control wheel and sprocket.
 - (3) Remove cotter pins and clevis pins which connect the engine and propeller control cables to control levers.

NOTE: Note the direction that each clevis pin is installed and the position of the cable housing in the mounting bracket so they may be reinstalled in the same direction.

- (4) Tag and disconnect wires.
 - (5) Remove screws attaching control quadrant to center pedestal and remove quadrant.

- B. Install Engine Control Quadrant as follows:

- (1) Position control quadrant in position in the center pedestal and install screws.
 - (2) Connect electrical wires and remove tags.
 - (3) Connect engine control cables to respective levers with clevis pins and safety with cotter pins.
 - (4) Refer to Chapter 5 and install elevator trim control wheel and sprocket.
 - (5) Install LH and RH side panels and friction knob.

NOTE: Connect mixture control cable in the second hole of the mixture level on airplanes 421C1207 and On.

- (6) Rig engine controls in accordance with rigging procedures (refer to Install Engine Controls).
 - (7) Perform engine operational check.

2. Disassembly/Assembly of Engine Control Quadrant (See Figure 2)

- A. Disassemble Engine Control Quadrant.

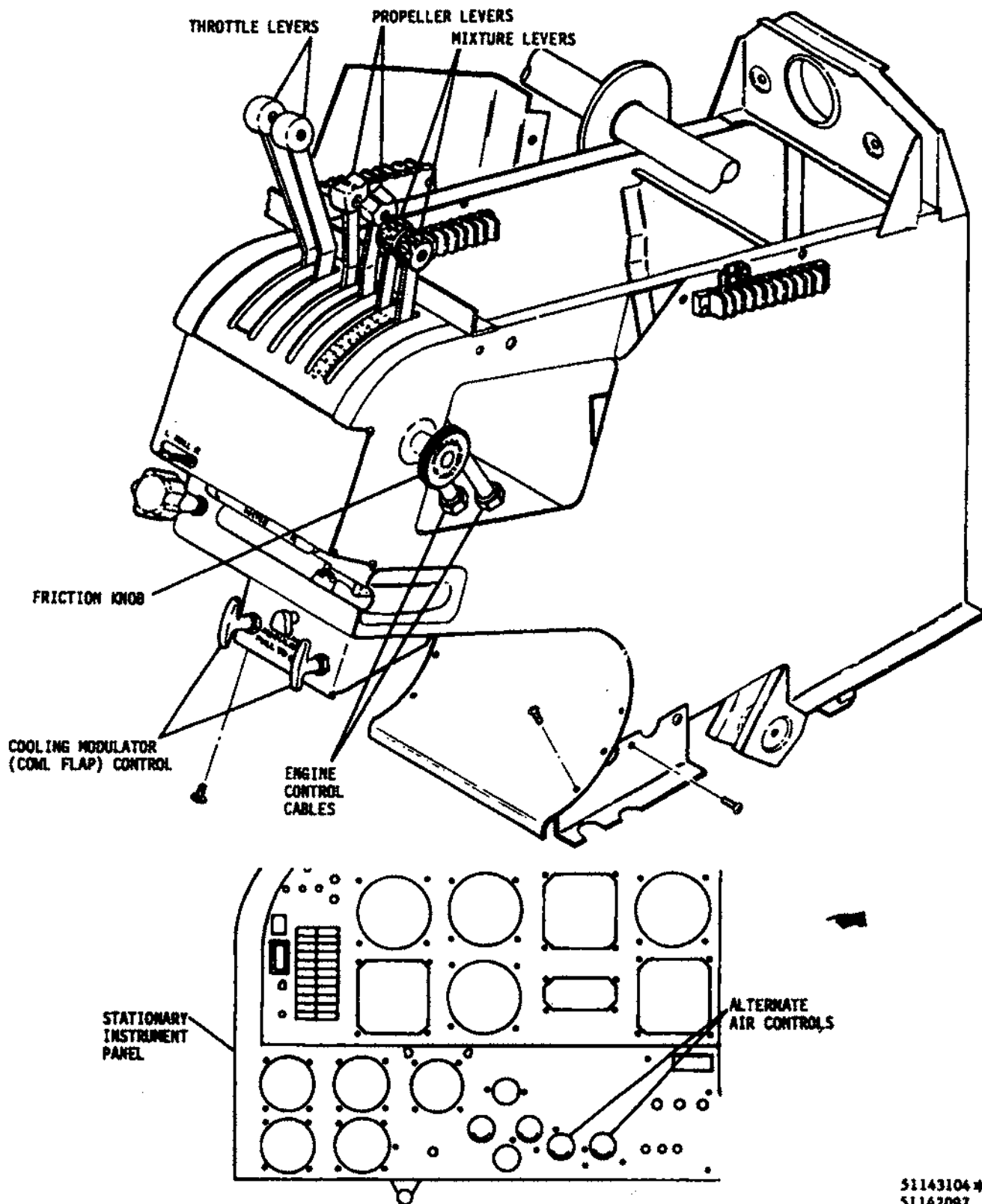
- (1) Remove engine control quadrant.
 - (2) Remove three screws (1) attaching right mounting plate (14) to guide rods (9).
 - (3) Remove washer (17) and spring (18) from end of center stud (16).

NOTE: Spacers (5), (7), and (8) are of different thickness.

- (3) Remove rack (6) and spacers (8) from guide rods, then remove spacer (19), friction disc (20) and control lever (10) from hub (22). Follow this sequence and remove the remaining parts assembled on the guide rods and hub.

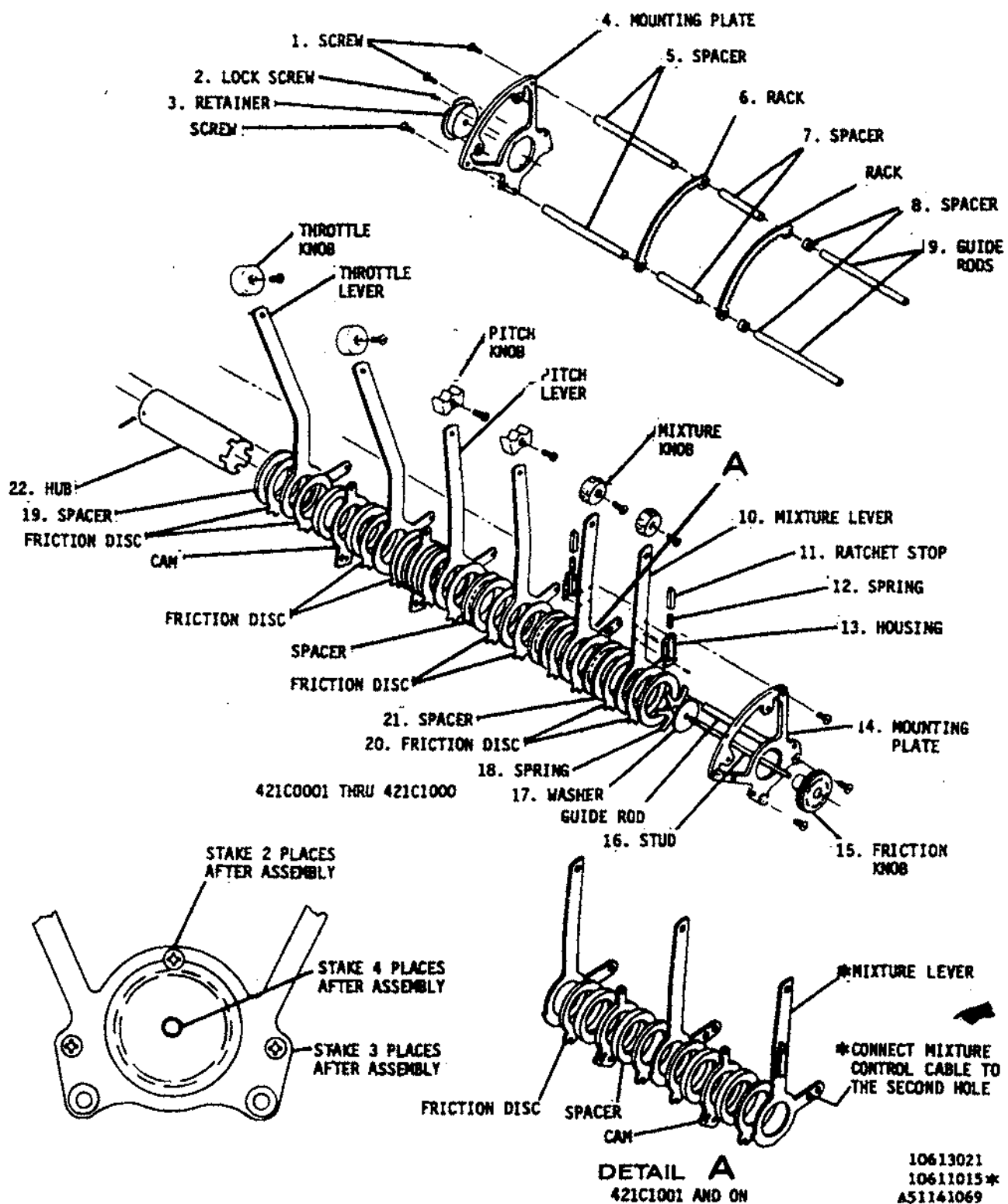
CAUTION: HOLD THE RATCHET STOP (11) ON MIXTURE CONTROL LEVERS DOWN WHEN REMOVING THE RACKS TO PREVENT THEM FROM SPRINGING OUT OF THEIR HOUSINGS.

- (4) Remove three screws (1) attaching rods to left mounting plate (4) and remove guide rods.



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Engine Control Quadrant Installation
Figure 1



Engine Control Quadrant Assembly
Figure 2

- (5) Remove lock screws (2) from left mounting plate (4) and remove hub (22) from mounting plate.
- (6) Unscrew retainer (3) from hub (22) and center stud (16) from retainer, to complete disassembly.

B. Assemble Engine Control Quadrant.

- (1) Screw center stud (16) into retainer (3).
- (2) Screw retainer into hub (22) and install hub in left mounting plate (4). Secure hub to mounting plate with lock screw (2).
- (3) Stake with a punch edge of lock screw after installing to prevent it from becoming loose and dropping out.
- (4) Install three guide rods (9) on left mounting plate (4) with three attaching screws (1).

NOTE: Do not lubricate the parts to be assembled on the hub. These parts must remain dry for proper operation of the control friction lock.

- (5) Assemble control levers, spacers, guides, etc., on hub and guide rods as illustrated.
- (6) Install right mounting plate (14) with three screws (1), attaching mounting plate to guide rods (9).

Inspection/Check

1. Inspection/Check of Engine Control Quadrant.

- A. Remove pedestal upper left and right side panels.

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MODEL 421
SERVICE MANUAL

ENGINE EXHAUST SYSTEM

Description

1. The engine exhaust system consists of a stack assembly mounted to each bank of cylinders, two slip joints and a collector assembly. Each stack assembly contains three risers connected by sealess slip joints. The inboard and outboard stack assemblies are connected to the collector by two slip joints and the collector is connected to the input side of the turbocharger turbine. The exhaust bypass valve is mounted to the collector assembly.

Maintenance Practices

1. Tools and Equipment.

Name	Number	Manufacturer	Use
Exhaust System Seal Replacement	SK421-40	Cessna Aircraft Co.	Replace slip joint seal in exhaust system.
Fel-Pro	C-5	Felt Products Mfg. Co. Chicago, Ill.	

2. Removal/Installation of Engine Exhaust System (See Figure 1)

NOTE: Removal/Installation procedures are the same for either left or right engines.

A. Remove Engine Exhaust System.

- (1) Remove engine cowlings.
- (2) Remove necessary access panels from underside of nacelle.
- (3) If installed, remove optional exhaust gas temperature probe.
- (4) Remove the ten bolts securing slip joint (4) to aft risers and collector assembly by removing cotter pins, nuts, washers and springs.
- (5) Compress slip joint (4) and remove.
- (6) Remove the four nuts holding risers (1), (2) and (3) to their respective cylinders.
- (7) Work risers down, free from cylinder studs and remove stack assembly.

NOTE: If difficulty is encountered in removing the stack assembly, refer to engine removal procedures and hoist engine from its mount high enough to provide removal clearance.

- (8) Remove nuts, washers and bolts securing exhaust bypass valve to collector assembly.
- (9) Remove nuts, washers and bolts securing collector assembly to turbocharger and remove collector assembly from nacelle.

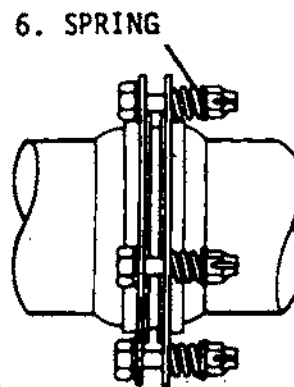
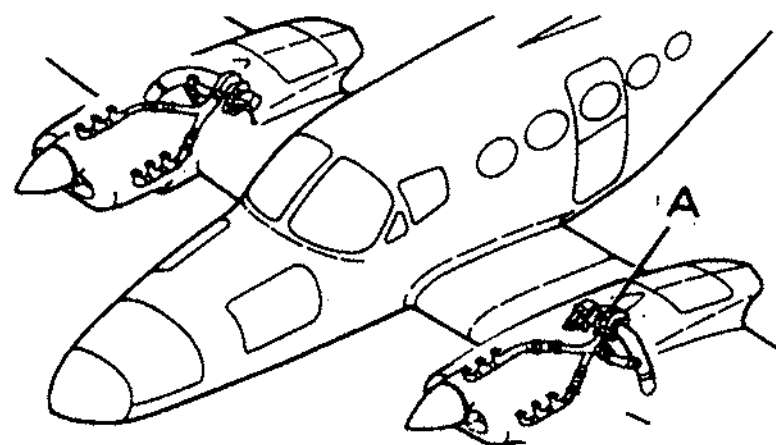
NOTE: Install temporary covers on all openings.

B. Install Engine Exhaust System.

NOTE: Unless otherwise specified, refer to torque chart Chapter 1 for engine exhaust system torque requirements.

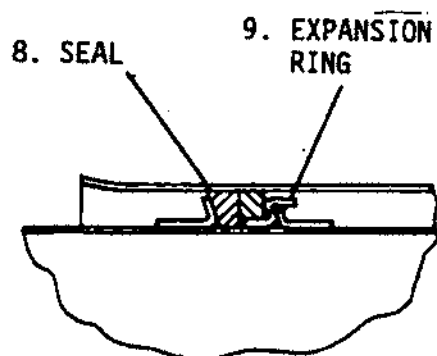
- (1) Remove temporary coverings from all openings.
NOTE: Apply Fel-Pro compound to threads in high heat areas.
- (2) Position collector assembly in place on turbocharger inlet and install bolts, washers and nuts.
- (3) Connect exhaust bypass valve to collector assembly by installing four bolts, washers and nuts.

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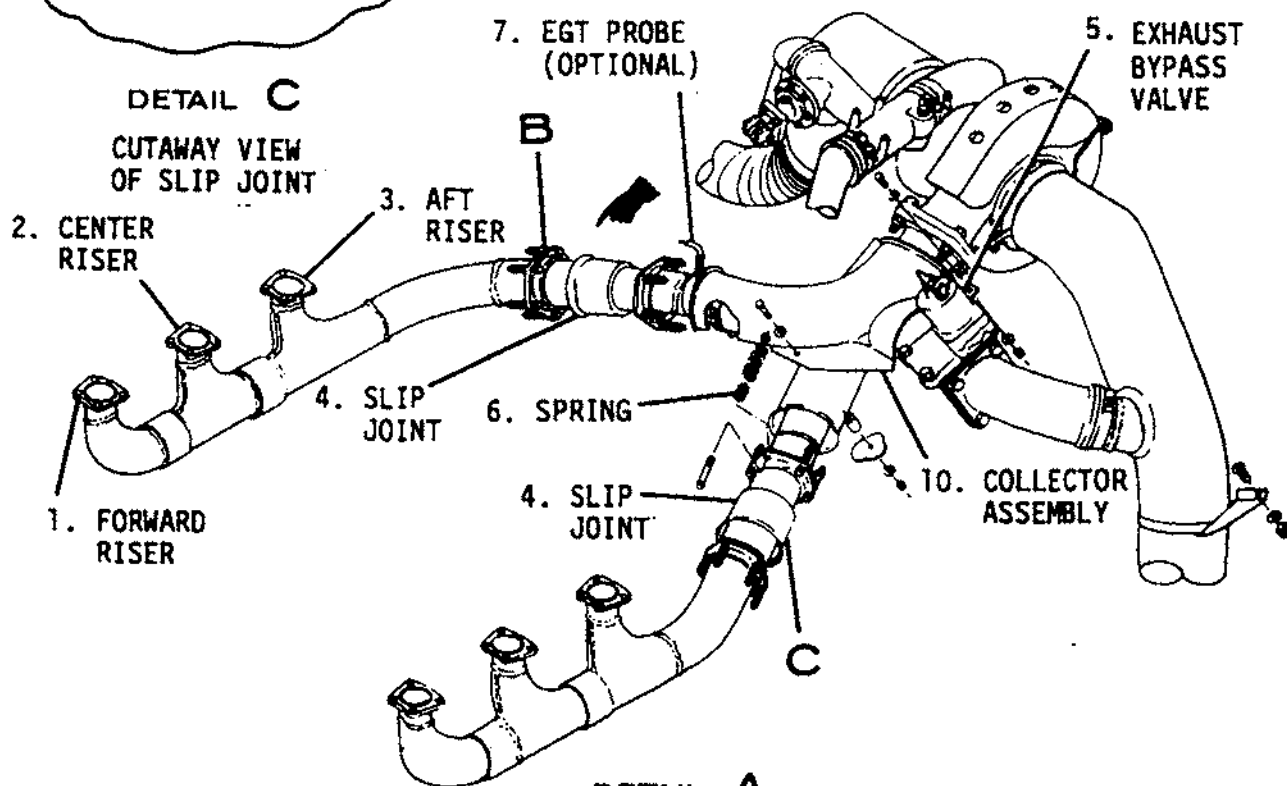
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-.030 (TYP)

DETAIL B



DETAIL C

CUTAWAY VIEW
OF SLIP JOINT



DETAIL A

Engine Exhaust System
Figure 1

51503014
A14501004
851543015
C14501003

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- (4) Work risers into place on cylinder studs and install nuts. See Figure 2 for sequence as numbered. Torque nuts on exhaust riser to 90 inch-pounds then retorque to 110 inch-pounds. After engine-run torque is to be rechecked and if necessary, retorqued to 110 inch-pounds prior to flight.

NOTE: Make sure seal (8) in slip joint (4) is in good condition before installing.

- (5) Compress slip joint (4) and install into position between exhaust stack and collector assembly with ten bolts, springs, washers and nuts.

NOTE: Ensure that springs are installed so that any leaking exhaust gas does not impinge on spring. Refer to Figure 1 for correct installation.

- (6) Tighten all five nuts on each end of slip joint (4) evenly to obtain proper dimension on springs.

NOTE: It may be necessary to add or remove washers to assure springs are compressed the proper dimension during installation.

- (7) Safety with cotter pins.
(8) If removed, connect optional exhaust gas temperature probe.
(9) Install access panels to underside of nacelle.
(10) Install engine cowlings.
(11) Perform engine operational check.

Replacement of Exhaust Slip Joint Seal and Expansion Ring

1. Remove exhaust system. Refer to Removal/Installation.
2. Disassemble slip joint and replace seal and expansion ring in accordance with SK421-40.

Inspection/Check

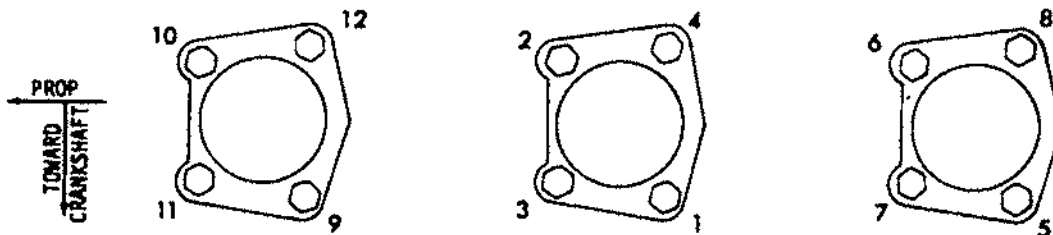
1. Inspection/Check of Engine Exhaust System.
 - A. Remove upper engine cowlings.

Cleaning/Painting

1. Cleaning Engine Exhaust System
 - A. Cleaning.
 - (1) Spray engine exhaust system with a suitable solvent and allow to drain dry.

WARNING: NEVER USE A FLAMMABLE SOLVENT OR WASH DOWN ENGINE EXHAUST SYSTEM WHILE HOT.
 - (2) Wipe dry with a clean cloth.

NOTE: Never use a wire brush or abrasives to clean exhaust system.



Exhaust Bolt Torque Sequence
Figure 2

14551002

EXHAUST GAS TEMPERATURE SYSTEMDescription

1. The Exhaust Gas Temperature System consists of the indicator and a sensing probe connected by electrical wires. The probe mounted in the exhaust system senses the most economical fuel-air mixture for cruising flight at a power setting of 75 percent or less. Exhaust gas temperature varies with the ratio of fuel-to-air mixture entering the engine cylinders.

Troubleshooting

1. Troubleshooting the exhaust gas temperature system is accomplished in accordance with troubleshooting chart. Refer to Figure 3.

Maintenance Practices

1. Removal/Installation of Exhaust Gas Temperature System (See Figure 1)

NOTE: Procedures are the same for either engine.

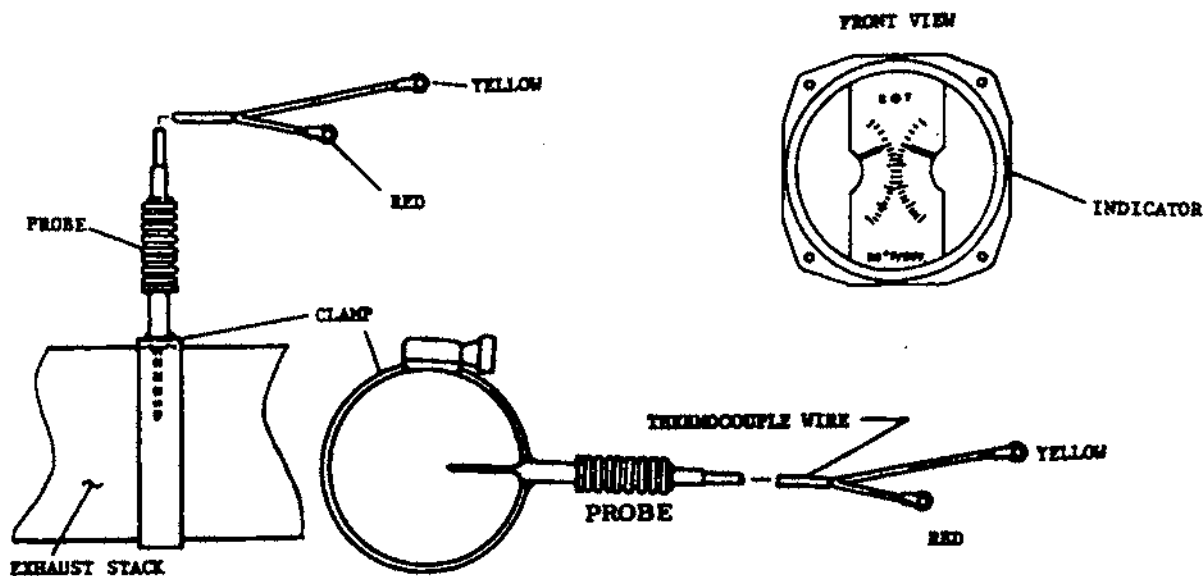
- A. Remove Exhaust Gas Temperature System.

- (1) Tag and disconnect electrical leads on indicator.
- (2) Remove indicator from instrument panel by removing attaching screws and post lights.
- (3) Remove upper engine cowl.
- (4) Disconnect electrical leads at the probe mounted in exhaust system and pull wire from fuselage and out into nacelle.
- (5) Loosen clamp securing probe and remove.

- B. Install Exhaust Gas Temperature System.

- (1) Install probe using a small wood dowel and light hammer to lightly tap clamp at junction of probe body to seat shoulder in hole while maintaining alignment.
- (2) Torque clamp and safety wire.

NOTE: The clamp torque for the slotted screw clamp is 35 $\pm$ 5 inch-pounds.
The clamp torque for the slotted hex screw clamp is 70 $\pm$ 5 inch-pounds.



Exhaust Gas Temperature System
Figure 1

- (2) Route electrical leads from probe in the engine nacelle through the wing into the fuselage and in place forward of instrument panel. Clamp and tie in electrical wire bundle.
- (3) Connect electrical leads at probe end and on the rear of the instrument panel.
- (4) Install indicator in instrument panel with attaching screws and post lights.
- (5) Install engine cowl.
- (6) Perform operational check.

Adjustment/Test

1. Calibration Check of Exhaust Gas Temperature System.

- A. Check Calibration.
- B. Refer to Chapter 13 wiring diagrams and perform continuity check using multi-meter.

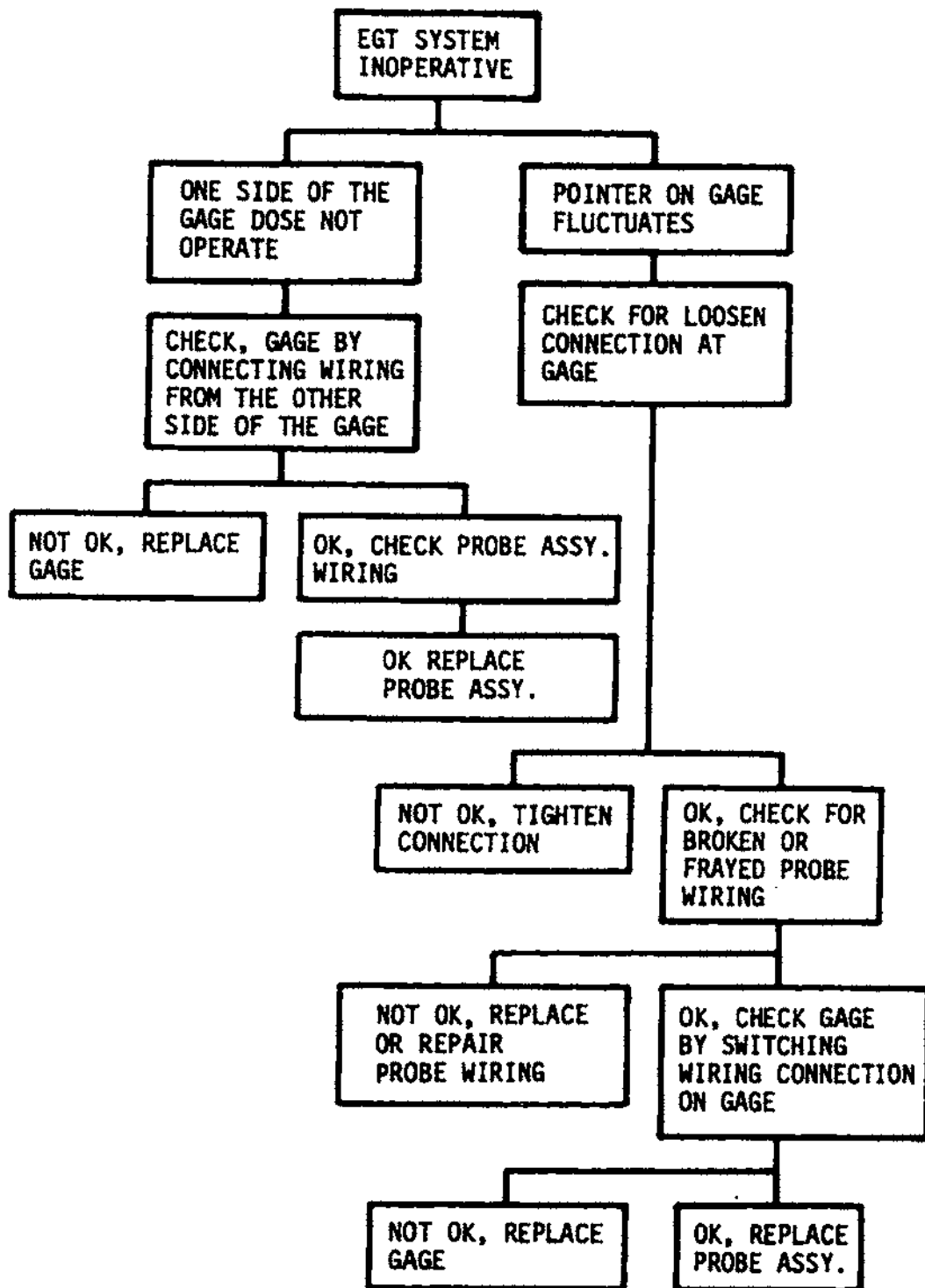
2. Calibration Check.

- A. Check the indicator accuracy in accordance with Figure 2.

NOTE: The information in Figure 2 contains millivolt values for use in checking calibration accuracy. Tests should be conducted at 75°F. The information corresponds to National Bureau of Standards Number 560. Refer to National Bureau of Standards monograph 125 publication.

<u>SCALE INDICATION</u>	<u>MILLIVOLT INPUT</u>	<u>TEMP. REF. OF</u>
0.00	28.37	1300
0.25	28.96	1325
0.50	29.54	1350
0.75	30.12	1375
1.00	30.70	1400
1.25	31.27	1425
1.50	31.85	1450
1.75	32.42	1475
2.00	32.98	1500
2.25	33.55	1525
2.50	34.12	1550
2.75	34.68	1575
3.00	35.24	1600
3.25	35.81	1625
3.50	36.36	1650
3.75	36.92	1675
4.00	37.48	1700
4.25	38.03	1725
4.50	38.58	1750
4.75	39.12	1775
5.00	39.67	1800

Scale Reading Versus Millivolt Input
Figure 2



Troubleshooting Chart - Engine Temperature Indicating System
Figure 3

ENGINE STARTING SYSTEMDescription

1. Each engine starting system consists of the engine 24 volt starter, a starter vibrator, a start relay, a start switch, a start relay circuit breaker and associated electrical wiring. The starter motor is mounted to the engine starter drive adapter on the rear of the engine. The start relays are mounted in the left stub wing for both engines while the start switches and circuit breakers are mounted on the left console panel inside the cockpit area. A single starter vibrator installed inside the left console is used for both engine starting.
2. With the Master Switch ON and the start switch pressed, the respective start relay will actuate applying power to the starter for engine cranking. Simultaneously, the starter vibrator will supply ignition voltage to the retard breaker points inside the magneto to start the engine.
3. On aircraft modified to CAA requirements, the start system incorporates an annunciator light for each starter to indicate when a starter is engaged. Each annunciator light circuit is protected by a circuit breaker.

Troubleshooting

1. For troubleshooting the engine starting system refer to Figure 1.

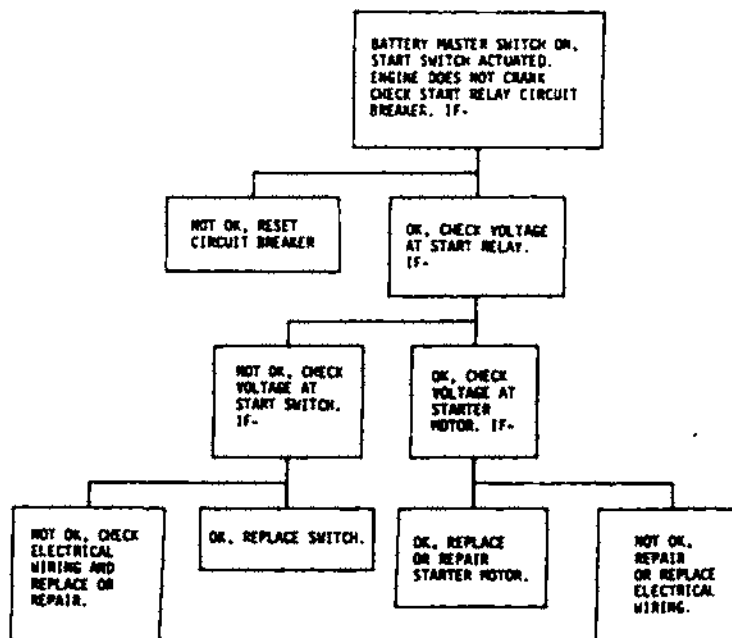
Maintenance Practices

1. Removal/Installation of Engine Starting System (See Figure 2)

NOTE: Removal/Installation procedures are the same for either engine.

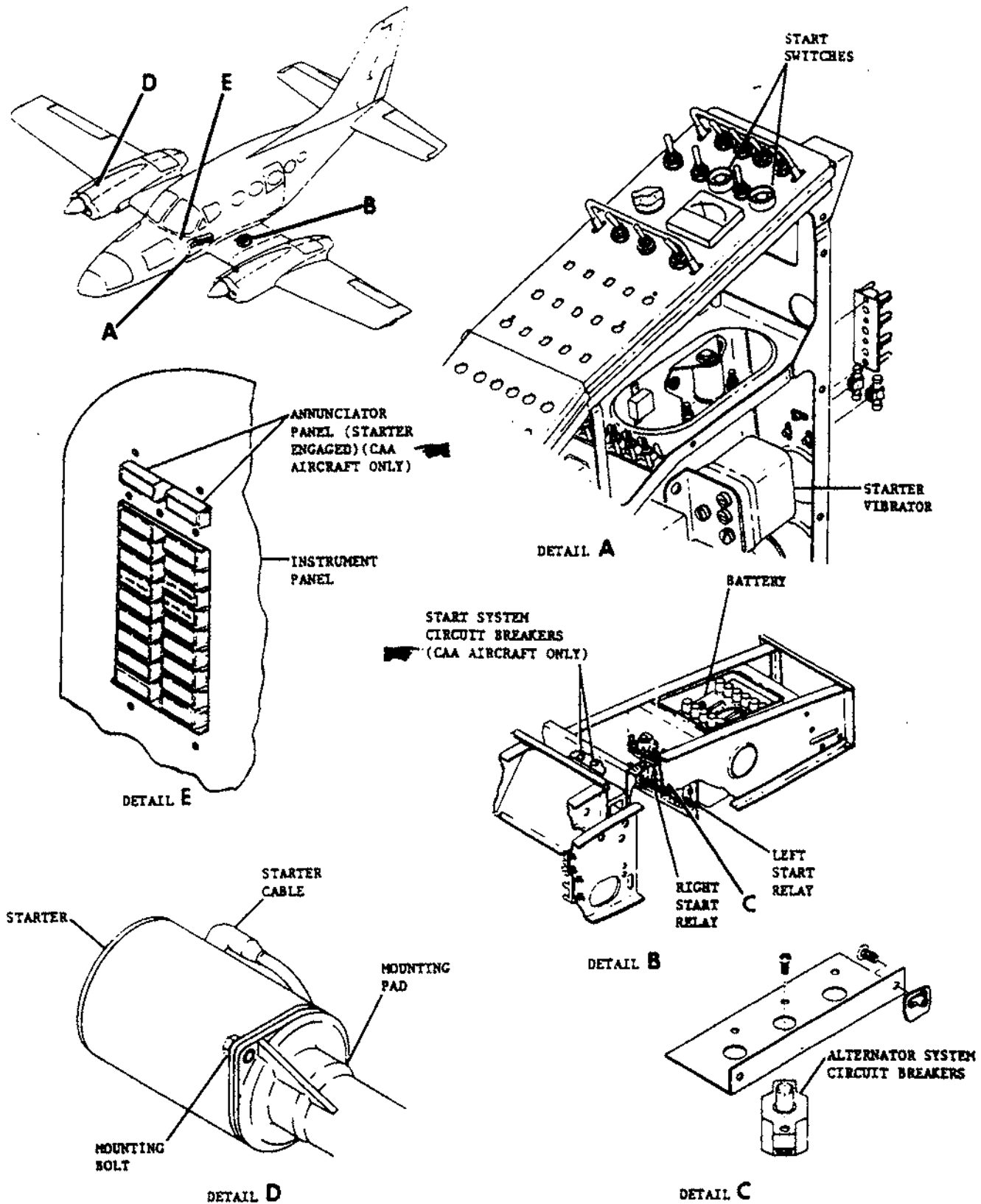
A. Remove Engine Starter.

- (1) Turn electrical power OFF.
- (2) Remove engine cowling.



Troubleshooting Chart - Engine Starting System
Figure 1

51986005



Engine Starting System
Figure 2

- (3) Disconnect starter electrical cable.
 - (4) Remove two mounting bolts securing starter to accessory drive adapter and remove starter.
 - (5) Install temporary cover on accessory drive.
- B. Install Engine Starter.
- (1) Remove temporary cover.
 - (2) Position starter on accessory drive adapter and install two mounting bolts.
 - (3) Connect starter electrical cable and slide terminal boot in place.
 - (4) Install engine cowl.
- C. Remove Start Relay
- (1) Remove battery access cover and necessary stub wing access plates.
 - (2) Turn electrical power OFF.
 - (3) Disconnect battery cables at battery terminals and stow.
 - (4) Tag and disconnect electrical wiring.
 - (5) Remove start relay mounting screws and lift start relay from stub wing.
- D. Install Start Relay.
- (1) Place start relay in position and install mounting screws.
 - (2) Connect electrical wiring and remove tags.
 - (3) Connect battery cables to battery terminals and install battery access cover.
 - (4) Install stub wing access plates.
- E. Remove Starting Vibrator.
- (1) Turn electrical power OFF.
 - (2) Remove pilots seat and left console access cover.
 - (3) Tag and disconnect electrical wires.
 - (4) Remove starting vibrator by removing attaching screws.
- F. Install Starting Vibrator.
- (1) Attach starting vibrator to left console with attaching screws.
 - (2) Connect electrical wires and remove tags.
 - (3) Install left console access cover and pilot's seat.
- G. Remove/Install Start Switches and Circuit Breakers.
- (1) Refer to Typical Switch and Circuit Breaker Removal and Installation, Chapter 13.

Inspection/Check

1. Inspection/Check of Engine Starting System.
 - A. Remove upper engine cowl.
 - B. Remove stub wing access plates.
 - C. Remove left console access cover.

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ENGINE INDICATING SYSTEM

Description

1. The engine indicating system consists of the tachometer, tachometer generator and associated wiring. The tachometer calibrates electrical current from the tachometer generator to revolutions per minute. The tachometer indicator on the instrument indicates propeller RPM.

Troubleshooting

1. For troubleshooting the engine indicating system, refer to Figure 1.

Maintenance Practices

1. Removal/Installation of Engine Indicating System, refer to Figure 2
 - A. Remove tachometer indicator in accordance with typical instrument removal, Chapter 10, Instrument Panel.
 - B. Remove Tachometer Generator.
 - (1) Remove engine upper cowling.
 - (2) Disconnect electrical connector.
 - (3) Remove heat shield from tachometer generator.
 - (4) Remove nuts, lockwashers and washers securing tachometer generator to drive adapter and remove.
 - C. Install tachometer indicator in accordance with typical instrument installation, Chapter 10, Instrument Panel.
 - D. Install Tachometer Generator.
 - (1) Mount tachometer generator to drive adapter securing with washers, lockwashers and nuts.
 - (2) Install heat shield from tachometer generator.
 - (3) Connect electrical connector to tachometer generator and secure with safety wire.
 - (4) Install engine upper cowling.
 - (5) Perform engine operation check.

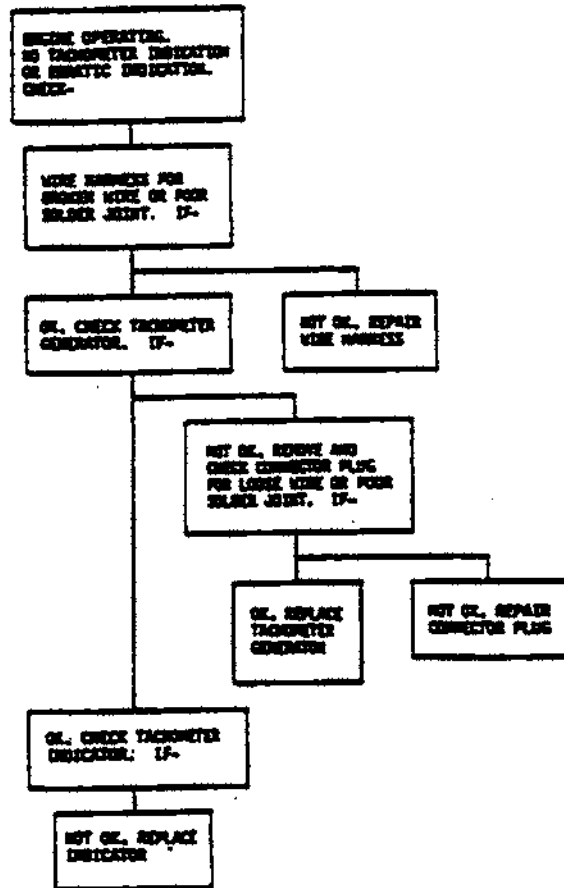
Adjustment/Test

1. Tachometer Generator Test.

NOTE: Test is typical for both tachometer generators.

- A. To determine if a tachometer generator has an electrical malfunction, checking the generator should be performed as follows:
 - (1) Remove upper engine cowling.
 - (2) Disconnect electrical connector from tachometer generator.
 - (3) Using an ohmmeter, measure the resistance of the three (3) generator coils.
 - (a) Pin A to B --- 34.6 to 38.7 Ohms.
 - (b) Pin B to C --- 34.5 to 38.6 Ohms.
 - (c) Pin C to A --- 34.4 to 38.6 Ohms.
 - (4) If a test stand is available to run the generators, voltage can also be measured across the same pin combinations mentioned above. The output should be 29.0 to 31.2 Volts Root-Means-Square (RMS) at 1250 RPM.
 - (5) If the tachometer generator cannot meet the electrical requirements in step (3) or (4), replace tachometer generator.
 - (6) Install upper engine cowling.

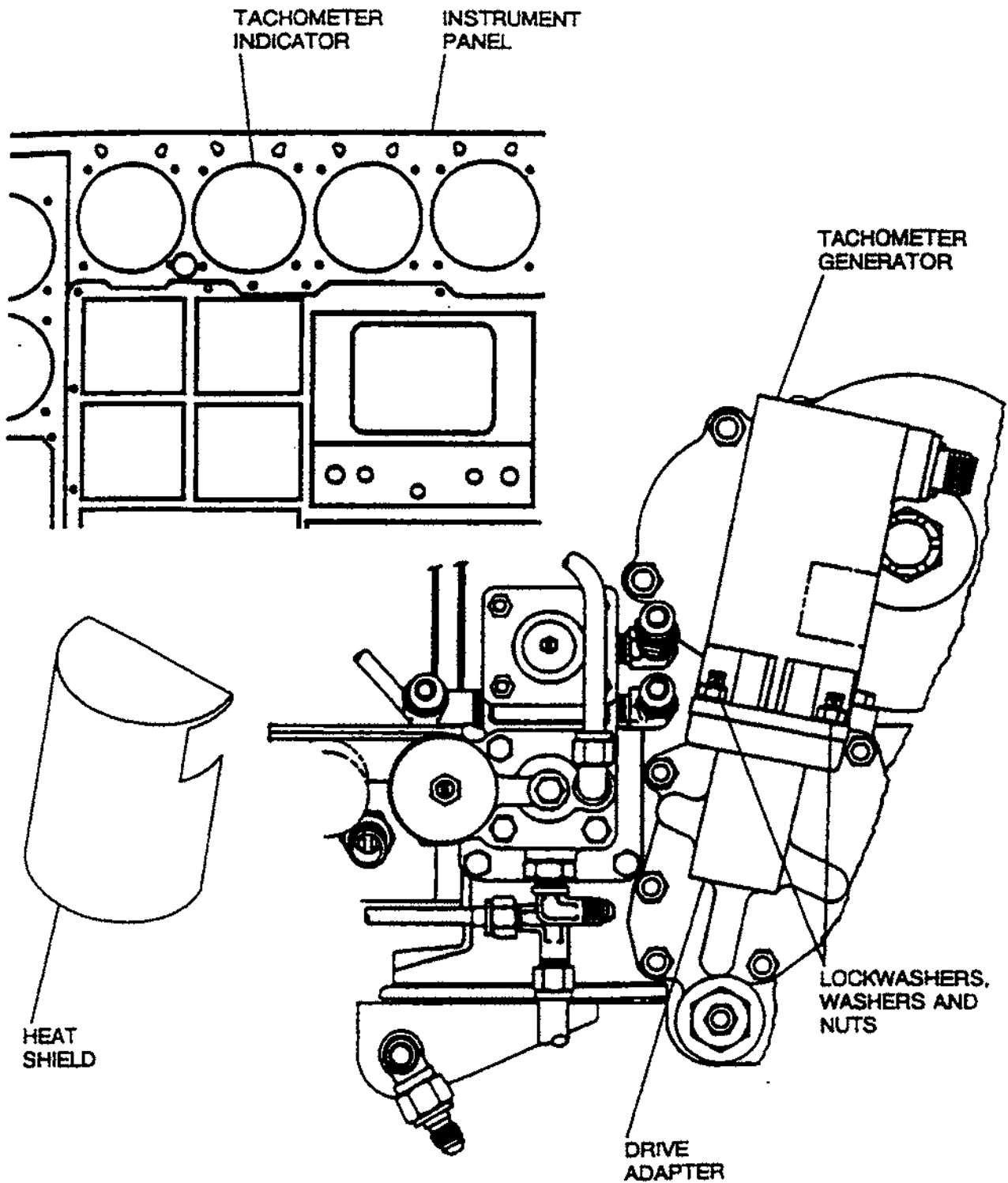
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Troubleshooting Chart - Engine Indicating System
Figure 1

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Engine Indicating System
Figure 2 (Sheet 1)

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ENGINE COMPARTMENT FIRE EXTINGUISHER

Description

1. The engine compartment fire extinguisher (optional) consists of three major components : The annunciator panel, thermal detectors and the extinguisher unit. The annunciator panel is mounted in a standard three inch instrument hole. Three thermal detectors are mounted in the high heat areas of each engine nacelle and the extinguisher unit is mounted in the leading edge of the wing just inboard of the nacelle. An exit line is routed from the extinguisher into the forward section of the engine where the freon gas is expelled. A smaller discharge hose which routes off the large discharge hose expels freon gas from the center of the nacelle area towards the inboard side of the nacelle. Airplane 421C1401 and On, a door is utilized to view the container pressure gage.

NOTE

The test switch does not check the detector system.

2. A test function is provided to test the system circuit. When the test switch is pushed, all lights on the annunciator panel should illuminate.
3. If an overheat condition is detected, the appropriate FIRE light will annunciate the engine to be extinguished. The extinguisher is activated by opening the appropriate guard and pressing the FIRE light. The E light (amber) will illuminate after the extinguisher has been discharged and will continue to show empty until a new bottle has been installed. The FIRE light will remain illuminated until the temperature in the compartment cools.

NOTE

Only one discharge is available per engine.

Troubleshooting

1. For troubleshooting the engine compartment fire extinguisher, see Figure 3.

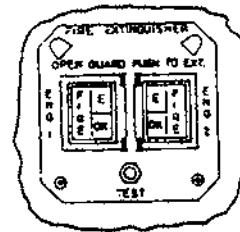
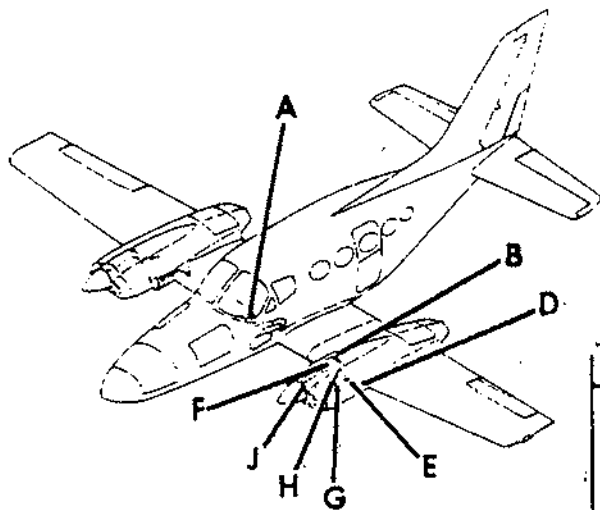
Maintenance Practices

1. General.
 - A. The maintenance practices describe fire extinguisher container removal / installation procedure, handling practices and component replacement.
2. Tools and Equipment.

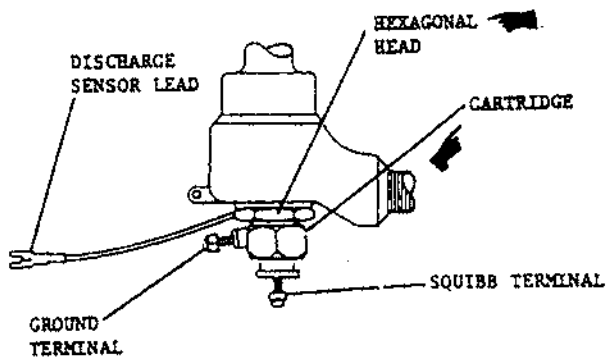
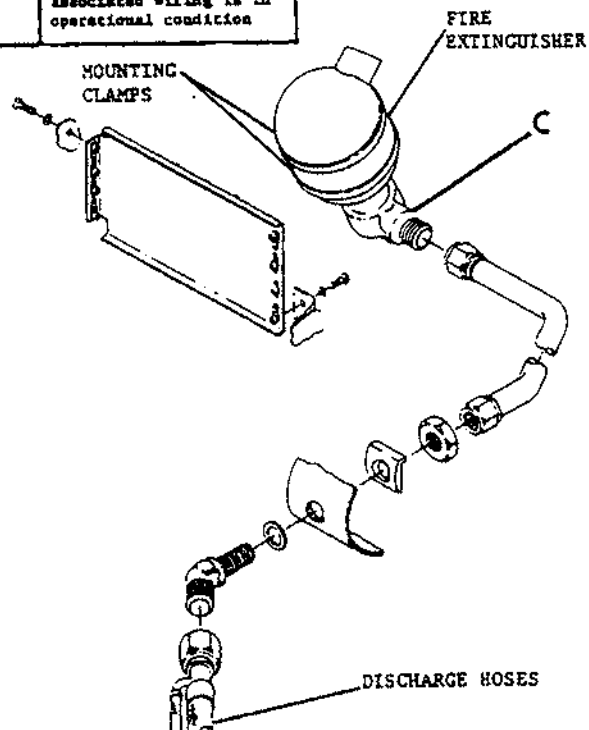
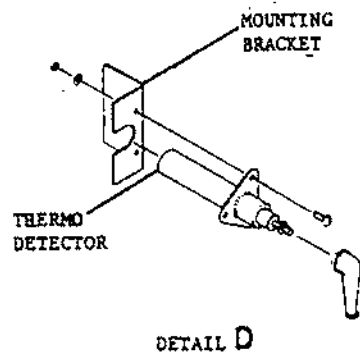
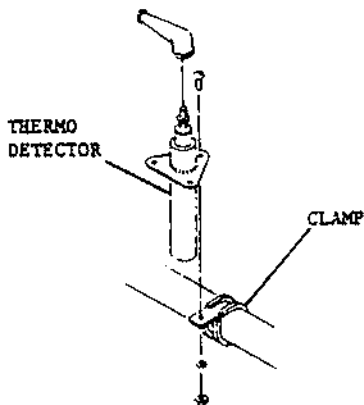
NOTE

Equivalent substitutes may be used for the following items.

Name	Number	Manufacture	Use
Multimeter	Model 260	Simpson Electric Co.	General.
Lubricant	DC-5	Dow Corning Corp. Midland, Mich.	Lubricate seals and threads.
Cleaning Solvent (Methyl n-Propyl Ketone)	CAS NO. 107-87-9	Eastman Chemical Products Inc. P.O. Box 431 Kingsport, TN 37662	Cleaning.
Discharge Tool	83000003	HTL Industries Inc. 373 S. Fair Oaks Drive Pasadena, Calif. 91105	Discharge container.
Shunt Wire			Shorting bar between terminals of cartridge.
Test Stand		Locally Make	Discharge agent from container.
Test Port	Thread size to match cartridge	Locally Make	Discharge cartridge.

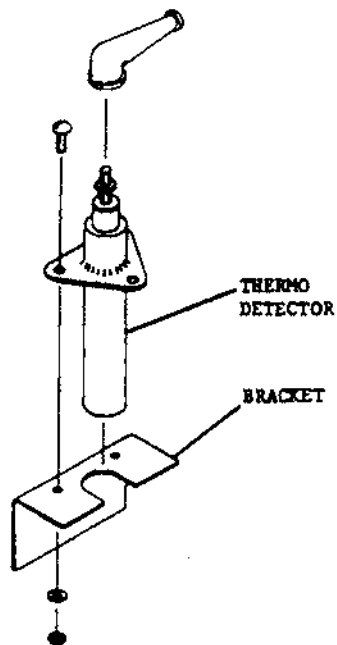


LEGEND	COLOR	CAUSE OF ILLUMINATION
Fire	Red	Fire condition existing in engine compartment
E	Amber	Fire extinguisher container empty
OK	Green	Fire cartridge and associated wiring is in operational condition

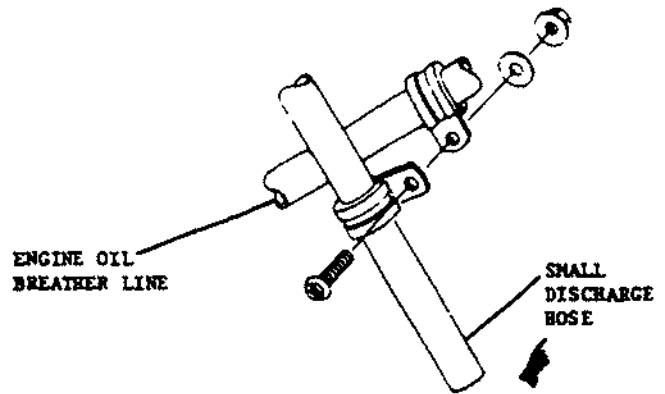


Engine Compartment Fire Extinguisher System
Figure 1 (Sheet 1 of 2)

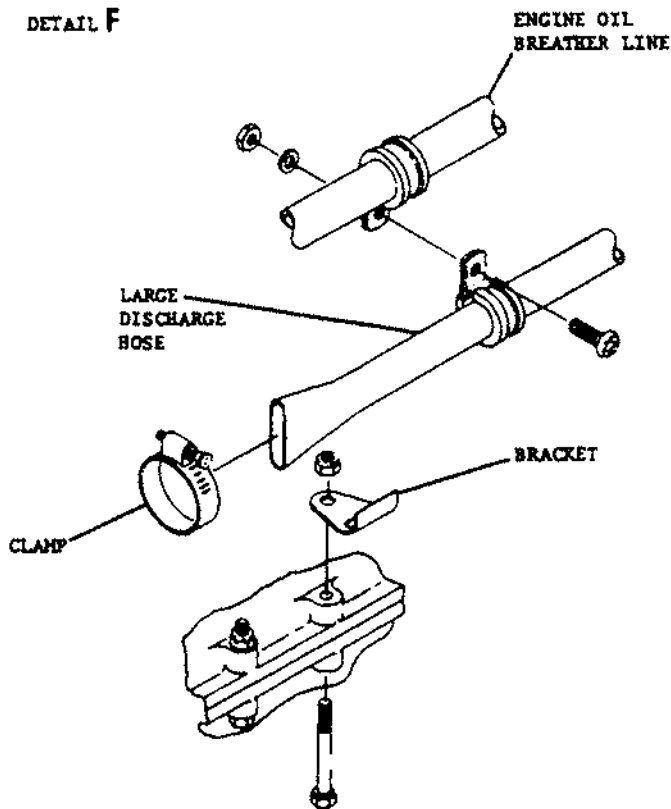
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B51543008
C14541008
D51541019
E51541019



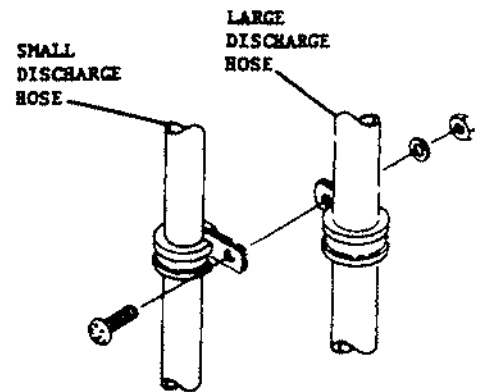
DETAIL F



DETAIL G



DETAIL J



DETAIL H

F51541019
G51541021
H51541017
J51541020

Engine Compartment Fire Extinguisher System
Figure 1 (Sheet 2)

3. Removal/Installation Fire Extinguisher Container (See Figure 1).

A. Remove Container.

- (1) Turn electrical power OFF.
- (2) Remove access cover.

WARNING: INSTALL A SHUNT WIRE BETWEEN GROUND TERMINAL AND SQUIB TERMINAL BEFORE ATTEMPTING TO REMOVE A CHARGED FIRE EXTINGUISHER CONTAINER OR CARTRIDGE.

- (3) Tag and disconnect wiring from fire extinguisher.
- (4) Disconnect line from fire extinguisher container.
- (5) Loosen mounting clamps from fire extinguisher container and remove fire extinguisher container from wing leading edge.

B. Install Container.

- (1) Position fire extinguisher container in place; tighten clamps.

WARNING: DO NOT REMOVE SHUNT WIRE FROM FIRE EXTINGUISHER CONTAINER OR CARTRIDGE UNTIL INSTALLATION IS COMPLETE IN ENGINE NACELLE.

- (2) Connect line to fire extinguisher container.

WARNING: BEFORE CONNECTING ELECTRICAL TERMINALS TO CARTRIDGE, CHECK CONNECTORS WITH A MULTIMETER TO ENSURE NO VOLTAGE IS PRESENT AT CONNECTOR.

- (3) Connect electrical wires.
- (4) Turn on electrical power and check:
 - (a) Annunciator lights are out.
 - (b) Press the test switch and determine that lights come ON.
- (5) Install access cover.

4. Discharging Fire Extinguisher Container.

A. Remove the container from the airplane.

- (1) Secure the container in the test stand so the fill fitting is facing down.
- (2) Remove cartridges from the container. Refer to the removal/installation procedure.
- (3) Screw the discharge tool part number 83000003 into the fill fitting until the extinguishing agent starts bleeding.

WARNING: THE EXTINGUISHING AGENT SHALL BE BLED IN A WELL-VENTILATED AREA.

- (4) Allow all extinguishing agent to be expelled; check pressure gage. Remove discharge tool from the fill fitting.
- (5) Remove fire extinguishing container from the test stand.

5. Charging Fire Extinguisher Container

- A. Ship container to authorized FAA service and overhaul repair station or manufacturer for charging container.

6. Removal/Installation of Cartridge

A. Remove Cartridge.

NOTE: Prior to removal of the cartridge, personnel shall carefully read all instructions and study illustrations.

- (1) Before proceeding with removal procedure, connect a shunt wire between the two terminals of the cartridge. The shunt wire must remain connected while container is being serviced or is in storage.

WARNING: THE CARTRIDGE IS A PYROTECHNIC DEVICE. INADVERTENT DETONATION OF THE CARTRIDGE CAN CAUSE PERSONNEL INJURY. FOR SAFE HANDLING, THE ELECTRICAL CONTACTS MUST BE SHORTED TOGETHER.

- (2) Remove safety wire from the housing assembly and cartridge.
- (3) Remove the cartridge from the housing assembly by unscrewing the cartridge while holding the hexagonal head of the housing assembly.

WARNING: DO NOT LOOSEN THE HOUSING ASSEMBLY IF THE CONTAINER IS PRESSURIZED. THIS MAY CAUSE THE CONTAINER TO DISCHARGE AND CAUSE SERIOUS INJURY.

- (4) Disposition of the cartridge.
 - (a) If the cartridge has service life remaining, properly tag cartridge, wrap in aluminum foil, place in a properly identified carton and store in a cool dry place. Return the cartridge to service as soon as possible.
 - 1) Once installed, the service life of the cartridge begins regardless of how many times or how long the cartridge is separated from the fire extinguisher container.
 - a) Life of the cartridge is a combination of shelf life and service life. Combination of shelf life and service life cannot exceed five years.

Shelf life - If the cartridge is carefully wrapped in aluminum foil and kept in a well-sealed container, the shelf life may be three years. If the cartridge is stored in a box, the shelf life is reduced to two years.

Service life - Service life of three years provided that the shelf life requirements described above have been met and the unit has been stored for two years maximum.

- (b) If the cartridge has exceeded the shelf life and/or service life, dispose of the cartridge.
 - 1) Install cartridge into a fixture specifically designed to withstand the detonation of the cartridge. If the fixture is not available, dispose of cartridge in accordance with local regulations governing disposition of Class "C" explosives.

NOTE: There is approximately 150 grains of powder in the cartridge.

- 2) Remove the shorting bar (shunt wire); apply 24 volts DC to the cartridge terminals.

WARNING: BEFORE APPLYING VOLTAGE TO THE CARTRIDGE, VISUALLY INSPECT THE FIXTURE FOR DAMAGE.

B. Install Cartridge.

- (1) Install new seal on cartridge.
- (2) Apply lubricant to the cartridge threads.
- (3) If the cartridge does not have a shunt wire, install shunt wire.
- (4) Install cartridge in housing assembly.
- (5) Hold hexagonal head of housing assembly with a wrench and tighten cartridge. Torque cartridge to approximately 100 inch-pounds.

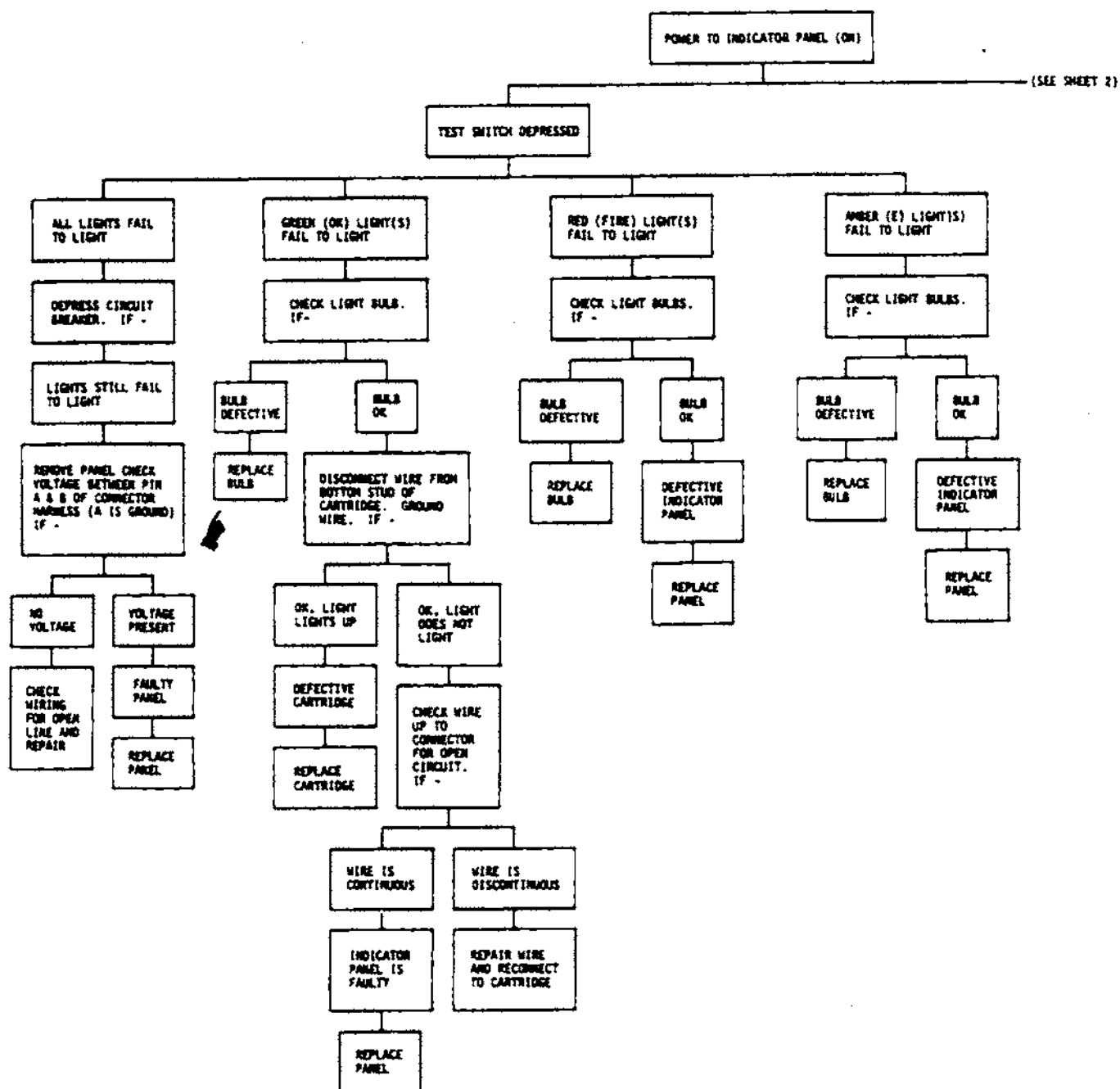
NOTE: Do not let the hexagonal head of the housing assembly rotate while torquing cartridge; excessive torque on housing assembly will result.

- (6) Safety wire cartridge and housing assembly.

7. Removal/Installation Thermo Detectors (See Figure 1).

A. Remove Thermo Detectors.

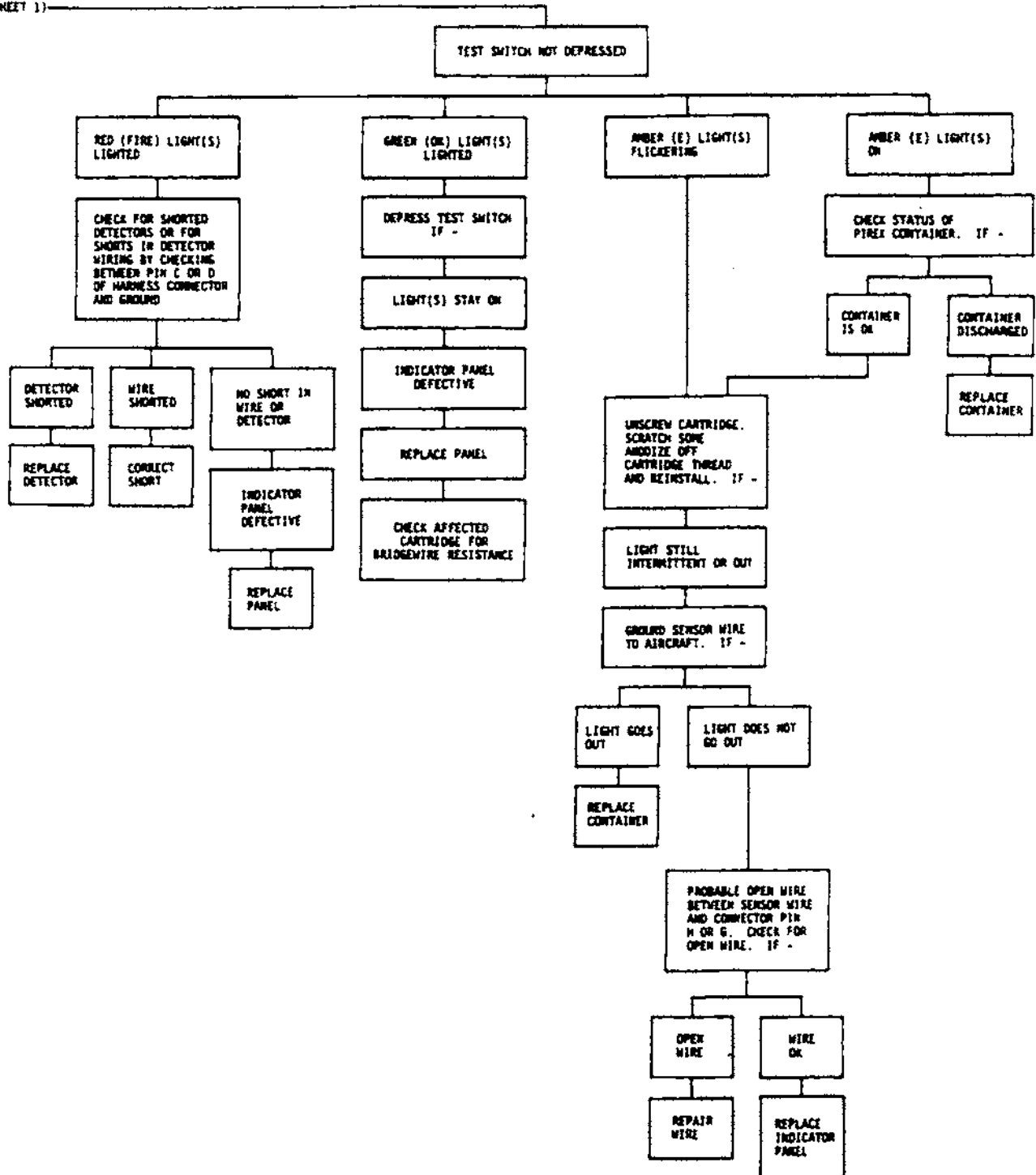
- (1) Turn electrical power OFF.
- (2) Remove engine cowl.
- (3) Loosen and remove nuts, washers and bolts attaching thermo detector to bracket or clamp.
- (4) Tag and disconnect electrical wire from detector.
- (5) Remove detector from nacelle.



Engine Fire Extinguishing System - Troubleshooting Chart
Figure 2 (Sheet 1 of 2)

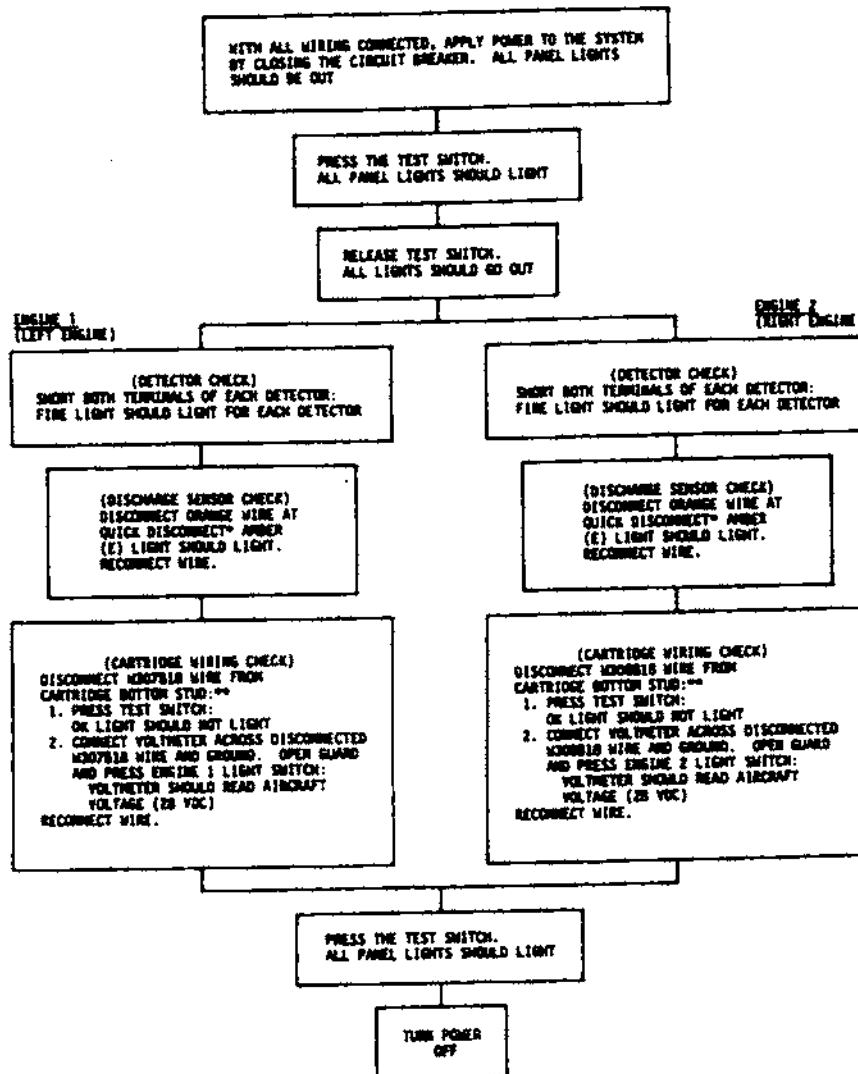
58988010

(SEE SHEET 1)



Engine Fire Extinguishing System - Troubleshooting Chart
Figure 2 (Sheet 2)

58988011



- * If amber light does not light, but green light stays out when test button is depressed, indicates that sensor and cartridge wires have been interchanged.
 ** If amber light lights, sensor and cartridge wires have been interchanged.

Checkout Chart - Fire Extinguisher System
Figure 3

10988027

B. Install Thermo Detector.

- (1) Position thermo detector in place and secure with bolt, washers and nuts.
- (2) Connect electrical wire to detector and remove tag.
- (3) Install engine cowl.

8. Removal/Installation Annunciator Panel (See Figure 1).

A. Remove Annunciator Panel.

- (1) Turn electrical power OFF.
- (2) Disconnect electrical connector.
- (3) Disconnect wiring from post lights and remove post lights.

B. Install Annunciator Panel.

- (1) Position annunciator panel in place and install the lower screws.
- (2) Install the two post lights in upper mounting holes and connect electrical wiring.
- (3) Connect electrical connector to annunciator panel.
- (4) Turn on electrical power and check the operation of annunciator panel.

Adjustment/Test

1. Check out engine compartment fire extinguisher container (see Figure 3).

Inspection/Check

1. Inspection/Check of Engine Compartment Fire Extinguisher.

- A. Remove upper engine cowl.
- B. Remove fire extinguisher container access plate in leading edge of wing.

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CHAPTER

8

PROPELLER

CESSNA AIRCRAFT COMPANY
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COMPONENTS LOCATION CHART
Propeller

<u>Components</u>	<u>Location</u>
Synchronizer Actuator	Right, Engine Compartment
Synchronizer Control Box	Upper, Glove Compartment
Synchrophasor	Aft Side, PS 100 Bulkhead
Unfeathering Accumulator	Left Side, Engine Mount Beam

PROPELLERDescription

1. The aircraft is equipped with all metal, three bladed, constant speed, full-feathering, single acting, and governor regulated propellers. Each propeller utilizes hydraulic pressure which opposes the forces of springs and counterweights to obtain the correct pitch for engine load. Hydraulic pressure from the engine-mounted governor urges blades toward low pitch (increasing rpm) while the springs and counterweights urge blades toward high pitch (decreasing rpm). The source of hydraulic pressure for propeller operation is the engine oil system, boosted in pressure by the governor gear pump, and supplied to the propeller hub through engine shaft flange. When the engine is not in operation, the high pitch latch mechanism prevents the propeller blades from moving into the feathered position. To feather the propeller blades, the propeller control levers on the control pedestal must be placed in the feathered position. Unfeathering the propeller is accomplished by positioning the propeller control levers to increase rpm position and rotating the blades to the low pitch position by starting the engine. If installed, the optional unfeathering system uses accumulator air and oil to force the propeller to the low pitch condition.

Troubleshooting

1. Troubleshooting the Propeller

- A. For a guide to troubleshooting the propeller system, refer to Figure 1.
- B. When troubleshooting a 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.
- C. Refer to Adjustment of Governor for typical malfunctions and corrections of malfunctions of the governor.

Adjustment Test

1. Operational Check of Propellers

NOTE: For additional service information for propellers, governors and accumulators, refer to McCauley Service/Parts Manuals.

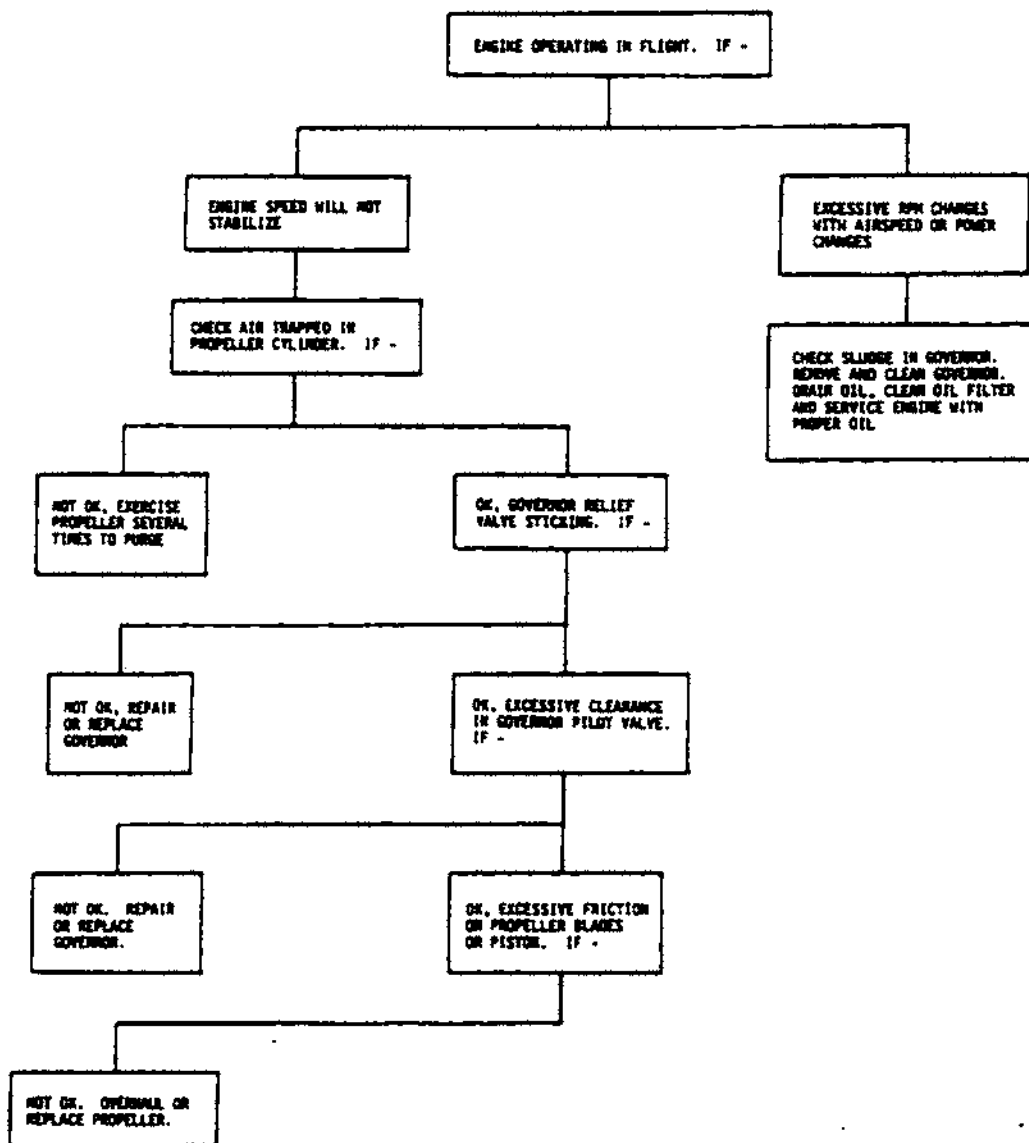
- A. Anytime the propellers or propeller governors have been removed, the following check should be performed after reinstallation, this will ensure that the engine-propeller-governor combination is in good operating adjustment and will give maximum performance.

- (1) Face aircraft into the wind. Start engines and allow to warm up with the oil temperature operating in the upper two thirds of the operating range, on the oil temperature indicator.

NOTE: Avoid running up engines where loose stones or cinders can be picked up by an inflow of air and damage the propeller blades.

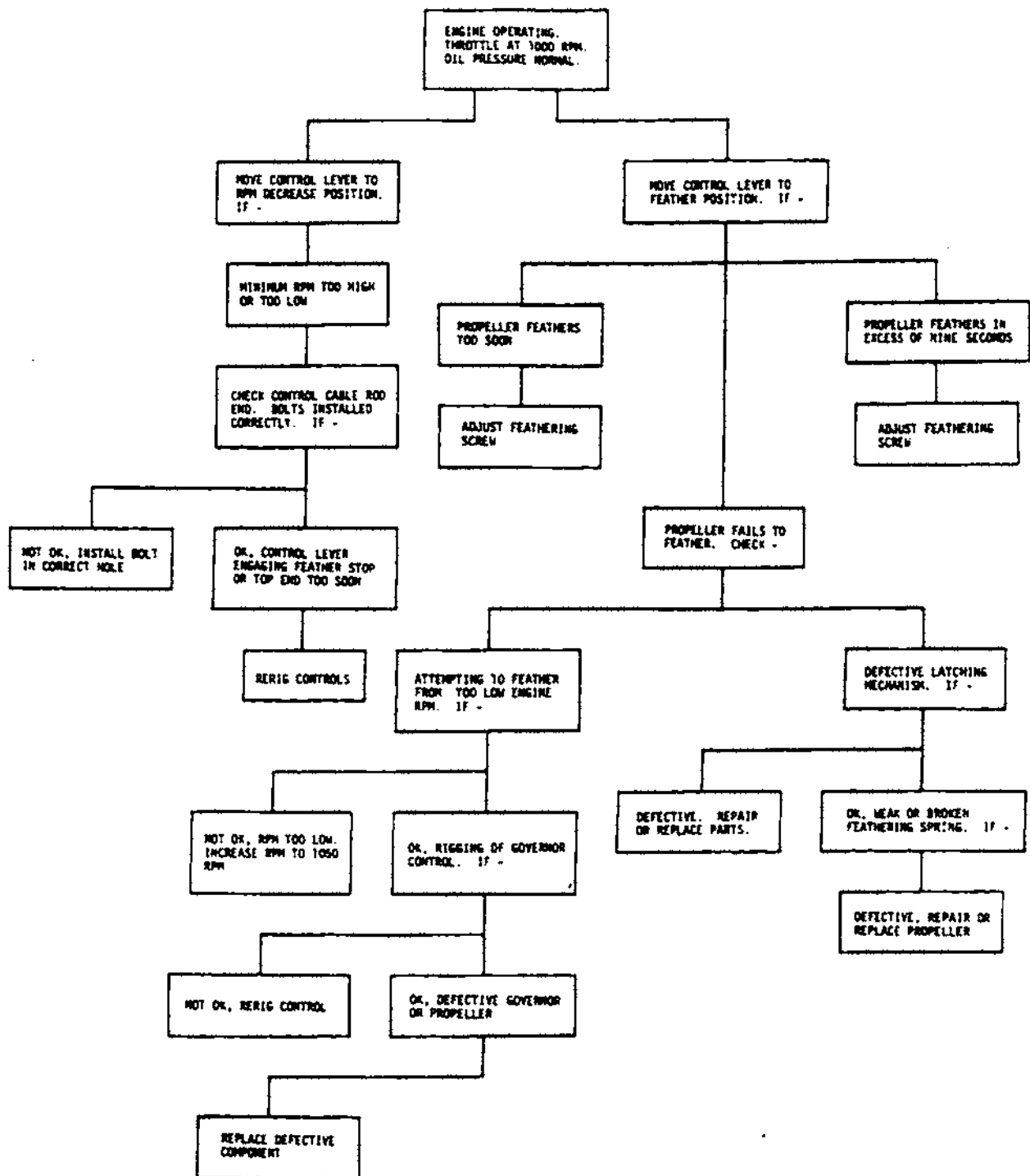
- (2) Maximum rpm check. If local wind and ambient temperature conditions allow ground attainment of maximum rpm, verify and/or adjust control system as follows:
 - (a) Check maximum rpm 2220 - 2235.
 - (b) Check top end of control lever for a minimum of 0.20 inches cushion. If necessary, adjust control lever to obtain proper cushion.
 - (c) Check override of control cable travel limits. Control should not reach internal stops before contact is established at governor or control quadrant stops.

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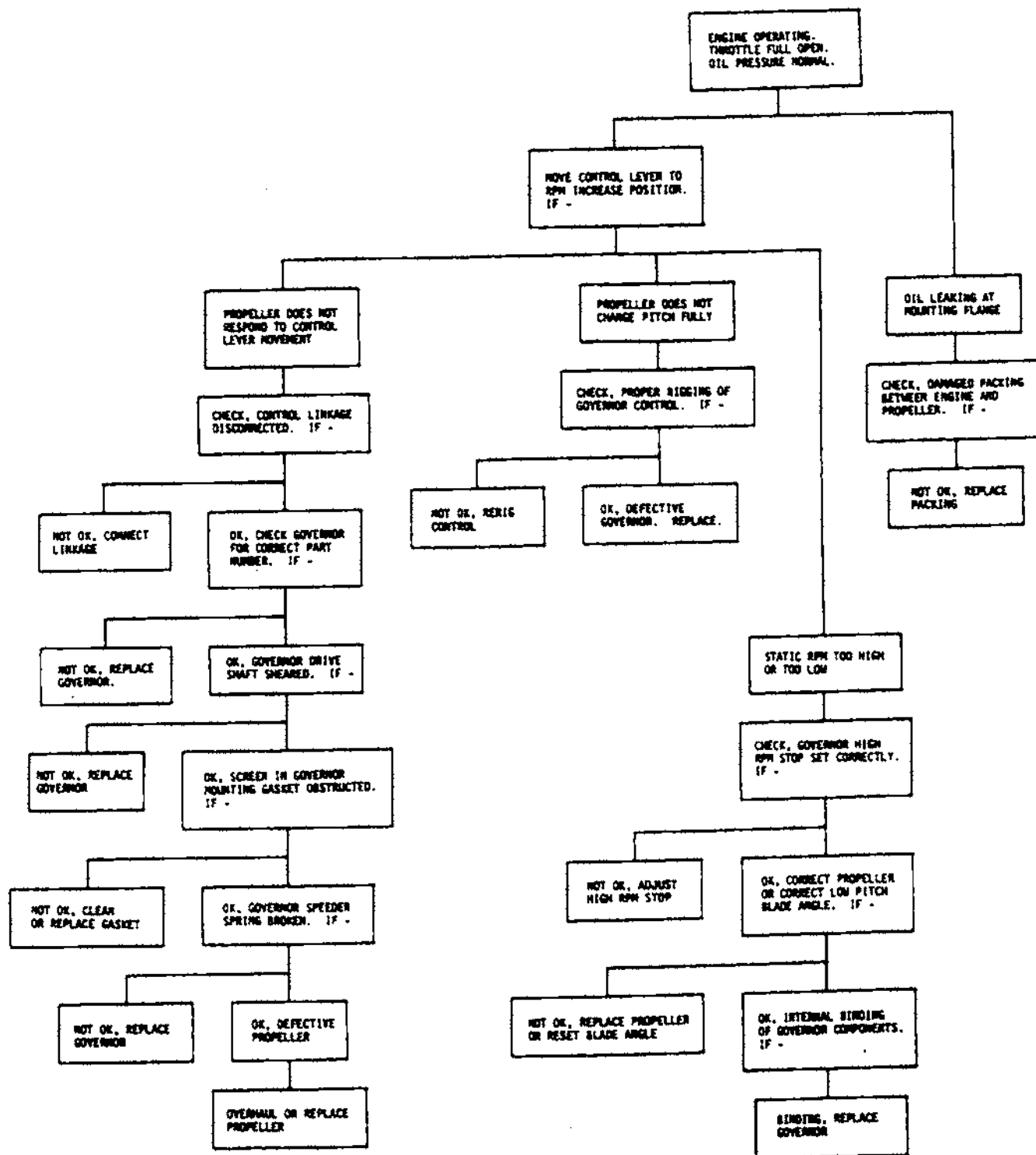
Troubleshooting Chart - Propeller System
Figure 1 (Sheet 1 of 3)

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Troubleshooting Chart - Propeller System
Figure 1 (Sheet 2)

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Troubleshooting Chart - Propeller System
Figure 1 (Sheet 3)

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- (d) If local wind and ambient temperature conditions do not allow ground attainment of maximum rpm, the airplane may be flown for flight testing only, providing the engine speed is not lower than 50 rpm from the maximum rpm and the difference between both engines does not exceed 25 rpm. For adjustment of governor, refer to Chapter 8-10, Adjustment Test.

CAUTION: IF ADJUSTMENTS PERFORMED ON THE MAXIMUM RPM SETTING SCREW ON THE GOVERNOR FAIL TO PROVIDE INCREMENTS OF GROUND MAXIMUM STATIC RPMs (AS INDICATION OF INABILITY TO ATTAIN MAXIMUM GOVERNING SPEEDS), THE GOVERNOR SETTING SCREW MUST BE RETURNED TO THE ORIGINAL ADJUSTMENT. THIS IS REQUIRED TO PREVENT THE POSSIBILITY OF AN OVERSPEED CONDITION DURING FLIGHT.

- (3) Minimum control check
- (a) With manifold pressure maintained at 24" Hg., gradually retard the propeller control levers and verify that with levers firmly against the feather gate stops, the indicated engine speed drop is within the 1400 to 1550 rpm range. If required, adjust control system as required.
 - (b) Gradually advance the propeller control levers and verify that identical engine speeds are available within a half knob differential between control levers.
- (4) Check control lever cushion as follows:
- (a) With engine control quadrant friction lock completely relaxed, verify that a minimum top end cushion of 0.20 inches is maintained. Any control cable system adjustments performed to correct inadequate cushion conditions, requires a new verification of maximum rpm step (2) and minimum control step (3).
- (5) Check operation of feathering as follows:
- (a) With propeller control full forward and mixture control in full rich position, reduce throttle to attain 1000 to 1050 rpm.

CATION: DO NOT FEATHER FROM A HIGH RPM AS THIS WILL CAUSE EXCESSIVE MANIFOLD PRESSURE AND POSSIBLE DAMAGE TO THE ENGINE.

- (b) After engine speed stabilizes between 1000 and 1050 rpm, place the propeller control lever behind the feather gate stop on the control pedestal. This motion must be at a rapid rate and feathering periods must be timed from the instant the propeller control lever reaches the feather cushion position.
- (c) Immediately retard the mixture control lever to the idle cut-off position.
- (d) Feathering periods terminate when the propeller blades cease to rotate about their axis, and must not exceed 9.0 seconds.
- (e) On aircraft incorporating an unfeathering system, move the propeller control lever to the feather gate stop position; propeller should return to the low pitch position.
- (f) Anytime the propeller attachment has been subjected to excessive engine roughness the propeller should be removed and the dowel pin inspected. Refer to Rough or Malfunction Engine Operation Check, Chapter 7.

Maintenance Practices

1. Tools and Equipment.

Name	Number	Manufacturer	Use
Propeller Torque Wrench Adapter	5090006-13	Cessna Aircraft Company Wichita, Kansas	Checking torque of propeller nuts
Propeller Torque Wrench		Commercially Available	Checking torque of propeller nuts

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2. Removal / Installation of Propeller (See Figure 2).

A. Remove propeller

NOTE : THE REMOVAL PROCEDURE IS THE SAME FOR EITHER PROPELLER. BEFORE REMOVING THE PROPELLER IT SHOULD BE PLACED IN THE FEATHERED POSITION. THIS WILL ALLOW THE OIL IN THE BLADE ACTUATING CYLINDER TO DRAIN BACK INTO THE ENGINE AND WILL PROTECT THE BLADE ACTUATING CYLINDER WALL FROM DAMAGE DURING THE REMOVAL PROCEDURE.

- (1) Feather the propeller. Refer to Adjustment/Test, Operational Check of Propellers.
- (2) If optional propeller unfeathering system is installed, it will be necessary to relieve pressure in the propeller system with the propeller blades remaining in the feathered position. To accomplish this, proceed as follows:
 - (a) After the propeller has been feathered and the engine shutdown, move propeller control out of the FEATHER position until blades start to unfeather then quickly pull the control back into FEATHER.
 - (b) Continue to "milk" pressure out of the system with the propeller control until the propeller blades will no longer move. This may require from 15 to 20 movements of the propeller control.

NOTE : DO NOT ALLOW PROPELLER BLADE TO ROTATE FAR ENOUGH TO LET HIGH PITCH LATCHES ENGAGE, OR ENGINE WILL HAVE TO BE RESTARTED, PROPELLER FEATHERED AGAIN AND THE PROCEDURE REPEATED.

- (3) Remove engine upper cowl and cowl nose cap. Refer to Chapter 7.

NOTE : IT IS PERMISSIBLE TO REMOVE AND INSTALL PROPELLER WITHOUT REMOVING SPINNER, IF DESIRED.

- (4) Remove screws attaching spinner (1) to spinner bulkhead (8). Retain all spacers (3) from behind support (2).

NOTE : IF THE AIRCRAFT IS EQUIPPED WITH A PROPELLER DEICE SYSTEM, REMOVE THE DEICE WIRES FROM TERMINALS AND RETAINER FROM BULKHEAD.

- (5) Remove eight attaching nuts securing the propeller hub (4) to engine crankshaft (6).

CAUTION : SUPPORT THE PROPELLER BEFORE REMOVING THE LAST NUT, TO PREVENT THE POSSIBILITY OF DROPPING PROPELLER.

- (6) Remove propeller from engine crankshaft.

- (7) Remove spinner bulkhead (8) and adapter (7) (or slip ring if propeller deice is installed) from propeller hub.

B. Install Propeller.

- (1) Position spinner bulkhead over propeller hub attack studs.
- (2) Wipe all dust and foreign particles from the propeller hub oil passage, the crankshaft flange and the crankshaft oil passage with a clean cloth.
- (3) Install of check packing in the propeller hub and lubricate lightly with engine oil.

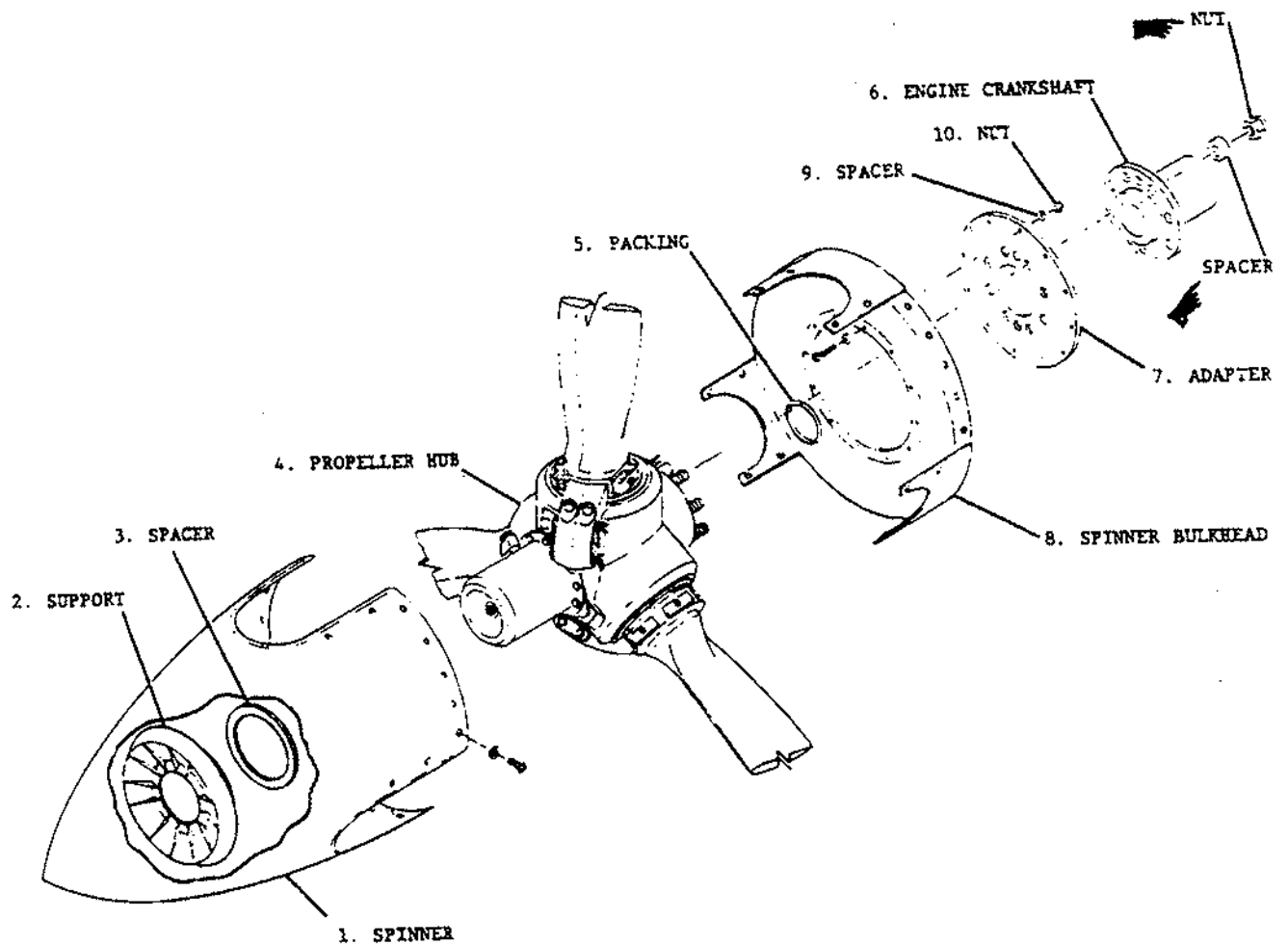
CAUTION : PRIOR TO INSTALLATION, THREADS OF BOTH THE STUDS AND NUTS SHOULD BE INSPECTED TO BE FREE FROM NICKS, BURRS OR SIMILAR DAMAGE. THE NUTS AND STUDS SHOULD BE CLEAN AND FREE FROM ANY FOREIGN MATERIALS. LIBERALLY APPLY GREASE (MIL-T-83483, MCCAULEY P/N A1637-16 TO THREADS OF BOTH THE NUTS AND STUDS, AND BOTH FACES OF THE SPACERS. TORQUE NUTS TO LUBRICATED TORQUE (68-72 FT-LBS). DO NOT TORQUE TO VALUE SHOWN ON ADAPTER.

- (4) Position propeller and spinner bulkhead on the crankshaft.
- (5) Secure propeller to crankshaft with eight nuts.

WARNING : DO NOT USE ALL STEEL LOCKNUTS. USE ONLY NEW ELASTIC ELEMENT LOCKNUTS WHEN INSTALLING PROPELLER.

- (6) Torque nuts 68 to 72 foot-pounds

NOTE : TORQUE WRENCH READING WILL BE 41 FOOT-POUNDS WHEN USING A 12 INCH TORQUE WRENCH WITH A 5090006-13 ADAPTER OR 48 FOOT-POUNDS WHEN USING AN 18 INCH TORQUE WRENCH.



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Propeller Installation
Figure 2

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NOTE : IF THE PROPELLER IS EQUIPPED WITH A DEICE SYSTEM,
CONNECT THE WIRES TO TERMINAL STRIP.

- (7) Install spinner as follows :
 - (a) Install spacer (3) and support (2).
 - (b) Lightly press spinner (1) to hold snug against support and check alignment of spinner holes with bulkhead (8).
 - (c) Alignment of 3/64 or less is a satisfactory fit. Add or remove shims to produce this condition.
 - (d) Pushing hard on the shell, install screws.
- (8) Replace cowling nose cap and engine upper cowl and check propeller for operation in accordance with the operational check procedure.
- (9) If optional propeller unfeathering system is installed, charge accumulator. Refer to Chapter 2.

Cleaning/Painting

1. Cleaning Propellers.

- A. Clean all metal parts in a mixture consisting of (1) one part lubricating oil. Specification MIL-L-6082, Grade 1030, and (2) two parts solvent, Federal Specification P-S-661. Clean small, highly finished parts separately, exercising care not to cause damage particularly to working surfaces.

NOTE : INSIDE DIAMETER OF COUNTERWEIGHT HALVES AND FERRULE GROOVE IN WHICH THE MOUNT, MUST BE FREE OF OIL. USE SOLVENT ONLY-NOT THE MIXTURE-TO THESE SURFACES. SHOULD CLEANING MIXTURE OR OTHER LUBRICANT ACCIDENTALLY COME INTO CONTACT WITH THESE SURFACES, CLEAN THOROUGHLY PRIOR TO REASSEMBLY.

- B. Clean non-metallic parts (except gaskets, packings and seals) by wiping with a soft, lint-free cloth dampened with cleaning mixture.
- C. Heavy and tightly adhering deposits may be removed with a soft brush.

CAUTION : UNDER NO CIRCUMSTANCES ARE ANY PARTS TO BE CLEANED WITH A STEEL, OTHER METAL, OR HARD BRISTLE BRUSH, OR TOOL OF ANY TYPE.

- D. After cleaning, allow parts to air dry, or remove excess mixture with a gentle stream of clean, dry compressed air. Keep nozzle well away from parts.
- E. Protect parts from collecting dust and dirt during storage and handling for overhaul. It is recommended that small parts be kept in transparent plastic bags.
- F. Parts which are to be coated with dry film lubricant are to be cleaned with ethyl acetate immediately prior to application of lubricant (Refer to McCauley Service/manual Accessory Division of Cessna Aircraft Company).

PROPELLER GOVERNORSDescription

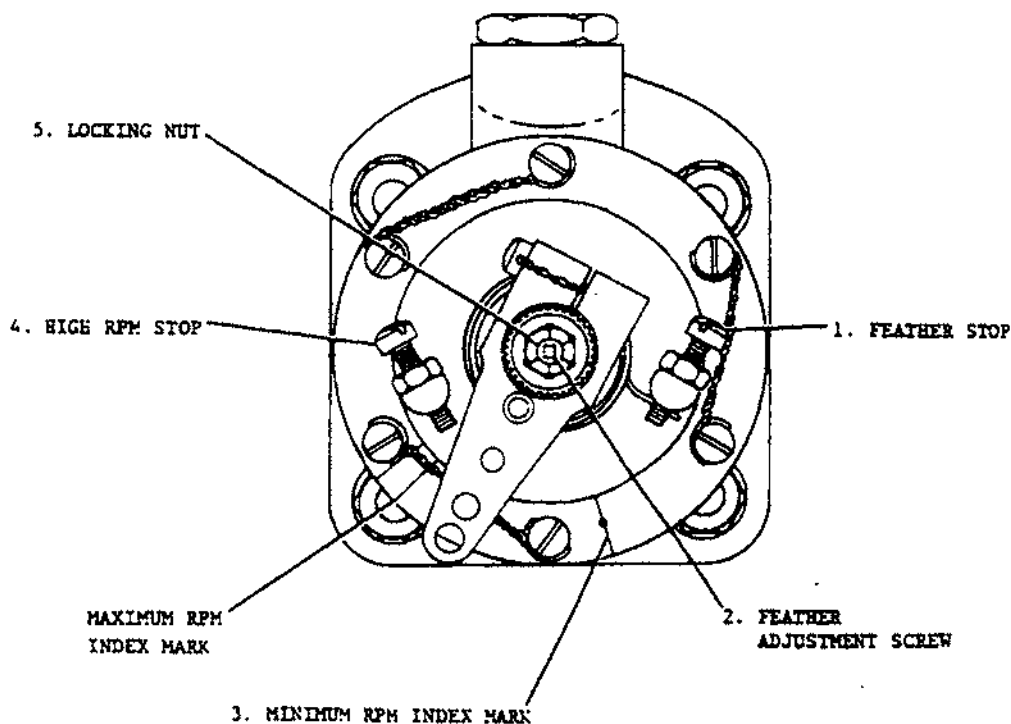
1. A lever head, base mounted, constant-speed, single-acting governor is installed on each engine to control the propeller pitch. The governors are engine-driven and are mounted on the left side of the crankcase just below and forward of the most forward cylinder. A gear type pump and relief valve is incorporated in each governor to boost engine oil pressure which, regulates aircraft engine speed by varying the pitch of the propeller to match load torque to engine torque in response to changing conditions of flight. Internal flyweights are attached to a pilot valve that directs high pressure oil to the propeller piston or allows oil to drain from the piston.

Troubleshooting

1. Troubleshooting Propeller Governor.
 - A. Refer to Adjustment of Governor for Troubleshooting the Governor.

Adjustment/Test

1. Adjustment/Test Propeller Governor System.
 - A. Rigging propeller governor controls (See Figure 1).
 - (1) Disconnect the propeller control rod end at the governor arm by removing nut, spacer, washer and bolt.
 - (2) Move propeller control lever from maximum to minimum rpm position (against feather gate stop).



Propeller Governor Adjustment
Figure 1

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- (3) Adjust control system cable rod ends, cable housing and support bracket as required to align rod end hole with rigging pin (No. 8 drill shank or equivalent) installed and positioned over the minimum rpm index mark (3).
- (4) Remove rigging pin and install bolt, washers, spacer and nut on outboard arm hole.
- (5) Cycle propeller control lever to insure a minimum top end cushion of 0.20 inch. Make minor adjustments as required to attain minimum cushion at top end and minimum control rpm of 1400 to 1550 rpm at the lower end of lever travel.

B. Adjustment of Governor (See Figure 1)

NOTE: PRIOR TO GOVERNOR MAXIMUM RPM ADJUSTMENTS, AND AFTER REACHING NORMAL OPERATING OIL TEMPERATURES, CYCLE THE PROPELLER CONTROL LEVER A MINIMUM OF SIX CYCLES TO PURGE AIR FROM THE HYDRAULIC SYSTEM AS FOLLOWS: ADVANCE THE THROTTLE TO 1500 RPM, MOVE PROPELLER CONTROL LEVER TO THE FEATHER GATE UNTIL PROPELLER SPEED IS REDUCED TO A RANGE OF 1000 TO 800 RPM, AND THEN ADVANCE PROPELLER CONTROL TO MAX RPM.

CAUTION: DO NOT ALLOW PROPELLER SPEED TO FALL BELOW 800 RPM. REPEAT ABOVE CYCLE A MINIMUM OF SIX TIMES.

- (1) If maximum rpm, low minimum rpm or propeller feathering periods are incorrect, adjust as required.
 - (a) If static rpm is too high, reduce by adjusting high rpm stop screw (4). Turn clockwise one revolution for each 25 rpm decrease. This reduction prevents possible overspeeding at takeoff.
 - (b) If static rpm is too low, it is possible that either the high rpm stop screw (4) or the propeller low pitch stop is the limiting factor. Move the propeller control lever toward decrease rpm and then to increase rpm position; if the maximum attainable rpm is reached at the same time as the governor stop, the governor is the limiting factor. Correct by adjusting the high rpm stop screw. Turn counterclockwise one revolution for each 25 rpm increase. If the maximum obtainable rpm is reached before governor stop is reached, the propeller low pitch stop may be the limiting factor. This would require an adjustment of the propeller blades to decrease the low pitch angle.
 - (c) If feathering time period is in excess of 9 seconds, adjust by loosening locking nut (5) and turn feather adjustment screw (2) counterclockwise. Hold screw position while securing locknut.
 - (d) If propeller feathers before control lever reaches a point 0.20 inch aft of the feather gate stop position, ascertain that propeller control is properly rigged and that minimum rpm range is on the high end of the 1400-1550 rpm range. If control rigging is correct, turn feather adjustment screw (2) clockwise to lower the feather position.
 - (e) If propeller fails to unfeather when propeller control lever is advanced forward of the feather gate stop, turn feather adjustment screw clockwise.
 - (f) For minimum rpm adjustments adjust controls in accordance with rigging procedures.

Maintenance Practices

1. Removal/Installation of Propeller Governor (See Figure 2)

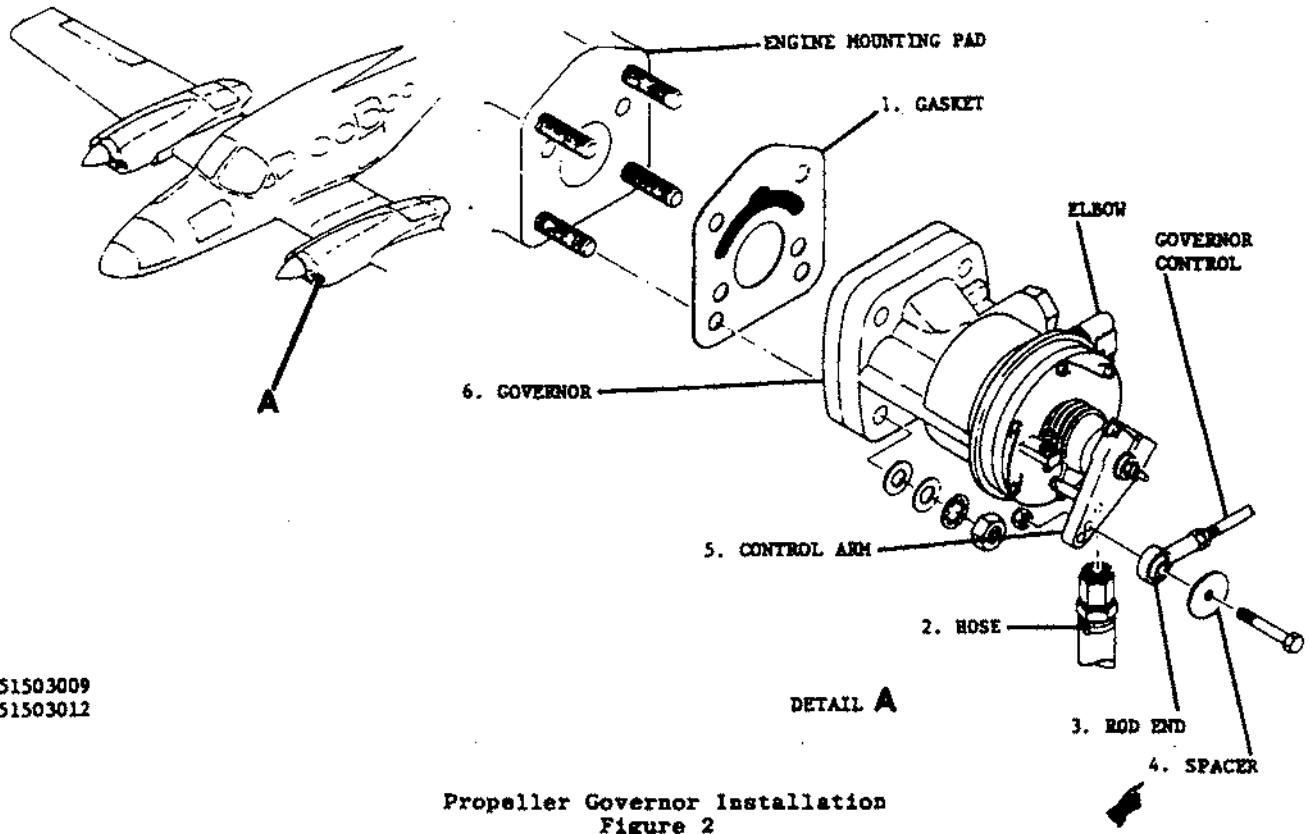
A. Remove Propeller Governor

NOTE: THE REMOVAL PROCEDURE IS THE SAME FOR EITHER PROPELLER GOVERNOR.

- (1) Refer to Chapter 7; remove engine cowlings and baffles as necessary to gain access to propeller governor.
- (2) Remove rod end (3) from governor control arm (5) by removing attaching nut, spacer (4), washer and bolt.

CAUTION: IF AIRPLANE IS EQUIPPED WITH OPTIONAL UNFEATHERING SYSTEM, RELEASE ACCUMULATOR PRESSURE PRIOR TO DISCONNECTING HOSE (2).

- (3) Remove governor (6) and mounting gasket (1) by removing the four nuts, internal tooth lock washers, and plain washers.



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Propeller Governor Installation
Figure 2

B. Install Propeller Governor

- (1) Place mounting gasket (1) over the governor mount studs with the raised surface of gasket screen facing away from the engine.
- (2) Align the splines on the governor shaft with the engine drive, and slide the governor into position.
- (3) Secure the governor in place with the four plain washers, lockwashers and nuts on the governor mount studs. Tighten nuts to 160 inch-pounds.
- (4) Rig propeller governor controls in accordance with rigging procedures.
- (5) Refer to Chapter 7; install engine baffles and cowling in accordance with installation procedures.
- (6) Perform operational check of propellers.
- (7) If optional propeller unfeathering system is installed, service accumulator. Refer to Propeller Unfeathering System Maintenance Practices.

PROPELLER UNFEATHERING SYSTEMDescription

1. Each optional unfeathering system consists of a dry air or nitrogen-charged accumulator, a special governor, and a hose running between the governor and the accumulator. The governor contains a spring-loaded check valve which is unseated while the propeller control is in any position except FEATHER, thus permitting governor-pressurized oil to flow to and from the accumulator. When the propeller control is moved to the FEATHER position, the check valve is seated and oil under governor-pressure is trapped in the accumulator and hose. As the propeller control is moved out of the FEATHER position, the trapped oil flows back through the governor to the propeller to unfeather it.

CAUTION: ALWAYS LEAVE PROPELLER CONTROL IN THE UNFEATHERED POSITION WHEN THE AIRCRAFT IS ON THE GROUND. THIS PROCEDURE PREVENTS THE POSSIBILITY OF HEAT CAUSING TRAPPED OIL TO EXPAND TO PRESSURES WHICH COULD DAMAGE THE ACCUMULATOR.

Troubleshooting

1. Troubleshooting Propeller Unfeathering System.

A. For a guide to troubleshooting the propeller unfeathering system, see Figure 1.

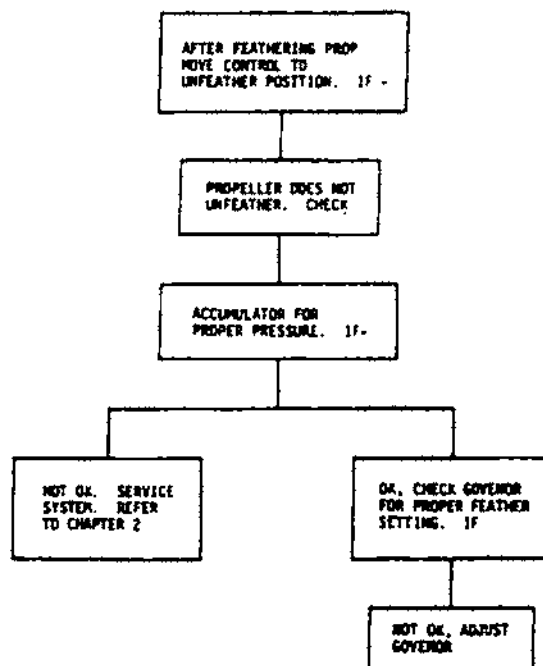
Maintenance Practices

1. Removal/Installation of Propeller Accumulator System (See Figure 2).

A. Remove Accumulator System.

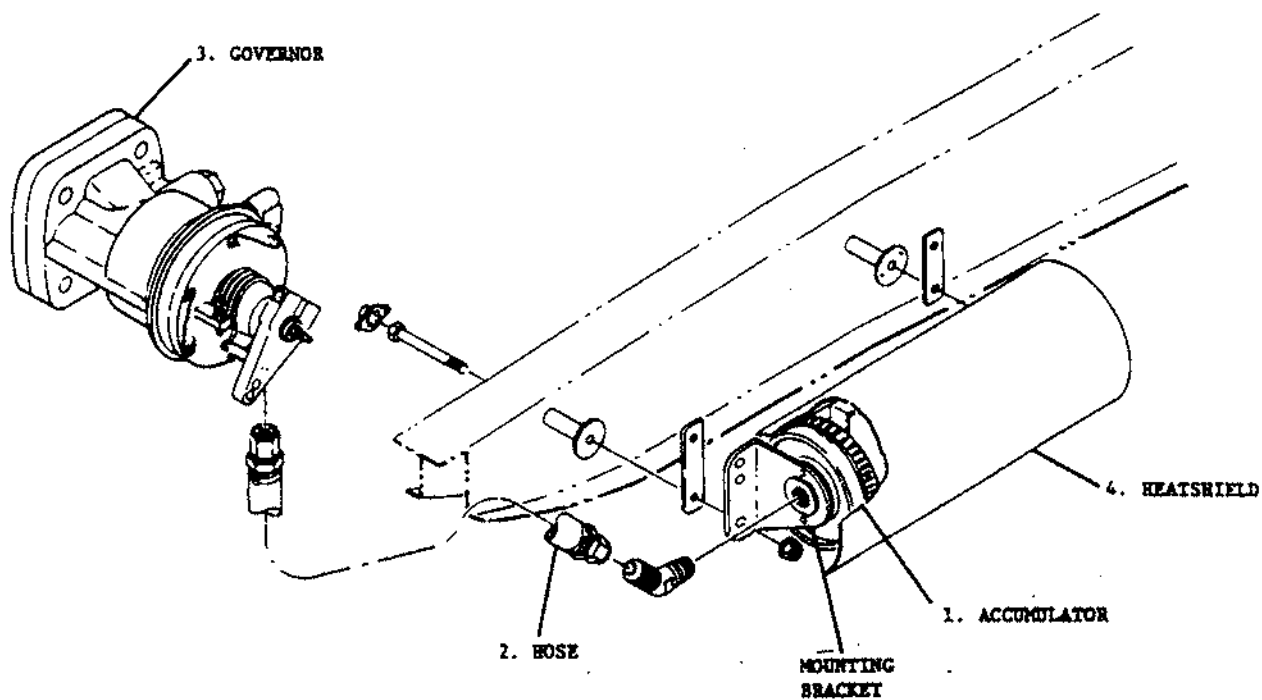
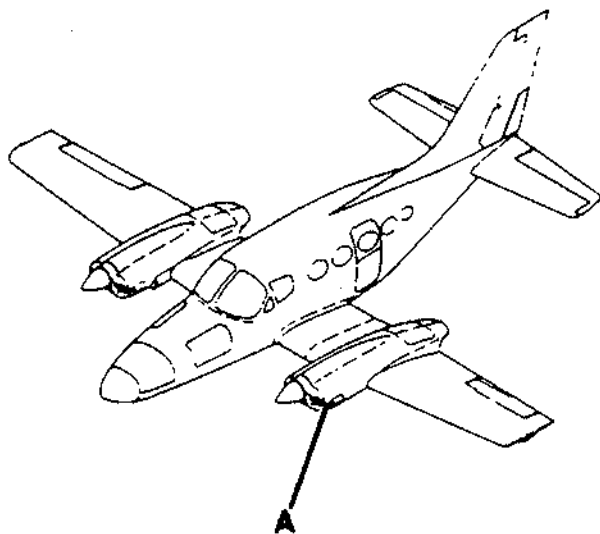
CAUTION: RELEASE SYSTEM PRESSURE BY PLACING PROPELLER CONTROL IN UNFEATHER POSITION AND RELEASE ACCUMULATOR PRESSURE THROUGH THE FILLER VALVE.

- (1) Disconnect hose (2) from governor (3) and accumulator (1).



Troubleshooting Chart - Propeller Unfeathering
Figure 1

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DETAIL A

Propeller Accumulator System Installation
Figure 2

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- (2) Loosen clamps securing heat shield (4) to accumulator and remove heat shield.
- (3) Remove accumulator by removing four nuts and bolts attaching accumulator to engine beam.
- (4) Remove governor. Refer to governor removal procedures.

NOTE: The unfeathering accumulator must be overhauled by an approved propeller governor repair station.

B. Install accumulator system.

- (1) Install governor. Refer to governor installation procedures.
- (2) Secure accumulator (1) to engine beam with four bolts.
- (3) Install hose (2) and secure in place.
- (4) Position heat shield (4) in place on accumulator and secure to accumulator by connecting and tightening clamps.
- (5) Service accumulator:
 - (a) Place propeller control in the unfeathered position before charging the accumulator to prevent the possibility of oil under pressure being trapped in the accumulator.
 - (b) Although the accumulator will function properly when charged with air, dry nitrogen gas is recommended to minimize corrosion.
 - (c) Either too much pressure or not enough pressure in the accumulator will reduce efficiency of the unfeathering system. With a normal amount of friction within the propeller a range of 125 - 130 psi is acceptable.

PROPELLER SYNCHRONIZER SYSTEMDescription

1. The component parts of the propeller synchronizer system are two electrical pulse pickups, trimmer assembly, actuator motor assembly, switch, interconnecting electrical cable assemblies, and an indicator light. The control box assembly, located on the underside of the glove compartment box, contains an all transistorized circuitry. The actuator motor is a stepping-type that operates on command from the control box and is located in the right engine nacelle. The flexible rotary shaft is connected to the actuator motor and trimmer assembly to trim the right engine speed setting. Magnetic pickups are mounted in each propeller governor to provide engine speed indicators to the control box assembly. The function of the propeller synchronizer system is to automatically match the rpm between the two engines; therefore, the left engine is designated as the "master" engine while the right engine is termed the "slave" engine. The electrical pulse from both magnetic pickups are fed into the control box from the governors. Any difference in these pulse rates will cause the control box assembly to run the actuator motor and through the flexible shaft, trim the "slave" engine governor speed setting to exactly match the "master" engine rpm. Normal governor operations and functions are unchanged but the synchronizer system will continuously monitor engine rpm and reset the "slave" engine governor as required. The limited synchronization range of +50 RPM prevents the "slave" engine losing more than a fixed amount of rpm in case the "master" engine is feathered with the synchronizer on.

Troubleshooting

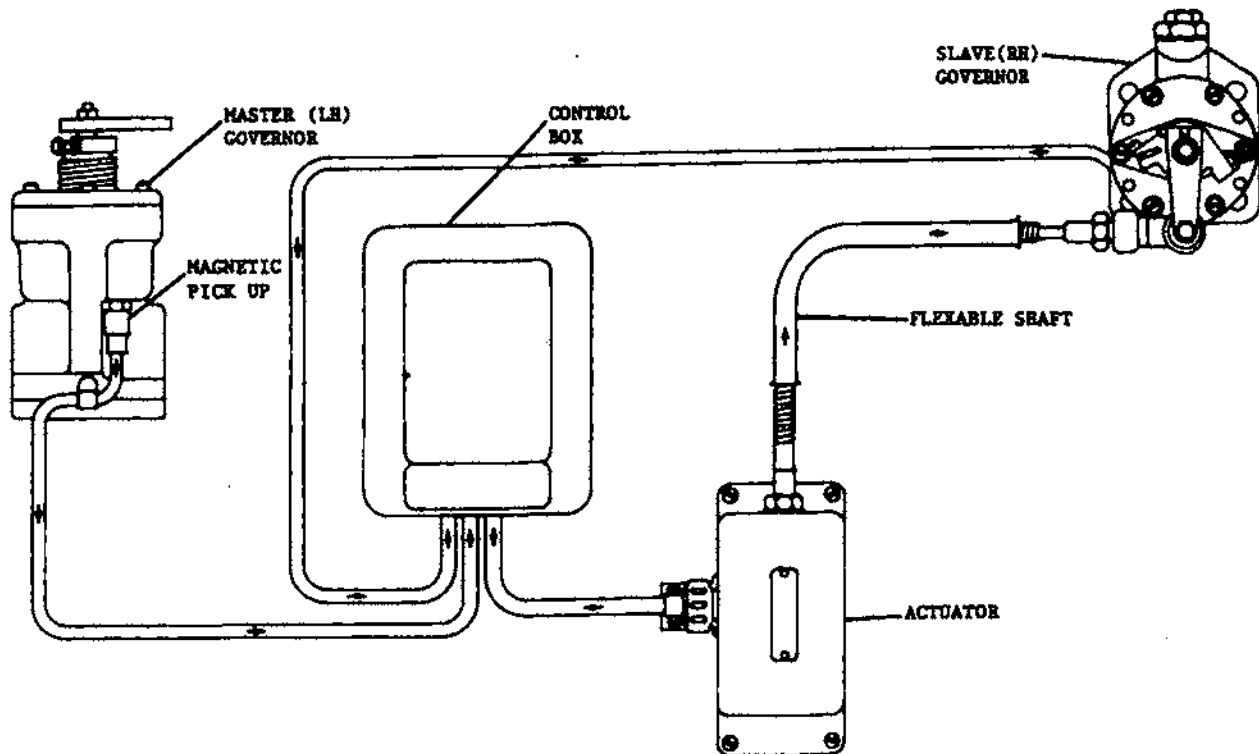
1. Troubleshooting Propeller Synchronizer System.
 - A. Refer to Woodward Governor Company, Rockford, Illinois, Bulletin 33049E for troubleshooting and remedial correction information.

Inspection/Check

1. Operational Check Propeller Synchronizer System.
 - A. To check the operation of the synchronizer in flight, first synchronize propellers manually and turn the synchronizer switch ON. Then slowly adjust the master engine propeller governor control lever, in small increments, to increase or decrease rpm. The rpm range over which the slave engine will remain synchronized with the master engine is the limited range mentioned above. With the synchronizer ON, move the master engine propeller governor control lever to a point which is close to the end of this limited travel. Turn the synchronizer OFF. An unsynchronized condition will develop as the actuator moves to its mid-position. When the synchronizer is turned ON again, synchronization will result. If the units do not become synchronized, the actuator has reached the end of its travel and must be recentered in this manner.
 - (1) Turn the switch OFF.
 - (2) Synchronize the engines manually.
 - (3) Turn the switch ON.
2. Electrical Check Propeller Synchronizer System.
 - A. To check electrical continuity and voltage check of the synchronizer system, refer to Woodward Governor Company, Rockford, Illinois, Bulletin 33049E.

Adjustment/Test

1. Adjustment/Check Propeller Synchronizer System.
 - A. Adjust Propeller Synchronizer System (See Figure 2).
 - (1) Start rigging procedures by disconnecting flexible shaft (4) from actuator (3).
 - (2) Rotate free end of flexible shaft (4) counting total turns available on the "slave" governor trimmer assembly (11).
 - (3) Return trimmer assembly to its center range.
 - (4) When trimmer assembly is centered, rig governor (6) and control cable (5) in accordance with Rigging Propeller Controls.
 - (5) Manually rotate trimmer assembly (11) to either end of its travel.



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Propeller Synchronizer Schematic
Figure 1

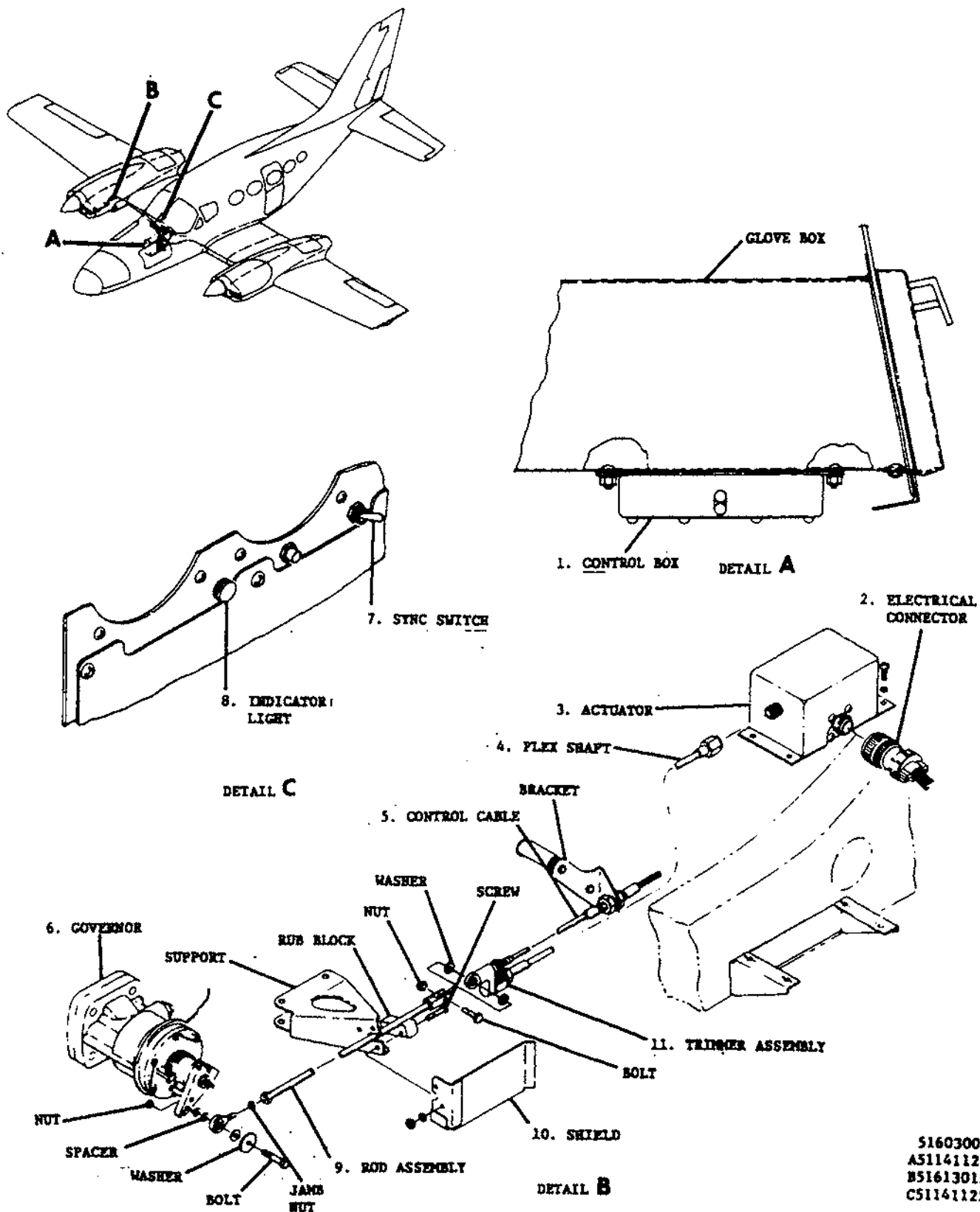
- (6) Move propeller pitch levers on the pedestal through its entire range, observing the governor speed adjusting lever to be certain it travels to the maximum and minimum rpm limits.
- (7) Manually rotate the trimmer assembly (11) to opposite end of its travel.
- (8) Perform step 6. again.
- (9) Recenter the trimmer assembly.
- (10) Insert a squared shaft into drive of actuator (3) and count total turns available.
- (11) Place actuator in its center range.
- (12) With both actuator and trimmer assembly centered, connect the flexible shaft (4) to actuator motor.
- (13) Check flexible shaft (4) for binding and clearance in the full rpm position.
- (14) Perform functional test.

Maintenance Practices

1. Removal/Installation Propeller Synchronizer System (See Figure 2).

A. Remove Synchronizer System.

- (1) Remove engine cowling.
- (2) Disconnect electrical connector (2) and flex shaft (4) from actuator (3).
- (3) Remove screws securing actuator to bracket and remove actuator from engine nacelle.
- (4) Disconnect flex shaft (4) and control cable (5) from trimmer assembly (11).
- (5) Loosen nuts securing control cable (5) from bracket, remove forward nut and route control aft through the bracket.
- (6) Remove nut, washer and bolt connecting rod assembly (9) to trimmer assembly (11) and remove trimmer assembly (11).



Propeller Synchronizer System Installation
Figure 2

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- (7) Remove nuts, washer and screw securing rub block and shield (10) to support and remove rub block and shield.
- (8) Remove nut, spacer, washer and bolt securing rod end on rod assembly (9) to governor arm.
- (9) Loosen jamb nut and remove rod end from rod assembly (9).
- (10) If synchronizer switch (7) or indicator light (8) are to be removed it will be necessary to remove the avionics panel and controls to gain access.

NOTE: For removal and installation of magnetic pickup, refer to Woodward Governor Company, Rockford, Illinois, Bulletin 33048E.

B. Install Synchronizer System.

- (1) If removed, install synchronizer switch (7) and indicator light (8).
- (2) Install rod end on rod assembly (9) and tighten jamb nut.
- (3) Connect rod assembly (9) to governor arm with bolt, washer, spacer and secure with nut.
- (4) Install screw in rub block and position rub block and shield (10) in place on support and secure with washer and nut.
- (5) Install rod assembly (9) to trimmer assembly (11) with bolt, washers and nut.
- (6) Route control cable (5) through bracket, install nut and tighten.
- (7) Connect flex shaft (4) and control cable (5) to trimmer assembly (11).
- (8) Position actuator in place on engine mount beam and install screws.
- (9) Connect electrical connector (2) and flex shaft (4) to actuator (3).
- (10) Refer to Adjustment/Test and perform adjustment and rig Propeller Synchronizer System.
- (11) Conduct operational check. Refer to Inspection/Check.

PROPELLER SYNCHROPHASER SYSTEM

Optional Equipment 421C0801 AND ON

Description

1. The synchrophaser system senses the RPM of both engines, compares this data and makes required adjustments to control engine RPM exactly the same. The pilot, by varying the phase control knob, can select the most desirable propeller phase relationship for various flying conditions.

The synchrophaser system consists of two propeller governors incorporating magnetic transducers and electromagnetic control coils, electronic control box, on-off switch and indicator light and potentiometer to adjust phase settings. The transducers create one negative to positive pulse per revolution that is fed into the control box and is used to synchronize the engines by comparing the time of arrival between signals of the two governors. Any error in time between signal comparison causes the governor control coil to change fly weight positions, speeding up the RPM of the slower running engine to bring about synchronization. The pilot by adjusting the potentiometer varies propeller phase relationship by changing signal timing between governors.

When the system is initially turned on, only the slow turning propeller is adjusted to increase RPM. This feature keeps the system operating more closely to the manually selected RPM. Also, if an engine is feathered without shutting of the system there will be no RPM loss by the operating engine below the manually selected RPM.

The on-off light is only an indicator that the system is on or off and in no way is it an indicator of system performance. If the bulb should happen to burn out or otherwise fail during operation, the system is still operative and the bulb may be replaced when convenient to do so.

For best operation, it is important to guard against propeller control creeping by setting the quadrant friction lock tightly. On extended flights, it may be necessary to periodically switch to the OFF position, reset propeller synchronization manually and re-engage the synchrophaser.

NOTE: Manually synchronize propellers within 25 RPM prior to turning system on. After system is operating, RPM adjustment may be made by moving both propeller control levers together. This should keep both governor settings close enough to remain in the synchrophaser's operating range.

If the propellers should go out of synch., turn system off, manually synchronize the engines and turn the system on.

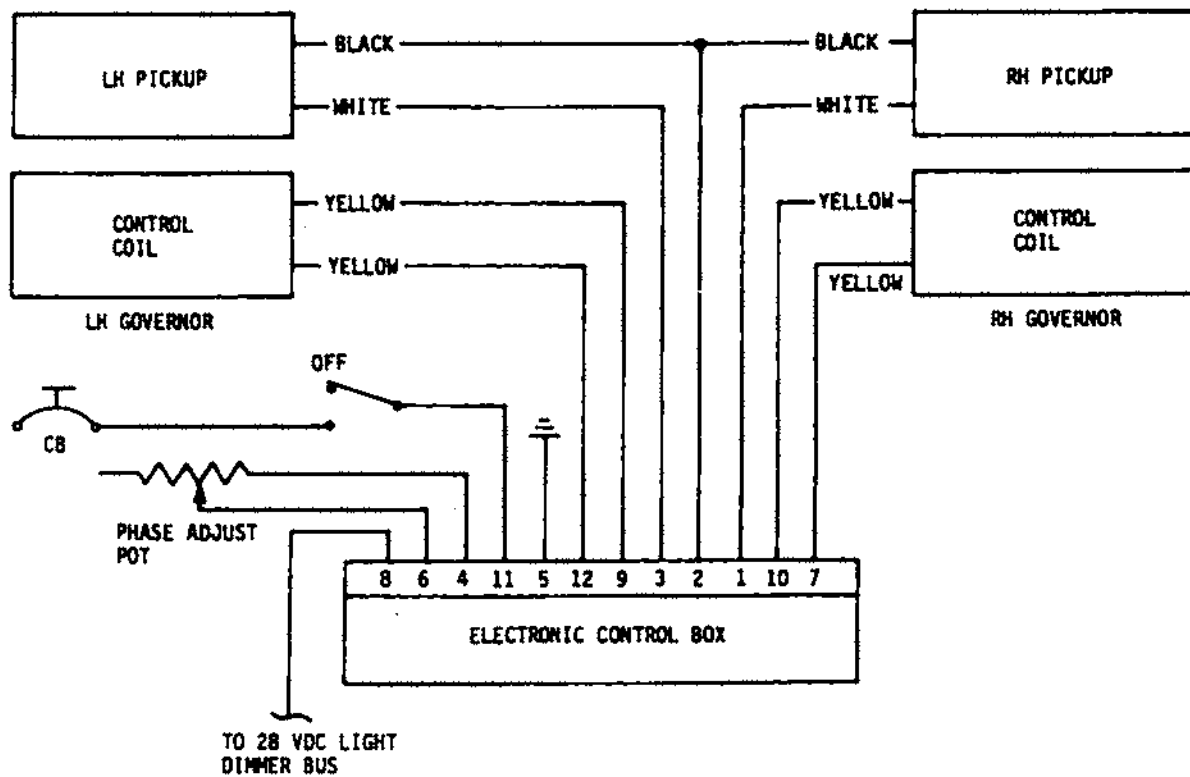
This propeller synchrophaser may be ON for take off and landing.

Tools and Equipment

Name	Number	Manufacturer	Use
Oscilloscope			Ground run test.
Ohmmeter			System tests.

Troubleshooting

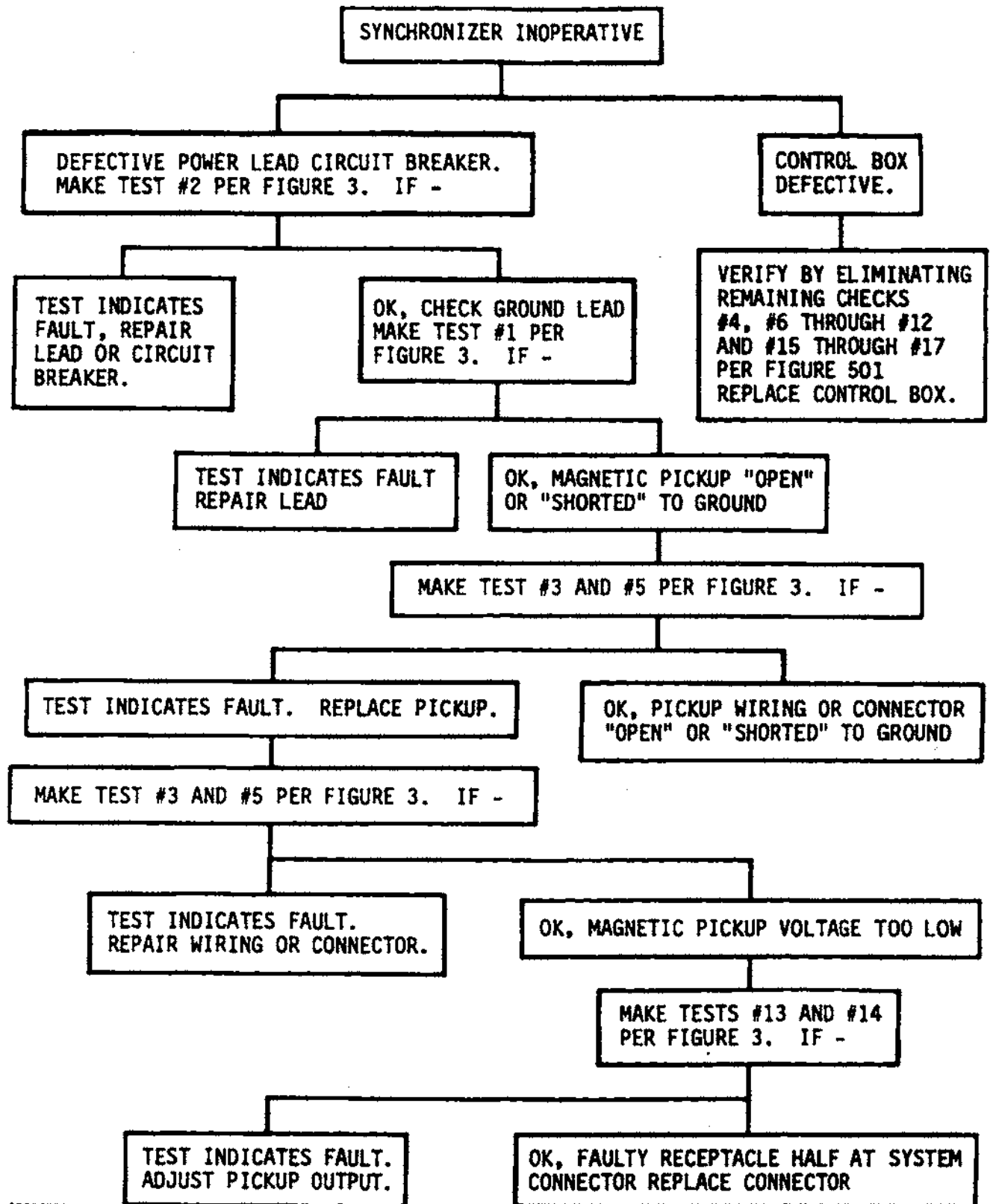
1. Refer to Figure 1 for System Diagram.
 - A. Refer to Troubleshooting Chart, Figure 2 for a guide in isolating fault and Figure 3 for checks and tests to support troubleshooting.



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Synchrophaser System Diagram
Figure 1

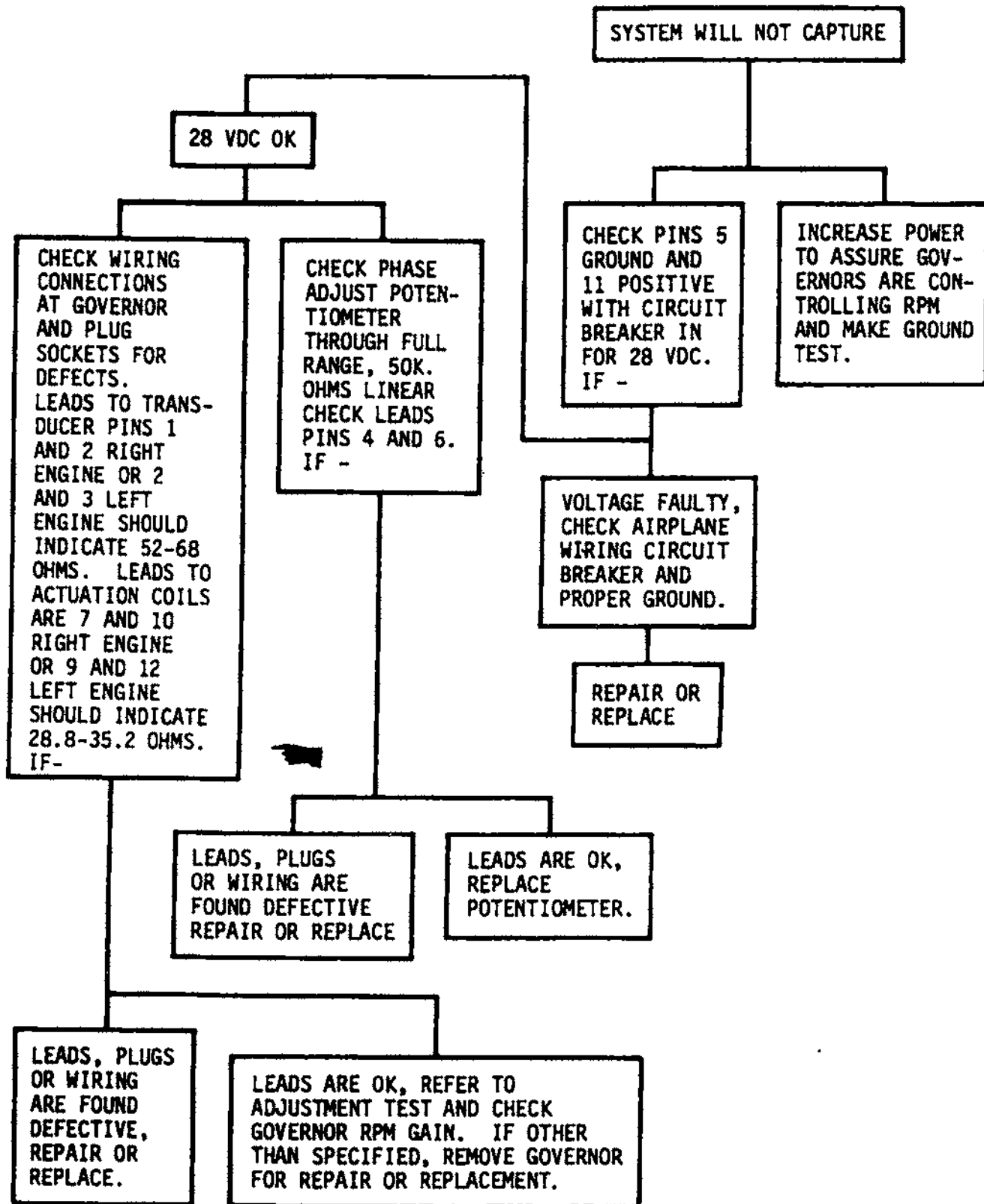
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Troubleshooting Chart, Synchrophaser
Figure 2 (Sheet 1)

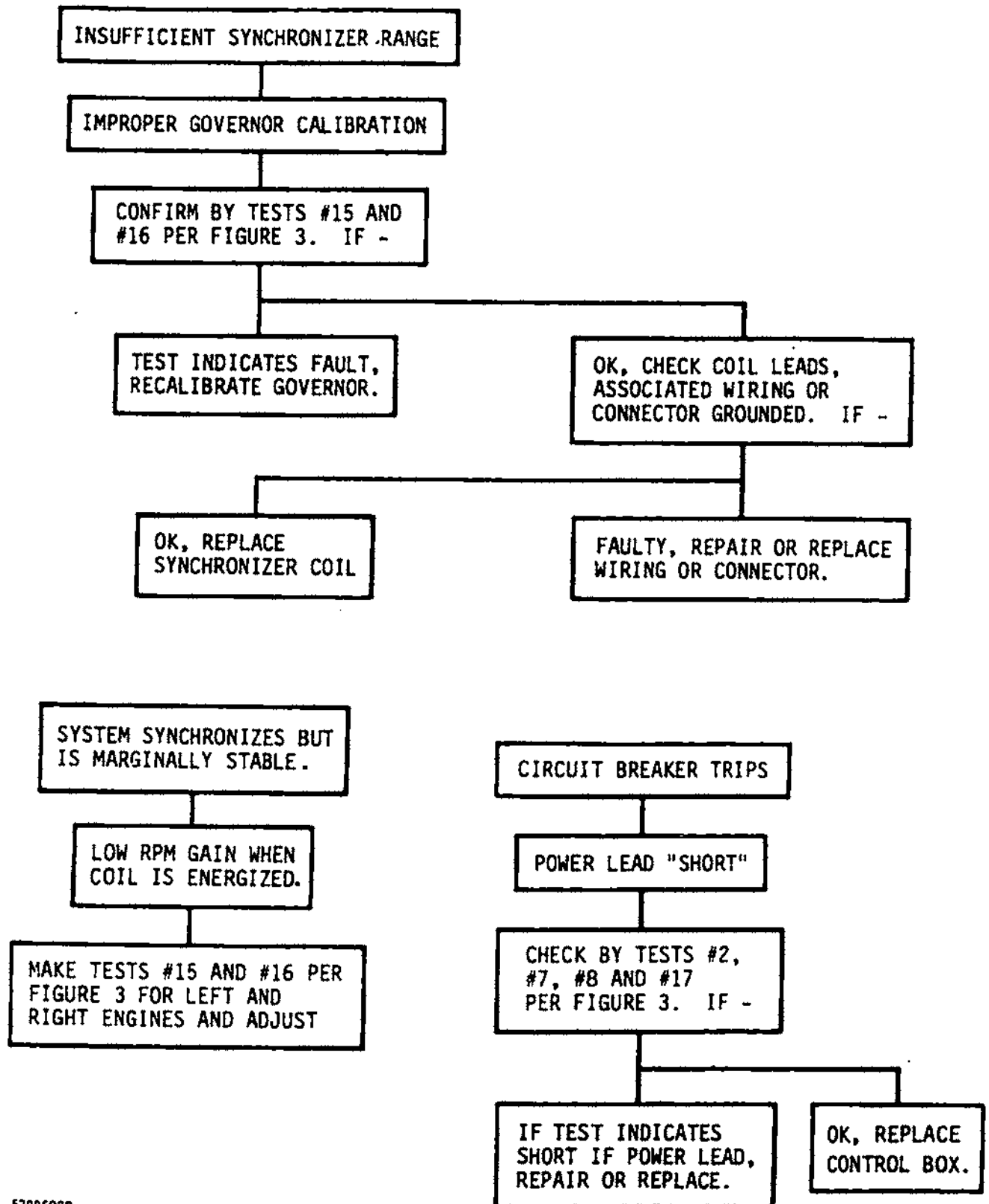
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Troubleshooting Chart, Synchrophaser
Figure 2 (Sheet 2)

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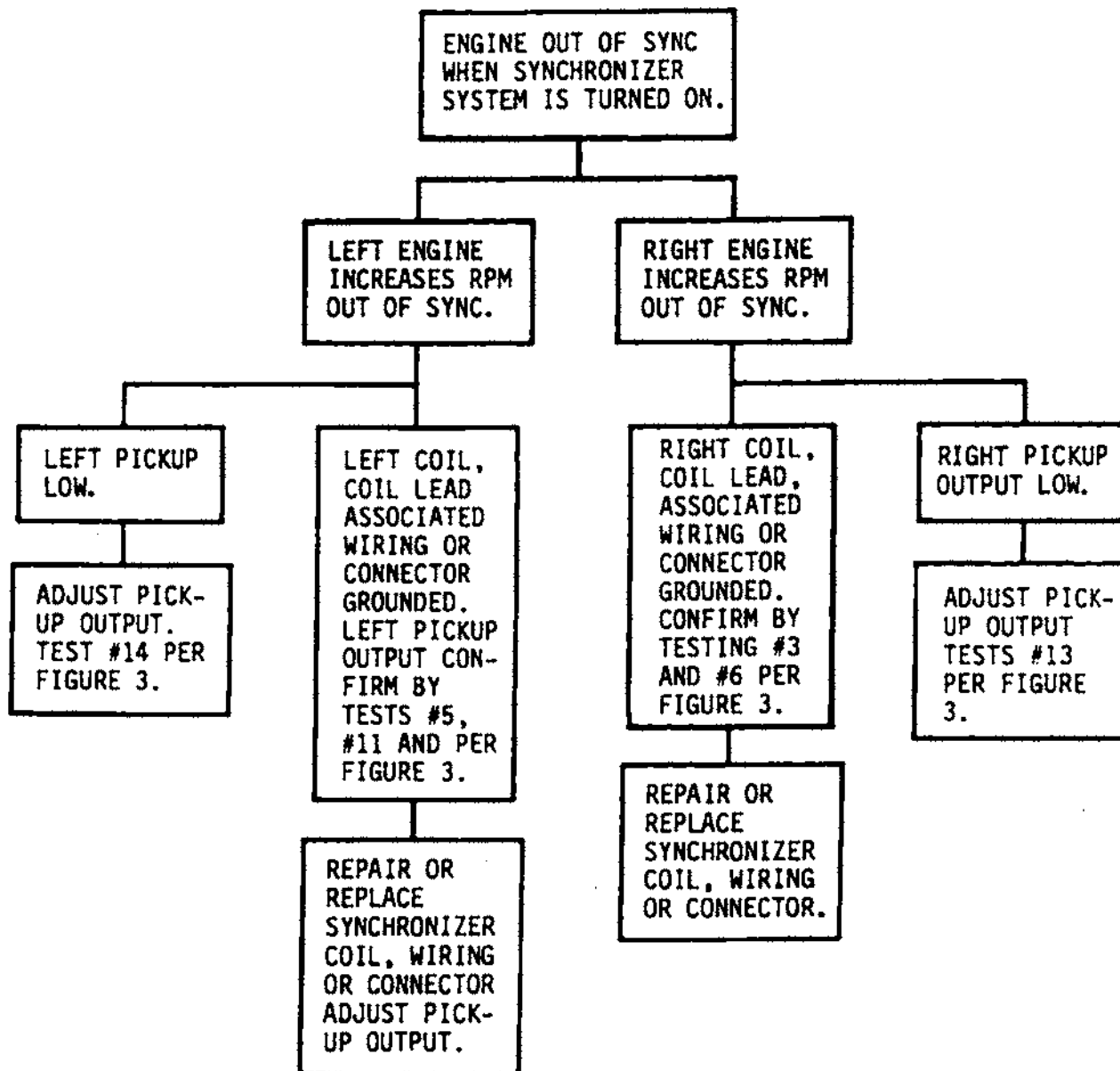
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Troubleshooting Chart, Synchrophaser
Figure 2 (Sheet 3)

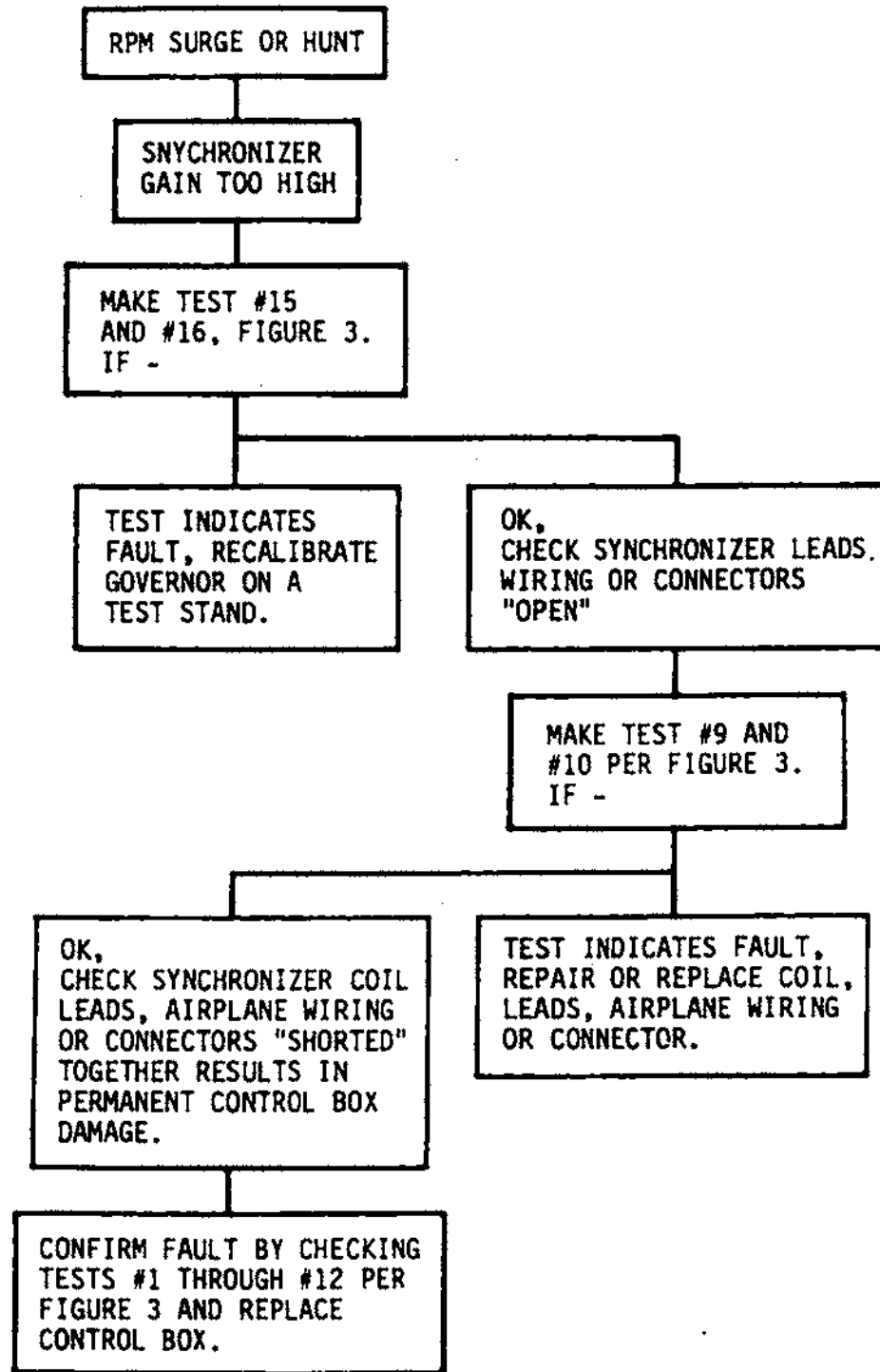
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Troubleshooting Chart, Synchrophaser
Figure 2 (Sheet 4)

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Troubleshooting Chart, Synchrophaser
Figure 2 (Sheet 5)

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- B. The following checks should be made prior to extensive troubleshooting procedures:
- (1) If synchrophaser is totally inoperative:
 - (a) Check wiring from governor to engine firewall. Look for broken or chafed wires. Pay particular attention to the area where the wire bundle is routed adjacent engine valve covers. It is necessary to disconnect ties and individually inspect each wire. Repair wires and replace ties as necessary.
 - (b) If no defective wires are found, pull connector plug from B-28000 control box (located on back of glove box in cockpit). Check for loose pins in the connector plug. Remove B-28000 control box and check for loose or enlarged pins in the control box connector plug. Loose pins can normally be reinserted in plugs without replacing entire plug assembly.
 - (c) Run engines to check synchrophaser operation (a ground run is acceptable but a flight check is preferable). If synchrophaser remains inoperative, proceed to additional troubleshooting procedures or consult McCauley's Service Manual.
 - (2) If synchrophaser functions properly most of the time but has occasional malfunctions during cruise flight (e.g. once every 15 minutes) or if RPM surges or oscillations occur during takeoff (with system turned on), the governor coil may require adjustment. Refer to Adjustment/Test.
- C. Make governor coil adjustment check. Refer to Adjustment/Test.
- D. If synchrophaser continues to malfunction, proceed with troubleshooting system.

Inspection/Check

1. Ground Test

- A. Connect an Oscilloscope to A/C plug transducer pins (1 & 2 Right or 2 & 3 Left) and verify proper pin and transducer connection by running each engine. As the engine RPM is increased the transducer output from base line to positive peak should be 1.0 volt AC RMS minimum and not to exceed 3.0 volts.



- B. Connect A/C plug to electronic control box. With both engines running, supply enough power that propellers will be controlled at same low RPM by the governors. Adjust the propeller pitch control bringing the engines within 25 RPM of being synchronized. Turn on the synchrophaser and observe RPM capture. (Tight RPM control during ground test should not be expected). If the system captures RPM the A/C is ready for flight test.

2. Flight Check

A. Operational Troubleshooting.

- (1) Operate airplane at normal cruise.
- (2) Position sync switch OFF and manually synchronize propellers.
 - (a) RESULT: Propellers should stay in relatively close synchronization. If hunting or RPM variation occurs isolate the problem engine. The cause of the problem could be one of the following.
 - 1) Defective governor.
 - 2) Abnormally high propeller friction (observed with airspeed power changes).
 - 3) Engine malfunction (fuel flow fluxuation).
 - 4) Excessive leakage at transfer bearing.

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- (3) Set propeller control levers slightly out of synchronization, turn sync switch ON.
 - (a) RESULT: Engine should synchronize. If not, the cause of the problem could be one of the following.
 - 1) SYNC light does not illuminate.
 - a) No power to system, check circuit.
 - b) Defective panel switch or light bulb.
 - 2) One engine increase RPM and maintains out of sync condition.
 - a) Weak transducer signal or short in transducer wire from governor of the engine that had increased RPM.
 - b) Defective control box or electrical connector at control box.
 - 3) SYNC light illuminated, but system is inoperative, refer to step (4).
- (4) SYNC switch OFF, manually synchronize propellers, set left engine at 150 RPM slower than the right engine. Place SYNC switch to the ON position.
 - (a) RESULT: Left engine should increase 46 - 50 RPM. If not, the cause of the problem could be one of the following.
 - 1) Right engine increases RPM.
 - a) Weak transducer (RPM) signal, open or short in transducer wire from the right engine governor.
 - b) Control box or the electrical connector at control box is defective.
 - 2) No RPM increases on the left engine.
 - a) Open or short in left engine governor control coil wiring. A short across the coil wire will damage control box.
 - b) Defective control box or electrical connector at control box.
 - c) Defective governor coil.
 - 3) Left engine increases less than 46 RPM.
 - a) RPM boost capability of the left engine governor is improperly adjusted. Refer to Adjustment/Test.
 - 4) Left engine increases more than 50 RPM.
 - a) RPM boost capability of the left engine is improperly adjusted. Refer to Adjustment/Test.
- (5) SYNC switch OFF, manually synchronize propellers, set right engine at 150 RPM slower than the left engine.
 - (a) RESULT: Right engine should increase 46 - 50 RPM. If not, the cause of the problem could be one of the following.
 - 1) Left engine increases RPM.
 - a) Weak transducer (RPM) signal, open or short in transducer wire from the left engine governor.
 - b) Control box or the electrical connector at control box is defective.
 - 2) No RPM increases on the right engine.
 - a) Open or short in right engine governor. Control coil wiring. A short across the coil wire will damage control box.
 - b) Defective control box or electrical connector at control box.
 - c) Defective governor coil.
 - 3) Right engine increase less than 46 RPM.
 - a) RPM boost capability of the right engine governor is improperly adjusted. Refer to Adjustment/Test.
 - 4) Right engine increases more than 50 RPM.
 - a) RPM boost capability of the right engine is improperly adjusted. Refer to Adjustment/Test.
- (6) Neither governor increases RPM when steps (4) and (5) were accomplished.
 - (a) Defective control box or electrical connector at control box.
 - (b) No power to system, check circuit.
- (7) System checks out through step (5), however, during prolonged flight, occasional system malfunctions.
 - (a) Short in wiring, inspect all wires from fire wall to governor.
 - (b) Electrical connector pins loose at control box.

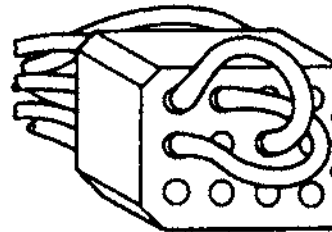
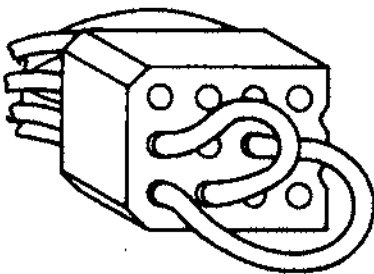
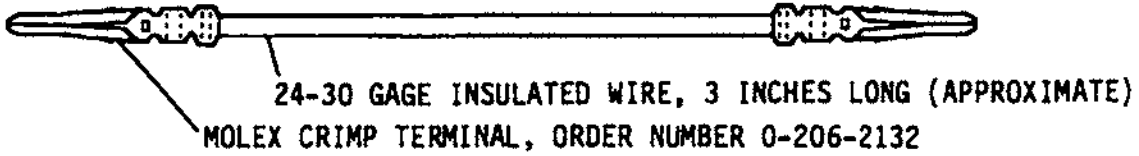
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TEST	System & Test Equipment Configuration		TEST BETWEEN RECEPTACLE #'s	REQUIRED
1	<u>STATIC CHECK</u>	Master switch "off" control box disconnected. C/B pulled	5 & Ground	0 Ohms
2		Refer to System Schematic Figure 1 for Circuit reference.	11 & Ground	Open Circuit
3			1 & 2	28-36 Ohms
4			7 & Ground	Open Circuit
5			3 & 2	28-36 Ohms
6			10 & Ground	Open Circuit
7			4 & 6	0-50K Ohms Variable
8			9 & Ground	Open Circuit
9			7 & 10	29-35 Ohms
10			9 & 12	52-62 Ohms
11			12 & Ground	Open Circuit
12	Master Switch "On" Control Box Disconnected, C/B Set.		11 & 5	Supply Voltage 11(+) & 5(-)
13	<u>GROUND RUN</u>	Operate engines to obtain 1800 engine RPM or 1483 Propeller RPM Positive Peak	Observe Pickup output on pins 1 & 2 for the right eng.	Base line to Positive peak 1.5 Vac Min.
14	Master Switch "on" control box disconnected, C/B reset			
	OSCILLOSCOPE			
	Base Line	1.5 Vac	Observe pickup output on pins 2 & 3 for the left eng.	Base line to Positive peak 1.5 Vac Min.
15	<u>GROUND RUN</u>	High enough power setting to be on the governors at mid cruise RPM	Energize pins 7 & 10 with 28 V.D.C. (Polarity irrelevant)	50-85 RPM increase on the right engine.
	Master Switch "on" control box disconnected, C/B reset			
16	Base Line 	1.0 Vac	Energize pins 9 & 12 with 28 V.D.C. (Polarity irrelevant)	50-85 RPM increase on the left engine
17	<u>IN FLIGHT</u>	Control box connected, C/B reset and master switch "on". Panel light on	Manually sync within 25 RPM & turn Sync "On"	Propellers synchronized

* NOTE: System will function if ON-OFF indicator light has failed.

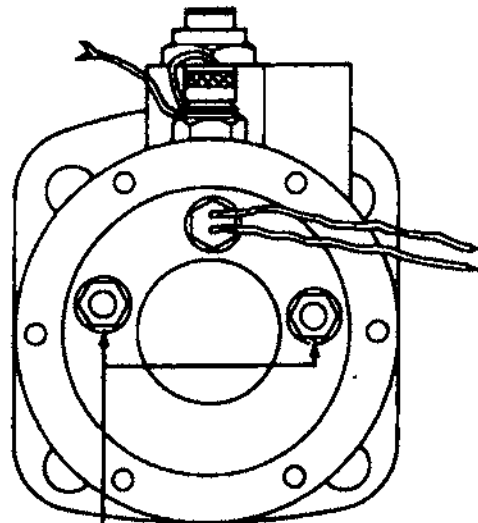
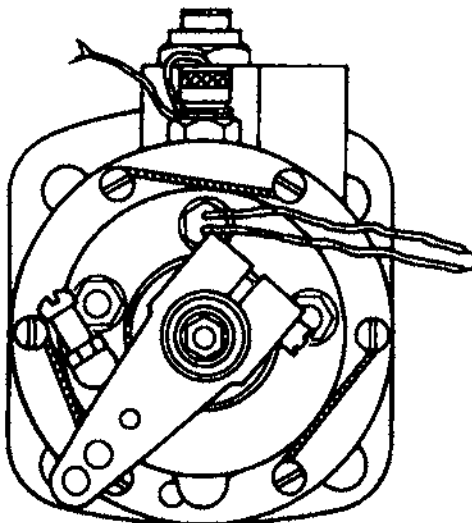
System - Check Out and Test Chart
Figure 3

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CONNECTOR PLUG WITH JUMPER
WIRES (LEFT ENGINE)

CONNECTOR PLUG WITH JUMPER
WIRES (RIGHT ENGINE)



GOVERNOR - TOP VIEW

COIL ADJUSTMENT NUTS
(1/2 TURN MAXIMUM ADJUSTMENT)

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Governor Adjustment Test
Figure 3A

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Adjustment/Test

1. Make adjustments required to achieve performance using system Check Out and Test Chart Figure 3 as a guide.
2. Governor RPM Gain Check.
 - A. Disconnect plug from control box. Connect sockets 5 to 7 and 11 to 10 for right engine, or 5 to 9 and 11 to 12 for left engine actuation coil test. Set desired engine at mid-range cruise with the governor controlling the RPM. Set synchrophaser circuit breaker in and switch to on. This should have a 50-85 RPM increase response. Low RPM gain hinders capture and operational range and excessive RPM gain may cause system instability.

NOTE: Do not connect Socket 5 to Socket 11.

B. Governor Coil Adjustment.

- (1) Fabricate two jumper wires as shown in figure 3A.
- (2) Pull connector plug from control box. Using jumper wires, connect pin 5 to pin 12 and connect pin 11 to pin 9 as shown in figure 3A. This will by-pass the control box and energize the left engine governor.
- (3) Run left engine at 1900 RPM (increase throttle to 27 maximum absolute pressure, then retard propeller control lever to 1900 RPM so that engine is operating "on the governor"). Turn synchrophaser switch ON and note increase in RPM. If governor is set properly, a 60 RPM (approximate) increase will be observed on the airplane's tachometer. If RPM increase exceeds 60 RPM, adjustment of governor coil is necessary.
- (4) Paint align marks across the adjustment nuts and cover of the governor.

CAUTION: TURNING THE ADJUSTMENT NUTS COUNTERCLOCKWISE WILL LOWER THE COIL. IF THE COIL IS LOWERED EXCESSIVELY, IT CAN CONTACT THE FLYWEIGHTS AND COULD RESULT IN METAL CONTAMINATION OF THE ENGINE.

- (5) Turn adjustment nuts as required to obtain the desired RPM gain or loss.

NOTE: Turn both adjustment nuts an equal amount to prevent cocking of the coil. The adjustment nuts are very sensitive, a quarter turn (90° rotation) affects coil RPM boost capability approximately 40 RPM. Total adjustment is a half turn (180° rotation) maximum in either direction.

- (6) If additional adjustment is required, send governor to a qualified repair shop.

CAUTION: DO NOT TURN GOVERNOR COIL ADJUSTING NUTS COUNTERCLOCKWISE FROM THEIR ORIGINAL POSITION. THIS WOULD LOWER THE COIL AND POSSIBLY CAUSE COIL TO CONTACT ROTATING FLYWEIGHTS.

- (7) Repeat steps 1 through 4 for right engine except connect jumper wires from pin 5 to pin 10 and connect pin 11 to pin 7 as shown in figure 3A.
- (8) Remove jumper wire, reconnect control box, reinstall cowl and flight check synchrophaser operation.

Maintenance Practices

1. Removal/Installation Propeller Synchrophaser System. (Refer to Figure 4)

CAUTION: VERIFY ALL WIRE NUMBERS AND CORRESPONDING PLUG PIN NUMBERS ARE MATCHED. FAILURE TO DO SO MAY RESULT IN DAMAGE TO RPM TRANSDUCER.

A. Removal/Installation of Governor.

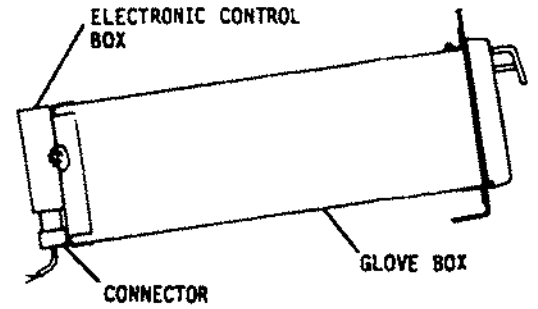
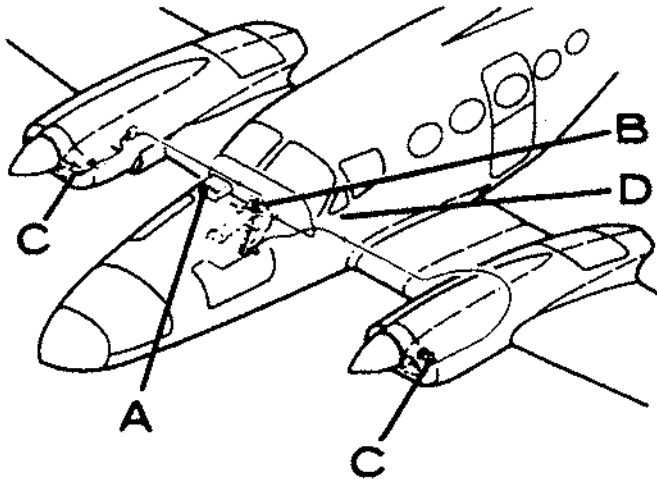
- (1) Ensure airplane power is OFF.
- (2) Disconnect electrical connection from governor.
- (3) Removal/installation procedure for synchrophaser governor is same as standard governor. Refer to Removal/Installation of Propeller Governor.

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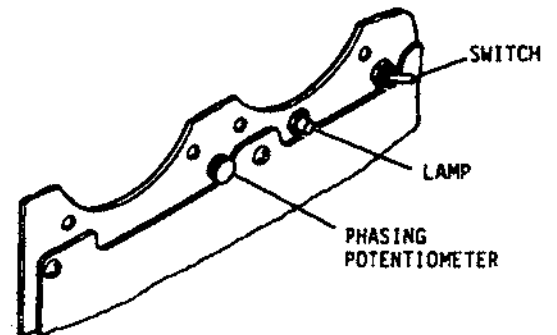
B. Removal/Installation of Control Box.

- (1) Ensure Airplane power is OFF.
- (2) Electronic control box is installed on the golve box and can be reached from under the instrument panel for installation or removal.

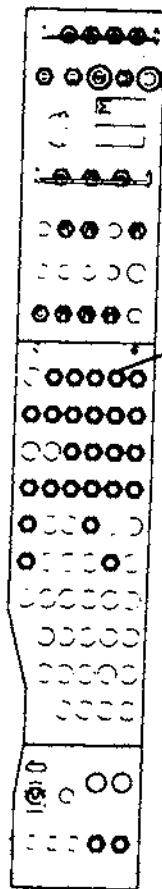
NOTE: Refer to Synchrophaser System Manual for repair information.



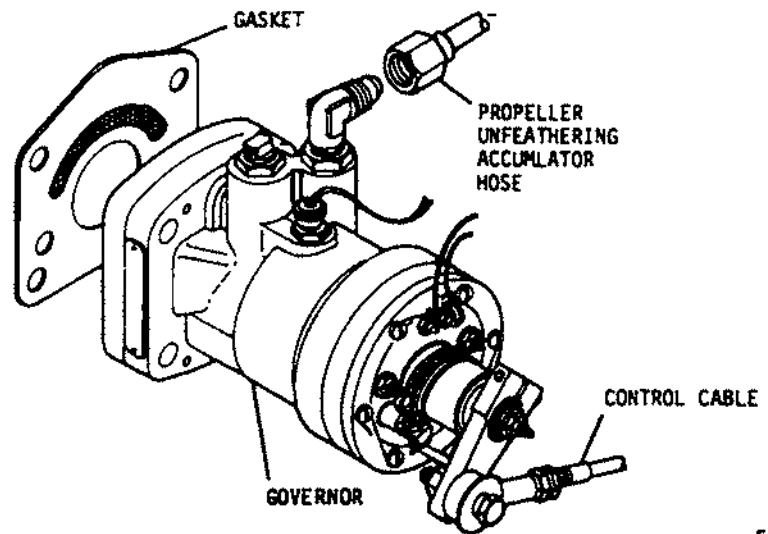
DETAIL A



DETAIL B



DETAIL D



DETAIL C

Synchrophaser Installation
Figure 4

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PROPELLER DEICE SYSTEMDescription

1. The propeller deice system is the electrothermal type. It consists of the following components added to the propeller installation: propeller blade deice boots bonded to the propeller blades, a slip ring assembly mounted to the spinner bulkhead, a brush holder assembly mounted to the engine crankcase, a repeat cycle timer, an ammeter mounted in the instrument panel, and a switch circuit breaker. The propeller blade deice boots are designed to remove ice under all probable icing conditions. Deicing is accomplished by raising the temperature of the ice and deice interface to a point at which centrifugal force removes the ice. The cycle timer used on the deicing system heats the propeller deice boots from 20 ± 0.2 seconds. The deicer outer elements cycle on the right propeller element from 20 ± 0.2 seconds, then on the inner element. It then cycles to the left propeller outer elements from 20 ± 0.2 seconds then to the left inner elements. It then returns to the right outer elements on the right propeller and continues cycling action. The cycling is done in order to maintain a balance between the left and right propellers and reduce power drain on the electrical system.

Troubleshooting

1. For a guide to troubleshooting the propeller deice system, see Figure 1.
2. Refer to Chapter 13 for conducting electrical continuity checks.

Maintenance Practices

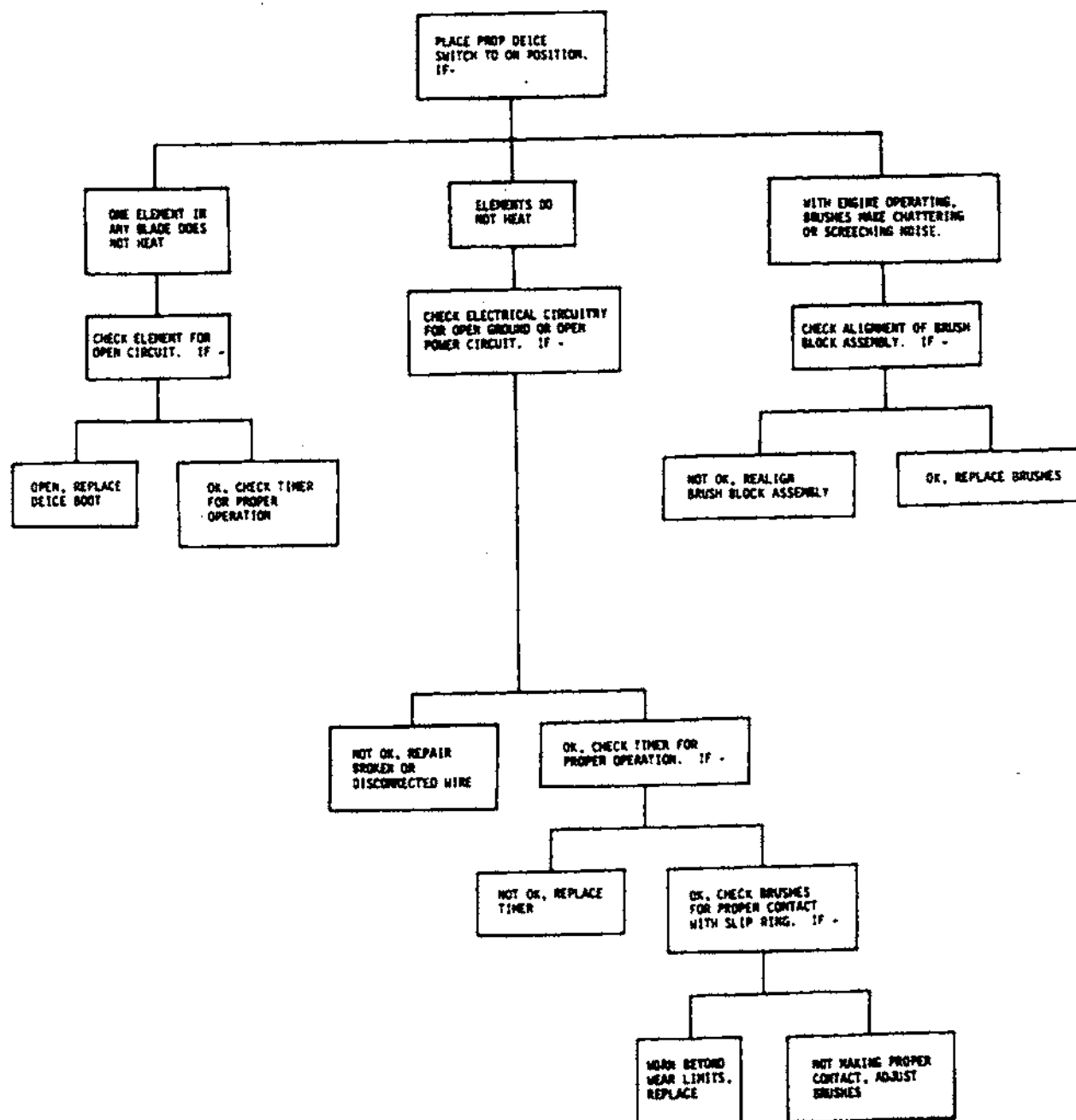
1. Tools and Equipment.

Name	Number	Manufacturer	Use
Safety wire	.020	Commercially Available	Safetying screws.
Methyl-Ethyl-Ketone (MEK)	TT-M-261	Commercially Available	Installing deice boots.
Toluol	TT-T-548	Commercially Available	Soften cement.
Cement	EC1300LP	Minnesota Mining and Mfg. Co., St. Paul, Minn.	Installing boots.
Coating	EC539P	Minnesota Mining and Mfg. Co., St. Paul, Minn.	Dress edge of boots.
Roller, Hand	One-fourth inch wide, metal stitcher roller		Installing boots.
Multimeter	Simpson Model 260	Commercially Available	Check continuity and voltage of electrical circuits.

2. Removal/Installation of Slip Ring (See Figure 2).

A. Remove Slip Ring.

- (1) Remove propeller, spinner bulkhead and slip ring from engine crankshaft. Refer to Removal of Propeller.
- (2) Tag and disconnect wires from terminals of slip ring (2). Remove electrical cable (10) from retainer (9).
- (3) Remove slip ring (2) from spinner bulkhead (1) by removing attaching screws and washers.



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Troubleshooting Chart - Propeller Deice System
Figure 1

B. Install Slip Ring.

- (1) Position slip ring (2) to spinner bulkhead (1) so that the slip ring terminals align with retainers (9). Secure in place with bolts, washers and nuts. Install safety wire.
- (2) Place spinner bulkhead assembly on propeller hub studs. Install propeller. Refer to Installation of Propeller.
- (3) Install electrical cable (10) on retainer (9). Connect wires to terminals of slip rings (2) and remove tags.

NOTE: Make certain that cable has sufficient length between bulkhead retainer and propeller terminal bracket so that there is no tension on the cable when propeller is feathered.

CAUTION: MAKE CERTAIN CLAMP (11) IS SEATED BEHIND THE ANTISLIP RING OF CABLE (10) TO PREVENT CABLE DAMAGE BY CENTRIFUGAL FORCE.

3. Removal/Installation of Brush Holder and Mounting Bracket (See Figure 2).

A. Remove brush holder and mounting bracket.

- (1) Tag and disconnect electrical terminals from brush holder (5).
- (2) Remove brush holder (5) from bracket (3) by removing nuts, spacers (4), washers and screws.
- (3) Remove wire bundle clamp from bracket by removing nut, washers and screw.
- (4) Remove brush holder bracket from engine by removing attaching nuts, spacers (6), washers and bolts.

B. Install brush holder and mounting bracket.

- (1) Install brush holder mounting bracket to engine with bolts, spacers (6), washers and nuts in sequence as shown.
- (2) Attach brush holder (5) to mounting bracket (3) with two washers and screws. Safety wire the screw heads.
- (3) Secure wire bundle to bracket with clamp, screw, washer and nut.
- (4) Connect brush wires to terminals and remove tags.

4. Removal/Installation of Deice Timer (See Figure 2).

A. Remove Deice Timer.

- (1) Locate timer on co-pilot seat structure.
- (2) Disconnect electrical connector from timer.
- (3) Remove timer by removing four attaching screws.

B. Install Deice Timer.

- (1) Position deice timer in place and secure with four screws.
- (2) Connect electrical connector and safety wire connector.

5. Removal/Installation of Deice Ammeter (See Figure 2)

A. Refer to Chapter 10, Typical Instrument Removal and Installation.

6. Removal/Installation of Deice Switch (See Figure 2).

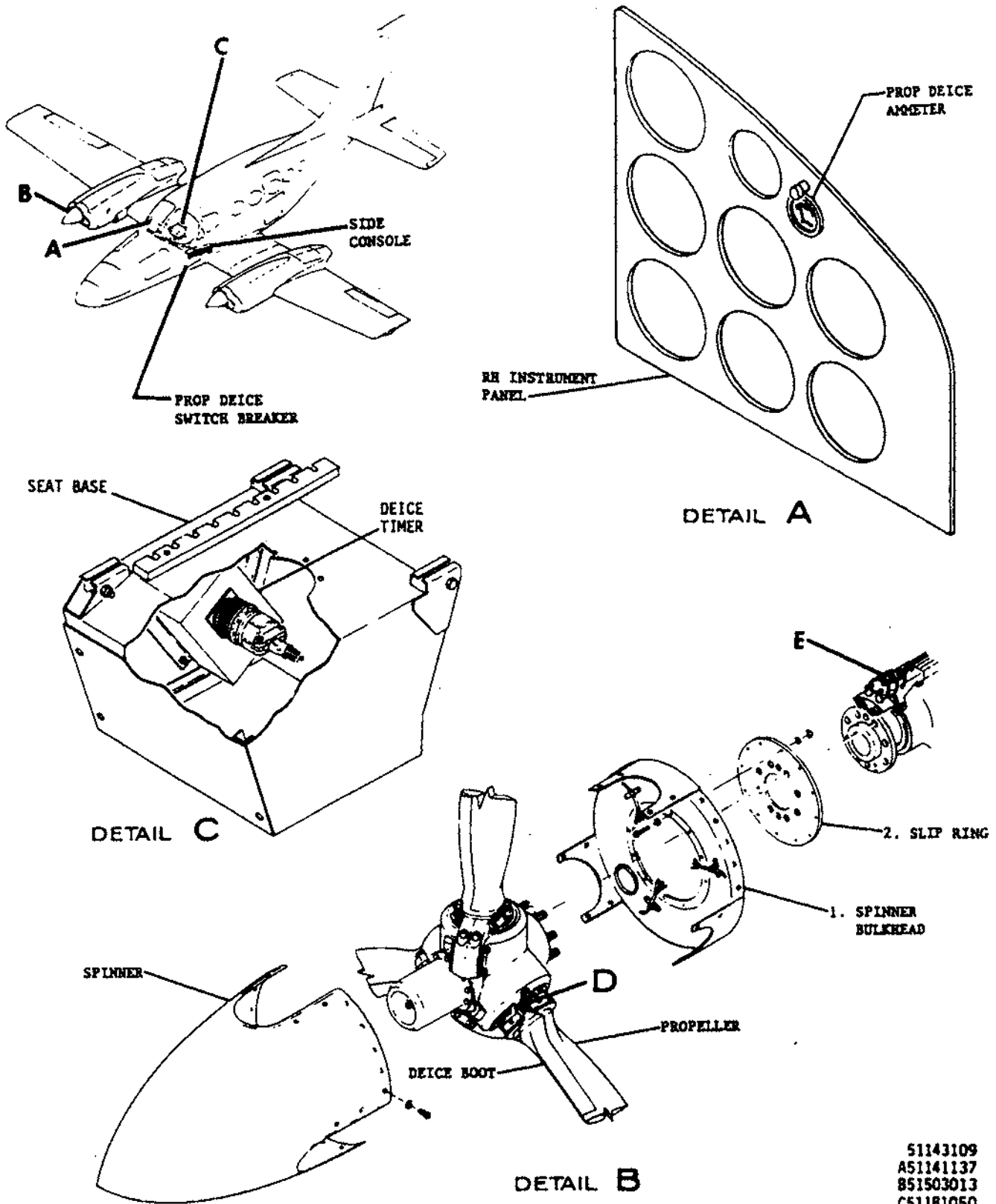
A. Refer to Chapter 13, Typical Switch Removal/Installation.

7. Removal/Installation of Deice Boot.

A. Remove Deice Boot.

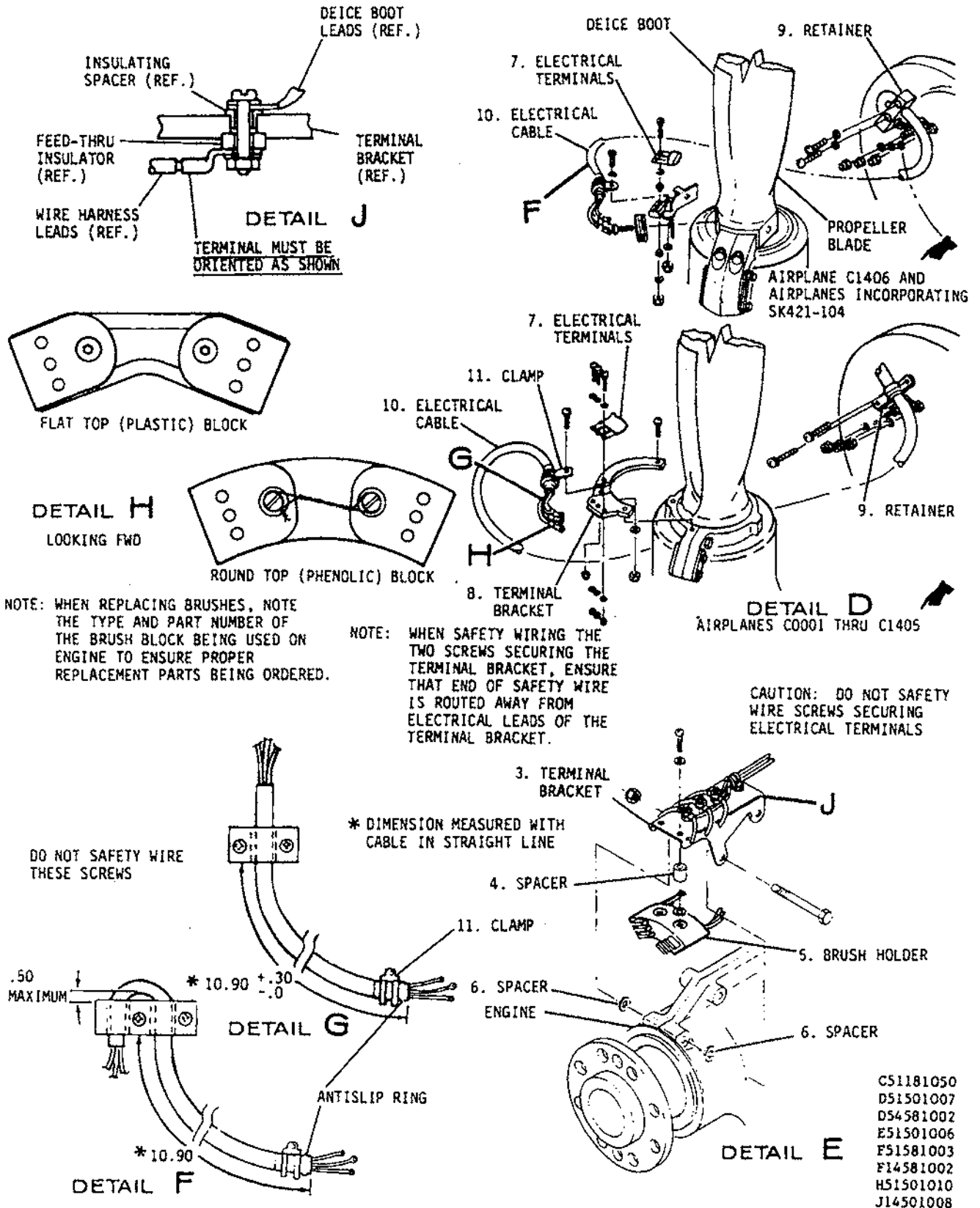
CAUTION: DO NOT USE SHARP TOOLS OR OBJECTS TO REMOVE BOOT AS DAMAGE TO THE PROPELLER MAY RESULT.

- (1) Remove deice boot from the propeller by softening the bond line of boot with Toluol until loosened.
- (2) Pull deice boot slowly from propeller blade as bond line is loosened.



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Propeller Deice System Installation
Figure 2 (Sheet 1 of 2)



Propeller Deice System Installation
Figure 2 (Sheet 2)

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B. Install Deice Boot.

- (1) Place deice boot on hub end of propeller blade, centered on blade leading edge and lead strap (terminal end) of boot aligned and against attach holes of installed terminal bracket.
- (2) Mark off an area on propeller blade (using masking tape) 1/2 inch from each side and outer end of deice boot.
- (3) Remove boot and clean the masked area of propeller blade using Methyl n-Propyl Ketone cleaning solvent. For final cleaning, wipe the solvent film off quickly with a clean dry cloth before it has time to dry.

WARNING

METHYL N-PROPYL KETONE MUST BE USED IN A WELL VENTILATED AREA. AVOID PROLONGED BREATHING OF FUMES. DURING ALL SURFACE CLEANING OPERATIONS, TAKE PRECAUTION TO GUARD AGAINST SPARKS OR OPEN FLAME IN WORK AREA.

- (4) Mix thoroughly the EC1300L Cement and apply one brush coat evenly to the cleaned metal surface. Allow to air dry for a minimum of one hour and then apply a second coat of EC1300L Cement.
- (5) Moisten a clean cloth with Methyl n-Propyl Ketone and clean the unglazed back surface of the deice boot, changing cloth frequently to avoid contamination of the area.
- (6) Apply an even brush coat of EC1300L Cement to the unglazed back surface of the deice boot.
- (7) Allow cement to dry; then using a silver (non-graphite, greaseless) pencil, mark a centerline along the leading edge of the propeller blade and corresponding centerline on the cemented side of the deice boot.
- (8) Reactivate the surfaces of the cement using a clean, lint free cloth, heavily moistened with Toluol solvent. Avoid excessive rubbing of cement which would remove it from surfaces.
- (9) Connect lead strap to bracket and position the deice boot centerline on the propeller leading edge with all marks and terminal leads aligned. Tack the deice boot centerline to the leading edge of the propeller blade.

NOTE

If the deice boot is allowed to get off centerlines, pull up with a quick motion and reposition properly. Roll firmly along centerline with a rubber roller.

- (10) Roll outwardly from the centerline to the edge. If excessive material at the edges tend to form puckers, work them out smoothly and carefully with fingers.
- (11) Roll the tapered edges of the deice boot with a metal hand stitch roller and ensure there are no bubbles entrapped under the boot and that all edges firmly adhere to the propeller. Use caution to not run the metal roller over the heating wires in the boot.

NOTE

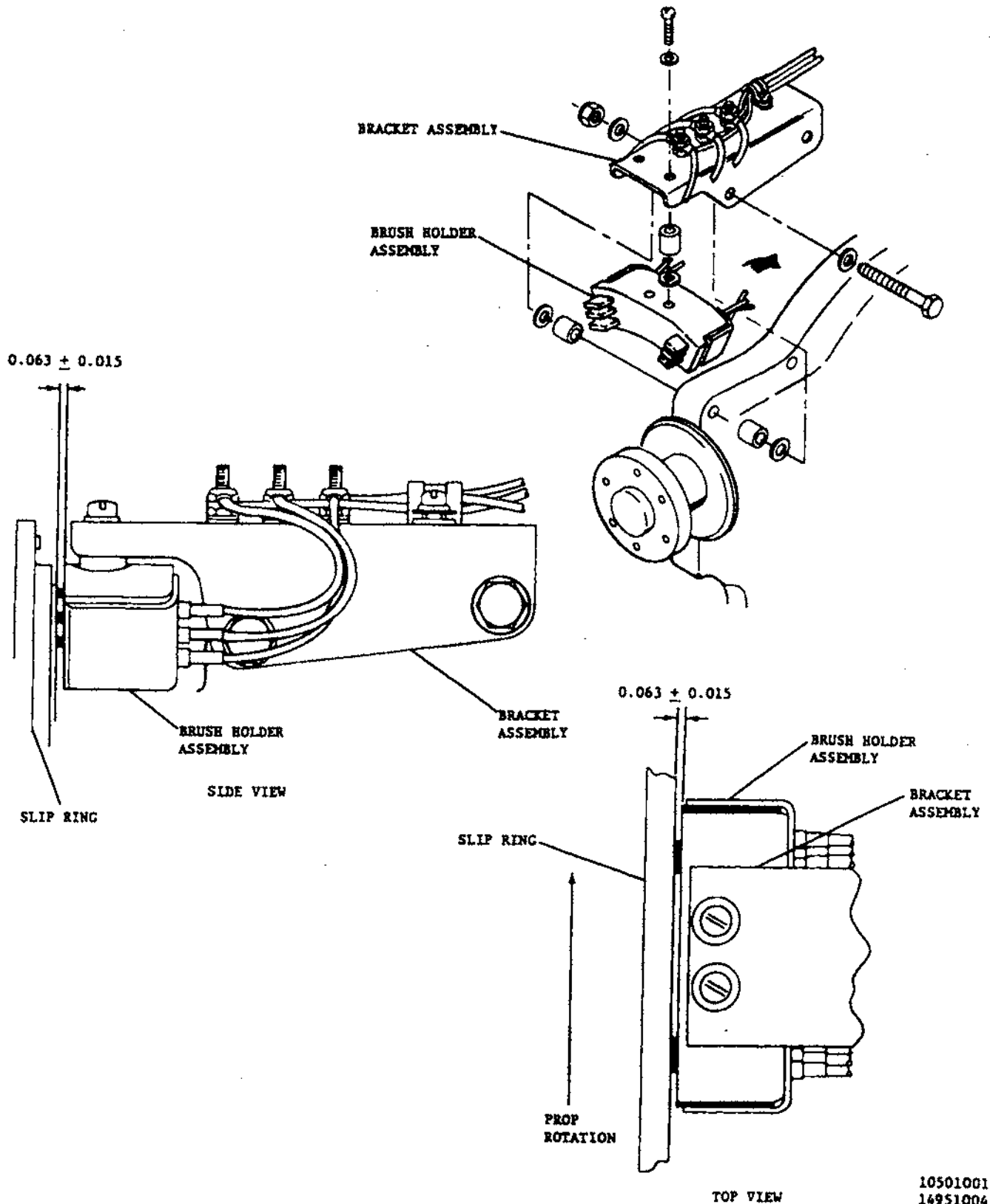
In the event it becomes necessary to remove or loosen installed deice boots, Toluol shall be used to soften the "cement" line. A minimum amount of this solvent should be applied to the cement line as tension is applied to peel back the deice boot. The removal should be slow enough to allow the solvent to undercut the cement so that the parts will not be damaged.

- (12) Apply one brush coat of EC539P coating, mixed per manufacturer instructions, evenly around the edges of the installed deice boot.

NOTE

Sealer will not adhere to bare metal surfaces. Apply wash primer touch-up to any exposed metal surfaces in area where sealer will be applied.

- (13) Remove masking tape from the propeller blade and clean the surface of the blade with a clean cloth dampened with Toluol.
- (14) Engines shall not be started for 24 hours after bonding deice boots to propeller; also, the deice boots shall not be operated for 72 hours after bonding.



Brush Holder Alignment
Figure 3

10501001
14951004
14951004
51501011

Adjustment/Test

1. Adjustment of Brush Holder Assembly (See Figure 3).

- A. When a chattering or screeching noise is emitted from the brush slip ring area, the probable cause is the improper alignment of the brushes and slip ring.

NOTE: If this chattering or screeching is noticed over idling engine noises, the trouble is severe and should be remedied immediately. A less severe chattering or screeching may be detected by pulling each propeller through slowly in the direction of rotation.

B. The brush holder assembly should be positioned as follows:

- (1) Loosen screws through bracket assembly and brush holder.
- (2) Adjust brush holder assembly by twisting brush holder assembly in brackets so that the brushes are perpendicular to the slip ring surfaces.
- (3) Check each brush for correct alignment with the slip ring surfaces through 360° rotation. Add or remove washers for correct alignment.
- (4) Check for a 0.063 ± 0.015 inch (nominal) clearance between the main body of the brush holder assembly and the slip ring through 360° rotation.
- (5) Check flatness of slip ring as follows:
 - (a) Mount a dial indicator on engine.
 - (b) Rotate slip ring through 360° of rotation.
 - (c) Observe dial indicator for a T.I.R. (Total Indicator Reading) of .012 .015.
 - (d) If reading is not in tolerance, replace slip ring.

Inspection/Test

1. Inspect and Test Propeller Deice System.

A. Inspect the Completed Installation.

- (1) Check propeller deice boots for wrinkling or loose spots.
- (2) Check wiring connections for correctness and tightness.
- (3) Check continuity of wiring. Remove plug from timer. Using ohmmeter, check continuity from:
 - (a) Pin C of the plug to Terminal A of one prop boot on the right engine.
 - (b) Pin D of the plug to Terminal B of one prop boot on the right engine.
 - (c) Pin E of the plug to Terminal A of one prop boot on the left engine.
 - (d) Pin F of the plug to Terminal B of one prop boot on the left engine.
 - (e) Pin G of the plug to ground.
 - (f) Terminal C of one prop boot on the right engine to ground.
 - (g) Terminal C of one prop boot on the left engine to ground.

B. System Tests.

- (1) Propeller Deice Boots Resistance Check:
 - (a) Using an ohmmeter, check the resistance between terminals A-C, B-C of prop boots in both engines. Resistance should be 4.53 to 5.21.
- (2) Timer Tests:
 - (a) Connect a jumper wire from Pin B of the timer receptacle to Terminal B of the connector plug and from Pin G of the timer receptacle to ground.
 - (b) Place the prop deice system switch in the "ON" position.
 - (c) Using a voltmeter check the DC volts to ground from Pin B of the timer. This should be approximately 24 volts DC.
 - (d) Check DC volts to ground from Pins C, D, E, F; these are the points at which the system voltage is applied in sequence to cycle power to the propeller deice boots. The following cycling action of the timer should be:
 - 1) Timing sequence Pin C, 20 ± 0.2 seconds, right engine propeller outboard halves.
 - 2) Timing sequence Pin D, 20 ± 0.2 seconds, right engine propeller inboard halves.
 - 3) Timing sequence Pin E, 20 ± 0.2 seconds, left engine propeller outboard halves.

- 4) Timing sequence Pin F, 20 ± 0.2 seconds, left engine propeller inboard halves.

NOTE: On time is approximately 20 ± 0.2 seconds when operating on alternator voltage. When operating on battery voltage as in this checkout procedure, on time may be longer.

NOTE: The timer does not reposition itself to start at Pin C when the system is turned off, but will begin its cycling at the same position in which it was last turned off. Cycling will then proceed in the order of C, D, E, F, as shown.

NOTE: Check Pins C, D, E, F, for a voltage reading of approximately 24 volts DC. Hold the voltmeter probe on the pin until the voltage drops to 0. Move the probe to the next pin in the sequence C, D, E, F. Check volts DC at each pin in sequence, 24 volts DC should be measured at each pin in the sequence C, D, E, F. When correctness of the cycling sequence is established, turn prop deice system switch off at the beginning of one of the on time periods and record the letter of the pin at which the voltage supply is present.

(3) Propeller Deice Heat Test:

- (a) Remove the jumper wire installed in paragraph B(2)(a) and replace the connector plug in the timer receptacle.
- (b) Referring to the position in which the timer was left in paragraph B(2)(d) have an assistant place the prop deice system switch in the "ON" position. As the switch is turned on, place a hand on each of the two deice areas which should be heated per paragraph B(2)(d).
- (c) The assistant in the cabin should note and record the prop deice system ammeter reading. This should be from 11 to 18 amps. Keep a close watch on the ammeter needle. The ammeter needle will deflect every 30 seconds because of the switching action of the timer. Each deflection will indicate a change in the heating areas of the prop deice boots.

NOTE: The observer in the cabin should call out these 20 ± 0.2 second interval deflections and the inspector at the propellers should change the position of his hands on the prop deicers accordingly, to check proper heating sequence of the prop deicer areas.

NOTE: If any irregularities are noted, recheck the wiring from the timer to the brush holder assembly and the prop deicer terminal connections. Make corrections as necessary and retest.

C. Slip Ring and Holder Assembly Check.

(1) Check for out of flatness:

- (a) Allowable tolerance is 0.008. If 0.008 is exceeded, shim under mounting bolts to bring within tolerance.

NOTE: Ground checkout of the system is allowed, with the engine not running.

Allow a minimum of 5 hours of engine running time to allow the brushes to become seated before turning on the propeller deice system.

CESSNA AIRCRAFT COMPANY

421

SERVICE MANUAL

CHAPTER

9

FUEL SYSTEM

CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL

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COMPONENTS LOCATION CHART
Fuel

<u>Components</u>	<u>Location</u>
Auxiliary In-Line Fuel Pump	Wing, Outboard of Nacelles
Auxiliary Pump Relay	Stub Wing
Boost Pump Relays	In Cabin, Inside Left Console
Pressure Switches	Aft Side of Transfer Pump Tanks, Near Nacelle
Prime Switch	In Cabin, On Left Console
Signal Conditioners	In Wing, Outboard of Nacelles
Transfer Pump	Aft Side, Main Tank, Near Nacelle
Wing Locker Transfer Pump	In Wing, Outboard of Wing Locker
Fuel Probes	Fwd of Access Hole on Lower Portion of Fuel Tank Inboard Rib

FUEL SYSTEMDescription

1. The airplane fuel system consists of an integrally sealed (wet) wing main tank outboard of each engine nacelle. Each wing main tank incorporates an auxiliary fuel pump and overboard vent. The right and left main tanks are fed directly to their respective engines; however, fuel may be fed from either main tank to either engine. The standard fuel system has a total fuel capacity of 213.4 U.S. Gallons. An optional wing locker fuel system may be installed in the left and/or right wing locker. The fuel capacities for each fuel system is specified in Chapter 2, Servicing.
2. Each engine is provided fuel pressure by an engine-driven pump. Each main tank contains an auxiliary fuel pump which automatically takes over should the engine-driven pumps become inoperative during takeoff and landing, with the auxiliary pump switch in the "ON" position.
3. Wing locker fuel is transferred to the respective main tank where it is fed to the engines.
4. Fuel selection and fuel flow to the engine-driven fuel pumps is controlled by the fuel select control handles, located in the forward cabin area between the pilot's and copilot's seats. Each control handle operates a fuel selector valve (in each wing) by a flex cable and positions the respective selector valve to the desired fuel selection as indicated at the control handle.
5. The fuel indicating system is a capacitance type consisting of: a fuel quantity indicator, fuel sensor units and signal conditioner in each wing. The fuel quantity indicator displays the fuel quantity in both pounds and gallons. A low level warning light (optional) in the annunciator panel illuminates when remaining fuel is 60 pounds or less.

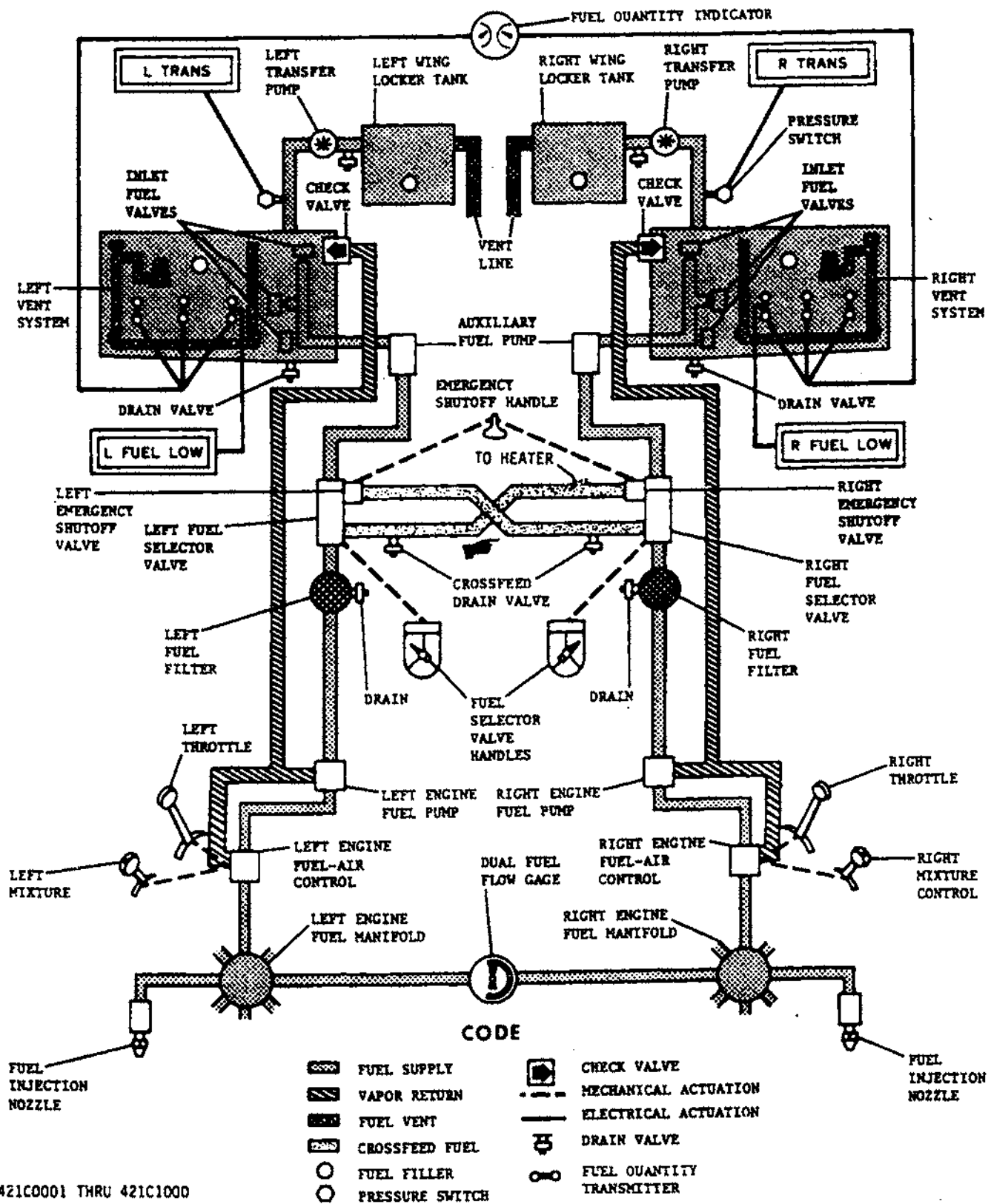
WARNING: DURING FUELING, DEFUELING AND FLUSHING, BOND THE NOZZLE OF THE HOSE TO THE AIRPLANE.

Troubleshooting

1. Troubleshooting the fuel system is a matter of knowing what part of the system can cause the trouble, isolating the problem, correcting the system or replacing faulty component.

TABLE I

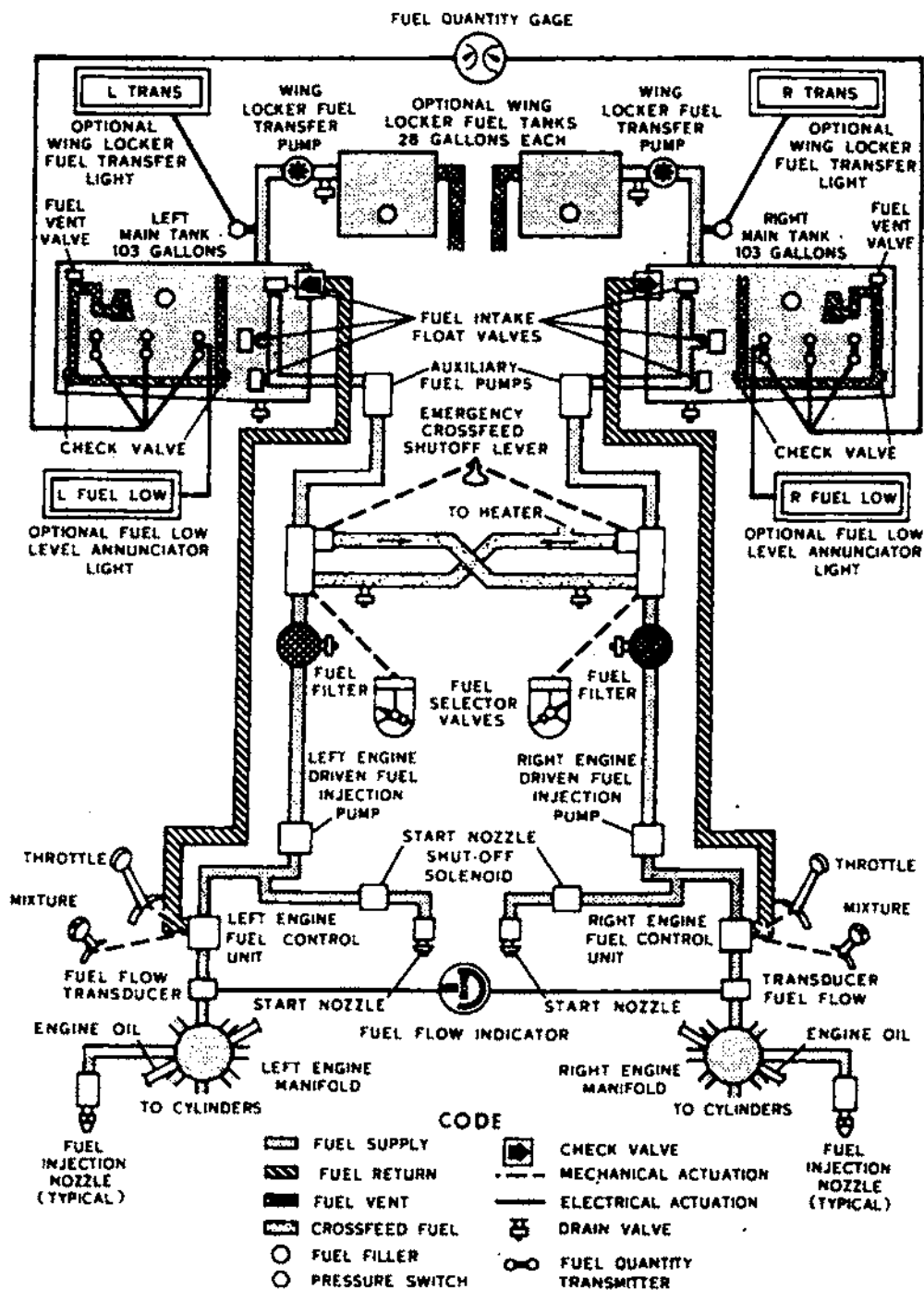
Name	Number	Manufacturer	Use
Fuel Quantity Tester	9910111-10	Cessna Aircraft Company Wichita, KS 67277	Calibrate and test fuel quantity system.
Fuel Quantity Tester	Model MD-2A	Consolidated Airborne Systems 900 Third Avenue New Hyde Park, Long Island, NY	Calibrate and test fuel quantity system.
Fuel Quantity Tester	Model 387016-1	Simmonds Precision Prod., Inc. Panton Rd. Vergennes, VT 05491	Calibrate and test fuel quantity system.
Fuel Quantity Tester	Model 387991-003	Simmonds Precision Products Inc. Panton Rd. Vergennes, VT 05491	Calibrate and test Fuel quantity system
Fuel Quantity Tester	Model TF20	Consolidated Airborne Systems 900 Third Avenue New Hyde Park, Long Island, NY	Calibrate and test fuel quantity system.
Fuel Quantity Tester	Model TF889	Consolidated Airborne Systems 900 Third Avenue New Hyde Park, Long Island, NY	Calibrate and test fuel quantity system.



421C0001 THRU 421C1000

Fuel System Schematic
Figure 1 (Sheet 1)

51982017



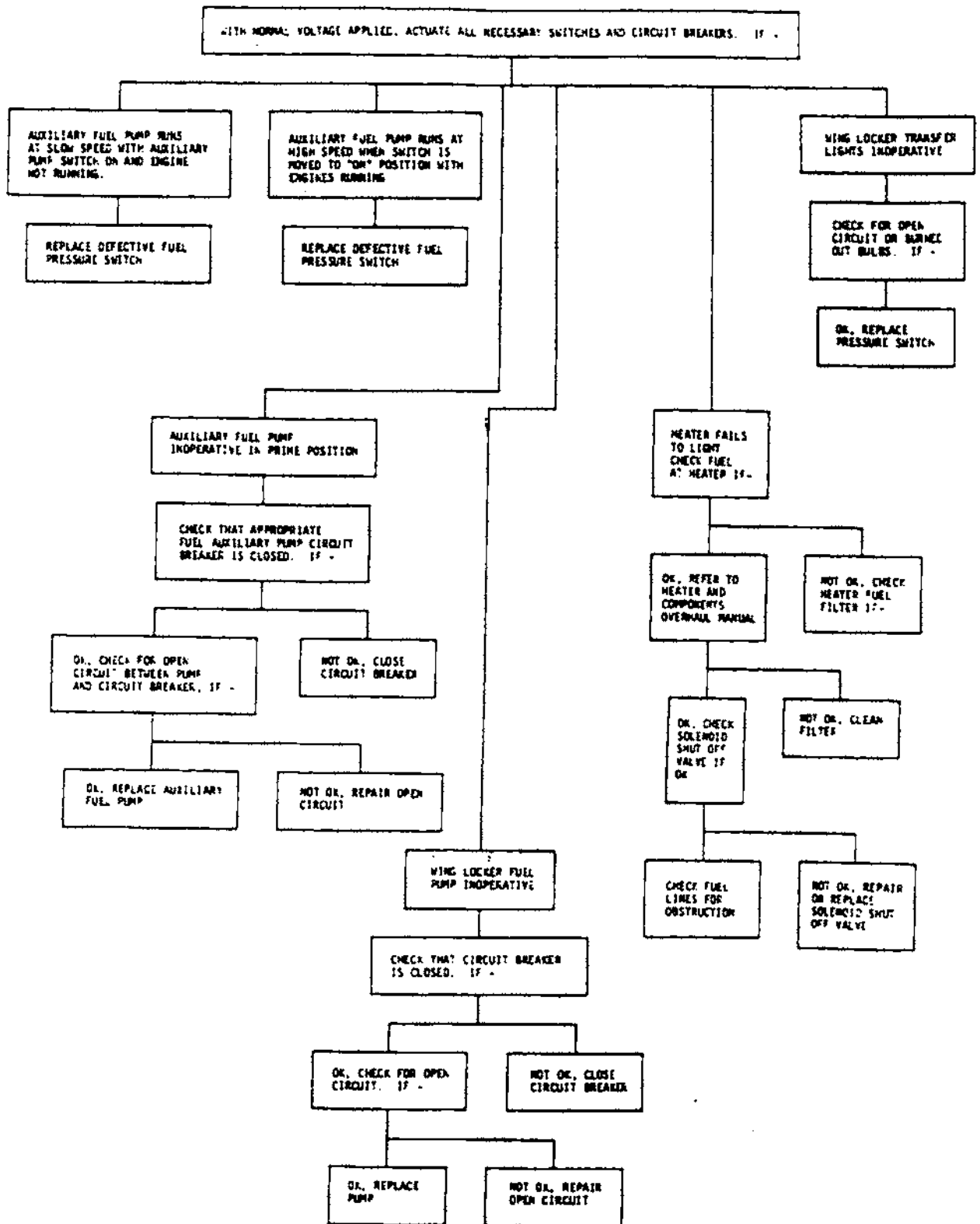
421C1001 AND ON

51967010

Fuel System Schematic
Figure 1 (Sheet 2)

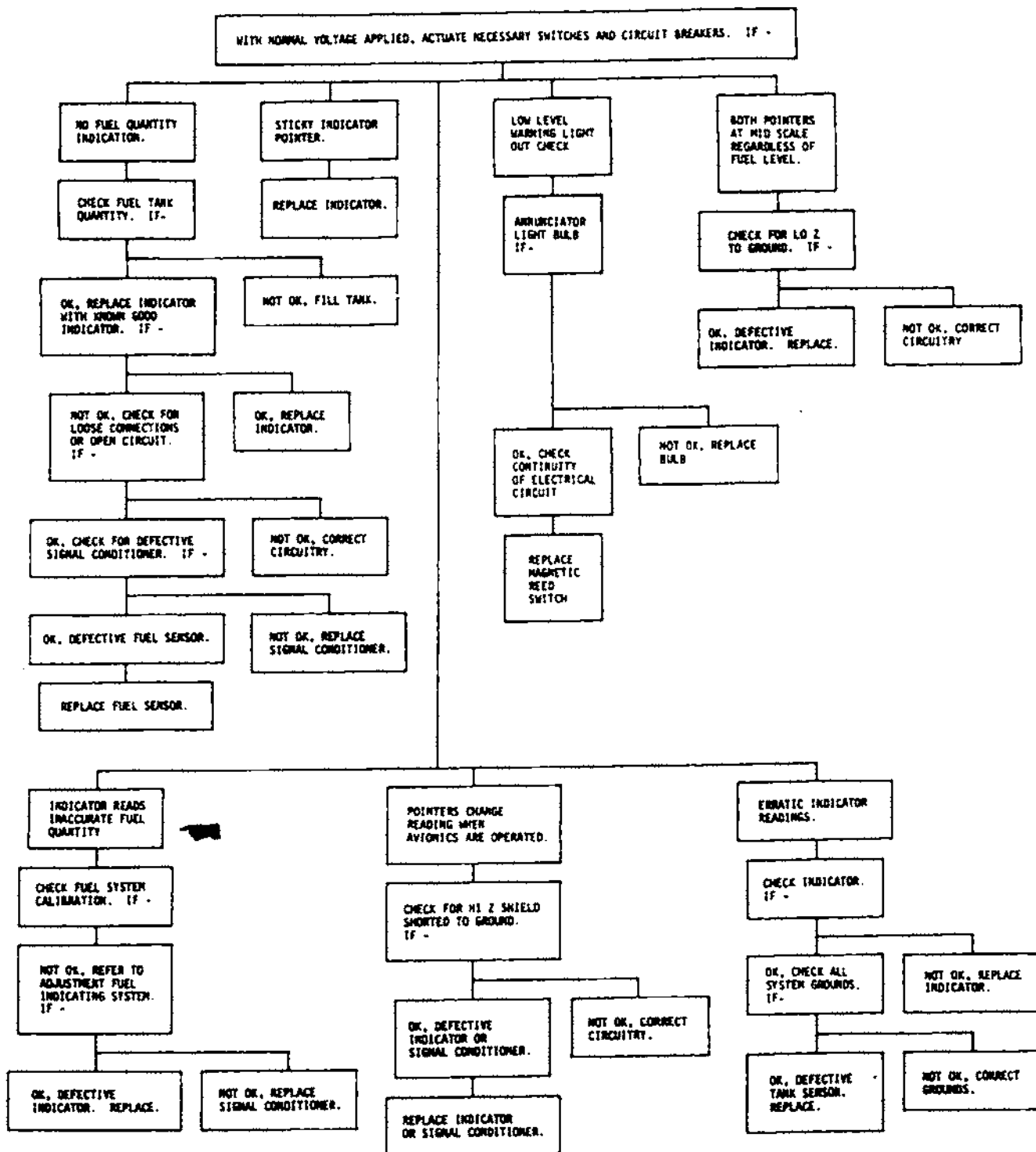
TABLE I
(Continued)

Name	Number	Manufacturer	Use
Fuel Quantity Tester	Model TF1820	Consolidated Airborne Systems 900 Third Avenue New Hyde Park, Long Island, NY	Calibrate and test fuel quantity system.
Fuel Quantity Tester	Model GTF-12	Gull Airborne Instrument, Inc. 55 Engineers Rd. Smithtown, NY	Calibrate and test fuel quantity system.
Fuel Quantity Tester	Model 2548GA	Barfield Instrument Corp. Miami, FL 23142	Calibrate and test fuel quantity system.
Fuel Quantity Tester	Model 472090-003	Simmonds Precision Prod., Inc. Panton, Rd. Vergennes, VT 05491	Calibrate and test fuel quantity system.
Fuel Quantity Tester	Model 472090-007	Simmonds Precision Prod., Inc. Panton Rd. Vergennes, VT 05491	Calibrate and test fuel quantity system.
Fuel Quantity Tester	Model 399000-005	Simmonds Precision Prod., Inc. Panton, Rd. Vergennes, VT 05491	Calibrate and test fuel quantity system.
Fuel Quantity Tester	Model MD-1	Genrad IN 3007 Baker Ave. Concord, MA 01742	Calibrate and test fuel quantity system.
Test Harness	5190508-7 (See Note 1)	Cessna Aircraft Co. Wichita, KS 67277	Check fuel system signal conditioner and associated wiring for Airplanes C0001 Thru C0098
Test Harness	5190508-9 (See Note 1)	Cessna Aircraft Co. Wichita, KS 67277	Check fuel system signal conditioner and associated wiring for Airplanes C0099 and On
Test Harness	5190508-11	Cessna Aircraft Co. Wichita, KS 67277	Check fuel system signal conditioner and associated wiring used with Simmonds and Consolidated test sets.
Test Harness	5190508-1 (See Note 2)	Cessna Aircraft Co. Wichita, KS 67277	To individually check fuel system probes on Airplanes C0001 and On
Test Harness	101-00411	Barfield Instrument Corp. Miami, FL 23142	To individually check fuel system probes on Airplanes C0001 and On
Test Harness	101-00435	Barfield Instrument Corp. Miami, FL 23142	To individually check fuel system probes.
Adapter	5190508-14	Cessna Aircraft Co. Wichita, KS 67277	This adapter required to interconnect Cessna harness with all test sets made by Conair-Bendix, Simmonds, Gull and General Radio.
Adapter	5190508-15	Cessna Aircraft Company Wichita, KS 67277	This adapter required to interconnect Cessna harness with all test sets made by Cessna and Barfield.
Test Harness	5190508-19	Cessna Aircraft Company Wichita, KS 67277	Fuel Quantity Indicator Linearity Test



Troubleshooting Chart - Fuel System
Figure 2

51988015



WARNING: DO NOT USE OHMMETER FOR CHECKING PROBE AND PROBE WIRING IN AIRCRAFT. ALWAYS USE THE CAPACITANCE FUEL SYSTEM TEST BOX FOR MAINTENANCE AND TROUBLESHOOTING THE FUEL INDICATING SYSTEM.

51988010

Troubleshooting Chart - Fuel Quantity Indicating System
Figure 3

TABLE I
(Continued)

Name	Number	Manufacturer	Use
Adapter	112-0007 (See Note 3)	Barfield Instrument Corp. Miami, FL 23142	This adapter required to interconnect Cessna harness with Barfield test set.
Adapter	2234-000-A000-20	Delta Electronics Beverly, MA	Alternate for 5190508-14
Adapter	112-407	Barfield Instrument Corp. Miami, FL 23142	Alternate for 5190508-15
Multimeter	Model 260	Simpson Electro Ld. Katy I 853 Dundee Ave Elgin, IL 60120	To check continuity
Screwdriver/ Fuel Sampler	CM3	Cessna Aircraft Co. Wichita, KS 67277	Fuel sample

NOTE 1: Designed for use with Cessna and Barfield test boxes. Can be used on Gull, Conair-Bendix, Simmonds and General Radio test boxes when 5190508-14 is used.

NOTE 2: Designed for use with Gull, Conair-Bendix, Simmonds and General Radio test boxes. Can be used on Cessna and Barfield test boxes when 5190508-15 is used.

NOTE 3: Supplied with each Barfield test set sold through Cessna Supply Division.

3. Troubleshooting Fuel System.

A. For a guide to troubleshooting the fuel system, refer to Figure 2.

4. Troubleshooting Fuel Indicating System.

A. For a guide to troubleshooting the fuel indicating system, refer to Figure 3.

Adjustment/Test

1. Tools and Equipment.

NOTE: Refer to troubleshooting for tools and equipment requirement.

2. Adjustment of Fuel Selector Valve Control Cable (Refer Figure 4)

NOTE: Adjustment procedures are the same for either right or left fuel selector valve control cable.

A. Adjust Fuel Selector Valve Control Cable.

- (1) (Refer to Figure 2, Chapter 9-10.) Remove selector handles (3) by removing screws and spacer.
- (2) (Refer to Figure 2, Chapter 9-10.) Remove fuel selector pan (4) by removing attaching screws.
- (3) Loosen carpet and pull forward enough to remove floorboard access panels.
- (4) (Refer to Figure 2, Chapter 9-10.) Disconnect fuel selector valve control cable (7) from gear box (6) by removing cotter pin (8), nut (9) and screw (1).

- (5) Refer to Chapter 1. Remove access plates at fuel selector valve in wing.
- (6) Disconnect fuel selector valve control cable from fuel selector valve by removing nut, washer, and screw.
- (7) Position fuel selector valve control rod to full IN (toward selector valve) position. Assure control rod is in the detent.

NOTE: With the fuel selector valve control cable disconnected at both ends, operate cable and assure freedom of movement, no binding must occur.

- (8) Connect fuel selector valve control cable at gear box and at fuel selector valve.

NOTE: Install selector handle at gear box temporarily.

- (9) On cabin floorboard, depress button and rotate right fuel selector valve handle to the right engine off position.

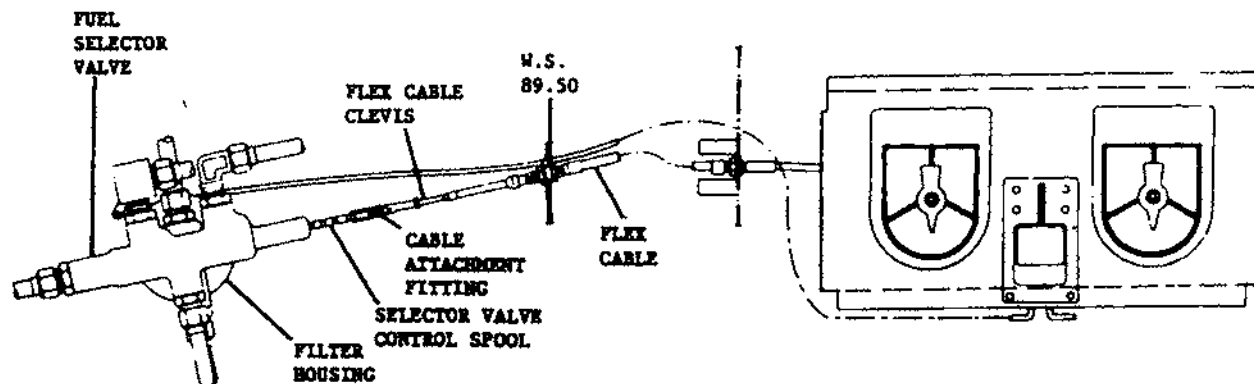
CAUTION: OBSERVE THAT THE FUEL SELECTOR VALVE HANDLE POINTER IS POINTING STRAIGHT AFT.

- (10) With the handles in the position described in steps (9), adjust terminal and jamb nuts on the fuel selector valve control cable until holes on gear box lever arm and fuel selector valve control cable terminal are aligned.
- (11) Install bolt, washer and nut.
- (12) Start from the OFF position and rotate counterclockwise for right-hand clockwise and left-hand handle towards right main until a definite detent is felt.
- (13) Observe that the pointer end of the handle is in the right main position when the detent is felt.
- (14) If the pointer is not in position when the definite detent is felt, it will be necessary to lengthen or shorten the fuel selector valve control cable to obtain proper position for the pointer.
- (15) Rotate from the right main position towards the left main position until a definite detent is felt in this position. If the pointer is not in the left main position it will be necessary to lengthen or shorten the fuel selector valve control cable until the pointer indicates proper position.

NOTE: On airplanes 421C1042 and On, ensure that three threads are showing through inspection hole in cable attachment.

- (16) Tighten jamb nuts on fuel selector valve control cable and rotate from left main to right main and to off positions. Rotate until a definite detent is felt.

CAUTION: IF A DEFINITE DETENT IS NOT PRESENT IN EACH POSITION, THE SYSTEM IS IMPROPERLY ADJUSTED.



51983006

Adjustment Fuel Selector Valve Control
Figure 4

- (17) Install access covers and panels.
- (18) Position the front carpet in position, remove selector valve handle, install fuel selector pan with attaching screws and replace fuel selector valve handle.

3. Adjustment of Crossfeed Shutoff Valve (See Figure 2 Chapter 9-10)

A. Procedures are the same for the right-hand and the left-hand side. However, both crossfeed shutoff valves must be adjusted for simultaneous operation.

- (1) Loosen carpet and pull forward enough to remove floorboard access panel.
- (2) Remove screws securing crossfeed shutoff lever assembly to floorboard, slide lever assembly aft, lift up and tilt forward.
- (3) Assure cable is connected securely to crossfeed shutoff lever.
- (4) Reposition crossfeed shutoff lever assembly to floorboard and loosen clamp block.
- (5) With crossfeed shutoff lever pulled up clamp crossfeed shutoff cable housing to allow approximately 0.50 inches from end of housing to end of cable. Operate lever to assure no interference in travel.
- (6) Install screws securing crossfeed shutoff lever assembly to floorboard.
- (7) Install access plates and carpet.
- (8) Remove fuel selector valve access plate and loosen screws securing cable housing to fuel selector valve in wing.
- (9) With crossfeed shutoff lever pulled up, clamp crossfeed shutoff cable housing to allow approximately 0.50 inches from end of cable housing to end of cable. Operate crossfeed shutoff lever to assure proper travel and no interference in travel.
- (10) Install fuel selector valve access plate and perform operational check.

4. Operational Check of Fuel Selector Valve and Crossfeed Shutoff Valve.

A. Perform operational check as follows:

NOTE: Procedures are the same for either engine. The following procedures apply to the left engine and left fuel selector valve and crossfeed shutoff valve.

- (1) Place the left fuel selector valve handle in the LEFT MAIN position and the right fuel selector valve handle in the OFF position. Start the left engine. When the engine is operating in operational range, advance the throttle to 1500 RPM. Observe the fuel flow gage to assure there are no radical fluctuations and for proper fuel flow. Observe the engine for a proper short continuous run. Place the left selector valve handle to the RIGHT MAIN position. Repeat the above steps and observations. With engine at idle RPM, the left fuel selector in the RIGHT MAIN position, pull up on crossfeed shutoff lever, the engine should run momentarily then stop. Position crossfeed shutoff lever down, restart engine and operate for a short period of time, then with engine at idle RPM, place the left fuel selector valve handle to the OFF position. The engine should run momentarily then stop.

5. Adjustment of Fuel Quantity Indicating System.

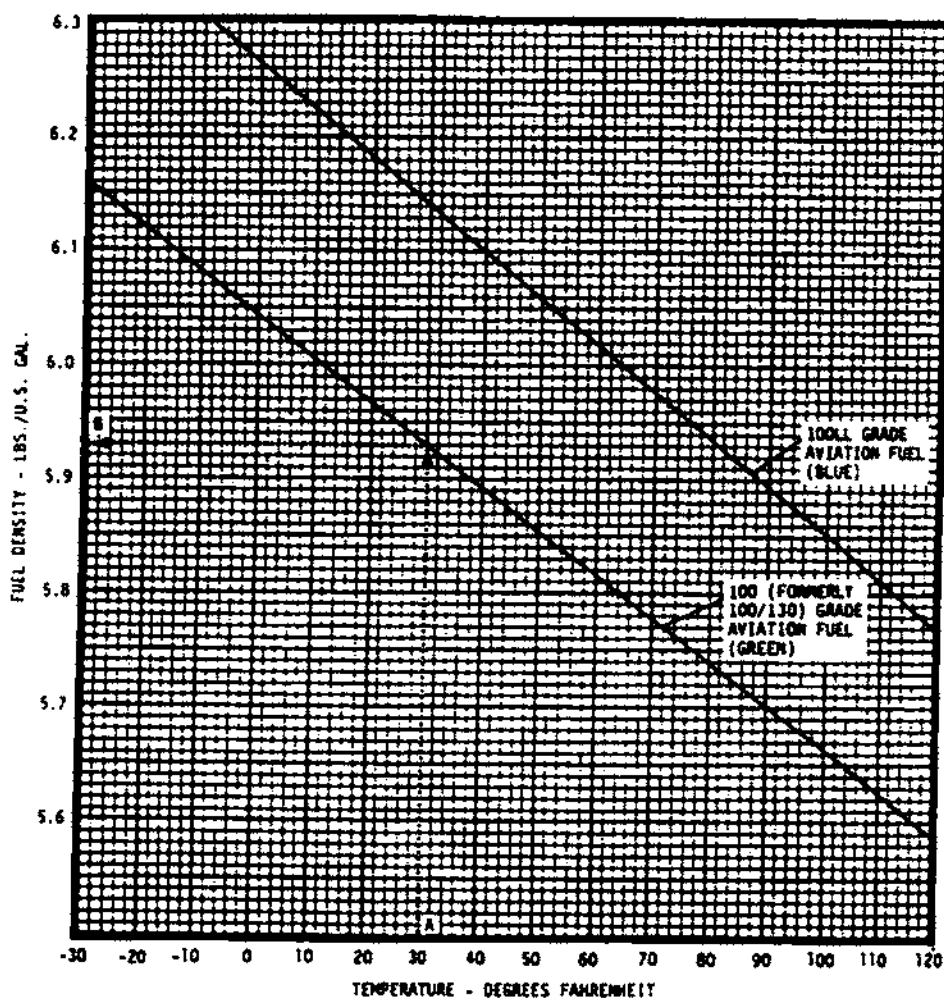
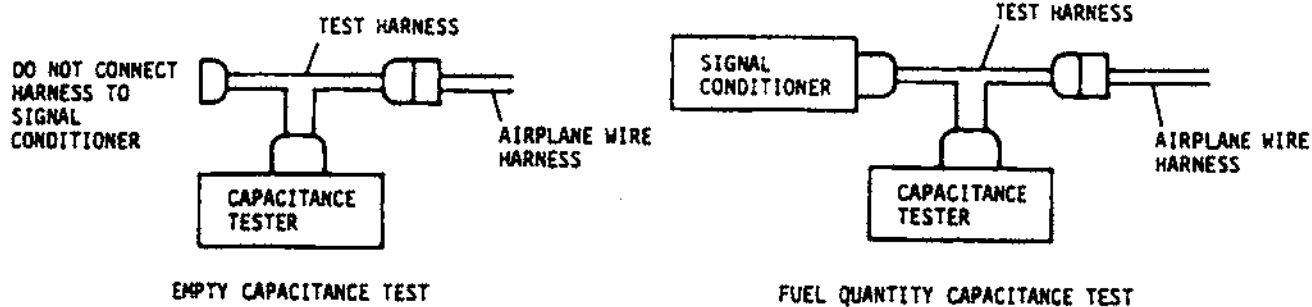
WARNING: DURING ALL DEFUELING AND TANK CALIBRATION, THE AIRPLANE MUST BE LOCATED A SAFE DISTANCE FROM OTHER AIRPLANES AND BUILDINGS. FIRE FIGHTING EQUIPMENT MUST BE AVAILABLE. TWO GROUND WIRES FROM DIFFERENT POINTS ON THE AIRPLANE TO SEPARATE APPROVED GROUNDING STAKES SHALL BE USED TO PREVENT ACCIDENTAL DISCONNECTING OF ONE GROUND WIRE.

A. Indicating Accuracy Check.

- (1) To verify that the indicating system is functioning correctly, a fairly accurate check can be calculated as follows:

NOTE: Apply electrical power. If airplane battery is used, assure battery voltage is 22 volts or more.

- (a) Defuel airplane. (Refer to Chapter 2) Indicator should read "0" pounds.



Fuel Quantity Calibration Test and Temperature Conversion Chart
Figure 5

51986013
10987013

- (b) Put a known quantity of fuel in the tank. Use chart (Figure 5). Select fuel density (Reference B) for known fuel type (100/130 AVGAS or 100LL) and temperature (Reference A).

Calculate: Density multiplied by known total gallons of fuel in tank equals total quantity in pounds. Read indicator for verification.

- (c) Fill tank and read indicator. Should show full indication.

NOTE: This check is not to be used for calibrating system.

8. Preparation for Calibration.

- (1) Defuel airplane. Refer to Chapter 2, Defueling-Servicing. Complete defueling from each tank by removing drain valves (refer to Chapter 9, Fuel System Drain Valve) from the bottom side of each fuel sump located on the underside of each wing outboard of main gear.
- (2) Remove access panels to signal conditioner.

NOTE: The fuel quantity indicator visually displays fuel quantity for each wing separately, therefore calibration procedure is repeated for the opposite wing.

- (3) Set up capacitance fuel system test box and harness assembly for insulation resistance test. Refer to Figure 5. Check insulation breakdown resistance on left and right main and auxiliary tanks. Circuit resistance should be 1000 megohms for the following circuits:
- (a) Shield to Structure Ground.
 - (b) Hi Z to Lo Z.
 - (c) Hi Z to Shield.
 - (d) Lo Z to Shield.
 - (e) Hi Z to Structure Ground.
 - (f) Lo Z to Structure Ground.
- (4) Interconnect test box and harness assembly into circuit as shown on Figure 5, Fuel Quantity Capacitance Test.
- (5) Make capacitance measurements on LH and RH main and auxiliary circuits. Net gain capacitance on the circuit and probe combinations should not exceed 2.00 pf of that of the probes noted on Table I. The 2.00 pf allowance is for additional capacitance induced by the system wiring.

NOTE: Any discrepancies found in Steps (3) and (5) should be checked out completely and corrected before proceeding further with the calibration.

- (6) Restore the circuits to original configuration.

C. Calibration.

- (1) Apply airplane power and assure battery is adequately charged; voltage should never be less than 22 volts when calibrating.
- (2) Place fuel selector valve to "Main" position and adjust the signal conditioner "Main Empty" potentiometer to read exact "Zero" pounds on the indicator.

NOTE: Slight tapping on the indicator may be required to overcome friction when meter is in static condition.

- (3) Ensure fuel selector is in "Main" position, interconnect the test box and harness assembly then adjust variable capacitance for added capacitance value. See Table I.

TABLE I

CAPACITANCE VALUES

CAPACITANCE VALUES IN PICO FARADS

CALIBRATION VALUES

Inboard	Middle	Tank Units Outboard	Empty Total	Added Capacitance	Indicator Setting
22.65 $\pm$ 0.5	22.22 $\pm$ 0.5	14.42 $\pm$ 0.5	61.29 $\pm$ 1.5	57.10 PF 100 Octane Low Lead	620 Lbs.

- (4) Adjust signal conditioner "Full" potentiometer to read 620 pounds or 310 pounds (Reference Table I) on the indicator. Tap indicator slightly to ensure that pointer has stabilized in final position.
- (5) Disconnect test box and harness assembly and restore circuit to original configuration.
- (6) Repeat steps (1) through (8) for opposite side.

6. Fuel Quantity Indicator Linearity Test.

- A. Connect fuel quantity indicator to tester (refer to Figure 5).
- B. Vary the tester current while slightly tapping on the indicator to overcome friction.
- C. Increase current to mid scale then bring pointer to "0". The current reading must be 0.054 microamperes $\pm$ 0.005, -0.0005.
- D. Increase current to bring pointer to 620 pounds, current reading must be between 0.746 and 0.778 microamperes.
- E. Using Table II, select the applicable chart (1 through 5) in which the maximum reading of the chart correspond with the reading obtained in step D. and test indicator.

7. Fuel Inlet Valve Checks.

- A. The fuel inlet valves test procedures in this section are to be conducted per the following requirements:

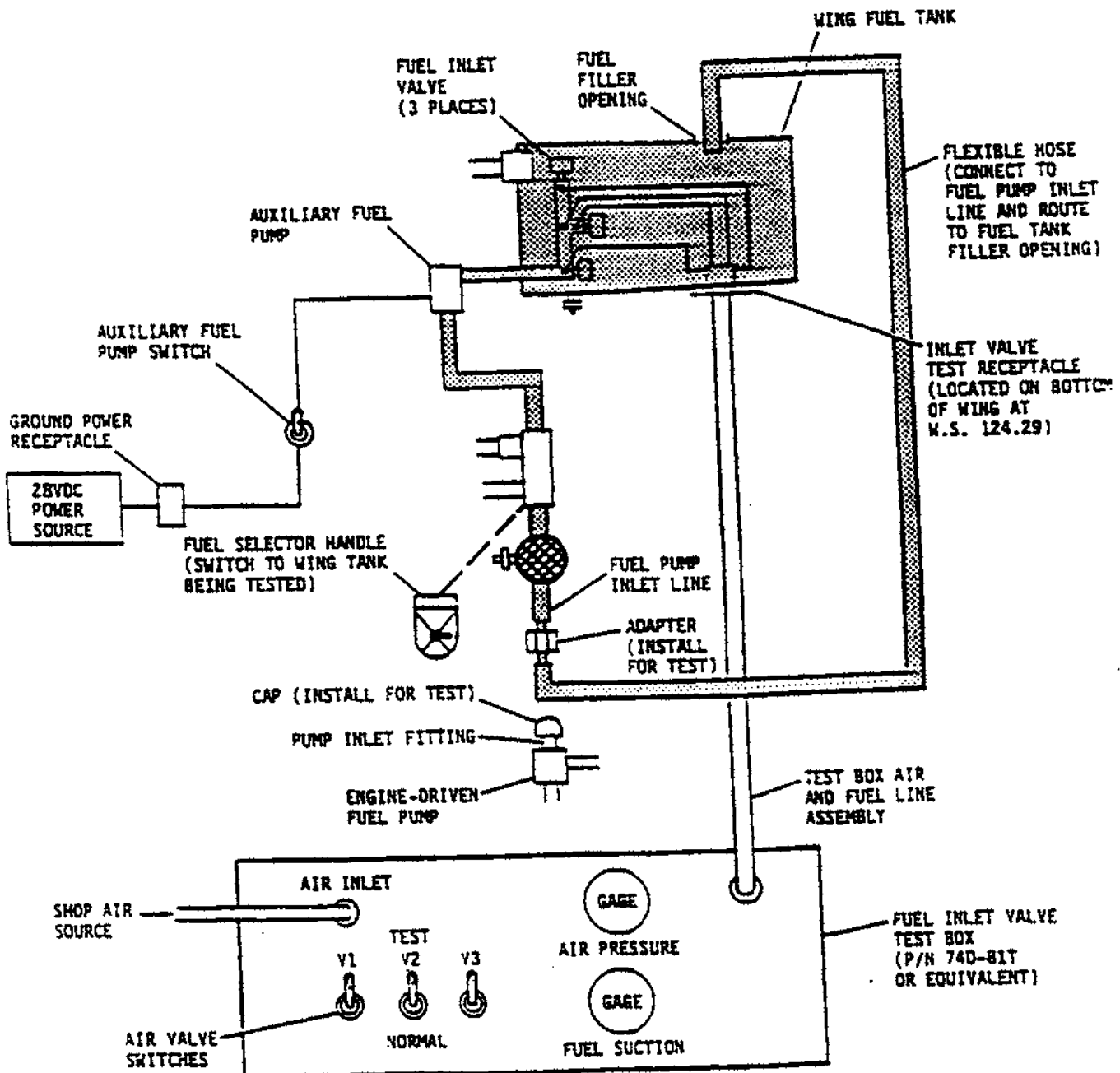
- (1) Fuel Inlet Valve Functional Test
 - (a) A functional test of the fuel inlet valves is to be accomplished at the time interval specified in Chapter 2, Time Limits/Maintenance Checks.
 - (b) A functional test is also to be conducted whenever the fuel inlet valve installation test described below is accomplished.
- (2) Fuel Inlet Valve Installation Test
 - (a) An installation test of the fuel inlet valves is to be conducted whenever maintenance (such as removal/replacement) has been accomplished on the fuel inlet valves system and related components.

B. Tools and Equipment

NOTE: EQUIVALENT SUBSTITUTES CAN BE USED IN PLACE OF THE ITEMS LISTED.

NAME	NUMBER	MANUFACTURER	USE
Fuel Inlet Box	74D-81T	Auto Valve, Inc. 1707 Guenther Road Dayton, OH 45427	Functional fuel inlet valve test.
Compressed Air Source		Obtained Locally	Functional fuel inlet valve test.
Electrical Power Source - 28 VDC		Obtained Locally	Functional fuel inlet valve test.

NOTE
TEST IS TO BE CONDUCTED
WITH 30 GAL. (180 LBS.)
OR MORE FUEL IN EACH TANK.



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Fuel Inlet Valve Functional Test Schematic
Figure 6

NAME	NUMBER	MANUFACTURER	USE
Vacuum Regulator (Range from 3.0 to 10.0 inches Hg)		Obtained Locally	Installation test of fuel inlet valves.
Vacuum Gauge (Range of 0 to 10.0 inches Hg vacuum)		Obtained Locally	Installation test of fuel inlet valves.
Air Pressure Regulator (Capable of accurately maintaining 2.0 PSI)		Obtained Locally	Installation test of fuel inlet valves.
Gauge (Capable of accurately indicating 2.0 PSI)		Obtained Locally	Installation test of fuel inlet valves.

C. Fuel Inlet Valve Functional Test (Refer to Figure 6.)

NOTE: CHECK IS TO BE CONDUCTED WITH 30 GALLONS (180 LBS.) OR MORE FUEL IN EACH FUEL TANK.

- (1) Connect test box (74D-81T) to fuel inlet valve test receptacle at W. S. 124.29.
- (2) Disconnect fuel line from inlet side of engine-drive fuel pump. Attach a clean flexible hose to the disconnected line and return this hose to the wing tank filler opening.
- (3) Airplane must be adequately grounded with two separate ground wires prior to test operation.
- (4) Connect 28 volt DC power source to airplane.
- (5) Connect shop air to air inlet fitting of test box. Regulated air should not exceed green arc on the test box in pressure gage. (25 to 35 PSI).
- (6) Position appropriate auxiliary fuel pump switch to "LOW" and check for fuel flow from fuel inlet line to wing tank filler opening.
- (7) Place air valve switches in test box to TEST position in sequential order (1, 2, 3). After the actuation of all air valves, the fuel suction gage on the test box should indicate between 3.6 to 4.6 inches Hg suction and stabilize in that range. This indicates proper shut-off function of the fuel inlet valves in the wing tank and the over-ride system in each valve.
- (8) If all three air valves are in the TEST position and the gage does not indicate between 3.5 and 4.6 inches Hg suction, the system is not functioning properly. The airplane should be defueled and each fuel inlet valve checked for proper alignment and adequate float travel.
- (9) If system functions as described in step g, move air valve switch no. 1 on the test box to "normal" and observe fuel suction pressure gage. Gage should indicate "0" inches Hg vacuum. Return switch No. 1 to TEST position and suction gage should indicate 3.6 to 4.6 inches Hg. If suction does not go to "0" but remains at 3.6 to 4.6 inches Hg, when the No. 1 switch is moved to "Normal", the No. 1 fuel inlet valve is malfunctioning. Repeat this procedure for air valve No. 2 and 3. If a fuel inlet valve is found to be malfunctioning, the airplane should be defueled and the valve checked for proper alignment and unobstructed float travel.

NOTE: IN PRECEDING TESTS, THE REMAINING TWO AIR VALVES MUST BE IN TEST POSITION.

- (10) Turn auxiliary fuel pump switch "OFF".
- (11) Remove test box from test receptacle and install receptacle plug (torque to 30 inch-pounds).
- (12) Remove hose from wing tank filler opening and disconnect from fuel pump inlet line. Reconnect fuel line to inlet side of engine driven fuel pump.
- (13) Repeat the above test procedure on opposite wing.
- (14) Remove DC power source and ground wires from airplane.

8. Fuel Inlet Valve Installation Test (Refer to Figure 7).

NOTE: PROCEDURES PERTAIN TO EITHER WING FUEL INLET VALVES

- (1) Ground airplane using two (2) separate ground wires

- (2) Ensure master switch is in OFF position.
- (3) Place fuel selector handle in OFF position.
- (4) Disconnect all electrical power from the airplane. Attach maintenance warning tags to the battery connectors and external power receptacle stating:

WARNING: DO NOT CONNECT ELECTRICAL POWER, MAINTENANCE IN PROGRESS.

- (5) Defuel the airplane and gain access to the fuel tank as necessary.

WARNING: REMOVE ALL IGNITION SOURCES FROM THE WORK AREA. OBSERVE ALL FUEL SYSTEM MAINTENANCE SAFETY PRACTICES.

CAUTION: OBSERVE ALL LOCAL AND FACILITY SAFETY REGULATIONS WHEN PERFORMING FUEL SYSTEM MAINTENANCE.

- (6) Disconnect fuel supply hose to the engine from fuel tank outlet adapter, located on rib at WING STATION 119.29. See 9-10, Figure 1. Cap end of disconnected hose.
- (7) Connect vacuum test equipment to fuel tank outlet adapter fitting using a hose or tube.
- (8) Set the vacuum regulator to 3.0 inches of Hg vacuum. Operate the vacuum pump until the vacuum gauge indicates 3.0 inches Hg. Close the shut-off valve and stop the vacuum pump.
 - (a) Verify that the system maintains 3.0 inches Hg vacuum for 1 minute.
 - (b) If the system does not maintain 3.0 inches Hg vacuum for 1 minute, check the system to ensure all fittings are tight and float travel is not restricted.
- (9) Disconnect hose or tube from fuel tank outlet adapter and cap hose or tube. Operate vacuum pump and set regulator to 6 to 10 inches Hg by reading vacuum gauge. Remove cap and reinstall hose or tube to fuel tank outlet adapter. Operate vacuum pump for 1 minute and verify a difference in vacuum of at least 1 inch Hg between regulator setting and vacuum gauge reading during pump operation.

NOTE: IF DIFFERENCE BETWEEN REGULATOR SETTING AND VACUUM GAUGE READING DURING VACUUM PUMP OPERATION IS 1 INCH HG OR GREATER, THE VALVES ARE FUNCTIONING PROPERLY.

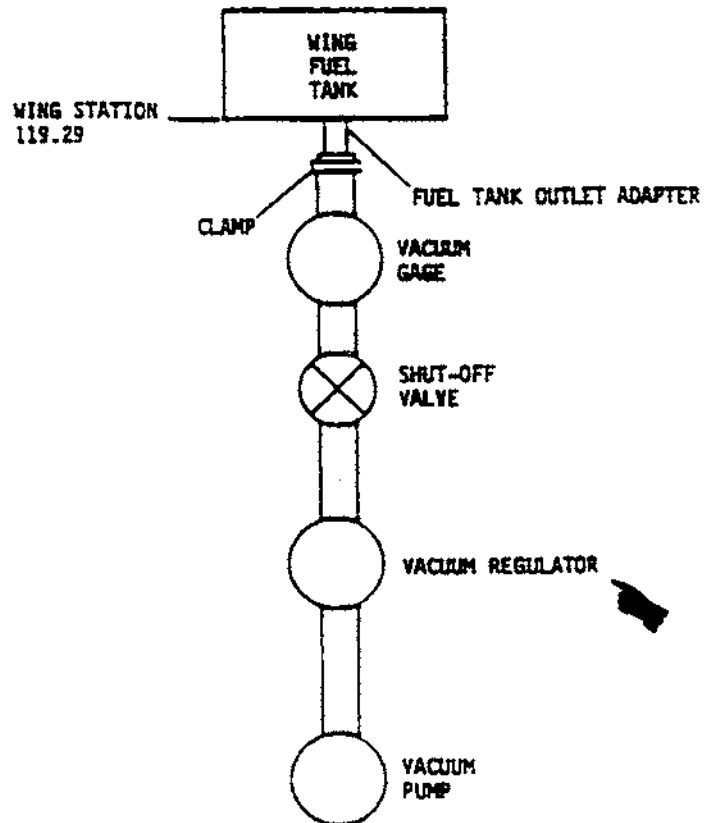
- (10) Apply a regulated air pressure of 2.0 pounds per square inch gauge (PSIG) to the fuel tank outlet adapter. Close the shut-off valve. Shut down the air supply. Verify that the system maintains 2.0 PSIG for 1 minute.
- (11) Replace any valve that did not pass all tests in steps 8, 9, 10.
- (12) If inlet valve is to be replaced, disconnect fuel and air pressure lines connected to the inlet valves inside and outside the fuel tank.

NOTE: REFER TO 9-10, 7, A AND B FOR VALVE REMOVAL AND INSTALLATION.

- (13) Remove the test equipment and reconnect the hose to the fuel tank outlet adapter.
- (14) Purge the fuel system to eliminate contamination. Refer to Chapter 12.
- (15) Install access plates on lower surface of wing.

CAUTION: WHEN INSTALLING ACCESS PANELS IN WET WING AREA, DO NOT USE SCREWS THAT ARE TOO LONG. SCREWS THAT ARE TOO LONG CAN DAMAGE DOME NUTPLATES AND CAUSE FUEL LEAKS.

- (16) Connect electrical power to airplane.
- (17) Remove maintenance warning tags from airplane.
- (18) Remove ground wires from airplane.
- (19) Perform an engine operational check. (Refer to Pilots Operating Handbook.)



Fuel Inlet Valve Installation Test Schematic
Figure 7

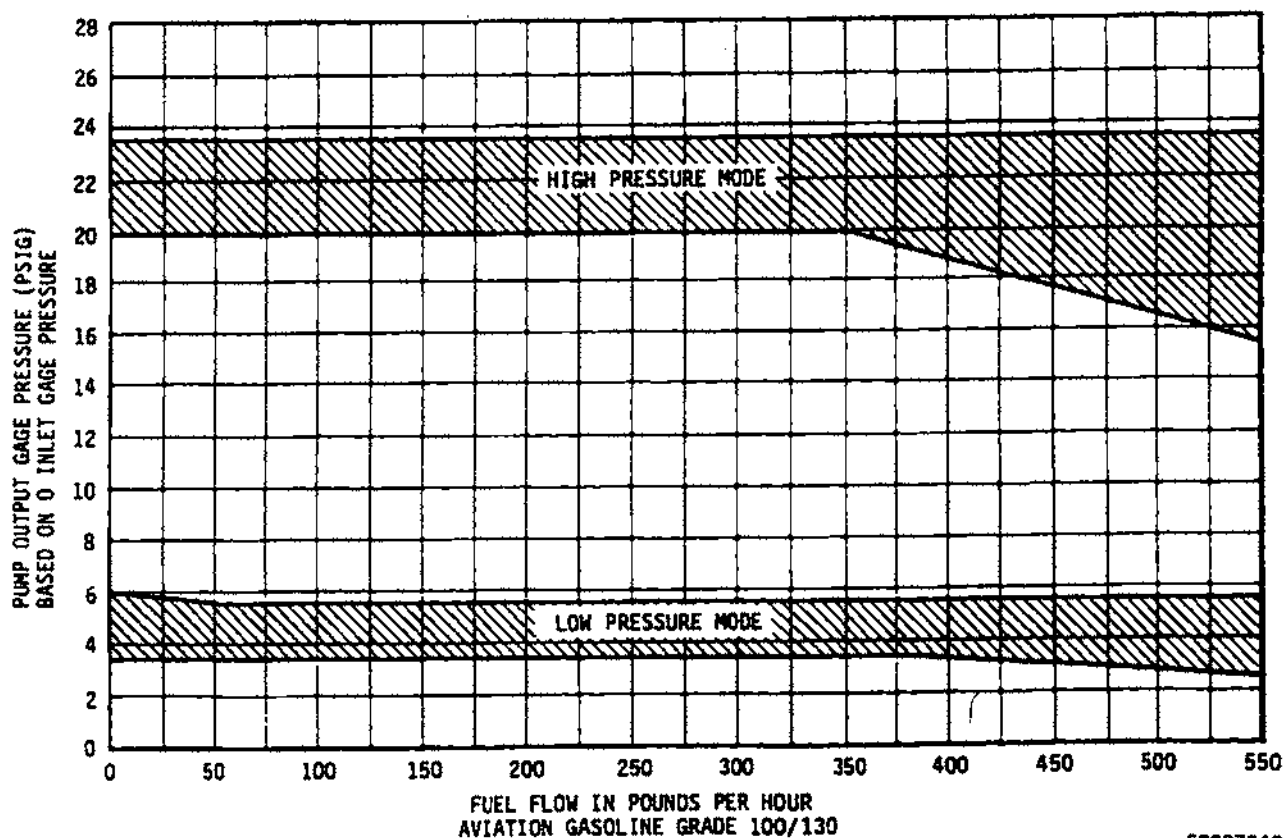
9. Fuel Vent System Check (Refer to 9-10, Figure 3).

- A. The vent system check must be performed any time the vent valve or system components are removed for maintenance. This check requires that the lower access plates in the fuel tank area be removed.

- (1) Defuel airplane.
- (2) Remove access plates from underside of wing.
- (3) Plug vent tube in inboard leading edge area.
- (4) Remove inboard and outboard check valve from tee fittings and cap tee fittings.
- (5) Block float on the vent valve to insure the vent valve is closed.
- (6) Plug hole in small standpipe on tee fitting at the outboard end of the leading edge.
- (7) Plug hole in pocket of flush vent scoop and attach water manometer to protruding vent on side of scoop on lower wing surface.
- (8) Apply 2.0 PSIG using a water manometer (U-shaped manometer reading is 27 inches of water, or 54 inches of water on a straight manometer). Allow pressure to stabilize 2 to 3 minutes. System must stand 30 minutes without leakage.

NOTE: A regulated source of dry nitrogen may be substituted for pressure if water manometer is not available.

- (9) If pressure drops, determine leak source using leak detector.
- (10) After completing leak check, remove plugs, unlock float valve and install check valves.
- (11) Install access plates and service with fuel. Refer to Chapter 2, Airplane Zoning and Access Plates/Panels Identification.



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Boost Pump Performance Requirements
Figure 8

10. Auxiliary Fuel Pump Check (Refer to Figure 8).

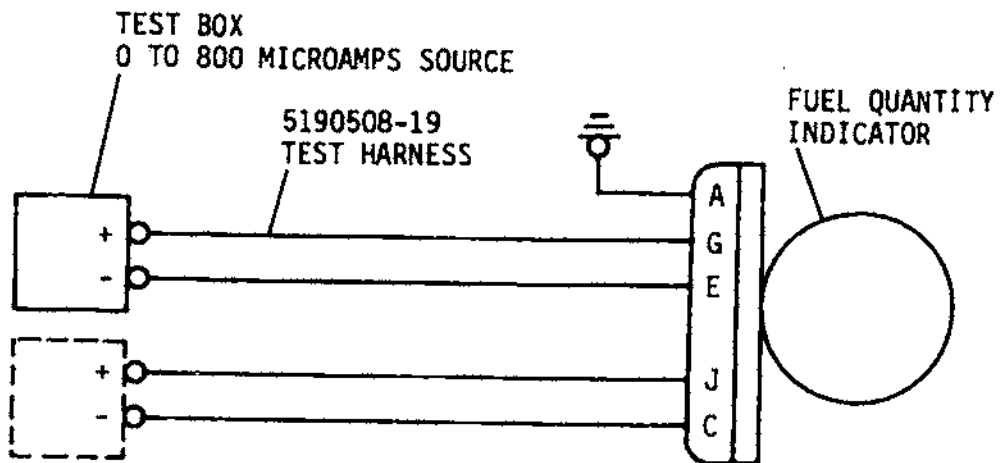
- A. The auxiliary fuel pump is not adjustable. The performance of the pump may be checked by:
 - (1) Tee into the fuel pressure line to the metering unit with an appropriate gage.
 - (2) With an auxiliary power unit, or the opposite engine running, maintain operating voltage and check auxiliary pump pressure to be within operational limits shown by Figure 8.

Inspection/Check

- 1. Inspection/Check of Fuel System.
 - A. Remove necessary wing and fuselage access plates.
 - B. Remove necessary seats and carpet.
- 2. Inspection/Check Fuel Filter.
 - A. Remove necessary wing access plates.

Cleaning/Painting

- 1. Cleaning Fuel Filter (Airplanes C0001 Thru C0400).
 - A. Cut safety and remove screws securing filter bowl.
 - B. Remove screw securing filter element and lower filter element from position.
 - C. Clean filter element with unleaded gasoline and dry with a jet of dry compressed air. Air pressure must not exceed 100 PSI.
 - D. Install filter and bowl, tighten screws and safety screws.
 - E. Perform operation check.
- 2. Cleaning Fuel Filter (Airplanes C0401 and On).
 - A. Cut safety wire and remove bowl nut and bowl.
 - B. Remove palnut and filter element.
 - C. Clean filter element with unleaded gasoline and dry with a jet of dry compressed air.
 - D. Install filter element and secure with palnut.
 - E. Install filter bowl; tighten bowl nut.
 - F. Turn fuel selector valve on, operate auxiliary fuel pump and check for leaks.
 - G. Turn electrical power OFF; install safety wire.



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Fuel Quantity Indicator Linearity Test
Figure 9

MAIN FUEL SYSTEMDescription

1. The main fuel system consists of: the main wing tanks, auxiliary fuel pumps, fuel selector control system, indicating system, overboard vent, low level warning light switch and necessary fuel plumbing.
2. The main fuel tanks (integrally sealed wet wing) are located in the wing panels outboard of the engine nacelles. Each tank has an auxiliary fuel pump, three fuel tank units, a low-level warning light switch, drain valve, vent scoop, baffles and fuel filler cap. A vapor return line from the engine-driven fuel pump to the main tank provides unused fuel return to each respective main tank. The vent scoop in each wing tank provides for overboard venting of fuel and vapors.
3. The auxiliary fuel pump which is electrically operated, is mounted outside the fuel cavity at W.S. 119.29 on each main tank. The auxiliary fuel pump provides fuel under pressure for priming the engine during starting and supplies fuel to the engine in the event the engine-driven fuel pump fails. The auxiliary fuel pump feeds fuel to the selector valve and in turn the selector valve routes fuel to the engine-driven fuel pump. The auxiliary fuel pump is controlled by three switches. When the prime switch is placed in the left position, the left auxiliary fuel pump, provides priming for the left engine. When the prime switch is placed in the right position, the right auxiliary fuel pump, provides priming for the right engine. During the priming operation the auxiliary fuel pump operates at high pressure. The auxiliary pump switches are a position center off switch. When placed in the LOW position, the auxiliary fuel pump provides pressure for purging. When the auxiliary fuel pump switch is placed in the ON position, the auxiliary fuel pump usually operates at low pressure. In case of an engine-driven fuel pump failure, the auxiliary fuel pump will automatically switch to high pressure if the switch is in the ON position. During takeoff and landing, the auxiliary fuel pump switch is positioned to ON. Fuel is picked up at three separate inlet ports inside the main fuel tank. Fuel is picked up at three separate inlet valves inside the main fuel tank. These inlet valves are controlled by floats to assure adequate fuel flow at any attitude of the aircraft during low fuel level condition.
4. The fuel selector control system consists of left and right fuel selector controls located between the pilot and copilot seats on the cabin floor; a left and right fuel selector valve, located in each wing between W.S. 100.60 and W.S. 106.79 just aft of the front spar, and inboard of the engine nacelle. Each selector valve has three positions which allows fuel to flow to the respective engine from the left tank, right tank, or shutoff all fuel flow through the valve. A fuel filter and a quick-drain valve to remove moisture and sediment is mounted directly under each fuel selector valve on a bracket. Each selector valve is connected to the corresponding fuel selector control by a flex cable.
 - A. The fuel selector control on the right, controls fuel flow to the right engine through the corresponding selector valve by allowing fuel to be used from the RIGHT MAIN or from the LEFT MAIN through the crossfeed system. The fuel selector control on the left, controls fuel flow to the left engine through the corresponding selector valve by allowing fuel to be used from the LEFT MAIN or from the RIGHT MAIN through the crossfeed system. The fuel selector controls are rotary-type and operate mechanically through a gear arrangement and a flex cable to each selector valve. Each fuel selector control has three positions; OFF, LEFT MAIN, and RIGHT MAIN, and OFF, RIGHT MAIN and LEFT MAIN. The fuel selector control handles indicate the position of the selector valves. The fuel selector control handles are protected by a locking mechanism which requires the button on the selector handle to be depressed prior to positioning selector handle to "OFF".

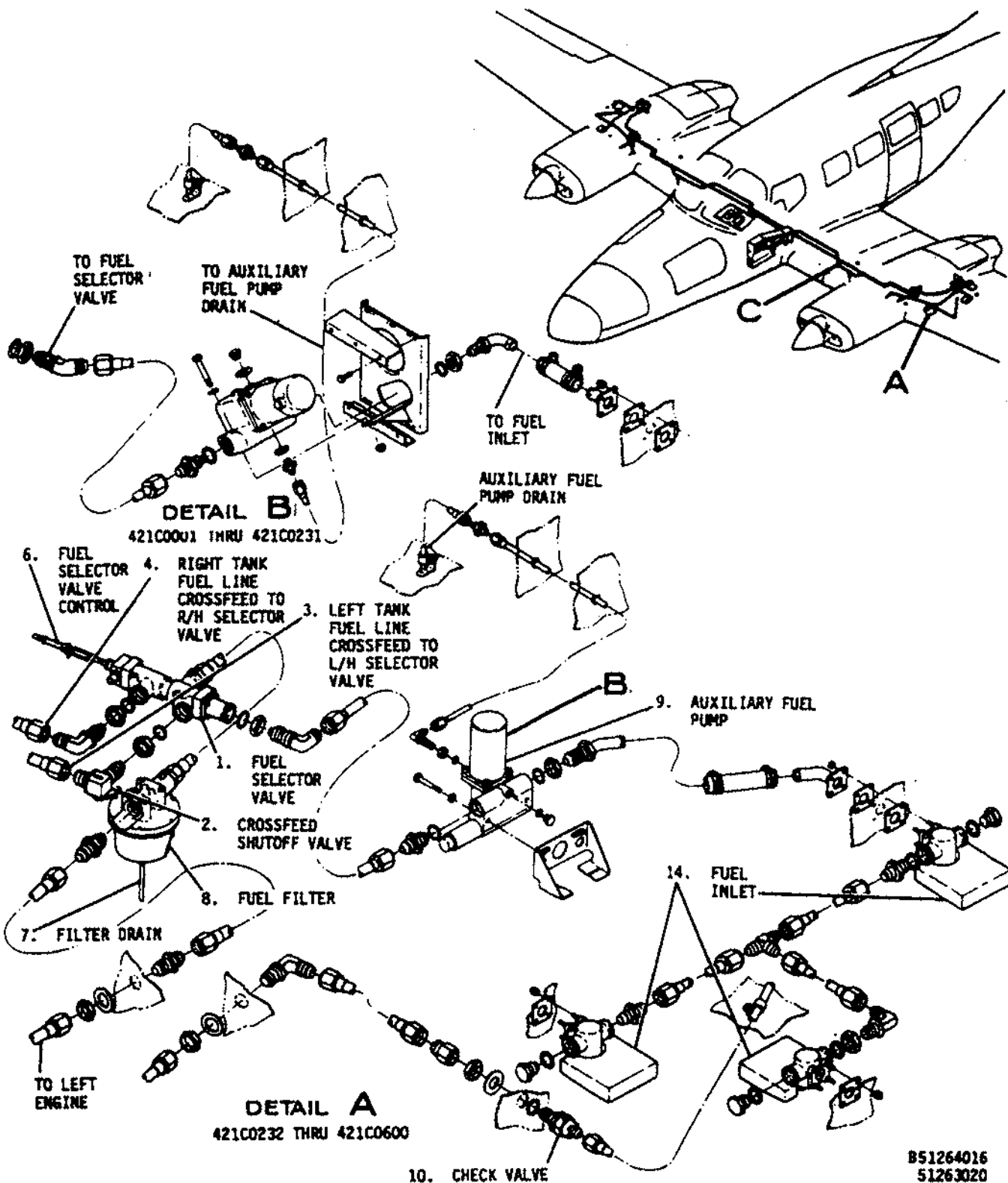
5. The vent scoop provides venting for the main fuel system and allows excess fuel to drain overboard. The vent scoop operates in all weather conditions without the use of heaters.

Troubleshooting

NOTE: For troubleshooting the main fuel system, refer to Fuel System Troubleshooting.

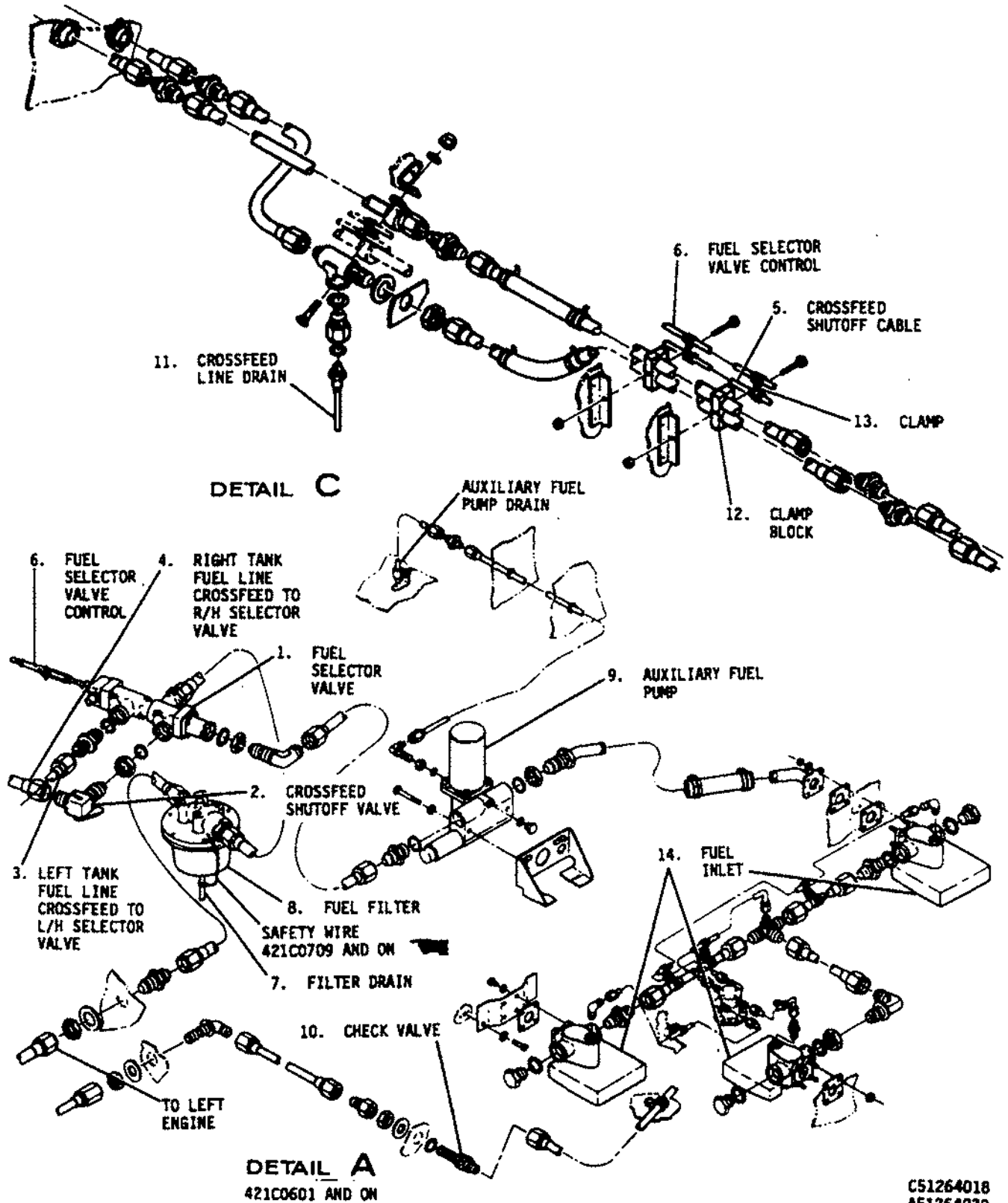
Adjustment/Test

NOTE: For adjustment/test of main fuel system, refer to Fuel System Adjustment/Test.



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Main Fuel System and Plumbing Installation
Figure 1 (Sheet 1 of 2)



Main Fuel System and Plumbing Installation
Figure 1 (Sheet 2)

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Maintenance Practices

WARNING: DURING FUEL SYSTEM MAINTENANCE PRACTICES, TWO GROUND WIRES ATTACHED FROM DIFFERENT POINTS ON THE AIRPLANE TO SEPARATE APPROVED GROUNDING STAKES SHALL BE USED TO PREVENT UNGROUNDING OF THE AIRPLANE DUE TO ACCIDENTAL DISCONNECTION OF ONE GROUND WIRE.

CAUTION: WHEN REPLACING ACCESS COVER ON WET WING DO NOT USE SCREWS THAT ARE TOO LONG. SCREWS THAT ARE TOO LONG WILL DAMAGE THE NUTPLATE AND CAUSE FUEL LEAKS.

NOTE: During removal/installation of fuel system components, all openings or fittings shall be capped or plugged.

The following torques are to be applied to all clamped nipple fittings:

Fitting ID	Torque Inch-Pounds
.25 Thru .50	12 - 16
.75 Thru 1.00	15 - 20
1.50	25 - 30
2.00	30 - 35
3.00	35 - 40

Before installing and connecting fuel lines, use Parker Fuel-Soluble Thread Lubricant No. 6PB (or equivalent) on all aluminum fuel line fittings.

1. Removal/Installation Auxiliary Fuel Pump.

NOTE: If auxiliary fuel pump is to be overhauled, refer to List of Publications for overhaul manual.

NOTE: Removal/Installation procedures are the same for either auxiliary fuel pump.

A. Remove Auxiliary Fuel Pump (421C0001 Thru 421C0252).

CAUTION: CARE SHOULD BE TAKEN TO GUARD AGAINST ENTRY OF FOREIGN MATTER INTO LINES DURING REMOVAL OF PUMP.

- (1) Insure fuel selector control handles are OFF. Electrical switches OFF.
- (2) Defuel applicable main tank. Refer to Chapter 2.
- (3) Remove access panel to auxiliary fuel pump. Refer to Chapter 2.
- (4) Disconnect electrical wires from fuel pump and electrical connector at signal conditioner.
- (5) Disconnect fuel lines and hoses from auxiliary fuel pump.
- (6) Remove signal conditioner by removing four attaching screws.
- (7) If installed, disconnect fuel line from wing locker fuel tank at aft elbow.
- (8) Remove bolts securing pump mounting bracket to upper and lower stringer brackets (6 places).
- (9) Slide pump and bracket assembly inboard while rotating 90° counterclockwise to remove fuel pump and pump mounting bracket assembly from airplane through access hole in lower skin.

B. Install Auxiliary Fuel Pump (421C0001 Thru 421C0252).

- (1) If a new auxiliary fuel pump is being installed, install fittings previously removed.
- (2) Install pump on mounting brackets.
- (3) Position auxiliary fuel pump in place by rotating 90° to slide into place and temporarily install six (6) bolts.
- (4) Remove caps and plugs from lines and hoses, connect to pump fittings and torque connections as required.

CAUTION: OBSERVE IN AND OUT MARKINGS ON PUMP RELATIVE TO LINES BEING CONNECTED.

- (5) Tighten bolts securing auxiliary fuel pump to brackets.
- (6) Connect electrical wires.
- (7) Service fuel tank with approximately 5 gallons of fuel; perform operational check of auxiliary fuel pump and assure no evidence of leaks.
- (8) Install access panel and service fuel tank in accordance with Chapter 2, Servicing.

C. Remove Auxiliary Fuel Pump (421C0252 and On).

NOTE: If auxiliary fuel pump is to be overhauled, refer to List of Publications for overhaul manual.

CAUTION: CARE SHOULD BE TAKEN TO GUARD AGAINST ENTRY OF FOREIGN MATTER INTO LINES.

- (1) Ensure fuel selector control handles are OFF.
- (2) Defuel applicable main tank. Refer to Chapter 2.
- (3) Remove necessary access panel to auxiliary fuel pump. Refer to Chapter 2.
- (4) Disconnect electrical wires.
- (5) Disconnect fuel lines and hoses from auxiliary fuel pump.
- (6) Remove bolts securing pump to bracket and slide auxiliary fuel pump out of bracket.
- (7) Cap all open lines and hoses.
- (8) If a new auxiliary fuel pump is being installed, remove fittings.

D. Install Auxiliary Fuel Pump (421C0252 and On).

- (1) If a new fuel pump is being installed, install fittings previously removed.
- (2) Position auxiliary fuel pump in place and temporarily install bolts in bracket.
- (3) Remove caps and plugs from lines and hoses; connect to pump fittings and torque connecting nuts as required.

CAUTION: OBSERVE IN AND OUT MARKINGS ON PUMP RELATIVE TO LINES BEING CONNECTED.

- (4) Tighten bolts securing auxiliary fuel pump to bracket.
- (5) Connect electrical wires.
- (6) Service fuel tank with approximately 5 gallons of fuel; perform operational check of auxiliary fuel pump and assure no evidence of leaks.
- (7) Install access panels and service fuel tank in accordance with Chapter 2.

2. Removal/Installation Fuel Selector Valve (See Figure 2).

WARNING: RESIDUAL FUEL DRAINING FROM THE LINES IS A FIRE HAZARD. CARE SHOULD BE EXERCISED IN DISPOSAL OF SUCH FUEL WHEN LINES ARE DISCONNECTED TO PREVENT ITS ACCUMULATION IN THE WING.

NOTE: Removal/Installation procedures are the same for either selector valve.

A. Remove Fuel Selector Valve.

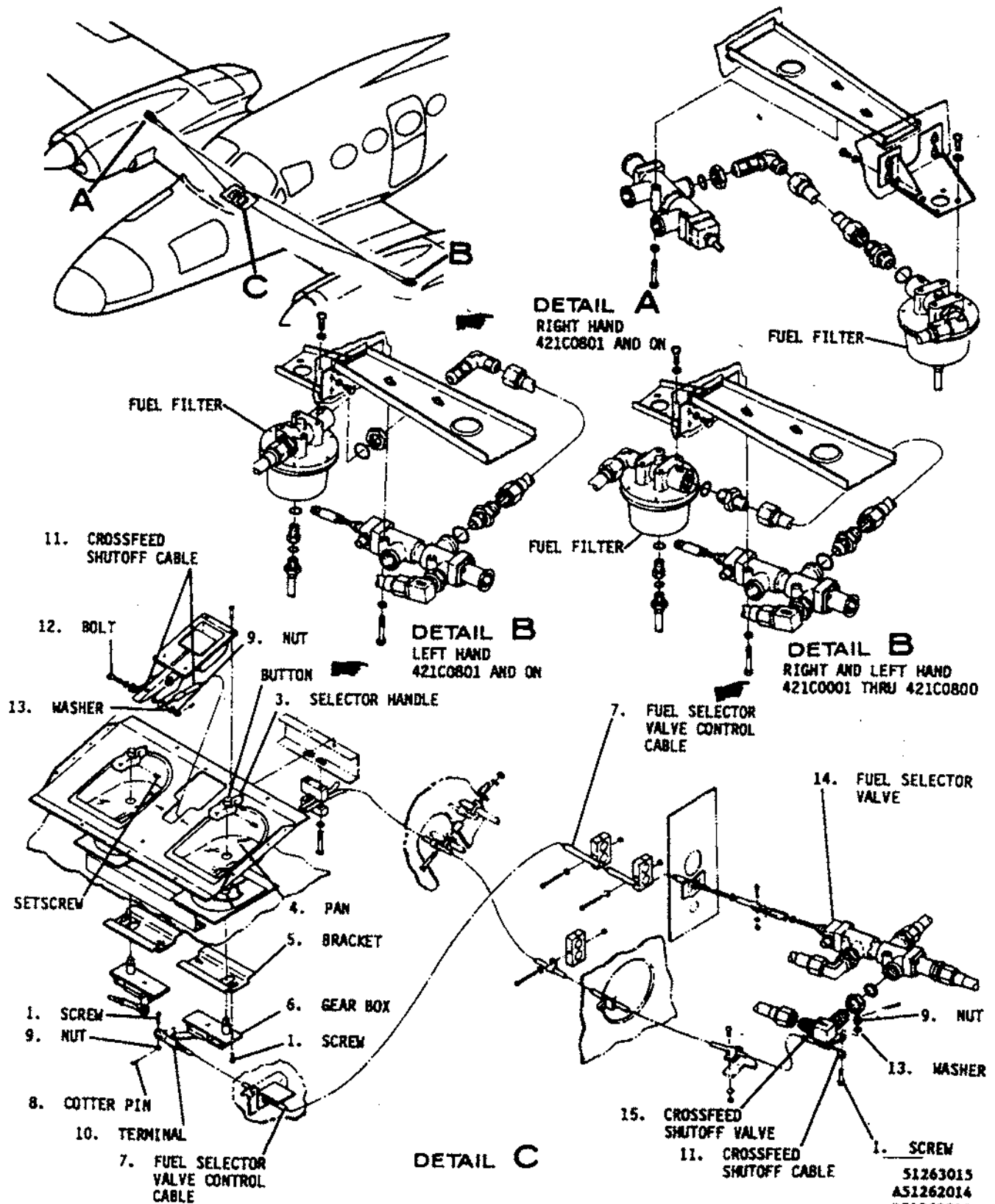
- (1) Drain all fuel from wing. Refer to Chapter 2.
- (2) Remove necessary access cover plates.
- (3) Disconnect lines and fittings.
- (4) Cap or plug all open lines or fittings.
- (5) Disconnect flex cable from selector valve control rod by removing nut, washer and screw.
- (6) Disconnect flex cable from crossfeed shutoff valve.
- (7) Remove bolts securing selector valve from bracket and remove selector valve from wing.
- (8) Remove bolts and screws securing selector valve and filter to bracket and remove as an assembly from the wing.
- (9) If the selector valve is being replaced by another valve, the fittings, filter lines, filter and filter brackets must be removed from selector valve.

B. Install Fuel Selector Valve.

- (1) If removed, install fittings in selector valve and clock in proper direction.
- (2) Assemble selector valve and filter in brackets and position in place.
- (3) Secure the selector valve and filter in place with screws and bolts.
- (4) Remove caps from lines, connect to proper selector valve fittings, and torque as required.
- (5) Connect flex cable to crossfeed shutoff valve.

NOTE: Ensure that flex cable has enough thread engagement in terminal and; on airplanes 421C1045 and On, an inspection hole has been provided in the terminal.

- (6) Connect flex cable to selector valve control rod, using screw, washer and nut.



Fuel Selector Valve and Controls Installation
Figure 2

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CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL

- (7) Fuel tank in accordance with fueling procedures, Chapter 2.
- (8) Perform operational check of fuel selector valve.
- (9) Assure no leaks are present and install access cover plates.

3. Removal/Installation Fuel Filter Element.

NOTE: Removal/Installation of fuel filter element is typical for either filter.

A. Remove Fuel Filter Element. (Refer to Figure 3.)

- (1) Gain access to fuel filter by removing access plate 521BB (left wing) or 621BB (right wing). Refer to Chapter 6, Airplane Zoning and Access Plates/Panels Identification - Description.
- (2) Place fuel selector to the OFF position.
- (3) Remove safety wire from drain valve assembly and remove drain valve assembly from bottom of filter bowl.
- (4) Remove bowl from fuel filter housing.
- (5) Remove retaining nut and filter element.
- (6) Clean filter element with shop air (do not exceed 100 PSI).

B. Install Fuel Filter Element.

NOTE: Prior to reinstallation, inspect O-ring in fuel filter housing and replace if necessary.

- (1) Install O-ring in fuel filter housing (if applicable). Lubricate O-ring with Parker Fuel Lube or other suitable lubricant.

CAUTION: IF O-RING IS NOT PROPERLY LUBRICATED, IT COULD POSSIBLY BE CUT WHEN BOWL IS INSTALLED TO HOUSING.

- (2) Install filter element and secure with retaining nut.
- (3) Install bowl and secure to housing with drain valve assembly.
- (4) Safety wire drain valve assembly to housing.
- (5) Perform leak check.
- (6) Install access plate.

4. Removal/Installation Fuel Selector Gear Box.

NOTE: Removal/Installation of the fuel selector gear box is the same for either fuel selector gear box.

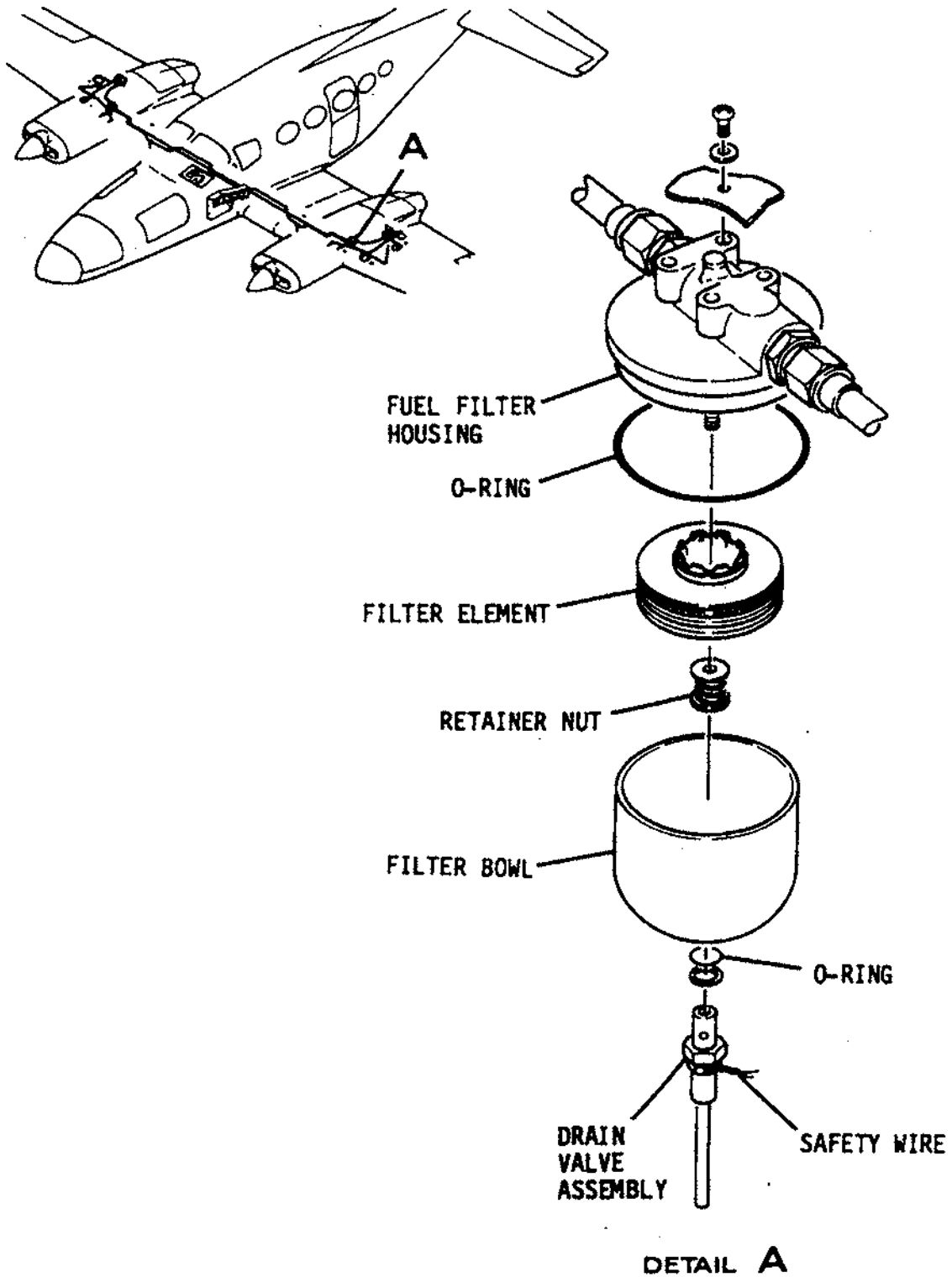
A. Remove Fuel Selector Gear Box. (Refer to Figure 4.)

- (1) Position fuel selector valve handles - OFF.
- (2) Remove pilot and copilot seats.
- (3) Remove carpet as required.
- (4) Remove floorboard access plate immediately forward and immediately aft of fuel selector valve handles.
- (5) Remove fuel selector valve handle.
- (6) Disconnect control cable from gear box lever by removing cotter pin, nut and bolt.
- (7) Remove two screws attaching gear box to bracket and remove gear box.

B. Install Fuel Selector Gear Box.

- (1) Attach gear box to bracket with two screws.
- (2) Connect flex cable to gear box lever, using bolt, nut and cotter pin.
- (3) Check operation of system and rig fuel control system if necessary. Refer to Fuel Control System Adjustment/Test.
- (4) Install forward and aft floorboard access cover.
- (5) Place carpet into place and install fuel pan and fuel selector valve gear handles.
- (6) Install pilot and copilot seats.

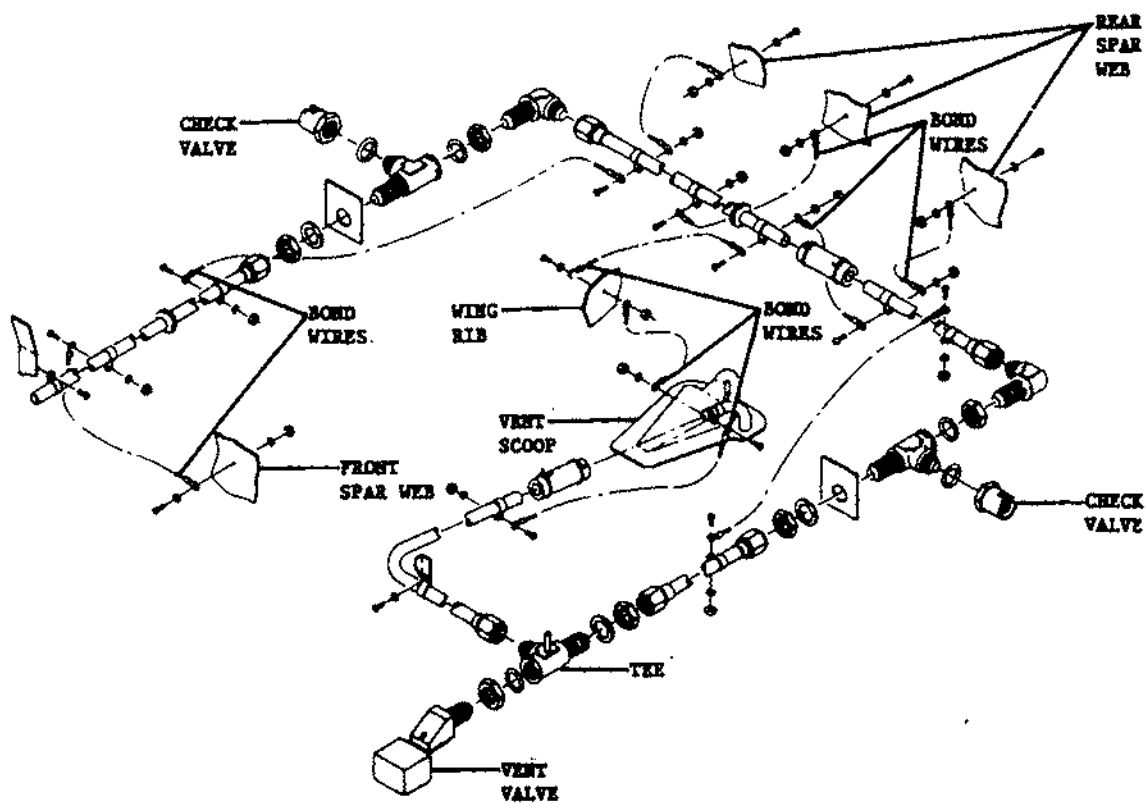
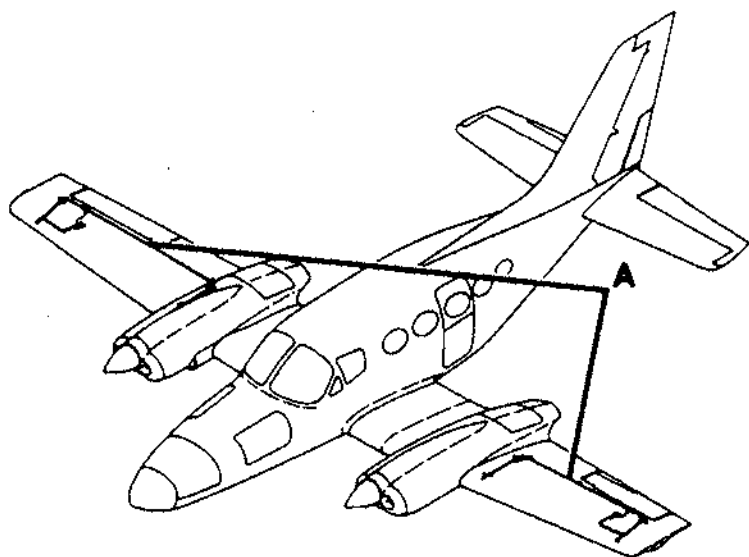
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Fuel Filter Installation
Figure 3

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DETAIL A

Main Fuel Vent Installation
Figure 4

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MODEL 421
SERVICE MANUAL

5. Removal/Installation Fuel Selector and Crossfeed Shutoff Control Cables. (Refer to Figure 2.)

NOTE: Removal/Installation of the control cables are the same for either side.

A. Remove Control Cables.

- (1) Position fuel selector valve handles to OFF.
- (2) Remove pilot and copilot seats.
- (3) Remove carpet as required.
- (4) Remove floorboard access plates immediately forward and immediately aft of the fuel selector valve handles.
- (5) Disconnect control cable from fuel selector valve gear box lever by removing cotter pin, nut and bolt.
- (6) Remove screws securing crossfeed shutoff lever assembly to floorboard, slide aft, lift up and rotate forward out of mounting position.
- (7) Disconnect control cable from the crossfeed shutoff lever assembly by removing cotter pin, nut, washer and bolt.
- (8) Remove clamps securing control cables in fuselage. Loosen jamb nut on the fuel selector valve control cable and remove terminal.
- (9) Remove heat exchanger in accordance with Chapter 6 and necessary wing access cover plates.
- (10) Disconnect fuel selector valve control cable from fuel selector valve control rod by removing nut, washer and screw.
- (11) Disconnect crossfeed control cable at the crossfeed shutoff valve lever, by removing nut, washer and screw. Loosen the cable clamp on fuel selector valve and slide cable out of the clamp.
- (12) Loosen jamb nut on fuel selector valve control cable and remove clevis.
- (13) Remove fuel selector valve control cable from feed-thru bracket at approximate W.S. 89.00 by removing nuts and spacer and routing cable inboard to remove from bracket.
- (14) Remove clamps securing cables to wing structure.
- (15) Remove pressure seals at fuselage and route cables out through the heat exchanger access openings.

B. Install Control Cables.

- (1) Route both the fuel selector valve control cable and the crossfeed shutoff control cable into position in the wing and fuselage. Do not clamp at this time.
- (2) Install nut and spacer on the feed-thru fitting of the control cable, at the feed-thru fitting approximate W.S. 89.00. Route cable through bracket and install nut on opposite side of the nut and spacer. Tighten finger tight.
- (3) Install jamb nut and clevis on the fuel selector valve control cable. Thread nut and clevis on as far as possible turning clockwise.
- (4) Insert crossfeed shutoff control cable into clamp on bottom of fuel selector, connect cable end to shutoff lever with screw, washer and nut. Position cable in clamp and tighten in position to allow one half inch from cable end to cable housing when the valve is actuated.
- (5) Align the hole in the fuel selector valve control cable clevis with the fuel selector valve control rod end fitting and install screw, washer and nut.

NOTE: If alignment cannot be obtained, it will be necessary to adjust the clevis on the fuel selector valve control until alignment is obtained.

- (6) Tighten jamb nut at the clevis and tighten the nut on the cable at the feed-thru bracket at W.S. 89.00.
- (7) Install pressure seals at fuselage and install jamb nut and terminal on the fuel selector valve control cable and connect to gear box lever with bolt, washer, nut and cotter pin.
- (8) Connect crossfeed shutoff controls at lever using bolt, washer, nut and cotter pin.
- (9) Clamp crossfeed shutoff control cable in position in clamp and tighten in position to allow one half inch from cable end to cable housing when lever is actuated (full up).
- (10) Slide crossfeed lever assembly aft and down into position and install screws.
- (11) Connect control cable from fuel selector valve to the gear box lever with bolt, nut and cotter pin.

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- (12) Install cable clamps in the wing and fuselage areas. Ensure all jamb nuts are tight.

NOTE: Proper support and security is most essential in the operation of the fuel selector valve and crossfeed shutoff valve controls.

- (13) Install fuel selector handle and rig the fuel selector valve. Refer to Adjustment of Fuel Selector Valve Control.
- (14) Rig the crossfeed shutoff valve. Refer to Adjustment of Crossfeed Shutoff Valve.
- (15) Remove fuel selector handle and install floorboard access cover plates, carpet, pilot and copilot seats.
- (16) Install fuel selector handle. Check systems by engine run up.

6. Removal/Installation Fuel Vent System. (Refer to Figure 4.)

A. Remove Fuel Vent System Components.

- (1) Ensure fuel selector control handles are OFF.
- (2) Defuel applicable main tank. Refer to Chapter 2, Defueling - Servicing.
- (3) Remove necessary access panels from underside of wing.
- (4) Disconnect bonding wires from lines by removing nut, washers and screw from clamps.
- (5) Disconnect vent lines at fittings and hose connections.
- (6) Remove respective attachment fittings and disassemble check valve and vent valve.
- (7) Plug or cap all open lines and fittings.
- (8) Removal of vent scoop is not recommended.

B. Install Fuel Vent System Components.

- (1) Remove caps or plugs from lines and fittings.
- (2) Install check valve and vent valve to respective fittings prior to installation in wing.
- (3) Connect lines at fittings and hose connections.
- (4) Install clamps and connect bonding wires with screws, washers and nuts.
- (5) Install access panels.
- (6) Service main tank. Refer to Chapter 2, Servicing - Fuel Loading.
- (7) Perform operational check.

7. Removal/Installation of Fuel Inlet Valves. (Refer to Figure 1.)

NOTE: Removal/installation procedures are the same for either one of the three inlet fuel valves.

A. Remove Inlet Fuel Valves.

CAUTION: CARE SHOULD BE TAKEN TO GUARD AGAINST ENTRY OF FOREIGN MATERIAL INTO LINES AND FUEL TANK DURING REMOVAL OF INLET VALVE. COVER ALL OPEN LINES, FITTINGS AND TANK OPENINGS.

- (1) Ensure fuel selector control handles are OFF.
- (2) Turn all electrical power OFF.
- (3) Remove auxiliary fuel pump. Refer to removal/installation procedures.
- (4) Remove necessary fuel tank access panels.
- (5) Disconnect fuel lines connected to the inlet valve, inside fuel tank and outside fuel tank.
- (6) Remove nuts and thread seals securing inlet valve to wing rib. Discard thread seals.
- (7) Pull inlet valve aft into fuel tank toward the wing rib access panel opening and remove.

NOTE: When removing the inlet valve installed in the leading edge, it will be necessary to return the inlet valve aft through the spar access to the wing rib access opening.

- (8) If a new inlet valve is to be installed, remove fittings.

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B. Install Inlet Fuel Valves.

CAUTION: FUEL LEAKAGE COULD RESULT FROM IMPROPER INSTALLATION OF THE INLET FLOAT VALVE GASKET AND ADAPTERS. ENSURE GASKET IS PROPERLY INSTALLED AND TIGHTENED EVENLY.

- (1) If the inlet valve is being replaced, install previously removed fittings and clock in proper direction.

NOTE: Use only cork gaskets as replacement. Ensure the float valve retaining nuts are tightened evenly to avoid unsymmetrical gasket compression. Torque the retaining nuts to 25 inch-pounds.

- (2) Install new gasket on inlet valve and route into place on wing rib; install new thread seals and secure with nuts.
- (3) Connect lines to valve on the inside and outside of main tank.
- (4) Install access panels.
- (5) Install auxiliary fuel pump. Refer to installation procedures.
- (6) Perform operation check. Refer to fuel system adjustment/test.

8. Fuel System Component Replacement (Airplanes -0601 and On).

- A. This procedure allows replacement to fuel system components (auxiliary fuel pumps, fuel selector valves and associated lines and hoses from the fuel tank outlet to the fuel selector valves) without defueling the airplane by utilizing the fuel inlet valve test box (part number 74D-81T).

B. Fuel Inlet Valve Test Box Setup. (Refer to Figure 5.)

NOTE: A 74D-81T fuel inlet valve test box must be available for use to accomplish this procedure.

- (1) Provide an electrical ground for the airplane. Remove access panels as required to gain access to the fuel system components requiring replacement.
- (2) Place the fuel selector handles in the OFF position.
- (3) Connect the fuel inlet valve test box to the receptacle on the lower wing skin as shown.
- (4) Apply shop air to the fuel inlet valve test box and place the air valve switches in the TEST position. This will close all three inlet valves inside the tank preventing fuel in the tank from reaching the fuel tank outlet.

CAUTION: THE TEST BOX MUST REMAIN CONNECTED AND AIR PRESSURE APPLIED DURING THE FUEL SYSTEM COMPONENT REPLACEMENT.

C. Fuel System Component Replacement.

- (1) Place rags in position to contain any fuel spillage during system breakdown.

CAUTION: DURING REMOVAL/INSTALLATION OF FUEL SYSTEM COMPONENTS, ALL OPENINGS MUST BE CAPPED OR PLUGGED SECURELY (USING AIRTIGHT TYPE CAPS OR PLUGS) TO PREVENT ENTRY OF FOREIGN MATTER INTO THE FUEL SYSTEM AND INADVERTENT FUEL LEAKAGE.

- (2) Upon initial fuel system breakdown, slowly loosen the fitting (do not remove completely) and allow residual fuel (should be less than one pint) to seep out of the loosened connection.
- (3) When the fuel seepage has stopped, continue on with component replacement.

NOTE: If fuel seepage does not stop, then this is an indication of one or more leaking fuel inlet valves (located inside the fuel tank). If this occurs, this procedure cannot be used and the fuel inlet valve leak must be located and corrected per Fuel Inlet Valve Adjustment and Test.

- (4) Complete the fuel system component replacement (ensure all connections have been made) and place the air valve switches on the fuel inlet valve test box to the NORMAL position to open the fuel inlet valves and allow fuel into the system.

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- (5) Apply electrical power to the airplane, ensure fuel selector valves are in the OFF position and operate the auxiliary fuel pumps (L or R AUX PUMP switches to the ON position) to pressurize the system.
- (6) Check for leaks at all disturbed fittings.
- (7) Disconnect the fuel inlet test box and reinstall all removed access covers.

Inspection/Check

1. General

- A. The airplane is equipped with two engine driven fuel pumps, two auxiliary fuel pumps and the wing locker transfer pump. Contamination may enter the system through use of improper filtering or improper handling.
- B. The fuel system filters ordinarily remove the minor contaminations; however, if maintenance has been performed on the tank or system, components have been replaced, it will be necessary to flush the system. Refer to flush fuel system paragraph.

2. Flush Fuel System.

A. Flush System.

- (1) Turn all electrical power OFF.
- (2) Remove engine cowlings.
- (3) Disconnect fuel lines from the inlet of each engine-driven fuel pump. Attach a clean flexible hose with an eight (8) micron filter in the line to the disconnected hose. Return this hose to the wing tank filler opening.
- (4) Add forty (40) gallons of fuel to each wing tank.
- (5) Assure airplane is properly grounded.
- (6) Connect external power unit and turn on.
- (7) Flush the wing locker tank lines by turning on transfer pumps and allow pumps to run until the five (5) gallons of fuel is transferred to the wing tanks. Insure that indicator light on panel illuminates when all fuel is transferred.

NOTE: The wing locker tanks transfer directly into main wing tanks; therefore, locker tanks must be flushed prior to flushing main tanks.

- (8) Flush fuel lines from left tank to left engine by setting the left fuel selector to LEFT MAIN and right fuel selector to ENGINE OFF. Turn on left auxiliary fuel pump and allow to run for five (5) minutes.

NOTE: A solid stream of fuel should be observed returning to left wing tank.

- (9) Flush fuel line from left tank to right engine by setting the left selector to ENG OFF and right selector to LEFT MAIN. Turn on left auxiliary pump and allow to run for five (5) minutes.

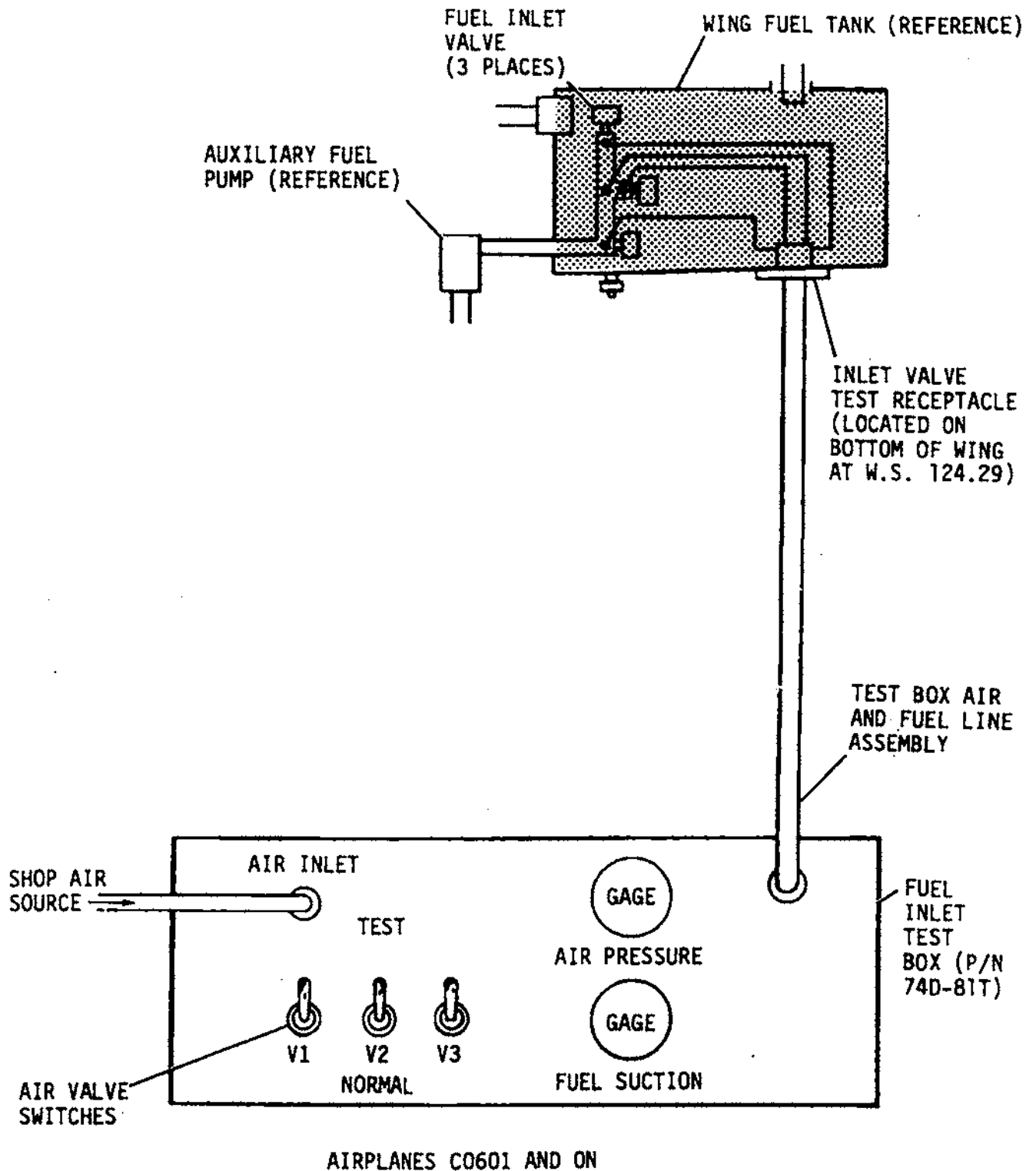
NOTE: A solid stream of fuel should be observed returning to right wing tank.

- (10) Flush the right fuel lines by repeating steps (7) and (9) on the right system.

CAUTION: IF ANY OBSTRUCTION IS NOTED DURING FLUSHING PROCEDURE, DISCONNECT LINES AS REQUIRED AND CORRECT ALL DISCREPANCY.

- (11) Set left fuel selector to LEFT MAIN and right fuel selector to RIGHT TANK. Turn on auxiliary pumps and transfer all fuel in left and right tanks to the fuel truck.
- (12) Remove filters and flexible hose and reconnect fuel lines to left and right engine-driven fuel pump.
- (13) Remove and clean filter elements from fuel filter in left and right wing.
- (14) Reinstall filter elements and sediment bowls on left and right fuel filters.
- (15) Replace cowlings.
- (16) Perform engine operational check.

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Fuel Inlet Valve Test Box Schematic
Figure 5

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WING LOCKER FUEL SYSTEMDescription

1. The wing locker fuel system (optional) consists of: a fuel cell (28.0 usable U.S. gallons) mounted in the forward portion of the wing locker; an electrically operated, manually controlled fuel transfer pump; a pressure switch to control the panel indicating light; a transfer switch; a drain valve and necessary plumbing. There is no fuel selector control or fuel quantity indicator for the wing locker fuel system. Fuel is pumped directly into the respective main tank with a transfer pump. There is no return line installed in the wing locker system; therefore, it is necessary the aircraft be flown with fuel selector handle on MAIN until approximately 420 pounds of fuel remain, in the respective main tank before transferring fuel from the wing locker fuel system. A control switch is mounted on the instrument panel with an indicator light below to illuminate when the fuel has been transferred.

Troubleshooting

NOTE: For troubleshooting the wing locker fuel system, refer to Fuel System Troubleshooting.

Adjustment/Test

NOTE: For adjustment/test of wing locker fuel system, refer to Fuel System Adjustment/Test.

Maintenance Practices

WARNING: DURING FUEL SYSTEM MAINTENANCE PRACTICES, TWO GROUND WIRES ATTACHED FROM DIFFERENT POINTS ON THE AIRCRAFT TO SEPARATE APPROVED GROUNDING STAKES SHALL BE USED TO PREVENT UNGROUNDING OF THE AIRCRAFT, DUE TO ACCIDENTAL DISCONNECTION OF ONE GROUND WIRE.

WARNING: RESIDUAL FUEL DRAINING FROM THE LINES IS A FIRE HAZARD. CARE SHOULD BE EXERCISED IN DISPOSAL OF SUCH FUEL WHEN LINES ARE DISCONNECTED TO PREVENT ITS ACCUMULATION IN THE WING.

NOTE: During removal/installation of fuel system components, all openings or fittings shall be capped or plugged.

1. Removal/Installation Wing Locker Fuel Tank (See Figure 1)

NOTE: Procedures are typical for either left or right wing locker.

A. Remove Wing Locker Fuel Tank

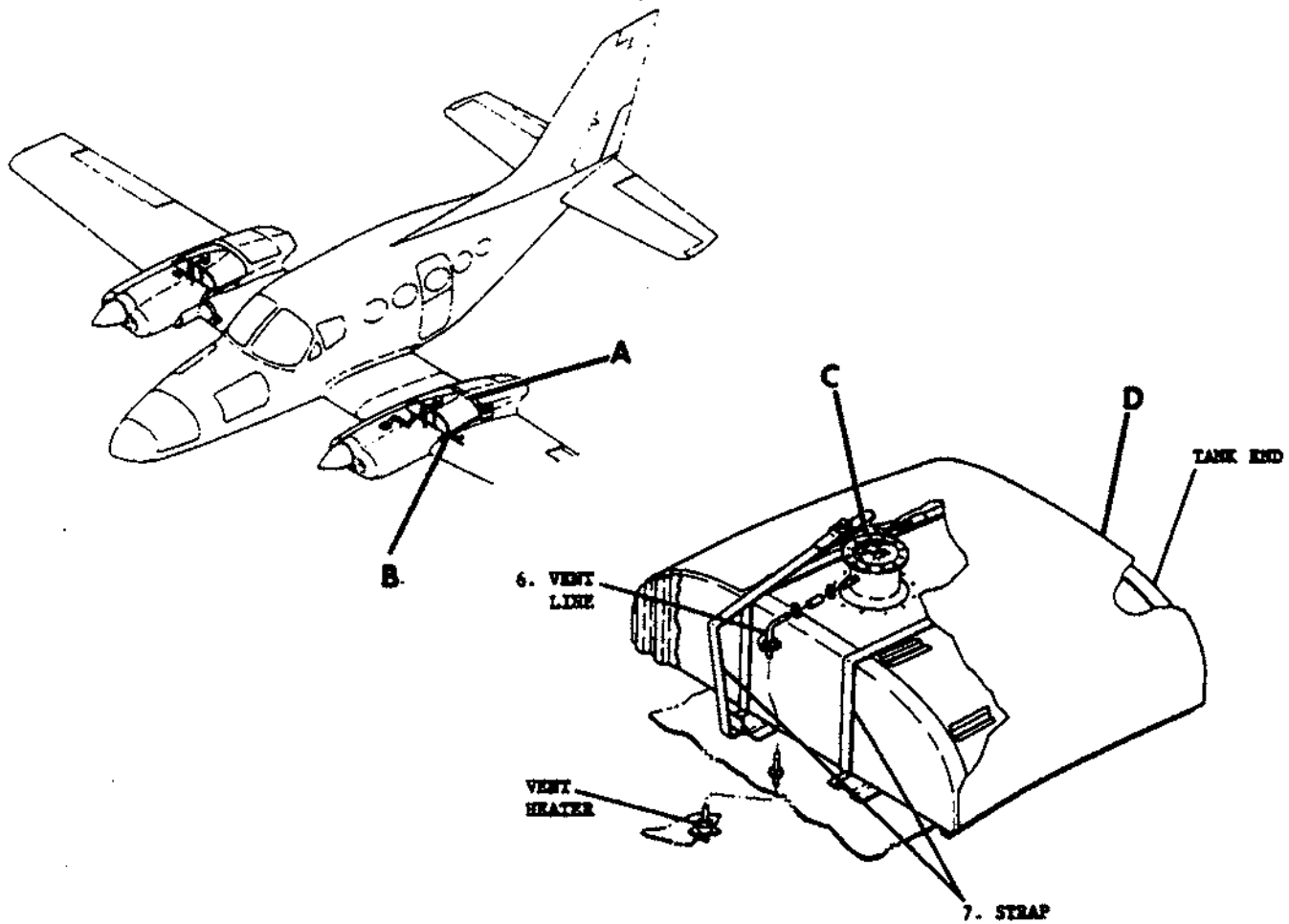
- (1) Defuel wing locker fuel tank, refer to Chapter 2.

NOTE: If the main tank fuel quantity is low, the wing locker fuel can be transferred, by the wing locker transfer pump to the main tank.

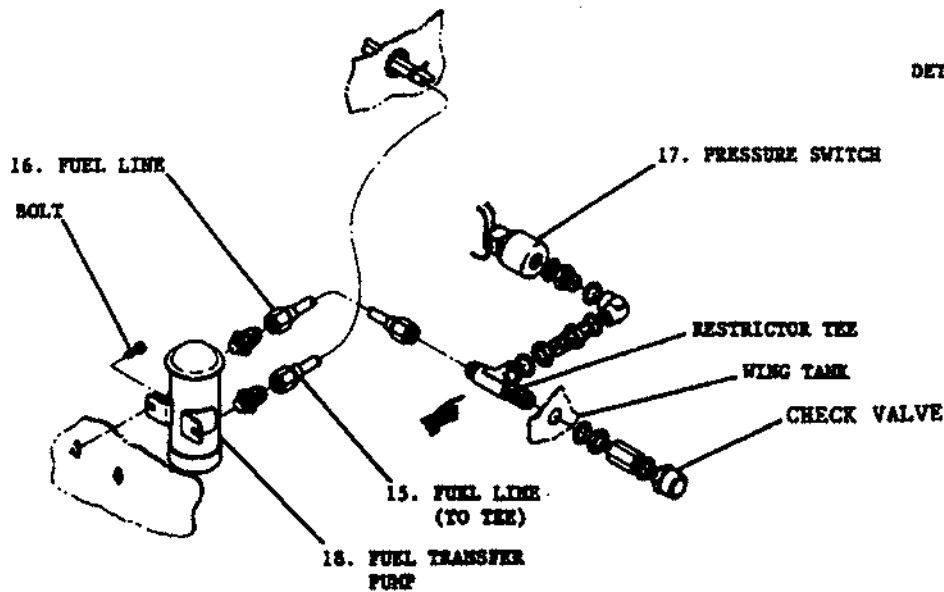
- (2) Turn all electrical power OFF.
- (3) Refer to Chapter 1. Remove wing locker and necessary wing access panels required to gain access to plumbing and wing locker fuel tank.

NOTE: To remove wing locker fuel tank access panel, it is necessary to remove the ten screws in the flange around the filler cap. Refer to Chapter 1.

- (4) Disconnect vent line (6), straps (7), loosen clamp (8), remove grommet (9) from tank, and lift the wing locker tank from the nacelle.
- (5) Remove tank end and screws (1) from adapter (2).
- (6) Release fuel cell fasteners holding fuel cell (3) to top of tank and slide fuel cell out the end of tank.



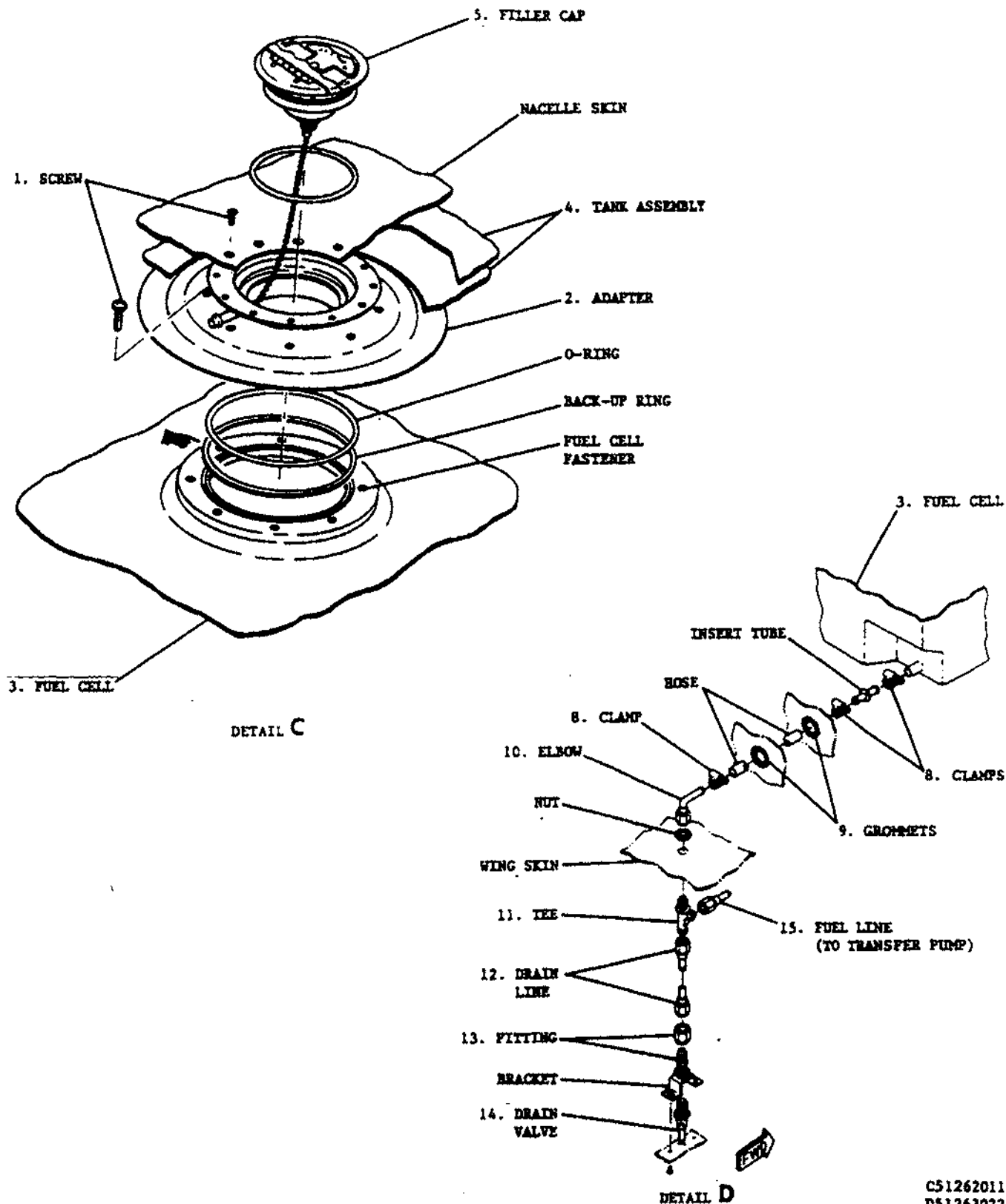
DETAIL A



DETAIL B

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Wing Locker Fuel System
Figure 1 (Sheet 1 of 2)



Wing Locker Fuel System
Figure 1 (Sheet 2)

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B. Install Wing Locker Fuel Tank

- (1) Position fuel cell inside tank and install fasteners holding fuel cell (3) to top of tank.
- (2) Install back-up ring and o-ring in place on fuel cell and secure to adapter (2) with screws (1).
- (3) Install both tank ends, position tank in nacelle and secure with straps (7).
- (4) Connect vent line (6), install grommets (9) and insert tube into fuel cell (3), being careful not to overtighten clamps.
- (5) Install access covers and service wing locker fuel tank (refer to Chapter 2).
- (6) Perform operational check and assure no leakage in system.

2. Removal/Installation Fuel Transfer Pump (See Figure 1)

NOTE: Procedures are typical for either left or right wing locker.

A. Remove Fuel Transfer Pump

- (1) Defuel wing locker fuel tank. Refer to Chapter 2.
- (2) Turn all electrical power OFF.
- (3) Refer to Chapter 1. Remove necessary access panels to gain access to transfer pump.
- (4) Tag and disconnect electrical wires from transfer pump.
- (5) Disconnect lines at fuel transfer pump.
- (6) Remove bolts securing transfer pump to spar and remove transfer pump from wing.
- (7) If the fuel transfer pump is being replaced with a new pump, remove fittings.

B. Install Fuel Transfer Pump.

- (1) If removed, install fittings in fuel transfer pump.

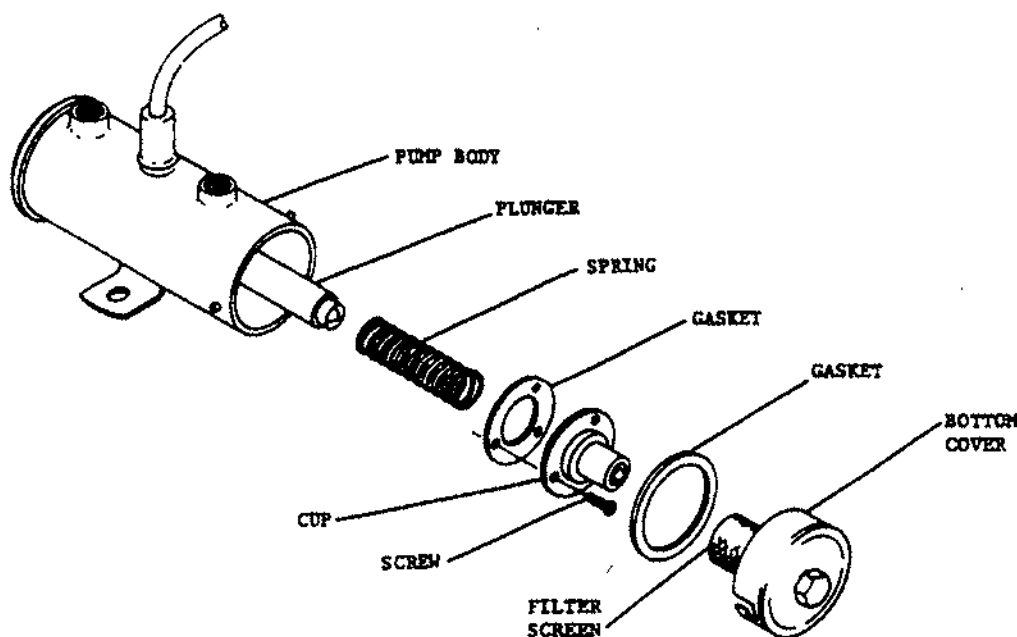
NOTE: Use only fuel soluble lubricant on fuel fittings.

- (2) Install fuel transfer pump on spar with bolts.
- (3) Remove caps or plugs and connect fuel lines to fuel transfer pump.
- (4) Connect electrical wires and remove tags.
- (5) Service wing locker fuel tank in accordance with Chapter 2.
- (6) Perform operational check and assure no leakage in system.
- (7) Install access covers.

3. Disassembly/Assembly Fuel Transfer Pump (See Figure 2).**A. Disassemble Fuel Transfer Pump.**

NOTE: The interrupter end of the main tank fuel transfer pump is sealed (air has been removed and an atmosphere of a special dry gas injected). Should any of the electrical components become inoperative, the fuel pump must be replaced. A gas seal is located in the center of the mounting bracket and no attempt should be made to break this seal, as it would render the pump useless.

- (1) Hold the pump body securely in one hand and release the bottom cover from the bayonet fittings by rotating it counterclockwise with a 5/8-inch wrench.
- (2) Remove the gasket from the cover.
- (3) Carefully remove the filter screen.
- (4) Remove the screws that hold the plunger spring cup to the pump body.
- (5) Remove the gasket and plunger spring.
- (6) Carefully withdraw the plunger from the pump body. Do not drop or mutilate the plunger.
- (7) Clean and inspect the transfer pump as follows:
 - (a) Wash the plunger assembly in Stoddard solvent or gasoline. If it fails to become thoroughly clean or if any rough spots are present, dress the surface carefully with crocus cloth. Rinse thoroughly to remove all foreign material.
 - (b) Dip the pump body in clean solvent, shake it lightly, then remove it and dry with compressed air.
 - (c) Blow out the plunger tube with compressed air and check for any rough spots, deposits or foreign material. If not smooth, wrap a piece of cloth around a wooden dowel, dip cloth in Stoddard solvent (Federal Specification P-D-880), and swab the plunger tube until clean.



Fuel Transfer Pump Assembly
Figure 2

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- (d) Rinse remaining parts in the solvent and dry with compressed air. Exercise care when drying the screen to prevent damage.
- (e) Inspect all parts visually for damage.
- (f) Inspect the fuel pump electrical resistance by connecting an ohmmeter between the connector terminal and ground on the pump housing. Resistance should be between 19.0 and 19.5 ohms. If the resistance is not within limits, replace the pump assembly.

B. Assemble Fuel Transfer Pump.

- (1) Insert the plunger assembly in the tube with buffer-spring end first. Check for proper fit by slowly raising and lowering the plunger in the tube; it should move freely without any tendency of sticking. A click should be heard each time the plunger approaches the top of the tube. If this click cannot be heard, the interrupter assembly in the sealed portion of the pump is not functioning properly, and the pump assembly must be replaced.
- (2) Install the plunger spring.
- (3) Place the spring cup gasket in position on the plunger spring cup and carefully attach this assembly to the pump body with the screws. Tighten screws securely.
- (4) Carefully install the screen, place cover gasket in position in cover and attach the cover to the pump body.
- (5) Hold the pump body securely with one hand and tighten the cover in place on the pump body bayonets with a 5/8-inch, open-end wrench or box socket.

4. Fuel Cell Repair

A. Repair Fuel Cell.

- (1) The fuel cells installed in the wings are a bladder-type constructed of Vithane, manufactured by Goodyear Tire and Rubber Company. Refer to Goodyear Repair and Maintenance Manual AP368 for Vithane Fuel Cell Repair. Manual is included in repair kit Part No. 2F1-3-37813.

CAUTION: REPAIR OF THE VITHANE FUEL CELLS IS RESTRICTED TO AUTHORIZED PERSONNEL, AND/OR THOSE CERTIFIED OR APPROVED BY FACTORY TRAINED SCHOOLS.

The repair procedures are approved repair practices of Vithane fuel cells. These procedures apply only to Vithane fuel cells and deviations from these procedures should not be permitted.

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FUEL INDICATING SYSTEM

Description

1. The main fuel system has a capacitance type fuel quantity indicating system, that is compensated for specific gravity and reads in both pounds and gallons.
2. The system consists of a dual indicator, three internally mounted main fuel tank units and a signal conditioner mounted in each wing and the necessary wiring harness connecting the system electrically.
3. Each main fuel tank unit consists of a main body of insulating material with two conducting surfaces, separately insulated around the outboard surface of the main fuel tank unit. One conducting surface is grounded to a single point ground in the indicator and the other surface is connected to the signal conditioner input bridge. The outer electrode is an aluminum tube, coated with insulating material on the outside. Openings in the sensor unit allows fuel to flow between the electrodes to the same level as the fuel in the tank. Fuel between the electrodes is the variable dielectric factor of the capacitor. Capacitance of the main fuel tank sensor units, which are part of the system bridge circuit provide a continuous signal to the signal conditioner and is amplified to the fuel quantity indicator.

Troubleshooting

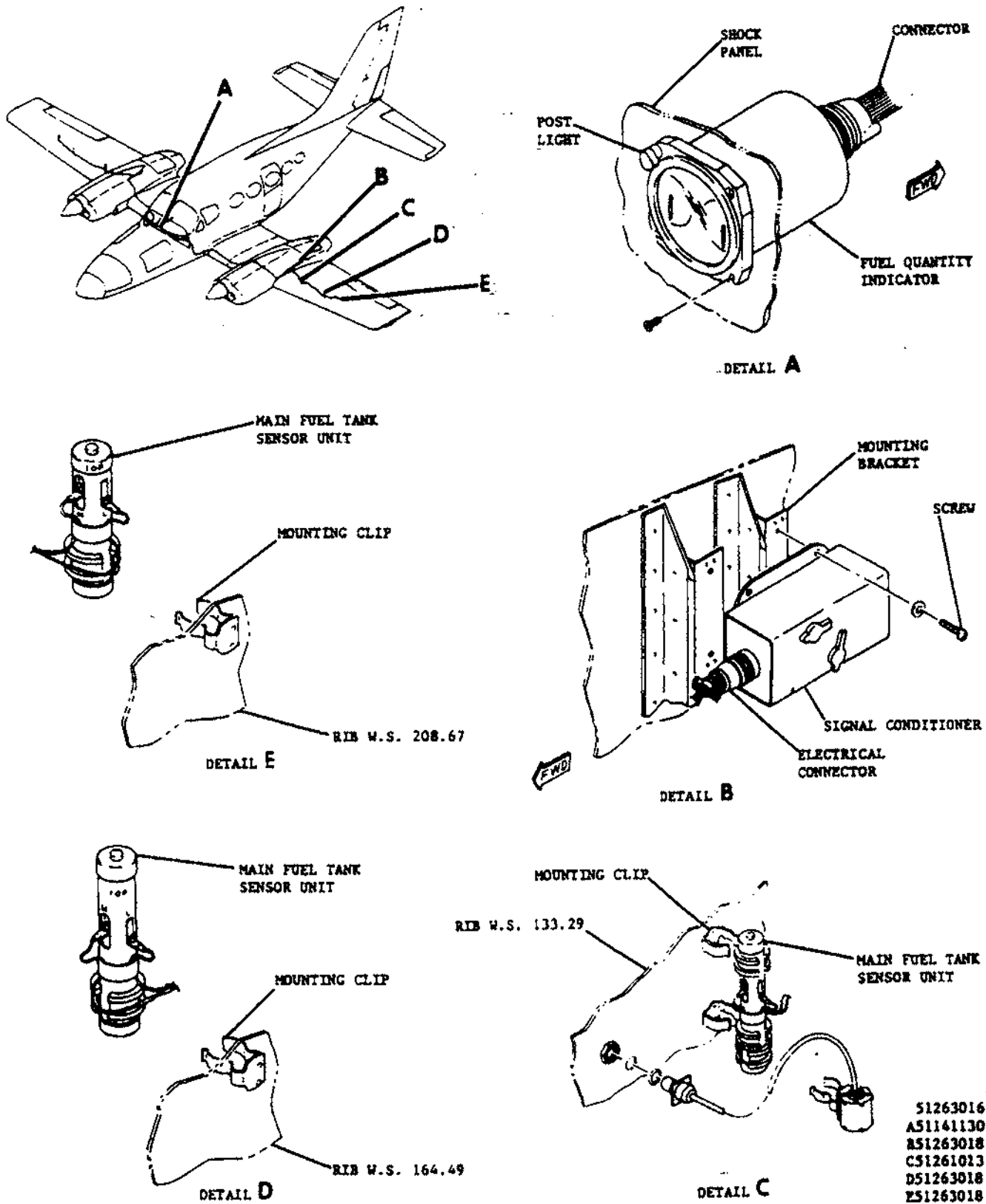
NOTE: For troubleshooting the fuel indicating system, refer to Fuel System Troubleshooting.

Adjustment/Test

1. Fuel Flow Indicating System.
 - A. Connect test box to fuel flow totalizer/indicator; right fuel flow transducer and left fuel flow transducer in accordance with Figure 2.
 - B. Connect auxiliary power unit to airplane.
 - C. Apply power to fuel flow system.
 - D. Turn test box left and right power switches ON.
 - E. Turn memory switch ON.
 - G. Connect digital volt meter (DVM) to the voltage monitor select switch on the test box. Verify the following reading.

PIN	READING	NOMENCLATURE
F	12 volts +1.0, -1.0	Left Transducer Input
H	0.5 to 12.0 volts	Left Transducer Output
N	12 volts +1.0, -1.0	Left Transducer Temperature Compensator Input Voltage
R	2.93 volts +1.0, -1.0	Left Temperature Compensator Voltage at 20°C
M	12 volts +1.0, -1.0	Right Transducer Temperature Compensator Input Voltage
J	2.93 volts +1.0, -1.0	Right Temperature Compensator Voltage at 20°C
E	12 volts +1.0, -1.0	Right Transducer Input
G	0.5 to 12.0 volts	Right Transducer Output

- H. Turn voltage monitor select switch OFF.



Main Fuel Indicating System Installation
Figure 1

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- I. The following procedures are typical for left and right sides.
 - (1) Rotate left and right frequency adjust control to the full counterclockwise position.
 - (2) Place applicable (left or right) simulator switch ON.
 - (3) Rotate applicable (left or right) frequency adjust control clockwise while tapping finger on the indicator. Indicator should advance smoothly.
 - (4) Set applicable (left or right) frequency adjust knob to 80 pounds per hour (PPH).
 - (5) Place applicable (left or right) temperature compensation simulator rotary switch from -10°C thru +60°C and observe change in indicator PPH reading, refer to Table 1.

Table 1

SWITCH SETTING at 80 PPH °C	INDICATOR READING CHANGE ± PPH	TOLERANCE ± PPH	TEMPERATURE SIMULATOR OUTPUT VDC ± 0.10
+60	-4	1	3.33
+20	0	1	2.93
- 5	+2.5	1	2.68
-40	+6	1	2.33

- (7) Turn temperature compensation simulator rotary switch OFF.
- (8) If any discrepancies are encountered, the indicator is faulty, replace indicator.
- (9) Turn electrical power OFF and disconnect test box.
- (10) Connect test box to engine transducer wiring, using fuel flow transducer test harness. The test harness is color coded to match airplane wiring, refer to Chapter 13, wiring diagram.
- (11) Repeat steps (2) thru (7), if any discrepancies are encountered, the airplane wiring is faulty. Refer to Chapter 13, wiring diagram.

Maintenance Practices

WARNING: DURING FUEL SYSTEM MAINTENANCE PRACTICES, TWO GROUND WIRES ATTACHED FROM DIFFERENT POINTS ON THE AIRCRAFT TO SEPARATE APPROVED GROUNDING STAKES SHALL BE USED TO PREVENT UNGROUNDING OF THE AIRCRAFT, DUE TO ACCIDENTAL DISCONNECTION OF ONE GROUND WIRE.

1. Removal/Installation Main Fuel Tank Sensor Units (Refer to Figure 1)

NOTE: Removal/installation of the main fuel tank sensor units.

A. Remove Main Fuel Tank Sensor Units.

- (1) Turn electrical power OFF.
- (2) Position fuel selector control handles to OFF.
- (3) Defuel applicable main fuel tank. Refer to Chapter 2.
- (4) Remove necessary access panels in the bottom of wing.
- (5) Remove safety wire and pull the main fuel tank sensor unit from the mounting clips.
- (6) Tag and disconnect electrical wires from main fuel tank sensor units and remove from tank.

B. Install Main Fuel Tank Sensor Units.

- (1) Place main fuel tank sensor units in place, connect electrical wires and remove tags.
- (2) Insert main fuel tank sensor unit in clips and install safety wire.
- (3) Assure area is clean, refer to Chapter 1 Sealing Procedures, seal access panels and install.
- (4) Check fuel calibration. Refer to Fuel System Adjustment/Test.
- (5) Service main tank. Refer to Chapter 2.
- (6) Check for leaks.

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2. Removal/Installation Fuel Signal Conditioner (Refer to Figure 1)

NOTE: Removal/installation for the signal is the same for either main tank.

A. Remove signal conditioner.

- (1) Turn all electrical power OFF.
- (2) Remove necessary access panel. Refer to Chapter 1.
- (3) Disconnect electrical connector from signal conditioner.
- (4) Remove four screws securing signal conditioner to mounting and remove signal conditioner from wing.

B. Install Signal Conditioner.

- (1) Position signal conditioner in place on mount and secure with four screws.
- (2) Connect electrical connector.
- (3) Check fuel calibration. Refer to Fuel System Adjustment/Test.
- (4) Install access panel.

3. Removal/Installation Fuel Quantity Indicator (Refer to Figure 1)

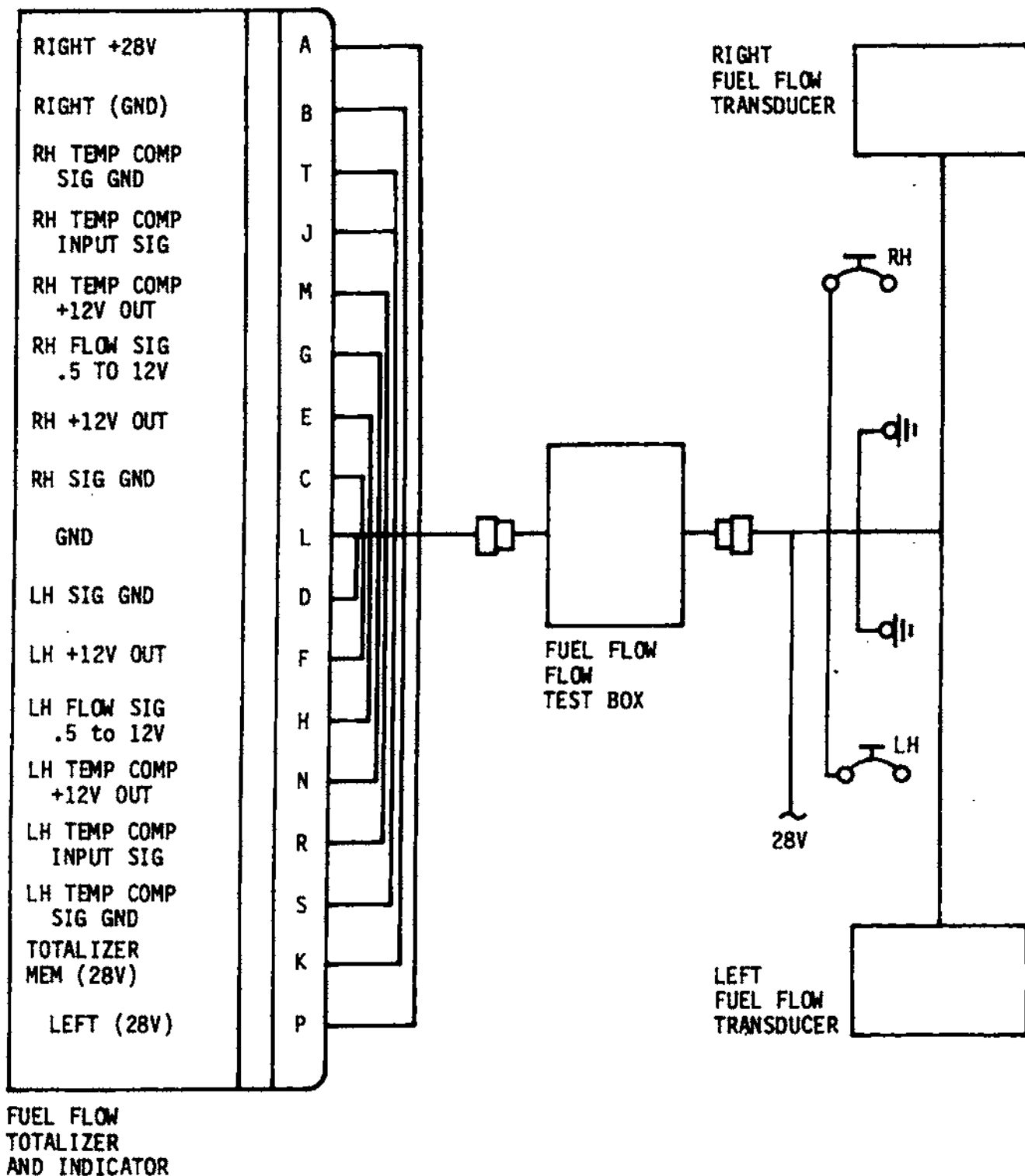
A. Remove Fuel Quantity Indicator.

- (1) Turn all electrical power OFF.
- (2) Disconnect electrical connector from indicator and post light.
- (3) Remove post light and screws securing fuel indicator to shock panel. Remove indicator.

B. Install Fuel Quantity Indicator.

- (1) Position fuel indicator in shock panel, secure with post light and screws.
- (2) Connect electrical connector to post light and indicator.
- (3) Check calibration of fuel system. Refer to Fuel System Adjustment/Test.

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Fuel Flow Test Box Hook-Up
Figure 2

51706003

FUEL LOW LEVEL WARNING SYSTEMDescription

1. The optional fuel low level warning system is connected to the main fuel tank unit. The system consists of a warning light in the annunciator panel, a magnetic reed type switch mounted on the inboard main fuel tank unit and the associated wiring harness. The light will illuminate when the remaining fuel in the main tank is sixty pounds or below.

Troubleshooting

NOTE: For troubleshooting the fuel low level warning system, refer to Fuel Indicating System Troubleshooting.

Maintenance Practices

WARNING: DURING FUEL SYSTEM MAINTENANCE PRACTICES, TWO GROUND WIRES ATTACHED FROM DIFFERENT POINTS ON THE AIRCRAFT TO SEPARATE APPROVED GROUNDING STAKES SHALL BE USED TO PREVENT UNGROUNDING OF THE AIRCRAFT, DUE TO ACCIDENTAL DISCONNECTION OF ONE GROUND WIRE.

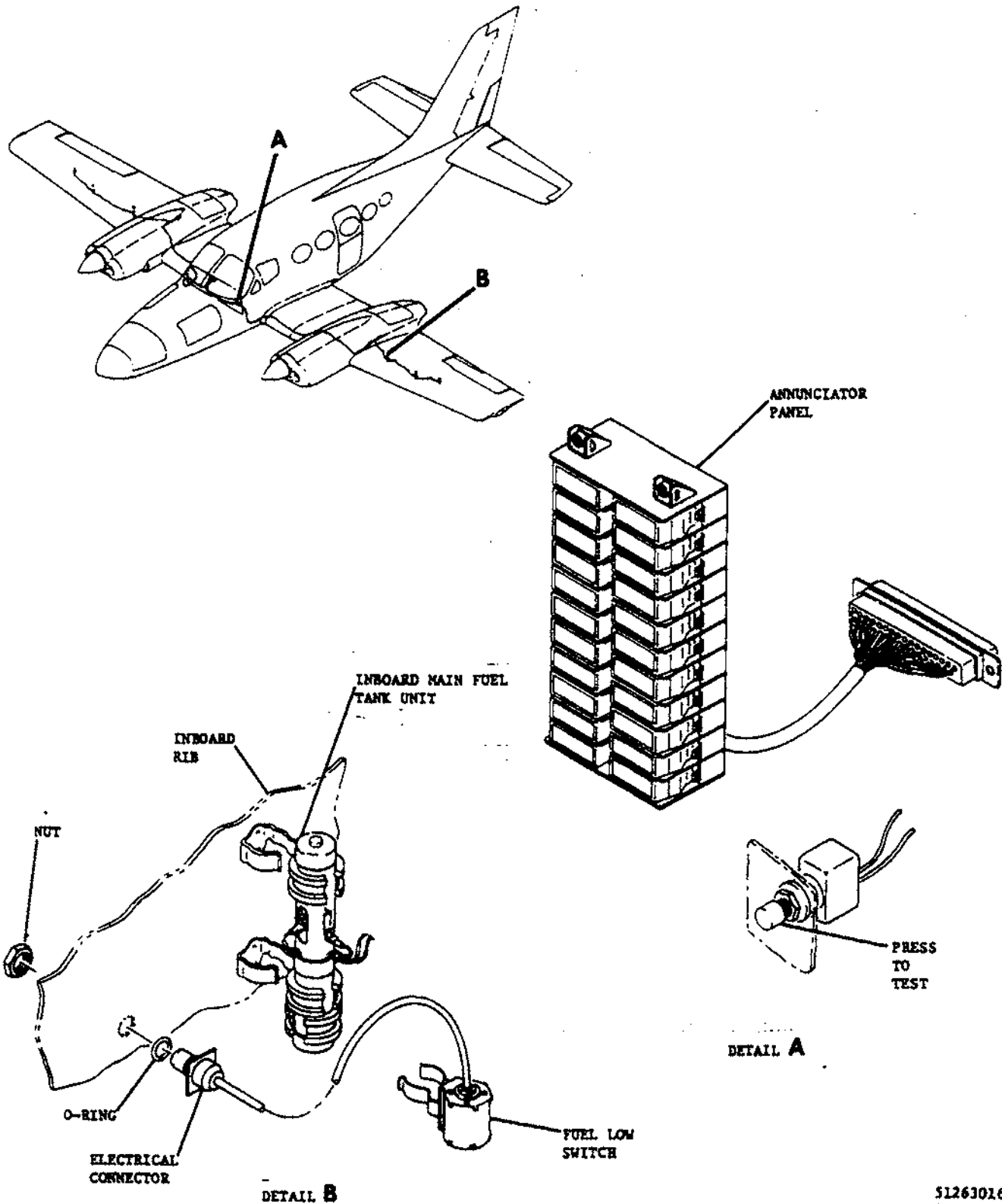
- I. Removal/Installation of Fuel Low Level Warning System (See Figure 1)

- A. Remove Fuel Low Switch.

- (1) Turn electrical power OFF.
 - (2) Position fuel selector control handles to OFF.
 - (3) Defuel applicable main fuel tank (refer to Chapter 2).
 - (4) Remove necessary access panels in the bottom of wing.
 - (5) Remove safety wire from clip, mounting the fuel low switch, and remove switch from mount.
 - (6) Disconnect electrical connector at inboard rib.
 - (7) Remove nut from electrical connector at inboard rib and remove switch and cable from wing.
 - (8) Discard o-ring and replace with new o-ring.

- B. Install Fuel Low Switch.

- (1) Install new o-ring on electrical connector, position electrical connector in place, inside main fuel tank at the inboard rib and secure with nut.
 - (2) Connect electrical connector.
 - (3) Install fuel low switch in position and safety wire clips.
 - (4) Assure area is clean. Refer to Chapter 1, sealing procedures, seal access panels and install.
 - (5) Turn electrical power ON. Assure annunciator panel low fuel light is ON. Turn electrical power OFF.
 - (6) Service main tank. Refer to Chapter 2.
 - (7) Turn electrical power ON. Assure annunciator panel low fuel light is OFF.
 - (8) Check for leaks.



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Fuel Low Level Warning System
Figure 1

CABIN HEATER FUEL SYSTEMDescription

1. On airplanes 421C0001 thru 421C0200, the cabin heater fuel system consists of a solenoid shutoff valve, fuel filter assembly and necessary plumbing for connection to the airplane's fuel system. The solenoid valve and filter assembly are mounted in the fuselage stub wing leading edge just outboard of the heat exchanger. On airplanes 421C0201 and On, the cabin heater fuel pump is mounted adjacent to the solenoid shutoff valve.

Troubleshooting

NOTE: For troubleshooting the cabin heater fuel system, refer to Fuel System Troubleshooting.

Maintenance Practices

WARNING: DURING FUEL SYSTEM MAINTENANCE PRACTICES, TWO GROUND WIRES ATTACHED FROM DIFFERENT POINTS ON THE AIRPLANE TO SEPARATE APPROVED GROUNDING STAKES SHALL BE USED TO PREVENT UNGROUNDING OF THE AIRPLANE, DUE TO ACCIDENTAL DISCONNECTION OF ONE GROUND WIRE.

WARNING: RESIDUAL FUEL DRAINING FROM THE LINES IS A FIRE HAZARD. CARE SHOULD BE EXERCISED IN DISPOSAL OF SUCH FUEL WHEN LINES ARE DISCONNECTED TO PREVENT ITS ACCUMULATION IN WING AND FUSELAGE.

NOTE: On installation, ensure drain and vent lines are installed to provide a positive drain.

NOTE: During removal/installation of heater fuel system components, all openings or fittings shall be capped or plugged.

1. Removal/Installation Solenoid Shutoff Valve (See Figure 1)

- A. Remove Solenoid Valve.

- (1) Turn all electrical power OFF.
 - (2) Position fuel selector control handles to OFF.
 - (3) Remove necessary access panels from bottom of stub wing leading edge.
 - (4) Tag and disconnect electrical wires.
 - (5) Disconnect fuel lines to solenoid valve.
 - (6) Remove solenoid by removing nuts, washers, clamp and screws.
 - (7) If a new solenoid valve is being installed, remove fittings from solenoid valve.

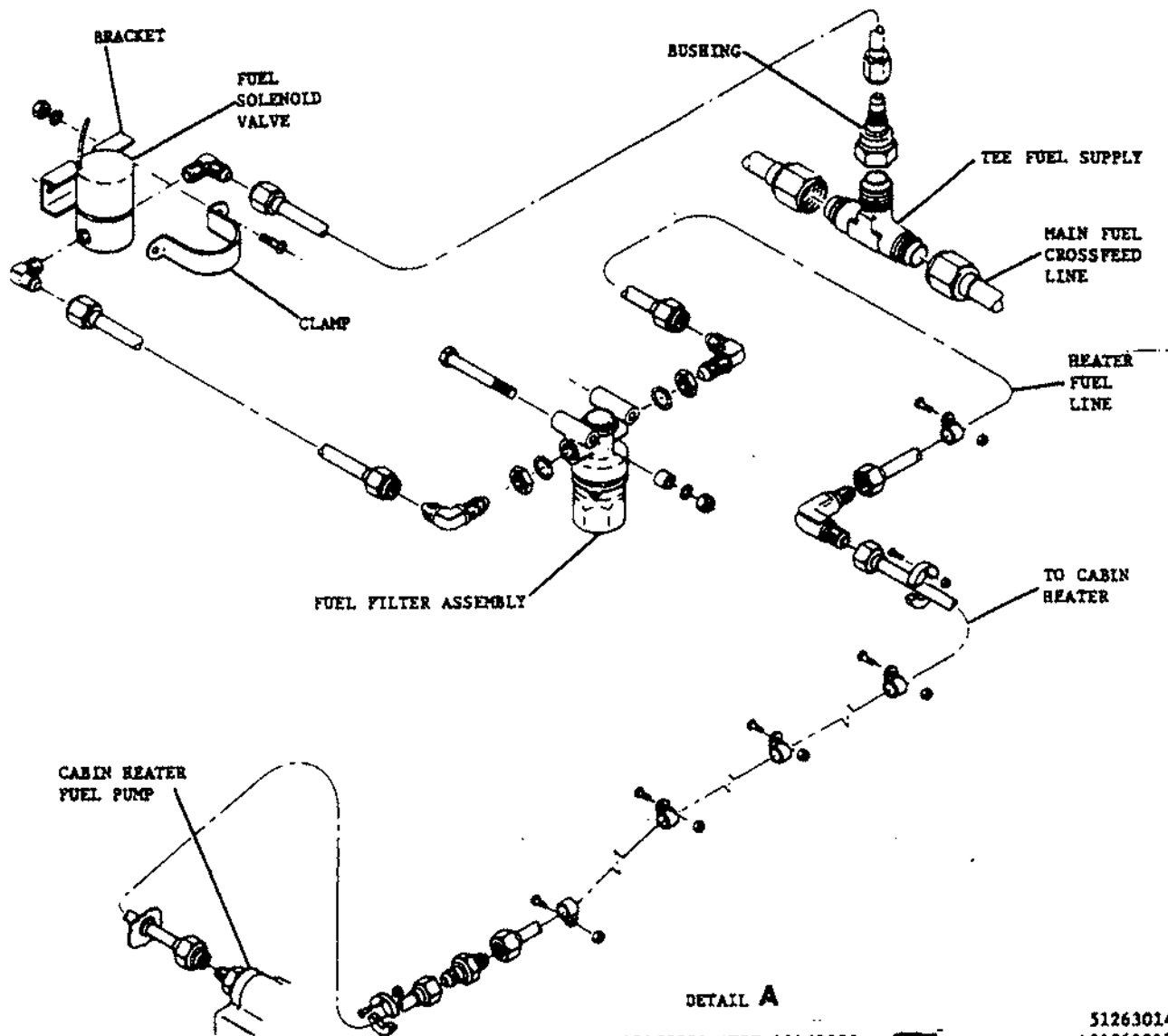
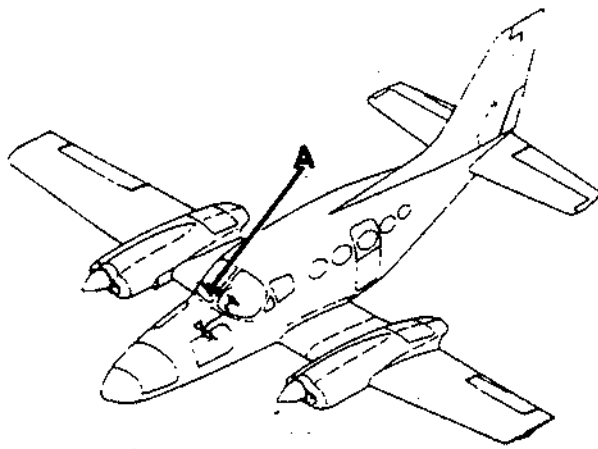
- B. Install Solenoid Valve.

- (1) If removed, install fittings and clock in proper direction.
 - (2) Attach solenoid valve to rib with clamp using screws, washers and nuts.
 - (3) Remove caps or plugs and connect fuel lines.
 - (4) Connect electrical wires and remove tags.
 - (5) Operate heater and assure no evidence of leakage.
 - (6) Install access panels on bottom of stub wing.

2. Removal/Installation Heater Fuel Filter Assembly (See Figure 1)

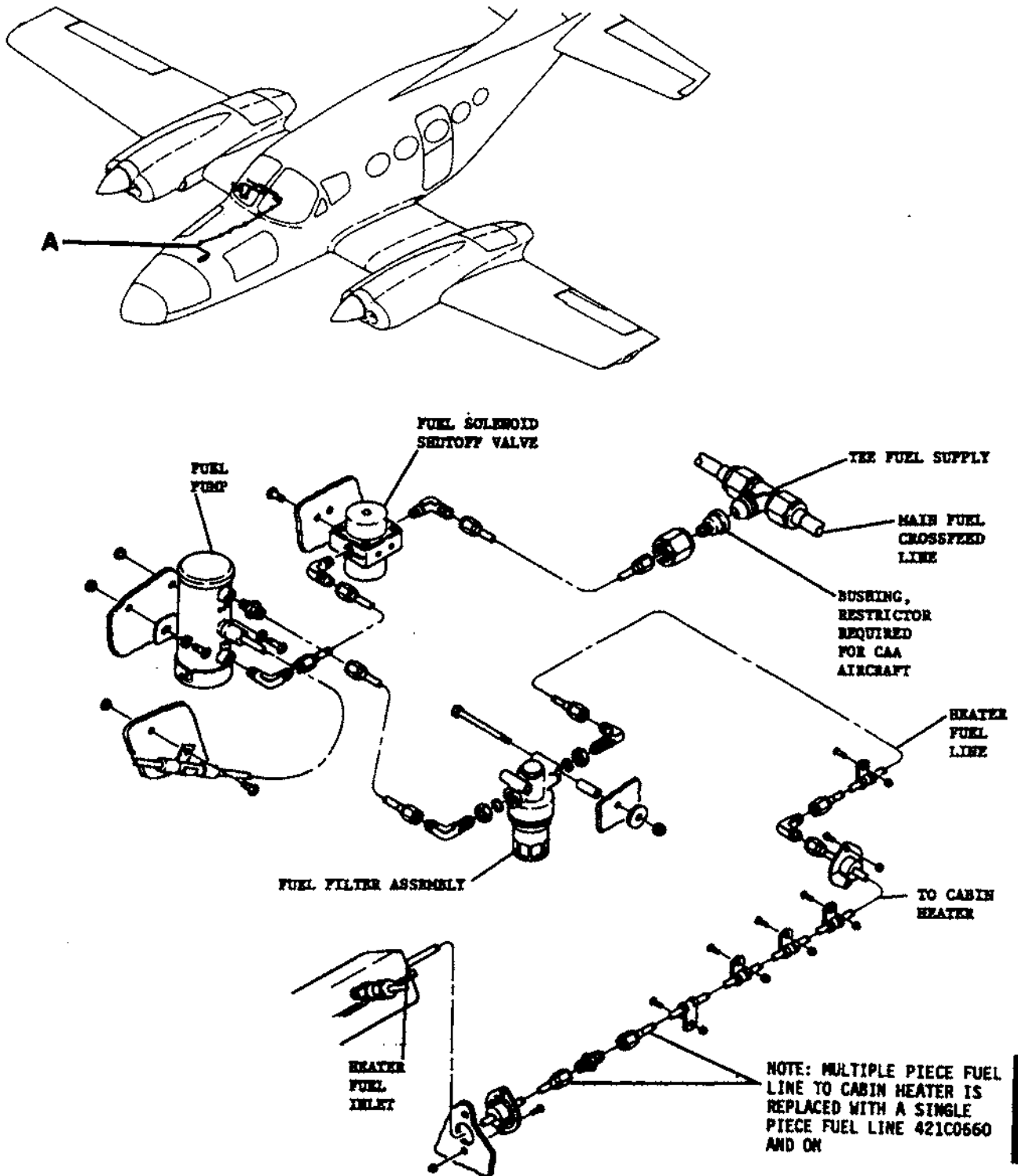
- A. Remove Heater Fuel Filter Assembly.

- (1) Turn all electrical power OFF.
 - (2) Remove necessary access panels from bottom of stub wing leading edge.
 - (3) Disconnect fuel lines from Heater Fuel Filter Assembly.
 - (4) Remove heater fuel filter assembly by removing nut, washers, spacers and bolt.
 - (5) For disassembly of heater fuel filter assembly, refer to Cessna Heater and Components Overhaul/Parts Manual.



421C0001 THRU 421C0200

51263014
A51263017Cabin Heater Fuel System
Figure 1 (Sheet 1 of 2)



DETAIL A

421C0201 AND ON

Cabin Heater Fuel System
Figure 1 (Sheet 2)51163008
A51163007

B. Install Heater Fuel Filter Assembly.

- (1) If removed, install fittings and clock in proper direction.
- (2) Attach heater fuel filter assembly to rib, using bolts, spacers, washers and nuts.
- (3) Remove caps or plugs and connect fuel lines.
- (4) Operate heater and assure no evidence of leakage.
- (5) Install access panels on bottom of stub wing.

3. Removal/Installation Heater Fuel Pump (421C0201 and On) (See Figure 1).

A. Remove Heater Fuel Pump.

- (1) Turn all electrical power OFF.
- (2) Remove necessary access panels from bottom of stub wing leading edge.
- (3) Disconnect fuel lines from the heater fuel pump.
- (4) Remove heater fuel pump by removing nuts, washers and screws.
- (5) For disassembly and inspection of the fuel pump, refer to Disassembly/Assembly Fuel Transfer Pump.

B. Install Heater Fuel Pump.

- (1) If removed, install fittings and clock in proper direction.
- (2) Secure heater fuel pump to rib with screws, washers and nuts.
- (3) Remove caps or plugs and connect fuel lines.
- (4) Operate heater and assure no evidence of leakage.
- (5) Install access panels on bottom of wing.

FUEL SYSTEM DRAIN VALVEDescription

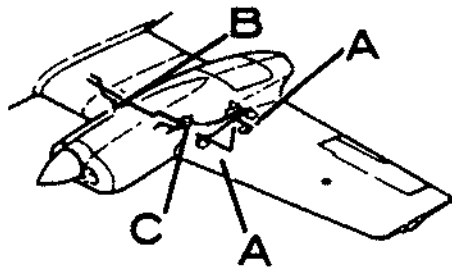
1. The airplane has five fuel drain valves installed in each wing. Three of the drain valves drain fuel from the wing fuel bays, one drains the fuel filter and the other one drains the fuel crossover lines.

Maintenance Practices

1. Removal/Installation Drain Valves (See Figure 1).

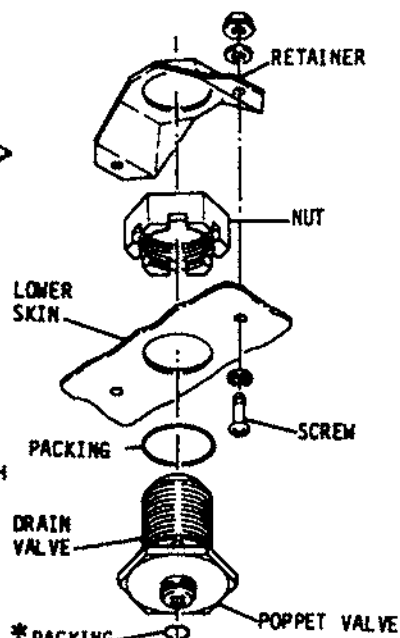
- A. Remove Drain Valves.

- (1) Close fuel selector valve.
- (2) Defuel wing if fuel bay drain valves are to be removed.
- (3) Drain fuel from fuel filter and fuel crossover lines when drain valves are being removed.
- (4) Removal/Installation of a drain valve in the fuel bays may be done with out removal of the retainer and nut, by just unscrewing the drain valve.
- (5) Removal/Installation of the fuel filter drain valve and fuel crossover line drain valve may be accomplished in accordance with Figure 1.
- (6) When installing fuel filter drain valves or fuel crossover line drain valves insure that valves are safety wired.

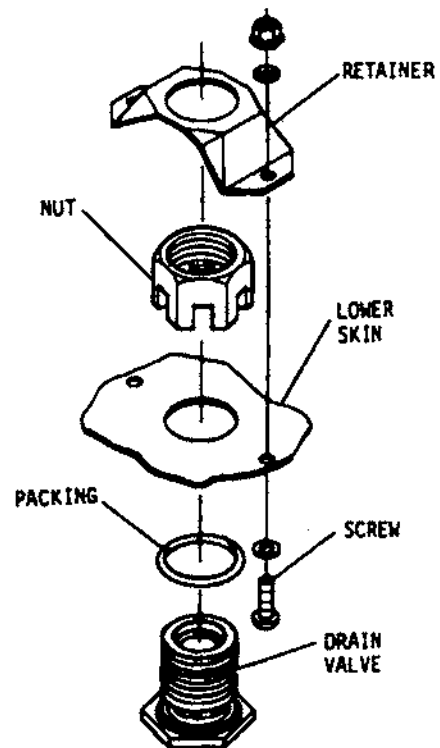


* NOTE

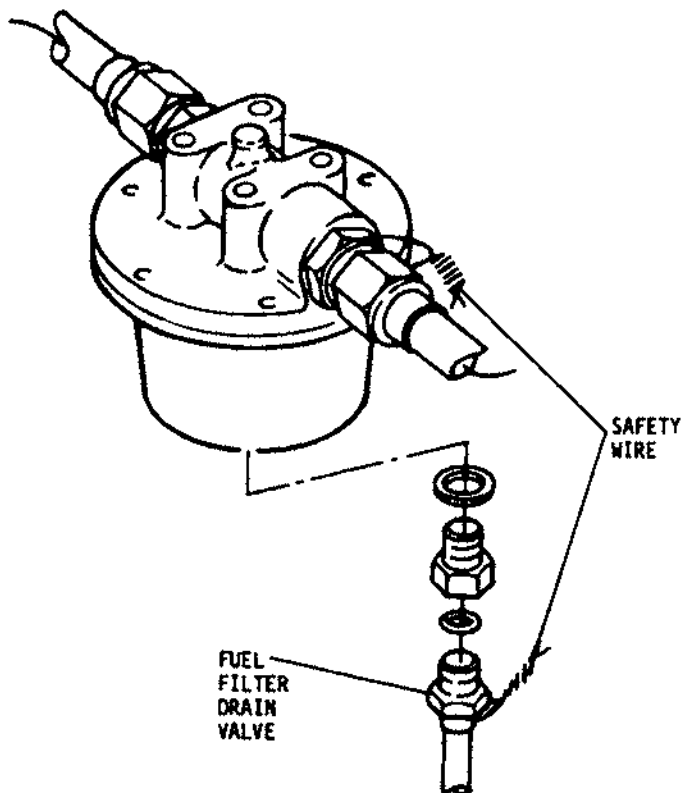
THIS PACKING CAN BE REPLACED ON DRAIN VALVE WITHOUT DRAINING FUEL TANK. TURN POPPET VALVE CLOCKWISE TO GAIN ACCESS TO PACKING. TO LOCK POPPET VALVE BACK INTO POSITION, PUSH UP ON POPPET VALVE AND TURN VALVE COUNTERCLOCKWISE FOR PACKING PART NUMBER, REFER TO PARTS CATALOG.



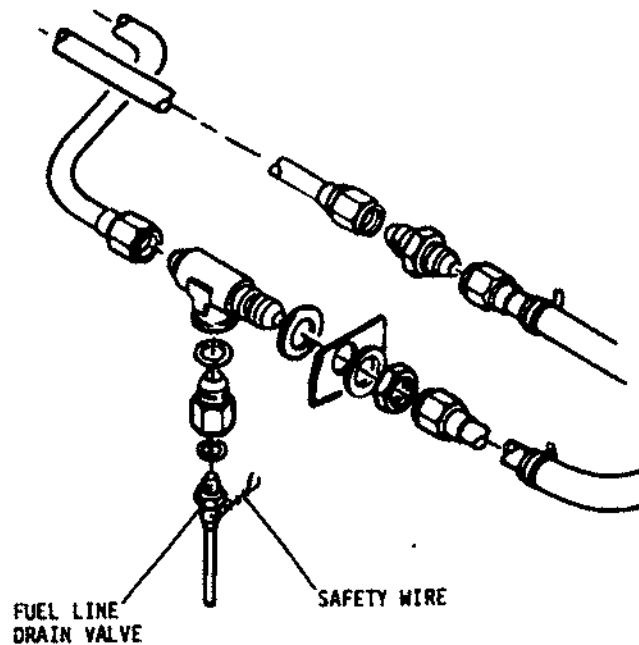
DETAIL A



DETAIL A



DETAIL C



DETAIL B

Drain Valve Installation
Figure 1

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CHAPTER

10

INSTRUMENTS

CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL

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INSTRUMENT PANELDescription

1. The stationary instrument panel is a part of the fuselage structure and is ordinarily considered not removable. The stationary instrument panel houses the pressurization system instruments, engine instruments, fuel quantity indicator, suction gage and oxygen pressure indicators. Two individually removable flight instrument panels and one avionics panel are mounted to the stationary instrument panel. Standard flight instruments are mounted in the left panel and optional flight instruments are mounted in the right panel. The center panel contains the avionics equipment and controls in addition to the engine fire extinguisher panel. All individual instruments are mounted in a similar manner therefore; a typical removal and installation procedure is provided in this chapter. The individual system instruments are shown in their applicable chapter.

Maintenance Practices

1. Removal/Installation Flight Instrument Panels (See Figure 1).

- A. Remove Flight Instrument Panel.

- (1) Turn all electrical power OFF.
- (2) Tag and disconnect lines and tubing to instruments.

NOTE: Most hose fittings are more accessible if disconnected from forward bulkhead.

- (3) Remove screws and spacers and pull flight instrument panel back far enough to disconnect electrical leads.
- (4) Tag and disconnect all electrical wires.
- (5) Plug all hoses and cap all fittings to prevent entry of foreign material.
- (6) Remove flight instrument panel from aircraft.

- B. Install Flight Instrument Panel.

- (1) Position flight instrument panel in place, connect electrical leads and remove tags.
- (2) Install flight instrument panel with spacers and screws.
- (3) Remove caps and plugs from lines and hoses, connect to respective fittings and remove tags.
- (4) Perform operational check of individual systems. Refer to applicable chapters.

- C. Remove Glareshield.

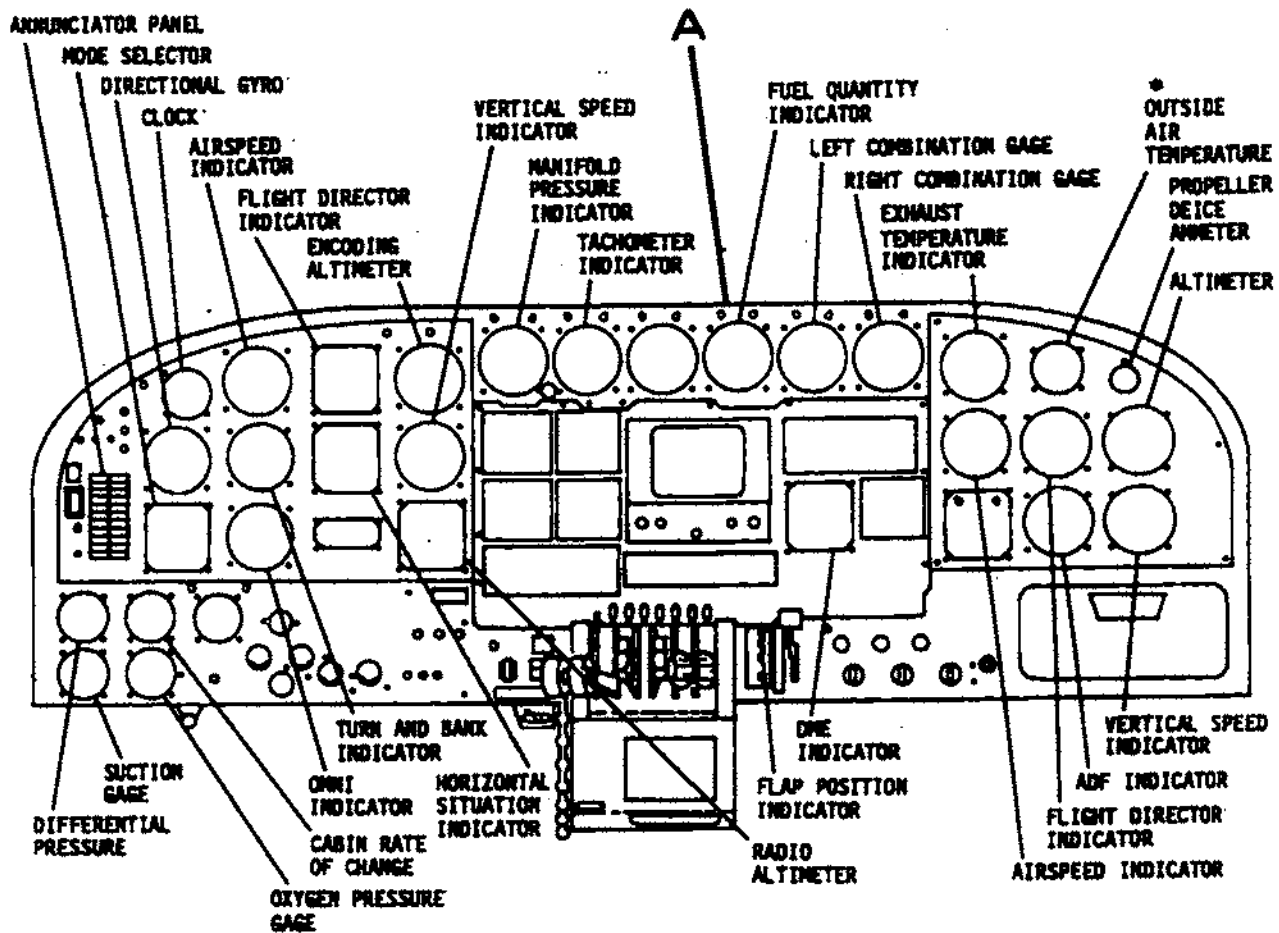
- (1) Remove screws and washers from glareshield (2).
- (2) Slide glareshield aft to release clips (3) at the forward side.

NOTE: If angle of attack system is installed, raise glareshield sufficiently to disconnect electrical connector to angle of attack indicator.

- (3) Remove glareshield from aircraft.

- D. Install Glareshield.

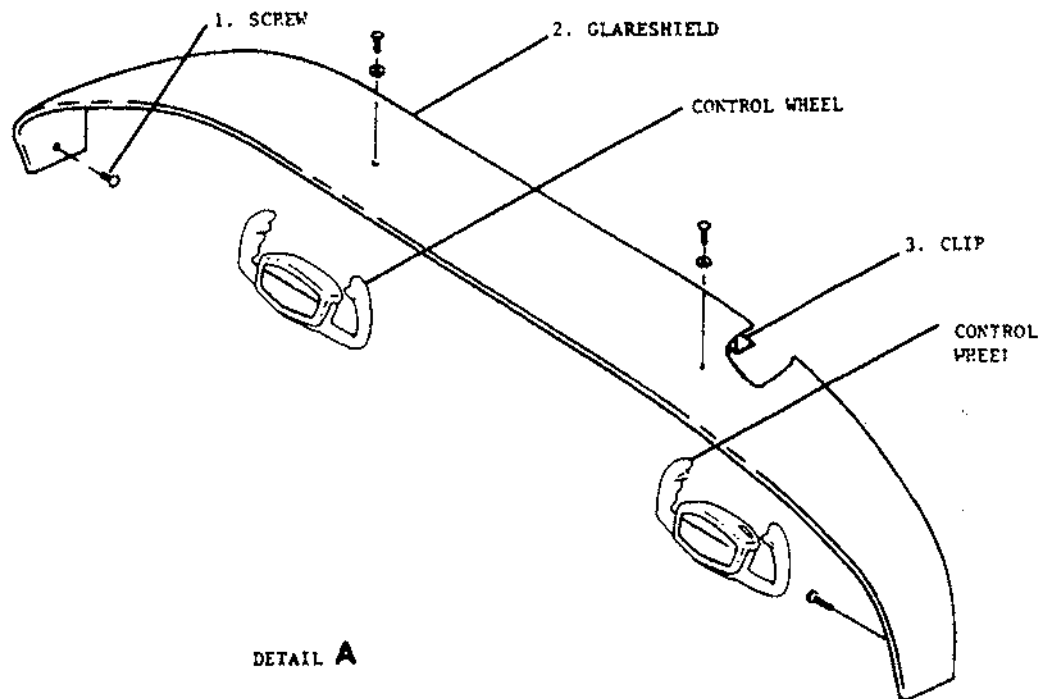
- (1) Position glareshield in place, and connect electrical connector to angle of attack.
- (2) Slide glareshield forward into clips on forward side.
- (3) Install screws and washers to secure glareshield.



* OUTSIDE AIR TEMPERATURE GAGE LOCATED ON LEFTHAND SIDE OF INSTRUMENT PANEL EFFECTIVITY 421C0601 AND ON.

Instrument Panel
Figure 1 (Sheet 1)

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Instrument Panel
Figure 1 (Sheet 2)

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A51151004

MISCELLANEOUS INSTRUMENTSDescription

1. The turn-and-bank indicator is a combination instrument, located on the left-hand flight instrument panel and is optional on the right-hand flight instrument panel. The indicator is an electrically-driven gyro mounted in a horizontal gimbal that is attached to a pointer which indicates the rate of turn. The slip indicator consists of a curved, liquid-filled glass tube in which an inclinometer ball, moving with dampened motion, changes positions according to the gravitational and centrifugal forces acting upon the aircraft.
2. The magnetic compass is mounted on the windshield center strip. It consists of a pair of parallel magnetic bars surrounded by a circular calibrated compass card visible through a window in the compass case. The compass case is a metal bowl filled with liquid to dampen dial oscillation. Lighting is integral and controlled by a rheostat on the switch panel. The compass has two adjusting set screws, one for N-S headings and one for E-W headings. These adjusting set screws are located on lower face of compass behind the metal discs.
3. The Outside Air Temperature Gage is calibrated in degrees Fahrenheit and operated electrically from a free air temperature bulb located externally on the bottom of the fuselage.
4. The clock is an eight-day aircraft clock with a sweep second hand. A winding stem is provided in the lower left-hand portion of the case.
5. Davtron digital clock removal/installation is typical. The clock may be located at various locations including different panels. The electrical cable assembly routing will vary according to the clock location. Battery replacement is accomplished by splicing electrical leads.
6. The Flight Hour Recorder (optional) instrument is activated by the landing gear safety switch. When the landing gear strut is extended, the switch is activated allowing the flight hour recorder to operate.
7. The True Airspeed Indicator is optional and composed of three elements: airspeed, altitude and temperature. The altitude and temperature mechanisms are correlated to operate a rotating dial over which the indicated airspeed indicates the true airspeed. The true airspeed indicator senses changes in pressure and temperature. This combination of altitude and temperature change results in a sum total of airspeed corrections to indicate true airspeed.

NOTE: It is possible during maintenance when airplane is on jacks for the flight hour recorder to operate when battery switch is ON. On airplanes 421C0001 thru 421C0200, the flight hour recorder fuse located in the left console should be removed or circuit breaker pulled on airplanes 421C0201 and On to deactivate the flight hour recorder.

Maintenance Practices

1. Removal/Installation Typical Instruments (See Figure 1).

- A. Remove Typical Instruments.

- (1) Turn electrical power OFF.

NOTE: If instrument is not accessible, remove flight instrument panel in accordance with removal procedures.

- (2) Tag and disconnect lines, hoses and electrical leads from rear of instrument being removed.
- (3) Plug all hoses and cap all fittings to prevent entry of foreign material.
- (4) Remove the connectors, nuts, lockwashers, and spacers from lighting fixture.
- (5) Remove lower attaching nuts and screws.

NOTE: If the instrument is to be replaced, remove the hose fittings or attaching hardware and install on replacement unit.

B. Install Typical Instruments.

NOTE: If removed, install fittings and attaching hardware. Lubricate straight threads with VV-P-236 petrolatum; tapered threads with JAN-A-689 anti-seize compound. Apply lubricant to male threads only omitting the first two threads.

- (1) Position instrument on back of instrument panel and secure with screws and nuts.
- (2) Install lighting fixtures, spacers, lockwashers, nuts and connectors.
- (3) Remove plugs and caps, connect lines, hoses and electrical leads on rear of instrument and remove tags.
- (4) Perform operational check of instrument.

2. Removal/Installation Magnetic Compass (See Figure 2).

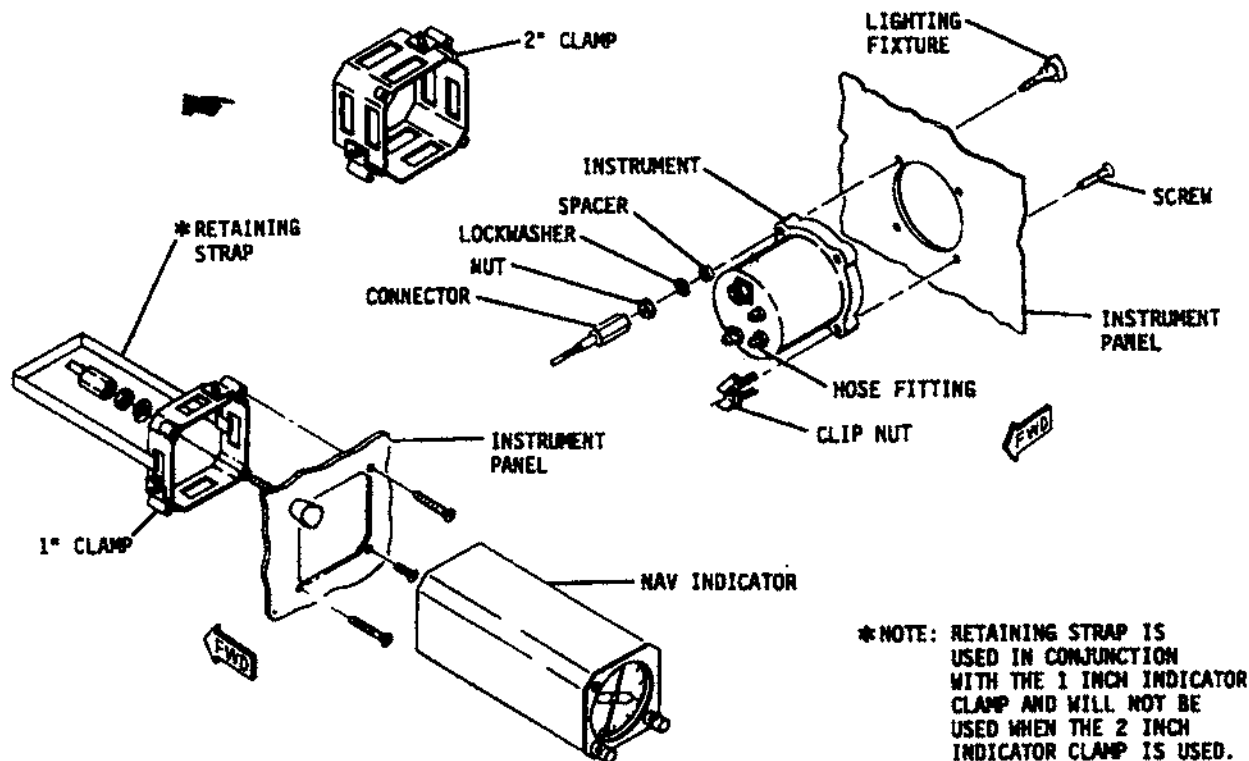
A. Remove Magnetic Compass.

- (1) Turn all electrical power OFF.
- (2) Disconnect light wire from compass card light by removing screw (4).
- (3) Remove two mounting screws (6) securing compass to mounting bracket.
- (4) Retain the compass card bracket for reassembly.

B. Install Magnetic Compass.

- (1) Position compass and compass card bracket on windshield center strip and secure with two screws (6).

NOTE: Screws (6) must be non-magnetic for mounting compass to windshield center strip.



*NOTE: RETAINING STRAP IS USED IN CONJUNCTION WITH THE 1 INCH INDICATOR CLAMP AND WILL NOT BE USED WHEN THE 2 INCH INDICATOR CLAMP IS USED.

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Typical Instrument Installation
Figure 1

- (2) Connect compass light wire to compass card light terminal with screws (4).

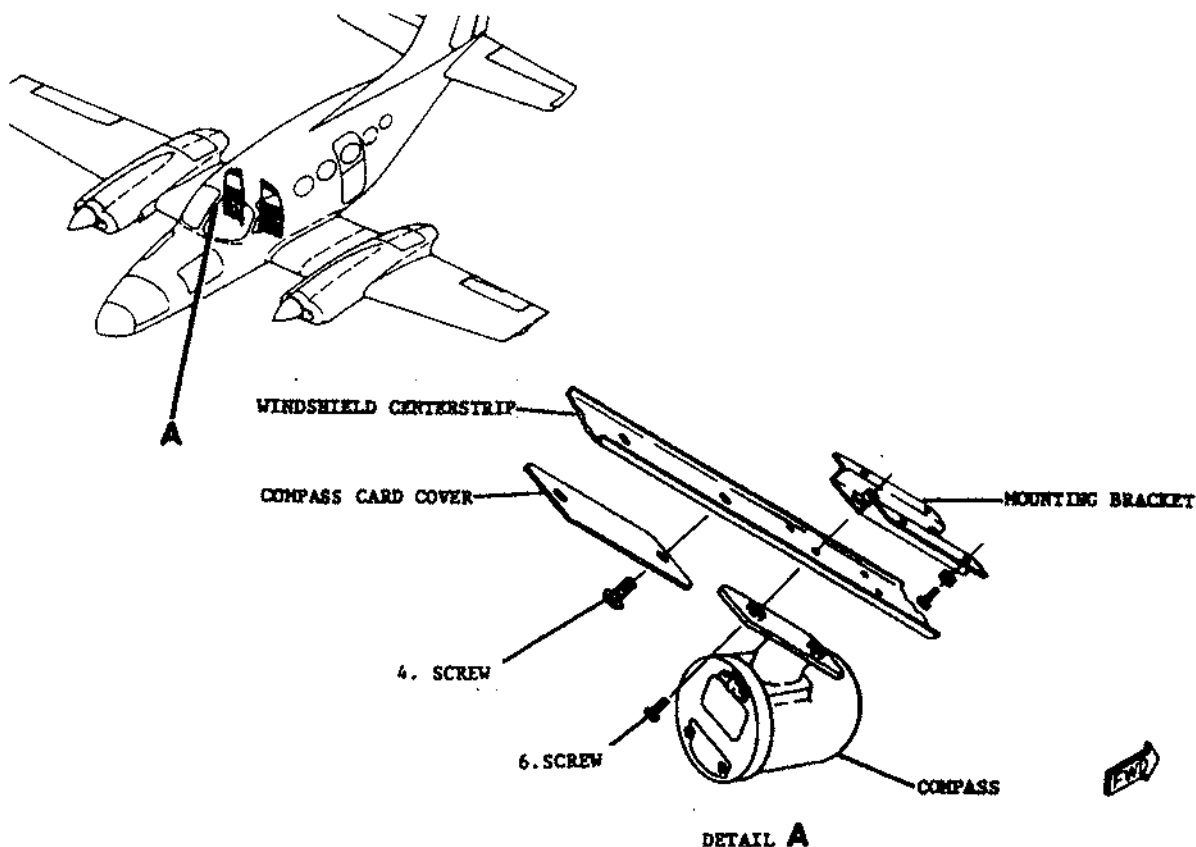
NOTE: Anytime the magnetic compass has been removed or a new magnetic compass has been installed, refer to Adjustment Magnetic Compass and perform compass alignment check.

3. Adjustment Magnetic Compass.

A. Compass Alignment.

NOTE: The compass alignment shall be performed on a calibrated compass rose.

- (1) Ensure compensator adjustments are set to a neutral position. The compensators are located on the lower face of compass behind the metal disc.
- (2) Using a hand-held magnetic compass, check all ferrous material parts for magnetism near the magnetic compass.
- (3) Degauss any parts within two feet which cause greater than 10° deflection of the magnetic compass, and any part within four feet which causes greater than 90° deflection of the magnetic compass.
- (4) Ensure that each of the applicable systems are controlled from the proper circuit breakers, and the corresponding "HDG" flag appears when the circuit breaker is disengaged.
- (5) Ensure all electrical instruments for the aircraft are installed and operative.
- (6) Ensure other aircraft and vehicles are a safe out of way distance.
- (7) Position aircraft on the 270° heading of the compass rose.



Magnetic Compass Installation
Figure 2

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A51141131

- (8) With both engines running 1000 RPM, turn on the following:
- (a) All circuit breakers.
 - (b) Inverters.
 - (c) All lights except landing lights and reading lights.
 - (d) All avionics systems.
 - (e) All electrical systems except pitot heat, stall and static heaters.
 - (f) Record the compass error in degrees.

NOTE: High readings are positive errors, low readings are negative errors.

- (9) Position aircraft on the 360° heading of the compass rose and repeat Step (8), (a) thru (f).
- (10) Position aircraft on the 90° heading of the compass rose and repeat Step (8), (a) thru (f).
- (11) Position aircraft on the 180° heading of the compass rose and repeat Step (8), (a) thru (f).
- (12) Algebraically sum the north and south errors, divide this sum by two and change the sign of the result. The resulting number is the amount and direction of the north/south compensator adjustment.
- (13) Repeat Step (12) for east/west compensator adjustment using east/west errors.

B. Compensation Adjustments.

- (1) The errors obtained in the Compass Alignment procedure Step (8) thru Step (13) will be used to determine the required amount and degree of compensation for the compass.

C. Compass Compensation.

- (1) At one cardinal heading, adjust the appropriate compensator the amount calculated in Compass Alignment procedure Step (8) thru Step (13).
- (2) Rotate the aircraft 90° and adjust the appropriate compensator the amount calculated.
- (3) Rotate the aircraft to the next two cardinal headings and ensure that no error greater than five degrees is present.
- (4) With normal aircraft power, all electrical systems on, rotate the aircraft to 30° headings (including cardinals). Stop on each heading long enough to allow compass to stabilize.
- (5) Record the headings indicated by the compass at the 30° positions. No error greater than ±5° shall be indicated by the compass.

4. Davtron Digital Clock Removal/Installation.

A. Remove Clock.

- (1) Remove electrical power; pull circuit breaker.
- (2) Disconnect electrical connector.

NOTE: To gain access to electrical connector, remove instrument panel screws and move panel aft.

- (3) Remove clock mounting screws and remove clock.

B. Install Clock.

NOTE: The clock should be checked for accuracy before installing. Refer to Pilot's Operating Handbook.

- (1) Position clock in instrument panel and install mounting screws.
- (2) Connect electrical connectors.
- (3) Secure instrument panel if disturbed during removal.
- (4) Reset circuit breaker and check clock display lighting.

C. Remove Faulty Battery.

- (1) Locate wire bundle and carefully cut heat shrink tubing (if installed).
- (2) Cut old battery leads at battery and remove battery.

D. Install New Nonchargeable Battery.

NOTE: Attach new battery while clock indicates within 5 minutes of the hour. Clock should start at 00 minute, 00 second when battery is attached. This action will eliminate holding the set switch on the clock for more than 5 minutes.

- (1) Identify battery and clock leads (red-positive and black-negative). Splice leads using butt splices or by soldering. Insulate splices and use heat shrink tubing and/or tie wire bundle and battery.

5. Adjustment Davtron Digital Clock.

- A. For adjustment of digital clock controls, refer to Pilot's Operating Handbook.

6. True Airspeed Indicator Removal/Installation (See Figure 3).

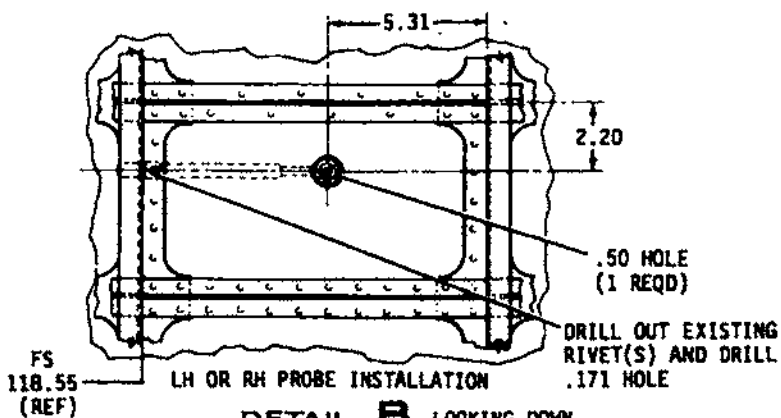
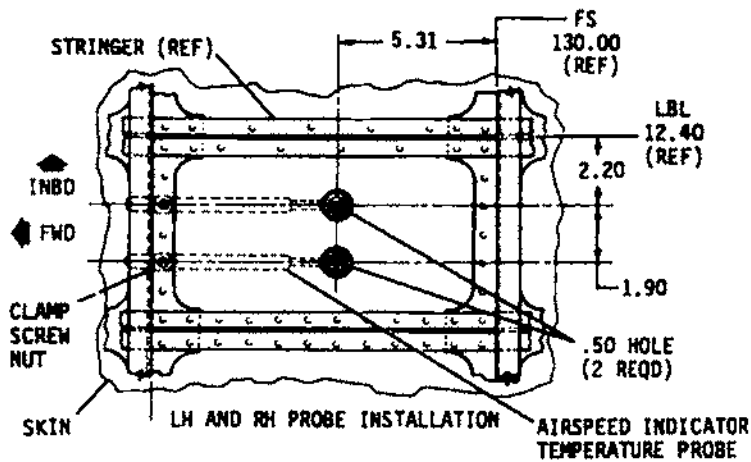
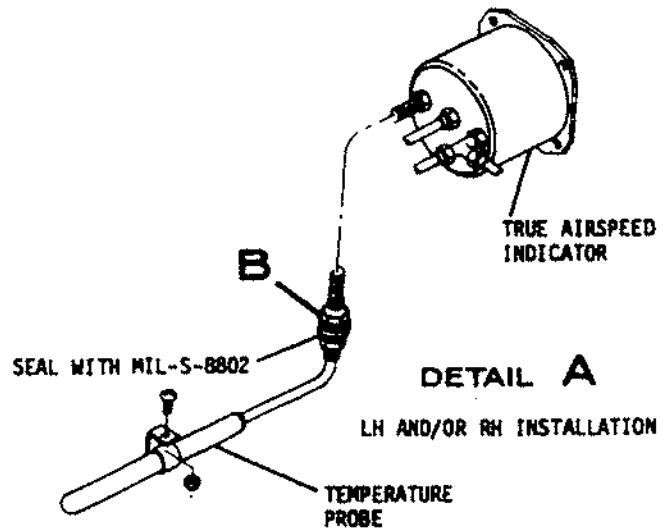
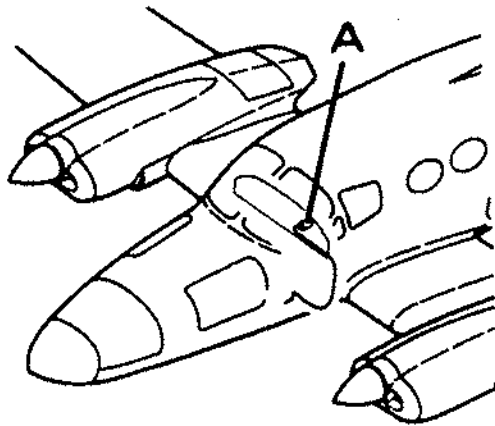
- A. Remove and install True Airspeed Indicator as follows:

- (1) Disconnect clamp securing temperature probe on bottom skin.
- (2) Loosen feed thru nut on temperature tube and work tube up and into the cockpit area.

CAUTION: AVOID SHARP BENDS, NICKS OR DENTS IN TEMPERATURE TUBE. INCORRECT READINGS COULD RESULT.

- (3) Remove indicator in accordance with Typical Instrument procedures Section 12.
- (4) Install true airspeed indicator by reversing removal procedures.

NOTE: Seal around feed thru fitting after installation.



True Airspeed Installation
Figure 3

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854141036

VACUUM SYSTEM AND RELATED INSTRUMENTSDescription

1. The vacuum system consists of: a vacuum pump on each engine, two relief valves, a manifold air filter, vacuum operated instruments and necessary plumbing. A dry vacuum pump which requires no lubrication is located on the aft left accessory mount pad on each engine. The pump outlets are exhausted into the engine nacelle. The vacuum line plumbing is routed from the vacuum pumps through the nacelles to the relief valves, mounted in each wing root area. From the relief valves, the lines are routed through the stub wing, through the cabin to the vacuum manifold located on the left side of the forward cabin bulkhead. The vacuum manifold has check valves included to prevent reverse flow should either vacuum pump fail. Hoses are routed from the manifold to the directional gyro, horizontal gyro and suction gage. Other hoses are connected from the gyros and suction gage to the vacuum air filter located on the forward side of the forward cabin pressure bulkhead. The suction gage is vented to ambient air through a fitting mounted in the forward cabin pressure bulkhead. The suction gage indicates the amount of vacuum present in the system as well as individual pump operation, using red indicator buttons to indicate pump failure. The vacuum air filter is provided to remove dust particles and vapor from the air entering the instruments. Vacuum air is routed to the outflow and safety valves located on the aft cabin pressure bulkhead.
2. The vacuum system instruments consists of: a directional gyro, horizontal gyro and suction gage for the standard installation. The optional installation includes dual directional gyros, dual horizontal gyros and the suction gage. For slaved directional gyro information, refer to Chapter 14.
 - A. The directional gyro is a flight instrument incorporating an air-driven gyro stabilized in the vertical plane. The gyro is rotated at high speed by lowering the pressure in the air tight case with the engine-driven vacuum pumps and simultaneously allowing air at atmospheric pressure to enter against the gyro buckets. Due to gyroscopic inertia, the spin axis continues to point in the same direction, even though the airplane yaws to the left or right. This relative motion between the gyro and the instrument case is shown on the instrument dial which is similar to a compass card. The dial, when set to agree with the airplane's magnetic compass, provides a "dead beat" azimuth indicator that is free from "swing".
 - B. The horizontal gyro is essentially an air-driven gyroscope rotating in a horizontal plane. The gyro is operated by the same supply of vacuum as the directional gyro. Due to gyroscopic inertia, the spin axis continues to point in the vertical direction providing a constant visual reference to the attitude of the airplane relative to its pitch and roll axis. A bar across the face of the instrument represents the horizon and a miniature adjustable airplane is mounted to the case. Aligning the miniature airplane to the horizontal bar simulates the alignment of the airplane to the actual horizon and any deviation simulates the deviation of the airplane from the true horizon. The horizontal gyro is marked from zero to 90 degrees.
 - C. The suction gage is calibrated in inches of mercury and visually displays the amount of vacuum created by the engine-driven vacuum pumps. The suction gage has four connecting lines. The upper line is routed directly to the directional gyro to monitor vacuum. The lower lines are attached to the vacuum system manifold for the purpose of monitoring vacuum pump function. The suction gage, also, incorporates red inoperative indicator buttons for each engine-driven vacuum pump.
 - D. Directional and attitude gyro precession. Acceptable limits for gyro drift is four degrees in either direction from a heading during a ten-minute period. Excessive gyro precession can be caused by low vacuum system pressure.

Troubleshooting

1. Troubleshooting the Vacuum System.

- A. For a guide to troubleshooting the vacuum system, refer to Figures 2 and 3.

2. Troubleshooting Vacuum System using Airborne's 343 Test Kit.

NOTE: When using Airborne's 343 Test Kit, it is recommended that a large compressor with an adequate storage tank be used.

Also, always try to position the airplane as close to the air compressor as possible.

On the side that is going to be tested for component location, refer to Figure 3.

- A. Remove wing gap fairings by removing all attaching screws.
- B. Remove upper engine cowlings.
- C. Remove engine system vacuum hose (1) from vacuum pump (dry air).
- D. Combine the test kit 1H88-1 regulator with the 1H89-1 ejector.
- E. Attach vacuum system hose (1), which was removed from pump, to the 5/8-inch tube on the 1H89-1 ejector and secure with clamp.
- F. Attach shop air supply hose to the fitting on the 1H88-1 regulator.

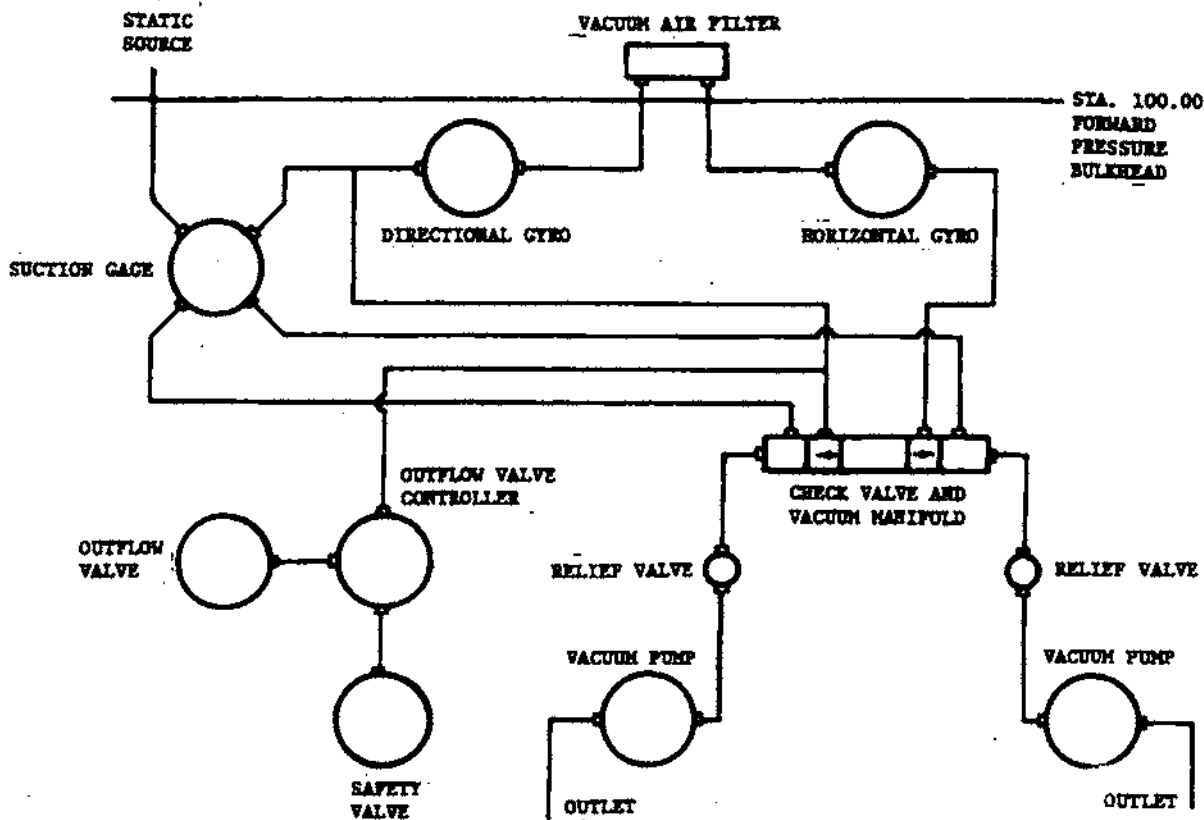
NOTE: Air supply hose 3/8-inch I.D. minimum.

- G. Slide the ON-OFF supply valve on the 1H88-1 regulator to the ON position, which is toward the regulator side, and screw adjustment down.
- H. Increase pressure until the 1H89-1 ejector gage peaks.
- J. If the reading on the 1H89-1 ejector is in excess of 8-inches Hg., there is some type of obstruction in the hoses. The difference between the reading at the 1H89-1 ejector gage and the airplane suction gage (2) with two gyro installation should be no greater than 1-inch Hg. With four gyro installation, it should be no greater than 2-inch Hg.
- K. Now with the system connected, proceed to the appropriate section for troubleshooting for step by step outline.

Troubleshooting Guide

1. No Vacuum.

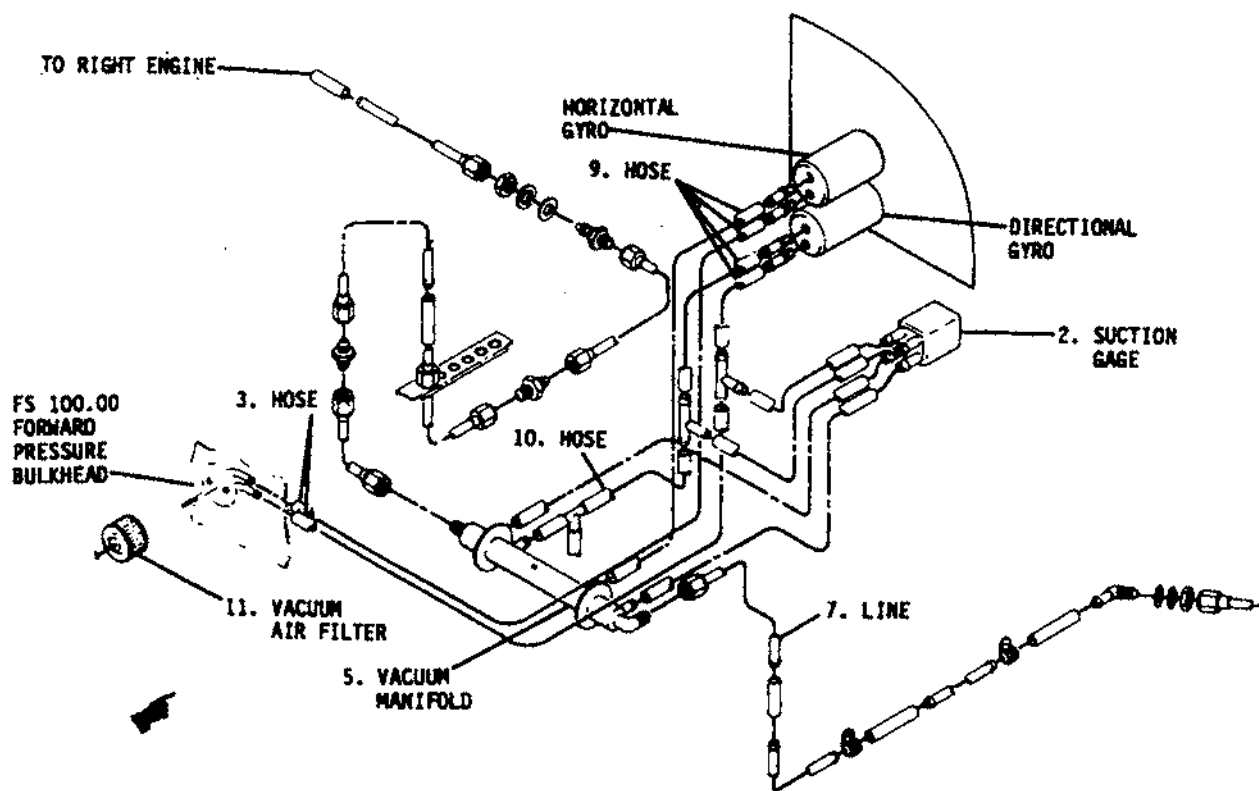
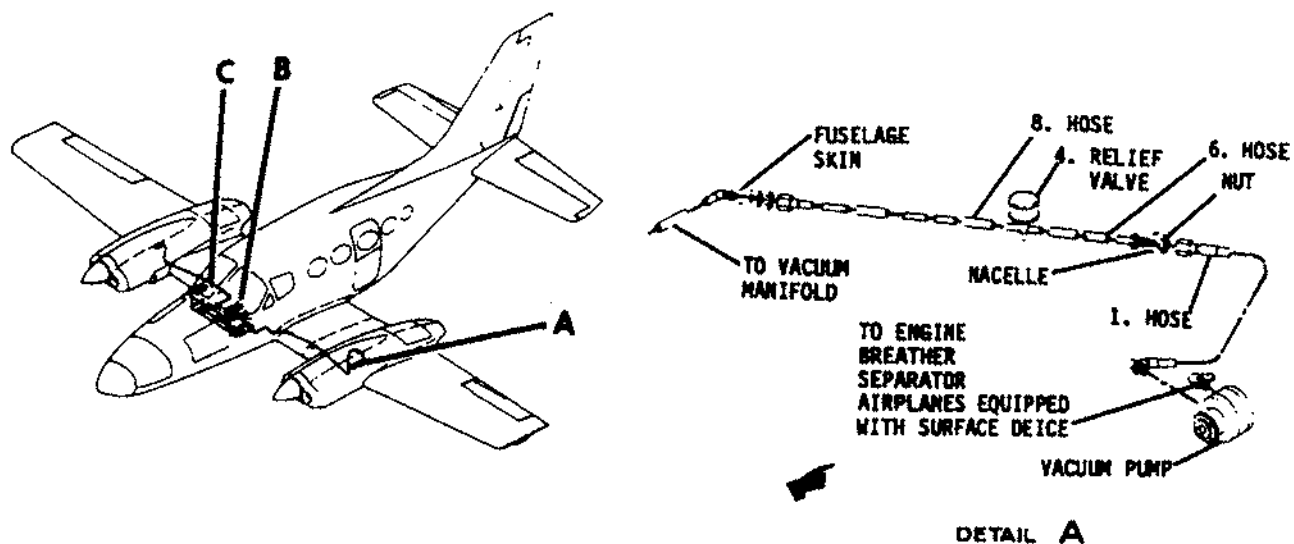
- A. The system performs satisfactorily.
 - (1) Vacuum pump is defective. Replace vacuum pump.
 - (2) If the system is still inoperative, proceed to step B.
- B. System still indicates that side is inoperative but you can hear the gyros are functioning.
 - (1) Using the 1G31-1 gage and probe, check the suction gage (2) by inserting probe in the hose pertinent to the side that is being tested.
 - (2) If there is a reading of 4.8-inches Hg., then suction gage (2) is defective.
 - (3) Replace suction gage (2).
 - (4) If there is no reading, proceed to step C.
- C. Using 1G31-1 gage and probe, check the system, starting right after the 1H89-1 ejector and working toward the vacuum air filter (11).
 - (1) Check the reading at hose (6). If reading is at or above 4.8-inches Hg., continue to check moving up the system. If the reading is extremely high, steadily increasing, one possibility is that the relief valve (4) may be stuck. If this situation exists, try to adjust the relief valve (4). If that doesn't resolve the problem replace relief valve. The other possibility is there is a partially plugged hose or line. Continue to check for a 4.8-inches Hg. reading working toward the relief valve (4). Once you do not get a reading, you have passed over a location of a partially plugged hose or line. Remove plugged substance from hose or line.



51982010

Vacuum System Schematic
Figure 1

- (2) A check should then be conducted at hose (8) to see if the relief valve (4) is operational. If the reading is 4.8-inches Hg., then proceed to step (4). If the reading is not 4.8-inches Hg., then relief valve (4) needs to be readjusted to 4.8-inches Hg. If it will not readjust, replace with a relief valve and adjust to 4.8-inches Hg.
- (3) Next check reading in hose (7) starting at the relief valve (4) and working toward manifold (5) to see if it is 4.8-inches Hg. If so, proceed to step (4). If, when checking hose (7), you get a reading which is not consistent with the system or no reading, it is possible that you have an obstruction in the hose and it should be removed.
- (4) Check the manifold (5) for proper operation by checking vacuum at hose (9) for the side you are testing as close to the manifold as possible. The reading should be 4.8-inches Hg. If so, proceed to next step. If not, there possibly is an obstruction in the manifold. Replace manifold.
- (5) Check the hose (9) from the manifold connection to the suction gage (2) always looking for the 4.8-inches Hg. reading. If the reading is continuous all the way through the hose up to the suction gage (2), the gage is defective. Replace gage. If, during checking of the hose (9) you lose the 4.8-inches Hg., then, in that portion of hose from where you were getting the 4.8-inches Hg. reading to where you lose the reading, there is some type of blockage or collapsed wall in the hose. Replace hose.

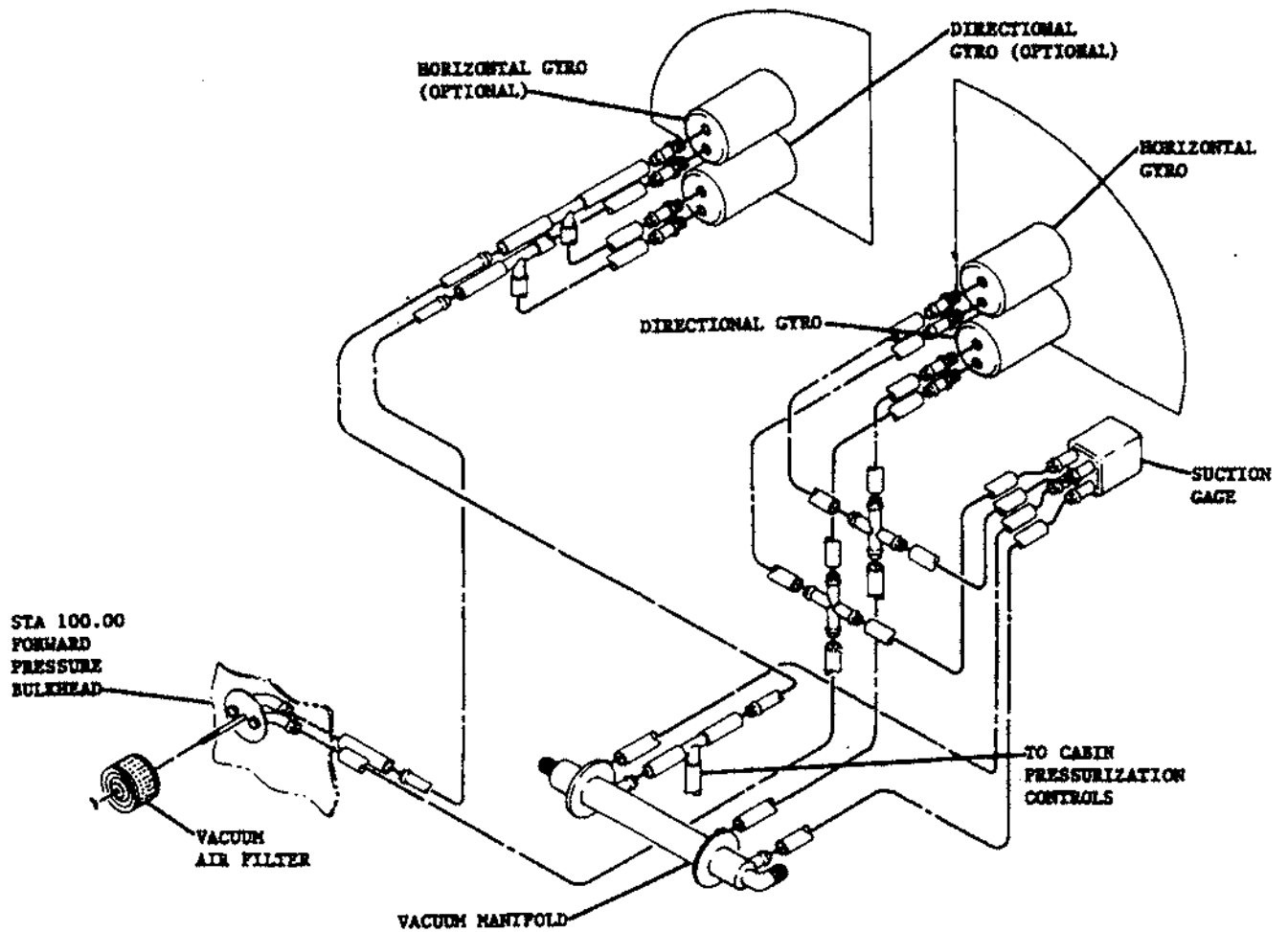


NOTE: ADAPTER FITTINGS MAY
BE USED TO FACILITATE
INSTALLATION OF FLIGHT
DIRECTOR INDICATOR.

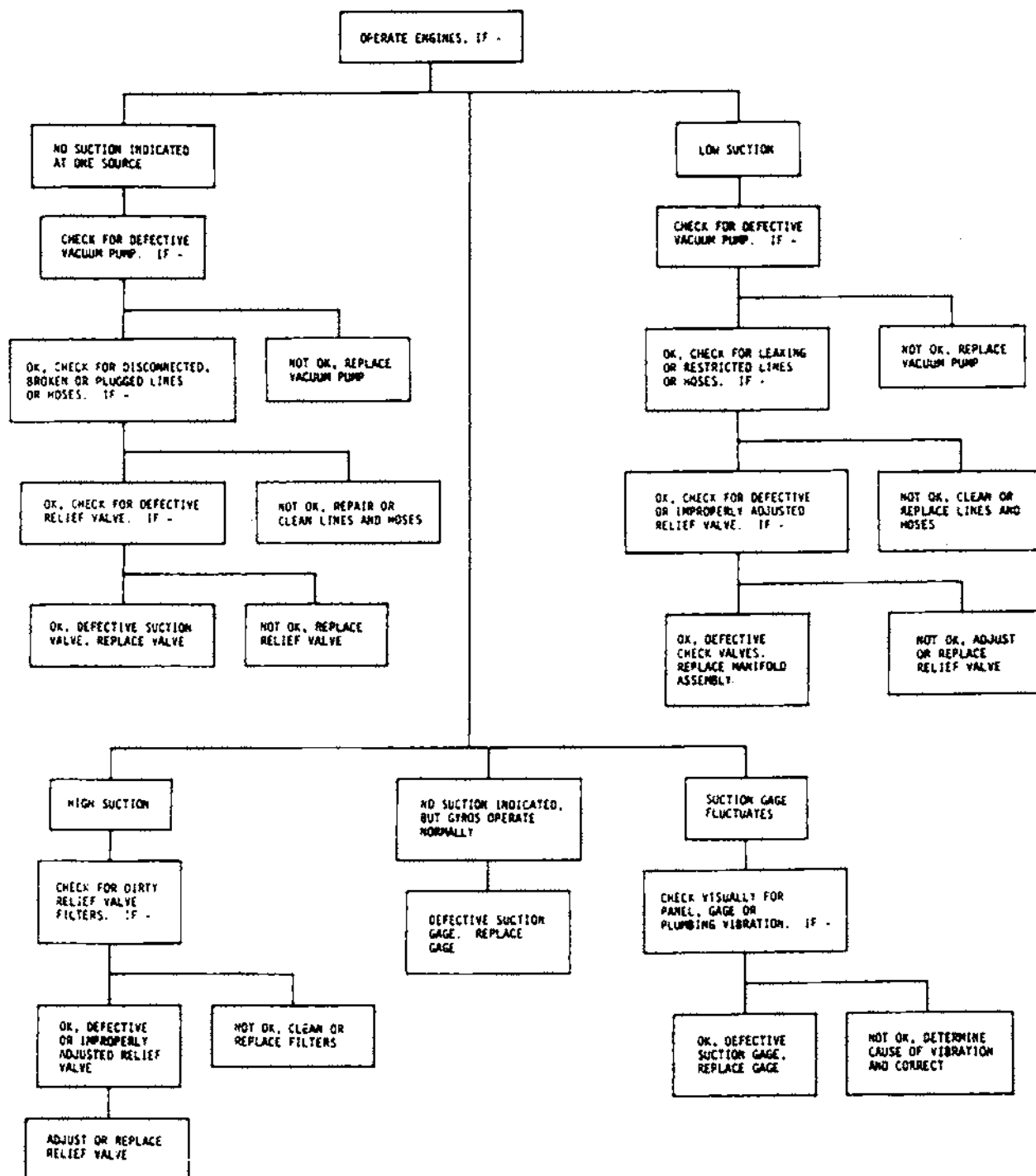
DETAIL B

51143100
A51143111
B51144028

Vacuum System Installation
Figure 2 (Sheet 1 of 2)



Vacuum System Installation
Figure 2 (Sheet 2)



Troubleshooting Chart - Vacuum
Figure 3

10988024

2. Low Vacuum.
 - A. The system performs satisfactorily.
 - (1) Vacuum pump is defective. Replace vacuum pump.
 - B. The system still indicates low vacuum.
 - (1) A system showing low vacuum should have all hoses checked for any loose clamps and connections. Then using the 1G31-1 gage and probe, check the system as outlined step-by-step.
 - (2) Check the reading at hose (8) for 4.8-inches Hg. If it is 4.8, proceed to the next step. If it is not, then the relief valve (4) needs to be readjusted. If it cannot be readjusted, replace relief valve.
 - (3) Check the manifold check valve (5) by checking the reading at hose (7) or (9) on the opposite side from test side for any reading. If there is no reading, proceed to next step. If there is a reading, the manifold check valve (5) is defective and is allowing ambient air to enter the system. Replace manifold check valve (5).
 - (4) Check the vacuum air filter at hose (3) for any reading. If there is none, then the filter is good, but if there is more than 1 1/4-inch Hg. reading, the filter is partially plugged and has to be replaced.
3. High Vacuum.
 - A. The system shows high vacuum using the 1G31-1 gage and probe. Proceed step-by-step as outlined.
 - (1) Check the reading at hose (8). If it is high and reads the same as suction gage (2), then the relief valve (4) filter is possibly dirty. Replace filter.
 - (2) Another possible problem is that the relief valve (4) is improperly adjusted. Readjust to 4.8-inches Hg. If it will not adjust, replace relief valve (4).
4. Suction Gage Fluctuates.
 - A. Check for panel vibration or plumbing vibration and correct as required.
5. Erratic Vacuum.
 - A. This is an indication that there might be some type of fluid in the vacuum pump; i.e., oil, varsol, water, etc. Check vacuum pump exterior for any signs of oil, varsol, etc. If it is apparent that there is fluid in the pump, remove and replace pump.
6. Gyro Gage Follows Engine RPM.
 - A. To simulate a gage following engine RPM, vary the pressure on the 1H88-1 regulator with excessive pressure. If the gage fluctuates, this is an indication that the relief valve (4) might have something in the seat. Remove the adjustment screw on the relief valve (4) and with clean shop compressed air, blow the seat area off. Reinstall adjustment screw and readjust relief valve (4). If relief valve (4) still fluctuates, replace relief valve (4).
7. One Gyro Inoperative.
 - A. If one gyro operates properly while the other gyro will not erect or precesses and tumbles, use the 1G31-1 gage and probe to check at the back of the inoperative gyro at the hose (10) connected to the manifold (5) for a reading of 4.8-inches Hg. If you get a reading of 4.8-inches Hg., this is an indication that that gyro is defective. Replace gyro. If there is no reading at the back of the gyro, there must be a clogged line from the manifold (5) to the gyro. With the 1G31-1 gage and probe, work your way toward the manifold (5) until you get a reading. Replace that plugged segment of hose.

NOTE: Make sure that the hose (3) from the vacuum air filter (11) to the gyro is also clean and unrastricted by checking with the 1G31-1 gage and probe to ensure that no vacuum is in that line. If there is a vacuum, replace filter or hose to correct the situation.

8. Gyros will not Erect.
 - A. In a nondifferential gage vacuum system, when the suction gage (2) reads okay, but the gyros will not erect, using the 1G31-1 gage and probe, check for any reading at hose (3). If there is any reading, this is an indication that the vacuum air filter is clogged or the hoses (3) could have a plugged section in them. Replace vacuum air filter or section of bad hose (3).
9. Both Fail Source Indicators Retract with One Side Operational.
 - A. Using the 1G31-1 gage and probe, check for a reading in hose (9) on the opposite side from testing. If you get a reading, then the manifold (5) is defective. Replace manifold.
10. Gyro Gage Indicates Frequent Regulator Adjustment.
 - A. In a differential gage system using the 1G31-1 gage and probe, check for any reading at hose (3). If there is a reading, then the vacuum air filter is partially clogged. Replace filter. Also, check for a higher than normal reading in hoses (10) and (7) which might be an obstruction in the hoses or lines. Remove obstruction.
11. Frequent Vacuum Pump Replacement.
 - A. If it is obvious that one side is having frequent vacuum pump replacement exhibiting shorter than normal vacuum pump life, then it is very important that that side be thoroughly inspected and tested using an Airborne 343 Test kit. Make sure that:
 - (1) This is proper vacuum pump for application.
 - (2) There are no restrictions in the discharge side of the vacuum pump.
 - (3) There are no kinked or plugged lines.
 - (4) Filters are all in satisfactory condition.
 - (5) Vacuum pressure is set properly.
 - (6) Deice control valve is operating properly.
12. Surface Deice Control Valve Operation.
 - A. If the airplane is equipped with surface deice system, ensure that the system is operating properly as outlined in applicable section or chapter of Maintenance Manual.
 - (1) If the pressure control valve electrical solenoid valve fails to return to its normally open (OFF) position after cycling or the vent is obstructed, the valve would remain in the closed, nonventing condition resulting in high system pressure and increased load on the vacuum pump. Increased pressure between the vacuum pump and pressure control valve could cause the pump to fail.
 - (2) Connect regulated air supply to hose at outlet port of vacuum pump. Ensure surface deice system is OFF. Apply regulated air and check pressure between vacuum pump and pressure control valve; reading should be zero (0) psi.

NOTE: For regulated air pressure, refer to Surface Deice System in applicable airplane Service or Maintenance Manual.

Adjustment/Test

1. Adjustment Vacuum Relief Valve.

NOTE: Since a relief valve is used for each vacuum source, each relief valve must be adjusted separately.

- A. Remove wing cover by removing attaching screws and remove safety wire from adjusting screw locknut.
- B. Start the engines and idle the right engine.
- C. With left engine operating and tachometer reading 1700 RPM, the suction gage should read 4.80 inches of mercury.

- D. Adjust the left relief valve by loosening the knurled screw locknut and adjusting to obtain the desired reading. Clockwise rotation of the adjusting screw increases the vacuum.
 - E. Idle the left engine and operate the right engine so tachometer reads 1700 RPM.
 - F. Adjust the right relief valve by loosening the knurled screw locknut and adjusting to obtain the 4.80 vacuum reading. Clockwise rotation of the adjusting screw increases the vacuum.
 - G. With both engines operating at tachometer RPM of 1700, the suction gage should read 5.00 $\pm$ 0.25 inches of mercury.
- NOTE:** If the suction gage reading is not within limits described, both relief valves should be readjusted to those limits.
- H. Shut down both engines and check that the locknuts on the knurled adjustment screws are tight and safety wire installed.
 - I. Install wing covers.

Inspection/Check

1. Inspection Vacuum System.

NOTE: Vacuum system inspection is a visual inspection of the plumbing, fittings, clamps, seals, hoses, hardware and brackets.

- A. Remove upper engine cowls, wing fairings and wing lower surface access parts as required to inspect all the items in the vacuum system.

(1) Engine compartments.

WARNING: FAILURE TO CORRECT OIL LEAKS MAY ALLOW OIL TO ENTER THE DRY AIR PUMP AND CAUSE PUMP FAILURE WITHIN A SHORT PERIOD OF OPERATION.

- (a) Inspect the area around the pump pad seal and lower surface of pumps for evidence of oil.
- (b) If evidence of oil exists, remove vacuum pump, replace pad seal in accordance with the engine manufacturer's recommended procedures. Reinstall vacuum pump as outlined in the "Install Vacuum Pump Section".
- (c) Inspect the engine compartment for evidence of any other oil leaks; i.e., fittings, hoses, gaskets, etc. Replace or repair as required.
- (d) Inspect vacuum pump for loose fittings. If any looseness is present, remove hose and secure fittings as outlined in the "Install Vacuum Pump" section. If the fitting is extremely loose, resulting in truncation on the threads of the fitting, replace fitting with new part.
- (e) Check the condition of the hoses in the pneumatic system. If hoses are found to be hard, cracked, oil soaked or brittle, replace with new hoses.
- (f) Check for proper hose alignment, routing and installation that may reduce the internal diameter, resulting in a restriction of the flow of air. It is important that the hoses are not collapsed, kinked or twisted, or are stressed to a point where any significant loads are imposed on system components or fittings.
- (g) Check the drive coupling and make sure it is in satisfactory condition.

NOTE: Service life for couplings is 6 years. The urethane becomes hard and brittle. After that, they should be replaced with the proper Airborne coupling kit.

- (h) If the vacuum pump is equipped with blast cooling, inspect for satisfactory condition of tubing/hose and associated hardware.
- (i) Check general condition of regulators and valves. If the regulators or valves are equipped with an electric solenoid, check electrical connection and wiring.

Cleaning/Painting

1. Cleaning Vacuum System Components.

A. Cleaning.

- (1) The vacuum system components may be cleaned by immersing lines and hoses in dry cleaning solvent, and dried with filtered dry compressed air.
- (2) Wipe exterior of lines and hoses with a clean, dry cloth.
- (3) Clean vacuum system filter with a jet of clean, dry air and tapping lightly while blowing air over the filter.
- (4) Remove the relief valve screen and submerge in suitable solvent. Allow to soak or wash until all foreign particles are dislodged.
- (5) Clean relief valve if required by washing in suitable solvent and drying with filtered dry compressed air.

Maintenance Practices

NOTE: All flexible and fixed line fittings, clamps, regulator valves, and filters must be cleaned and suitably protected by caps or bags until installed in the aircraft. The vacuum system shall not be open while awaiting the remaining parts to be installed. Prior to running of the engine-driven vacuum pumps, the lines shall be flushed with air to approximately seven cubic feet per minute while alternately closing off the ends of the lines. This will create pressure pulses to dislodge and eject foreign matter.

NOTE: When removing/installing lines at bulkhead fittings, ensure that fitting is secured to prevent twisting line on opposite side from one being installed. Hold fitting with wrench while loosening/tightening line connection.

1. Removal/Installation Vacuum Pump (See Figure 2).

NOTE: Removal/Installation for both vacuum pumps is the same.

A. Remove Vacuum Pump.

- (1) Remove upper engine cowl.
- (2) Loosen the two hose clamps securing hoses to vacuum pump fittings and disconnect hoses.
- (3) Remove vacuum pump by removing nuts and washers securing pump to engine accessory pad.

CAUTION: DO NOT CLEAN VACUUM PUMP IN SOLVENT. CLEAN BY WIPING WITH A CLEAN CLOTH.

B. Install Vacuum Pump.

NOTE: If a new vacuum pump is being installed, remove the serviceable fittings from the old pump. Discard twisted fittings.

- (1) Pad inspection.
 - (a) Check the condition of the pad seal. If the seal shows any signs of oil leakage, replace the seal. Replace seal if there is any doubt as to its serviceability.
- (2) Installation of vacuum pump.

CAUTION: NEVER INSTALL A VACUUM PUMP THAT HAS BEEN DROPPED.

NOTE: Consult the current parts manual to verify that the vacuum pump is the correct model for the engine and/or system.

- (a) Place the vacuum pump mounting flange in a jaw-protected vice with the drive coupling downward. Protect the vacuum pump mounting flange with soft metal or wood.

CAUTION: VACUUM PUMP HOUSING SHOULD NEVER BE PLACED DIRECTLY IN A VISE SINCE CLAMPING ACROSS THE CENTER HOUSING WILL CAUSE AN INTERNAL FAILURE OF THE CARBON ROTOR.

- (b) Spray the fitting threads with silicone and let dry. DO NOT use teflon tape, pipe dope or thread lube.
 - (c) Install fittings in the vacuum pump. Hand tighten.
 - (d) Use only a box wrench to tighten fittings to desired position. Do not make more than one and one half (1-1/2) turns beyond hand-tight position.
 - (e) Install new vacuum pump mounting gasket (supplied with new vacuum pump).
 - (f) Align splines on the vacuum pump drive with splines on the engine drive. Slide vacuum pump into position so the ports are facing to the right.
 - (g) Always replace ALL locking washers when installing a new vacuum pump. Tighten all four (4) mounting nuts to approximately 50 to 70 pounds.
- (3) Inspection of hoses.
- (a) Before installing hoses, inspect each hose carefully to make sure it is clean and free of all debris, oils or solvents. Use vacuum or air pressure to clean the lines. Remove the hoses from the airplane if necessary.
 - (b) Replace old, hard, cracked or brittle hose, particularly on the vacuum pump inlet. Sections of the inner layers may separate causing a pump failure.
 - (c) Where hose clearance is tight making it difficult to reinstall it onto the vacuum pump fitting, spray the fitting at the hose end with silicone. Let dry, then install hose by pushing it straight on.

CAUTION: DO NOT WIGGLE HOSE FROM SIDE TO SIDE. WIGGLING COULD CAUSE PARTICLES TO BE CUT FROM HOSE I.D. THESE PARTICLES WILL DAMAGE THE VACUUM PUMP.

- (d) Make certain that hoses are connected to the correct fittings. Incorrect installation will cause damage to the gyro system.
- (4) Filters.

CAUTION: REPLACE ALL THE FILTERS IN THE SYSTEM.

- (a) Clogged filters will restrict the flow of air required for proper vacuum pump operation and cooling. Premature pump failure or shortened pump life may result.
- (5) Install upper engine cowl.

2. Removal/Installation Vacuum Relief Valve (See Figure 2).

A. Remove Vacuum Relief Valve.

- (1) Remove wing gap access cover by removing attaching screws.
- (2) Remove clamps attaching hoses to relief valve and remove the relief valve.

B. Install Vacuum Relief Valve.

- (1) Position the relief valve and connect the hoses to the valve, using clamps.
- (2) Adjust the vacuum relief valve. Refer to Adjustment/Test.
- (3) Install wing gap fairings with screws.

3. Removal/Installation Vacuum Manifold (See Figure 2).

A. Remove Vacuum Manifold.

- (1) Identify and disconnect hoses from the manifold.
- (2) Remove manifold by removing screws.

B. Install Vacuum Manifold.

- (1) Secure manifold to bulkhead, using screws.
- (2) Identify and connect hoses to manifold, using clamps.

4. Removal/Installation Vacuum Air Filter Element (See Figure 2).

A. Remove Air Filter Element.

- (1) Open nose baggage compartment.
- (2) Refer to Chapter 12. Remove upholstery panel from forward bulkhead.
- (3) Remove wing nut and remove air filter element.

B. Install Air Filter Element.

- (1) Install air filter element and secure with wing nut.
- (2) Install upholstery panel to bulkhead.

5. Removal/Installation Vacuum System Instruments.

NOTE: Refer to Miscellaneous Instruments, Removal/Installation Typical Instruments.

PITOT-STATIC SYSTEM AND RELATED INSTRUMENTSDescription

1. Pitot System.

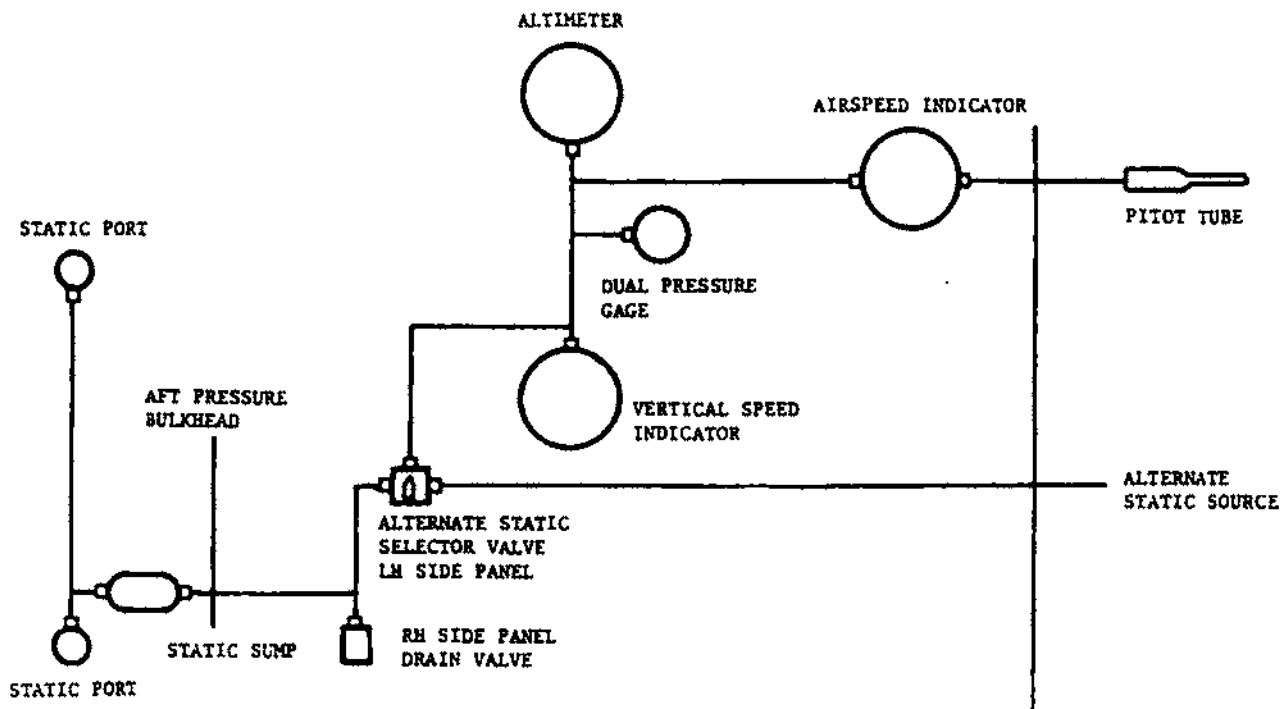
- A. The single pitot system (standard aircraft) utilizes one pitot tube mounted in the nose. The pitot tube incorporates an electric heating element to prevent ice from obstructing the passage of ram air through the pitot tube. Ram air is routed to the pilot's airspeed indicator through lines and hoses.
- B. The dual pitot system (optional) utilizes two pitot tubes in the nose, the standard aircraft installation located in the center of the nose and the dual system which is located on the left side of the nose. Both pitot tubes incorporate an electrical heating element to prevent pitot tube icing. Each pitot system is independent of the other and supplies ram air through lines and hoses to their respective airspeed indicators. The left pitot system supplies ram air to the pilot's instrument and the right pitot system supplies ram air to the copilot's instrument.

2. Static System.

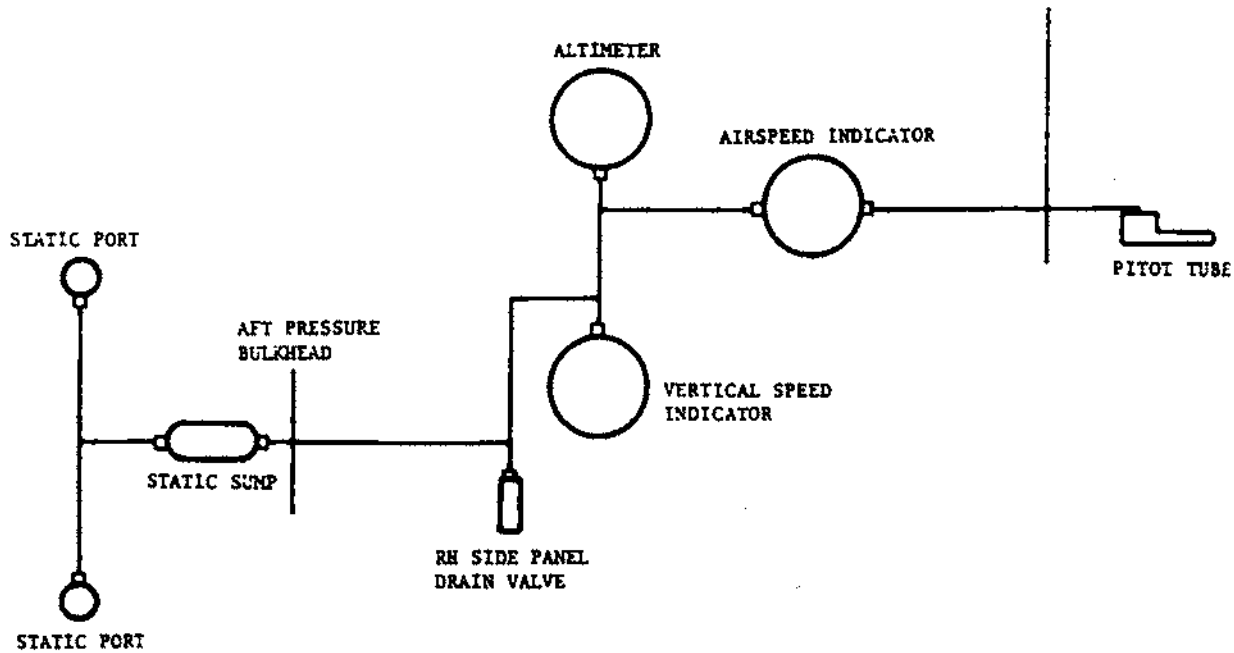
- A. The single static system (standard aircraft) utilizes two static ports (heated optional) static sump, drain valve, alternate selector valve, and necessary plumbing to the pilot's airspeed indicator, vertical speed indicator, and the altimeter. Static pressure is routed from the two static ports, mounted on opposite sides of the aircraft fuselage aft of the pressure cabin, through the static sump to the airspeed indicator, vertical speed indicator and altimeter. The static drain valve is forward of the tee and is accessible through the copilot's side pocket to release accumulated moisture. The static pressure line is routed from the tee up the right side and across to the altimeter, vertical speed indicator, and airspeed indicator. The alternate static source valve substitutes an alternate ambient air pressure for atmospheric air pressure in emergencies. The alternate static source valve is located forward of the switch and console on the left side of the fuselage. The valve is connected to the airspeed indicator with lines and fittings.
- B. The dual static system (optional) is used with the dual pitot system (heated optional). The dual static system is two independent systems, one system providing static pressure to the pilot's airspeed indicator, vertical speed indicator and altimeter. The second static system provides static pressure to the copilot's airspeed indicator, vertical speed indicator, and altimeter. Each static system consists of two static ports, static sump, drain valve and necessary plumbing.

3. Pitot-Static Instruments.

- A. The Sensitive Altimeter is a pressure instrument that measures the change in static pressure by means of an indicator attached to an aneroid and corrected to sea level. A barometric scale calibrated in inches of mercury and is manually adjusted by a knob in the lower left corner of the altimeter case. Three pointers on the instrument dial indicate the altitude in 100 feet, 1000 feet and 10,000 feet.
- B. The encoding altimeter system (optional) provides altitude and encoding information for (ATC) Air Traffic Control when the ALT mode is selected on the transponder. The system consists of an encoding altimeter in the pilot's panel, a standard backup altimeter in the copilot's panel and a transponder. The encoding altimeter is servo driven, using 28 VDC. The altimeter will function whenever the battery switch is on and the altimeter failure bar is retracted from the altitude display. In addition, altitude encoding will be provided when the ALT mode is selected on the transponder. At altitudes less than 10,000 feet, a warning flag will be presented in the 10,000 foot window.
- C. The Airspeed Indicator (standard) measures the differential between ram air or impact air pressure taken at the pitot tube and static air pressure. The instrument dial is calibrated in both knots and miles per hour.
- D. The True Airspeed Indicator (optional) senses three elements; airspeed, altitude and temperature. The altitude and temperature mechanisms are correlated to operate a rotating dial over which the indicated airspeed indicates true airspeed. The true airspeed indicator senses changes in pressure and temperature. This combination of altitude and temperature change results in a sum total of airspeed corrections to indicate true airspeed.



STANDARD

FORWARD
PRESSURE
BULKHEAD

OPTIONAL DUAL

51982011

Pitot Static System Schematic
Figure 1

- E. The Vertical Speed Indicator measures the rate of change in static pressure when the aircraft is climbing or descending. By means of a pointer and dial, it indicates in feet per minute the rate of ascent or descent of the aircraft.
- F. The Cabin Altitude and Differential Pressure Indicator is a dual purpose instrument which indicates the cabin altitude in feet and the differential pressure between cabin pressure and atmospheric pressure in PSI.
- G. The Cabin Rate of Change Indicator indicates in feet per minute the rate at which the cabin pressure is changing. The indicator dial is calibrated in 100 feet increments. The cabin rate of change indicator is similar in function to the vertical velocity indicator except the cabin rate of change indicator is referenced to cabin pressure instead of static air pressure.

Troubleshooting

1. Troubleshooting Pitot-Static System.

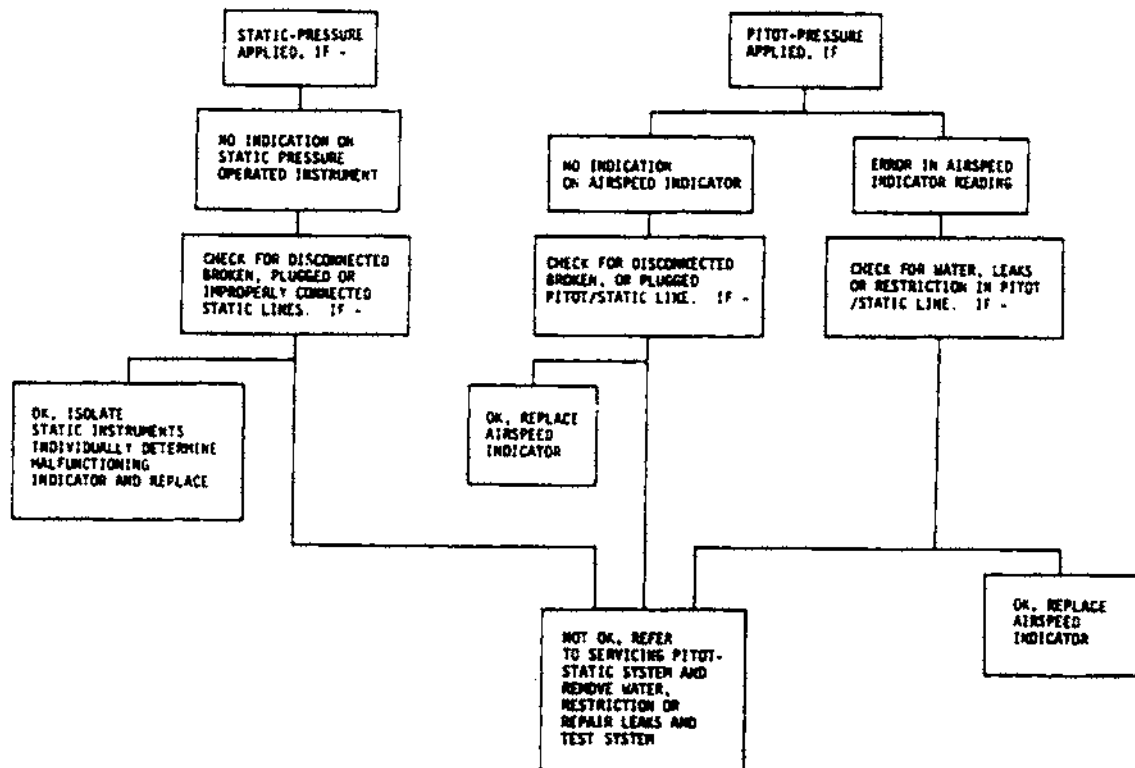
- A. For a guide to troubleshooting the vacuum system, see Figure 2.

Inspection/Check

1. Inspection Pitot-Static System.

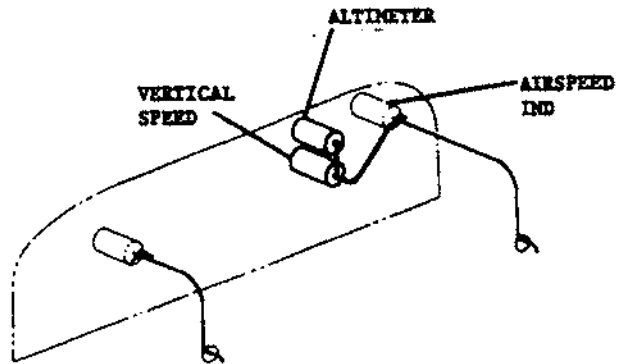
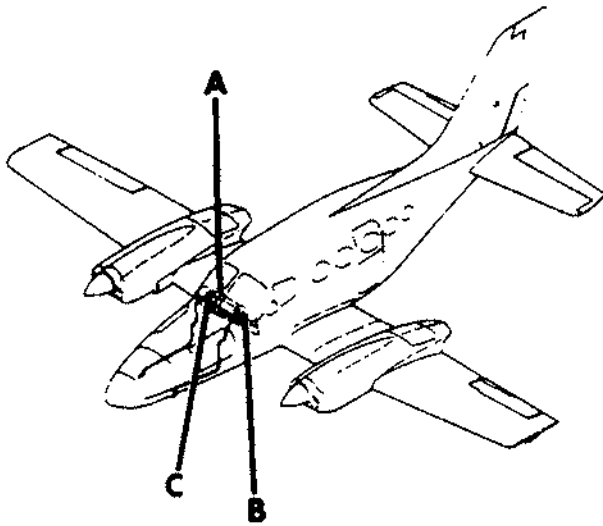
NOTE: Pitot-Static System inspection is a visual inspection of the plumbing.

- A. Remove necessary access plates and upholstery side panels to gain access to plumbing.
- B. Reinstall removed access plates and upholstery side panels.

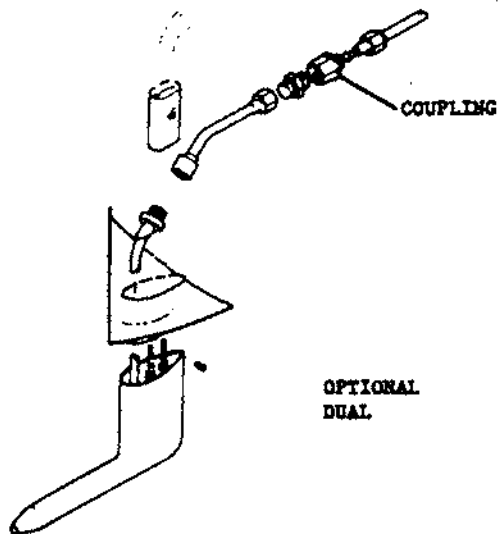


Troubleshooting Chart - Pitot-Static System
Figure 2

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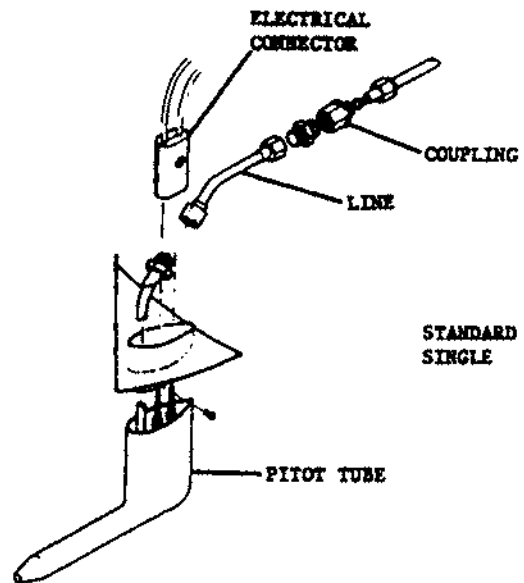


DETAIL A



OPTIONAL
DUAL

DETAIL C

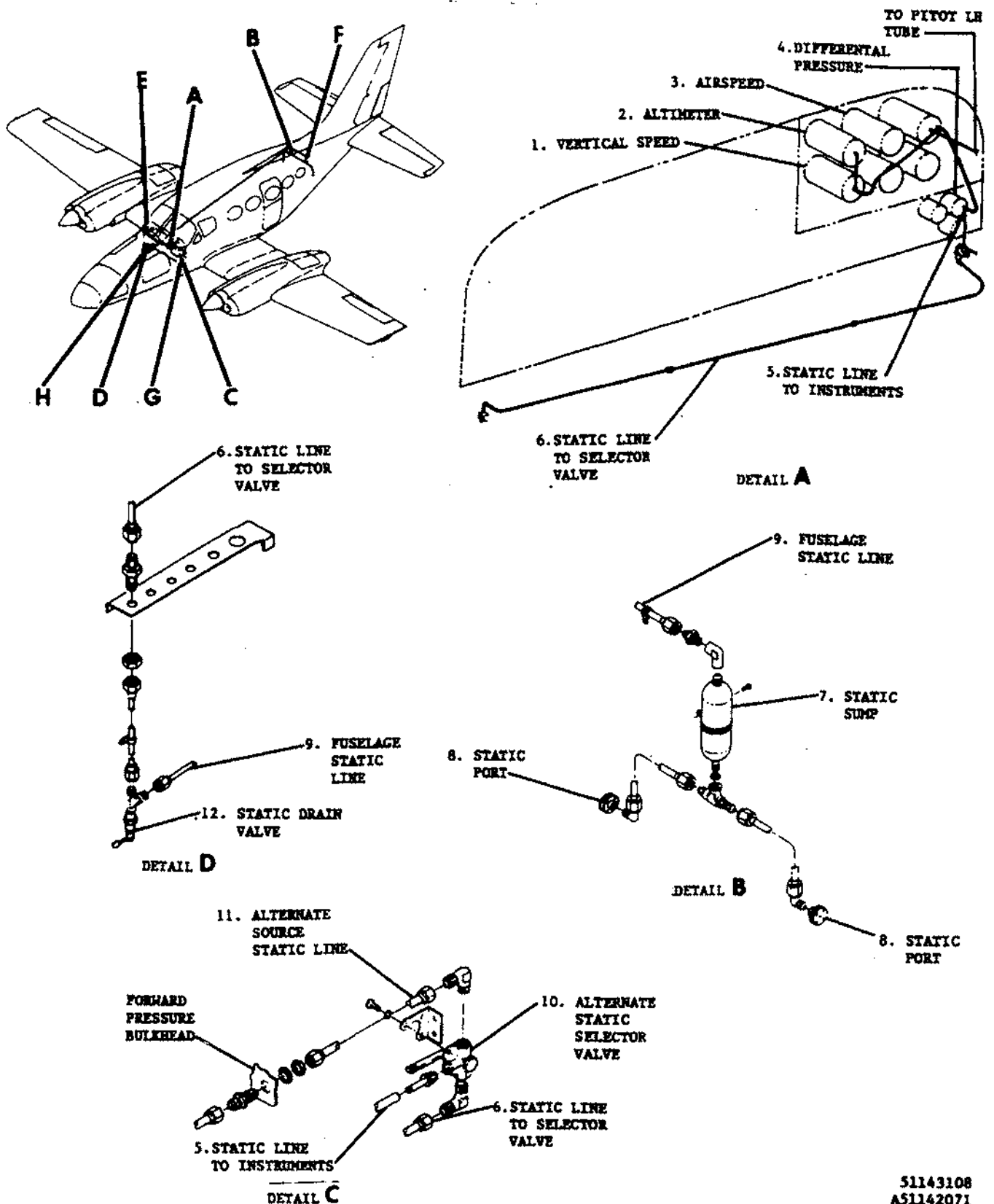


STANDARD
SINGLE

DETAIL B

Pitot System Installation
Figure 3

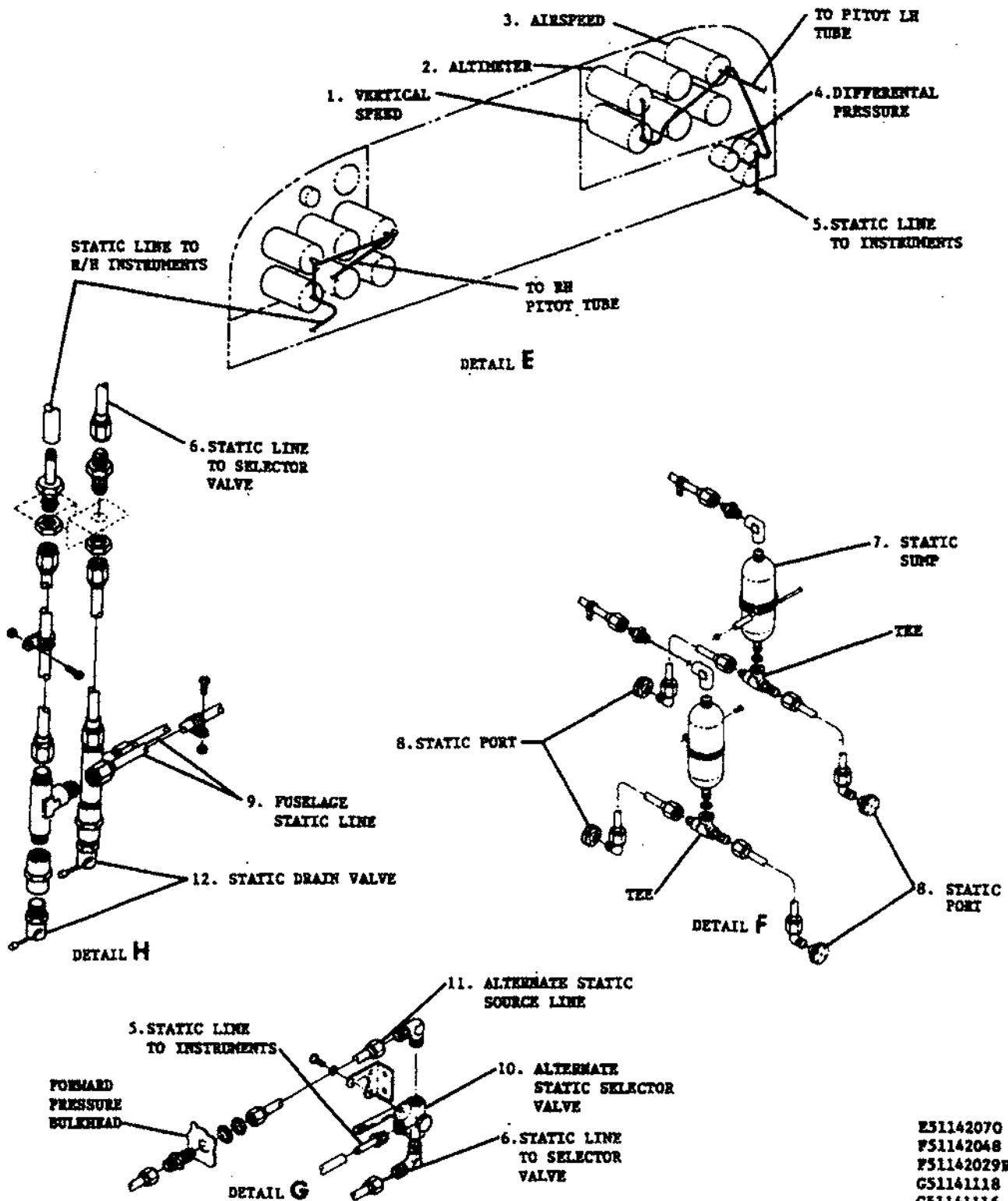
51143095
A34142001R
B52143041
C52143041



Static System Installation (Standard)
Figure 4 (Sheet 1 of 2)

51143108
A51142071
B51142029R
C51141116
C51141118
D52142030

421
SERVICE MANUAL



Static System Installation (Optional)
Figure 4 (Sheet 2)

E51142070
F51142048
F51142029R
G51141118
G51141116
H51141108

Maintenance Practices

1. Servicing Pitot-Static System (See Figure 3).

A. Purge Pitot System.

NOTE: Each pitot system must be purged separately.

- (1) Disconnect pitot hose to airspeed indicator.
- (2) Connect purging source (low pressure) clean dry air to disconnected hose behind instrument panel.
- (3) Blow air from the indicator end toward the pitot tube.

CAUTION: NEVER BLOW AIR THROUGH THE PITOT LINES TOWARD INSTRUMENTS.

- (4) Connect hose to airspeed indicator.
- (5) Perform leak check. Refer to Adjustment/Test.

B. Purge Static System.

NOTE: Each static system must be purged separately.NOTE: If autopilot (optional) is installed, disconnect static line from computer.

- (1) Turn static source selector valve to "Alternate Service".
- (2) Open static source line drain valve.
- (3) Plug one static port.
- (4) Purge system from the drain valve with clean dry air for a period of at least two minutes.
- (5) Plug opposite static port and repeat Step 4.
- (6) Close static drain valve and turn static source selector valve from alternate source to main static source.
- (7) Leak check static system.

2. Removal/Installation Pitot Tube (See Figure 3).

A. Remove Pitot Tube.

- (1) Remove screws securing pitot tube in place and pull pitot tube down.
- (2) Disconnect lines and cap to prevent entry of foreign material.
- (3) Disconnect electrical plug.

B. Install Pitot Tube.

- (1) Connect electrical plug to pitot tube, remove caps and connect lines to respective fittings.
- (2) Insert pitot tube in place and secure with screws.
- (3) Perform leak check.

3. Removal/Installation Pitot-Static System Instruments.

NOTE: Refer to Miscellaneous Instruments, Removal/Installation Typical Instruments.

4. Adjustment/Test Pitot-Static System (See Figure 5).

A. Tools and Equipment.

Name	Number	Manufacturer	Use
Test Set	Type MB-1A	MIL-T-8078	Checking, testing and troubleshooting pitot-static system.

B. Test Pitot System.

NOTE: If dual pitot system (optional) is installed, test each system separately.

- (1) Connect a pressure source to openings in pitot tube.

CAUTION: DO NOT APPLY SUCTION TO PITOT PRESSURE LINE.

- (2) Apply pressure slowly until airspeed indicator reads 150 knots. Clamp off the pressure source, hold at this point for one minute.

CAUTION: THE AMOUNT OF PRESSURE REQUIRED FOR A 150 KNOT INDICATION IS LESS THAN 1/2 PSI. AVOID HIGH PRESSURE, INSTRUMENT DAMAGE COULD RESULT.

- (3) If airspeed indicator drops more than 10 knots in one minute, disconnect hose from airspeed indicator.
- (4) Plug hose and apply pressure.
- (5) Coat lines and connections with a solution of soap and water to locate leak.
- (6) Tighten or repair faulty connection. Connect hose to airspeed indicator and repeat test procedure.

C. Test Static System.

NOTE: If dual static system (optional) is installed, test each system separately.

- (1) Assure static drain valve and the alternate static source valves are closed.
- (2) Carefully seal one static port with plastic tape.
- (3) Connect test equipment to the opposite static port.
- (4) If installed, disconnect and cap the pitot line at the aft cabin airspeed indicator.
- (5) Attach a vacuum line to pitot tube. This is to equalize pressure within the cockpit airspeed instrument to prevent damage when a vacuum is applied to the static system.

CAUTION: DO NOT USE POSITIVE PRESSURE IN THE STATIC SYSTEM WITH INSTRUMENTS CONNECTED. WHEN APPLYING OR RELEASING VACUUM FROM THE STATIC SYSTEM, DO NOT EXCEED RANGE OF THE VERTICAL SPEED INDICATOR.

- (6) Set the aircraft altimeter to 0.
- (7) Slowly apply vacuum until differential pressure gage on the test set indicates 10.2 inches Hg. and/or the aircraft altimeter reads 11,060 feet.
- (8) Cut off the vacuum and allow system to stabilize.
- (9) The altimeter in the test set and/or the aircraft altimeter shall not drop below 10,840 feet in one minute.

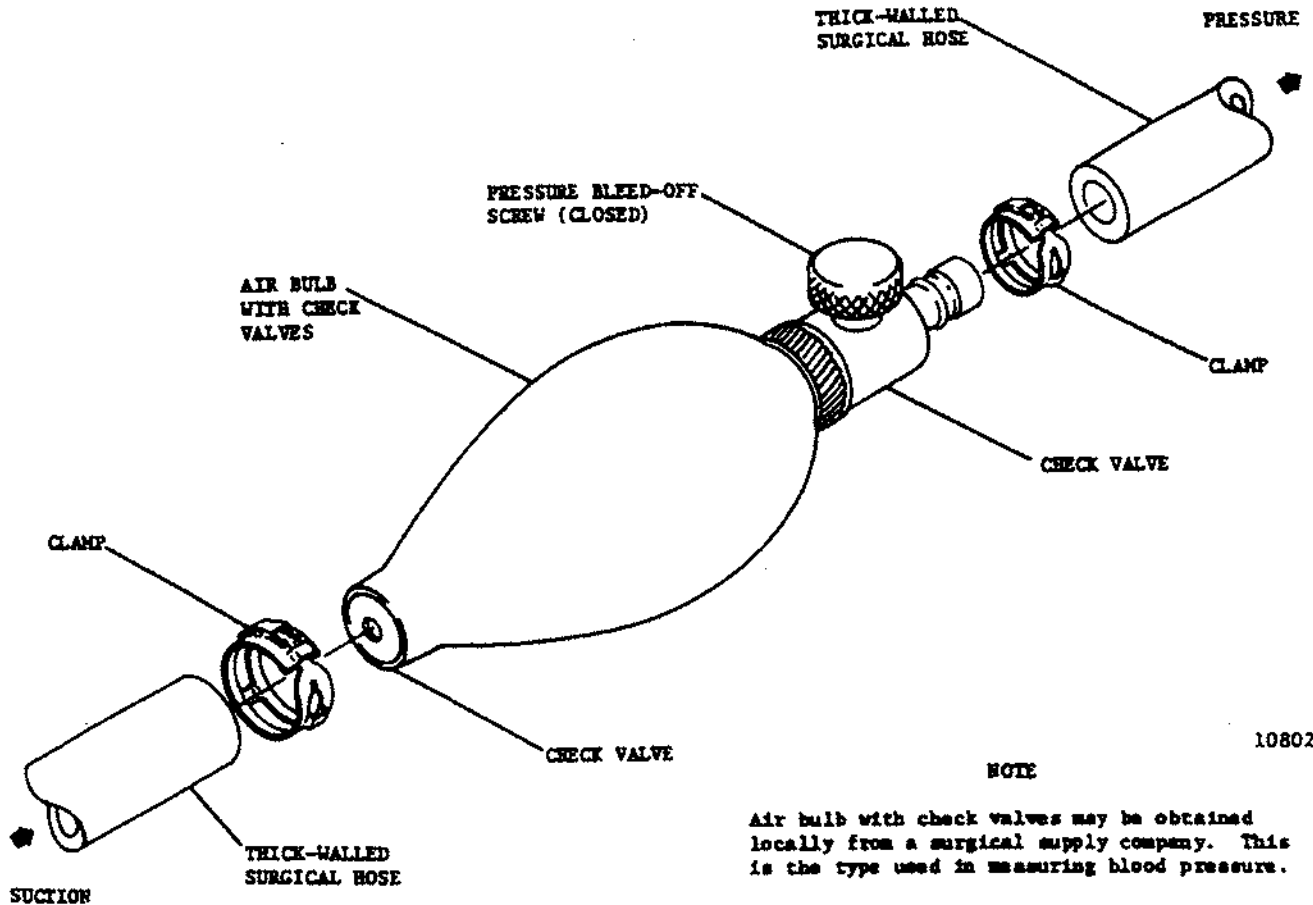
NOTE: Tap indicator lightly during leak check.

- (10) If the system leak rate exceeds 220 feet per minute, refer to Isolation procedure, locate and repair leaks.
- (11) Repeat static test to assure leak rate does not exceed 220 feet per minute.
- (12) Remove static test equipment from static port and connect to alternate static source fitting in nose compartment.
- (13) Position alternate static selector valve to "Alternate" position.
- (14) Repeat Steps 1 through 11.
- (15) If installed, reconnect pitot line at aft cabin airspeed indicator.

D. Isolation Procedures.

If the system leak down rate exceeds 220 feet per minute, the leakage must be located and corrected. Possible sources are the static port assemblies, system connections and fittings, selector and drain valves and instrument case leakage. When checking for excessive leakage, proceed as follows:

- (1) Remove the static line from one of the tail cone static ports and plug the line. Apply vacuum to the system and leak check for one minute as described above. Check the leakage rate. Repeat the above test with the other static port disconnected from the system. If system leak down rate is improved with static ports out of the system, either or both ports are leaking and should be resealed or replaced as follows:
 - (a) Remove static port by drilling out four rivets. Install a tube in the static port, seal the vent hole securely, apply positive pressure while



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TO APPLY SUCTION:

1. Squeeze air bulb to expel as much air as possible.
2. Hold suction hose firmly against static pressure source opening.
3. Slowly release air bulb to obtain desired suction, then pinch hose shut tightly to trap suction in system.
4. After leak test, release suction slowly by intermittently allowing a small amount of air to enter static system. To do this, tilt end of suction hose away from opening, then immediately tilt it back against opening. Continue to admit this small amount of air intermittently until all suction is released, then remove test equipment.

TO APPLY PRESSURE:

1. Connect pressure hose to pitot tube.
2. Slowly squeeze air bulb to apply desired pressure to pitot system. Desired pressure may be maintained by repeatedly squeezing bulb to replace any air escaping through leaks.
3. Release pressure by slowly opening pressure bleed-off screw, then remove test equipment.

Fabrication Pitot-Static System Test Equipment

Figure 5

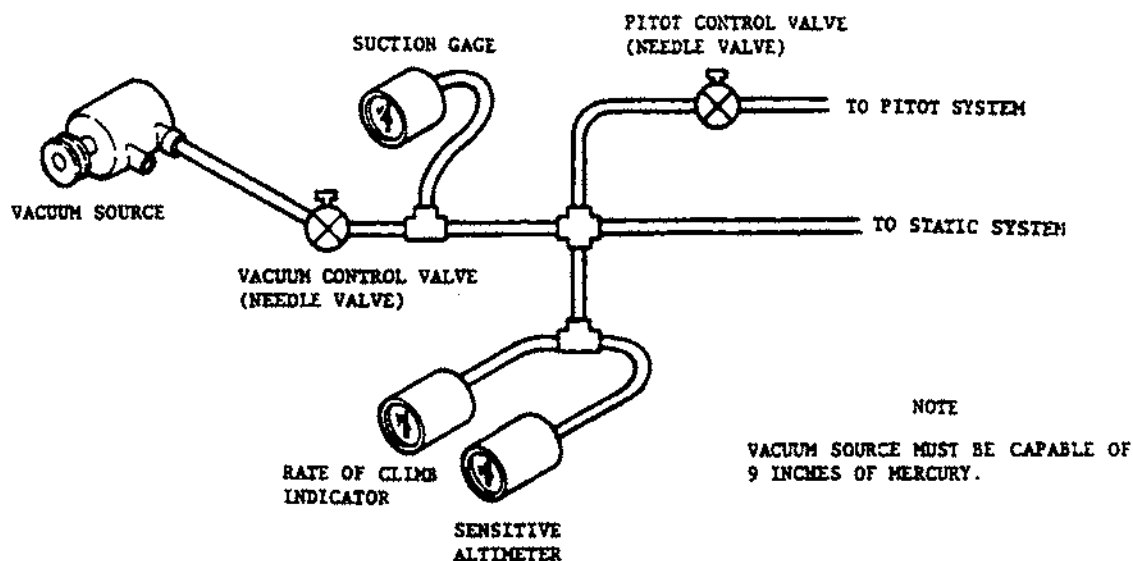
static port is immersed in water to detect leakage. If the static port is leaking, replace it.

- (b) If the static port assembly does not leak, it should be reinstalled and sealed.

NOTE: Insert a wire through the vent hole to prevent sealant from plugging hole. Do not apply vacuum to static port, for a period of 4 hours after resealing to allow sealant to set. Remove wire after sealant has set.

- (2) Connect static port lines together and apply vacuum to 11,060 feet altitude and check leak down rate for one minute.
- (3) If static system leak down rate is still in excess of 220 feet per minute, slowly remove the vacuum source, disconnect and plug cockpit instrument static line at the instrument side of the static drain valve (located at the copilot's side pocket). This isolates the cockpit instruments from the remainder of the system.
- (4) Slowly apply vacuum to the static and pitot systems of the cockpit instruments as described previously (monitor pitot vacuum) until 11,060 feet altitude is indicated. Lock pressure in the system and conduct leak check for one minute.
- (5) A leak rate of less than 220 feet per minute indicates cockpit instrument system is satisfactory and excessive system leakage is isolated to the remainder of the system in the fuselage.
 - (a) Remove line fittings at static system drain valve, aft cabin bulkhead and tail cone sump and make sure fittings are not cracked. Reinstall fittings using a light coating of Parker thread lube or equivalent for sealant.
 - (b) Reconnect the cockpit instrument system and the fuselage system at the static drain valve. Apply vacuum to 11,060 to check leak down rate. If leakage is less than 220 feet per minute, the system is satisfactory.
- (6) A leak down rate in excess of 220 feet per minute while testing cockpit instruments, as described in item (4) above, requires that the leakage be isolated and corrected.
 - (a) Release vacuum from the cockpit instrument system and remove the glove box for easier access to lines behind the instrument panel.
 - (b) Disconnect and plug pitot and static lines between pilot and copilot instrument group (copilot optional instruments) behind the copilot's instrument panel.
 - (c) With pilot's instruments isolated, apply vacuum to the pitot and static systems (monitor airspeed pitot vacuum) until 11,060 feet altitude is reached and conduct leak check for one minute.
 - (d) If leak rate for the pilot's instrument group is less than 220 feet per minute, release vacuum slowly from the system, reconnect pitot and static lines between pilot and copilot instrument groups coupling the cockpit instruments together again.
- (7) The above test indicated excess leakage in the copilot instrument group. Check for leak as follows:
 - (a) Isolate copilot instruments in the following order, one at a time - airspeed rate of climb indicator and altimeter. Disconnect and plug the static line at the instrument (both pitot and static lines for airspeed) and apply vacuum to the remainder of the system, until a 11,060 foot altitude is reached and conduct leak down check for one minute.
 - (b) After each instrument is tested by removing it from the system, lines should be reconnected to each acceptable instrument before proceeding. The results of these tests will show the source of leakage.
 - (c) Instruments found to be leaking excessively should be replaced.
- (8) If the test of the pilot's instruments (6)(d) above indicates a leak rate over 220 feet per minute, the following isolation procedure is required:
 - (a) Release vacuum from the system and isolate instruments in the following order, one at a time - airspeed, rate of climb, cabin differential pressure gage and altimeter. Disconnect and plug the static line at the instrument (both pitot and static lines for airspeed). Apply vacuum to the remainder of the system until the test altitude is reached and check leak down rate for one minute.
 - (b) Reconnect each acceptable instrument to the static system before proceeding. If instruments leak, replace instruments.

NOTE: If leakage is indicated at a point other than the pilot's instruments, be sure to test the static line to the autopilot computer.



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Typical Static System Test Equipment
Figure 6

- (9) With leakage isolated and corrected in the cockpit instrument system and in the fuselage system, reconnect lines to the tail cone static ports. Check security of connections of static lines at the static drain valve.
- (10) Apply vacuum to the complete system (monitor airspeed pitot vacuum) until 11,060 feet is indicated on the altimeters. Lock pressure in the static and pitot systems and check leak down rate for one minute. The altitude loss should not exceed 220 feet per minute.
- (11) Replace glove box, remove test equipment, reconnect pitot line at the aft cabin airspeed, and replace access openings to return the aircraft to service.

CAUTION: IF STATIC DRAIN VALVE IS LEFT OPEN DURING FLIGHT, DAMAGE TO INSTRUMENTS CAN OCCUR.

ANGLE OF ATTACK SYSTEMDescription

1. The angle of attack system (optional) continuously monitors the aircraft's wing lift loading and visually displays the angle of attack by an indicator. The angle of attack system consists of an indicator incorporating a press-to-test circuit (for ground test or inflight test of the system) and a transducer. The indicator is mounted forward of the instrument panel glare shield. The transducer is located on the leading edge of the left wing tip and transmits electrical signals to the indicator for angle of attack display. The transducer incorporates a heater element operated by the pitot heat switch, to prevent ice from hampering the operation of the transducer. The system also incorporates a stall warning circuit which, when energized, causes the stall warning horn to sound.

Maintenance Practices

1. Removal/Installation Angle of Attack Indicator (See Figure 1).

- A. Remove Indicator.

- (1) Ensure aircraft electrical power is off.
- (2) Disconnect electrical connector to indicator.
- (3) Remove cover from indicator by removing screw.
- (4) Remove screws securing indicator to mounting bracket.
- (5) Remove grommet from deck cover; remove indicator.

- B. Install Indicator.

- (1) Insert wire cable of indicator through hole in deck cover.
- (2) Install grommet in deck cover.
- (3) Position indicator on mounting bracket and secure with screws.
- (4) Install cover on indicator with screw.
- (5) Reconnect electrical plug.

2. Removal/Installation Angle of Attack Transducer (See Figure 1).

NOTE: Before removal of transducer, it is important that the exact fore-aft location of the vane be marked on the wing so that the replacement unit may be installed identically.

- A. Remove Transducer.

- (1) Turn all electrical power OFF.
- (2) Remove screws securing transducer to wing tip and pull transducer straight out from tip.
- (3) Disconnect electrical plug.

- B. Install Transducer.

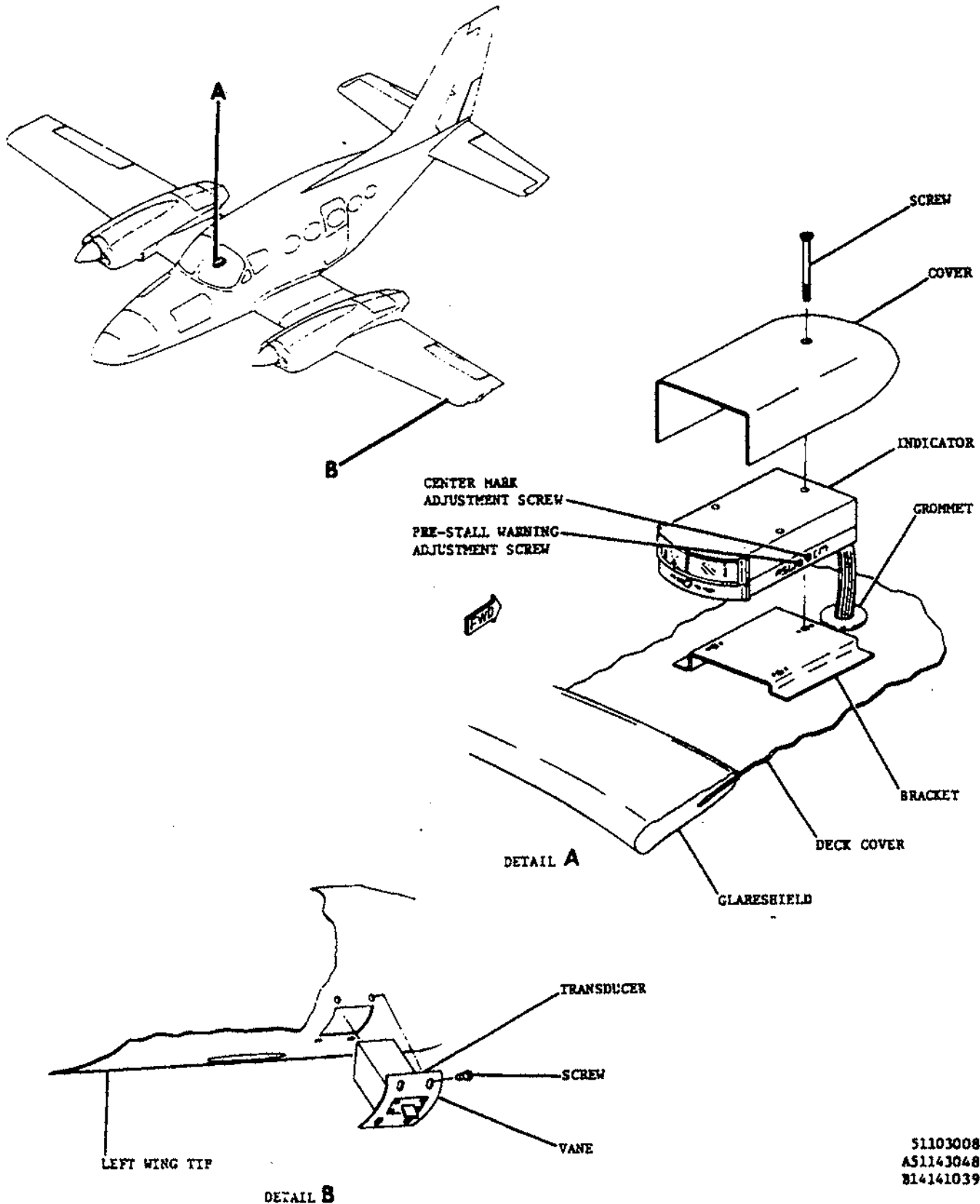
- (1) Connect electrical plug and position transducer in wing tip.
- (2) Install screws.
- (3) Perform operational check.

3. Adjustment/Test Angle of Attack System.

- A. Test Angle of Attack System.

- (1) Move battery switch to ON position. Push the Press-to-Test button on the indicator.
- (2) Check that the indicator needle moves to the left (SLOW) end of scale and the stall warning horn sounds with the needle in the red zone. The needle should return to the SLOW diamond when the button is released.
- (3) Turn the pitot heat switch ON and check to see that the transducer mounting plate on the left wing leading edge heats up.
- (4) Turn pitot heat OFF.

NOTE: The pitot heat switch should not be left on any longer than necessary to determine that mounting plate is heating.



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Angle of Attack System
Figure 1

- (5) Push the transducer vane gently aft (down). Check that the needle moves to the right (FAST) end of scale. When released, the vane should return to approximate center of its travel and the needle should return to the SLOW diamond.
- (6) Push the transducer vane gently forward (up). The indicator needle should move to the left (SLOW) end of scale and the stall warning horn should sound. When released, the vane should return to the approximate center of travel, the needle to the SLOW diamond, and the stall warning horn should stop.
- (7) Turn battery switch OFF.

B. Ground Adjustment Check Angle of Attack System.

- (1) Before applying electrical power to the system, check the SLOW/FAST needle position. It should be at a position midway between the SLOW (left) diamond and the SLOW legend.
- (2) Turn on battery master switch. Check that the aircraft voltage is at least 24 volts.
- (3) Press the test button on the front of the indicator. The needle shall move to the left end of the scale and the pre-stall warning horn shall sound. Release the test button. The SLOW/FAST needle shall return to a position near the SLOW diamond and the prestall warning horn shall stop.
- (4) Remove cover, using a small screwdriver, turn the adjustment screw marked PSW (Pre-Stall Warning), located on the side of the indicator, clockwise until the pre-stall warning horn sounds. Then turn the PSW screw counterclockwise until the horn stops.
- (5) Push the vane on the lift transducer, located on the leading edge of the left wing forward (up). The pre-stall warning horn shall sound. Release the vane and the horn shall stop. If it does not stop within 3 to 4 seconds after the vane is released, turn the PSW adjustment screw counterclockwise one complete turn. Recheck by pushing the vane forward and releasing it to ensure that the horn will stop within 3 to 4 seconds after the vane is released. The system is now ready for flight check and adjustment.

4. Flight Check and Adjustment Angle of Attack System.

A. Flight Check.

- (1) The flight check should be performed in smooth air at a safe altitude to perform stalls. Using the data recorded in the Flight Check portion of the Operational Check of Stall Warning System (Chapter 13), adjust the angle of attack system to provide an "on speed" indication when the indicated airspeed is within ± 2 knots of the approach speed determined from the Approach and Stall Speed Chart, correct for weight at time of the test for the following configurations:
 - (a) Landing gear down.
 - (b) Flaps full down.
 - (c) Power as required to maintain a stable rate of descent at 500 FPM.
- (2) With power off (IDLE), flaps down, gear down, trim the aircraft for a speed approximately 20 knots above the stall speed determined from the Approach and Stall Speed Chart. Then slowly reduce speed at no more than 1 knot per second, and observe the speed at which the pre-stall warning horn sounds. Continue to reduce speed at no more than 1 knot per second until the aircraft stalls, and observe the stall speed. The pre-stall warning horn shall sound 3 to 5 knots before stall. If it does not, proceed as in Steps 3 and 4.
- (3) If the speed at which the horn sounded was greater than 5 knots before stall, turn the PSW (Pre-Stall Warning) adjustment screw on the side of the indicator counterclockwise approximately 1/2 turn for each knob the warning speed must be reduced. Then repeat Step (2) until the warning horn sounds at 3 to 5 knots before stall speed. Do not allow the speed to decrease at greater than 1 knot per second during these checks.
- (4) If the speed at which the pre-stall warning sounded was less than 3 knots before stall, adjustment of the lift transducer location on the wing is required. Land and loosen the screws in the slotted holes in the corners of the lift transducer mounting plate, and slide the transducer forward (up) on the wing tip. Retighten screws and repeat Step (2) and Step (3) if necessary. Do not attempt to increase the warning horn speed by turning the PSW adjustment screw clockwise, as the maximum clockwise setting was determined in the ground adjustment check steps 4 and 5. Any further clockwise adjustment will cause the horn to sound when the aircraft is at rest on the ground.
- (5) After the pre-stall warning horn is properly adjusted, determine the weight of the aircraft. Using the Approach and Speed Chart, find the approach speed.

- (6) With flaps and gear down, trim the aircraft for level flight at speed determined in Step (5). Altitude hold may be used to facilitate this adjustment, if available. Maintaining this speed, observe the position of the SLOW/FAST needle. It should be at the center mark. If the needle is to the left of the center mark, turn the adjustment screw marked CM (Center Mark), located on the side of the indicator, clockwise. If it is to the right of the center mark, turn the adjusting screw counterclockwise. Make the adjustment in steps of 2 to 3 turns in the appropriate direction, then recheck the needle position and the airspeed to ensure that the speed is being maintained at the proper value.
- (7) After completion of the flight check and alignment, replace the cover on the indicator and secure in place.

CESSNA AIRCRAFT COMPANY

421

SERVICE MANUAL

CHAPTER

11

HYDRAULIC

CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL

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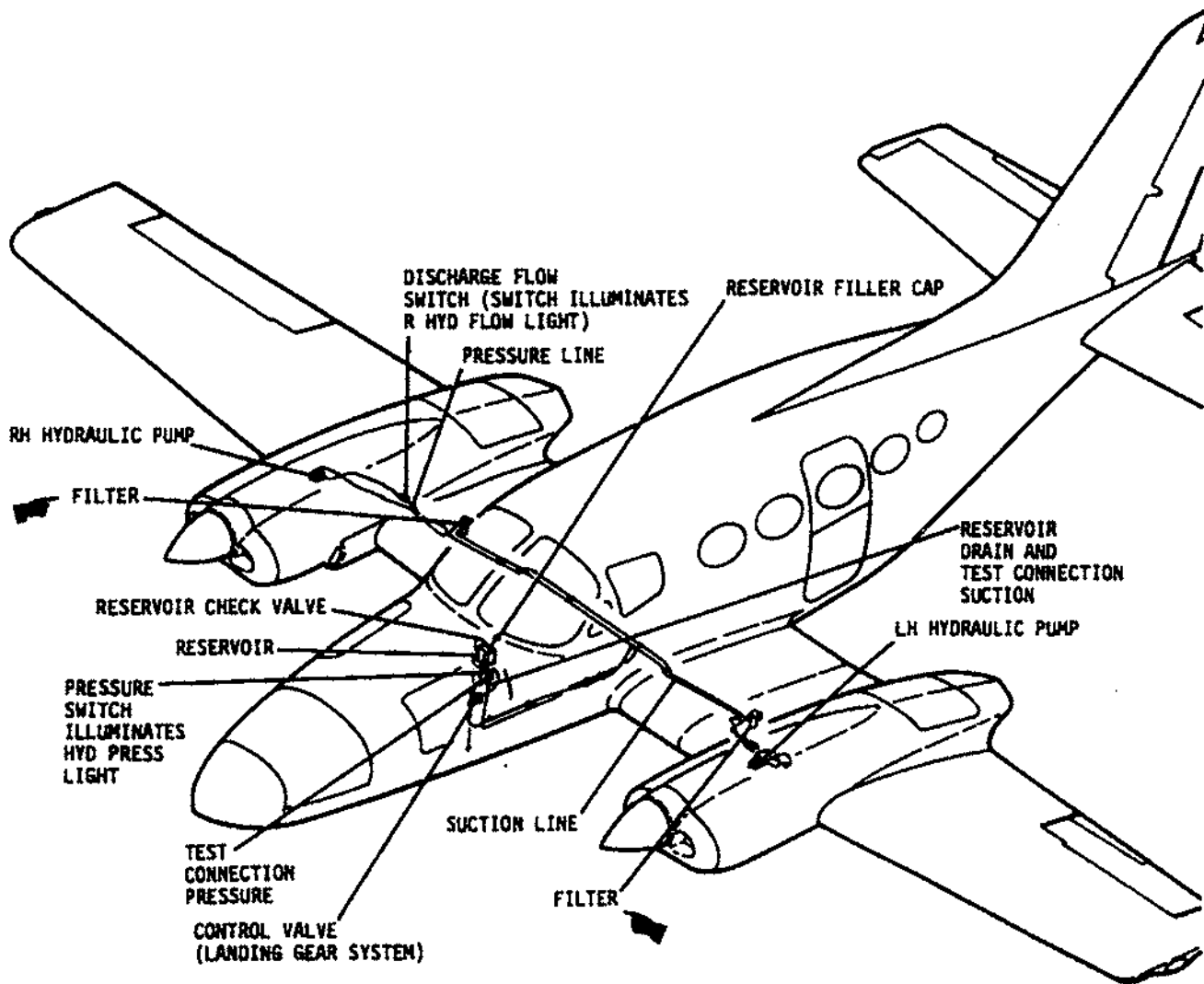
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COMPONENTS LOCATION CHART
Hydraulics

<u>Components</u>	<u>Location</u>
Flow Switch	Adjacent to Hydraulic Pump and Filter
Hydraulic Pressure Switch	Hydraulic Manifold Assembly in Each Wing

MAIN HYDRAULIC SYSTEMDescription

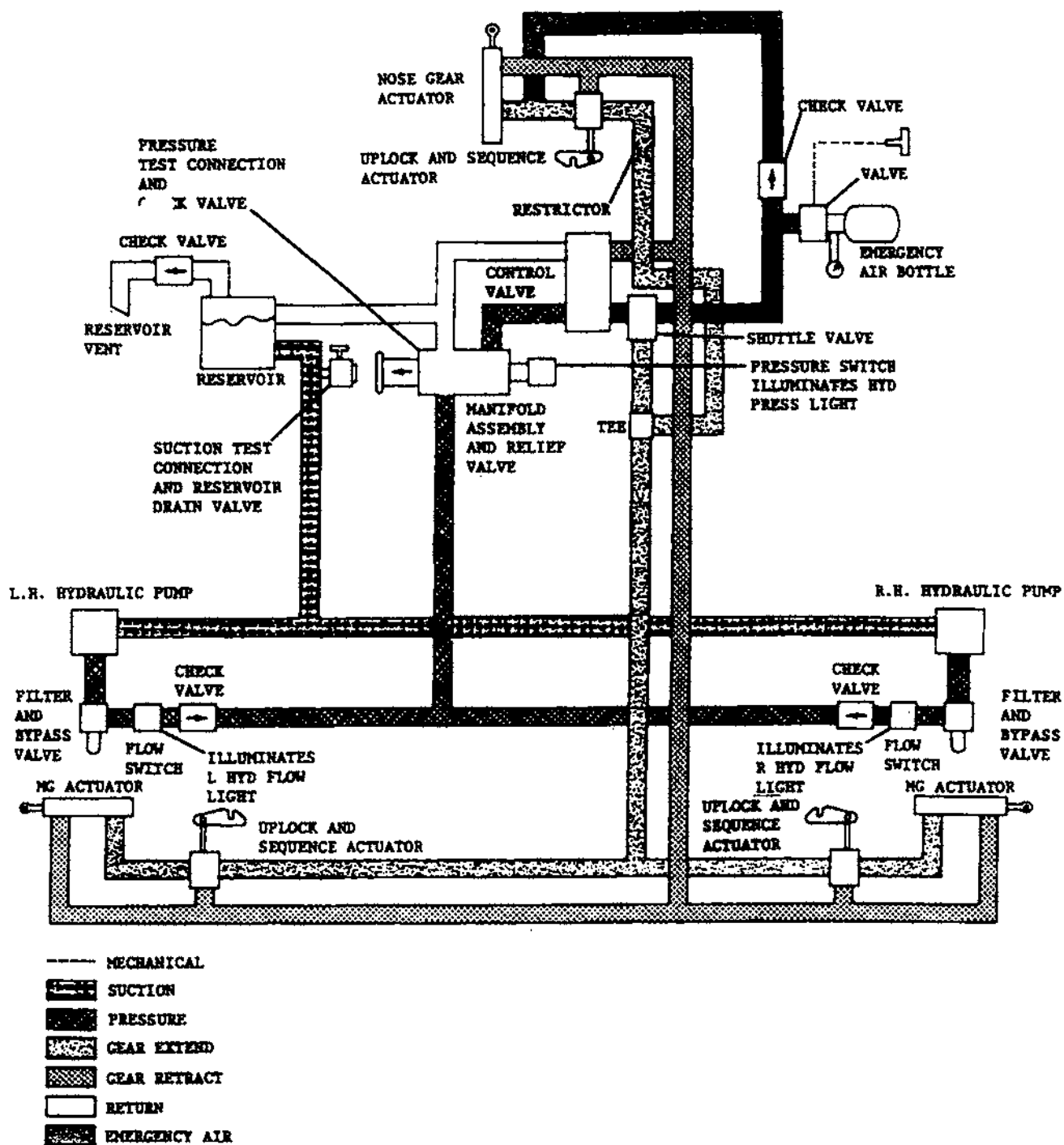
1. The hydraulic system is utilized to power the landing gear system. The hydraulic system consists of: a fluid reservoir, hydraulic manifold assembly, engine-driven pumps, filters, indicating systems, ground test connections and check valves. This chapter does not include hydraulic components for the landing gear system. For landing gear system information, refer to Chapter 4.
2. The hydraulic system operating pressure is 1750 psi, furnished by the engine-driven pumps and controlled by the relief valve in the manifold assembly. A normally open manifold assembly allows flow of hydraulic fluid from the pressure side to the return side of the reservoir. When the landing gear system is actuated, electrical power is applied to the manifold assembly solenoid and the manifold loading valve closes and hydraulic fluid is routed to the landing gear system and reservoir by the electrically operated control valve. When the landing gear has reached the selected position, the manifold loading valve opens and fluid pressure will bypass the control valve and flow through the manifold assembly back to the reservoir.
3. Ground Test Connections.
 - A. Ground test connections are incorporated in the system, one below the reservoir (suction) and one at the manifold assembly (pressure) for utilizing ground test equipment. The test connection below the reservoir incorporates a drain valve for draining the reservoir (drain valve must be open with test cart connected). The test connection (pressure) at the manifold assembly is a check valve, which prevents system fluid spillage and reverse flow from manifold assembly. When test stand is connected.
4. Hydraulic Fluid Reservoir
 - A. The reservoir is mounted on the forward pressure bulkhead. The reservoir incorporates an external filler cap (located on the exterior skin adjacent to the baggage door), strainer, baffle and fluid level sight gage. A check valve is incorporated in the reservoir. The check valve opens at 10 psi on 421C0001 thru 421C0154 and at 25 psi on 421C0155 and On, allowing flow overboard should over-pressurization occur.
5. Hydraulic Manifold Assembly
 - A. The hydraulic manifold assembly is solenoid (electrically) operated and serves as a bypass valve. The manifold assembly incorporates the solenoid loading valve and pressure relief valve. Also, a pressure switch (hydraulic pressure indicating system) and check valve (pressure test connection) are installed in the manifold. Each port of the manifold assembly is individually marked to show direction of flow and to prevent improper plumbing. The manifold assembly is normally open (deenergized) and routes hydraulic fluid from the pressure line to the return line of the reservoir. When the landing gear system is actuated, electrical power energizes (closes) the manifold assembly loading valve, allowing fluid flow to the control valve which controls fluid flow to the landing gear system.
6. Hydraulic Pumps.
 - A. The hydraulic pumps are engine-driven. Each pump is mounted on an accessory pad of its respective engine. When optional air conditioning system is installed, the right-hand pump is mounted on the back of the air conditioning system hydraulic pump. The hydraulic pumps are fixed displacement gear type. Each pump supplies approximately 2.5 GPM at takeoff RPM and output pressure of 1750 psi. If one pump should malfunction, the opposite pump can power the hydraulic system.
7. Hydraulic Filters
 - A. A filter is installed in the pressure line from each hydraulic pump. These filters have three (3) GPM nominal capacity, 5 to 10 micron nominal rating and 15 micron absolute rating. Each filter incorporates a bypass valve that opens with a pressure differential of 50 psi; allowing fluid to bypass the filter element should it become clogged.



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Hydraulic System Component Location
Figure 1

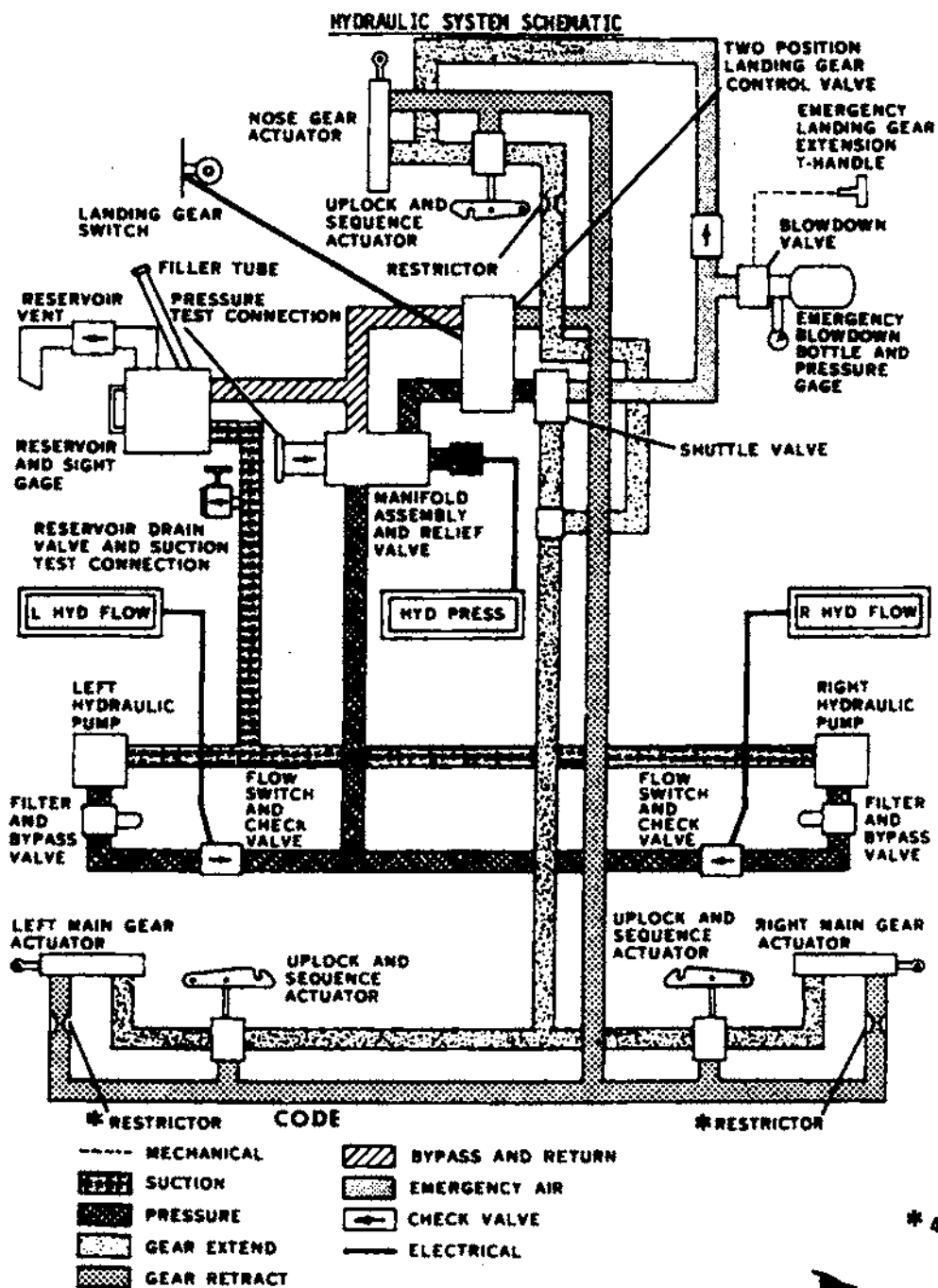
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AIRPLANES C0001 THRU C0600

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Hydraulic System Schematic
Figure 2 (Sheet 1 of 2)



* 421C0801 AND ON

421C0601 AND ON

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Hydraulic System Schematic
Figure 2 (Sheet 2)

8. Check Valves

- A. A check valve is connected to the discharge flow switch downstream of each engine-driven pump. Each check valve function is to prevent reverse fluid flow through the opposite pump should an engine malfunction exist. A check valve is installed in the reservoir vent line to prevent foreign material from contaminating the hydraulic system. Also in the nose gear blowdown line is a check valve, it prevents hydraulic oil, under pressure, from entering the blowdown line.

9. Hydraulic Indicating System.

A. Hydraulic Pressure Indicating System.

- (1) The hydraulic pressure indicating system is utilized to indicate hydraulic pressure is flowing to the landing gear system when actuated and that the manifold valve has closed. The system consists of: a pressure switch and HYD PRESS light located on the annunciator panel. The pressure switch is installed in one of the pressure ports of the manifold assembly. The switch is normally open and actuates with hydraulic pressure above 155 psi.

B. Hydraulic Flow Indicating System.

- (1) The hydraulic system incorporates two hydraulic flow indicating systems, one for each engine-driven pump, each system is independent of the other. Each system consists of a discharge flow switch and L or R HYD FLOW indicating light on the annunciator panel. The discharge flow switch is incorporated in the pressure line of each engine-driven pump downstream of the filter. The switch is normally closed and is set to close on decreasing fluid flow of 1.25 GPM.

Troubleshooting

1. Tools and Equipment.

NOTE: Equivalent substitutes may be used instead of the following items.

Name	Number	Manufacturer	Use
Hydraulic Test Stand	SE 1300 or SE 589*	Cessna Aircraft Co. Wichita, Kansas	Test hydraulic system.
Container		Commercially Available	Catch spillage from lines.
Eye Protectors		Commercially Available	Protect eyes from hydraulic fluid.
Multimeter	Model 260	Simpson Electric Co.	Voltage and continuity check.

*When modified by SK421-68.

2. General Troubleshooting

- A. To successfully troubleshoot the hydraulic system, it is necessary to have a clear understanding of the operation of the system. After the system and its operation is clearly understood, an orderly analysis of what can cause improper operation can be made. Common areas of trouble are: electrical malfunctions, insufficient fluid, air in the system, leaks and clogged lines or fittings.
- B. The location and elimination of trouble in a particular unit can usually be traced to one or more of the following: leaks, either internal or external; foreign particles clogging or holding open some part of a unit; improper adjustment; mechanical damage; structural damage; or excessive clearance resulting from wear. When the trouble is isolated to a particular unit, remove it from the aircraft for overhaul or installation of a new unit.

NOTE: When a hydraulic unit has been changed or hydraulic lines have been disconnected, check the affected system under pressure for leaks and proper operation before placing the aircraft in service.

C. Tube Leaks and Failures.

- (1) Trouble in the tubing may be broadly classified into two groups; leaks and failures.

D. Cause of Leaks at Flared Joints.

- (1) Poor flare, rough surface, cracks and splits.
- (2) Damage to flare.
- (3) Foreign material under flare.
- (4) Improper wrench torque.
- (5) Insufficient support of tubing.
- (6) Badly fitted or mismatched parts.
- (7) Careless assembly.
- (8) Threads seized or galled.

E. Causes of Leaks at Straight-Threaded Joints Using Packings.

- (1) Improper positioning of packing on fitting.
- (2) Improper use of back-up rings.
- (3) Fitting not properly positioned in boss.
- (4) Insufficient wrench torque to squeeze packing and make seal.
- (5) Careless assembly.
- (6) Packing not lubricated.

F. Tubing Failures.

- (1) Vibration resulting from chattering or insufficient support and rubbing contact is the cause of most tubing failures.

G. Premature Hydraulic Pump Failure.

- (1) Check packing in reservoir filler neck for damage or missing.
- (2) Check clamps and fittings from reservoir for leaks.

3. Troubleshooting Hydraulic System

- A. For a guide to troubleshooting the hydraulic system, refer to Figure 3.

Maintenance Practices**1. General Maintenance Practices**

NOTE: Before any maintenance is performed on the hydraulic system, personnel should read and thoroughly understand the following precautions. Careful adherence to these instructions will aid in maintaining a functional and troublefree system.

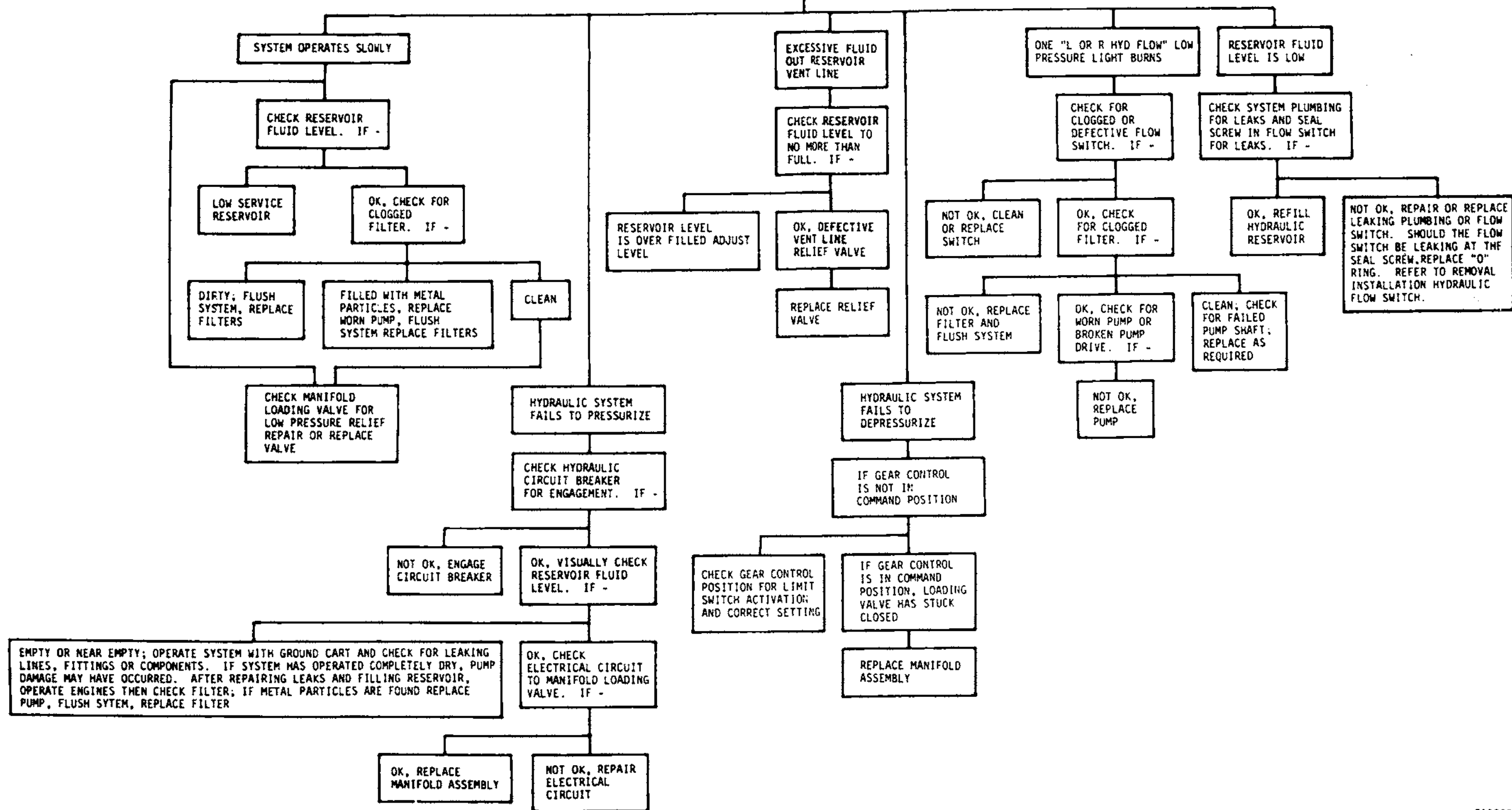
A. Safety Precautions.

- (1) Wear eye protection when pressure testing components or systems and any time there is a possibility of fluid splashing into eyes.
- (2) If fluid splashes into eyes, treat eyes immediately by irrigating thoroughly with clear, cold water.

B. Technical Precautions.

- (1) Keep fluid spillage to an absolute minimum, place rags under fittings before disconnecting lines. Clean up spilled hydraulic fluid immediately to prevent entry into adjacent areas of the aircraft, and to prevent future false hydraulic leak reports. If spillage occurs, wipe up the fluid with a dry cloth and wash area with naphtha, Federal Specification P-D-680 (Type 1) or a high flash Stoddard solvent.
- (2) When lines are disconnected and/or components are removed, provide suitable protection to prevent foreign material from entering the lines or components by use of caps or covers.
- (3) Always check position and angle of all fittings removed from components to ensure placement and alignment on installation or replacement components.
- (4) When washing metal parts before assembly, use only naphtha, Federal Specification P-D-680 (Type 1) or a high flash Stoddard solvent, and ensure that all traces of the solvent are removed before assembly.

THE HYDRAULIC SYSTEM FAILS TO MAINTAIN OPERATING FLOW OR PRESSURE. IF -

Troubleshooting Chart - Hydraulic System
Figure 3

51988005

- (5) When washing rubber parts or assemblies containing exposed rubber parts, use only Methyl-Ethyl-Ketone.
- (6) Use only clean hydraulic fluid for flushing or testing hydraulic components.
- (7) Use only clean fluid when filling reservoir.
- (8) Do not unpack packings and seals until they are required and ensure that only approved rings and seals are used.
- (9) When assembling hydraulic system packings and seals, lubricate only with hydraulic fluid. Always lubricate packings and seals immediately before installation. Threaded fittings should be assembled without the use of lubricants whenever possible. If a lubricant is required to prevent galling or to otherwise ease installation, use hydraulic fluid.

CAUTION: TAKE SPECIAL CARE TO AVOID CONTAMINATION OF PACKINGS AFTER LUBRICATION.

- (10) Take care to prevent contamination of hydraulic fluid with other oils, water or dirt.
- (11) If system becomes contaminated, drain the system and flush with clean hydraulic fluid.
- (12) When interfacing the airplane system with service unit or fluid supply, all precautions listed are also applicable to the interfacing equipment. Ensure that fluid type is compatible and all precautions for cleanliness are observed before the equipment is connected.

2. Drain Hydraulic Fluid Reservoir.

A. Drain Reservoir.

- (1) Attach hose or tube to reservoir drain valve (suction test connection), place hose or tube in container to catch drain fluid. Open drain valve.

3. Servicing Hydraulic Fluid Reservoir.

- A. The reservoir may be serviced with ground test equipment or manually. For Servicing, refer to Chapter 2.

4. Bleeding Airplane Hydraulic System.

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

- A. Jack airplane, refer to Chapter 1.
- B. Connect test stand to airplane at ground test connections (see Figure 1).
- C. Use test stand to operate landing gear through five complete cycles.
- D. Use only clean filtered hydraulic fluid (MIL-H-5606) to fill hydraulic system and test stand.

Inspection/Check

1. General

- A. The airplane is equipped with two engine-driven pumps, these pumps may be the source of contamination of the hydraulic system fluid. In addition, contamination may enter the system through inadvertent use of externally contaminated fluid or improper type of fluid, either when the reservoir is filled or when a test stand is connected to the system. Fluid contamination must be guarded against and; when discovered, must be removed immediately to prevent damage to the various system components and possible failure of the hydraulic systems.

- B. Contamination may consist of foreign particles (metal, rubber, dirt), fluids other than MIL-H-5606 and hydraulic fluids which because of excessive heat is not suitable for use in the hydraulic system.
- C. The hydraulic system filters ordinarily remove the minor contamination associated with normal wear. These filters are equipped with disposable elements to be replaced at regular intervals, refer to Chapter 2, Inspection and Servicing.
- D. Contamination which requires the system to be flushed is usually the result of:
 - (1) A damaged unit such as pump failure.
 - (2) Overheated fluid or diluted fluid.
 - (3) A malfunctioning system where contaminated fluid is a possible cause.

2. Purpose of Inspection.

- A. The purpose of this procedure is to provide a logical guide for removing contamination (foreign particles) from the hydraulic fluid, units and lines of the hydraulic system.
- B. Deviation from this procedure may be dictated by individual circumstances. Overheated or diluted fluid removal would follow generally the same procedure with the exception that the contaminated fluid would be caught in separate containers rather than recirculated through the test stand.

3. Detection of Hydraulic Fluid Contamination

A. Detecting Contamination.

- (1) Check filter elements and bowl for visible contamination.
- (2) Take samples of hydraulic fluid from the system and check for visible signs of contamination.

4. Tools and Equipment.

NOTE: Equivalent substitutes may be used instead of the following listed items.

Name	Number	Manufacturer	Use
Hydraulic Test Stand	SE 589*	Cessna Aircraft Co. Wichita, KS 67277	Test hydraulic system.
Container		Commercially available	Catch spillage from lines.
Eye Protectors		Commercially available	Protect eyes from hydraulic fluid.
Hand Pump 0 to 10,000 psi equipped with filter and 0 to 4000 psi gage)		Commercially available	To pressurize lines for leak test.
Needle Valve 3000 psi		Commercially available	To maintain line pressure
Hydraulic Hose	Size 6	Commercially available	General in line leak test.

*When modified by SK421-68.

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MODEL 421
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5. Flush Hydraulic System

A. Flush System.

- (1) Jack airplane, refer to Chapter 1, Lifting and Shoring.
- (2) Disconnect lines from back side of nose and main gear uplock actuators. Cap actuators and lines.
- (3) Disconnect lines from nose and main gear actuators, engine-driven hydraulic pumps. Reconnect lines with appropriate fittings to allow flow through the system. Cap actuator and pump ports.
- (4) Remove nose compartment left aft baggage retainer.
- (5) Connect ground test cart to ground test connections (pressure line connect to manifold check valve fitting and suction line to reservoir drain valve).
- (6) Open reservoir drain valve.

WARNING: RESERVOIR DRAIN VALVE MUST BE IN "OPEN" POSITION AT ALL TIMES, WHEN THE GROUND TEST CART IS CONNECTED TO THE AIRPLANE.

- (7) Check security of reservoir filler plug.
- (8) Apply electrical power to airplane.
- (9) Adjust ground test cart to zero flow and turn power ON.
- (10) Adjust flow to five gallons-per-minute (GPM).
- (11) Maintain flow while cycling gear handle up and down periodically.
- (12) System should be adequately flushed at the end of a five minute period. Periodically check return filter in ground test cart for gross contamination.

NOTE: A grossly contaminated filter may generate a higher than normal back pressure indicated on the carts low pressure gage.

- (13) Shut down test cart.
- (14) Turn off airplane's electrical power.
- (15) Reconnect all lines to their respective component with their original fittings and lines.
- (16) Remove and replace hydraulic system filter elements.
- (17) Apply power to ground test cart.
- (18) Apply electrical power to airplane.
- (19) Cycle gear several times to assure proper operation and system does not leak.
- (20) Turn OFF electrical power to airplane.
- (21) Shut down ground test cart.
- (22) At test cart shut down, airplane reservoir will be full. Reservoir should slowly drain down into cart through the return line hose. When fluid level reaches "Max Full" the reservoir drain shall be closed.
- (23) Disconnect ground test cart from hydraulic system test fitting. Install caps on hydraulic system test fittings.
- (24) Remove jacks.

6. Hydraulic Pressure Lines Leak Test

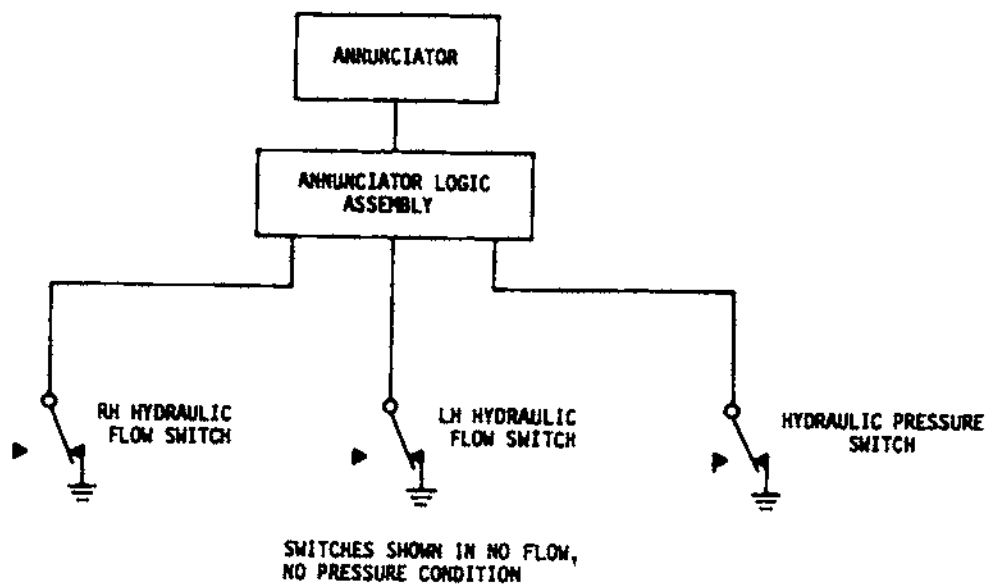
A. Inspection Instructions.

NOTE: The airplane hydraulic system must be fully serviced and operational prior to accomplishment of the following:

- (1) Jack the airplane until the tires clear the floor. Refer to Chapter 1, Lifting and Shoring.
- (2) Connect an external electrical power supply. Disengage all circuit breakers except LDG GEAR.

NOTE: Electrical power must be applied throughout test. Battery switch must be in the OFF position when external power supply is utilized.

- (3) Position the gear to a down but not locked position.
- (4) Connect test equipment to the airplane hydraulic system. (Refer to Figure 5.)
 - (a) Gain access to hydraulic system reservoir return line.
 - (b) Disconnect the hydraulic system return line from hydraulic reservoir.
 - (c) Rotate the return line elbow in the side of reservoir approximately 180 degrees (opening up).



Hydraulic System Simplified Schematic
Figure 4

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MODEL 421
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- (d) Cap the elbow as shown to prevent system contamination and spillage of reservoir hydraulic fluid.
- (e) Procure fittings and hose as required to provide an arrangement capable of positive shutoff of the hydraulic system return line and also capable of bleeding off system pressure into a metal container as shown.
- (f) Remove the discharge line from the engine-driven hydraulic pump in each nacelle and cap the pump port using an AN929-6 Cap.
- (g) Procure fittings and hose as required to connect the hand-operated hydraulic pump, gage and shutoff valve to the left hydraulic system pressure hose as shown.

NOTE: Ensure the hand-operated hydraulic pump is serviced with filtered MIL-H-5606 hydraulic fluid.

- (5) Vent the right hydraulic pressure hose into a metal container for observation of possible leakage. There must be no leakage during the entire pressure test.

NOTE: Leakage of fluid from the right pump pressure hose indicates a failed check valve.

- (6) Tighten the cap on the end of the hose attached to the return line to allow no leaks.
- (7) Place the gear handle in the full retract position.
- (8) Using the hand pump, apply 2625, +50, -50 psi to the hydraulic system and observe the following:
 - (a) Allow one minute for the system pressure to stabilize. If necessary, adjust the pressure to 2625, +50, -50 psi and tighten shutoff valve at the hand pump.
 - (b) Verify that no fluid is leaking from the test equipment lines or fittings.
 - (c) Allow system to remain pressurized for a minimum of three minutes and check gage for pressure drop.

WARNING: WHENEVER BLEEDING OFF HYDRAULIC FLUID THROUGH THE CAP AT THE END OF THE HYDRAULIC SYSTEM RETURN LINE, EXERCISE EXTREME CAUTION AND WEAR EYE PROTECTION. HIGH PRESSURE HYDRAULIC FLUID ESCAPING FROM FITTINGS CAN CAUSE SERIOUS INJURY.

- 1) If the pressure did not drop within the three-minute period, do not bleed off the system pressure at this time. Proceed to step (9).

WARNING: HIGH PRESSURE HYDRAULIC FLUID ESCAPING FROM LINES, FITTINGS AND COMPONENTS CAN CAUSE SERIOUS INJURY. USE EXTREME CAUTION AND WEAR EYE PROTECTION WHEN CHECKING FOR LEAKS.

- 2) If there was a pressure drop within the three-minute period, carefully examine all hydraulic pressure line components and fittings for leakage.
 - a) Repair any leaks as required, and reperform steps (8), (a) through (8), (c), 2).
- (9) While the hydraulic system is still pressurized, place the gear handle to the full extend position and carefully loosen the cap in the metal container at the end of the reservoir return line. Observe that the landing gear is positioned in the down and locked position.

NOTE: The cap at the end of the return line in the metal container must be loose enough to allow system fluid movement. The intent of this step is to ensure that the actuators are fully extended.

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WARNING: HIGH PRESSURE HYDRAULIC FLUID ESCAPING FROM LINES, FITTINGS AND COMPONENTS CAN CAUSE SERIOUS INJURY. USE EXTREME CAUTION AND WEAR EYE PROTECTION WHEN CHECKING FOR LEAKS.

- (10) Bleed the system pressure off (through the cap in the metal container at the end of the reservoir return line) and remove the hand-operated hydraulic pump with gage, test hose and fittings.

WARNING: WHENEVER RELIEVING HYDRAULIC FLUID THROUGH THE CAP AT THE END OF OF THE HYDRAULIC SYSTEM RETURN LINE, EXERCISE EXTREME CAUTION AND WEAR EYE PROTECTION. HIGH PRESSURE HYDRAULIC FLUID ESCAPING FROM FITTINGS CAN CAUSE SERIOUS INJURY.

- (11) Connect the hand-operated pump, gage and shutoff valve to the right hydraulic system pressure hose as shown.
- (12) Vent the left hydraulic pressure hose into a metal container for observation of possible leakage. There must be no leakage during the entire pressure test.

NOTE: Leakage of fluid from the left pump pressure hose indicates a failed check valve.

- (13) Tighten the cap on the end of the hose attached to the return line to allow no leaks.
- (14) Using the hand pump, apply 2625, +50, -50 psi to the hydraulic system and observe the following:
 - (a) Allow one minute for the system pressure to stabilize. If necessary, adjust the pressure to 2625, +50, -50 psi and tighten shutoff valve at the hand pump.
 - (b) Verify that no fluid is leaking from the test equipment, lines or fittings.
 - (c) Allow the system to remain pressurized for a minimum of three minutes, then check gage for pressure drop.

WARNING: WHENEVER BLEEDING OFF HYDRAULIC FLUID THROUGH RETURN LINE, EXERCISE EXTREME CAUTION AND WEAR EYE PROTECTION. HIGH PRESSURE HYDRAULIC FLUID ESCAPING FROM FITTINGS CAN CAUSE SERIOUS INJURY.

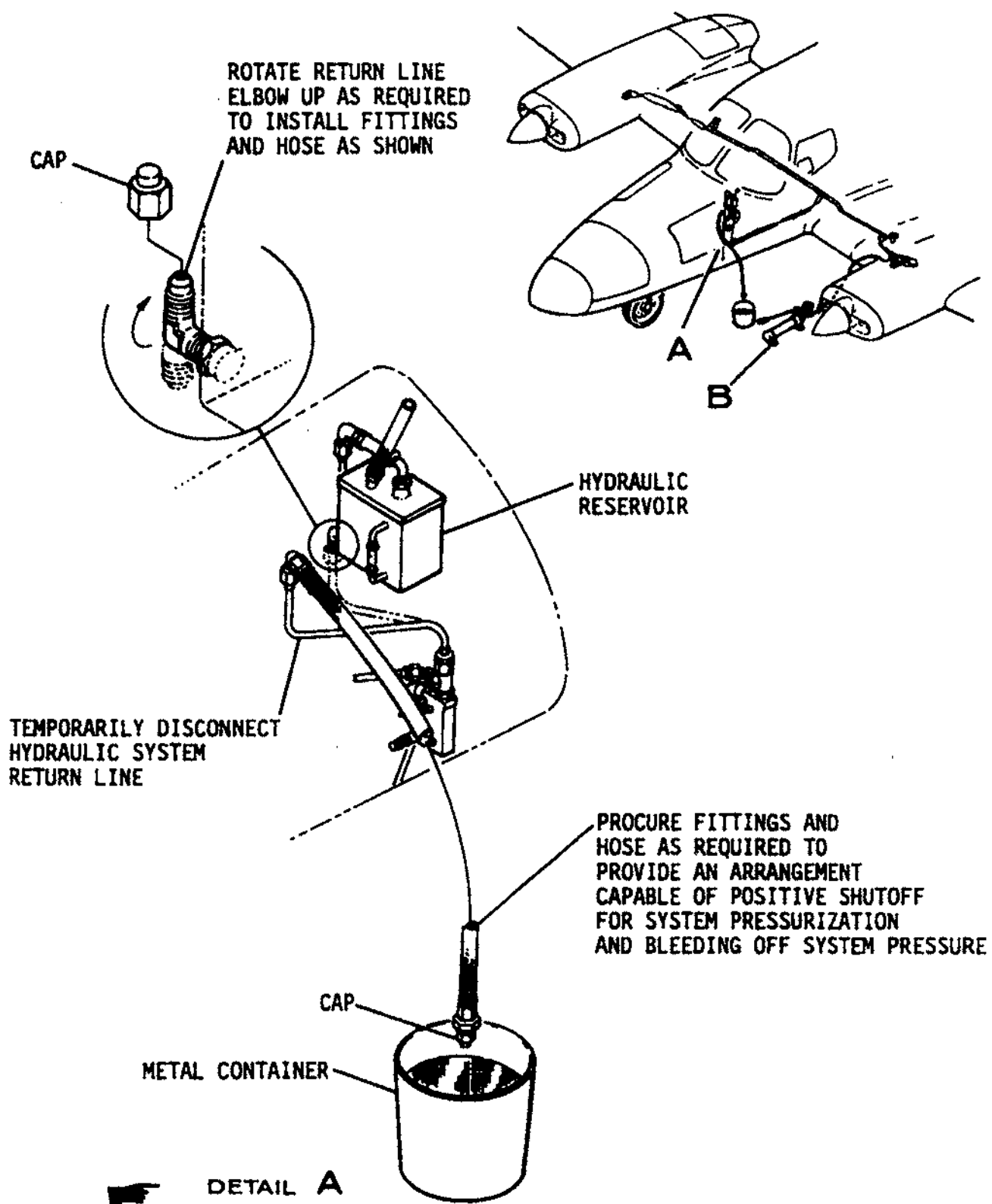
- 1) If the pressure did not drop within the three-minute period, (through the cap in the metal container at the end of the reservoir return line) bleed off the system pressure and remove the hand-operated hydraulic pump, gage, test hoses and fittings. Proceed to step (15).

WARNING: HIGH PRESSURE HYDRAULIC FLUID ESCAPING FROM LINES, FITTINGS AND COMPONENTS CAN CAUSE SERIOUS INJURY. USE EXTREME CAUTION AND WEAR EYE PROTECTION WHEN CHECKING FOR LEAKS.

- 2) If there was a pressure drop within the three-minute period, carefully examine the hydraulic lines, components and fittings from the hand-operated pump to the inline check valve just downstream from the right engine-driven pump.

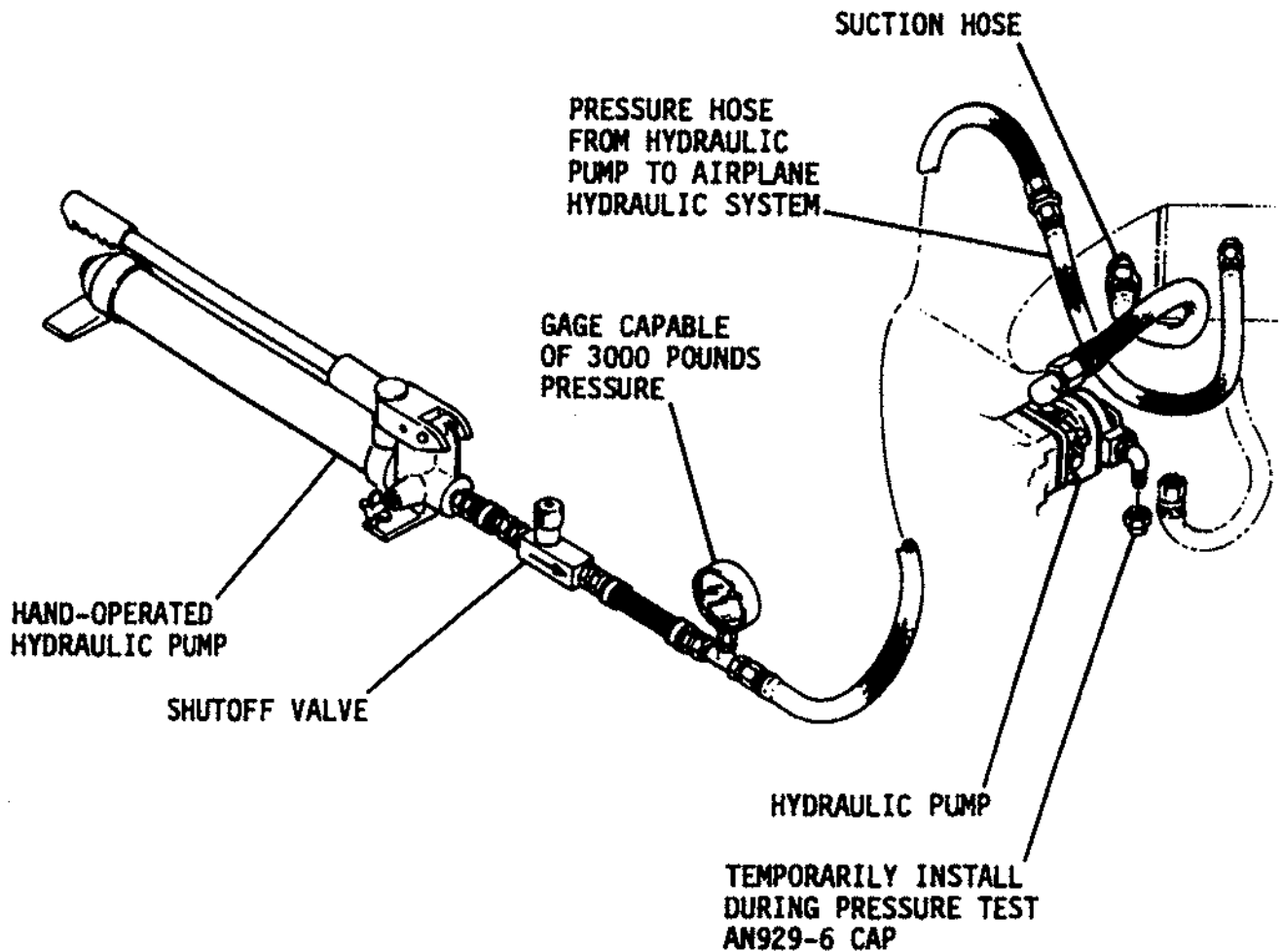
NOTE: All other lines were previously pressure checked.

- 3) Repair any leaks as required, and reperform steps (14) through (14), (c) 2).
- (15) Remove all test equipment and reconnect hydraulic system lines disturbed during the pressure test.
- (16) Service the airplane hydraulic system and cycle the gear at least five times.
- (17) Check for leaks at the hydraulic reservoir return line and hydraulic pump pressure hose connections.
- (18) Reinstall the left and right engine upper cowls.
- (19) Remove external electrical power source.



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Hydraulic System Test Connections
Figure 5 (Sheet 1 of 2)



DETAIL B

TYPICAL BOTH SIDES

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Hydraulic System Test Connections
Figure 5 (Sheet 2)

HYDRAULIC RESERVOIR AND MANIFOLD ASSEMBLYDescription

1. The hydraulic fluid reservoir and manifold assembly are mounted on the forward side of the forward cabin pressure bulkhead. Access to the units and plumbing is gained by removing the LH aft baggage retainer in the nose baggage compartment. For individual component descriptions, refer to Main Hydraulic System.

Maintenance Practices

NOTE: Before performing maintenance personnel should read and adhere to General Maintenance Practices, refer to Main Hydraulic System.

CAUTION: IF ANY PART OF THE HYDRAULIC SYSTEM IS OPENED, THE LANDING GEAR MUST BE CYCLED A MINIMUM OF 5 TIMES.

1. Removal/Installation Hydraulic Reservoir (Figure 1).

- A. Remove Reservoir.

- (1) Remove LH aft baggage retainer in nose compartment, refer to Chapter 3.
 - (2) Drain reservoir, refer to Main Hydraulic System, General Maintenance Practices.
 - (3) Disconnect and cap all lines and fittings from reservoir.
 - (4) Remove reservoir by removing screws and washers.
 - (5) If new reservoir is being installed, remove all fittings and sight gage.

- B. Install Reservoir.

- (1) Install fittings and new packings in reservoir, if removed.
 - (2) Position reservoir in place and secure with screws and washers.
 - (3) Remove caps and connect suction line, filler hose, vent line and return line to reservoir.
 - (4) Position airplane on jacks, refer to Chapter 1.
 - (5) Connect ground test cart to test connections.
 - (6) Perform landing gear operational test, refer to Chapter 4. Check system for leaks.
 - (7) After completion of operational test, ensure reservoir fluid level is at "MAX FULL." Disconnect test cart and cap test connections.
 - (8) Install LH aft baggage retainer, refer to Chapter 3.

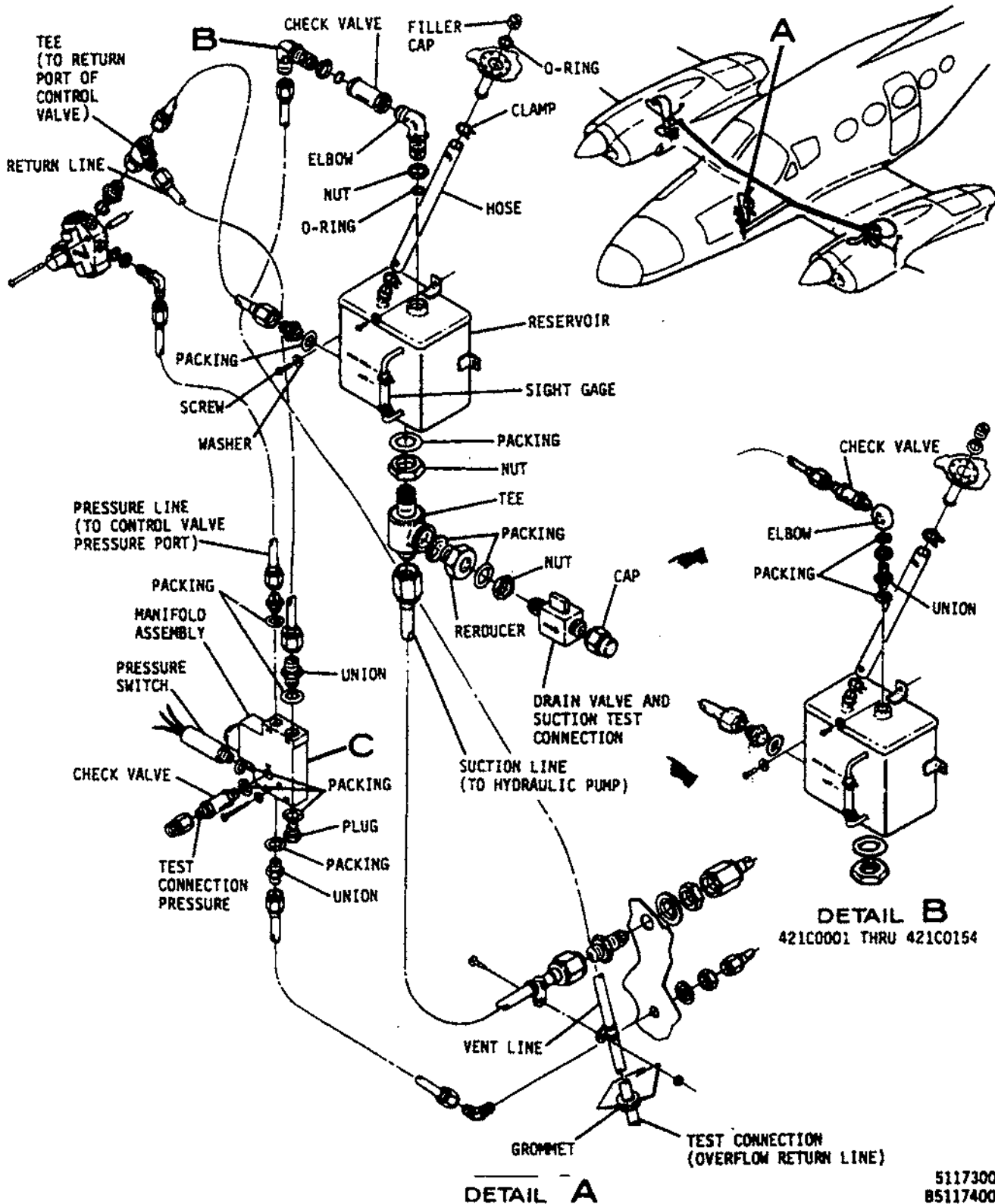
2. Removal/Installation Manifold Assembly (See Figure 1)

- A. Remove Manifold Assembly.

- (1) Remove LH aft baggage retainer in the nose compartment, refer to Chapter 3.
 - (2) Drain reservoir, refer to Main Hydraulic System, General Maintenance Practices.
 - (3) Ensure airplane's electrical power is OFF.
 - (4) Identify and disconnect electrical wiring from manifold assembly.
 - (5) Disconnect pressure and return lines from manifold assembly. Cap all openings.
 - (6) Remove manifold assembly by removing screws and washers.
 - (7) If new manifold assembly is being installed, remove check valve and all fittings and packings.

- B. Install Manifold Assembly.

- (1) Install fittings, packings, backup rings and check valve, if removed.
 - (2) Position manifold assembly on pressure bulkhead and secure with screws and washers.
 - (3) Remove caps from lines and fittings and connect pressure and return lines to manifold assembly.
 - (4) Identify and connect electrical wires.
 - (5) Position airplane on jacks, refer to Chapter 1.
 - (6) Connect ground test cart to test connections.
 - (7) Perform landing gear operational test, refer to Chapter 4. Check system for leaks.
 - (8) After completion of operational test, ensure reservoir fluid level is at "MAX FULL." Disconnect test cart on cap test fittings.
 - (9) Install LH aft baggage retainer, refer to Chapter 3.



Hydraulic Reservoir and Manifold Installation
Figure 1

51173001
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A51174006

HYDRAULIC PUMPDescription

1. The aircraft is equipped with two engine-driven hydraulic pumps to power the hydraulic system. The hydraulic pump is located on the aft portion of each engine adjacent to the vacuum pump.
2. Pump installation is the same for LH and RH pumps when the aircraft is not equipped with air conditioning. If air conditioning is installed the RH pump mounts to the hydraulic pump of the air conditioning system.

Maintenance Practices

NOTE: Before performing maintenance personnel should read and adhere to General Maintenance Practices, refer to Main Hydraulic System.

1. Removal/Installation Hydraulic Pump (See Figure 1)

- A. Remove Pump.

- (1) Remove LH aft baggage retainer in nose compartment, refer to Chapter 3.
 - (2) Drain hydraulic fluid from reservoir, refer to General Maintenance Practices, Chapter 11-00.
 - (3) Remove upper engine cowl, refer to Chapter 7.
 - (4) Disconnect suction and pressure hoses from elbows and drain line. Cap all fittings.
 - (5) Remove nuts and washers securing pump and remove pump.
 - (6) If new pump installation is required; remove all fittings.

- B. Install Pump.

- (1) Install packings, and fittings, if removed.
 - (2) Install pump using gasket, washers and nuts.
 - (3) Remove caps and connect suction, pressure and drain lines to pump.

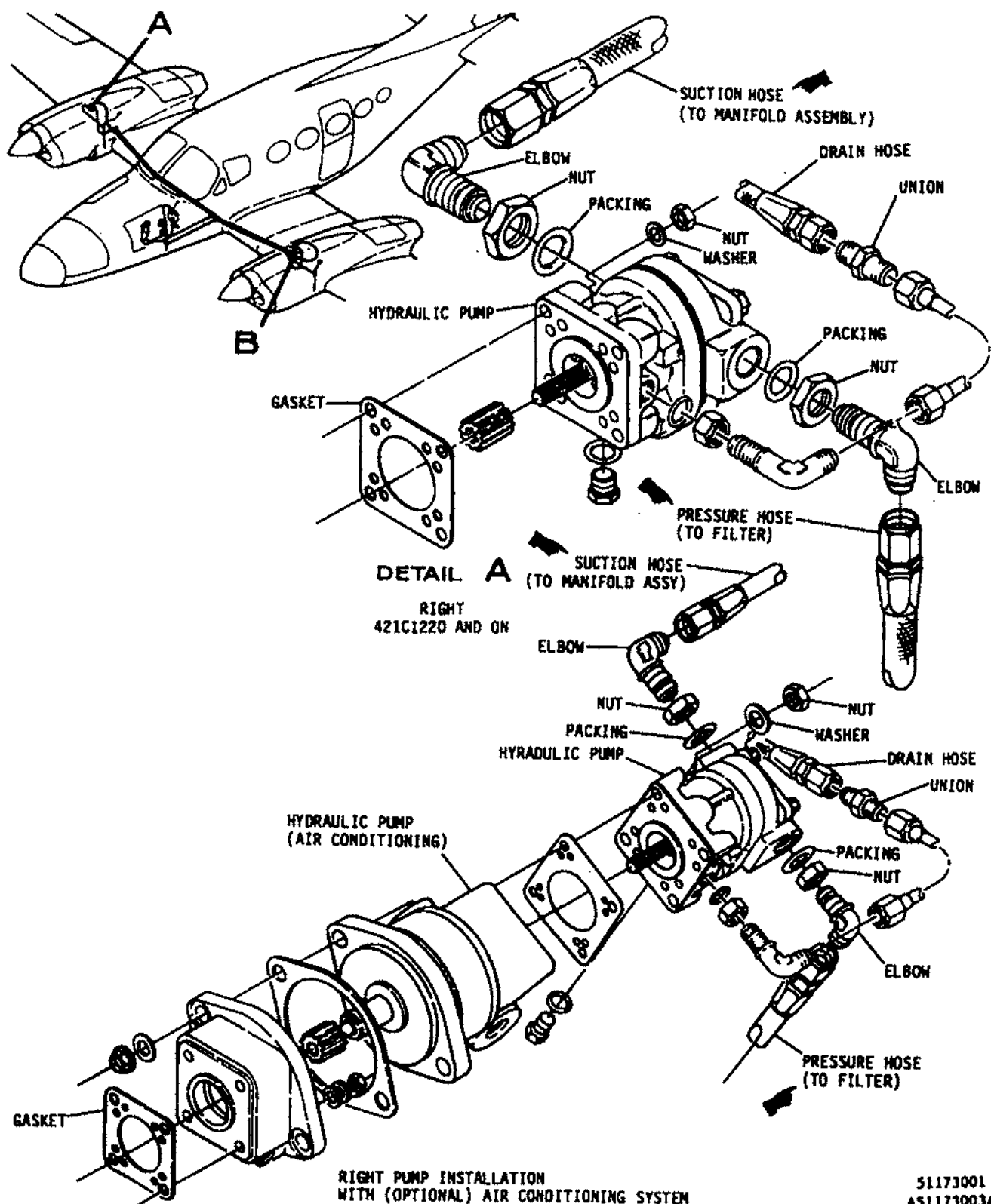
NOTE: Pump ports are identified for correct plumbing.

- (4) Service reservoir, refer to Chapter 2.
 - (5) Start engine and allow to warm up.
 - (6) Check pump HYD FLOW light for proper operation.
 - (7) Shutdown engine and check for leaks.
 - (8) Recheck reservoir for proper level.
 - (9) Install engine cowl.

2. Inspection/Check Hydraulic Pump.

- A. Visual Check.

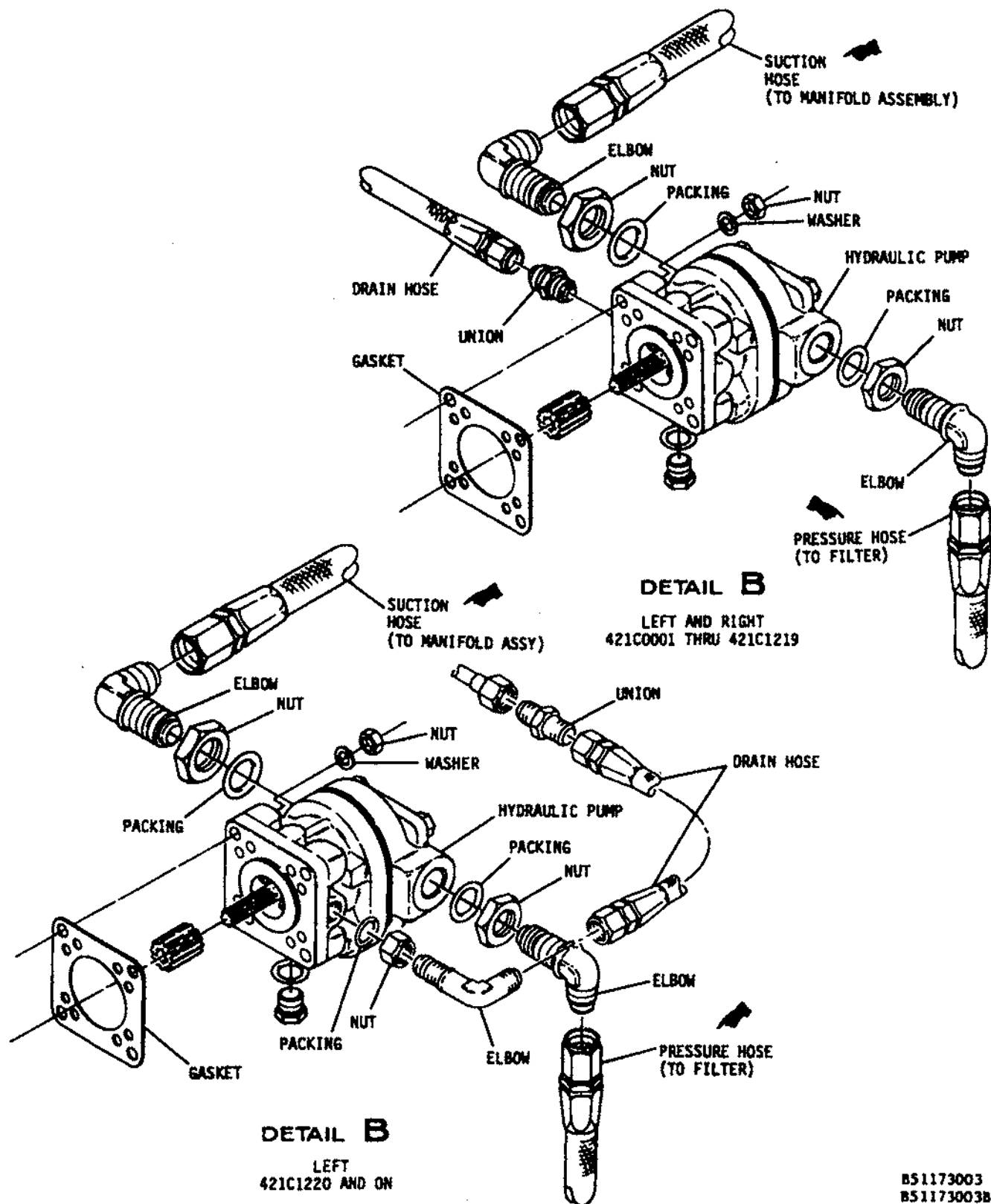
- (1) Remove upper engine cowl.
 - (2) Check hydraulic pump for security of mounting.
 - (3) Check hydraulic lines for general condition; security of attachment to pump.



RIGHT PUMP INSTALLATION
WITH (OPTIONAL) AIR CONDITIONING SYSTEM

Hydraulic Pump Installation
Figure 1 (Sheet 1 of 2)

51173001
AS1173003A
51172001A



Hydraulic Pump Installation
Figure 1 (Sheet 2)

BS1173003
BS1173003B

HYDRAULIC FILTERDescription

1. A pressure line filter is installed in each engine nacelle, mounted to a bracket which attaches to the engine mount beam. The filters are equipped with a disposable element. Access to the filters is gained by removing the engine cowl.

Maintenance Practices

NOTE: Before performing maintenance, personnel should read and adhere to General Maintenance Practices, Main Hydraulic System.

1. Removal/Installation Hydraulic Filter Assembly (See Figure 1)

- A. Remove Hydraulic Filter Assembly.

- (1) Disconnect pressure hose and line from filter assembly; cap openings.
 - (2) Remove filter assembly from filter bracket.
 - (3) Remove fittings from filter assembly.

- B. Install Hydraulic Filter.

- (1) Install fittings with new O-rings in filter assembly inlet and outlet ports.
 - (2) Secure filter assembly to bracket.
 - (3) Connect pressure hose and line to filter assembly.
 - (4) Service reservoir, refer to Chapter 2.
 - (5) Start engine and allow engine to warm up. Check HYD FLOW light for proper operation.
 - (6) Shutdown engine and check for leaks.
 - (7) Install engine cowl.
 - (8) Ensure reservoir is serviced to proper level.

2. Removal/Installation Filter Element (See Figure 1)

- A. Remove Filter Element.

- (1) Remove access door to filter bowl.
 - (2) Cut safety wire and loosen filter bowl.
 - (3) Remove filter bowl and element together. Remove and discard gasket.

- B. Install Filter Element.

- (1) Position new gasket in place.
 - (2) Insert new filter element in filter bowl and install.

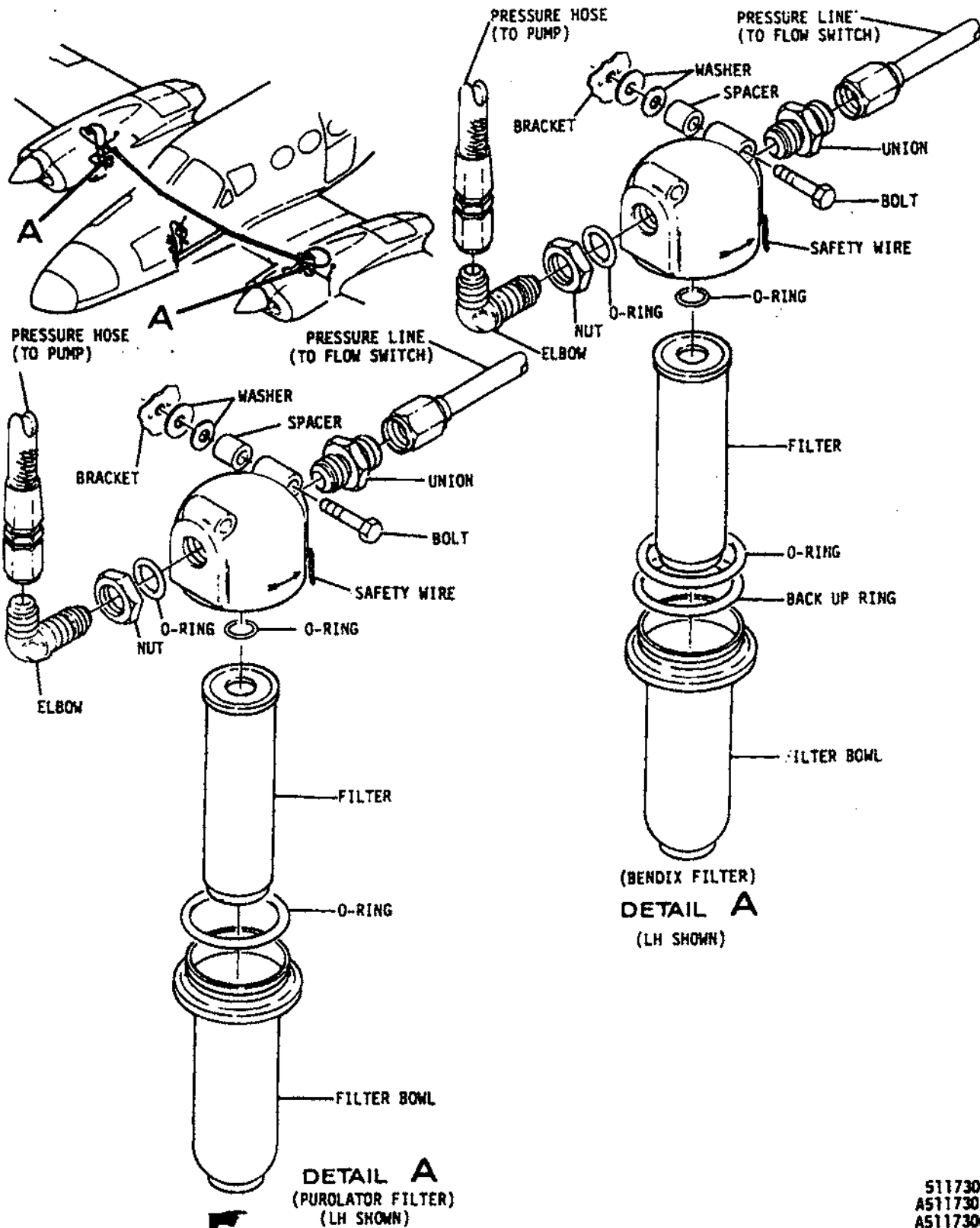
NOTE: Assure gasket seats properly in filter before final torque.

- (3) Torque in accordance with instructions on filter. Safety wire.
 - (4) Service reservoir, refer to Chapter 2.
 - (5) Start engine and allow engine to warm up.
 - (6) Check HYD FLOW light for proper operation.
 - (7) Shutdown engine and check for leaks.
 - (8) Install access door.
 - (9) Ensure reservoir is serviced to proper level.

3. Inspection/Check Hydraulic Filter

- A. Visual Inspection.

- (1) Pressurize hydraulic system.
 - (2) Check for leaks and security of attachment.
 - (3) Check for security of bowl and bowl lockwire.



Hydraulic Filter Assembly Installation
Figure 1

51173001
A51173004
A51173002

GROUND POWER CONNECTIONSDescription

1. The ground power connectors for the hydraulic system are located in the nose baggage compartment left aft side. Access to the test connection is gained by removing the LH aft baggage retainer.
2. The suction test connector is located below the hydraulic fluid reservoir. The connector consists of a cap and drain valve; when test equipment is connected to the drain valve, ensure drain valve is open before testing system.
3. The pressure test connector is located on the forward face of the manifold assembly and consists of a cap and check valve.
4. For test fitting locations, refer to Section 11-01, Figure 1.

HYDRAULIC INDICATING SYSTEMDescription

1. The hydraulic system incorporates two indicating systems, hydraulic pressure indicating system and hydraulic flow indicating system. Each system indicating lamps are located on the annunciator panel. The lamps may be tested by the annunciator panel PRESS TO TEST switch.
2. Hydraulic Pressure Indicating System
 - A. The hydraulic pressure indicating system consists of: a pressure switch and indicating (HYD PRESS) lamp. The pressure switch is mounted on the manifold assembly. The system indicates hydraulic pressure (HYD PRESS light illuminated) is flowing to the landing gear system, when landing gear system is actuated. The lamp will remain illuminated, until the landing gear has completed the selected position. After the landing gear has reached the selected position, the manifold assembly will open, allowing hydraulic pressure to decrease and the lamp will go out. Should the lamp fail to illuminate with landing gear actuation, this indicates the manifold loading valve has failed to close and hydraulic pressure is not available for the landing gear system.
3. Hydraulic Flow Indicating
 - A. The hydraulic flow indicating system is a dual system, each independent of the other. Each system is utilized to indicate hydraulic flow from its respective pump. Each system consists of a discharge flow switch and (HYD FLOW) lamp. The discharge flow switch is incorporated in the pressure line downstream of the engine-driven pump and filter. The switch is normally closed. As pump flow increases, the switch will open and stay open until fluid flow decreases to approximately 1.25 GPM. Then the switch will close, illuminating the HYD FLOW lamp.

Troubleshooting

1. General

- A. The annunciator panel test switch may be used to check for defective bulbs.
- B. Troubleshooting the indicating systems pertains to open electrical circuits or malfunctioning switches. For Wiring Diagrams, refer to Chapter 13.

2. Tools and Equipment

NOTE: Equivalent substitutes may be used for the following listed item:

Name	Number	Manufacturer	Use
Multimeter	Model 260	Katy Industries, Inc. Simpson Electric Co. 853 Dundee Ave. Elgin, IL 60120	Voltage and continuity checks.

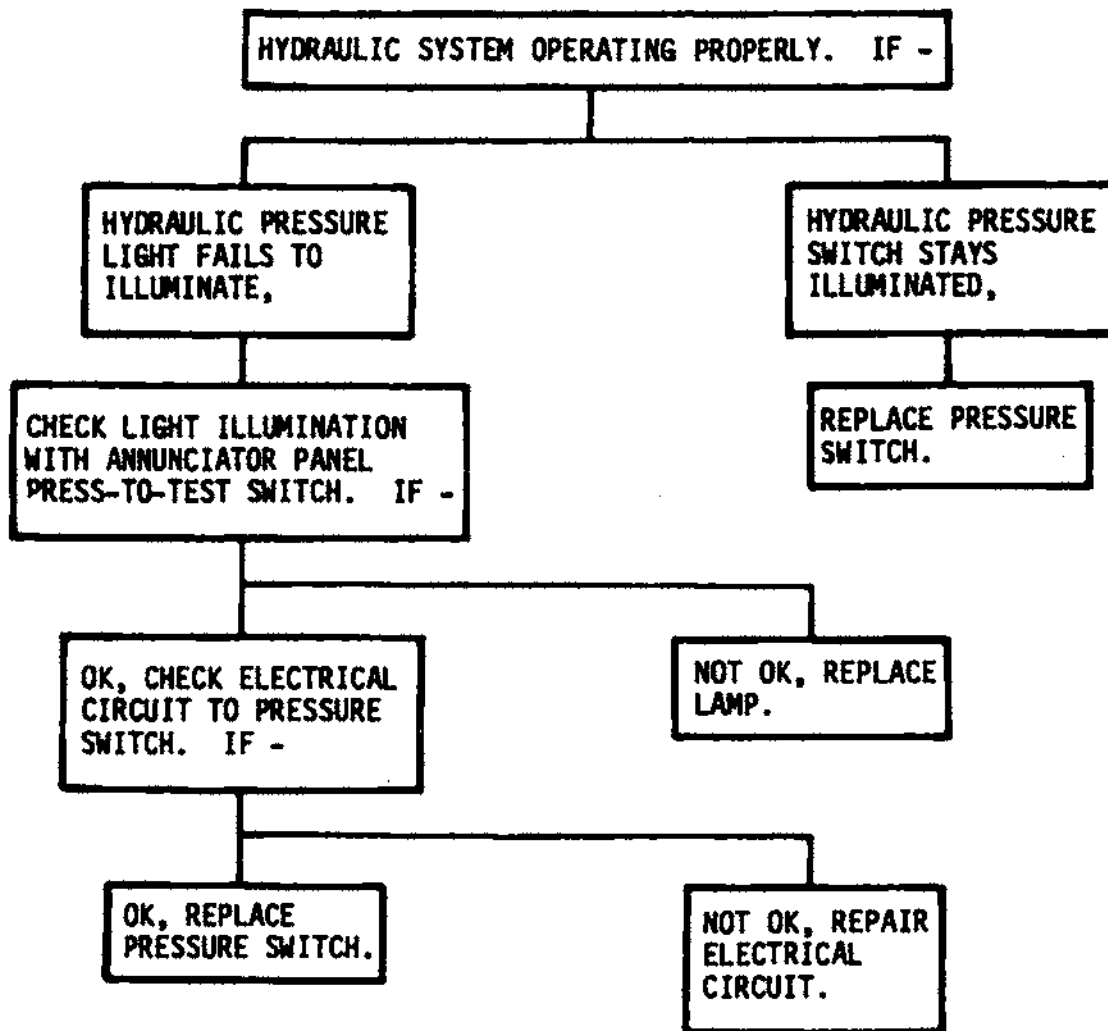
Maintenance Practices

NOTE: Before performing maintenance personnel should read and adhere to General Maintenance Practices, refer to Main Hydraulic System.

1. Removal/Installation Hydraulic Pressure Switch (See Figure 1)

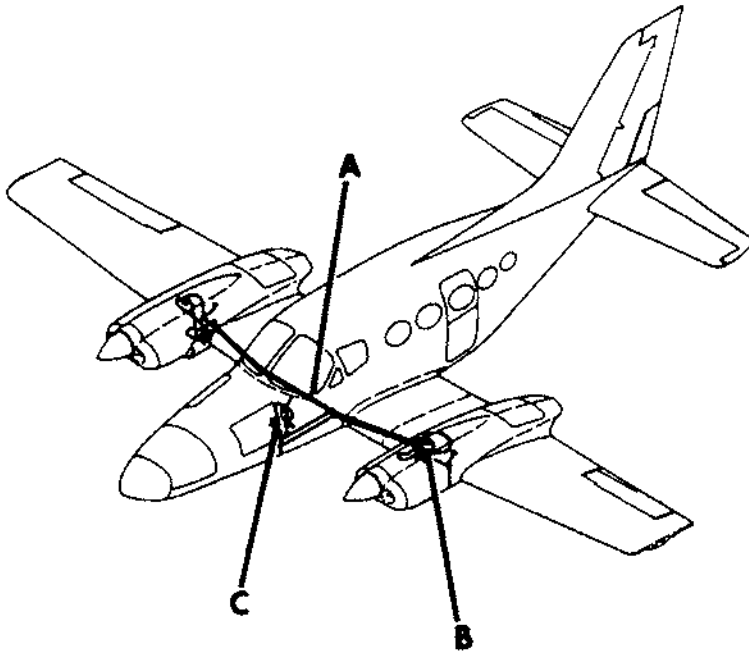
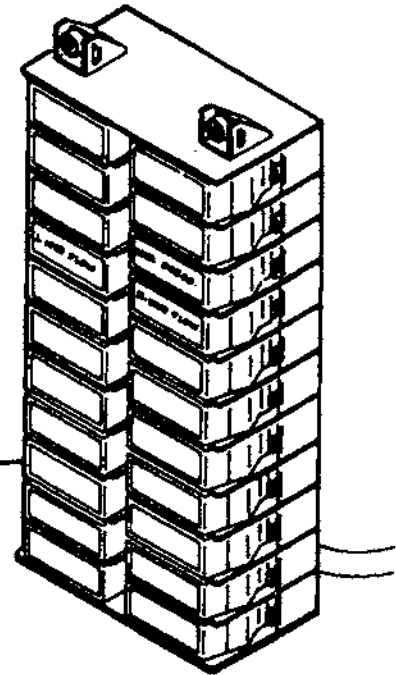
A. Remove Pressure Switch.

- (1) Remove LH aft baggage retainer in the nose compartment, refer to Chapter 3.
- (2) Ensure aircraft's electrical power is OFF.
- (3) Identify and disconnect electrical wiring from pressure switch.
- (4) Remove pressure switch from manifold assembly.

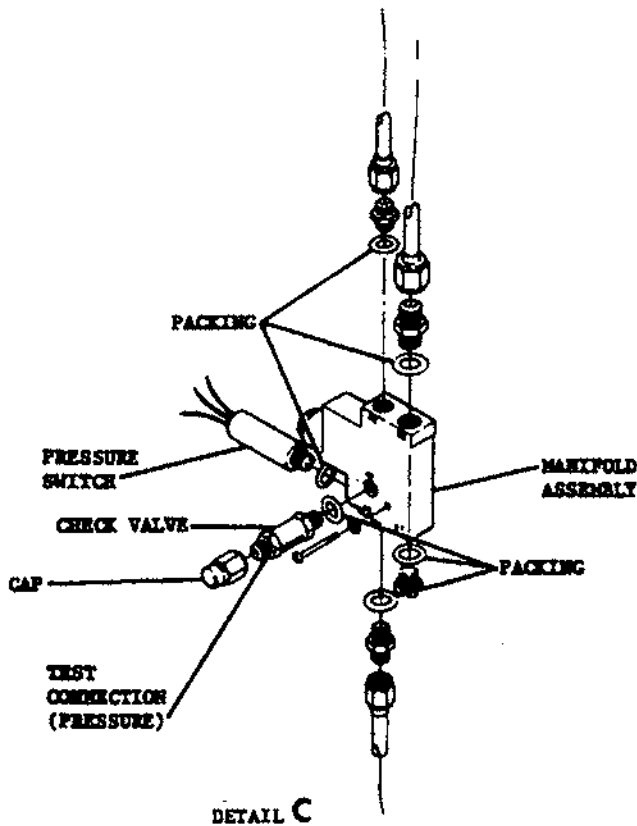


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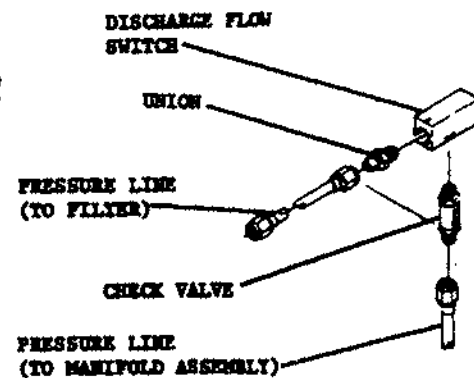
Troubleshooting Chart - Hydraulic Pressure Switch
Figure 1

ANNUNCIATOR
PANEL

DETAIL A



DETAIL C



DETAIL B

Hydraulic Indicating System
Figure 251173001
A51181046
B51174002R
C51174004R

B. Install Pressure Switch.

- (1) Install pressure switch in manifold with a new packing.
- (2) Identify and connect electrical wiring.
- (3) Jack aircraft, refer to Chapter 1.
- (4) Connect ground test cart to test connections.
- (5) Perform landing gear operational test, refer to Chapter 4. Check operation of pressure switch and for leaks.
- (6) After completion of operational test, ensure reservoir fluid level is at "MAX FULL."
- (7) Install LH aft baggage retainer, refer to Chapter 3.

2. Removal/Installation Hydraulic Discharge Flow Switch (See Figure 2)

NOTE: Removal/Installation procedures are for the left-hand installation, right-hand the same.

A. Remove Flow Switch.

- (1) Ensure airplane electrical power is OFF.
- (2) Remove access panel inboard of engine nacelle on lower leading edge surface. For access panel location, refer to Chapter 1.
- (3) Disconnect electrical wiring to flow switch.
- (4) Disconnect pressure lines from union and check valve.
- (5) Remove flow switch.
- (6) If flow switch is being replaced, remove union and check valve.

NOTE: If flow switch shows evidence of leakage at seal screws, remove screw. Clean the threaded area with solvent; wipe dry. Reinstall screw with a 0795034 O-ring (PPM Hexsol Company). Lock screw in place with Loctite 222 sealant (sealant requires three hours to seal); this is required on Models 421C0001 thru 421C0464.

B. Install Flow Switch.

- (1) If removed, install union and packing in inlet port and check valve in outlet port of flow switch.
- (2) Connect pressure lines to flow switch union and check valve.
- (3) Identify and connect electrical wiring.
- (4) Service reservoir, refer to Chapter 2.
- (5) Apply electrical power to airplane, HYD FLOW light should illuminate.
- (6) Start engine; HYD FLOW light should go out at run up RPMs (approximately 1200 RPM and above).
- (7) Shut down engine and check for connection leakage.
- (8) Install access panel.

CHAPTER

12

EQUIPMENT AND FURNISHINGS

CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL

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UPHOLSTERY AND TRIMDescription

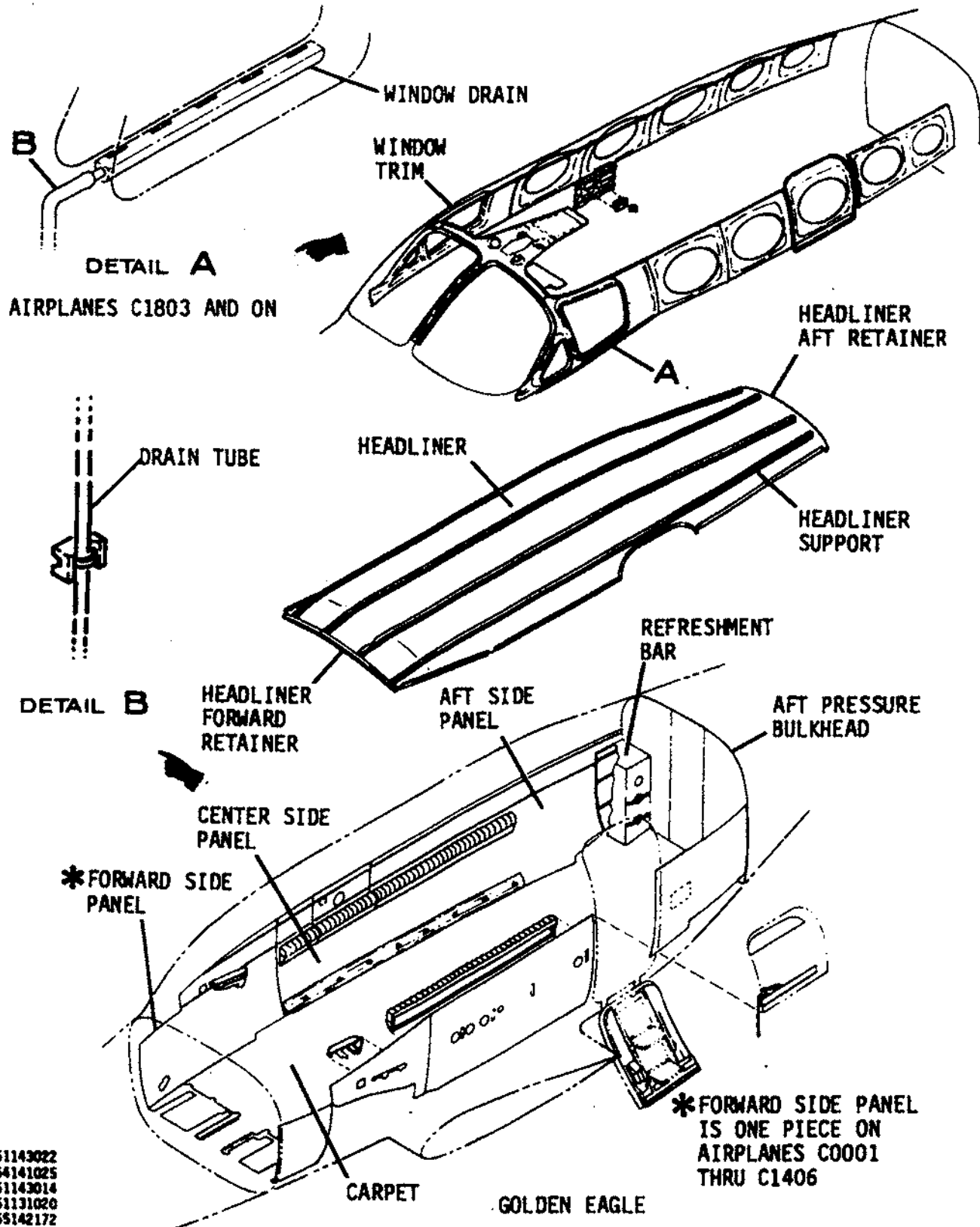
1. The aircraft's interior upholstery and trim consists of upholstery panels, headliner, and trim. The upholstery panels and window trims are secured to the structure by screws. The headliner is made up of three sections and is attached to the fuselage structure with retainers and headliner wires.
2. The main upholstery (side) panels are divided into forward, center, and aft sections on each side of the interior. The side panels are held in place to the structure by screws. In addition heater ducts are installed on the lower portion of the side panels.
3. The aft cabin pressure bulkhead upholstery is divided into three sections, with center section incorporating the tailcone access panel. The wing locker baggage area and the optional nose baggage compartment upholstery trim is attached by retainers to the side-walls and adhesives to the floor.

Maintenance Practices

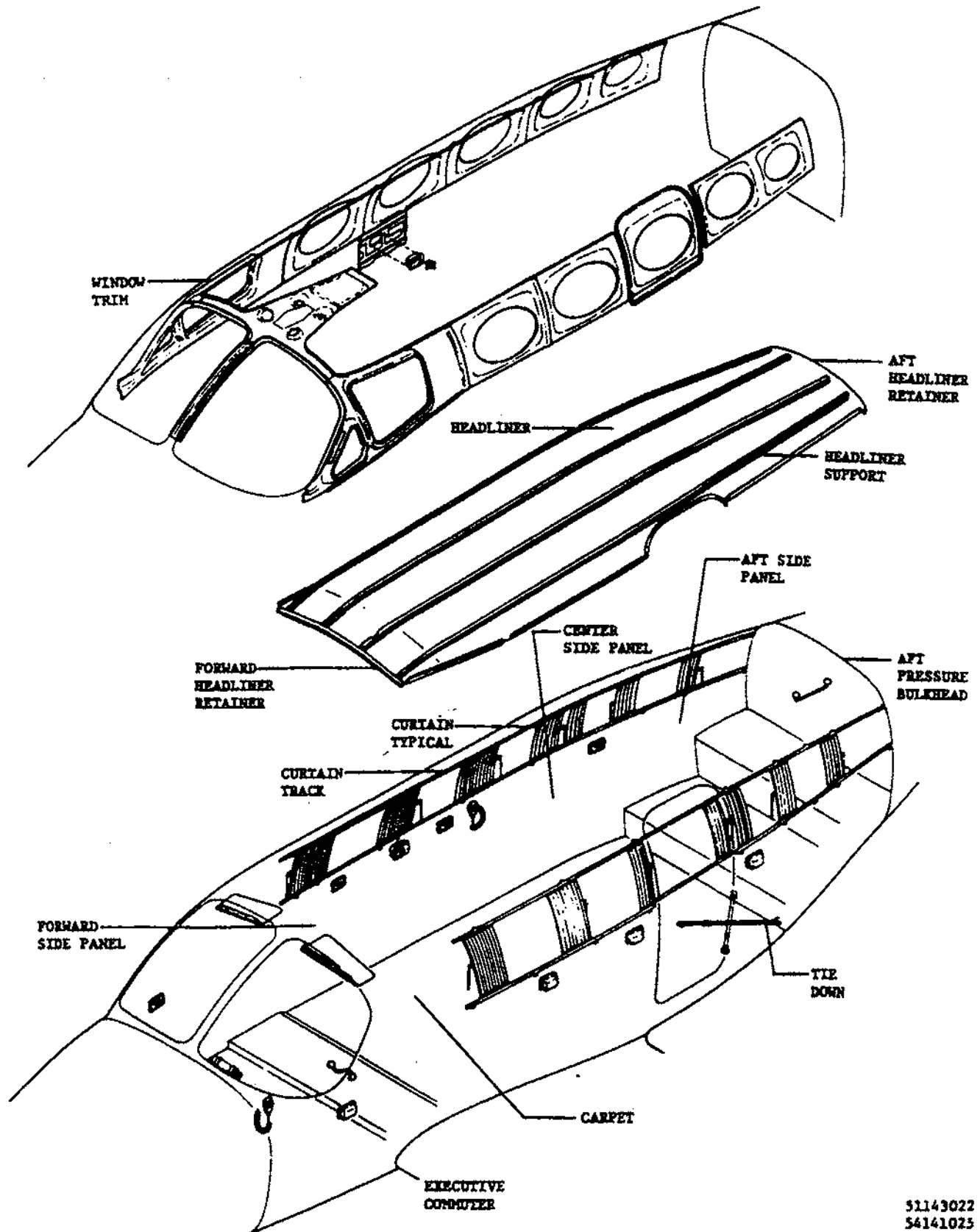
1. Removal/Installation Upholstery and Trim

A. For removal and installation of upholstery and trim, see Figure 1.

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Upholstery Installation
Figure 1 (Sheet 2)

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PILOT'S AND COPILOT'S SEATS AND SEAT BELTSDescription

1. The standard pilot and copilot seats are identical. The seats are adjustable fore and aft, upright and recline positions by two knobs located in front of each seat.
2. The optional pilot and copilot seats manually or electrically operated are the same. The difference being the manual adjustable seat uses a crank and the electrical adjustable seat uses an electric motor.
3. Seat belts and shoulder harnesses are installed on each individual seat. An optional inertia reel type shoulder harness may be installed in lieu of the standard harness.

Maintenance Practices

1. Removal/Installation Pilot and Copilot Seats (See Figure 1)

NOTE: Removal procedures are the same for either pilot or copilot seat.

A. Remove Pilot/Copilot Seat.

- (1) Pull up on right-hand adjusting handle and tilt seat back as far as possible.
- (2) Remove screws and adjusting handle nuts securing seat stops on left seat rail and pan assembly.
- (3) Pull up on left-hand adjusting handle and slide seat aft to remove.

NOTE: If (optional) cabin divider is installed, slide seat forward to remove.

- (4) Remove seat from the aircraft and disassemble and assemble in accordance with Figure 1.

B. Install Pilot/Copilot Seat.

- (1) Pull up on seat right-hand adjusting handle and tilt the seat back as far as possible.
- (2) Install seat pan assembly on floorboard seat supports.
- (3) Pull up on the left-hand adjusting handle and slide seat forward until the rear seat stops come to rest against the seat supports.
- (4) Install the front stop plates on seat pan with screws and nuts.

WARNING: AFTER SEAT HAS BEEN INSTALLED, ENSURE THAT STOP PLATE HAS BEEN PROPERLY INSTALLED AND SEAT ADJUSTMENT MECHANISM FUNCTIONS PROPERLY.

2. Removal/Installation Seat Belts (See Figure 2)

A. Remove Seat Belts.

- (1) Remove nut, washers, spacer, and bolt from seat belt anchor.
- (2) Remove seat belt (2).

B. Install Seat Belts.

- (1) Attach seat belts (2) to anchor using bolts, spacers, washers and nuts.

3. Removal/Installation of Shoulder Harness (See Figure 2)

A. Remove Shoulder Harness.

- (1) Remove bracket cover.
- (2) Remove nut, washer, spacer, hook and bolt securing shoulder harness to bracket.

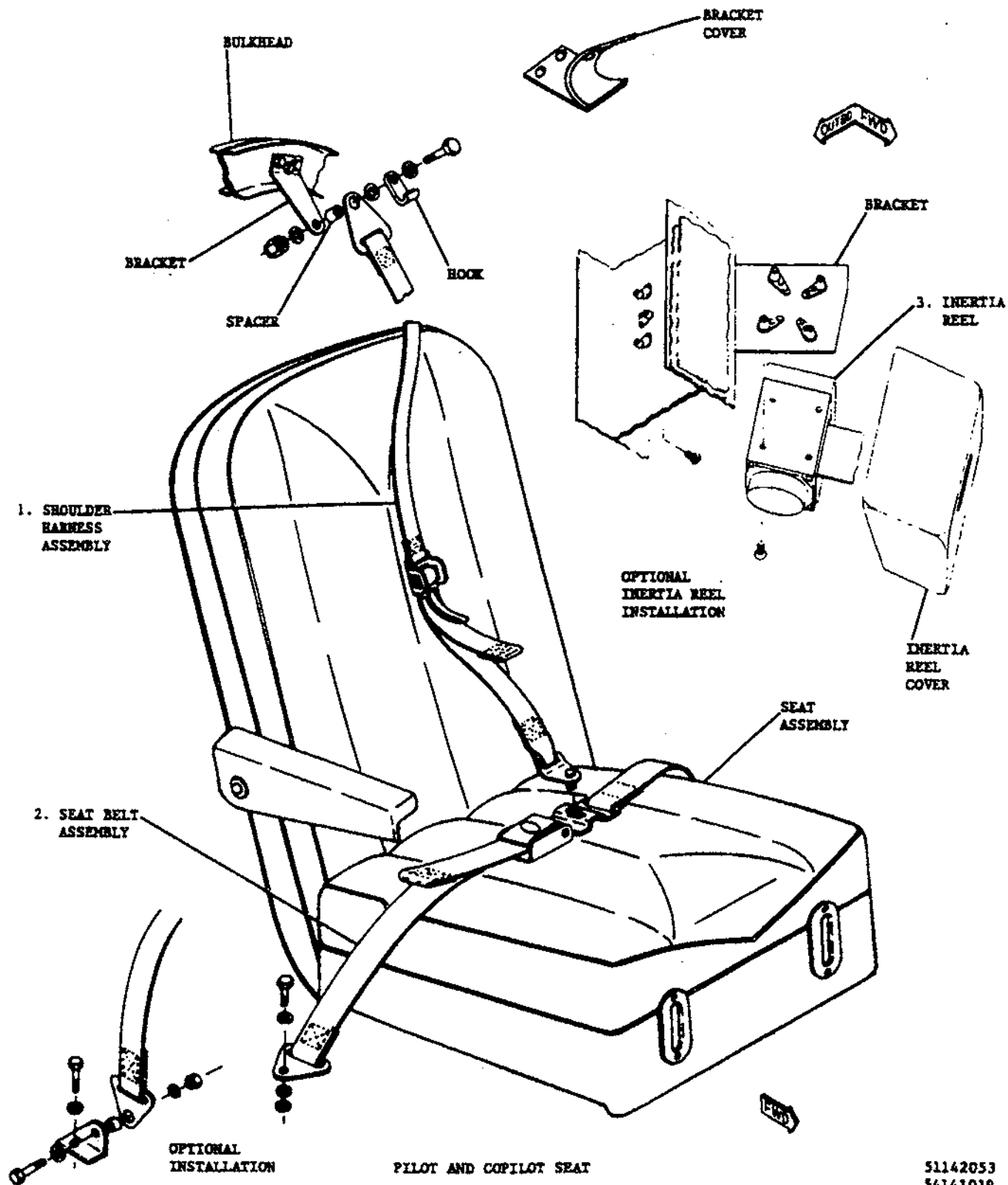
B. Install Shoulder Harness.

- (1) Install shoulder harness securing with bolt, hook, spacer, washer, and nut.
- (2) Replace bracket cover.

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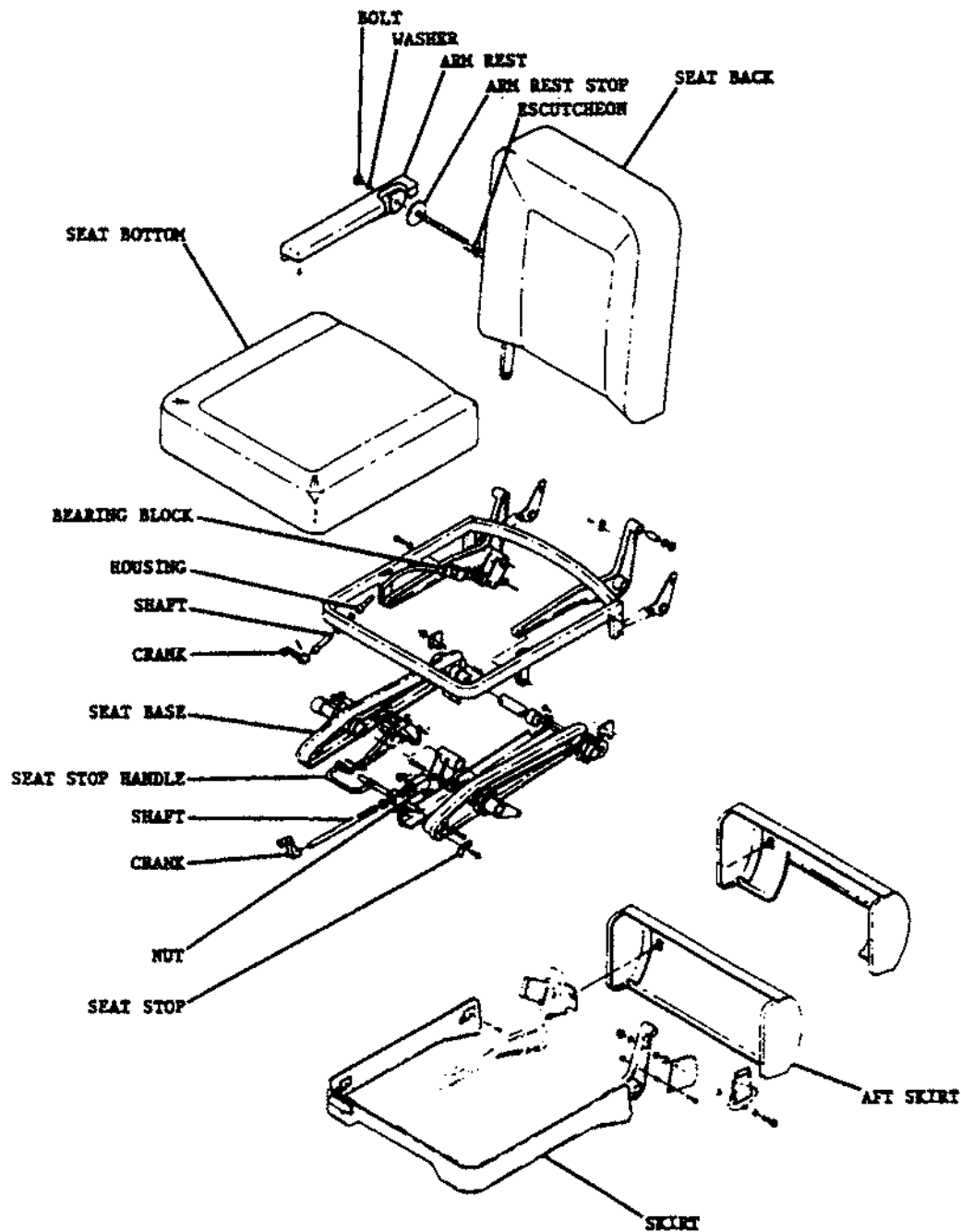


12-10
Page 2
Nov/75



Seat Belt and Shoulder Harness Installation
Figure 2

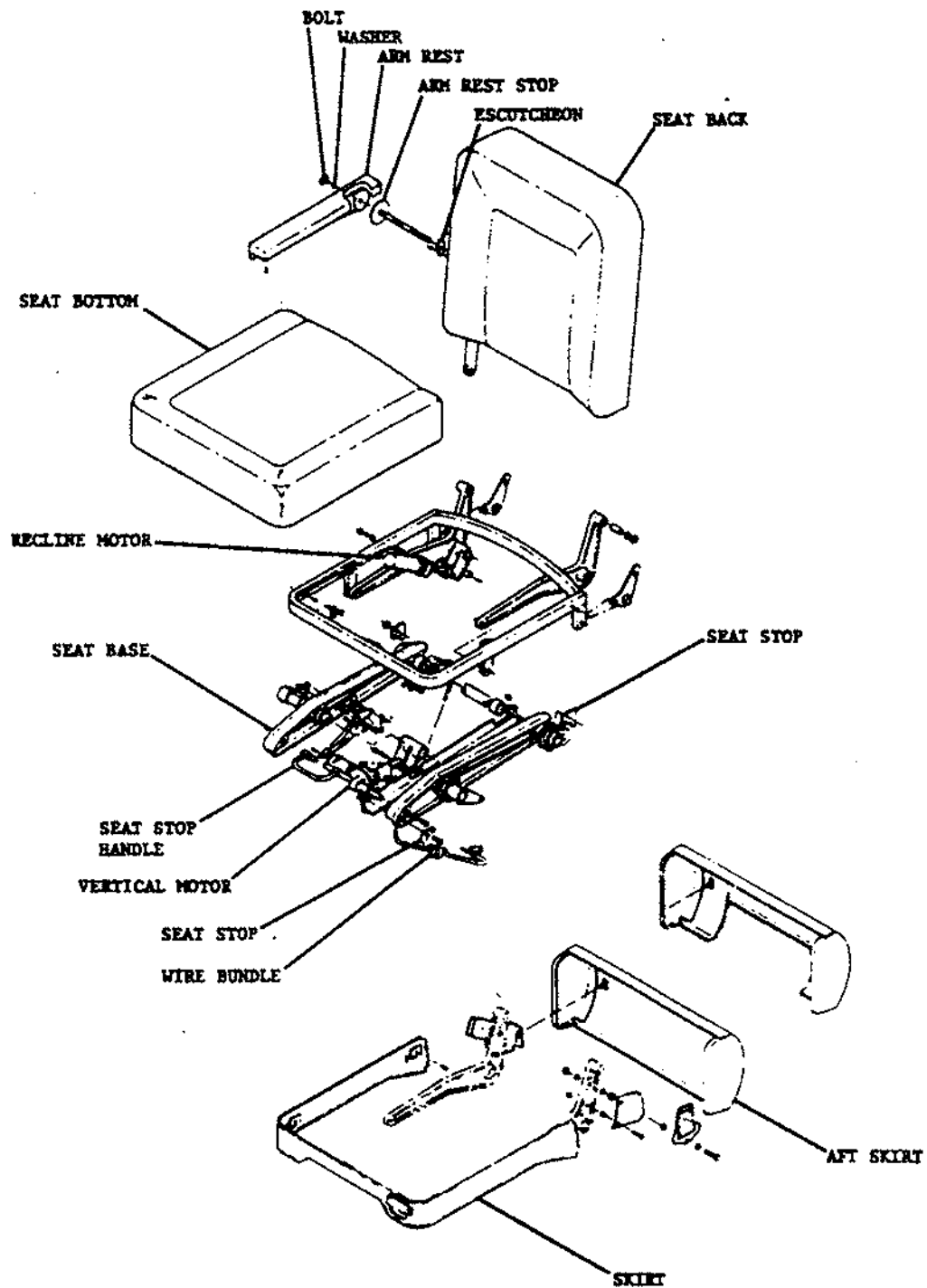
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MANUAL ADJUSTABLE SEAT

51144016

Pilot and Copilot Manual and Electrical Adjustable Seat
Figure 3 (Sheet 1 of 2)



ELECTRICAL ADJUSTABLE SEAT

51144017

Pilot and Copilot Manual and Electrical Adjustable Seat
Figure 3 (Sheet 2)

4. Removal/Installation Inertia Reel (Optional) (See Figure 2)**A. Remove Inertia Reel.**

- (1) Remove inertia reel cover by removing screw and spacer. Retain spacers for reinstallation.
- (2) Loosen mounting screws securing inertia reel to bracket and remove.

B. Install Inertia Reel.

- (1) Position inertia reel in place on bracket and install screws.
- (2) Install inertia reel cover using spacer and screw.

5. Removal/Installation Pilot and Copilot Seats, Manually or Electrically Adjustable (See Figure 3)

NOTE: Removal procedures are the same for either pilot or copilot seats.

A. Remove Pilot/Copilot Seat.

- (1) Raise seat to the highest position.
- (2) Remove seat stops on each side of the seat rail by removing nuts and screws.
- (3) Tag and disconnect wiring.
- (4) Pull up on seat stop handle and slide seat aft and remove seat from mounting.
- (5) If disassembly and assembly are required, refer to Figure 3.

B. Install Pilot/Copilot Seat.

- (1) Insert seat on seat rails and slide forward.
- (2) Pull up on seat stop handle and allow seat to move forward far enough to install seat stops.
- (3) Connect wiring and remove tags.
- (4) Install seat stops with screws and nuts.
- (5) Turn on electrical power and check operation.
- (6) If seat is manually controlled, operate with crank and assure seat functions properly.

PASSENGER SEATS

Description

1. Passenger seats consist of forward and rear facing seats, and the seven and eight-place arrangements. All passenger seats are attached to the seat rails and are adjustable fore and aft with the exception of the seventh and eighth seats which are mounted stationary. Passenger seats on the Executive Commuter are attached to the seat rails and are not adjustable.

Maintenance Practices

1. Removal/Installation Passenger Seats (Refer to Figure 1).

NOTE: Removal/installation procedures are the same for either passenger seat, including forward facing and rear facing.

A. Remove Passenger Seat.

- (1) Remove rail stops by removing cotter pins.
- (2) Pull up on the left-hand adjusting handle and slide the guide and rollers over the cutout in the rail.
- (3) Disengage seat rollers from seat rail.
- (4) Remove seat from airplane.
- (5) If disassembly is required, refer to Figure 1.
- (6) To remove aft facing seats, lift latch pin and slide seat to cutouts in rail and lift seat out.

B. Install Passenger Seat.

- (1) Engage seat guide on track assembly at the cutout.
- (2) Install rail stops on track assembly and install cotter pin.
- (3) Aft facing passenger seats are installed in the same manner as forward facing seats. Seat position is obtained by seat stops and the seat back is positioned with adjusting bolt.
- (4) Install seat stop.

WARNING: FORWARD-FACING SEATS MUST NOT BE INSTALLED OR USED AS AFT-FACING SEATS, UNLESS ROLLERS AND SEAT RAIL STOPS ARE REVERSED. WHEN INSTALLING SEATS, MAKE CERTAIN DUAL ROLLERS GUIDE IS INSTALLED IN THE AFT SIDE OF THE SEAT ON FORWARD-FACING SEATS AND ON THE FORWARD SIDE OF THE SEAT ON AFT-FACING SEATS. IMPROPER ROLLER, RAIL AND STOP PIN ALIGNMENT WILL ADVERSELY AFFECT WEIGHT DISTRIBUTION, BALANCE AND PASSENGER PROTECTION.

WARNING: AFTER SEAT HAS BEEN ENGAGED TO RAIL ASSEMBLY PROPERLY, INSURE RAIL STOPS ARE INSTALLED PROPERLY AND THE SEAT ADJUSTMENT MECHANISMS FUNCTION PROPERLY.

2. Removal/Installation of Seventh Seat (Refer to Figure 2).

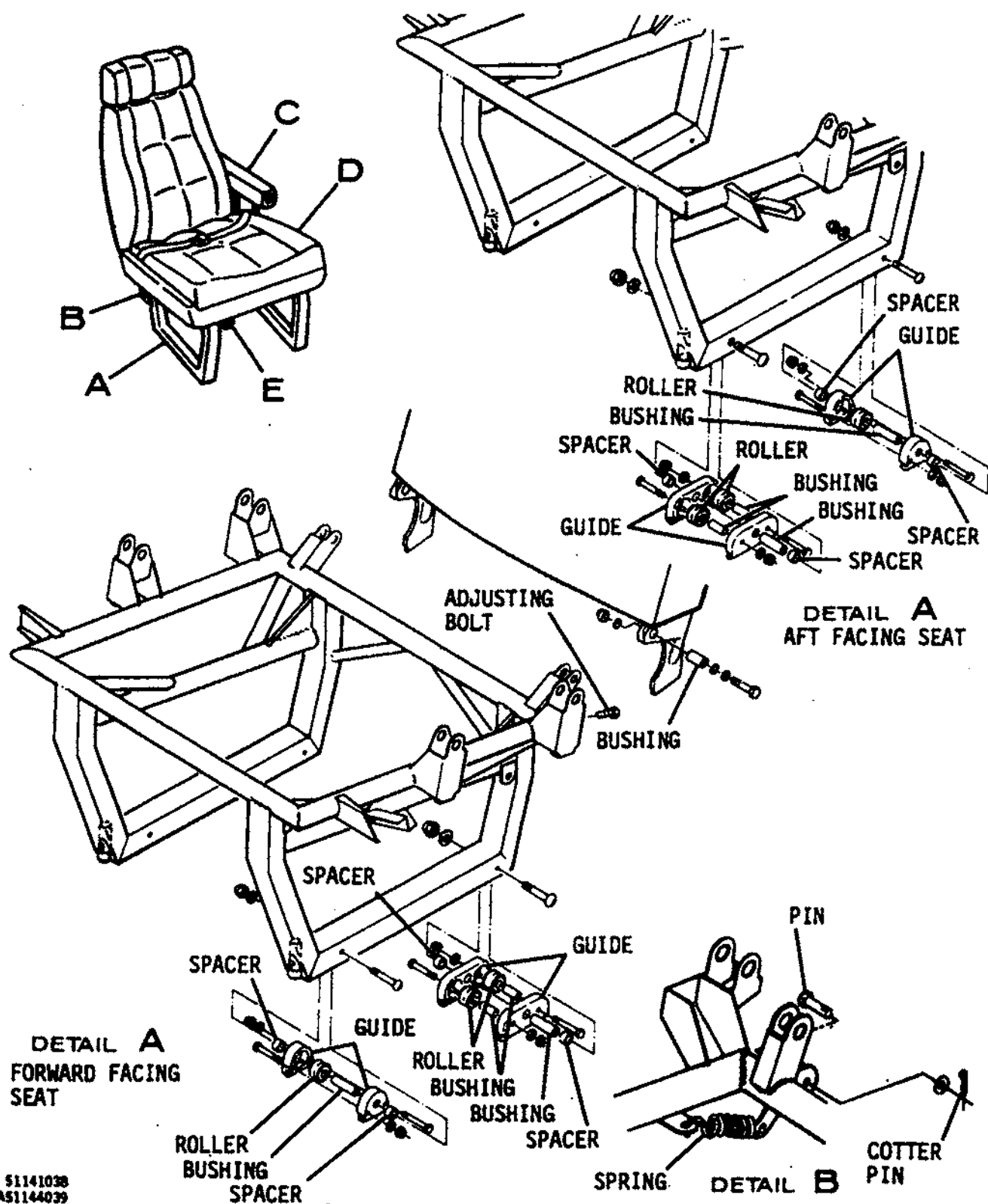
A. Remove Seventh Seat.

- (1) Remove seat rail stops.
- (2) Tilt seat back as far forward as possible.
- (3) Lift handle and slide seat to cutouts in seat rail.
- (4) Disengage seat from rails and remove from airplane.
- (5) If disassembly is required.

B. Install Seventh Seat.

- (1) Position seat in place on seat rails by engaging rollers at cutout.
- (2) Install seat rail stops.
- (3) Check operation of seat.

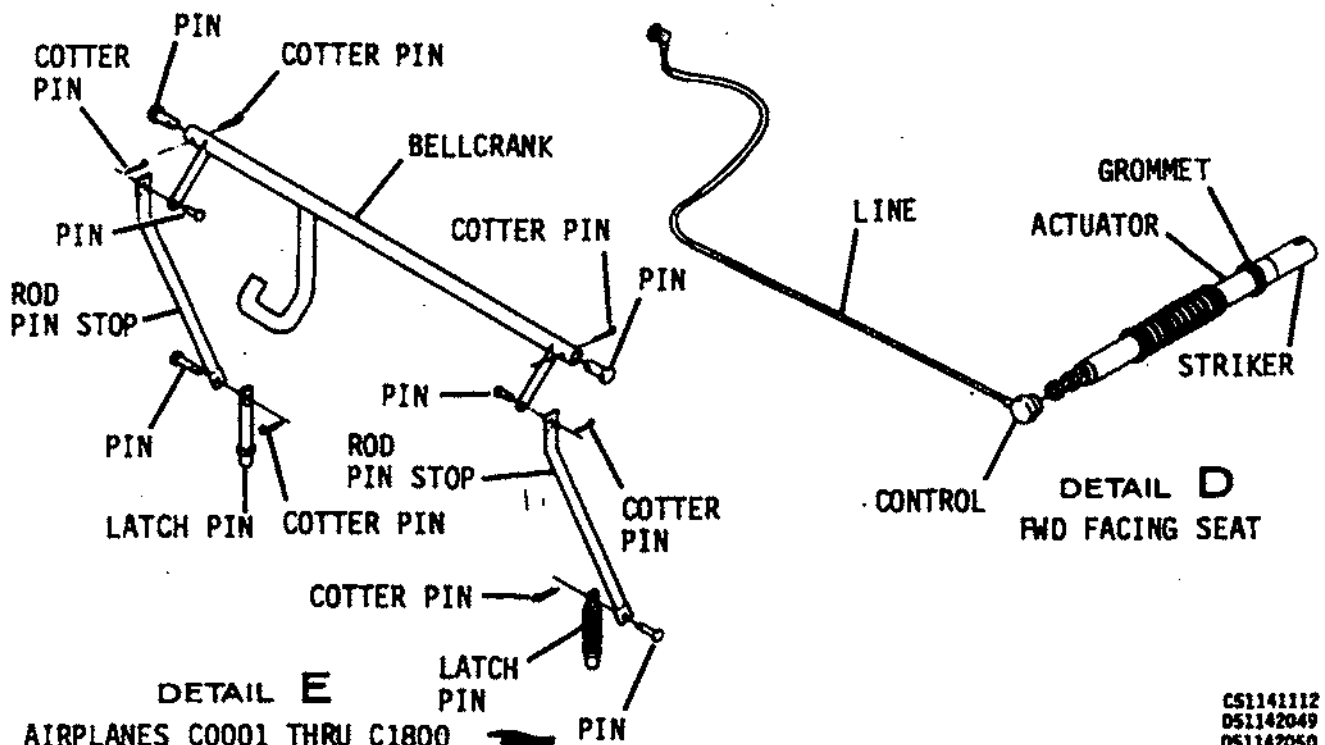
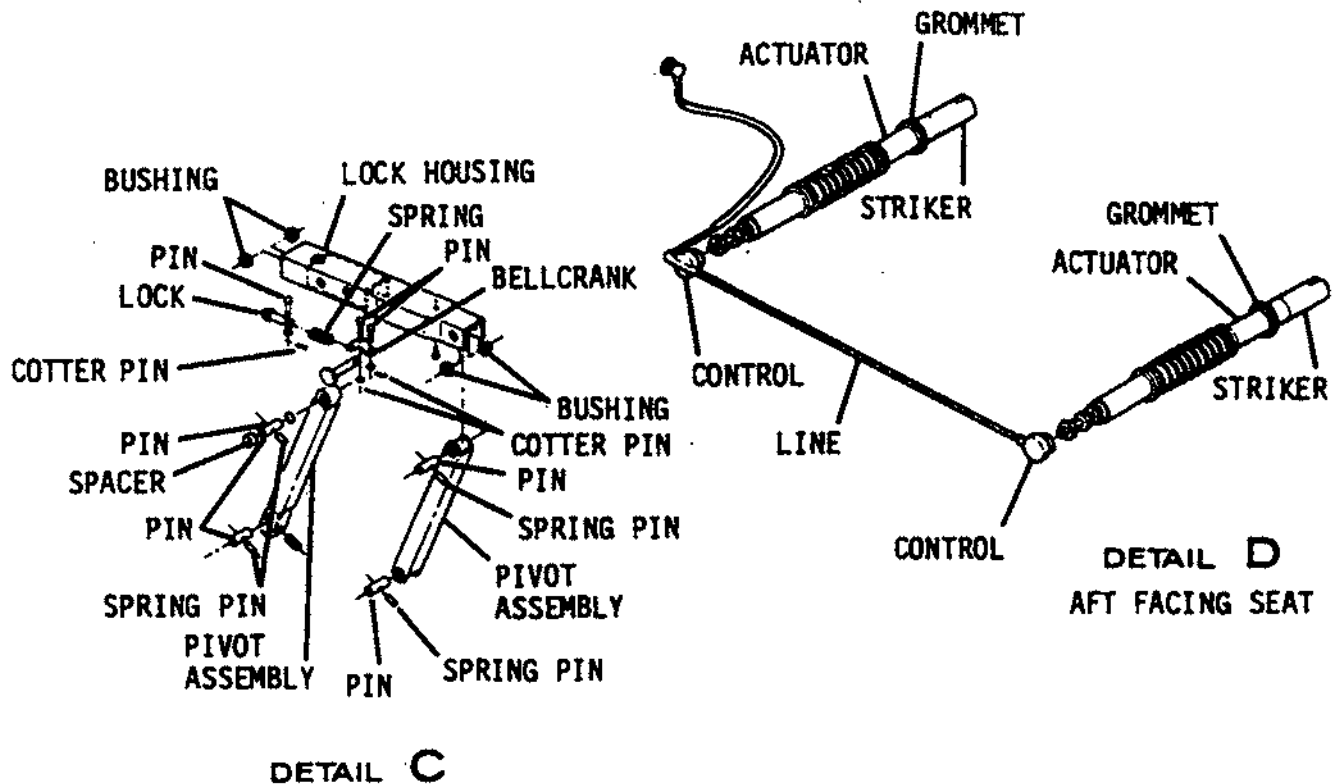
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AIRPLANES C0001 THRU C1800
Passenger Seats Forward and Aft Facing Installation
Figure 1 (Sheet 1)

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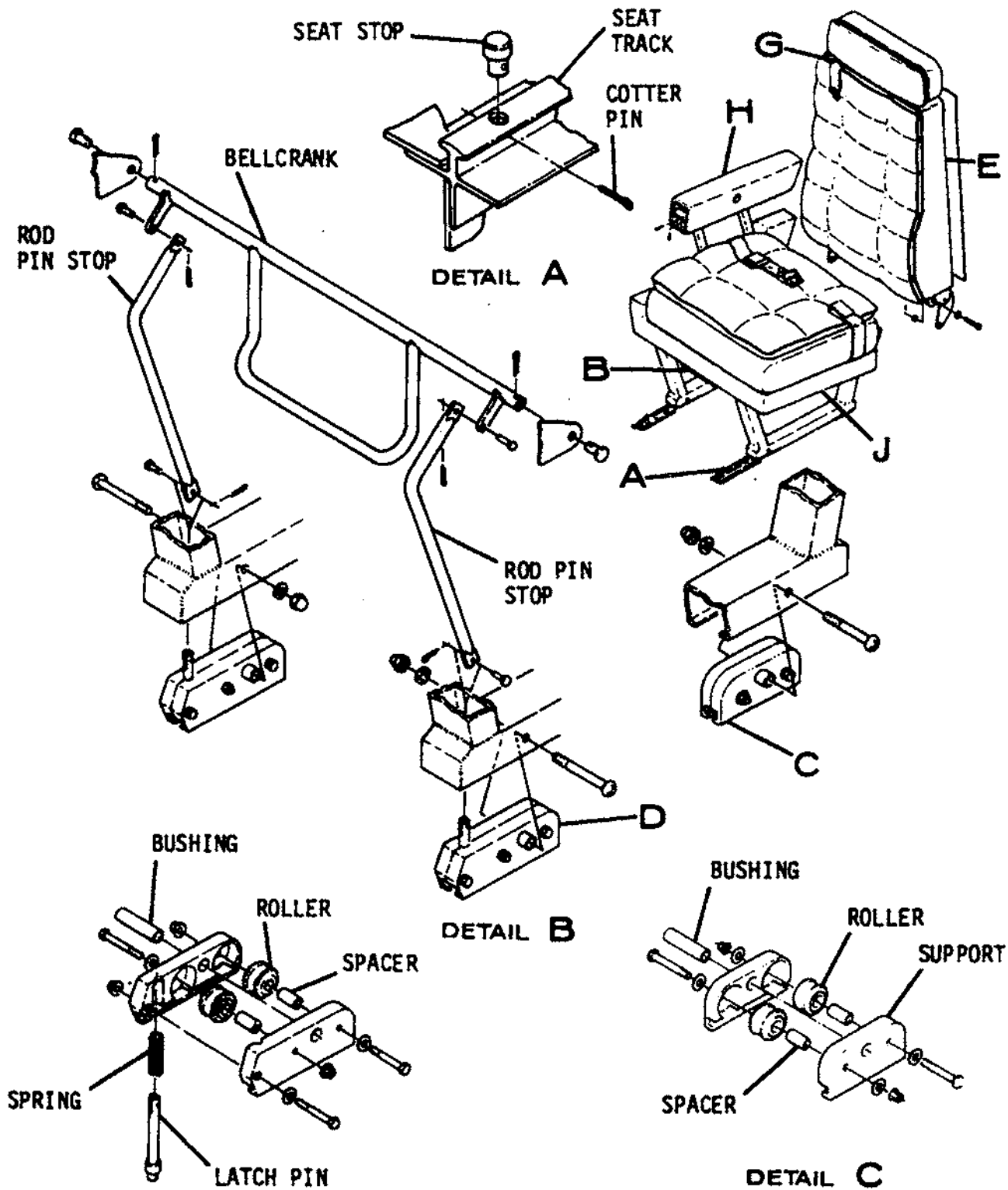


AIRPLANES C0001 THRU C1800

Passenger Seats Forward and Aft Facing Installation
Figure 1 (Sheet 2)

CS1141112
DS1142049
DS1142050
ES1141040

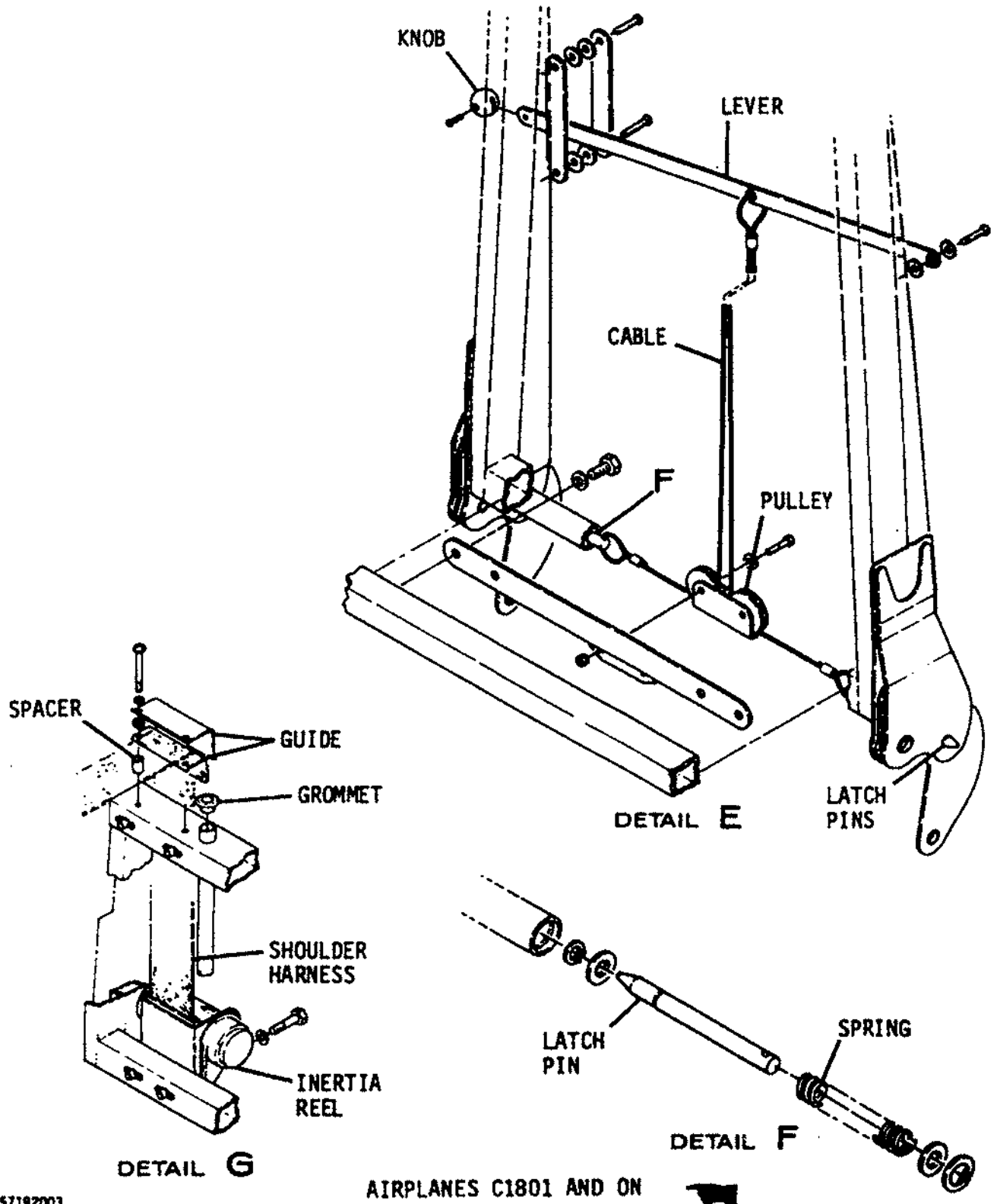
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DETAIL D AIRPLANES C1801 AND ON

Passenger Seats Forward and Aft Facing Installation
Figure 1 (Sheet 3)

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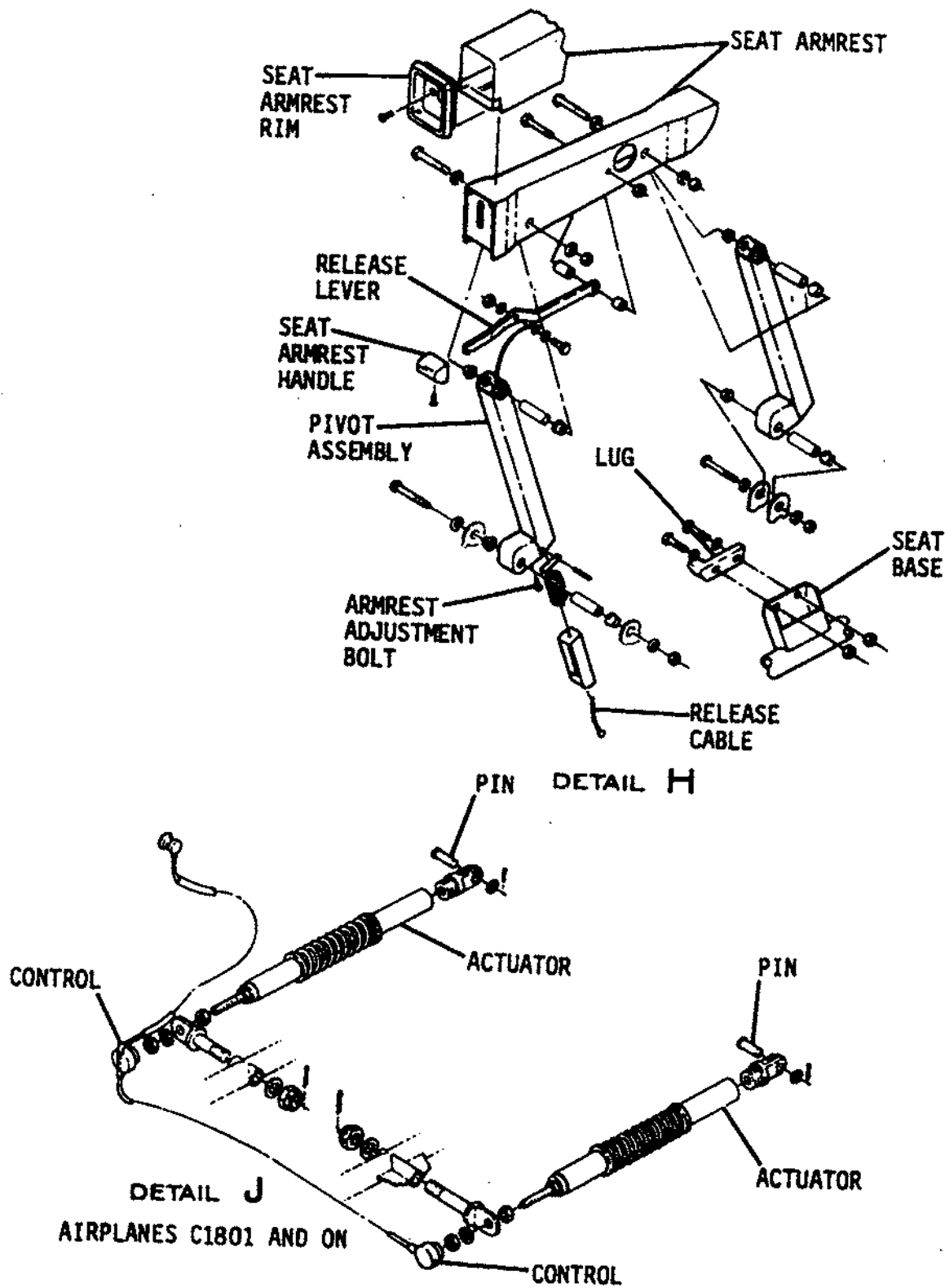


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AIRPLANES C1801 AND ON

Passenger Seats Forward and Aft Facing Installation
Figure 1 (Sheet 4)

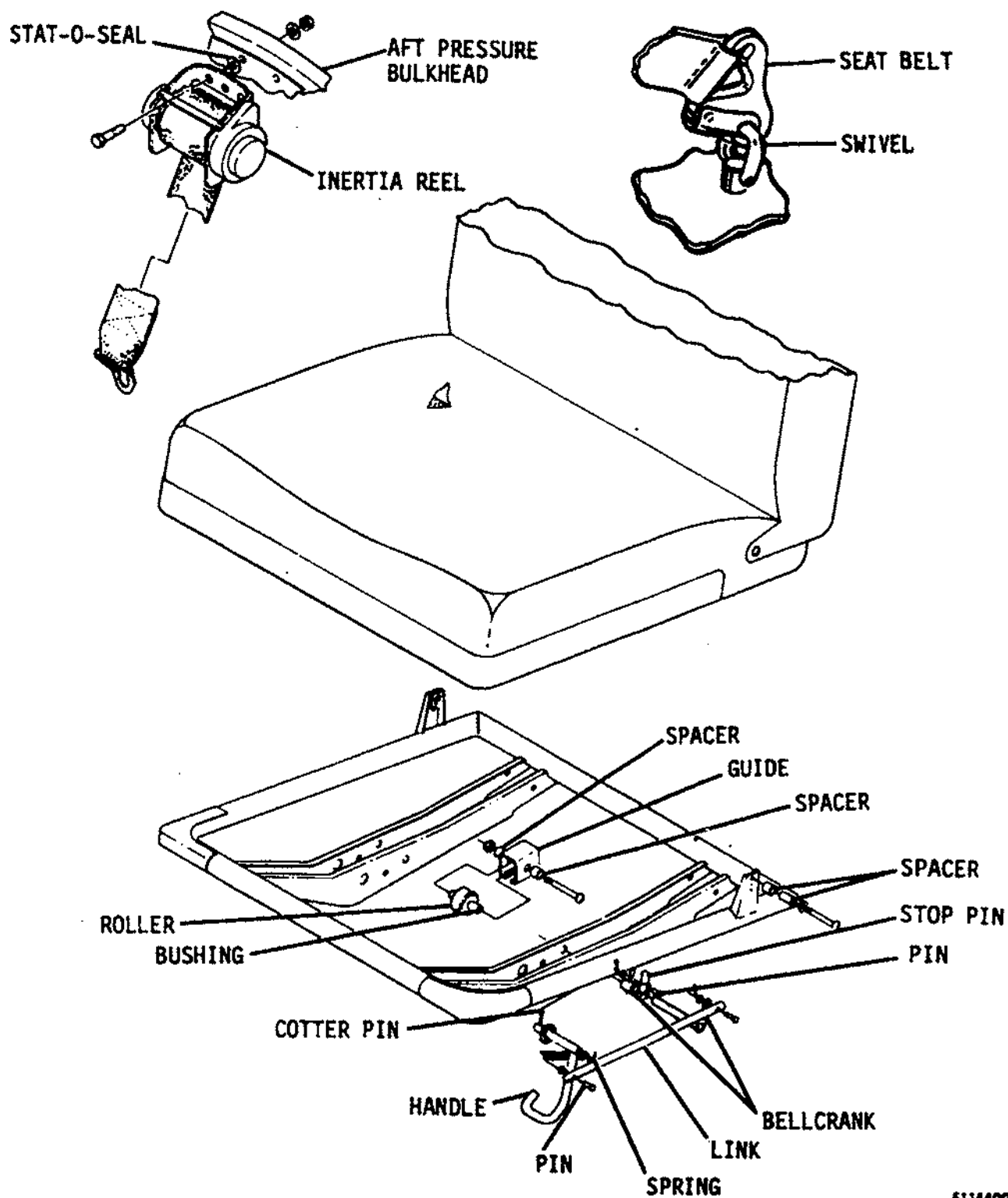
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Passenger Seats Forward and Aft Facing Installation
Figure 1 (Sheet 5)

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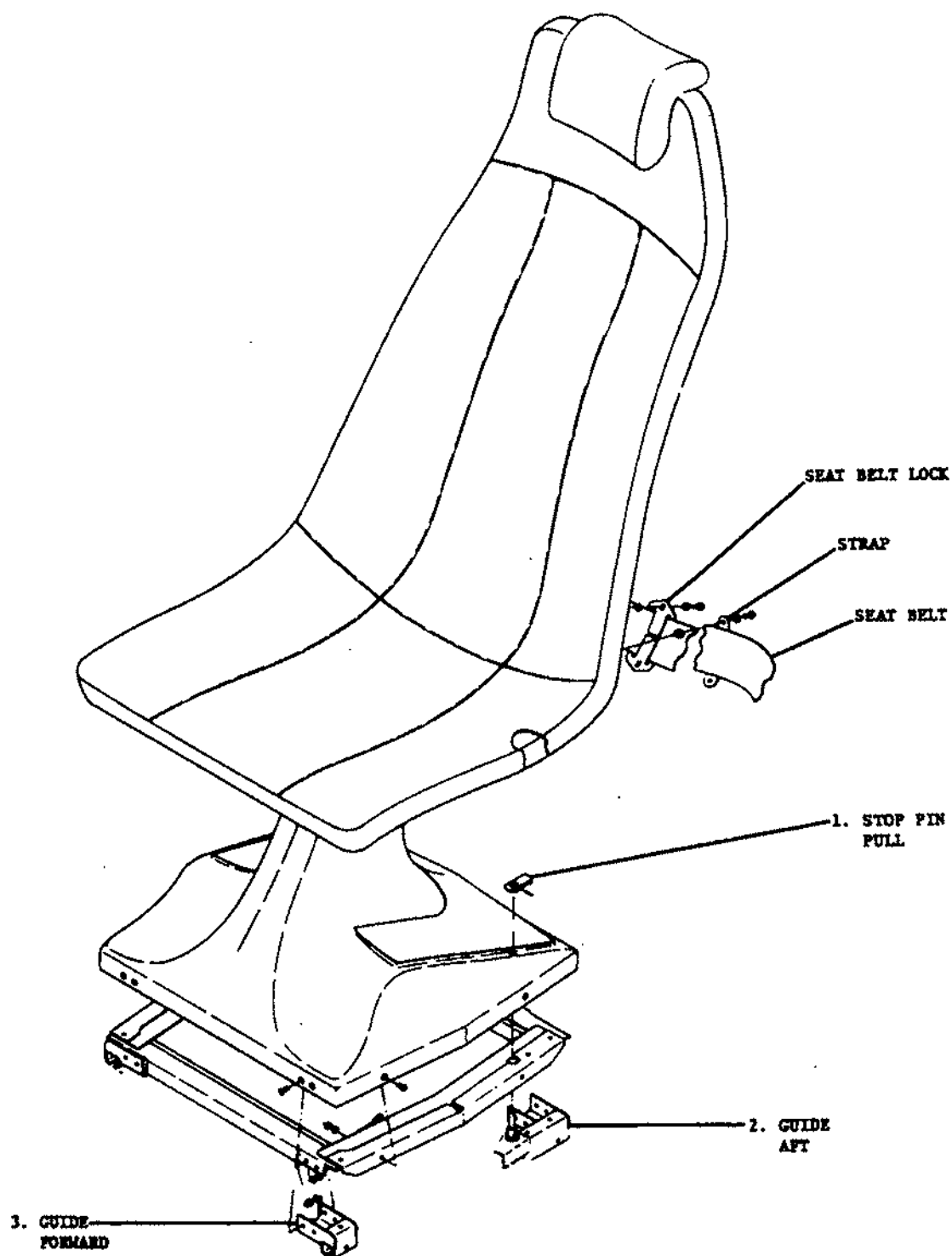
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Passenger Seventh and Eighth Seat Installation
Figure 2

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52253005
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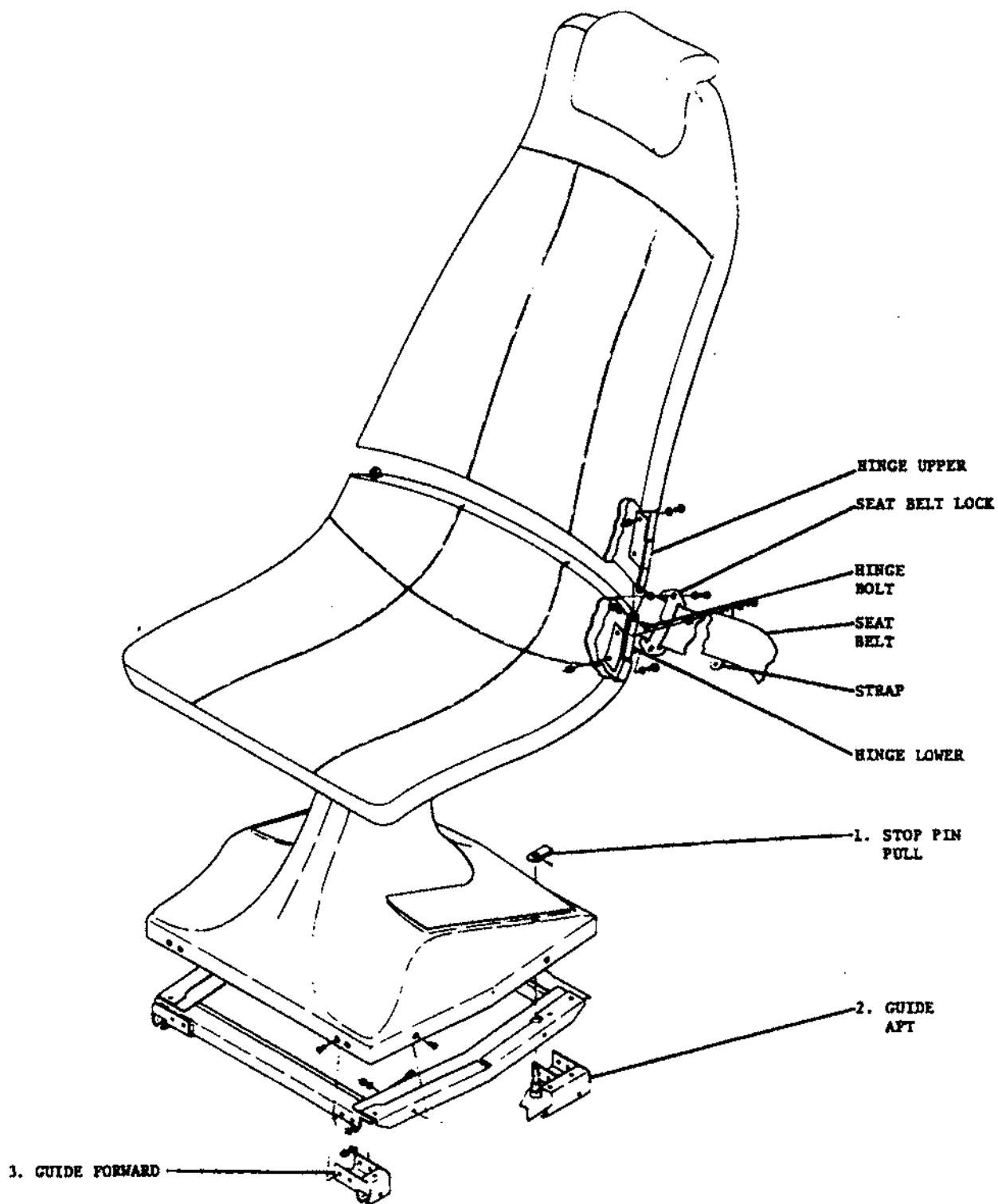
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51144012

Passenger Seats Executive Commuter Installation
Figure 3 (Sheet 1 of 3)

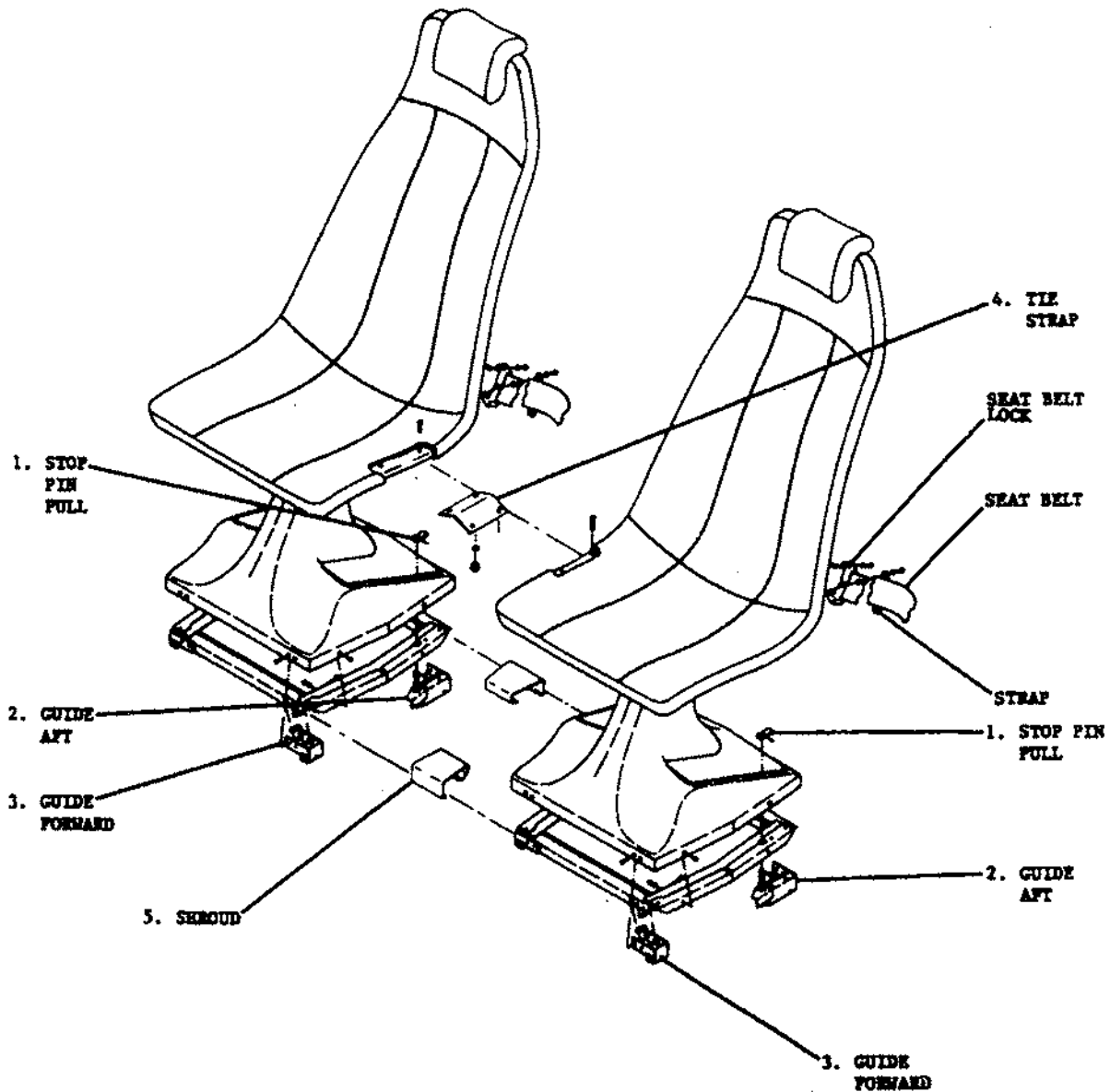
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51144011

Passenger Seats Executive Commuter Installation
Figure 3 (Sheet 2)

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52143053

Passenger Seats Executive Commuter Installation
Figure 3 (Sheet 3)

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3. Removal/Installation of Inertia Reel (Refer to Figure 1 and 2)

A. Remove Inertia Reel (Forward and Aft Facing Seats).

- (1) Remove seat back upholstery.
- (2) Remove screws and spacers securing guide to the seat back.
- (3) Remove bolts securing inertia reel to seat.

B. Install Inertia Reel (Forward and Aft Facing Seats).

- (1) Position inertia reel on seat and secure with bolts.
- (2) Route shoulder harness through guide and secure guide to seat back with spacers and screws.
- (3) Install seat back upholstery.

C. Remove Inertia Reel (Seventh and Eighth Seats).

- (1) Remove screws securing cover to bulkhead.
- (2) Remove bolts, washers, Stat-O-Seals and nuts.

4. Removal/Installation of Passenger Seats Executive Commuter (Refer to Figure 3)

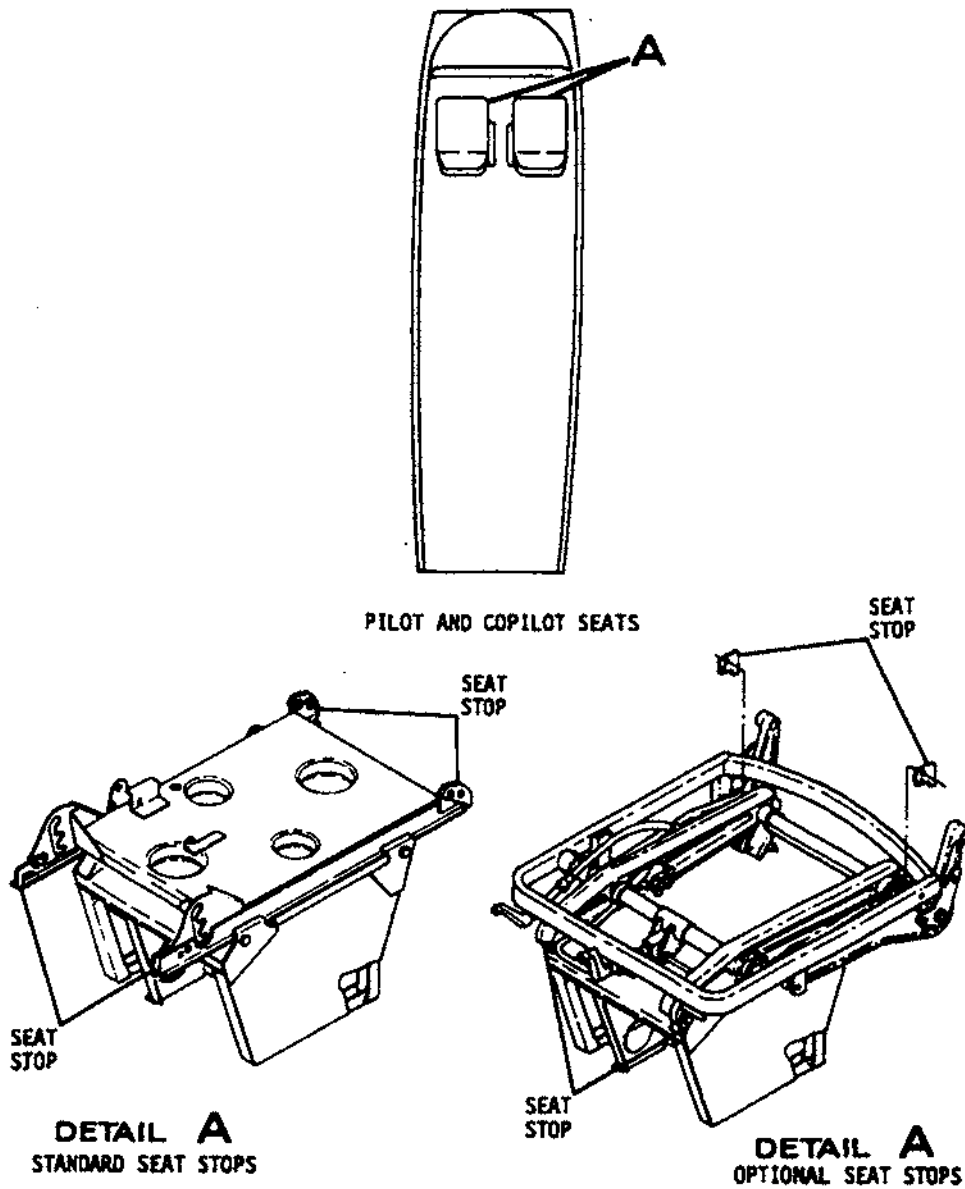
A. Remove Passenger Seats.

- (1) Pull up on stop pin (1), slide seat to cutout in rail.
- (2) Disengage guide (2) and guide (3) from seat rail by lifting seat off rail at cutout.
- (3) If the twin seat assembly is being removed, tie strap (4) and shroud (5) must be removed prior to removal by removing screws securing seats together.

B. Install Passenger Seats.

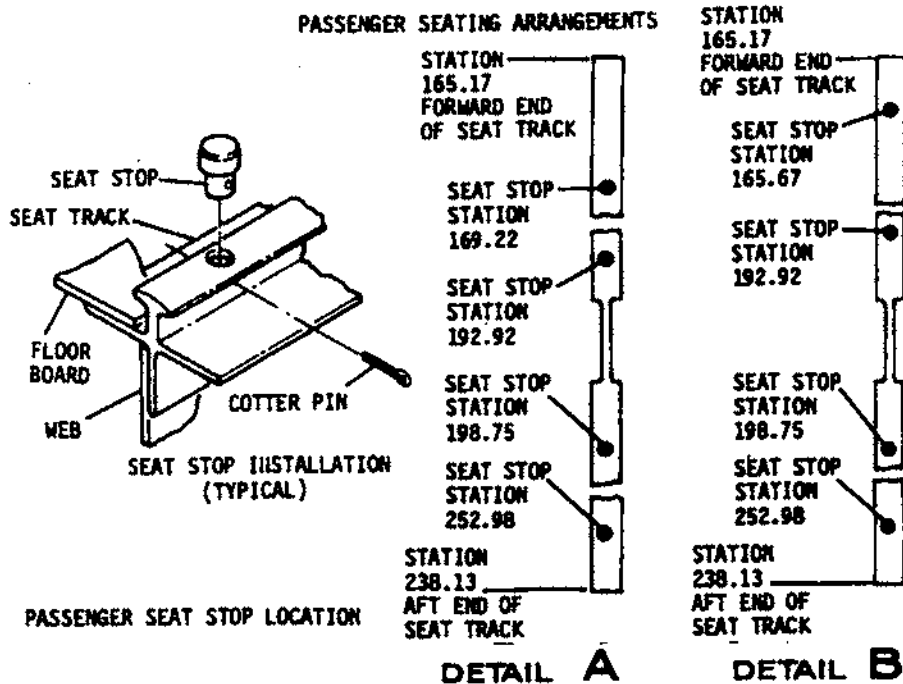
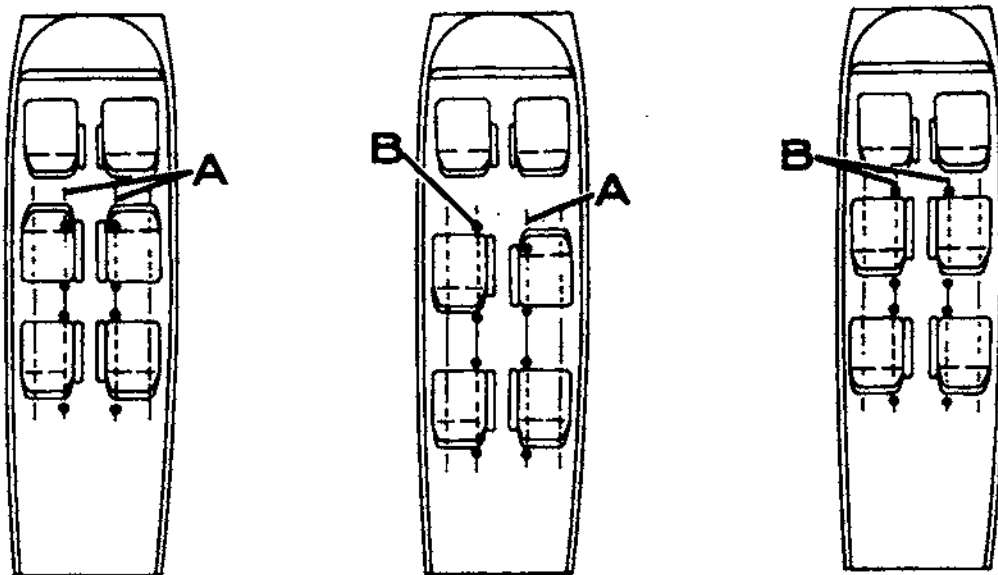
- (1) Engage guides (2) and (3) onto seat rail and slide seat into proper location.
- (2) Engage seat stop (1) and assure seat is locked into position.

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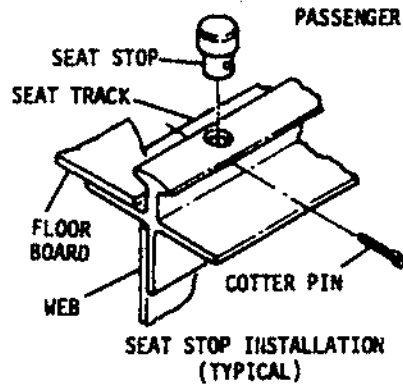
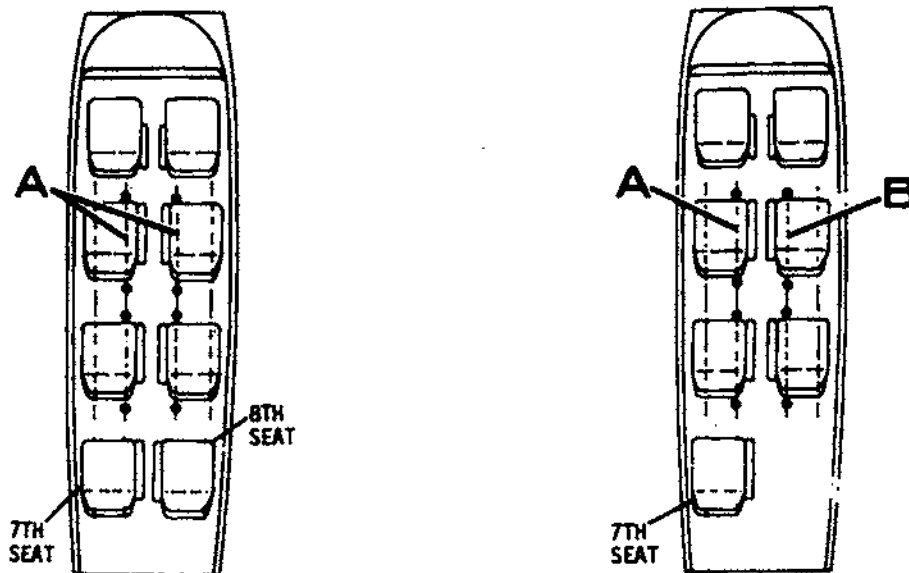
Seating Arrangement Schematic and Seat Stop Locations
Figure 4 (Sheet 1)

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Seating Arrangement Schematic and Seat Stop Locations
Figure 4 (Sheet 2)

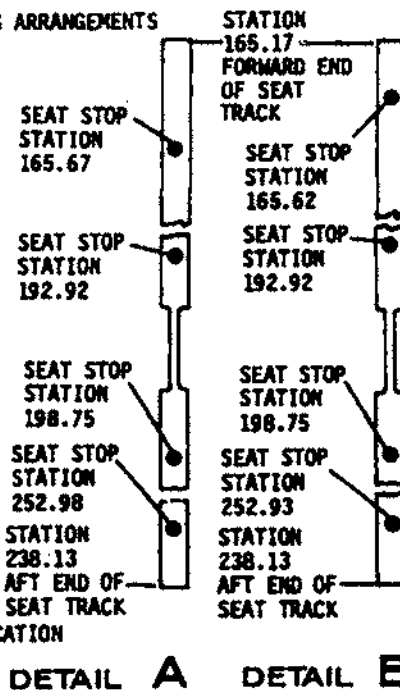
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NOTE 1. 7TH AND 8TH SEAT IS STATIONARY. IF MOUNTED ON A TRACK INSTALL STOP IN ONLY AVAILABLE HOLE.

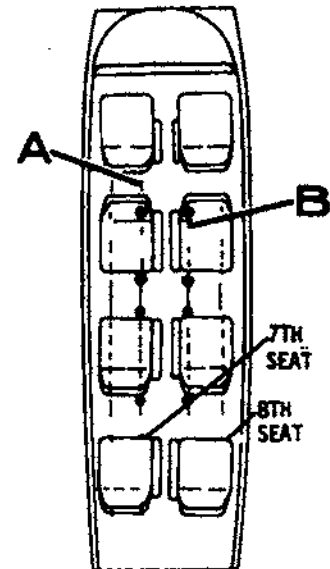
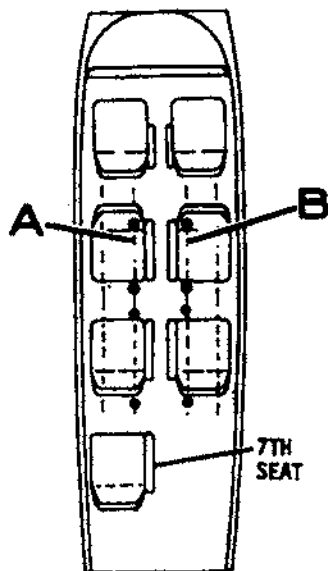
NOTE 2. WITH TOILET, INSTALL AFT STOP ON RIGHT SIDE AT STATION 233.63.

PASSENGER SEAT STOP LOCATION

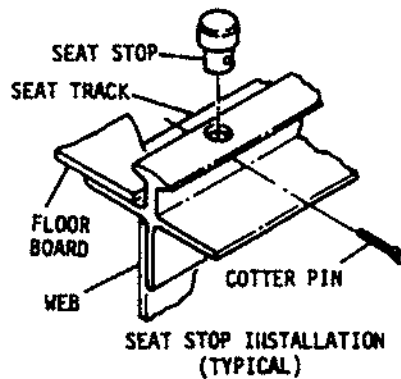


Seating Arrangement Schematic and Seat Stop Locations
Figure 4 (Sheet 3)

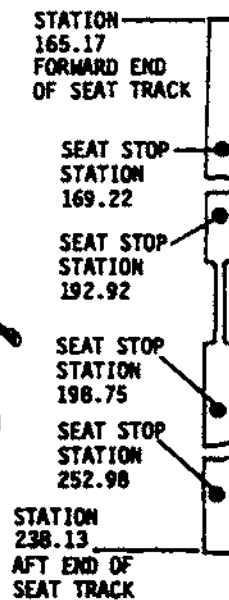
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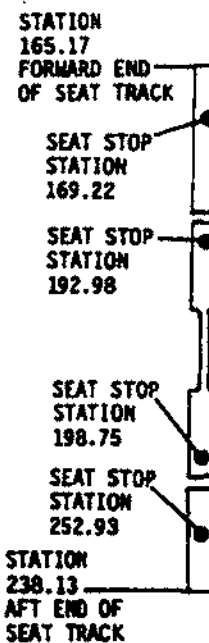
PASSENGER SEATING ARRANGEMENTS



PASSENGER SEAT STOP LOCATION



DETAIL A



DETAIL B

Seating Arrangement Schematic and Seat Stop Locations
Figure 4 (Sheet 4)

TOILET AND RELIEF TUBE

DESCRIPTION

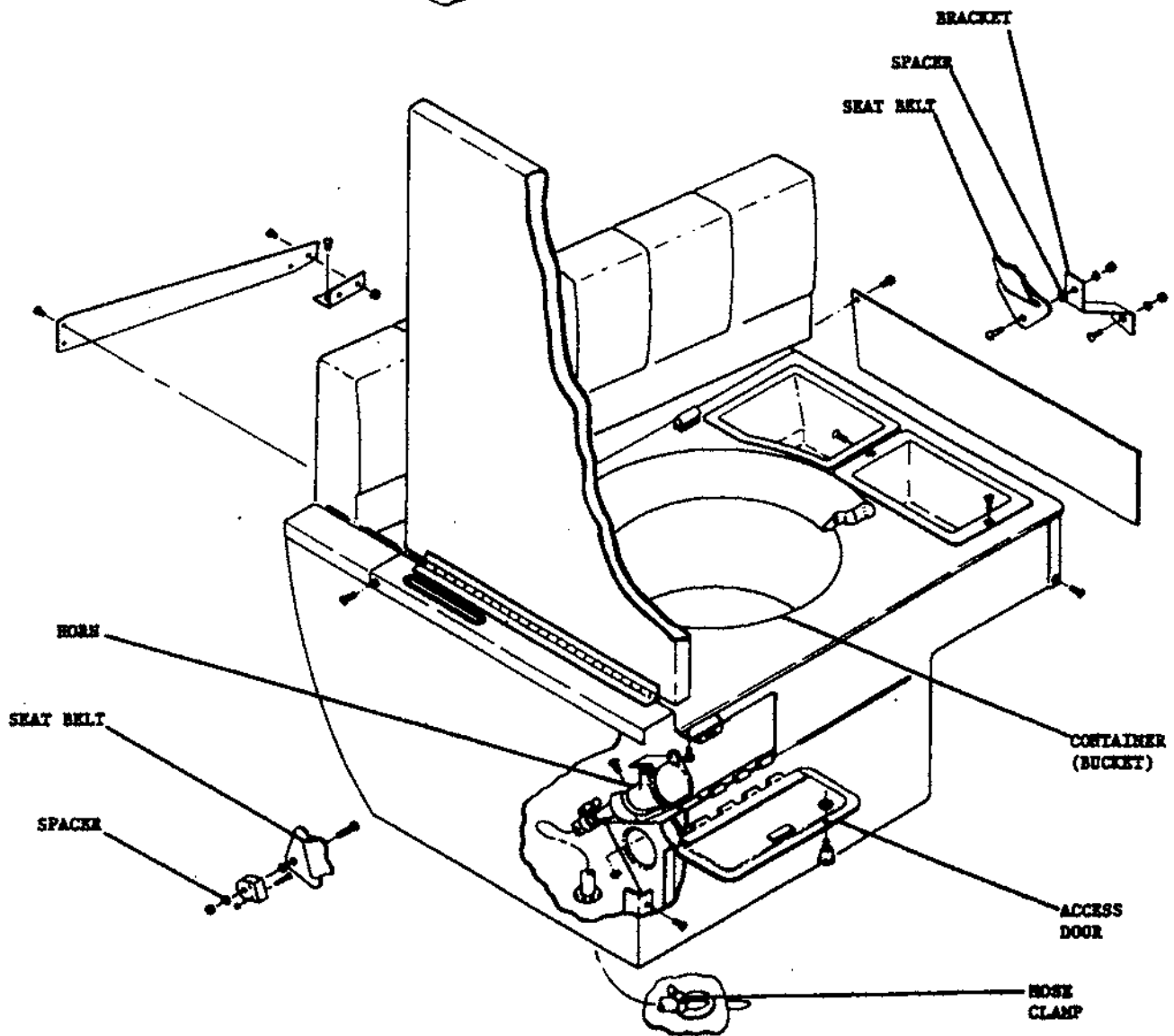
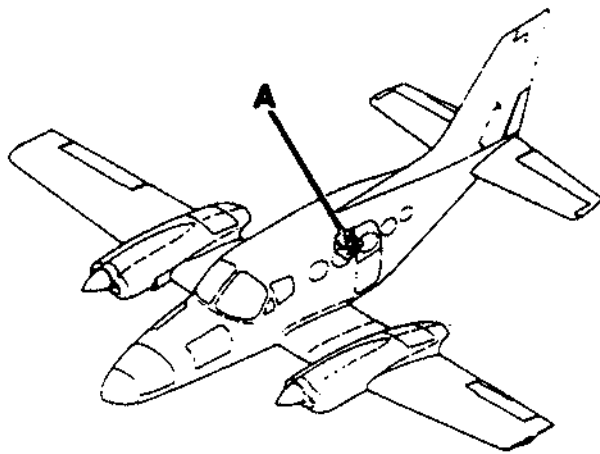
1. The toilet assembly is located on the right side of the cabin and aft of the rear cabin divider. The assembly also contains the relief tube installation mounted in the forward section of the assembly and is accessible through the access door on the front of the assembly. Seat belts are provided for takeoff and landing when the toilet assembly is used as a passenger seat.

Maintenance Practices

1. Removal/Installation of Toilet Assembly (See Figure 1).
 - A. Remove Toilet Assembly.
 - (1) Remove necessary seats and aft cabin divider.
 - (2) Remove screws securing toilet assembly to structure.
 - (3) Raise toilet assembly enough to gain access and remove hose clamp from relief tube.
 - (4) Remove toilet assembly from aircraft.
 - B. Install Toilet Assembly.
 - (1) Position toilet assembly in place, connect relief tube and tighten hose clamp.
 - (2) Install screws securing toilet assembly to structure.
 - (3) Install removed seats and cabin divider.
2. Cleaning and Painting Toilet Assembly.
 - A. Remove container to service area.
 - B. Clean container and surrounding area with a commercial disinfectant and allow to dry.
 - C. Flush relief tube on post flight with a diluted solution of commercial disinfectant and water, approximately one quart.
 - D. Allow relief tube to air dry.
3. Servicing Flush Toilet.
 - A. Reservoir.
 - (1) Lift cover and ring assembly and disconnect the electrical connector plug.
 - (2) Unlock reservoir by turning wing-head fasteners one-half turn counterclockwise.
 - (3) Remove reservoir to service area. Remove cap from waste discharge spout on tank and pour contents into commode.
 - (4) Rinse reservoir thoroughly. Replace cap on waste spout. Recharge tank with mixture of 2 quarts of clear water and one 3-ounce package of Monogram DG-19 chemical.
 - (5) Replace reservoir in aircraft and lock in place with wing-head fasteners. Connect the electrical connector plug and check for proper operation.

CAUTION: IF TEMPERATURES ARE BELOW FREEZING AND AIRCRAFT IS TO BE STOWED IN AN UNHEATED HANGAR, ETHYLENE GLYCOL BASE ANTI-FREEZE, MIXED TO MANUFACTURER'S INSTRUCTIONS, MAY BE ADDED TO THE FLUSH SOLUTION TO PREVENT FREEZING.
 - B. Napkin Dispenser.
 - (1) Pull out storage drawer.
 - (2) Insert napkin box in receptacle.
 - (3) Close storage drawer.

CESSNA AIRCRAFT COMPANY
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SERVICE MANUAL



AIRPLANES C0001 THRU C1800

DETAIL A
Toilet and Relief Tube Installation
Figure 1

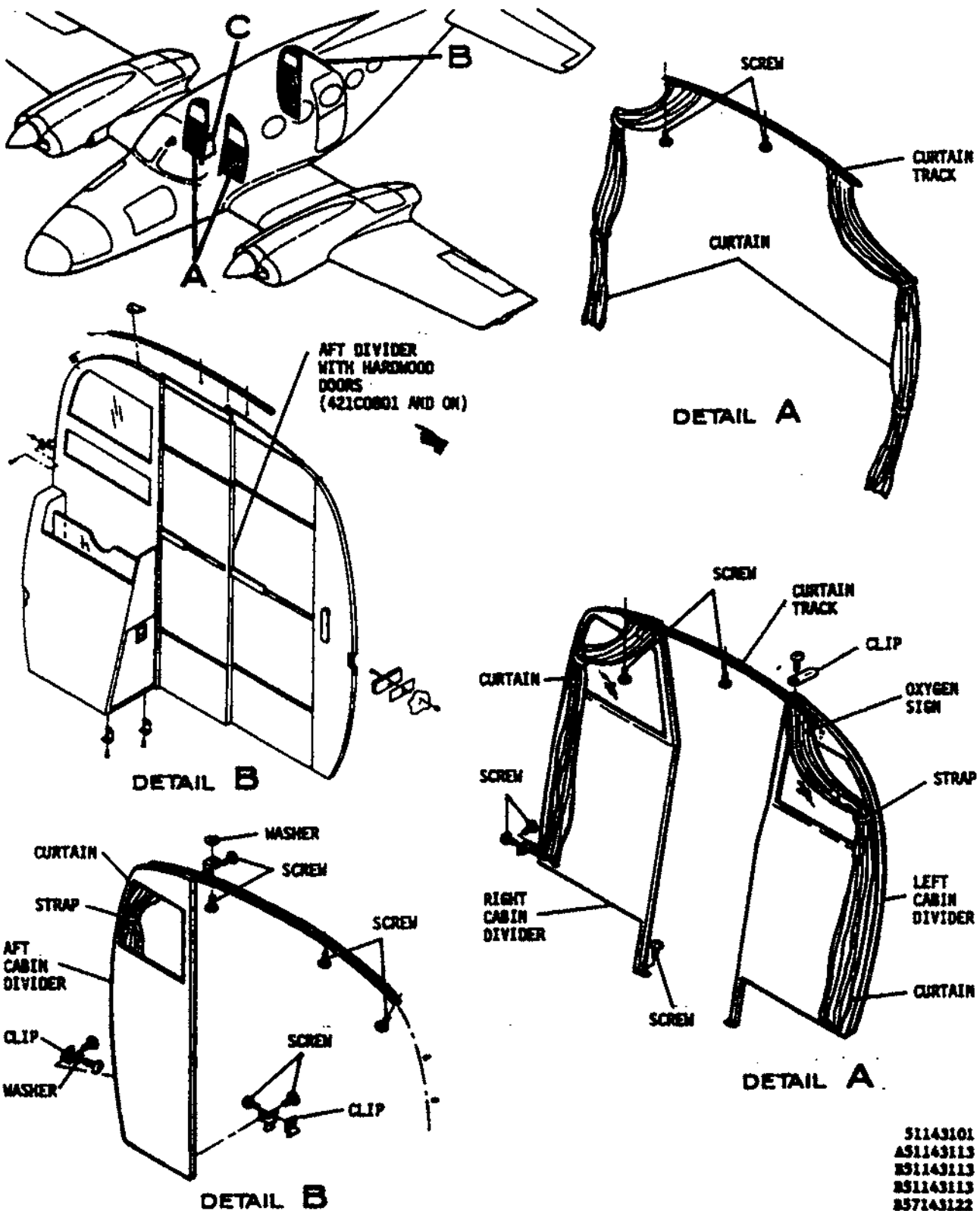
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CABIN DIVIDERSDescription

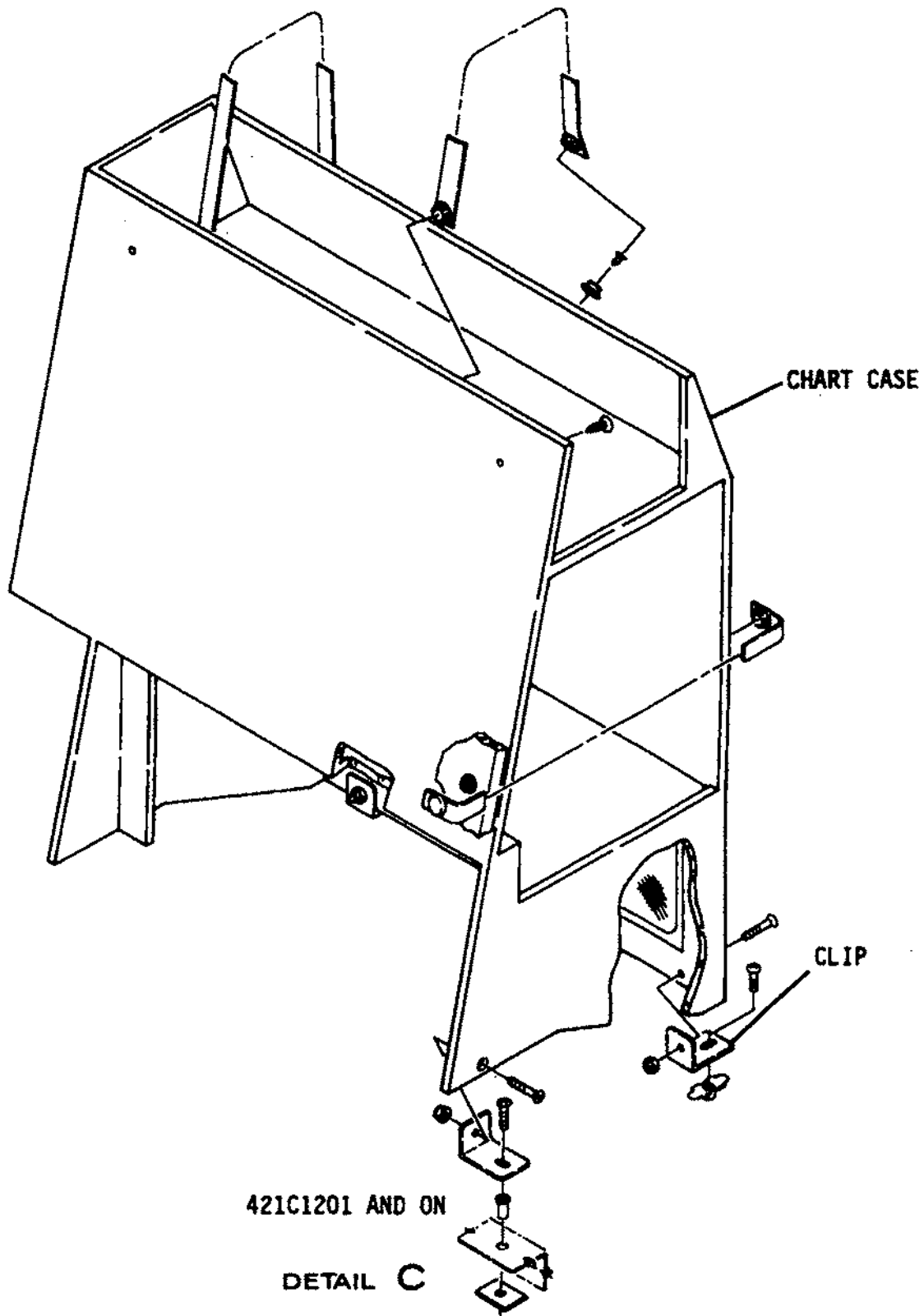
1. Cabin dividers are installed at Fuselage Stations 154.50 and 238.13 as optional equipment. The forward cabin divider houses the oxygen, seat belt and no smoking signs and separates the flight deck from the passenger compartment. The aft cabin divider separates the toilet, refreshment bar and baggage area from the passenger compartment. Both cabin dividers are equipped with a telescoping door, that may be stowed out of the way when not in use.

Maintenance Practices

1. Removal/Installation of Cabin Dividers (See Figure 1)
 - A. Remove Forward Cabin Divider.
 - (1) Slide pilot and copilot seats full forward.
 - (2) Slide passenger seats full aft.
 - (3) Remove screws and washers from clips and tracks and remove dividers.
 - B. Install Forward Cabin Divider.
 - (1) Position cabin divider into position, align mounting clips with mounting nuts and insert screws.
 - (2) Install screws in curtain track.
 - C. Remove Aft Cabin Divider.
 - (1) Slide passenger seat full forward.
 - (2) Remove screws securing cabin divider to structure and toilet assembly (if installed).
 - (3) Remove aft cabin divider.
 - D. Install Aft Cabin Divider.
 - (1) Position aft cabin divider in place and install screws into clips and into structure.
 - (2) Install screws into toilet assembly.
2. Removal/Installation Chart Case (421C1201 and On) (See Figure 1).
 - A. Remove Chart Case.
 - (1) Slide copilot seat full forward.
 - (2) Remove screws and washer securing chart case to structure.
 - B. Install Chart Case.
 - (1) Position chart case on structure and secure with screws.



Cabin Dividers Installation
Figure 1 (Sheet 1)



CS9193002

Cabin Dividers Installation
Figure 1 (Sheet 2)

EXECUTIVE TABLEDescription

1. The executive table (optional) is mounted on either the left or right side of the cabin. The executive table folds down and out between the passenger seats or may be stowed in its mounting along the side of the cabin.

Maintenance Practices

1. Removal/Installation of Executive Table (See Figure 1)

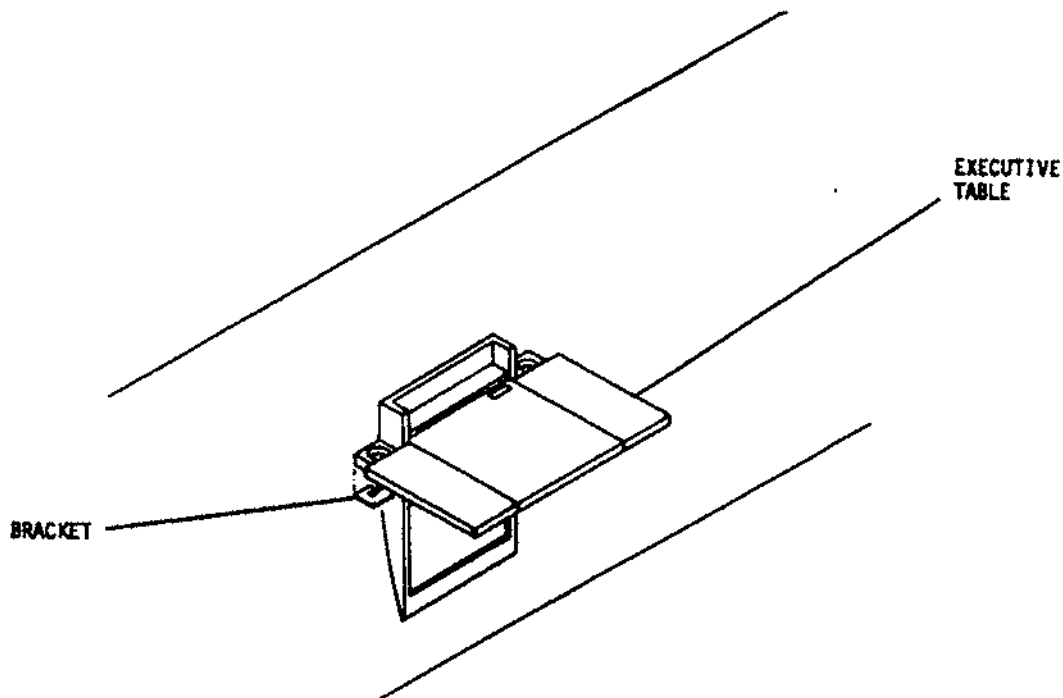
NOTE: Procedures are the same for either side.

A. Remove Executive Table.

- (1) Fold table into the stowed position.
- (2) Remove screws securing executive table to structure and remove.

B. Install Executive Table.

- (1) Position executive table in place.
- (2) Align mounting holes in table with the structure mounting holes using a small drill shank.
- (3) Install screws.



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Executive Table Installation
Figure 1

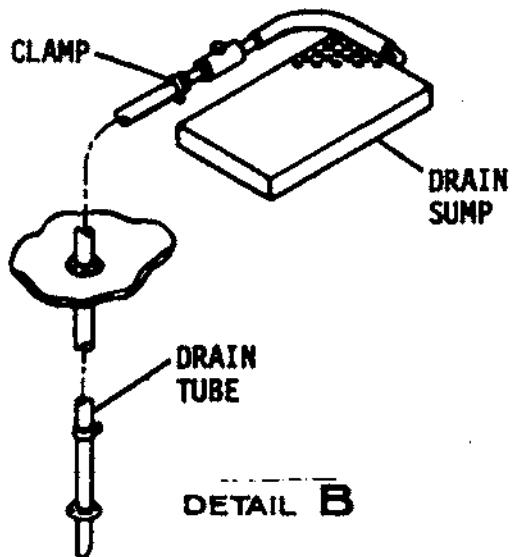
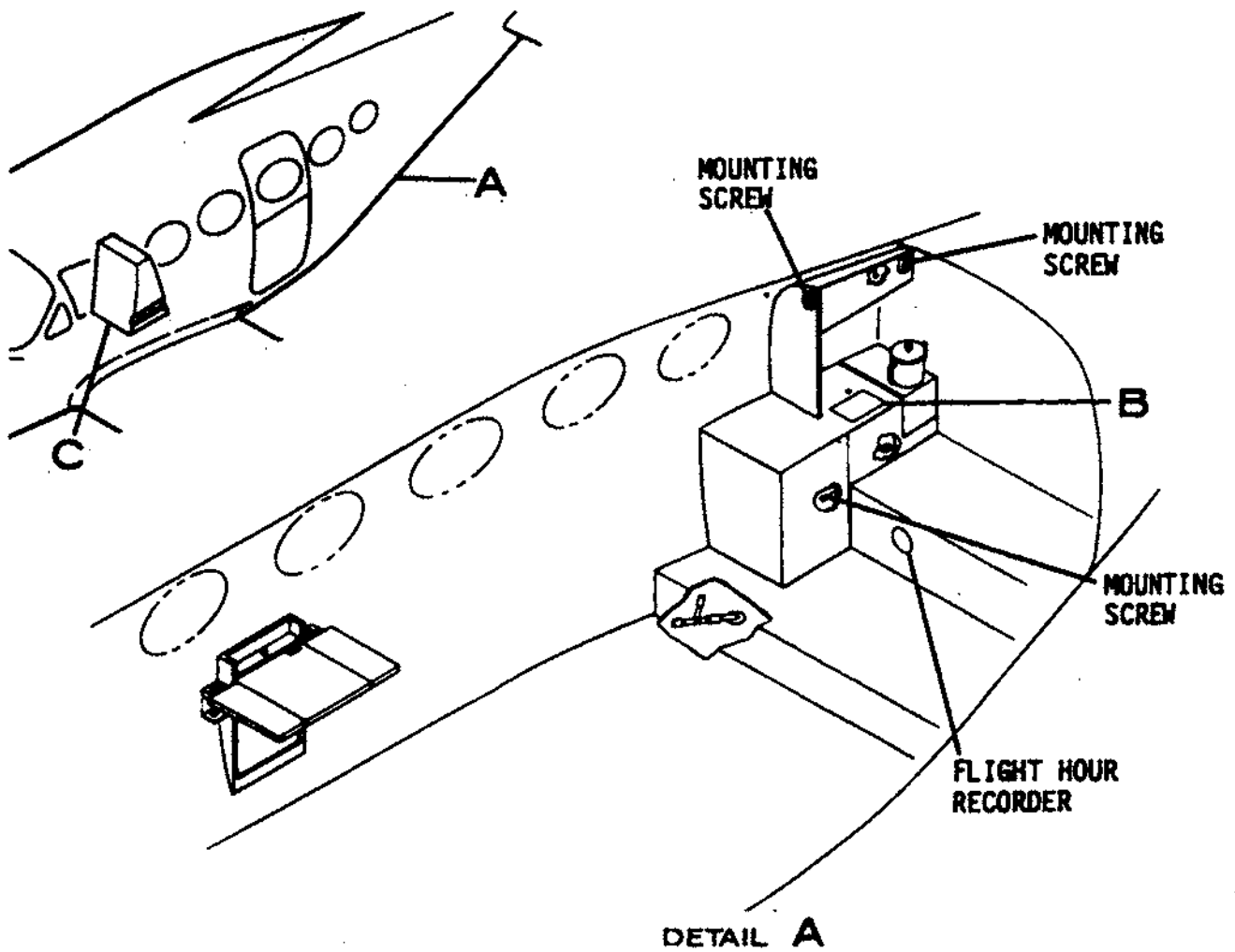
REFRESHMENT CENTERDescription

The refreshment centers are optional. On airplanes 421C0001 thru 421C1200, the refreshment center is installed in the aft cabin. On airplanes 421C1201 and On, the refreshment center is installed in the forward cabin.

Maintenance Practices

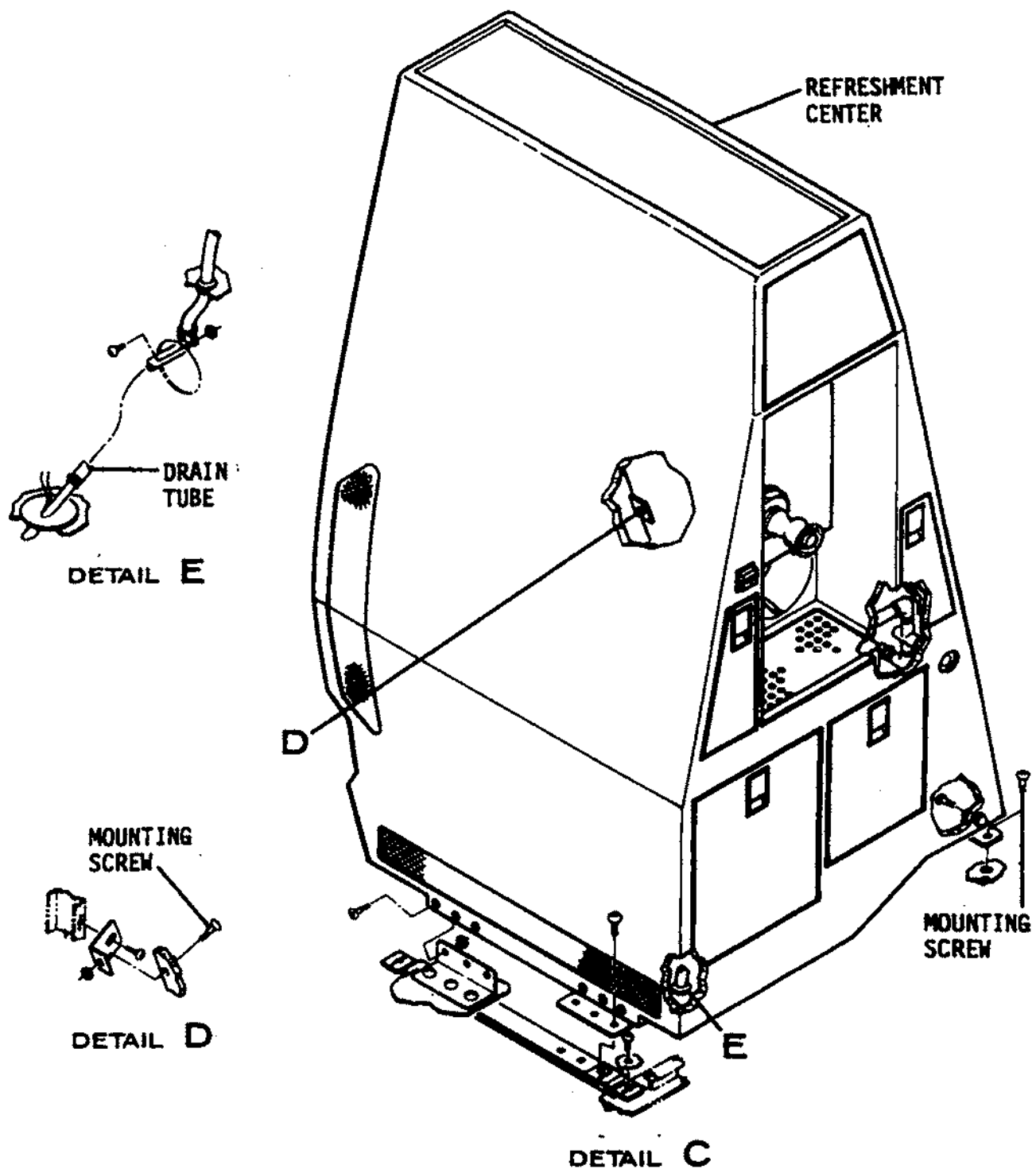
1. Removal/Installation.

A. Removal and installation may be accomplished in accordance with figure 1.



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Refreshment Center
Figure 1 (Sheet 1)



Refreshment Center
Figure 1 (Sheet 2)

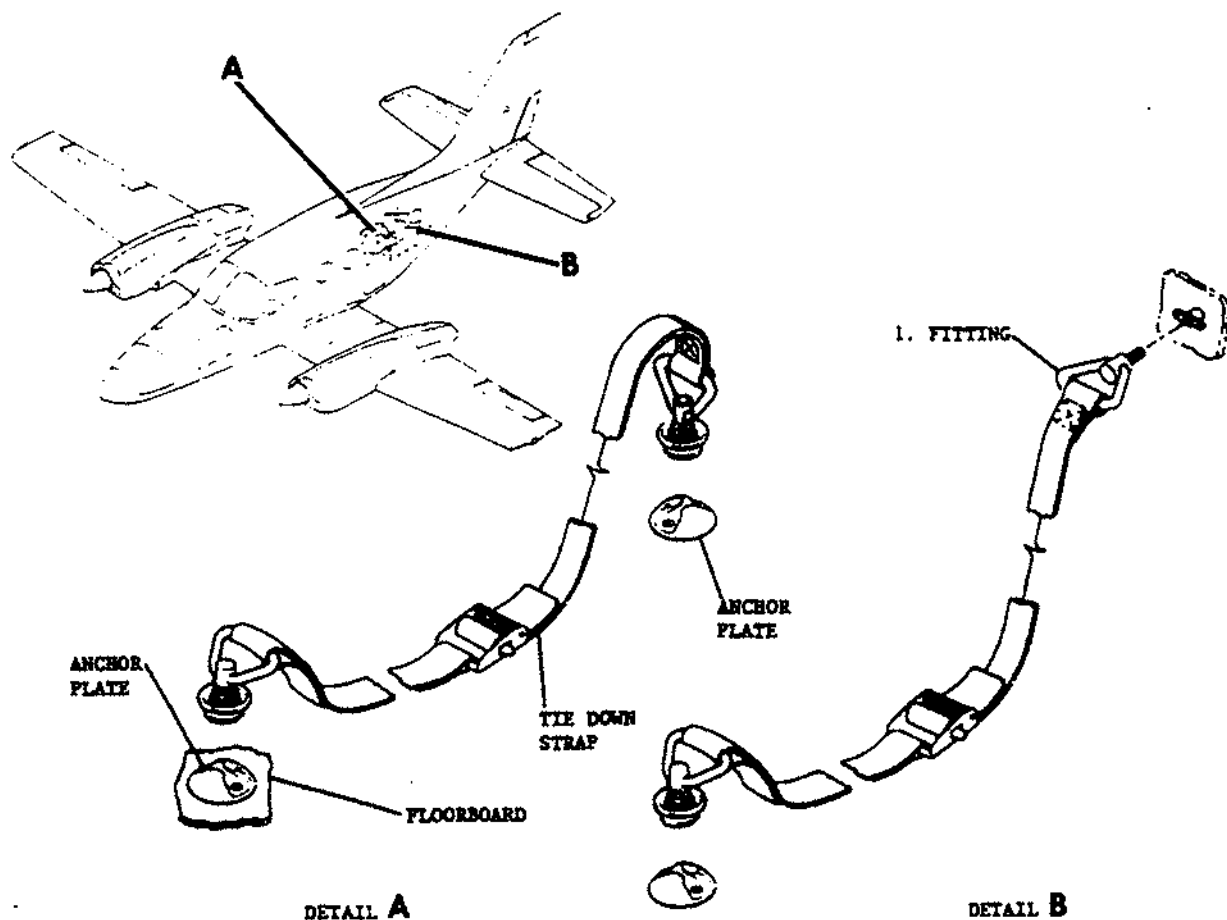
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CARGO AND BAGGAGE TIE DOWNSDescription

1. The cargo and baggage tie downs consist of the anchor plate and straps. Anchor plates are installed in the floorboards in the baggage area and are the quick-disconnect type. Each strap has a disconnect fitting which engages with the anchor plate when in use and is stored with the aircraft loose equipment when not in use. The seventh and eighth seat belt anchors may also be used for tie downs by installing tie down fittings as shown in Figure 1.

Maintenance Practices

1. Removal/Installation of Cargo and Baggage Tie Downs (See Figure 1)
 - A. Remove Cargo and Baggage Tie Downs.
 - (1) Remove tie down straps by sliding out of anchor plates.
 - (2) If installed, remove fittings (1).
 - B. Install Cargo and Baggage Tie Downs.
 - (1) Install fitting (1).
 - (2) Install tie down straps by inserting fitting into anchor plate.



Cargo and Baggage Tie Downs
Figure 1

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HAND FIRE EXTINGUISHERDescription

1. The hand fire extinguisher (optional) mounted on the copilot's seat contains a pressurized dry chemical charge. The fire extinguisher may be used on combustible, liquid, or electrical fires. The charge is non-toxic and non-corrosive. Residue left after use may be removed with a damp cloth or picked up with a vacuum source. The fire extinguisher is rechargeable and may be filled by most fire equipment dealers.

Maintenance Practices

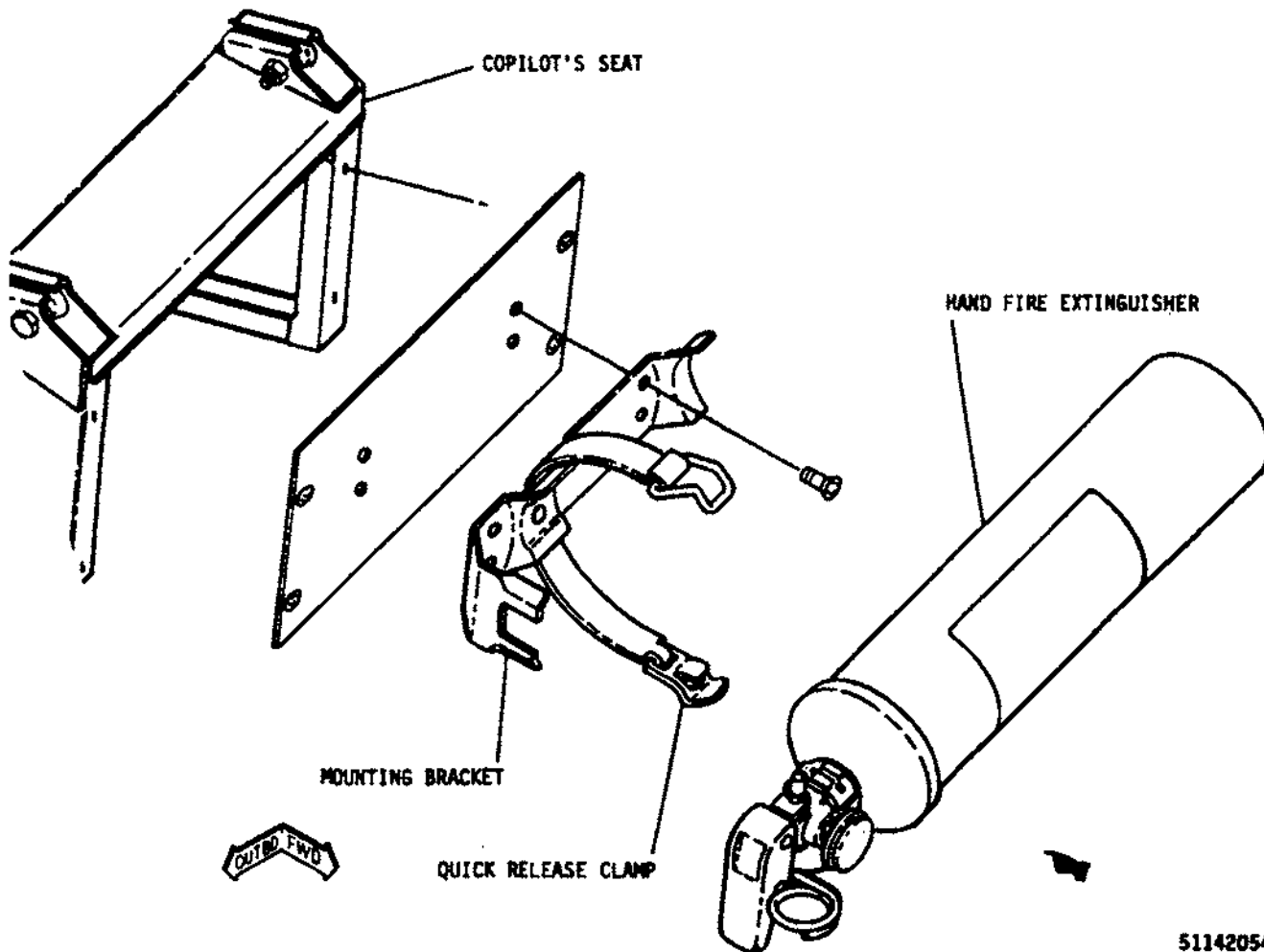
1. Removal/Installation of Hand Fire Extinguisher

- A. Remove Hand Fire Extinguisher.

- (1) Release quick release clamp.
 - (2) Remove fire extinguisher from bracket.

- B. Install Hand Fire Extinguisher.

- (1) Position hand fire extinguisher in place.
 - (2) Secure with quick release clamp.



Hand Fire Extinguisher Installation
Figure 1

51142054
51143090

CARPETDescription

1. The airplane's carpet is installed in sections on the floorboards for ease of removal and installation. The carpet is held in place with screws.

Maintenance Practices

1. Removal/Installation Carpet (See Figure 1)

A. Remove Carpet.

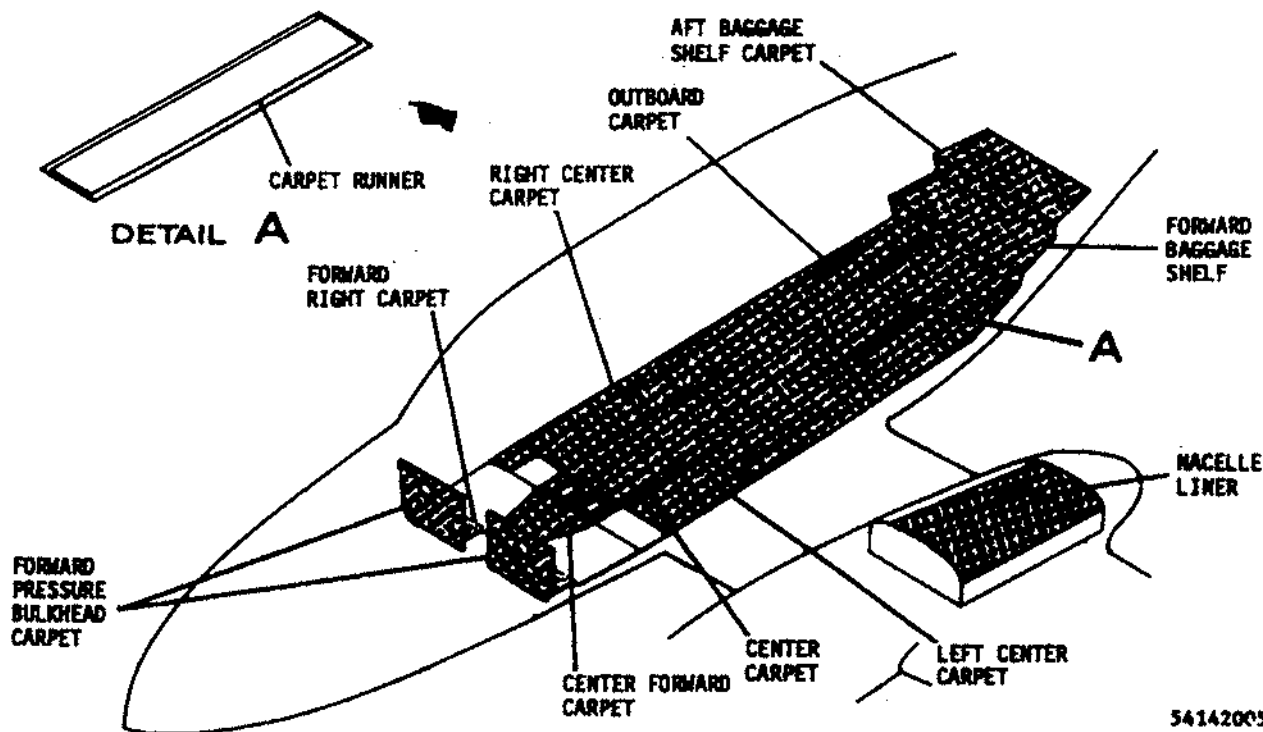
- (1) Remove pilot and copilot seats, refer to seat removal procedures.
- (2) Remove passengers seats, refer to seat removal procedures.
- (3) Remove kick plates by removing attaching screws.
- (4) Remove screws attaching cover plates to floorboards and the pedestal and remove cover plates.
- (5) Remove carpet retainers by removing screws.
- (6) Remove carpet from airplane.
- (7) If forward bulkhead carpet is being removed, peel the bonded carpet carefully from the metal.

B. Install Carpet.

- (1) If removed, install forward bulkhead carpet, bond to metal using cement (EC880 or equivalent).
- (2) Place carpet in place on airplane's floorboards.
- (3) Install retainers with screws.
- (4) Install cover plates and kick plates with screws.
- (5) Install passenger seats, refer to seat installation procedures.
- (6) Install pilot and copilot seats, refer to installation procedures.
- (7) Assure seats will slide freely on seat rails.

C. Cleaning Carpet.

- (1) Refer to Chapter 2 for cleaning procedures.



Carpet Installation
Figure 1

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CABIN STEREO EQUIPMENT

Description

1. The eight track cabin stereo system (optional) consists of the stereo tape player installed in the stereo cabinet, speakers and the headset transducer. The eight track tape player has automatic switching of programs with continuous play and push button control for immediate program change.
2. The cabin cassette stereo system (optional) consists of a stereo tape player installed in the stereo cabinet. The cassette stereo features automatic music select system along with the usual volume, tone, balance, reverse, fast forward and rewind functions. The automatic music select system allows the operator to repeat a selection that has just played or to bypass a selection and resume play.

Maintenance Practices

1. Removal/Installation of Cabin Stereo Equipment (Refer to Figure 1)

A. Remove Stereo Tape Player.

- (1) Disconnect electrical connector from stereo tape player.
- (2) Remove screws fastening stereo cabinet to floorboard.
- (3) Remove stereo cabinet with stereo tape player from the airplane.
- (4) Remove screws securing stereo tape player in cabinet and slide out of cabinet.

B. Install Stereo Tape Player.

- (1) If removed from cabinet, slide stereo tape player into cabinet and secure with screws and if applicable install nuts and washers.
- (2) Position stereo cabinet in place and install screws in floorboard.
- (3) Connect electrical connection.
- (4) Check operation.

C. Remove Speaker.

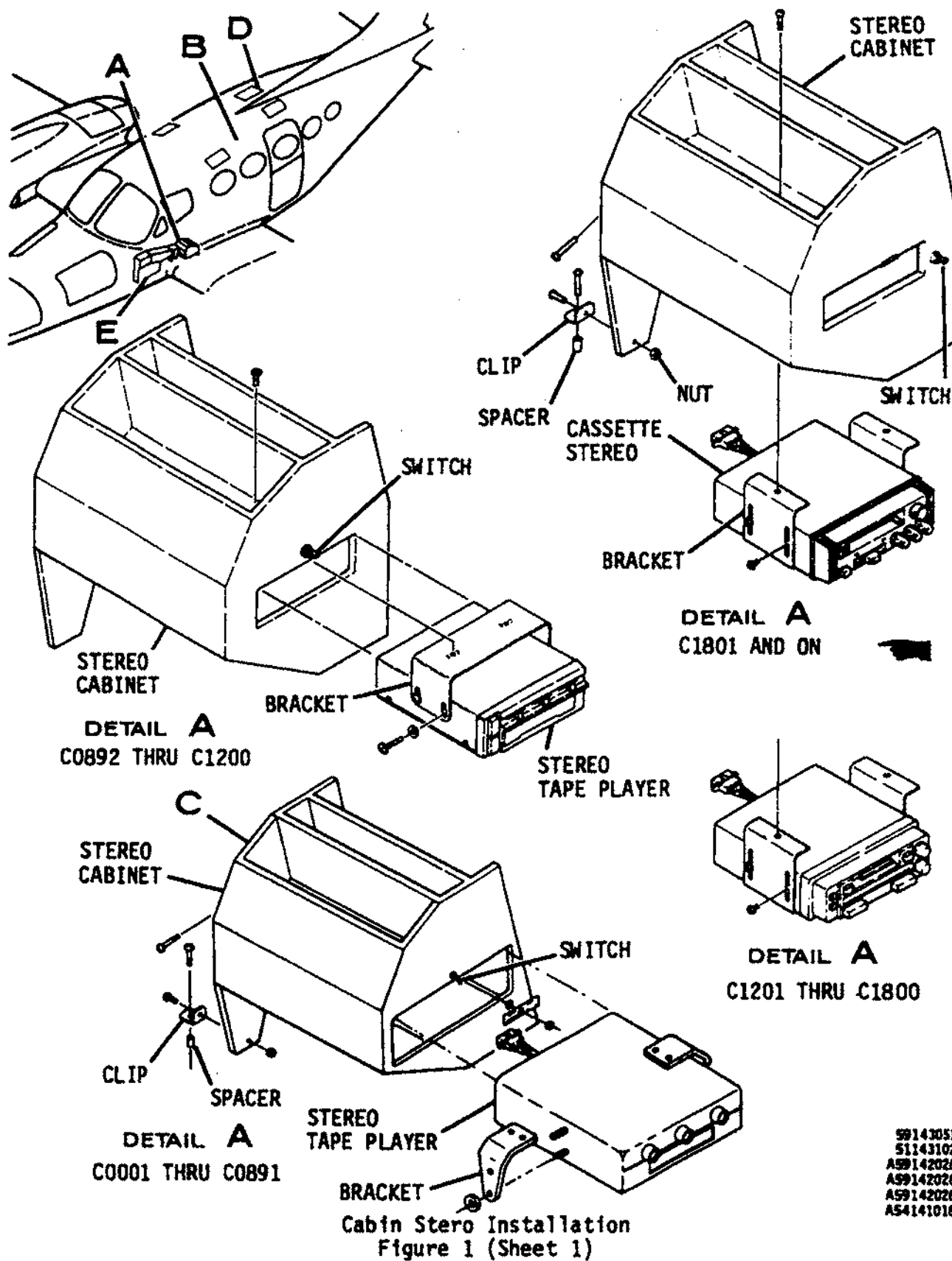
NOTE: Procedures are typical for each of the stereo speakers.

- (1) Remove necessary headliner to gain access to stereo speakers.
- (2) Remove speaker and baffle.
- (3) Tag and disconnect speaker wires; remove speaker.

D. Install Speakers.

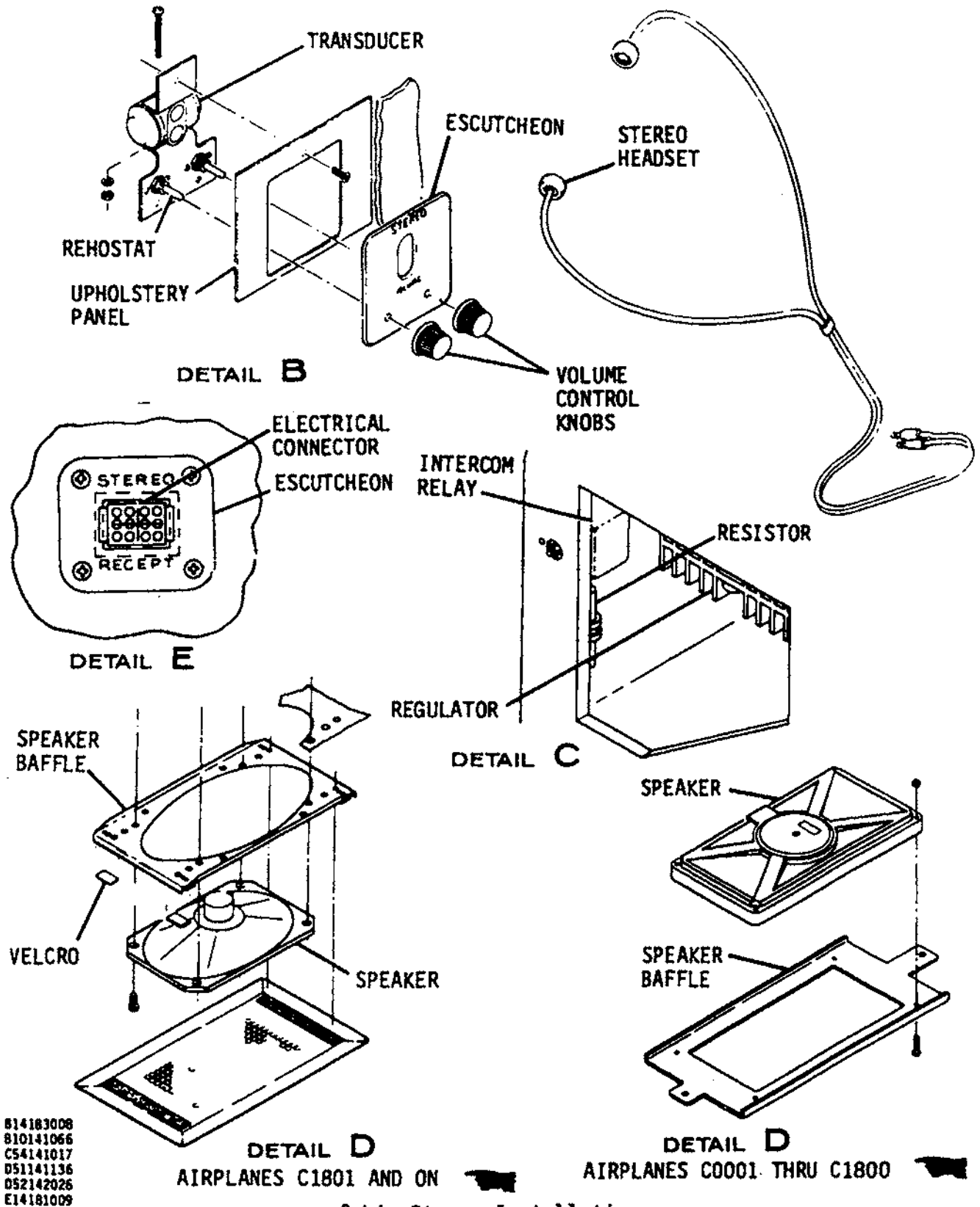
- (1) Connect speaker wires and remove tags and install speaker.
- (2) Place baffle in position and secure.
- (3) Install headliner insulation and headliner.

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421
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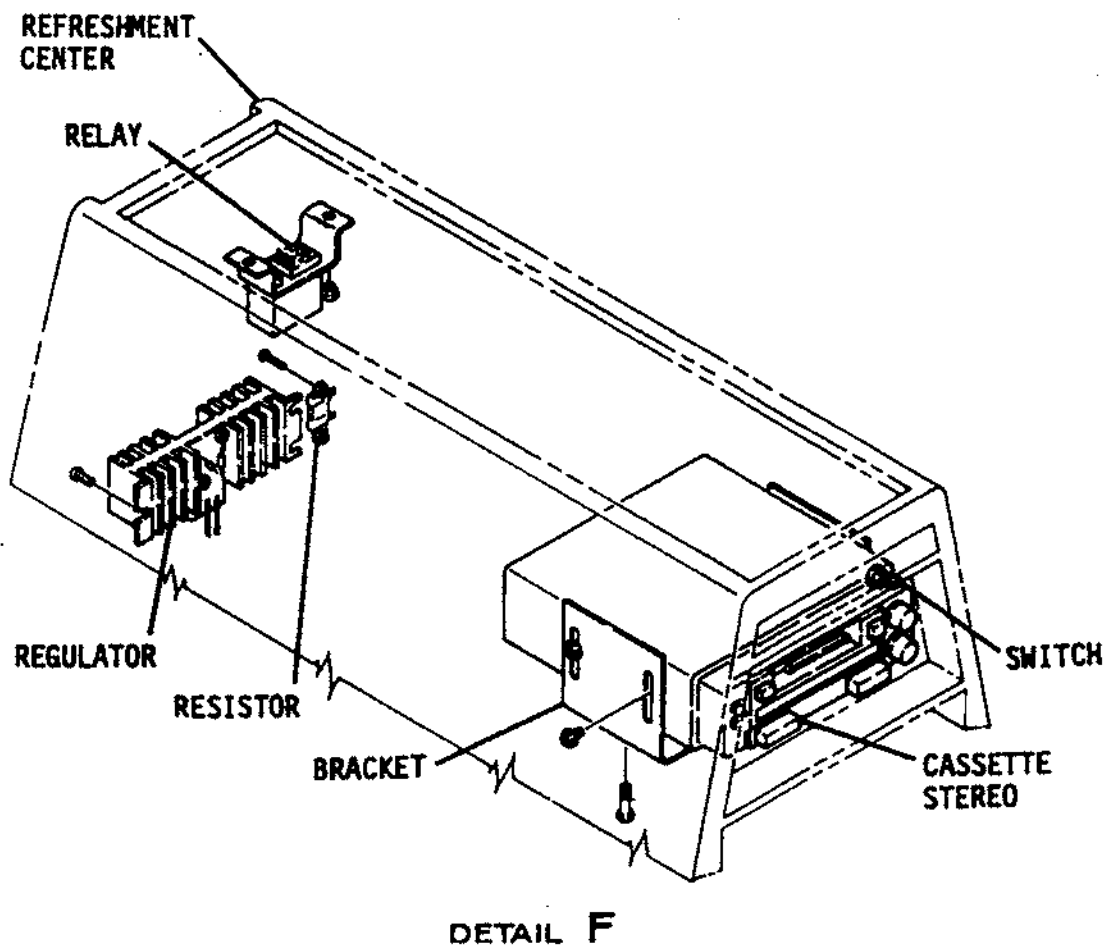


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Cabin Stereo Installation
Figure 1 (Sheet 2)



Cabin Stereo Installation
Figure 1 (Sheet 3)

739142021A

SURFACE DEICE SYSTEMDescription

1. The surface deice system (optional) is utilized to break up ice accumulations on the wing leading edge and the horizontal and vertical stabilizer leading edge. Air is routed from each engine-driven vacuum pump by tubing to the rubber boots bonded to the leading edge of the wing, horizontal stabilizer and vertical stabilizer.
2. The system consists of; engine-driven vacuum pumps, shuttle valves, oil separators, air filter assemblies, pressure switch electrical timer and the inflatable rubber deice boots. The system is electrically controlled and pneumatically operated. Air for inflation of the boots is supplied by the pressure side of each engine-driven vacuum pump. A wing deice light is incorporated on the outboard side of the engine nacelles to provide an aid in observing ice formations during night operation.
3. To operate the deice system, the engines must be operating to provide air. Momentarily position the surface deice switch, located on the side console to ON. The control valve closes its overboard air valve and directs the air from the pressure side of the vacuum pump through a filter and check valve to the three flow valves. The timer module electrically opens the flow valve to the stabilizers allowing the boots to inflate. After the six-second inflation cycle is complete, the timer module closes the flow valve to the stabilizers and opens the wing flow valve. After the six-second inflation cycle, the wing flow valves are closed completing the cycle. After each inflation cycle, air pressure from the boot is vented from the flow valve through a relief. When vent air pressure drops to approximately 1 PSI, the relief closes and the vacuum pump then holds the boots in a deflated position. The pressure indicator light will illuminate when the inflated boot pressure at the horizontal and vertical stabilizers reach 6 to 8.5 PSI.
4. Refer to vendor manual for maintenance and overhaul of pressure control valve.

Troubleshooting

1. Troubleshooting the pneumatic deice system is isolating the fault to the air or electrical part. Refer to Chapter 13 for wiring diagrams.
2. Tools and Equipment

NOTE: Equivalent substitutes may be used for the following listed items.

Name	Number	Manufacturer	Use
Multimeter	Model 260	Katy Industries, Inc. Simpson Electric Co.	To check voltage and continuity in the electrical circuits.

3. Troubleshooting the Pneumatic Deice System Electrical Parts

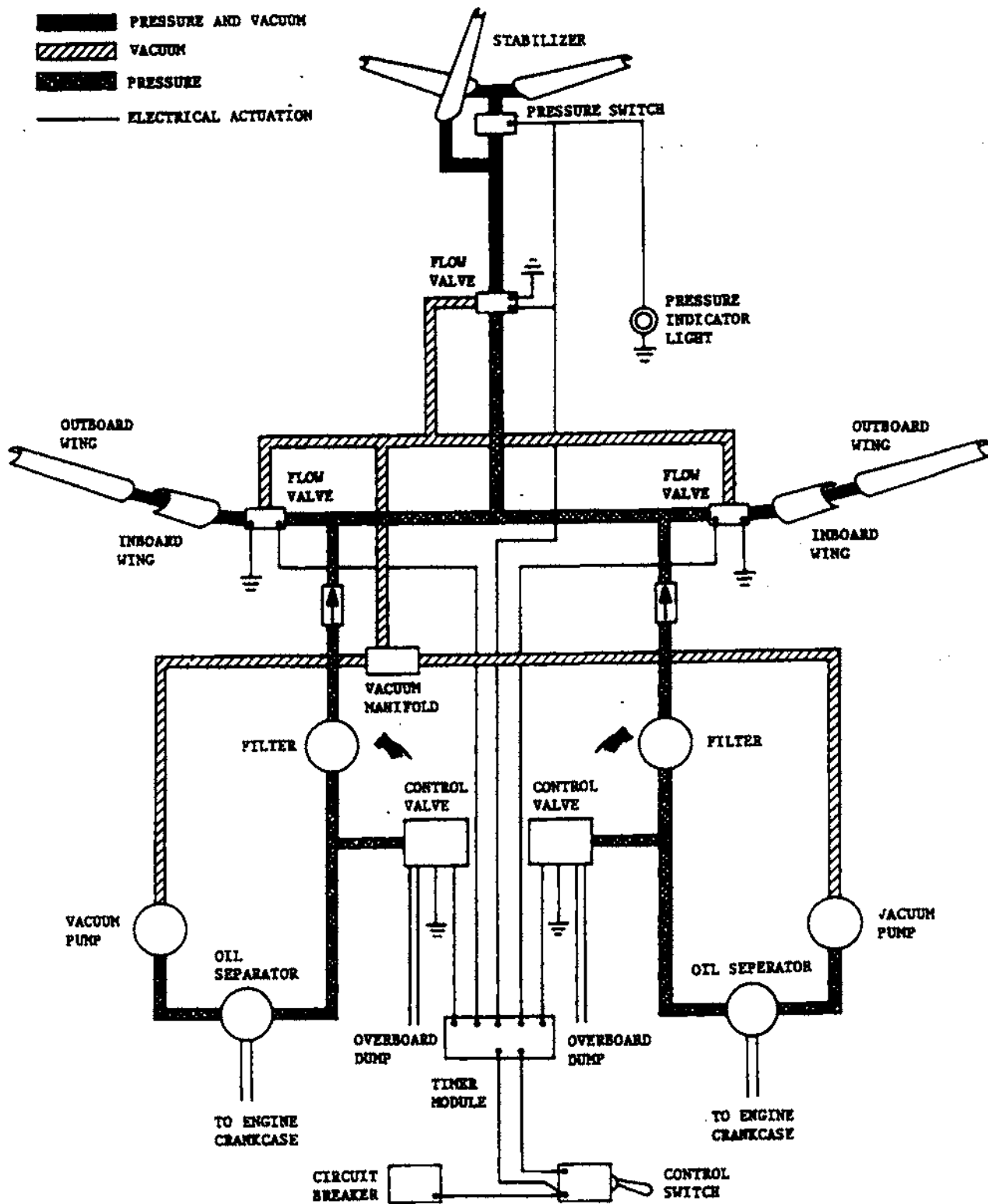
- A. For Troubleshooting the Deice System, see Figure 2.

Adjustment/Test

1. Tools and Equipment

NOTE: Equivalent substitutes may be used for the following listed items:

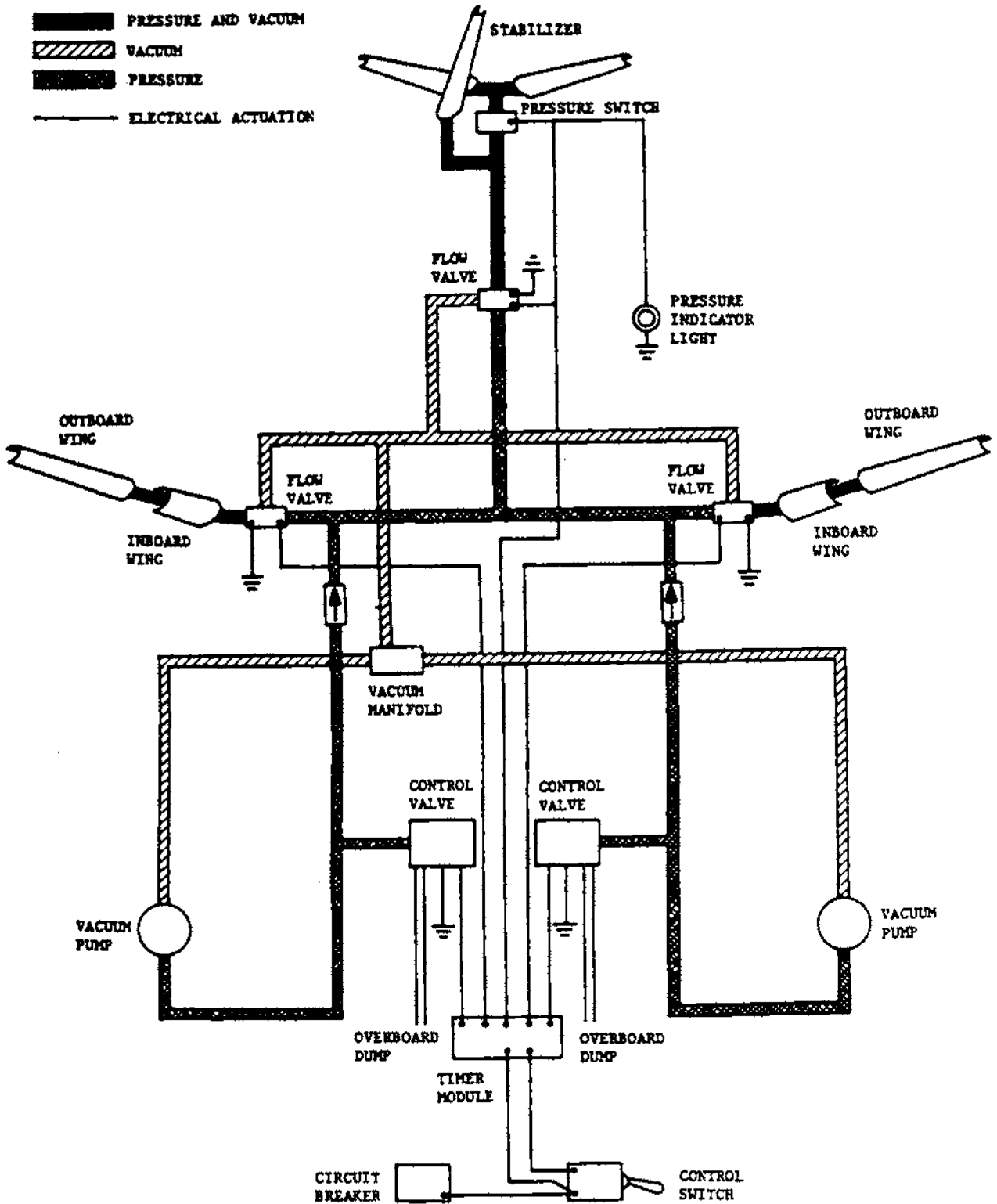
Name	Number	Manufacturer	Use
Test kit	343	Airborne 711 Taylor St. Elyria, OH 44035	To check system air pressure.
Hose plug	AN933-4	Airborne 711 Taylor St. Elyria, OH 44035	To plug air leakage test.



421C0001 THRU 421C0115

 Surface Deice Schematic
 Figure 1 (Sheet 1 of 2)

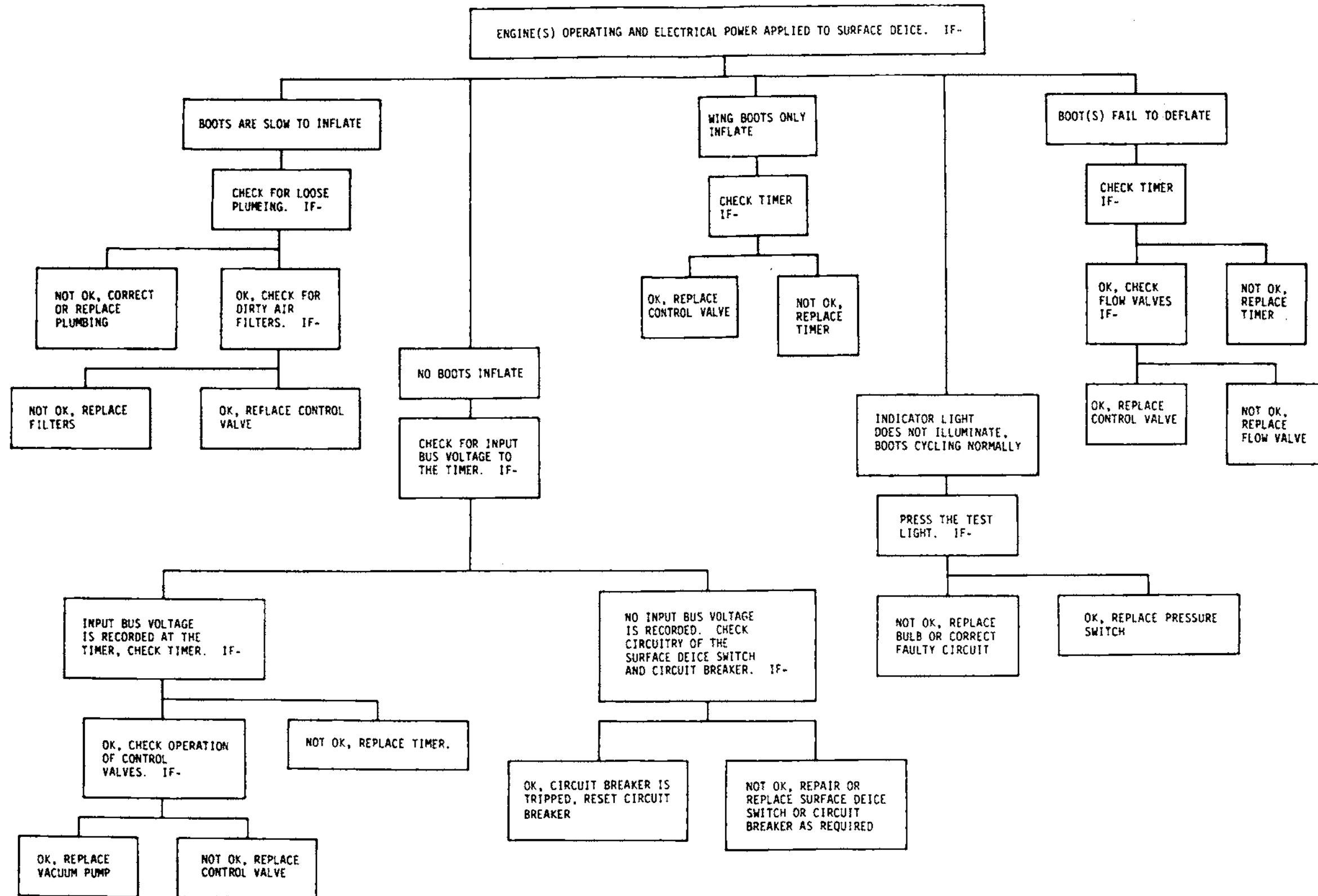
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421C0116 AND ON

Surface Deice Schematic
 Figure 1 (Sheet 2)

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Troubleshooting Chart Surface Deice System
 Figure 2

51988018

2. Test Surface Deice System.

A. Electrical Test.

- (1) Surface deice circuit breaker CLOSE.
- (2) Position surface deice control switch OFF.
- (3) Position battery master switch ON.
- (4) Press annunciator panel test switch to check light circuit and bulb.
- (5) With both engines running at 1500 RPM or using Airborne's 343 Test Kit, momentarily position surface deice switch to ON.
- (6) Check that timer inflates the boots on the stabilizers first for a period of approximately six seconds and then cycles to inflate the boots on the wing for a period of six seconds and then deactivates itself.
- (7) The surface deice light in the annunciator panel will illuminate during the first (stabilizer) cycle to indicate the system is operating.
- (8) Position wing deice light switch to ON and check that wing deice lights are illuminated.
- (9) Shut down engines or disconnect the Airborne 343 Test Kit, and position all switches OFF.
- (10) If boots inflate or deflate slowly or incompletely recycle system with 1G31-1 pressure gage in boot line. System should read a minimum of 12.5 PSIG on inflation and -4 in. Hg. on deflation. If pressure is not reached, determine cause and correct.

3. Pressure Side

A. Leak Test

NOTE: This test can be performed in either the left or right nacelle. The following steps pertain to the left nacelle.

- (1) Disconnect pressure hose (outlet port) from the dry air pump.
- (2) Using the 1H88-1 regulator assembly with the 1K99-1 fitting assembly, connect the disconnected pressure hose from the pump to the fitting assembly. Secure with clamp.
- (3) Connect a source of clean dry shop air to the inlet side of the 1H88-1 regulator for operation.
- (4) Disconnect tube from overboard port of the control valve and plug the port with an AN933-4 plug.
- (5) Disconnect the electrical power lead to the control valve and each of the three flow valves in timer module.

CAUTION: DO NOT ATTEMPT AIR LEAKAGE TEST WITH DEICE TIMER MODULE CONNECTED IN CIRCUIT.

- (6) Connect a 28 volts direct current (VDC) electrical source to the control valve and each flow valve to energize the valves.

NOTE: For test or troubleshooting, one flow valve may be actuated at a time to test and isolate each system.

- (7) Apply regulated air pressure to system at 1H88-1 regulator assembly by sliding ON/OFF slide valve to the ON position (toward regulator). Gradually increase pressure by turning upper adjustment screw in to obtain 12 PSI or screw out until 12 PSI is obtained. The leakage rate should not exceed a pressure drop of 4.0 PSI per minute. Repair leaks and repeat test to ensure leakproof system.
- (8) In checking system for leakage, readings can be obtained at different locations in the system by using the 1G31-1 gage and assembly. The gage unit will help isolate localized problems.
- (9) Remove test equipment after test is complete.
- (10) Reconnect pressure hose to dry air pump.
- (11) Remove plug from control valve and reconnect tube.
- (12) Reconnect the timer wire module.
- (13) Remove the 28 VDC system source.

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4. Vacuum Side

A. Leak Test

- (1) Use the 1H88-1 regulator assembly and the 1H89-1 ejector assembly combined for vacuum test.
- (2) Isolate boot vacuum from instrument vacuum system at vacuum manifold in cabin.
- (3) Disconnect the vacuum line (right port) from the dry air pump and attach the vacuum hose to the 1H89-1 ejector assembly and secure with clamp.
- (4) Connect a source of clean dry shop air to the inlet side of the 1H88-1 regulator.
- (5) Apply pressure to the 1H88-1 regulator assembly by sliding ON/OFF valve to the ON position (toward regulator) and adjust the vacuum by the upper adjustment screw on the regulator maintain 2.5 PSI, which should read 5.1 inches of Mercury on the 1H89-1 ejector assembly gage.
- (6) With this set in place, the system should hold for 30 seconds without any loss. It must not drop below 2 PSI (4.1 inches of Mercury) during that period of time. If it does, then fix leaks as required.
- (7) After test is complete, remove vacuum hose from 1H89-1 ejector and reconnect vacuum hose to dry air pump.
- (8) Repeat test for the other side.

Cleaning / Printing

1. Cleaning Deice System Components

A. Cleaning.

- (1) The deice system components can be washed down with the engine using Stoddard Solvent.

B. For Servicing the surface deice boots and propeller deice boots, refer to Servicing - Deice Boots, Chapter 2-60.

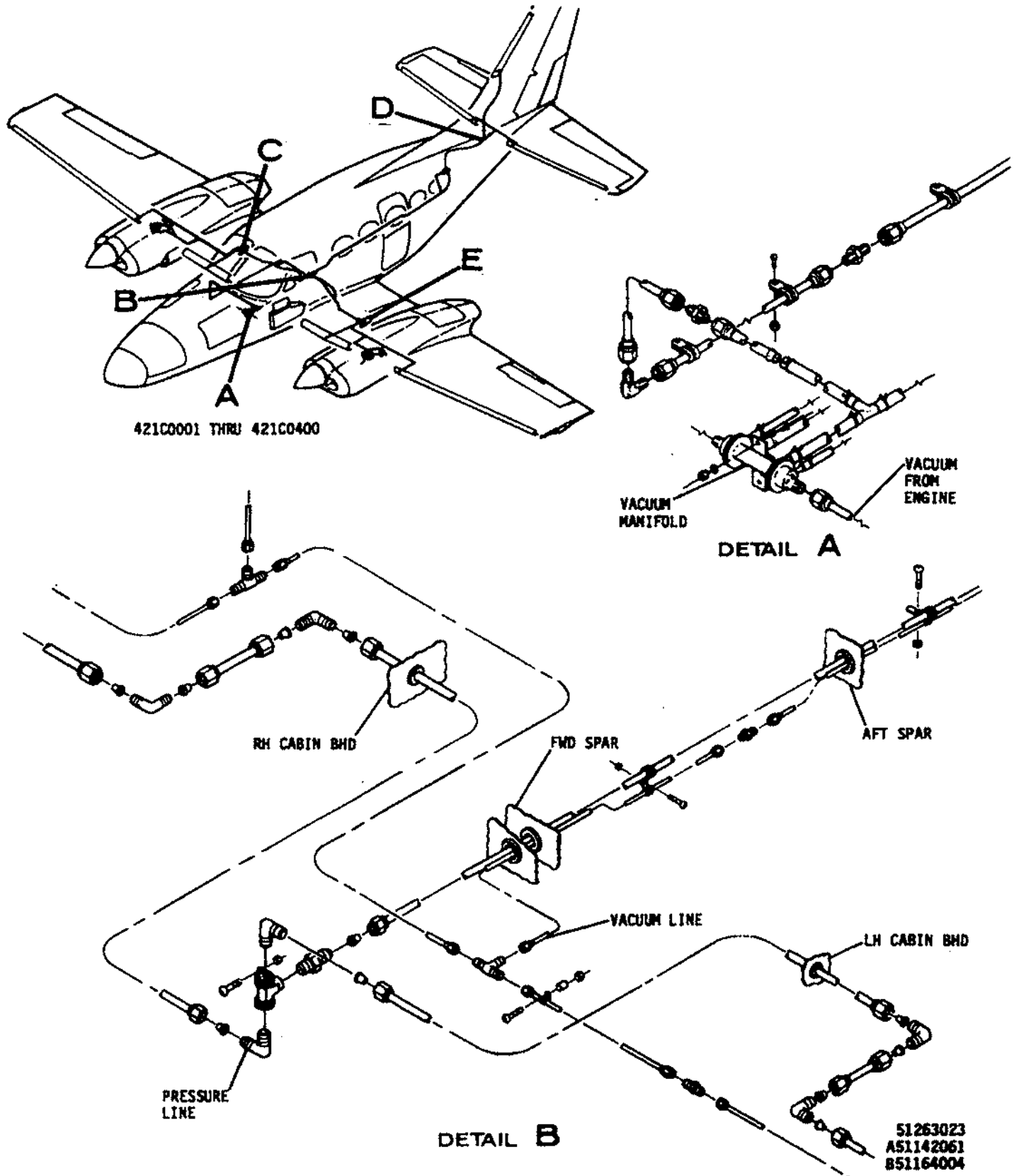
Maintenance Practices

1. Tools and Equipment.

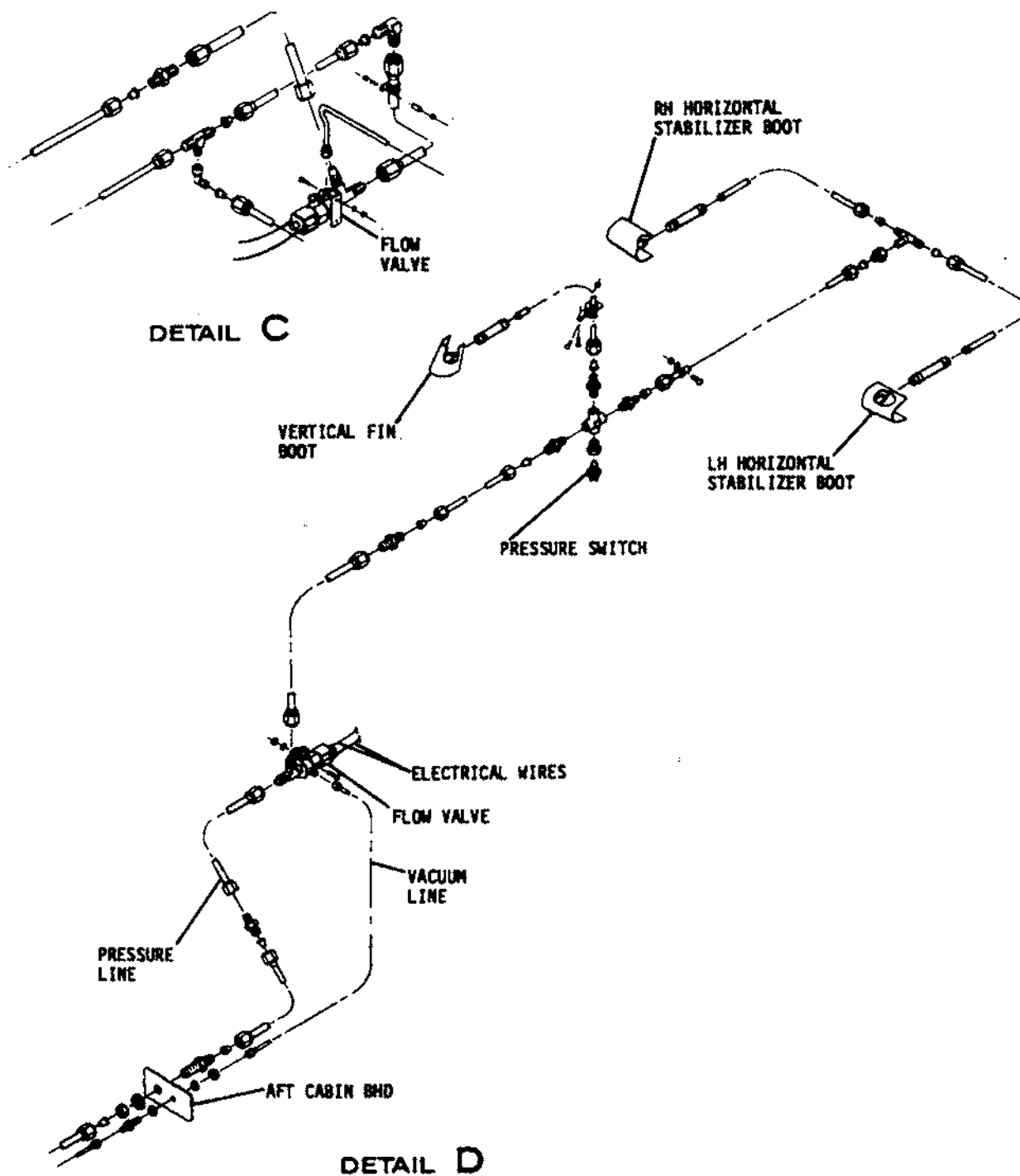
Name	Number	Manufacture	Use
Wash Primer	WMS 30-1	Commercially Available	Prepare bare metal for application of paint.
Cleaning Solvent (Methyl n-Propyl Ketone)	CAS NO. 107-87-9	Eastman Chemical Products Inc. P.O. Box 431 Kingsport, TN 37662	Clean deice boot and mating surface.
Adhesive	EC1300L	Minnesota Mining and Manufacturing Company St. Paul, MN	To bond deice boot to wing.
Adhesive	EC-776	Minnesota Mining and Manufacturing Company St. Paul, MN	Barrier coat.
Coating	78-U-1003 Enamel U-1001 Catalyst	Sterling Lacquer and Paint Company	To dress edge of deice boot.
Rymplecloth	301	International Paper Veratec Divison 100 Elm Street Walpole, MA 02081	To clean surfaces.
Hand Roller, Rubber 2 1/2 Inches Long x 2 Inches Diameter	74-451-74	B.F. Goodrich Co. Aerospace and Defense Products Akron, OH	Install deice boot.

Name	Number	Manufacturer	Use
Metal Hand Stitcher Roller, 1/8 Inch Long x 1 1/8 Inches Diameter	74-451-73	B.F. Goodrich Co. Aerospace and Defense Products Akron, OH	Install deice boot
Carpenter's Chalk and Chalk Line		Commercially Available	Install deice boot.
Paint and Lacquer Remover	TT-R-248	Commercially Available	Remove paint prior to installing deice boot.
Scotch-Brite,	Type A, Fine	Minnesota Mining and Manufacturing Company St. Paul, MN	To abrade metal surface.
Paint Brush (2 Inches Wide)	Nylon Bristle	Commercially Available	To apply adhesive.
Vacuum Pump (See Note)			To supply suction to deice boot when bonding to surface.
Cold Patch Repair Kit	74-451-C	B.F. Goodrich Co. Aerospace and Defense Products Akron, OH	Repair deice boot.
Fillet	77-451-21	B.F. Goodrich Co. Aerospace and Defense Products Akron, OH	Repair deice boot.
Neoprene Coated Splicing Tape	74-451-22	B.F. Goodrich Co. Aerospace and Defense Products Akron, OH	Repair deice boot.
Neoprene Surface Ply	74-451-23	B.F. Goodrich Co. Aerospace and Defense Products Akron, OH	Repair deice boot.

NOTE: Air ejector (Bendix Fluid Power Div., P/N 19E17-1) or jet pump (Penberthy Div., Roudaille Industries, Inc., P/N GL 1/2A) or equivalent vacuum pump capable of reducing the absolute pressure to 15 inches of mercury or less.

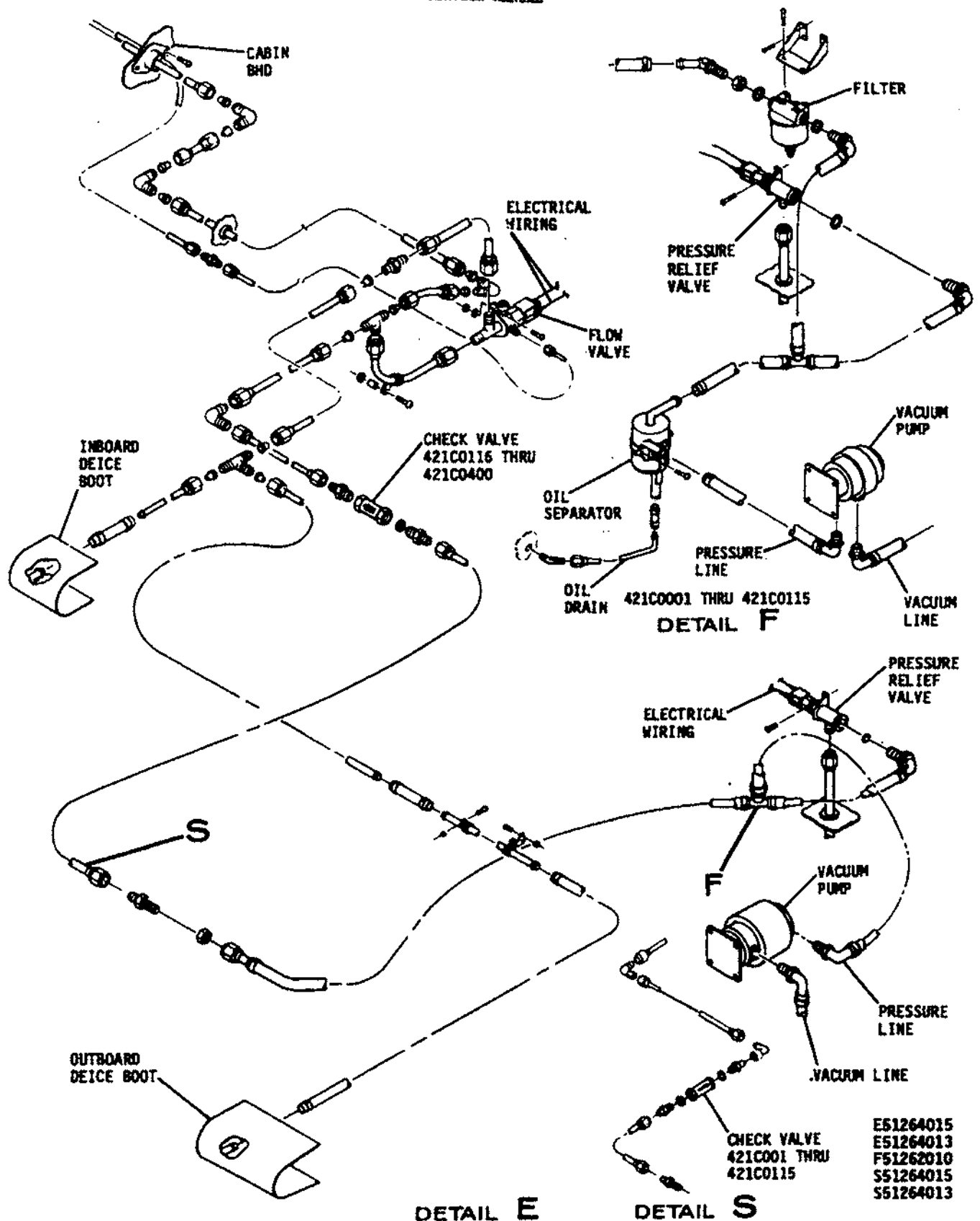


Surface Deice System Installation
Figure 3 (Sheet 1)



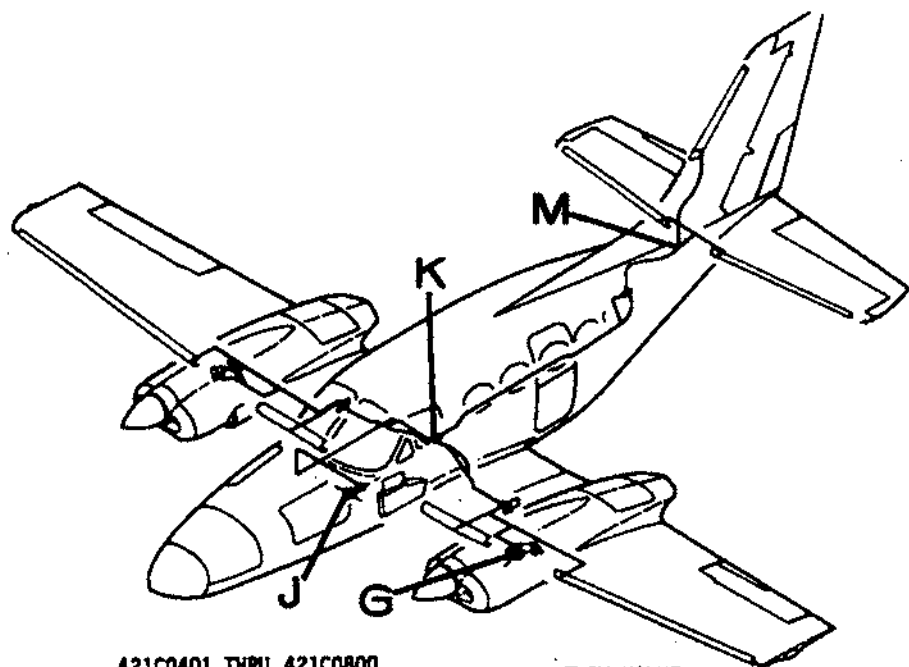
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Surface Deice System Installation
Figure 3 (Sheet 2)

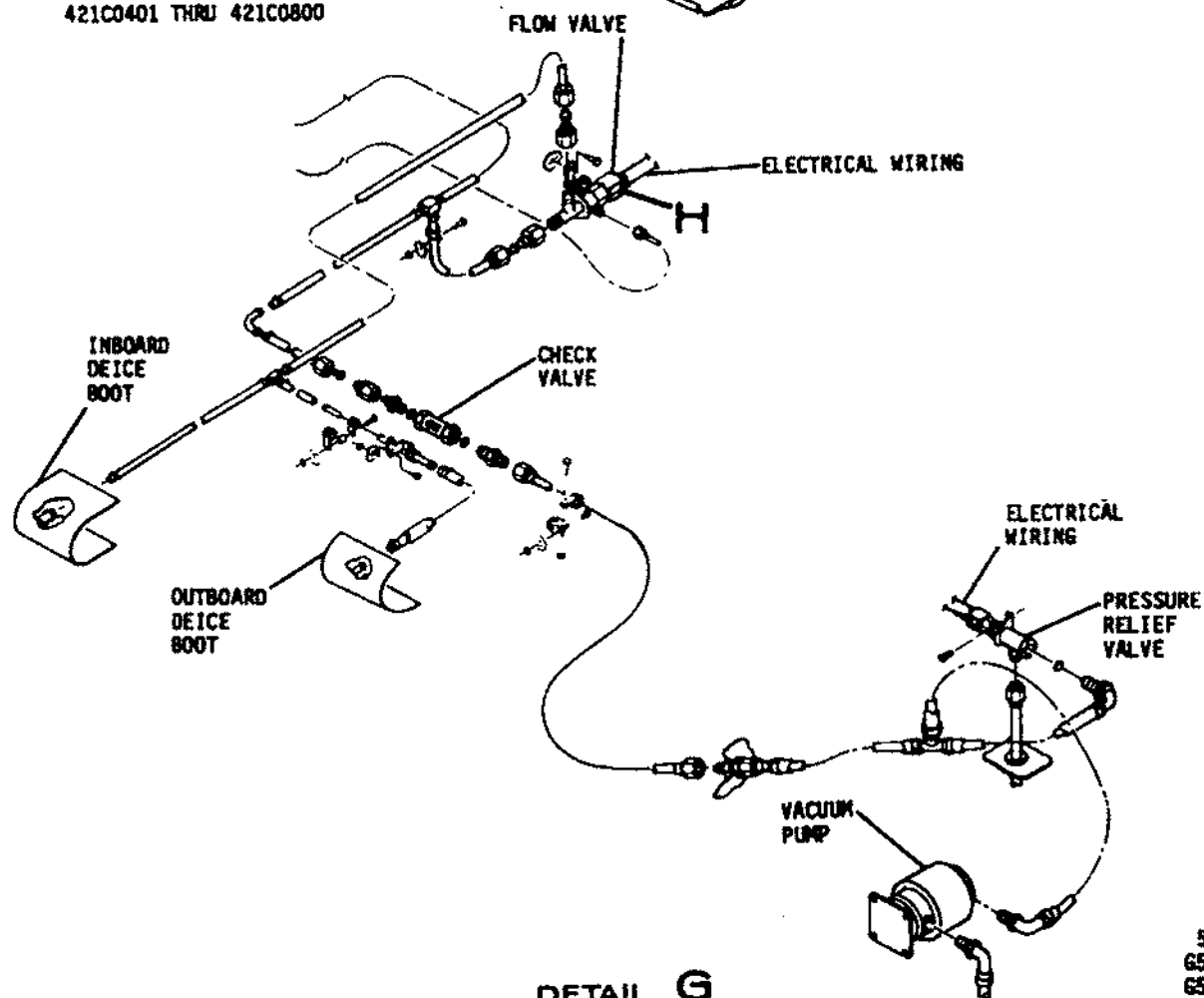


Surface Deice System Installation
Figure 3 (Sheet 3)

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E51264013
F51262010
S51264015
S51264013



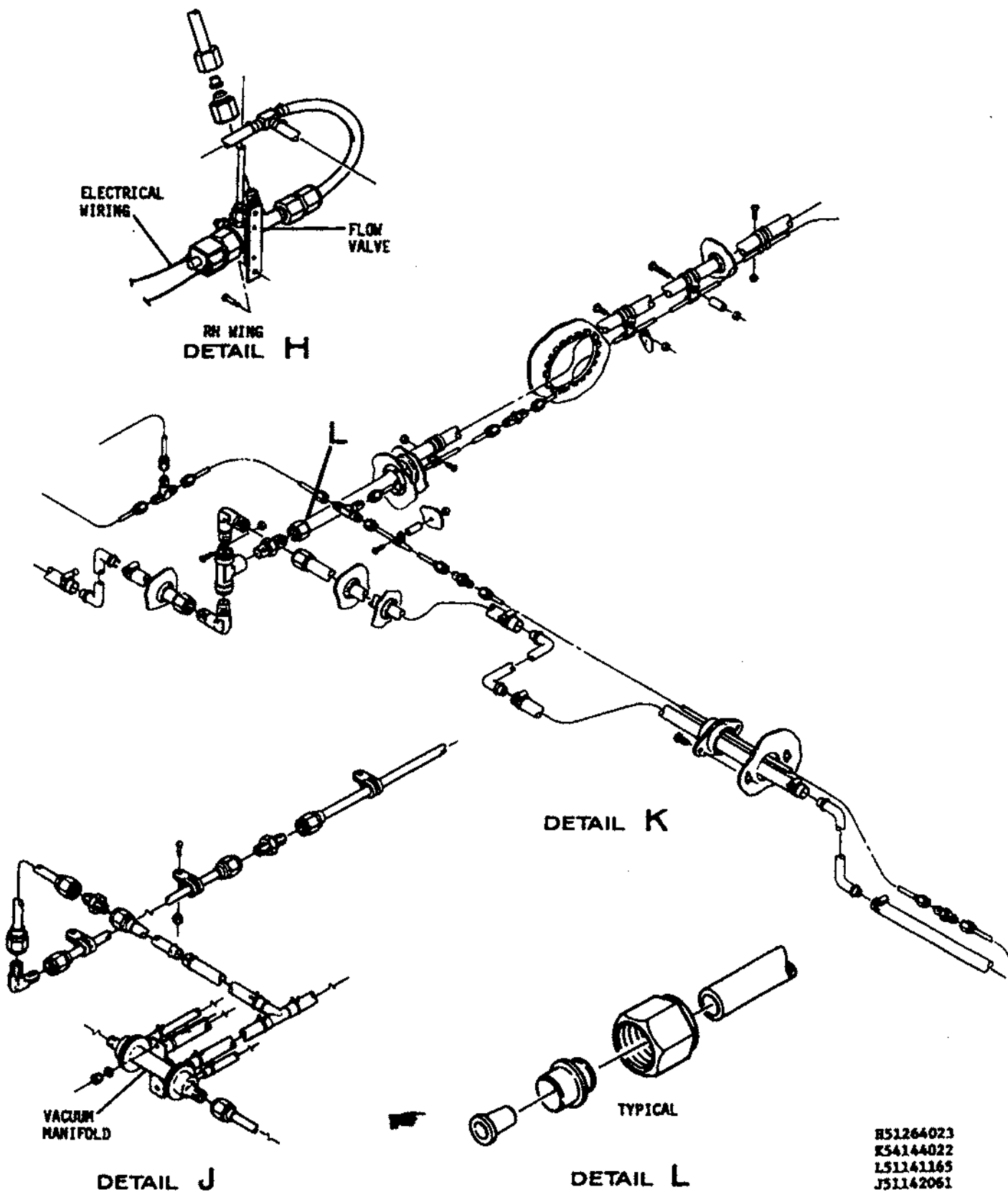
421C0401 THRU 421C0800



DETAIL G

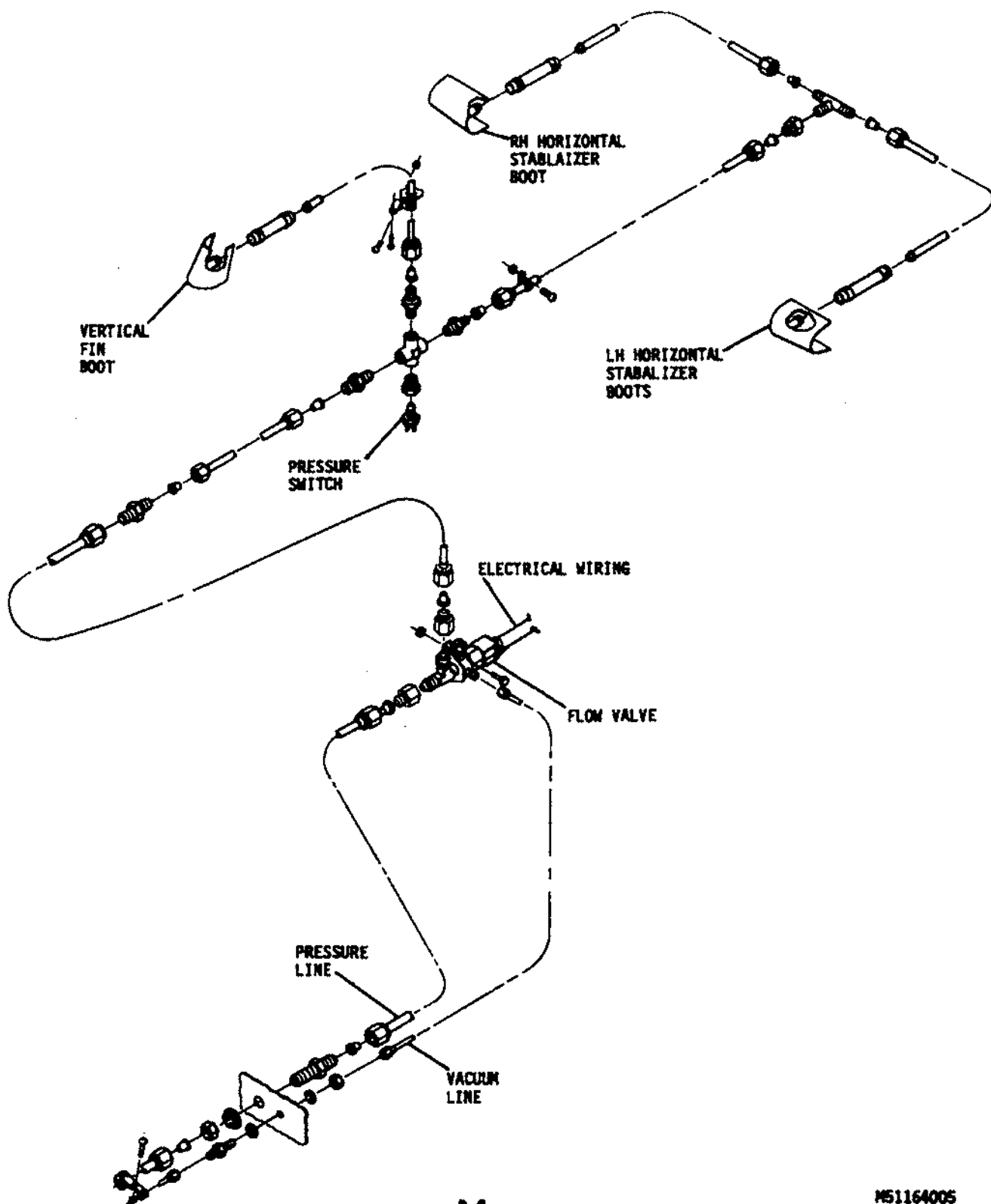
Surface Deice System Installation
Figure 3 (Sheet 4)

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Surface Deice System Installation
Figure 3 (Sheet 5)

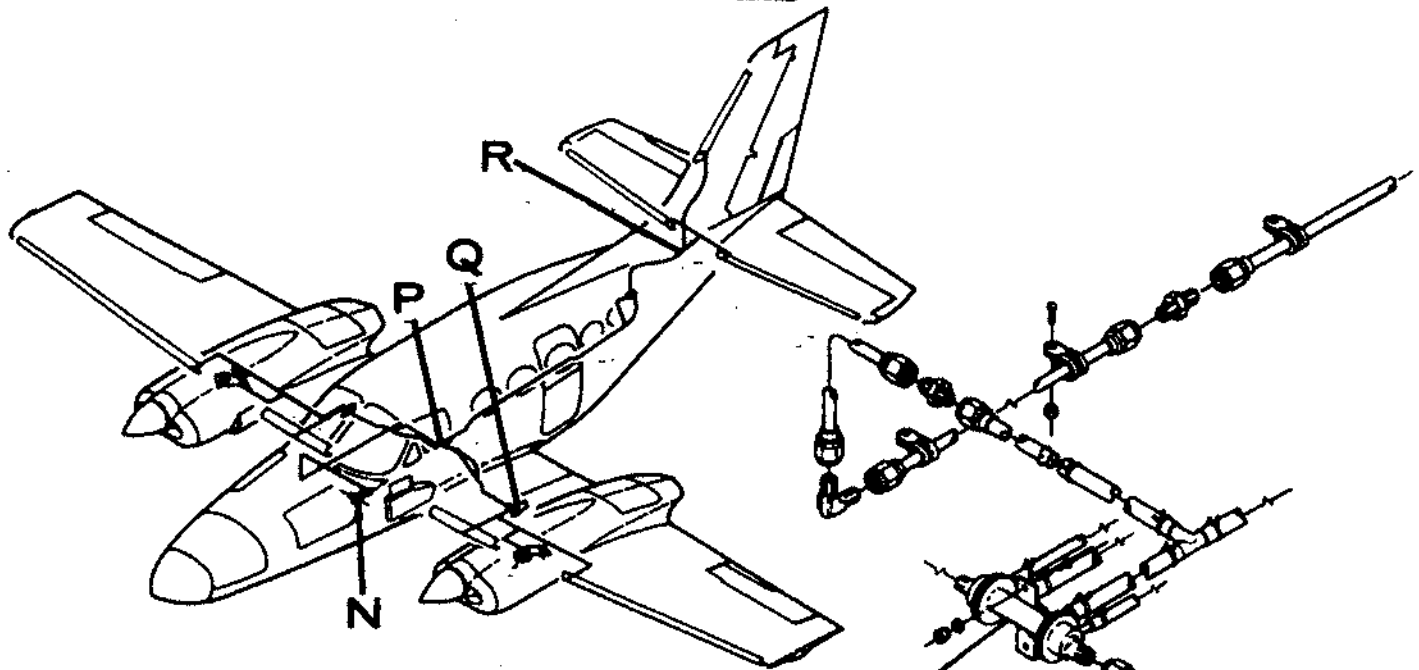
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DETAIL M

Surface Deice System Installation
Figure 3 (Sheet 6)

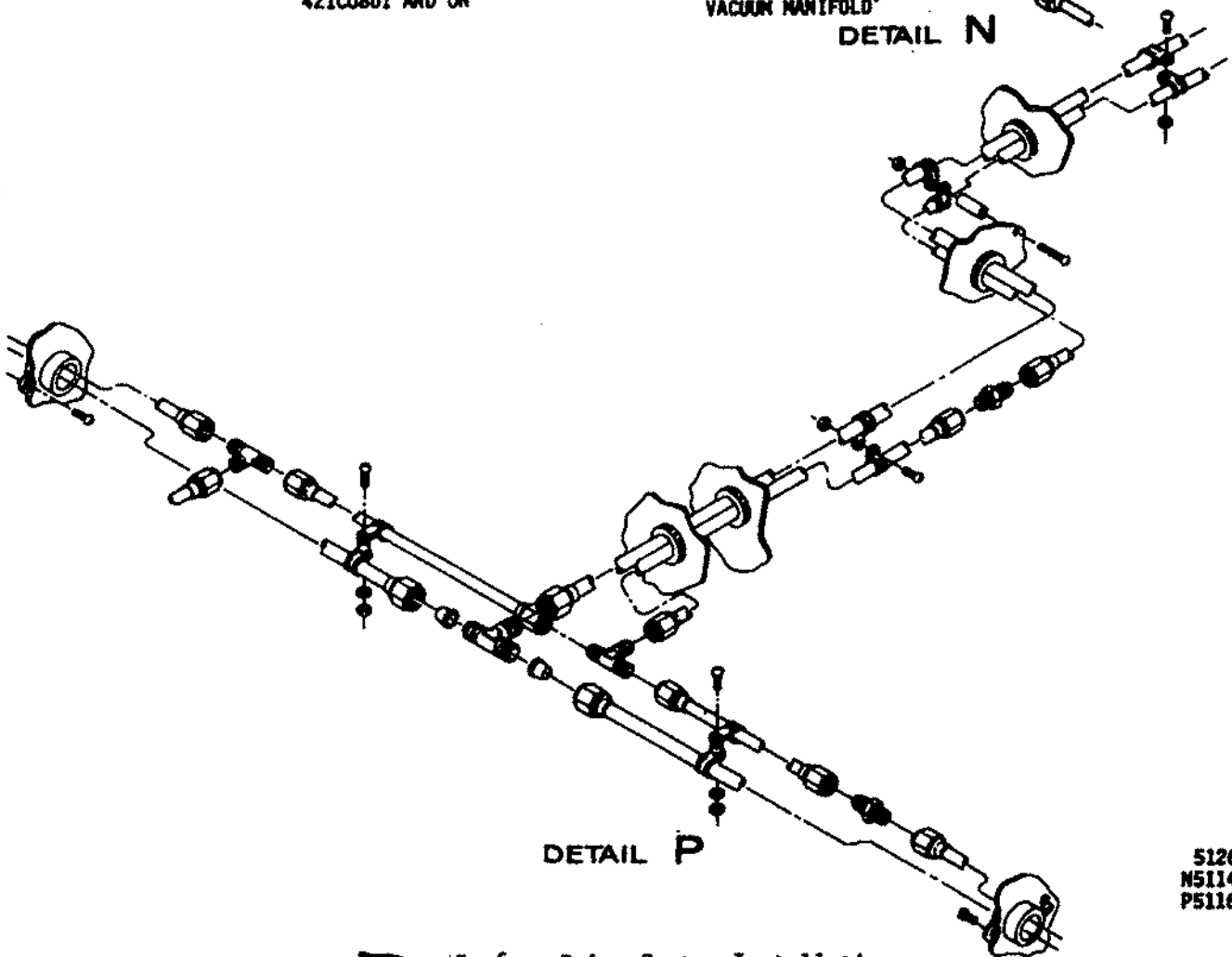
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421C0801 AND ON

VACUUM MANIFOLD

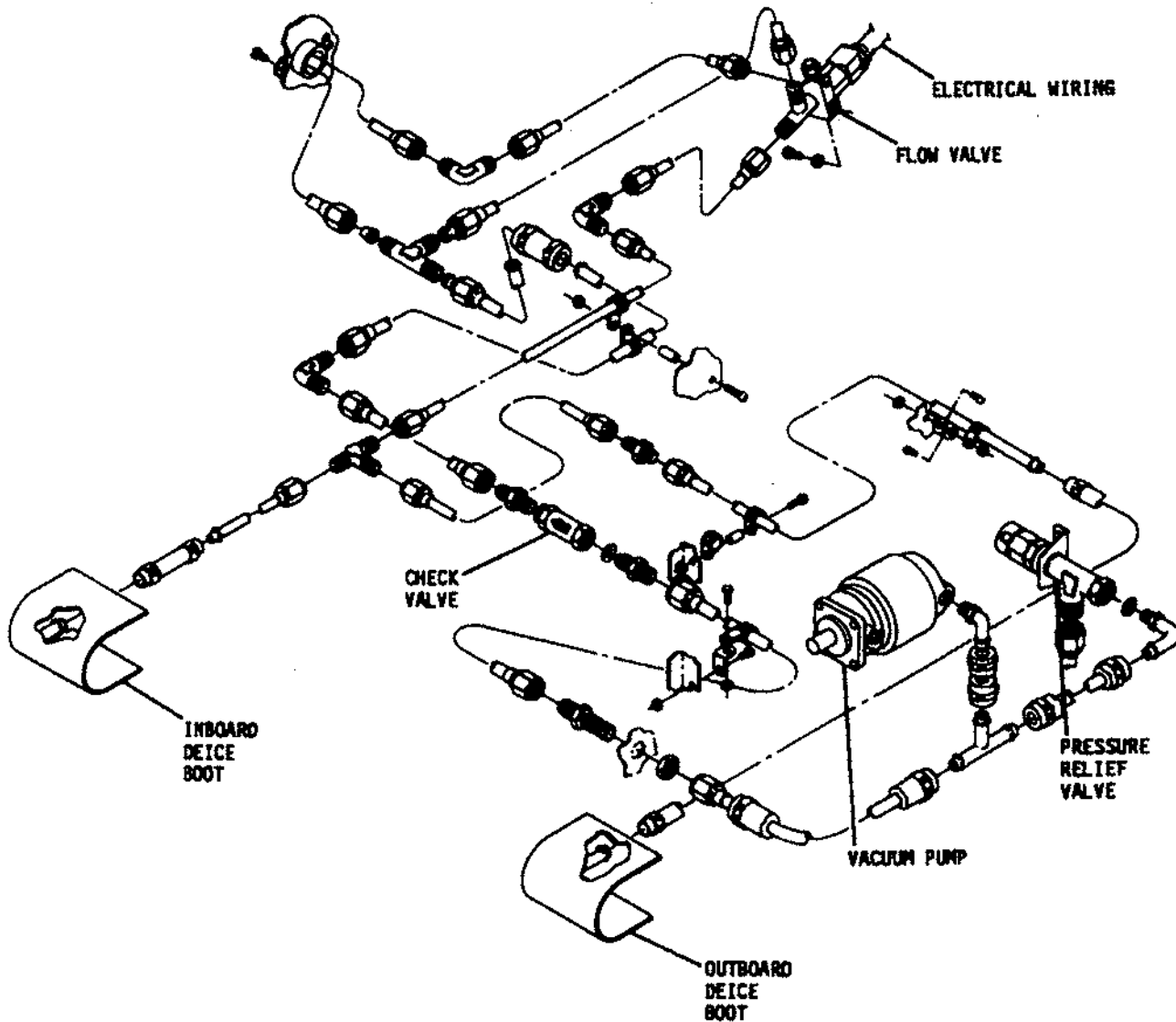
DETAIL N



DETAIL P

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P51163010

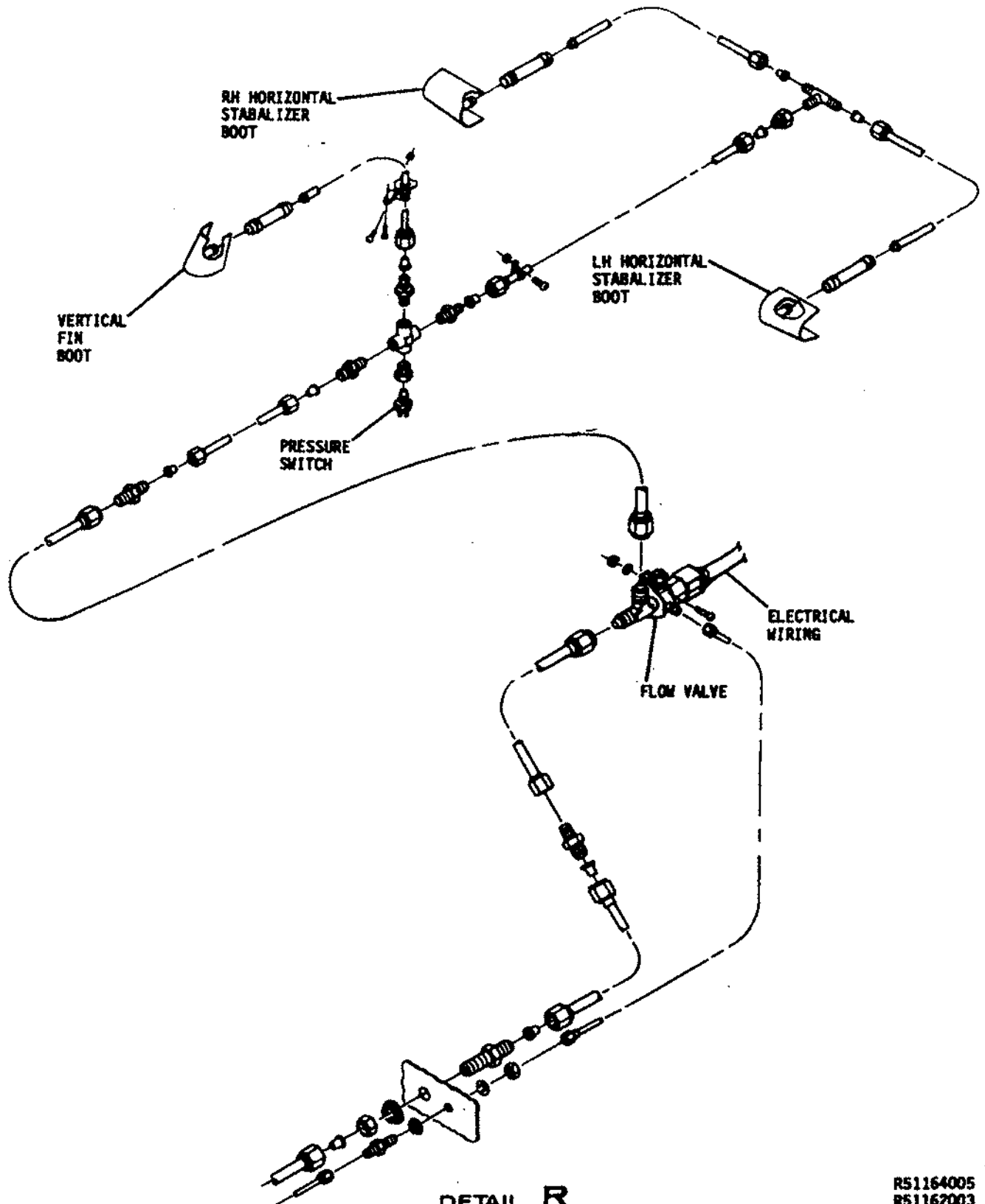
Surface Deice System Installation
Figure 3 (Sheet 7)



DETAIL Q

Q51264022

Surface Deice System Installation
Figure 3 (Sheet 8)



Surface Deice System Installation
Figure 3 (Sheet 9)

R51164005
R51162003

2. Removal/Installation Pressure Control Valve (See Figure 3)

A. Remove Pressure Control Valve.

- (1) Remove engine cowl.
- (2) Tag and disconnect electrical wires.
- (3) Loosen clamps and remove hoses from pressure control valve and cap all open fittings and hoses.
- (4) Remove nut, washers and bolts from pressure control valve.

B. Install Pressure Control Valve.

- (1) Position pressure control valve in place and attach with bolts, washers and nuts.
- (2) Remove caps from hoses and fittings, connect hoses to respective fittings and tighten clamps.
- (3) Connect electrical wires and remove tags.
- (4) Install engine cowl.
- (5) Check operation of surface deice system, refer to Adjustment/Test procedures.

3. Removal/Installation Air Filter (See Figure 3)

A. Remove Air Filter.

- (1) Remove engine cowl.
- (2) Loosen clamps and remove hoses from surface deice filter fittings. Cap all open fittings and hoses.
- (3) Remove nuts, washers and bolts securing the filter to bracket and remove the filter from nacelle.

B. Install Air Filter.

- (1) Position filter in bracket and install bolts, washers, and nuts.
- (2) Remove caps and connect hoses to respective fittings.
- (3) Install engine cowl.

C. Remove Surface Deice Air Filter Element.

- (1) Remove engine cowl.
- (2) Cut safety and loosen nut on filter and remove filter element.

D. Install Surface Deice Air Filter Element.

- (1) Place filter element inside case, position in place on filter and tighten nut.
- (2) Install safety wire.
- (3) Install engine cowl.

4. Removal/Installation Flow Valve (See Figure 3)

A. Remove Flow Valve.

NOTE: Procedures are the same for either left or right wing.

- (1) Remove engine cowl.
- (2) Tag and disconnect electrical wires.
- (3) Disconnect lines at flow valve fittings and remove flow valve.
- (4) Plug and cap all open lines and fittings.
- (5) If flow valve is being replaced with a new flow valve, remove fittings.

B. Install Flow Valve.

- (1) If removed, install fitting and clock in proper direction.
- (2) Remove plugs and caps from lines.
- (3) Position flow valve in place and connect lines to fittings.
- (4) Connect electrical wires and remove tags.
- (5) Install engine cowl.
- (6) Perform operational check of surface deice system.

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5. Removal / Installation Vacuum Pump

- A. Refer to Chapter 10 for vacuum pump removal / installation.

6. Removal / Installation Deice Boot.

- A. Remove Deice Boot.

NOTE

To remove or loosen an installed boot, Methyl n-Propyl Ketone shall be used to soften the bond line. A minimum quantity of toluene should be applied to the bond line while tension is carefully applied to peel back the boot. The removal should be slow enough to allow the solvent to undercut the adhesive so that the boot will not be damaged. Excessive Quantities of the solvent must not be allowed on the airplane surface.

- (1) Refer to Chapter 10 or 13. If installed, remove angle of attack transducer; if not, remove stall warning transmitter.
- (2) Remove screws securing bonding plate at the wing tip.
- (3) Remove access plates as required to remove clamp and tube from boot.
- (4) Remove boot.

- B. Install Deice Boot.

- (1) Requirements.

NOTE

Ensure that adhesive has been stored properly in accordance with manufacturer instructions.

- (a) EC1300L and EC776 shall not be used beyond the three (3) months even though they have been retested and approved. Gelled or contaminated adhesives shall not be used.
- (b) Containers for adhesives, primers and coatings shall be kept tightly closed, when the materials are not being used, unless otherwise specified.
- (c) Per-assembly operations such as fitting, drilling, deburring, punching, trimming, masking, etc., shall be completed prior to cleaning and bonding. Slight tensioning of the deice boots may be required when reducing the internal pressure in order to remove any minor wrinkles and obtain a smooth surface both for adhesive application and installation of the deice boots. Vacuum shall be used to reduce the internal pressure of the boot to 15" Hg Abs. or less during cleaning and bonding.
- (d) Surfaces must be cleaned and dry, free from dust, lint, chips, grease, oil, condensation or other moisture and all other contaminating substances prior to the application of adhesives, primers and coatings.
- (e) Methyl n-Propyl Ketone shall be used on the back surface of the deice boots and on the metal surfaces.
- (f) All paints, lacquers, primer, etc., shall be removed prior to cleaning and bonding.
- (g) Cleaning and bonding shall not be accomplished when the temperature of the structure, deice boots or bonding materials is below 60 degrees Fahrenheit nor when the relative humidity is 90 percent or more.
- (h) Bonding must be accomplished before the adhesive becomes too dry on either surface. The adhesive must be tacky on both surfaces throughout the entire attachment of the deice boot.
- (i) Bonds shall be free of wrinkles and entrapped air bubbles. They shall not be loose at the edges nor exhibit poor adhesion.
- (j) To avoid damage to deice boots, do not use metal, hard stitcher-roller over tube or wires in deice boots.
- (k) Adhesives, primers and coatings shall be stirred thoroughly prior to application.
- (l) Caution should be observed during cleaning and bonding. Cleaning solvents and solvents in adhesives are toxic and flammable. Fresh air masks and/or adequate ventilation are required for all closed areas.
- (m) Waxes or wax like materials shall not be used on deice boots.

- (2) Positioning.
- (a) Indexing marks shall be placed on the metal surface outside of the bonding area or a chalk line shall be snapped lengthwise down the bonding area approximately on the center line of the leading edge. The faying surface of the boot shall be marked in a similar manner, if necessary, to provide for correct alignment during the installation and attachment of the boot. Intensify the chalk line on the leading edge and the reference line on the boot using a ball point pen just after the first coat of adhesive is thoroughly dry.
 - (b) The deice boot shall be positioned on the metal surface, to which the boot is to be bonded, in order to provide a guide for masking and to check the fit of the boot.
 - (c) Leaving an edge margin of approximately one-half inch from the boot or pattern, a single strip of one inch wide masking tape shall be applied to the metal surface around the periphery of the boot or pattern. (Masking should be accurate so that clean-up time will be minimal.) The boot or pattern shall then be removed.
 - (d) All required mounting holes shall be punched or drilled and then smoothed or deburred.
- (3) Cleaning.
- (a) All paint in the masked off area shall be removed with paint and lacquer remover. The loosened paint and remover shall be wiped off and the area shall be thoroughly rinsed with clean water and dried with rymplecloth.
 - (b) All surfaces to be bonded shall be clean and dry. Lightly abrade the surface in the masked off area.
 - (c) Lightly abrade the metal surface in the masked off area using abrasive Scotch-Brite Brand N' Finish Material, Type A, Fine. Then, using vacuum pump, reduce the pressure in the boot to 15 inches of mercury (absolute) or less to smooth the surface on the back side. Cleaning shall be accomplished by scrubbing the metal surface in the masked off area and the rough, unglazed faying surface of the deice boot using clean cheesecloth moistened with solvent (MEK). The cloth should not be saturated to the point where dripping will occur. Solvent shall be wiped from the surfaces before evaporation using a piece of clean, dry cheesecloth in order that oils, grease, wax, etc., will not be redeposited.
 - (d) Cleaning solvent should never be poured or sprayed on a structure.
 - (e) Final cleaning shall be accomplished immediately prior to bonding. The areas cleaned previously shall be thoroughly recleaned. When the area is being scrubbed with a moistened cloth in one hand, another clean dry cloth shall be held in the other hand and shall be used to dry the area. The solvent must be wiped from the surfaces before it evaporates.
 - (f) Bonding procedures shall be started as soon as possible after cleaning and drying the surfaces. Do not allow handling of the surfaces between the cleaning and bonding operations.
 - (g) Caution should be observed during cleaning and bonding. The solvents, adhesives, etc., are toxic and flammable. Fresh air masks and/or adequate ventilation are required for all closed areas. The structure shall be electrically grounded before starting any cleaning or bonding operation.
- (4) Preparation and Application of Fuel Barrier.
- (a) Adhesive EC776 must be thoroughly stirred prior to application as a barrier coat. A uniform coat of barrier shall be brushed onto the masked off metal surface and allowed to dry thoroughly till it does not have any tack.
- (5) Preparation and application bonding material.

NOTE: The surface to which the deice boot is to be bonded shall be treated with application of fuel barrier prior to this treatment.

Ensure adhesive has been stored properly.

- (a) Adhesive EC1300L must be thoroughly stirred prior to application. A uniform coat of adhesive shall be brushed onto the masked off metal surface and onto the faying surface of the deicer boot. When brushing adhesives, use good, clean brushes. Avoid hot air drafts from heaters or fans as this will cause dragging and produce a very rough surface. The adhesive shall be allowed to dry thoroughly (at least one hour at 77°F and 50% relative humidity - lower temperatures and/or higher humidities will require longer drying times to become "bone-dry") and

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should not have any tack. A second uniform coat of adhesive shall be brushed onto each of the faying surfaces and allowed to dry thoroughly as above. The dry adhesive shall be covered and kept clean until it is reactivated. The adhesive shall be reactivated within 48 hours by wiping lightly with clean cheesecloth slightly moistened with solvent Methyl n-Propyl Ketone. Only a small area, 3" x 18", more or less depending on how fast the solvent dries, shall be reactivated at a time. Do not let the adhesive become too dry before placing the deice boot in contact with the metal. Excessive rubbing of solvent shall be avoided when reactivating so that adhesive will not be removed.

NOTE: Ensure adhesive is stored properly.

(6) Install Deice Boot.

NOTE: Fastboot pneumatic deice boots incorporate a bonding system with a unique pressure sensitive adhesive applied to the deicer bond side in the manufacturing process. For fastboot installation, refer to the instructions included with each boot.

(a) Trim Boot.

- 1) Position boot to mating surface on the airfoil, aligning the boot nipple (hose connection) with existing hole in the airfoil.
- 2) With the boot held in position, check for excessive material. Excessive material may be referred to as the material extending beyond the bond line of the removed boot.

NOTE: Use the remove boot bond line as a guide. Cleaning the surface for paint to adhere to is a lengthy process.

- (b) Clean the mating surfaces of the airplane and deice boot to be bonded. Refer to the paragraph on cleaning.
- (c) Identify the position and location of the deice boot on the airplane. Refer to the paragraph on positioning.
- (d) Repeat applicable cleaning requirements. Refer to the paragraph on cleaning.
- (e) Apply fuel barrier to surface of left and right outboard wing leading edge. Refer to paragraph on preparation and application of fuel barrier.
- (f) Apply bonding material. Refer to paragraph on preparation and application of bonding material.
- (g) Attach the hose to the deice boot nipple with clamp.
- (h) Route hose and nipple through the skin. Attach vacuum to open end of hose and activate vacuum. This provides suction which inhibits the amount of air trapped within the deice boot during installation.
- (i) Hold the boot near but not touching the metal surface and align with connection locations and positioning marks. Then, by reactivating the adhesive, the boot shall be attached around connections and then attached down the centerline. If the boot is allowed to get "off course" or out of position, it shall be pulled up by using solvent Methyl n-Propyl Ketone to soften adhesion line and then repositioned properly. Avoid twisting, bending sharply or jerking the boot. If adhesive is removed completely from either surface, it shall be applied again to the bare surface per Procedure A. If adhesive is removed from fasteners, they shall be treated per preparation and Application of Fuel Barrier followed by Procedure A. A rubber roller shall be rolled firmly along the centerline of the boot and from there in spanwise strips over the entire surface, being careful not to trap any air under the boot. Distortion of the boot shall be held to a minimum. Pneumatic boot shall be rubber rolled parallel to the inflatable tubes. The stitcher roller shall be used around boot edges, air hose attachment, etc., but shall not be used over wires or inflatable tubes. When reactivating adhesive and using the rubber roller, roll down the reactivated area in such a way as to leave an open angle to permit easy access for reactivating the adjacent area.

NOTE: Pneumatic boots shall be rubber rolled parallel to the inflatable tubes. The stitcher roller shall be used around boot edges.

(j) Edge Seal Deice Boot.

NOTE: Perform touch up painting prior to edge sealing, as edge sealing, as edge sealing aids in protecting leading edge of paint film from erosion.

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- 1) Apply masking parallel along edge of boot leaving a strip for sealer to overlap a minimum of 1/4 inch on the boot and 1/2 inch on wing surface. Apply masking so that a straight line is provided on wing for finish appearance. Clean all excess adhesive from edge of boot.

NOTE: Sealer will not adhere to bare metal. Apply wash primer to any bare metal surface in area of sealer application. Rough up painted surfaces prior to sealer application.

- 2) Remove masking and apply a new coat prior to painting.
 - 3) Mix the black polyurethane enamel (78-U-1003) with the catalyst (U-1001) at a ratio of two parts enamel to one part catalyst and apply a uniform brush coating around the periphery of the boot to edge seal.
 - 4) Remove the masking immediately after coating is applied.
- (k) Remove vacuum pump and connect boot to airplane deice plumbing.
(l) Install angle of attack transducer or stall warning transmitter.
(m) Install all access panels.
(n) Airplane may be flown 1 hour after bonding on the deice boot, but deice boot shall not be inflated for 48 hours after bonding.

7. Approved Repairs.

A. Cold Patch Repair of Deice Boots.

- (1) There are four types of areas of damage that are most common to the deice boots. An outline of the cold patch repair procedure for each follows:

NOTE: When repairing the deice boots and replacement layers are being installed, exercise care to prevent trapping air beneath the replacement layers. If air blisters appear after material is applied, remove them with a hypodermic needle. Should air blisters appear after boots have been installed, for a length of time, it is permissible to cut a slit in the deice boot, apply adhesive and repair in accordance with the following cold patch repair procedures. An alternate method of repair is to peel the deice boot back using Toluene and reapply using normal adhesives.

- (2) Scuff or Surface Damage. This type of damage is the most commonly encountered and is usually caused by scuffing the outer surface of the deice boots while using scaffolds, refueling hoses, ladders, etc. Repair is generally not necessary because the thick outer veneer provides protection to the natural rubber underneath. If the scuff is severe and has caused removal of the entire thickness of veneer (exposing the brown natural rubber underneath) the damage should be repaired as outlined below:
 - (a) Select a patch (Part Number 74-451-16, 74-451-17, 74-451-18) of ample size to cover the damaged area.
 - (b) Clean the area to be repaired with a cloth dampened slightly with solvent.
 - (c) Buff the area around the damage with steel wool so that the area is moderately but completely roughened.
 - (d) Wipe the buffed area clean with a cloth slightly dampened in solvent to remove all loose particles.
 - (e) Apply one even thorough coat of cement (Part Number 74-451-20) to the patch and to the corresponding damaged area of the deice boot. Allow cement to set until it becomes tacky.
 - (f) Apply patch to the deice boot with an edge of the center adhering first, then work the remainder of the patch down being careful to avoid trapping air pockets.
 - (g) Roll the patch thoroughly with a stitcher roller (Part Number 74-451-73) and allow to set for ten to fifteen minutes.
 - (h) Wipe the patch and surrounding area from the center of the patch outward, with a cloth slightly dampened with solvent.
 - (i) Apply one light coat of A-56-B conductive cement (Part Number 74-451-11) to the patched area.

NOTE: Satisfactory adhesion should be obtained in four hours; however, if the patch is allowed to cure for a minimum of 20 minutes, the deice boots may be inflated to check the repair.

- (3) Damage to tube area. This type of damage consists of cuts, tears, or ruptures to the inflatable tube area and a fabric reinforced patch must be used for this repair. Damage to the tube area should be repaired as outlined below:

- (a) Select a patch (Part Number 74-451-16, 74-451-17, 74-451-18, or 74-451-19) of ample size to extend at least 5/8 inch beyond the damaged area.

NOTE: If none of these patches is of proper size, one may be cut to the size desired from one of the larger patches. If this is done, the edge should be beveled by cutting with the shears at an angle. These patches are manufactured so they will stretch in one direction only. Be sure to cut the patch selected so that the stretch is in the widthwise direction of the inflatable tubes.

- (b) Clean the area to be repaired with a cloth dampened slightly with solvent.
- (c) Buff the area around the damage with steel wool so that area is moderately but completely roughened.
- (d) Wipe the buffed area clean with a cloth slightly dampened in solvent to remove all loose particles.
- (e) Apply one even thorough coat of cement (Part Number 74-451-20) to the patch and the corresponding damaged area of the deice boot. Allow cement to set until it becomes tacky.
- (f) Apply the patch to the deice boot with the stretch in the widthwise direction of the inflatable tubes, sticking edge of patch in place first and working remainder down with a very slight pulling action so the rupture is closed. Use care not to trap air between patch and deice surface.
- (g) Roll the patch thoroughly with a stitcher-roller (Part Number 74-451-73) and allow to set for ten to fifteen minutes.
- (h) Wipe the patch and surrounding area, from the center of the patch outward, with a cloth slightly dampened with solvent.
- (i) Apply one light coat of A-56-8 conductive cement (Part Number 74-451-11) to restore conductivity.

NOTE: Satisfactory adhesion of patch to deice boot should be reached in four hours; however, if the patch is allowed to cure for a minimum of 20 minutes, the deice boots may be inflated to check the repair.

- (4) Damage to Fillet Area. This includes any tears or cuts to the tapered area aft of the inflatable tubes. Damage to the fillet area should be repaired as outlined below:
- (a) Trim damaged area square and remove excess material. Cut must be sharp and clean to permit good butt joint in inlay.
 - (b) Cut inlay from tapered fillet (Part Number 74-451-21) to match cutout area.
 - (c) Using solvent, loosen edges of the deice boot around area approximately 1-1/2 inch from all edges.
 - (d) Clean the area to be repaired with a cloth dampened slightly with solvent.
 - (e) Lift back edges of cutout and apply one coat of EC1300L cement to the underneath side of loosened portion of the boot.
 - (f) Apply one coat of EC1300L cement to the wing skin underneath the loosened edges of the deice boot and extending 1-1/2 inch beyond edges of deice boot into the cutout area.
 - (g) Apply second coat of cement to underneath side of deice boot as outlined in step (e).
 - (h) Apply one coat of EC1300L cement to one side of a 2-inch wide neoprene coated fabric tape (Part Number 74-451-22) and allow to dry and trim to size.
 - (i) Reactivate cemented surfaces with solvent and apply reinforcing tape to wing skin, using care to center tape under all edges of cutout.
 - (j) Roll down tape on wing skin with stitcher-roller (Part Number 74-451-73) to assure good adhesion, being careful to avoid air pockets.
 - (k) Apply one coat of EC1300L cement to top surface of tape and allow to dry approximately 5 to 10 minutes.

- (l) Reactivate cemented surfaces with solvent. Working toward cutout, roll down the edges of the loosened deice boot, being careful to avoid trapping air pockets. The edges should overlap on the tape approximately 1 inch.
 - (m) Roughen back surface of inlay repair material (Part Number 74-451-21) previously cut to size) with buffing stick P/N 74-451-75. Clean with solvent and apply one coat of EC1300L cement.
 - (n) Apply one coat of EC1300L cement to wing skin inside of the cutout area and allow to dry.
 - (o) Apply the second coat of EC1300L cement to back side of inlay material and allow to dry.
 - (p) Reactivate cemented surfaces with solvent and carefully insert inlay material with feathered edge aft. Working from the leading edge of wing aft, roll down the inlay material carefully to avoid trapping air.
 - (q) Roughen area on outer surface of deice boot and inlay with steel wool 1-1/2 inch on each side of the splice. Clean with solvent and apply one coat of EC1300L cement to this area.
 - (r) Apply one coat of EC1300L cement to one side of 2-inch wide neoprene coated fabric tape (Part Number 74-451-22) trim to size and center tape over splice on all three sides.
 - (s) Roll down tape on deice boot with stitcher-roller (Part Number 74-451-73) to assure good adhesion, being careful to avoid air pockets.
 - (t) Apply one light coat of A-56-B conductive cement (Part Number 74-451-11) to restore conductivity.
- (5) Damaged Veneer - Loose from Deice Boot. If the veneer should become loosened from the deice boot, repairs should be made as outlined below.
- (a) Peel and trim the loose veneer to the point where the adhesion of veneer to the deice boot is good.
 - (b) Roughen the area in which veneer is removed with steel wool, rubbing parallel to cut edge of veneer ply to prevent loosening it.
 - (c) Taper edges of veneer down to the tan rubber ply by rubbing parallel to the edges with steel wool and solvent.
 - (d) Cut a piece of veneer material (Part Number 74-451-23) to cover the damaged area and extend at least 1 inch beyond in all directions.
 - (e) Mask off an area 1/2 inch larger in length and width than the size of veneer patch.
 - (f) Apply one coat of 74-451-20 cement to the damaged area and one coat to the veneer ply. Allow cement to set until it becomes tacky.
 - (g) Roll the veneer ply to the deice boot with a 2-inch rubber roller, applying a slight tension on the veneer ply when applying to prevent trapping air.
 - (h) Wipe the patch and surrounding area, from the center of the patch outward, with a cloth slightly dampened with solvent.
 - (i) Apply one light coat of A-56-B conductive cement (Part Number 74-451-11) to restore conductivity.

WINDSHIELD ANTI-ICE SYSTEM (ALCOHOL)Description

1. The alcohol windshield anti-ice system (optional), consists of: a three gallon capacity tank which provides approximately one hour anti-icing capability; an electrically operated pump actuated by a switch breaker, located on the left console panel; and orificed tubes to disperse the anti-ice fluid over the windshield. A restrictor orifice is utilized in the dispersal system to meter the alcohol for maximum efficiency.
2. The tank and electric pump are located in the aft portion of the right wing nacelle baggage compartment. A service door is provided for access to the tank filler cap. The system is serviced with isopropyl alcohol (refer to Chapter 2).

Troubleshooting

1. For troubleshooting the windshield anti-ice system, refer to Figure 1.

Adjustment/Test

1. Windshield Anti-Ice System Operational Check.

- A. Service reservoir. Refer to Chapter 1.
- B. Turn master switch ON.
- C. Turn windshield anti-ice switch ON.
- D. Assure alcohol flows evenly from all five holes on each side. Nominal flow rate is approximately 20 minutes per gallon.

NOTE: The left-hand spray pattern may be slightly greater than the right-hand spray pattern. Spray should extend approximately 4 to 6 inches above nozzles during ground operation.

- E. Turn windshield anti-ice switch to OFF. Alcohol flow should cease.
- F. If alcohol flow is irregular or fails to shut off, check pressure at pump. Pressure should be 4.0 to 4.75 PSIG.

Maintenance Practices

1. Removal/Installation Windshield Anti-Ice System (See Figure 2)

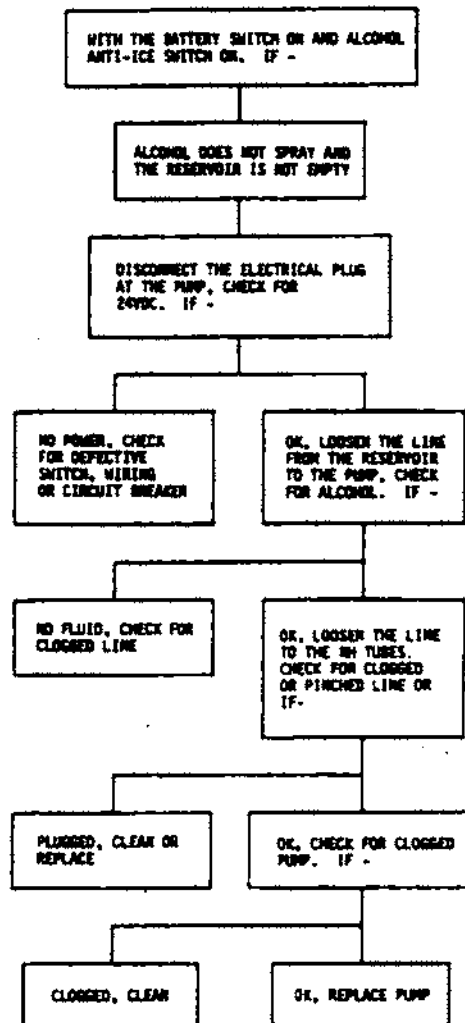
- A. Remove Windshield Anti-Ice System.

- (1) Remove aft nacelle baggage compartment upholstery panel.
- (2) Extend flaps.
- (3) Disconnect line (6) at elbow and using a suitable tube attached to the line, pump remaining fluid from tank (3).
- (4) Disconnect line (6) from pump (4) and remove line (7).
- (5) Disconnect electrical wire from pump (4) at splice.
- (6) Remove pump (4) from tank (3) by removing bolts (5) and washers.
- (7) Remove screws (1) securing tank (3) to structure.
- (8) Lift forward end of tank (3) until vent tube clears bottom skin and carefully slide tank forward until clear of structure, then lift tank from baggage compartment.
- (9) Remove RH wing gap fairings to gain access to lines.
- (10) Remove clamps and remove lines (8), (9) and (10).
- (11) Remove RH forward side panel to gain access to line (11). Remove clamp and remove line.
- (12) Working through nose baggage door, remove line (12), restrictor tee (15) and tubes (13) and (14). Refer to Chapter 3 for removal of baggage retainer.

- B. Install Windshield Anti-Ice System.

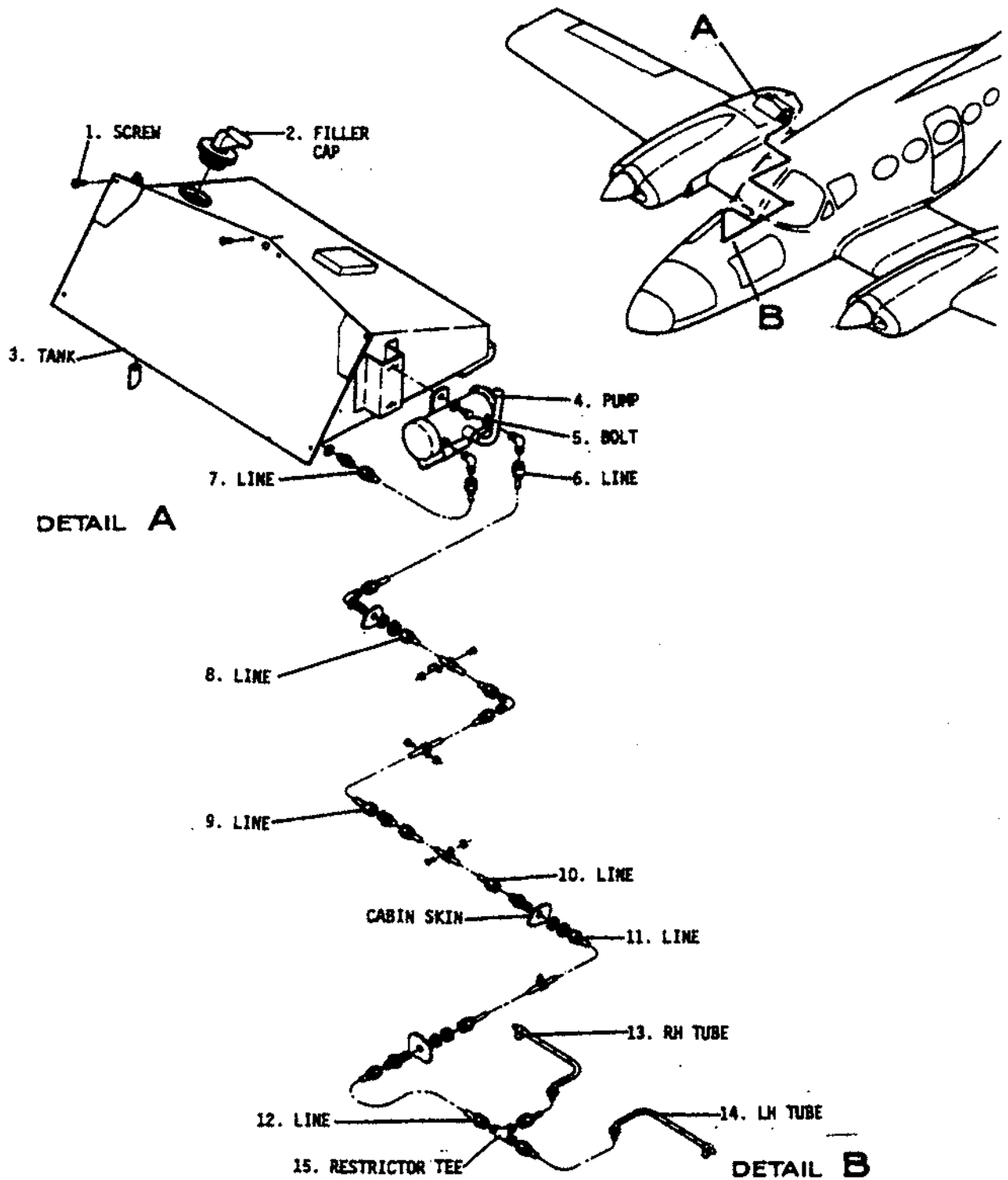
- (1) Position tank (3) in place and secure with screws (1).

NOTE: Make certain vent extends below lower skin 0.40 inch and scarfed side is forward.



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Troubleshooting Chart Windshield Anti-Ice System
Figure 1



Windshield Anti-Ice System (Alcohol)
Figure 2

- (2) Install pump (4) with bolts (5) and washers.
- (3) Install lines (8), (9) and (10) and clamp in place.
- (4) Install line (11) and clamp in place.
- (5) Install line (12) and restrictor tee (15).

NOTE: Restrictor tee must be installed with restricted ports downstream.

- (6) Install tubes (13 and 14), and clamp in place.

NOTE: Make certain tubes maintain a minimum gap of 0.10 inch between tubes and windshield retainer.

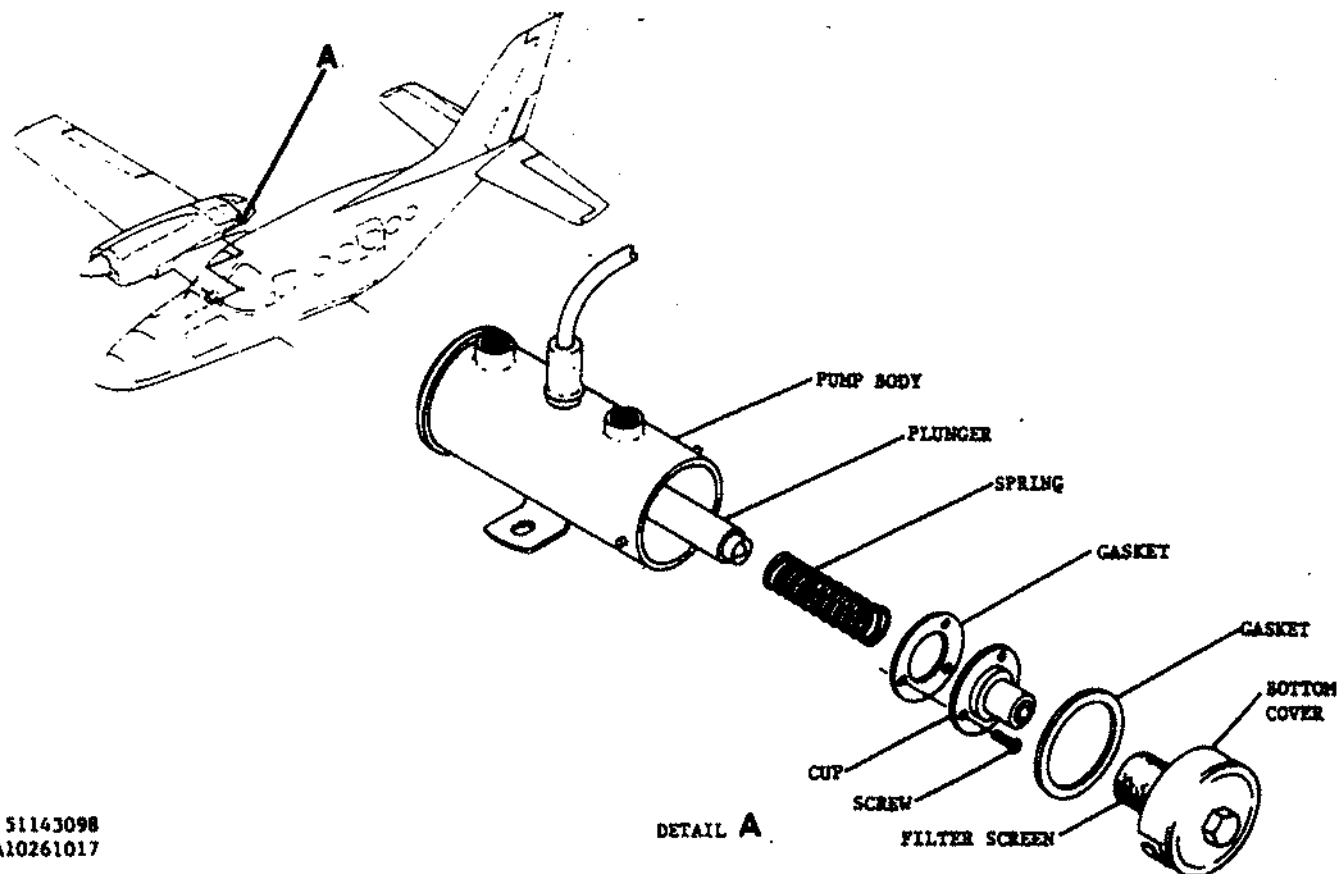
- (7) Install nose baggage retainer, refer to Chapter 3.
- (8) Connect electrical wires to pump.
- (9) Service system, check operation and for leaks.
- (10) Install aft nacelle baggage compartment upholstery panel, forward right cabin upholstery panel.
- (11) Install wing gap fairings.

2. Disassembly/Assembly Windshield Anti-Ice Pump (See Figure 3)

A. Disassemble Windshield Anti-Ice Pump.

NOTE: The interrupter end of the windshield anti-ice pump is sealed (air has been removed and an atmosphere of a special dry gas injected). Should any of the electrical components become inoperative, the pump must be replaced. A gas seal is located in the center of the mounting bracket and no attempt should be made to break this seal, as it would render the pump useless.

- (1) Hold the pump body securely in one hand and release the bottom cover from the bayonet fittings by rotating it counterclockwise with a 5/8 inch wrench.



Windshield Anti-Ice Pump Assembly
Figure 3

- (2) Remove the gasket from the cover.
- (3) Carefully remove the filter screen.
- (4) Remove the screws that hold the plunger spring cup to the pump body.
- (5) Remove the gasket and plunger spring.
- (6) Carefully withdraw the plunger from the pump body. Do not drop or mutilate the plunger.
- (7) Clean and inspect the pump as follows:
 - (a) Wash the plunger assembly in Stoddard Solvent or gasoline. If it fails to become thoroughly clean or if any rough spots are present, dress the surface carefully with crocus cloth. Rinse thoroughly to remove all foreign material.
 - (b) Dip the pump body in clean solvent, shake it lightly, then remove it and dry with compressed air.
 - (c) Blow out the plunger tube with compressed air and check for any rough spots, deposits or foreign material. If not smooth, wrap a piece of cloth around a wooden dowel, dip cloth in Stoddard Solvent (Federal Specification P-D-880), and swab the plunger tube until clean.
 - (d) Rinse remaining parts in the solvent and dry with compressed air. Exercise care when drying the screen to prevent damage.
 - (e) Inspect all parts visually for damage.
 - (f) Inspect the pump electrical resistance by connecting an ohmmeter between the connector terminal and ground on the pump housing. Resistance should be between 19.0 and 19.5 ohms. If the resistance is not within limits, replace the pump assembly.

B. Assemble Windshield Anti-Ice Pump.

- (1) Insert the plunger assembly in the tube with buffer-spring end first. Check for proper fit by slowly raising and lowering the plunger in the tube; it should move freely without any tendency of sticking. A click should be heard each time the plunger approaches the top of the tube. If this click cannot be heard, the interrupter assembly in the sealed portion of the pump is not functioning properly, and the pump assembly must be replaced.
- (2) Install the plunger spring.
- (3) Place the spring cup gasket in position on the plunger spring cup and carefully attach this assembly to the pump body, with the screws. Tighten screws securely.
- (4) Carefully install the screen, place new cover gasket in position in cover and attach the cover to the pump body.
- (5) Hold the pump body securely with one hand and tighten the cover in place on the pump body bayonets with a 5/8 inch open-end wrench or box socket.
- (6) Check pump for proper operation.

3. Clean Windshield Anti-Ice Components.

A. Cleaning.

- (1) Immerse lines in a dry cleaning solvent.

NOTE: Lines not readily removable from aircraft may be flushed with cleaning solvent. Take necessary precautions to protect windshield.

- (2) Dry lines with filtered compressed air.
- (3) Clean pump filter screen, refer to Disassembly/Assembly Windshield Anti-Ice Pump.

CABIN DISPLAY SYSTEMDescription

1. The passenger compartment digital display system, located on the forward cabin divider annunciates true airspeed, altitude and outside air temperature. The system receives it's data input from two pressure transducers and a temperature probe. The pressure transducers are housed in a remote transducer-assembly and require only two physical connections to the Pitot-Static system: One to the Pitot line and the other to the Static line. A connector provides a 5 wire connection to the indicator. The temperature probe consists of an electronic temperature transducer housed in the probe. Three wires connect the temperature probe to the indicator. 28VDC from the airplane bus powers the entire system. The power drain is approximately 250 MA.

NOTE: It takes approximately ten minutes for the transducers to stabilize at a controlled temperature of 35°C.

2. The transducers sense the absolute pressure (Altitude), and the Pitot-Static differential pressure (Indicated Airspeed). These pressures are changed into data signals and transmitted to the indicator. The Outside Air Temperature is similarly converted to an electrical signal and sent to the indicator. Inside the indicator a micro-processor uses these three factors, (Altitude, Indicated Airspeed and Outside Air Temperature), to compute True Airspeed.
3. The only front panel control is a Barometric adjustment switch. This is used to set the altitude display to agree with the pilots altimeter prior to takeoff. This adjustment may also be made during flight to accommodate barometric changes. The resolution of the altitude display is 100 feet. The resolution of the Temperature display is 1°C or 2°F. The resolution of the True Airspeed display varies with airspeed. At low airspeeds (below 100 knots), the displayed airspeed changes in increments of several knots. At typical cruising speeds the display has 2 knot resolution.
4. The micro-processor is capable of valid computations at all airspeeds up to 511 knots indicated airspeed, 50,000 feet of altitude and temperatures ranging from -68°C to +70°C. The digital displays may be field programed to display True Airspeed in Knots, Miles per Hour, or Kilometers per Hour. The altitude may be displayed in Feet or Meters. The temperature can be displayed Celsius or Fahrenheit. The display program is changed by operating four switches located on the rear panel of the indicator. The temperature calibration can be accomplished by adjusting the potentiometer on the back of the indicator until the display agrees with an accurate thermometer placed near the temperature probe outside the airframe.

NOTE: The passenger display system is not a cockpit flight instrument and should not be used as a flight data reference by the cockpit crew.

As a result the indicated airspeed will probably display an obviously high reading when the system is first turned on. This is a normal condition. Within 10 minutes all readings will be nominal and valid barometric settings may be entered into the system. In addition, insure that switches on the rear panel are compatible with legends on front of display and are correctly set.

Adjustment/Test

1. Calibration and Testing of Indicators.
 - A. The temperature circuit may be recalibrated by turning the adjustment screw on the rear of the display until the reading on the display is the same as a thermometer placard next to the temperature probe. Testing of the temperature circuit may be accomplished by switching from Celsius to Fahrenheit on the programming switches and noting whether or not temperatures indicate correct readings for both scales.

- B. A barometric adjustment switch is located on the front panel and is used to set the altitude display to agree with the pilot's altimeter prior to takeoff. This adjustment may also be made during flight to accommodate barometric change.

NOTE: Do not use the Barometric switch until you have adjusted the temperature.

- C. The pitot-static transducer may be replaced in the field but must be recalibrated at the factory.
- D. When power is applied to the completely installed system and the airplane is sitting on the ground, the airspeed should read "0", the altitude should read within 100 feet of field elevation and the temperature, after adjustment, should read approximately the ambient temperature.

Maintenance Practices

1. Removal/Installation Cabin Display System (See Figure 1)

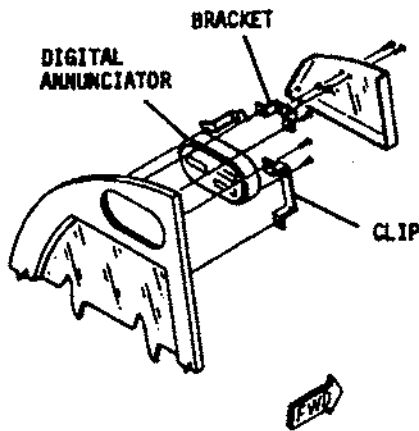
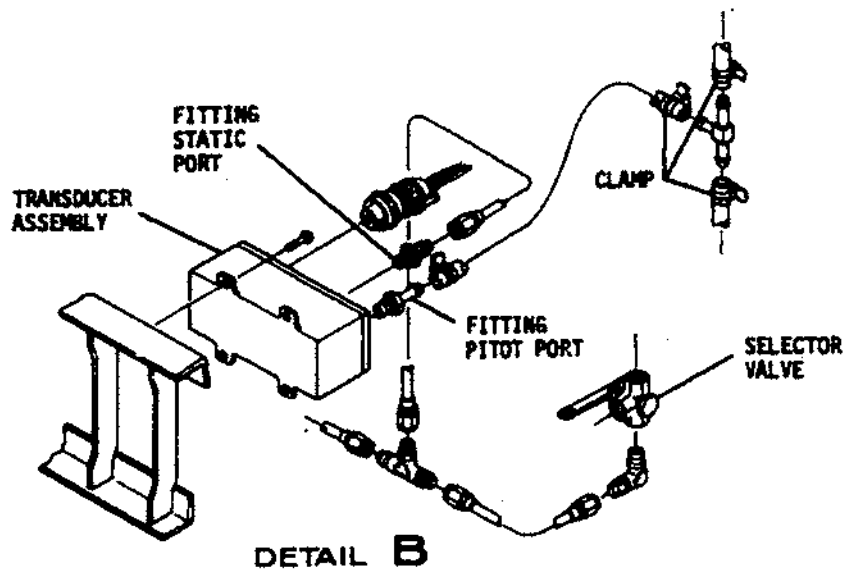
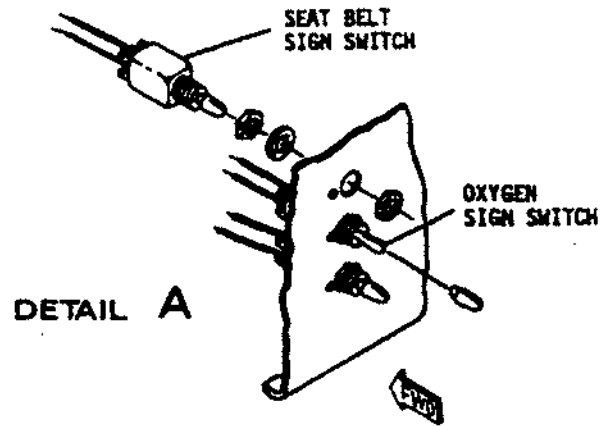
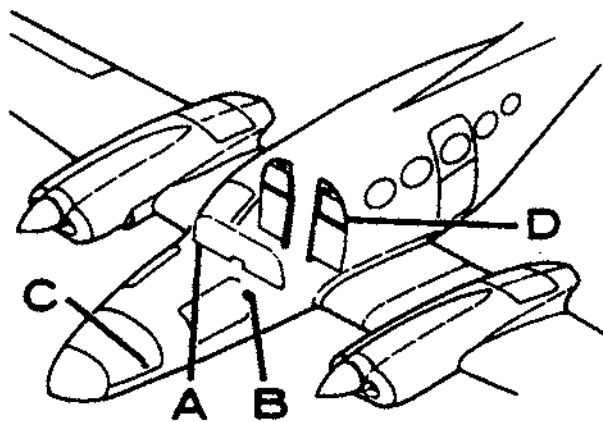
A. Removal of Cabin Display System.

- (1) Remove screws holding clips in place.
- (2) Disconnect wires leading to display.
- (3) Remove from divider.

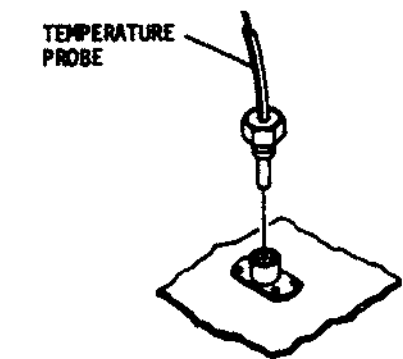
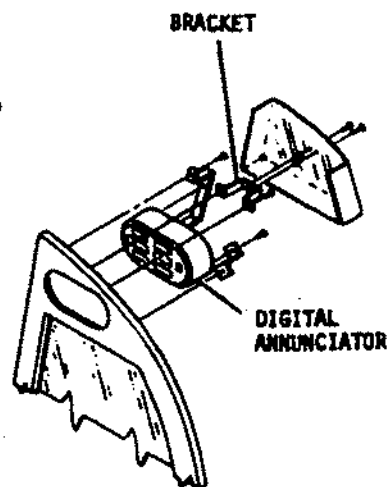
CAUTION: UNDER NO CIRCUMSTANCES SHOULD POWER BE APPLIED TO THE TRANSDUCER BOX OR THE TEMPERATURE TRANSDUCER WHEN POWER IS NOT APPLIED TO THE DISPLAY UNIT, UNLESS YOU ARE ABSOLUTELY CERTAIN THAT THE SIGNAL WIRES FROM THE TRANSDUCERS ARE DISCONNECTED FROM THE DISPLAY UNIT. IF SIGNALS ARE APPLIED TO THE DISPLAY UNIT WITH NO POWER APPLIED TO THE DISPLAY UNIT, THE SIGNALS WILL DESTROY THE MULTIPLEXER CIRCUITRY INSIDE THE DISPLAY UNIT.

B. Install Cabin Display System.

- (1) (Reverse removal procedures).
- (2) Adjust calibrations.



DETAIL D



DETAIL C

51143145
A57143008
B51142075
C57143008
D58142037

Cabin Display System
Figure 1

CHAPTER

13

ELECTRICAL SYSTEMS

CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL

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COMPONENTS LOCATION CHART

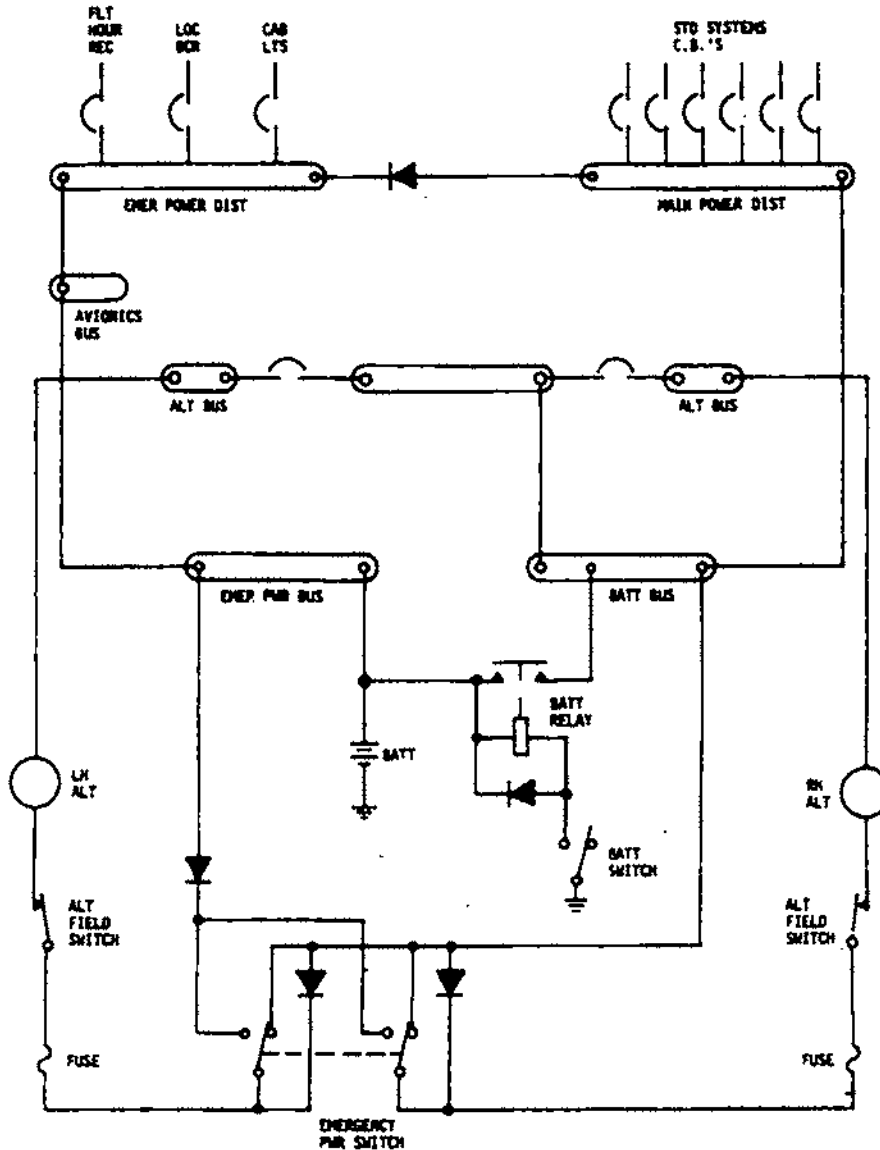
Electrical

<u>Components</u>	<u>Location</u>
Alternator Field Fuse	On Left Console in Cabin
Alternator Field Switches	On Left Console in Cabin
Alternator Overvoltage Relay	Inside Left Console in Cabin
Alternator Fail Sensor	Next to Alternator in Engine Nacelle
Battery Solenoid	Forward of Battery, Left Stub Wing
Battery Switch	On Left Side Console in Cabin
Battery Auxiliary Switch	Forward of Battery, Left Stub Wing
Cigar Lighter Fuse	On Left Console in Cabin
Deice System Timer	Inside Left Console
Emergency Power Switch	In Cabin, On Left Console
External Power Receptacle	Bottom, Left-Hand Wing Locker
Field Diodes	Next to Alternators in Engine Nacelle
Filter Capacitor	Next to Alternators in Engine Nacelle
Flight Hour Recorder Switch	Top, Inside Left Console
Landing Light Circuit Breaker	In Cabin, On Left Console
Low Voltage Monitor Fuse	In Cabin, in Left Console
Strobe Flasher Unit	Floorboards, Left-Hand Aft, Below Passenger Seats
Electric Windshield Relay	In Cabin, Inside Left Console
Heater Hour Meter	In Nose, Right-Hand Baggage Retainer

POWER DISTRIBUTIONDescription

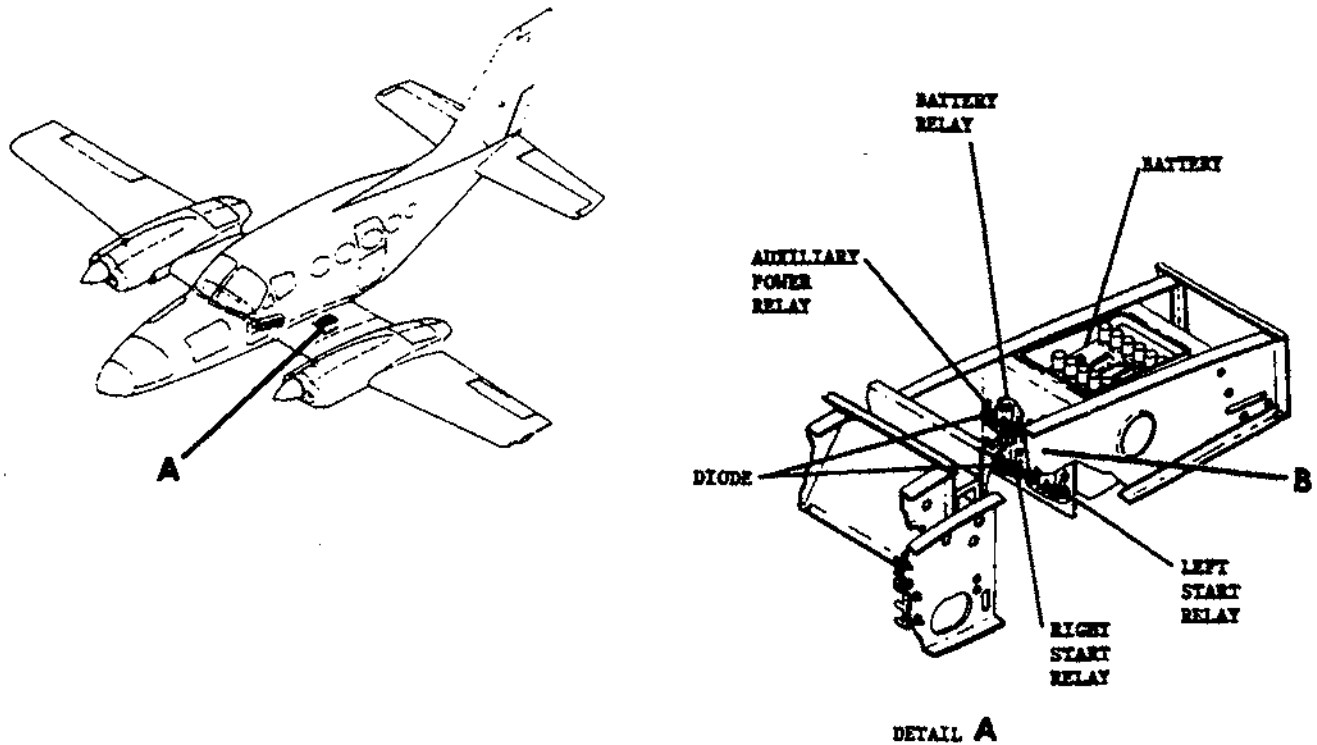
1. DC electrical power is the airplane's main source of electrical power. The DC electrical power system is divided into two independent systems; the left-hand and right-hand. Each system has a power source. A cross-tie bus connects the systems together to supply power to the various load demands throughout the airplane. Normally both systems operate in parallel. In the event of a power loss of one alternator system, electrical power is supplied from the opposite system through the cross-tie bus. When the airplane is on the ground, a DC external power receptacle (optional) is utilized to supply DC power to the airplane's electrical system.
2. Two engine-driven alternators, one on each engine, are normally the source of power supplied to all DC load buses and to charge the storage battery. The standard alternator system includes two 50-ampere alternators, the optional system includes two 100-ampere alternators.
3. One 24-volt lead acid battery, located in the left-hand stub wing, is the airplane's secondary DC power source. Battery power is utilized to start the engines. Also, if the alternator system fails, the battery will supply power to the electrical systems.
4. External DC power can be connected to the airplane through the external power receptacle (optional), located on the aft lower surface of the left-hand nacelle baggage compartment. When external power is connected, the external power relay energizes, connecting the external power source to the hot battery bus, supplying DC power to the electrical systems. When external power provisions are available on the airplane, its use is recommended for engine starting and electrical ground maintenance operations.
5. Electrical load distribution, from the power sources to the various using systems throughout the airplane, is accomplished by wiring, buses and circuit breakers. The circuit breakers and switch breakers are located on the left side console.
6. Controls and Indicators.
 - A. The electrical power source control switches and indicators are located on the left side console.
 - (1) The battery master switch is located between the left and right alternator switches on the left side console. A switch bar is installed across the top of the three switches to permit simultaneous shutoff. When the battery switch is placed in ON position, it actuates the battery relay which connects the battery to the battery shunt.
 - (2) Two alternator switches marked L ALT and R ALT have two positions ON and OFF. With the alternator switch in the ON position, the alternator control for regulation, protection and load bus connection is automatic. Placing the switch to OFF will isolate the alternator from its load bus. Should an overvoltage in the system result, causing tripping of the overvoltage relay, reposition the respective alternator switch from ON to OFF, back to ON will reset the overvoltage relay.
 - (3) A voltmeter, located on the left side console, is provided to monitor alternator current output, battery charge or discharge rate and bus voltage. An AMP METER SELECT switch, labeled L ALT, R ALT, BATT and VOLTS is located to the left of the voltmeter. Positioning the switch L ALT, R ALT or BATT position, the respective alternator or battery amperage can be monitored positioning the switch to volts position, the electrical system bus voltage can be monitored.
 - B. Indicator Lights.
 - (1) The alternator failure lights, located on the annunciator panel, will illuminate when the respective alternator system malfunctions.
 - (2) The battery voltage monitor light, located on the annunciator panel, provided a warning when illuminated that the electrical system is operating on battery power. The battery voltage monitor system, consists of a low voltage monitor assembly, located inside the left side console, the warning lamp and electrical wiring. The monitor assembly will illuminate the warning light with decreasing voltage between 24.5 and 25.5 volts and remain ON with voltage lower than turn on voltage. The warning light will turn OFF with increasing voltage between 24.5 and 26.0 and remain off with voltage higher; then turn off voltage.

7. The aircraft's major light circuits are; the interior lights and exterior lights.
8. A stall warning system with a transmitter installed in the leading edge of the left wing tip, provides audio warning from a warning horn when the aircraft approaches a stall.



51987007

Electrical Power Simplified Schematic
Figure 1



START SYSTEM
CIRCUIT BREAKERS
(CAA AIRCRAFT ONLY)

ALTERNATOR SYSTEM
CIRCUIT BREAKERS

DETAIL B

Electrical DC Power System Components
Figure 2

51183018
A51181044R
B51181056

9. Precautions.

- A. Disconnect the battery before connecting or disconnecting test instruments (except voltammeter) or before removing or replacing any unit or wiring. Accidental grounding or shorting at the voltage regulator, alternator, voltammeter, or accessories, will cause severe damage to the units and/or wiring.
- B. The alternator output lead must not be removed from the alternator with the field circuit energized and the alternator operating.
- C. Do not attempt to polarize the alternator. No polarization is required. Any attempt to do so may result in damage to the alternator, voltage regulator or circuits.
- D. Ground of the alternator output terminal may damage the alternator and/or circuit and components.
- E. Reversed battery connections may damage the alternator, wiring or other components of the charging system. Battery polarity should be checked with a voltammeter before connecting the battery.
- F. When using an auxiliary power unit, make sure the voltage and polarity are set to correspond with the system voltage and polarity.

NOTE: While powering the airplane electrical system from an external source for extended periods of time, turn the battery switch OFF to avoid damage to battery by improper charging. Also, turn the alternator switches OFF and pull the alternator circuit breakers to avoid damage to the alternators.

10. Spare Fuses.

- A. (Airplanes C1408 and On.) A fuse bag is located on the cover of the avionics junction box (located in the nose compartment) and provides storage space for spare fuses used in the electrical system. Below is a list of fuses contained inside the fuse bag when the airplane is delivered from the factory.

PART NUMBER	QUANTITY	NOMENCLATURE
MDL 3/4	1	Fuse
MDL 1.0	1	Fuse
AGC-3	1	Fuse
AGC-2	2	Fuse
AGC-1	3	Fuse

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AC HEATED WINDSHIELD

Description

1. The AC (alternating current) heated windshield anti-ice system is an optional system for airplanes C0001 thru C0800 except airplanes C0001 thru C0800 incorporating SK421-119. The system consists of the DC-AC inverter, controller, pilot's heated windshield, control switch, circuit breaker and indicator light.
2. The DC-AC inverter is located in the right-hand stub wing. The inverter is utilized to convert DC (direct current) voltage to AC voltage to operate the electric heated windshield. The inverter input power is 28 VDC and output power is 1500 VA at 204 (nominal) VAC. Access to the inverter is gained by removing the access cover over the inverter. A decal is provided on the access cover (inside surface) giving instructions for proper inverter connections to the windshield terminals. An access plate on the top of the inverter is provided for access to the inverter output voltage taps. Inverter tap voltage is as follows with a voltage tolerance of ± 4 volts:
Tap 1 - 198 VAC true RMS for load resistance 31.14 to 33.45 ohms.
Tap 2 - 204 VAC true RMS for load resistance 33.45 to 35.75 ohms.
Tap 3 - 211 VAC true RMS for load resistance 35.75 to 38.06 ohms.
3. The controller is located in the left side console. Actuation of the WINDSHIELD ANTI-ICE switch activates the controller, which senses windshield heat from a wire sensor imbedded in the windshield. If the windshield heat is not within the limits established by the sensor and controller, the controller closes, applying DC voltage to the inverter. The inverter converts the DC voltage to AC voltage to heat the windshield heat element. When the windshield reaches the cutout temperature. The controller will open, removing AC voltage from the windshield.
4. The windshield is a laminated stretched acrylic construction utilizing a deposited metallic film for the heating element. The windshield incorporates electrical terminal connections and a resistance wire sensor. Each windshield is permanently marked in the lower left-hand corner with the resistance value of that windshield. The windshield resistance valve circuit must be connected to the proper tap inside the inverter as indicated on the inverter access cover decal.
5. The heated windshield anti-ice indicator light is located on the annunciator panel. The light will illuminate each time the controller automatically closes and stays illuminated until the controller automatically opens. The function of the light is to indicate the controller is operating and DC voltage is being applied to operate the inverter.

Troubleshooting

1. General

- A. Troubleshooting the windshield anti-ice system is isolating the malfunction to a replaceable component. Isolating the trouble is reduced with the aid of the system's indicator light.

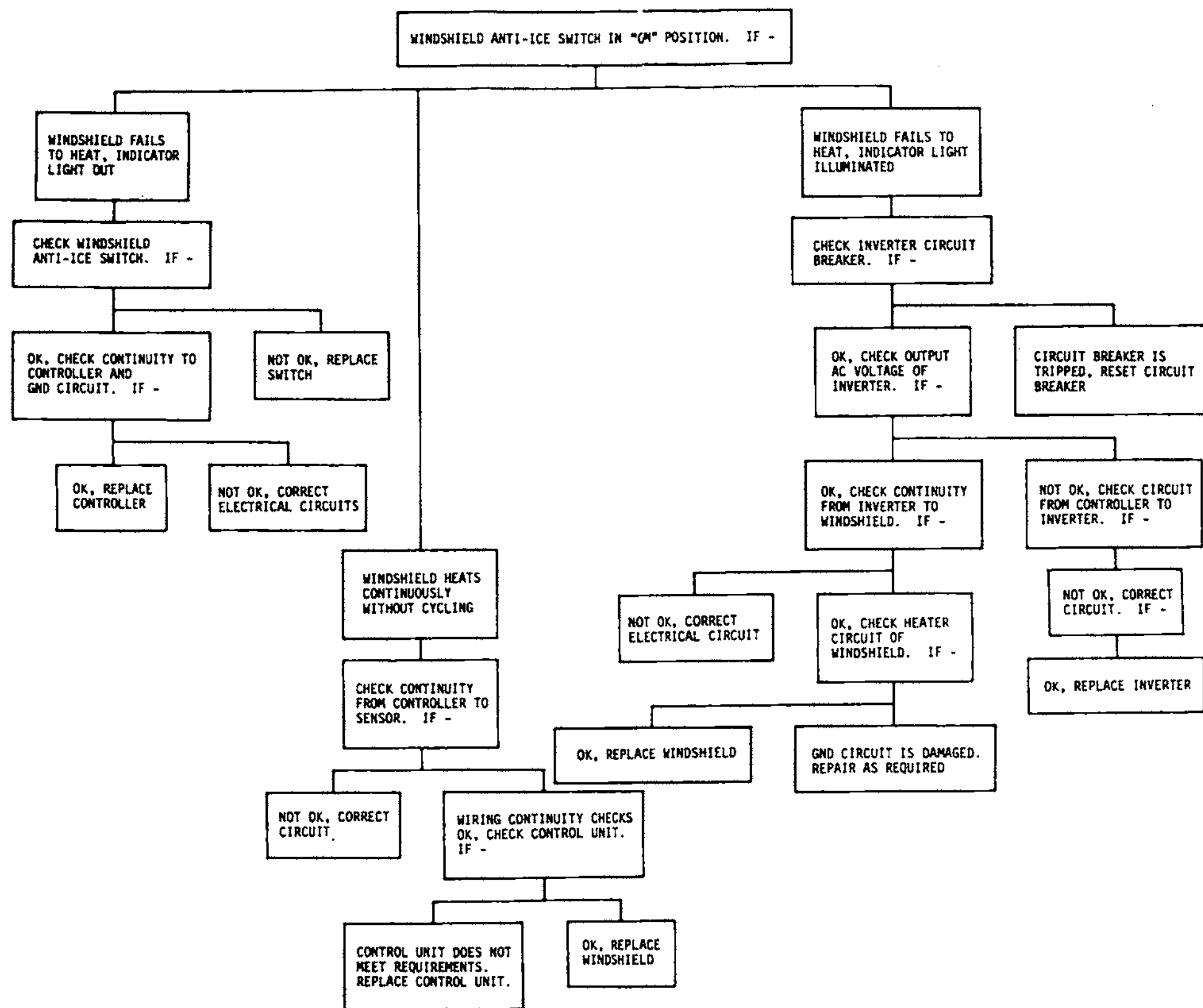
2. Tools and Equipment.

NOTE: Equivalent substitutes may be used for the following listed items.

Name	Number	Manufacturer	Use
Multimeter	Simpson Model 260		To check voltage, resistance and continuity of the electrical circuits.

3. Troubleshooting Heated Windshield Anti-Ice System

- A. For troubleshooting the windshield anti-ice system, refer to Figure 1.
- B. Audio noise interference caused by the heated windshield system may be effectively reduced by the addition of filler kit consisting of a coil and capacitor shown in Figure 2.



Troubleshooting Chart - Heated Windshield Anti-Ice System
Figure 1

51988019R

Adjustment/Test

1. Operational Test AC Heated Windshield Anti-Ice System

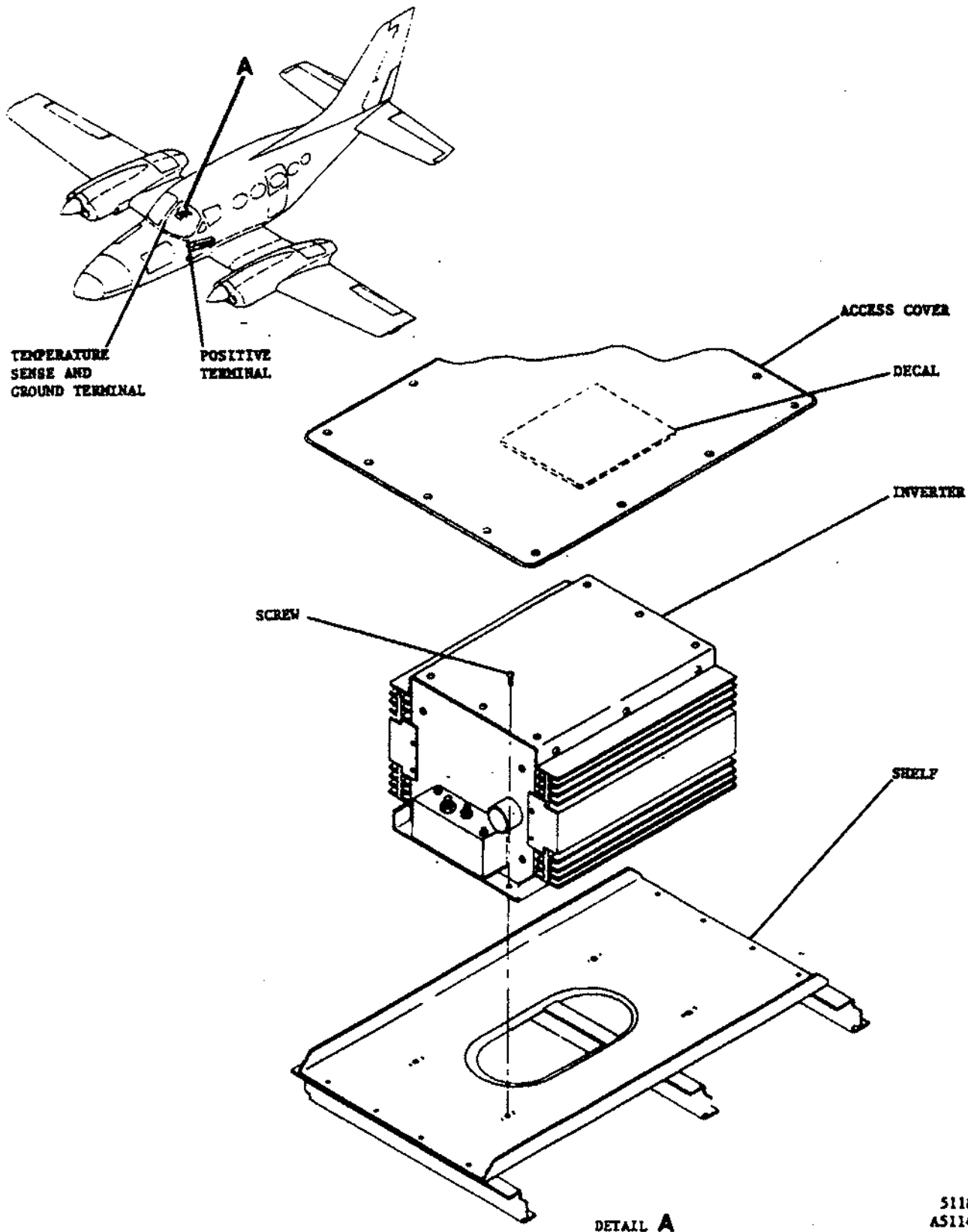
A. Ground Test Heated Windshield Anti-Ice System.

- (1) Allow the temperature of the windshield to stabilize in a hangar temperature environment of approximately 75°F for two to three hours; preferably overnight, when possible.
- (2) If external power receptacle is installed on airplane, connect auxiliary power unit.
- (3) Turn the Windshield Anti-Ice switch ON and allow windshield cycle to stabilize. Initial turn-on time should be less than one minute and the stabilized on-off cycle should be: ON between 4 to 6 seconds, OFF 30 to 60 seconds, indicated by the Windshield ON light on the annunciator panel.
- (4) If the windshield ground cycle is normal, turn off electrical power.
- (5) If the windshield ON light remains on at all times, check the windshield for heating by feeling it with your hand. If the windshield is warm, or hot, but it does not cycle OFF, do not operate the windshield in excess of two minutes or damage to windshield will result. Replace windshield temperature controller or repair electrical circuit as required.
- (6) If temperature controller is working properly, but still the windshield ON light remains ON, check windshield inverter for correct voltage output and terminal hookup as follows:
 - (a) Measure the voltage at the electrical terminal connections of the windshield. Voltage should be 194 to 215 AC volts.
 - (b) If AC voltage is present, measure the resistance of the heated windshield terminals. Resistance should be 45 ohms $\pm$ 10% for airplanes 421C0001 thru 421C0200. For airplanes 421C0201 and On, resistance should be within limits given on inverter access cover decal.

CAUTION: WHEN MAKING THE ABOVE RESISTANCE MEASUREMENTS, ALWAYS DISCONNECT WIRING AT TERMINALS AND ENSURE BATTERY IS TURNED OFF.

- (c) If resistance is within tolerance, measure resistance from ground terminal to primary structure. Resistance should be no greater than .005 ohms.
- (d) If AC voltage is not present at windshield connections terminals, disconnect AC wiring at terminals of inverter.
- (e) Measure AC voltage at inverter output terminals. If AC voltage is not present, disconnect DC voltage terminal wires and check for 28 volts DC.
- (f) If DC voltage is present, inverter is inoperative.
- (g) If AC voltage is present at the inverter terminals, check for wiring continuity between inverter and the heated windshield.
- (h) If DC voltage is not present, check circuitry at controller and to inverter. If okay, disconnect wiring from sensing unit at windshield terminals.
- (i) Measure resistance of sensing element. Resistance should be 315 $\pm$ 5, -10 ohms with temperature of windshield at 75°F.
- (7) If the windshield is heating and all other components of the system are operating normal, but it will not cycle OFF during the ground test, then it is very likely that the windshield is defective and should be replaced. A defective windshield will exhibit the following symptoms:
 - (a) Incorrect temperature distribution - Windshield will be hotter at the outboard section than in the inboard (sensor) area. Some distortion may be noticed in the hot section.

NOTE: The use of surface thermocouple devices is not recommended for checking windshield temperature. Their use may result in permanent damage to the windshield. Temperature uniformity testing may be done with the use of an infrared non-contact thermometer, such as Wahl Model HSA-8E or equivalent.



51183016
AS1142044

Heated Windshield Inverter Installation
Figure 2

- (b) Hot spots - Distortion in the hot spot area will be noticed.
- (c) Sensor Open - Windshield "ON" light will remain OFF at all times.
- (d) Heating Element Open - Windshield "ON" light will remain ON but the windshield will be cold.

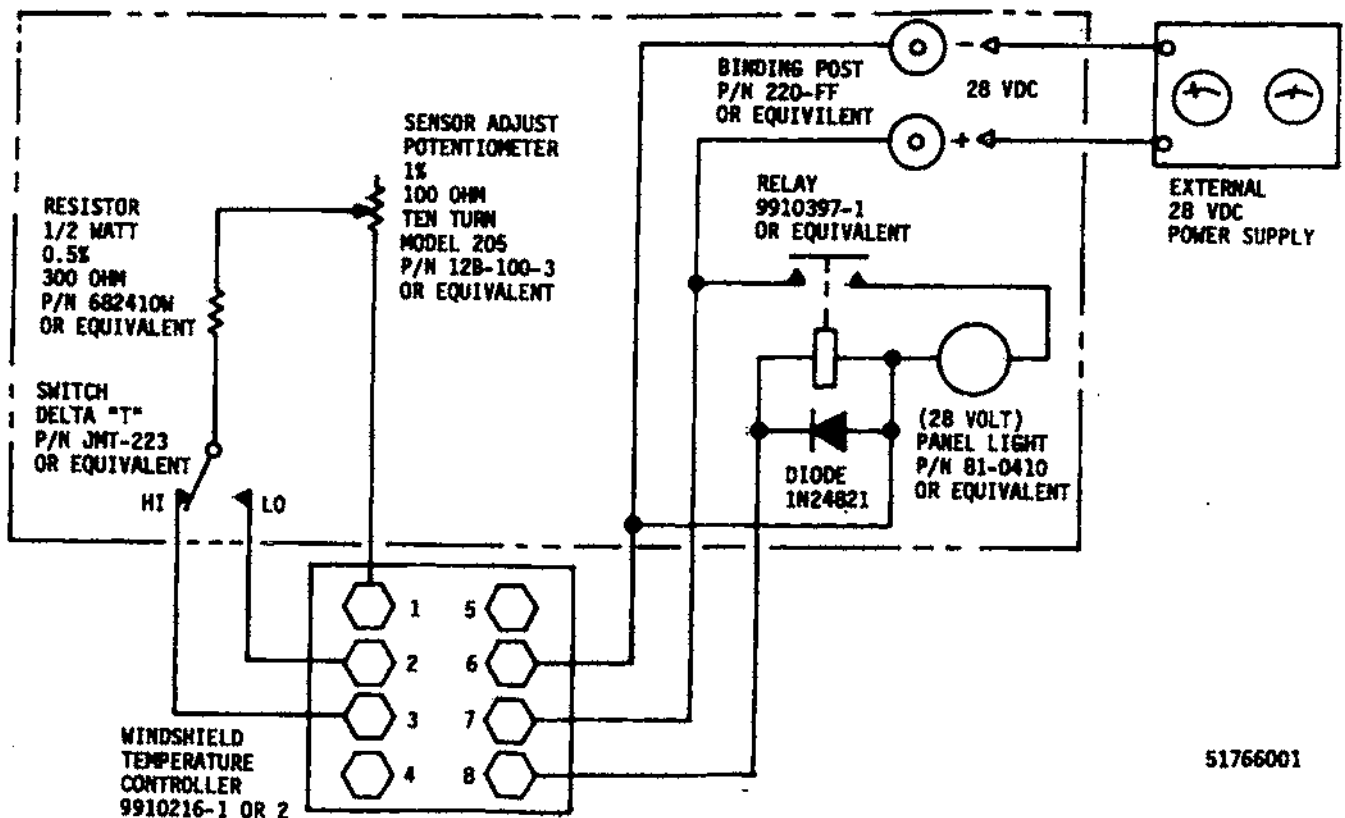
2. Operational Checkout Procedure for Windshield Temperature Controller P/N 9910216-1 and 9910216-2 (Airplanes C0001 thru C0274).

A. Testing the Temperature Controller.

- (1) Fabricate electrical test fixture (variable resistance) per Figure 3.

NOTE: Tester may be fabricated locally using a standard 28 volt airplane starter or battery relay in addition to the standard electrical components called out in Figure 3.

- (2) Connect temperature controller to tester as shown in Figure 3.
- (3) Place "Delta T" switch to "HI" position.
- (4) Set sensor adjust pot to read 50.0.
- (5) Place power switch to the "ON" position. Heat light should come on.
- (6) Increase sensor adjust pot until the light goes out. The pot should read 59.0 or $59 + 300 \text{ ohms} = 359 \pm 0.5 \text{ ohms}$.
- (7) Decrease sensor adjust pot until the light comes on. Dial should now read 5 ohms below the turn-off point or 54 ohms on the dial, $54 + 300 = 354 \text{ ohms} \pm 0.5 \text{ ohms}$.
- (8) Ensure the above settings remain stable with 22 VDC and 32 VDC inputs.
- (9) Place "Delta T" switch to the "LO" position.
- (10) With the sensor adjust pot set at 50.0 on the dial reading, the light should be off.
- (11) Decrease sensor adjustment pot until "Heat Light" comes on. The dial should read $40 \pm 0.5 \text{ ohms} + 300 = 340 \text{ ohms} \pm 0.5 \text{ ohms}$.
- (12) Increase sensor adjustment pot until "Heat Light" goes off. The dial reading should be $45 \pm 0.5 \text{ ohms} + 300 = 345 \text{ ohms} \pm 0.5 \text{ ohms}$.
- (13) Ensure that the ON-OFF readings remain stable at 22 VDC and 32 VDC inputs.
- (14) Remove power from test fixture and disconnect controller.



Test Fixture (Variable Resistance) Fabrication
Figure 3

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Maintenance Practices

1. Tools and Equipment

Name	Number	Manufacturer	Use
Adhesive	Fast Weld No. 10	Ren Plastics 5656 S. Cedar Lansing, Mich. 48909	Attach ground strips.
ANSTAC-M		Chemical Development Corp., Denver, Mass.	Anti-Static agent and cleaner.
Wilco Anti-Static Cleaner		Wilco Co. Los Angeles, Calif.	Anti-Static agent and cleaner.
Aliphatic Naphtha	Type II, TT-N-95	Commercially Available	
Kerosene		Commercially Available	
Polishing Cloth		Kendall Co. Textile Division 111 W. 40th St. New York, N.Y.	Polishing windshield.
Tape General	Scotch Brand No-Mar Protective Tape No. 343	3M Company St. Paul, Minn.	Protection during maintenance.

2. Removal/Installation Heated Windshield

A. Remove Heated Windshield.

- (1) Disconnect electrical wiring to magnetic compass, remove compass.
- (2) Tag and disconnect windshield wiring.
- (3) Remove static discharge strip (refer to removal procedures).
- (4) Remove windshield, refer to Chapter 3.

B. Install Heated Windshield.

- (1) Install windshield, refer to Chapter 3.
- (2) Connect wiring to windshield.

NOTE: On installation, airplanes 421C0001 thru 421C0274 the windshield wiring is connected to the highest voltage available from inverter. On airplanes 421C0274 and On, refer to decal on underside of inverter access cover for voltage tap identification. Measure resistance across power terminals of heated windshield and make connection to proper voltage tap.

- (3) Install static discharge strip (refer to installation procedures).
- (4) Install magnetic compass and connect wiring, refer to Chapter 10.
- (5) Check operation of heated windshield, refer to Adjustment/Test.

3. Removal/Installation Heated Windshield Inverter (See Figure 2)

A. Remove Inverter.

- (1) Ensure battery switch is positioned to OFF.
- (2) Remove access cover from right-hand stub wing.
- (3) Identify and disconnect wiring from positive and negative terminals of inverter.
- (4) Disconnect electrical plug at inverter.
- (5) Remove screws securing inverter to shelf and remove.

B. Install Inverter.

- (1) Remove cover plate from inverter and check voltage setting. Placard on inside of inverter access cover lists voltage requirements.
- (2) Install inverter on shelf and secure with screws.
- (3) Identify and connect electrical wires to positive and negative terminals of inverter.
- (4) Connect electrical plug to inverter.

NOTE: If new inverter is being installed, ensure inverter tap connection is compatible to ohm resistance of windshield and as outlined on access cover decal.

- (5) Check operation of heated windshield, refer to Adjustment/Test.
- (6) Install access cover.

4. Removal/Installation of Static Discharge Strip

A. Remove Strip

- (1) Remove screw grounding strip at windshield frame.
- (2) Peel the strip from windshield.
- (3) Remove any adhesive remaining on the windshield with isopropyl alcohol.

B. Install Strip (see Figure 4).

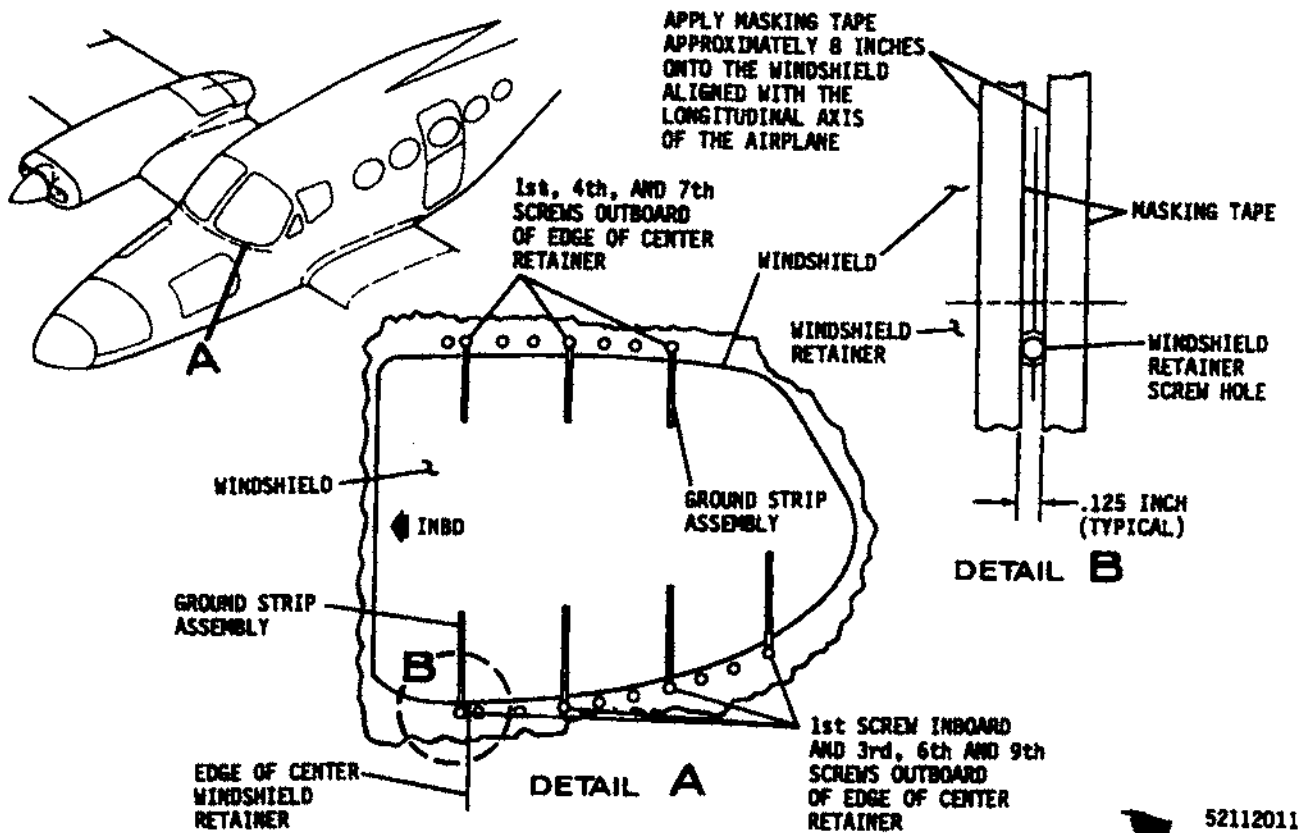
- (1) Clean the windshield area around the strip location, refer to Cleaning Heated Windshield. Thoroughly clean the underside of the grounding screw head and the countersink surface of hole to ensure an electrical contact.
- (2) Apply masking tape as shown in Figure 4.
- (3) Position the strip on windshield with the terminal located over ground screw hole and mark (on the masking tape) the location at end of strip extending onto windshield.
- (4) Apply a bead (approximately .10 inch diameter) of Fast Weld No. 10 Adhesive Sealant to the windshield between the masking tape.
- (5) If the end of strip (braided wire) is frayed, carefully trim to a crisp cut end.
- (6) Clean the strip with isopropyl alcohol.
- (7) Apply a small amount of Fast Weld No. 10 Adhesive Sealant to the screw threads.

NOTE: Ensure that no sealant is allowed to come between the screw thread and the countersink surface.

- (8) Place strip in position and install screw through terminal end. Gently press the strip into the adhesive sealant. Ensure that end of the braided wire is covered with the adhesive sealant (approximately .25 inch). Wipe off excess sealant from the upper surface of the tip, but allow a thin coating to remain. The upper surface of the braid must remain free of adhesive sealant except for the tip.
- (9) Remove the masking tape before the adhesive sealant begins to set-up.

NOTE: Excess adhesive sealant may be cleaned from the windshield with isopropyl alcohol. No adhesive sealant should remain on the windshield except directly beneath the strip assemblies.

- (10) Using a volt-ohmmeter (VOM) check the continuity of the ground strip assembly to the airplane structure. Resistance should be no greater than .05 ohm. If greater resistance is indicated, remove the ground screw and clean the head and contact surfaces. Reinstall screw and recheck resistance.



Static Discharge Strip Locations
Figure 4

- (11) Allow 2 hours for the Fast Weld No. 10 Adhesive Sealant to cure at room temperature (77°F) before flying airplane.

NOTE: To apply Fast Weld No. 10 combine equal weights or volume of both components. Mix together until material is one color. Apply to joint. Work life is only 5 minutes and material sets in 10 minutes. Apply pressure to the joint or component being bonded.

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DC HEATED WINDSHIELD

Description

1. The DC (direct current) electric heated windshield is an optional installation. There are two types of DC electric heated windshields which could be installed on the airplane. On airplanes C0801 thru C1400, except airplanes incorporating SK425-20, the DC windshield is plexiglas. On airplanes C1401 and On and airplanes C0801 thru C1400 incorporating SK425-20 and airplanes C0001 thru C0800 incorporating SK421-119 the DC windshield is glass.
2. The DC heated windshield system consist of a power relay, ground relay, temperature controller and glass windshield. Imbedded in the windshield are two elements and a sensor. The elements heat the windshield and the sensor determines the temperature and sends an electrical signal to the controller. A WINDSHIELD annunciator light is incorporated to provide an indication of heated windshield operation. An ELECT WSHLD ANTI-ICE switch on the left side console provides HI, OFF and LO positions for heating windshield.
3. The purpose of the DC heated windshield system is to prevent ice formation while flying through icing condition.
4. The temperature controller and relays are located on a shelf under the floorboard at approximately FS 162.00 and LBL 14.00. A resistor is located next to the relays for airplanes C1209 thru C1229 except airplanes incorporating SK425-20.
5. The temperature controller controls the power relay which controls ON-OFF cycling. Refer to Figure 1. The purpose of the ground relay is to determine whether current passes through one or two elements in the windshield. When the HI position is selected by the ELECT WSHLD ANTI-ICE switch the ground relay closes to provide a direct ground so current will flow through only one element. When the LO position is selected the ground relay opens and current must flow through two elements to ground.

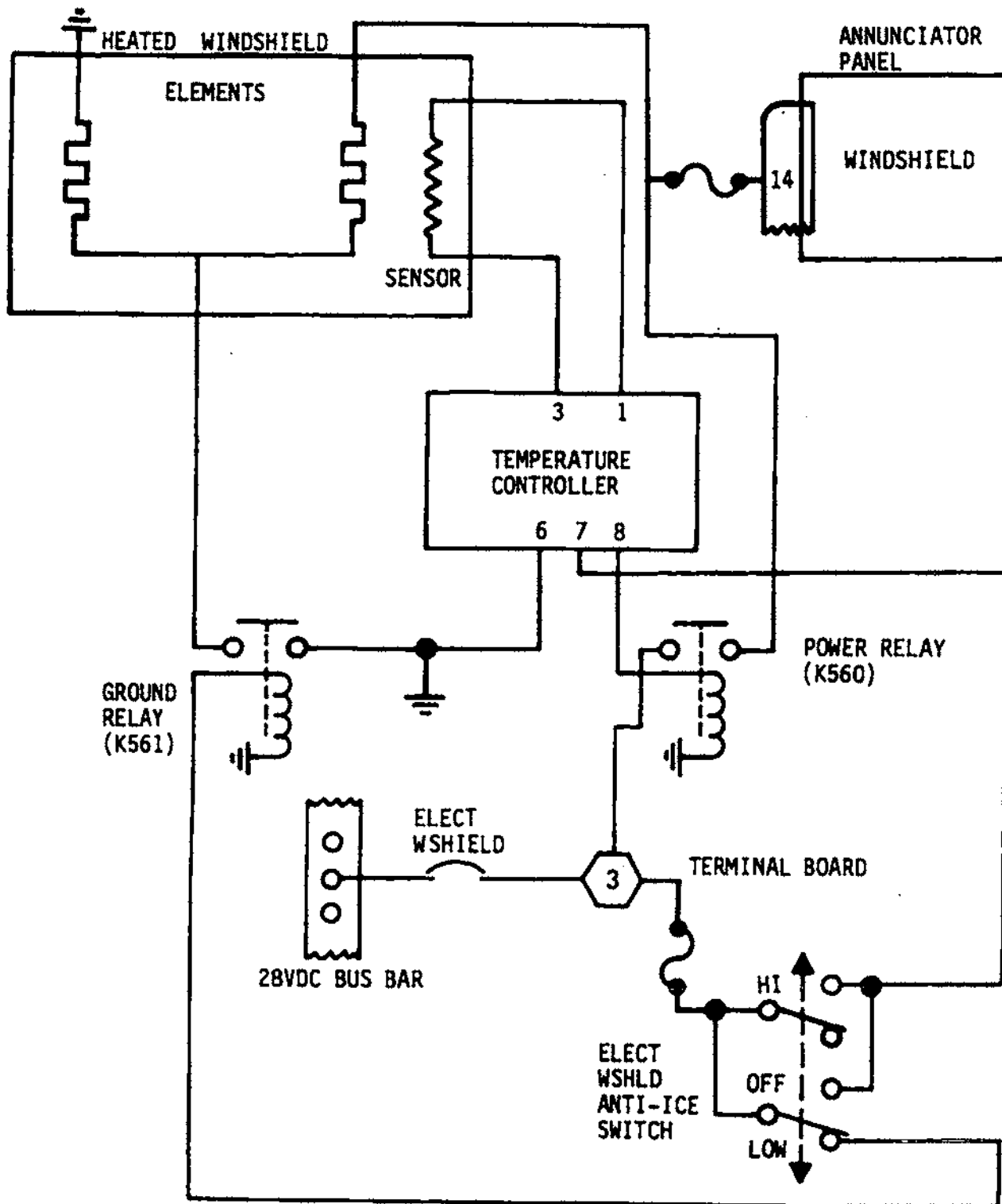
Troubleshooting

1. General
 - A. Troubleshooting the windshield anti-ice system is isolating the malfunction to a replaceable component. Isolating the trouble is reduced with the aid of the system's indicator light (WINDSHIELD annunciator light).
2. Troubleshooting DC Heated Windshield System.
 - A. For troubleshooting guidelines of the DC heated windshield system, refer to Figure 2.

Adjustment/Test

1. Operational Test DC Windshield.
 - A. Apply power to the airplane.
 - B. Engage ELECT WSHLD circuit breaker.
 - C. Place the WSHLD ANTI-ICE ELECT switch to the LO position.
NOTE: The WINDSHIELD annunciator light should illuminate to indicate power is being supplied to the windshield heating elements.
 - D. Allow heated windshield to operate at least five ON-OFF cycles while continuously monitoring annunciator light.
NOTE: This process may be expedited by using a cooling fan to dissipate the heat in the windshield.
 - E. Place the WSHLD ANTI-ICE ELECT switch to the OFF position and allow windshield to cool for at least three minutes.
 - F. Place the WSHLD ANTI-ICE ELECT switch to the HI position.
 - G. Allow heated windshield to operate for at least three ON-OFF cycles while continuously monitoring the annunciator light.
NOTE: This process may be expedited by using a cooling fan to dissipate the heat in the windshield.
 - H. Place the WSHLD ANTI-ICE ELECT switch to the OFF position.
NOTE: The WINDSHIELD annunciator light should illuminate to indicate power is being supplied to the windshield heating elements.

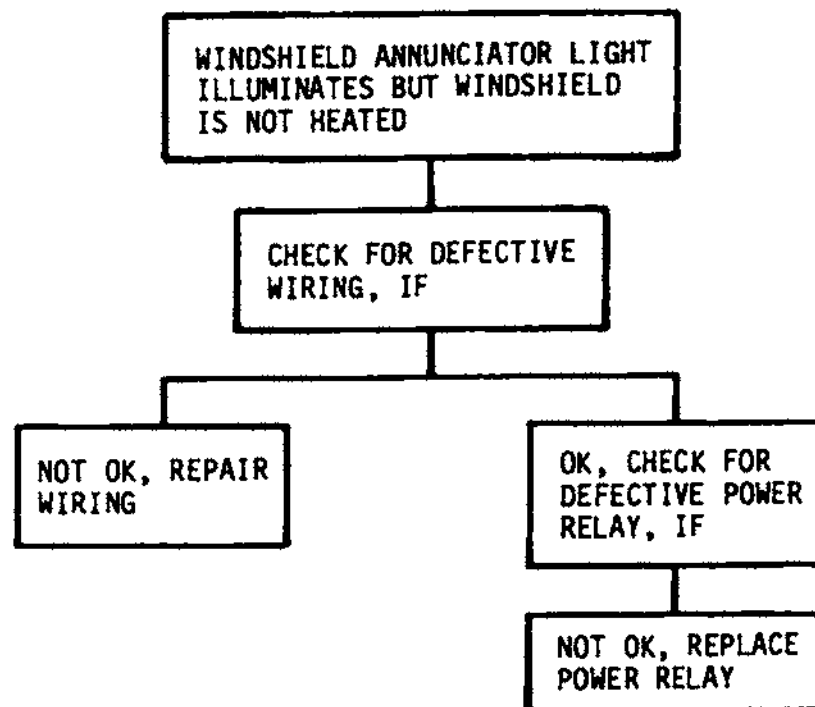
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DC Heated Windshield Schematic
Figure 1

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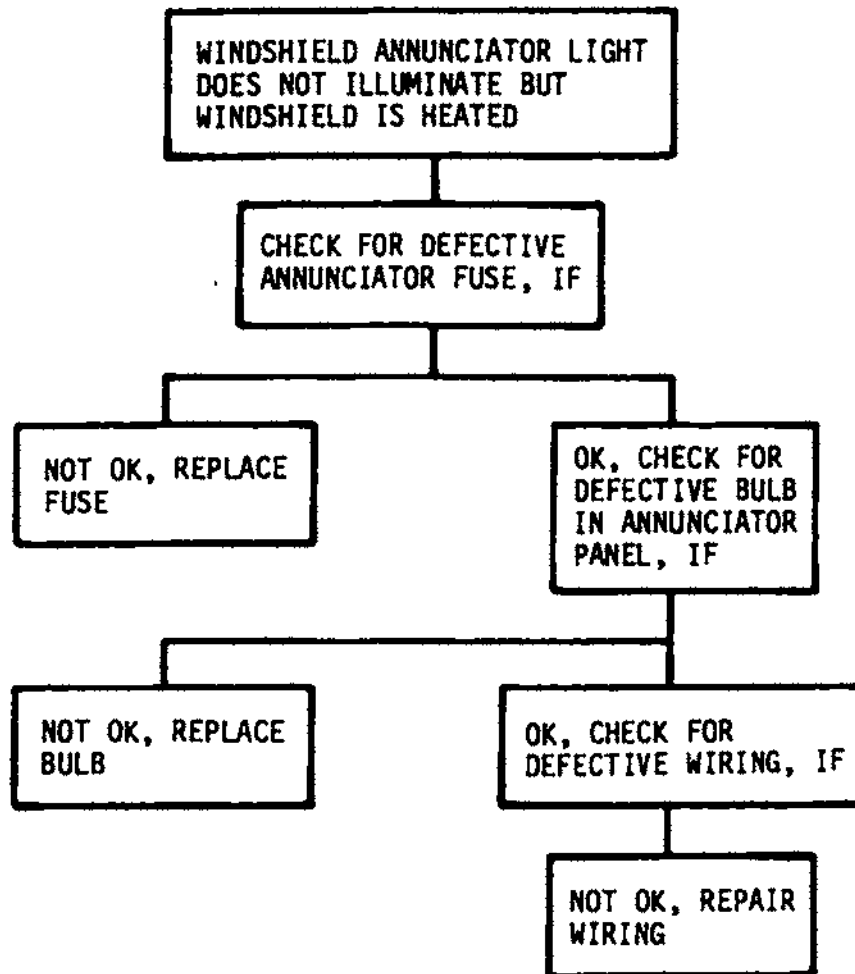
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DC Heated Windshield System Troubleshooting Chart
Figure 2 (Sheet 1)

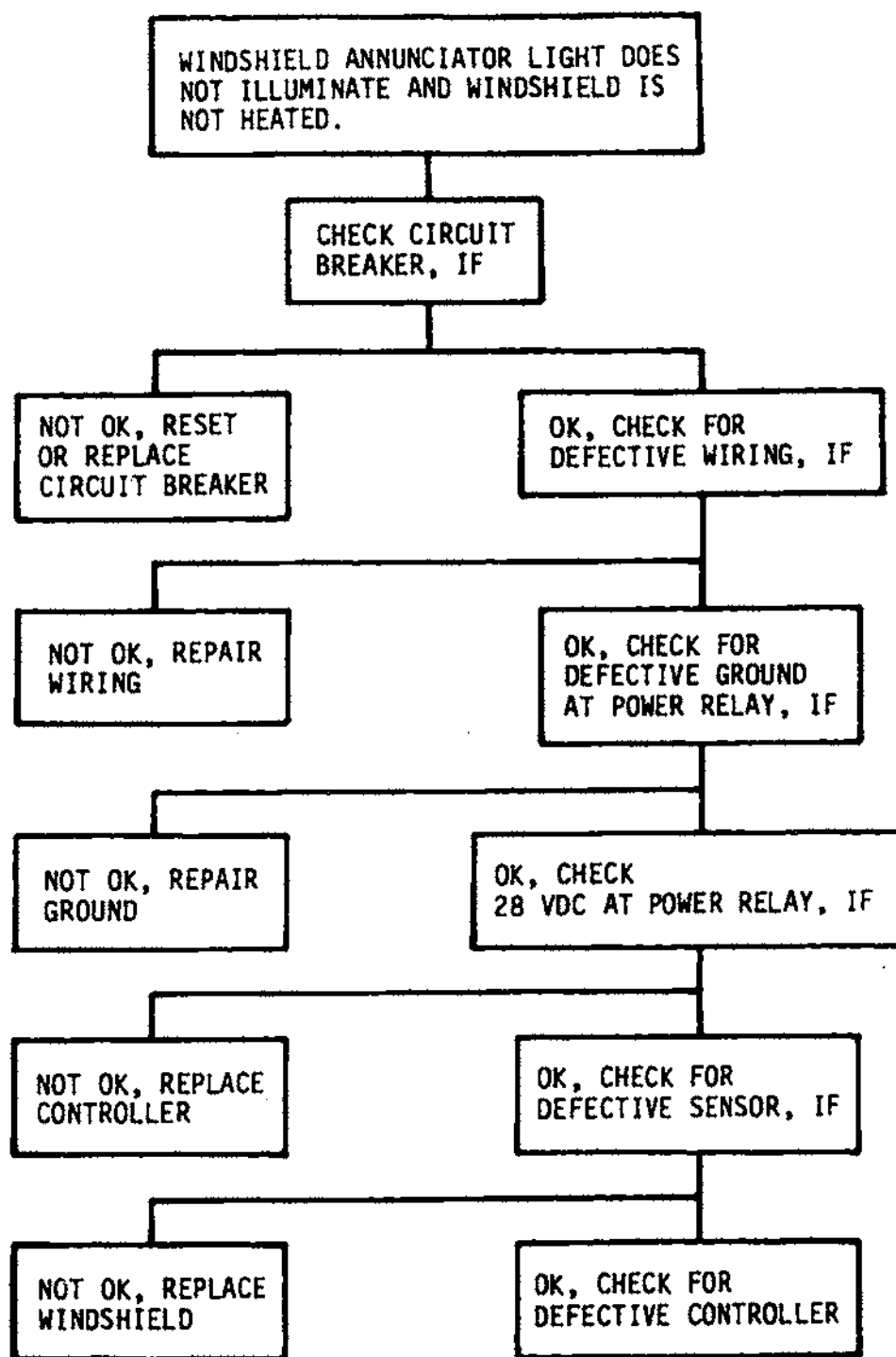
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DC Heated Windshield System Troubleshooting Chart
Figure 2 (Sheet 2)

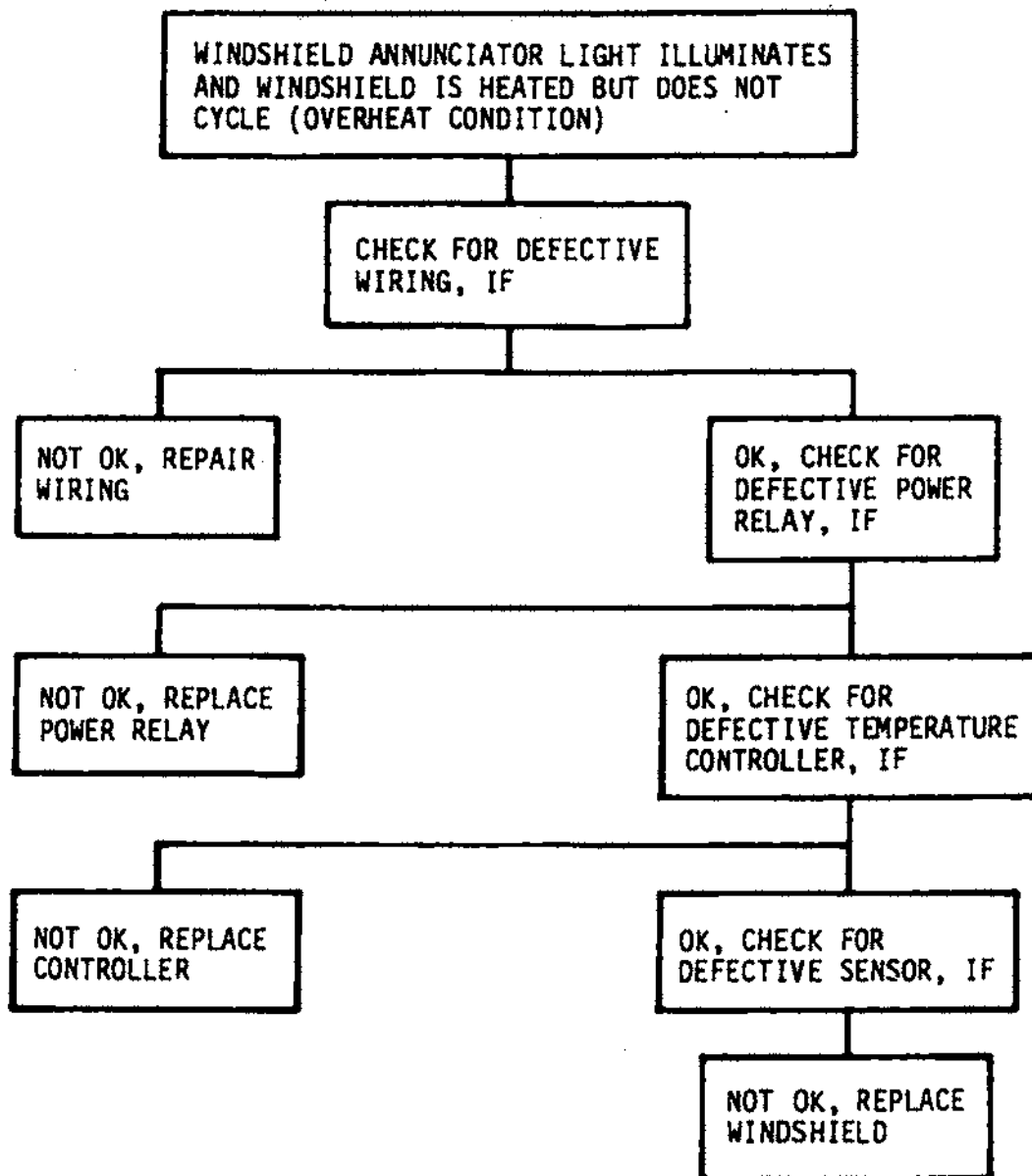
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DC Heated Windshield System Troubleshooting Chart
Figure 2 (Sheet 3)

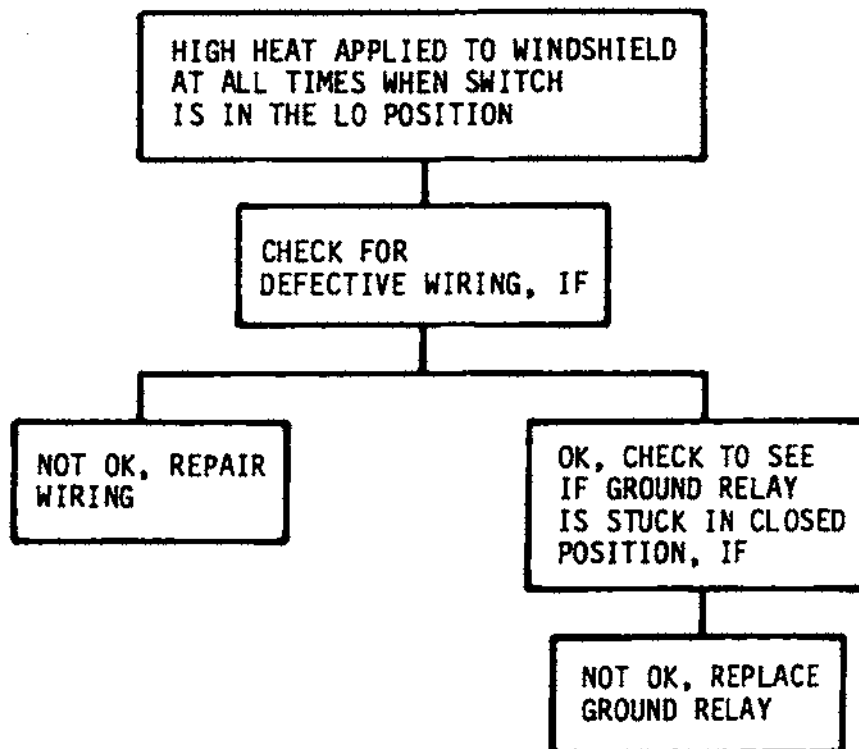
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DC Heated Windshield System Troubleshooting Chart
Figure 2 (Sheet 4)

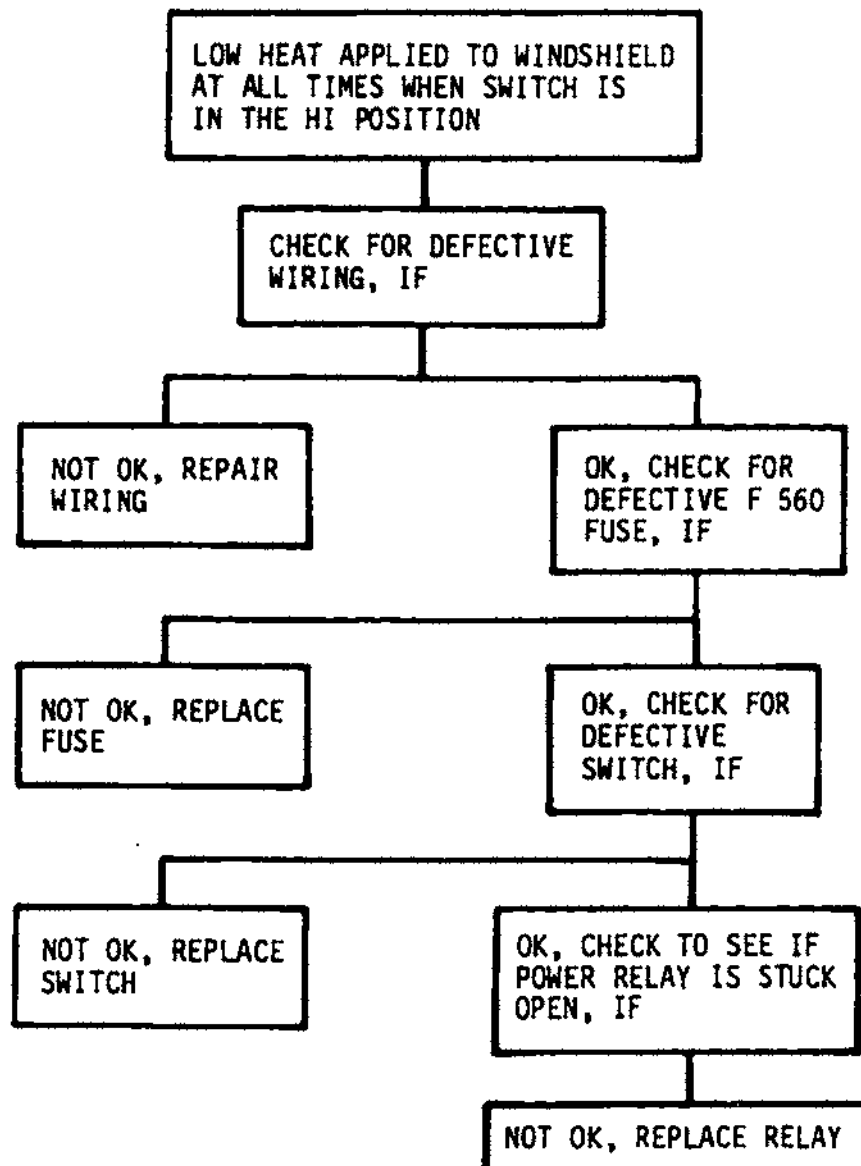
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DC Heated Windshield System Troubleshooting Chart
Figure 2 (Sheet 5)

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DC Heated Windshield System Troubleshooting Chart
Figure 2 (Sheet 6)

2. Windshield Temperature Controller Circuit Test.

- A. Disengage ELECT WSHLD circuit breaker.
- B. Disconnect temperature controller sensor wiring and windshield power wire at the windshield. Refer to wiring diagram.
- C. Connect a decade box to the windshield temperature sensor wires.
- E. Connect a voltmeter capable of reading 28 volts DC to the windshield power wire.
- F. Engage ELECT WSHLD circuit breaker.
- G. Place windshield switch to the HI position.
- H. Set decade box to 300 ohms, the voltmeter should read 0 VDC.
- I. Set decade box to 349 ohms (windshield temperature 121.5°F) the voltmeter should read 28 VDC.
- J. Set decade box to 354 ohms (windshield temperature 128.3 °F) the voltmeter should read 0 VDC.
- K. Reconnect temperature controller sensor wiring and windshield power wire to windshield. Refer to wiring diagram.

Maintenance Practices

1. Removal/Installation Heated Windshield

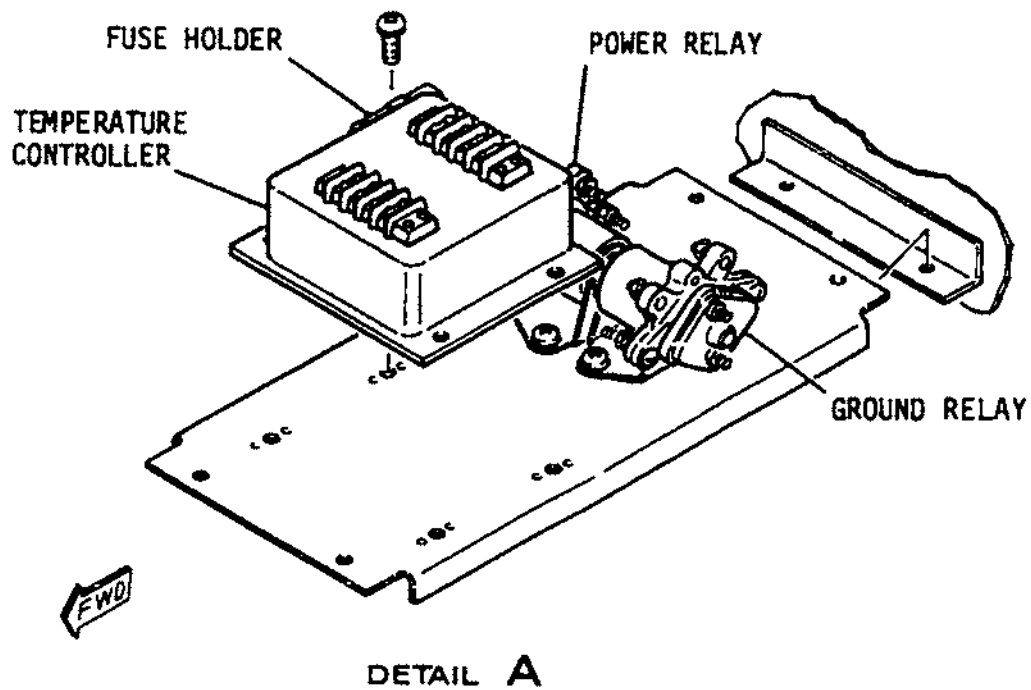
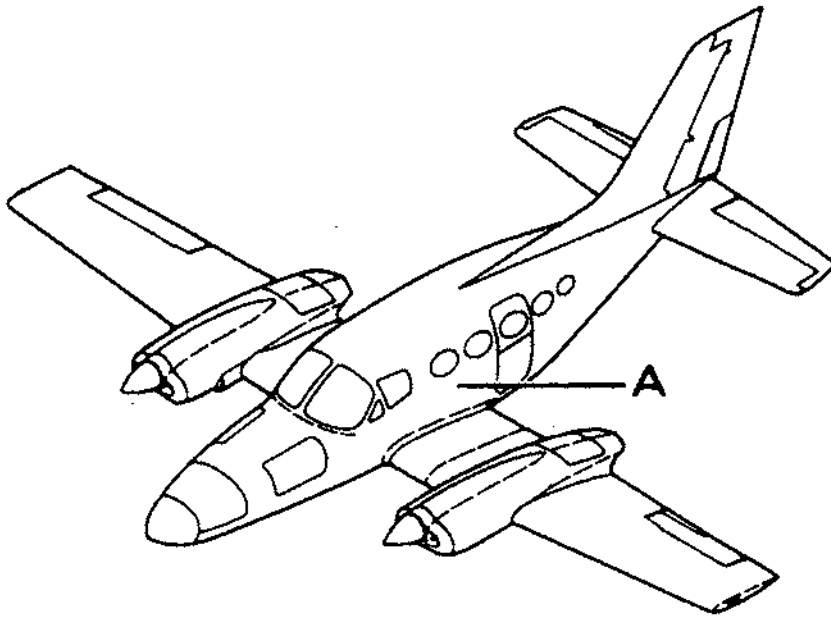
- A. Remove Heated Windshield.
 - (1) Disconnect electrical wiring to magnetic compass, remove compass.
 - (2) Tag and disconnect windshield wiring.
 - (3) Remove windshield, refer to Chapter 3, Windshield.
- B. Install Heated Windshield.
 - (1) Install windshield, refer to Chapter 3, Windshield.
 - (2) Connect wiring to windshield.
 - (3) Install magnetic compass and connect wiring, refer to Chapter 10, Miscellaneous Instruments.
 - (4) Check operation of heated windshield, refer to Operational Test.

2. Removal/Installation DC Heated Windshield Components.

NOTE: Removal of controller and relays are typical.

- A. Remove Heated Windshield Components.
 - (1) Turn electrical power OFF.
 - (2) Gain access to components by removing floorboard.
 - (3) Tag and disconnect electrical wires from controller or relay(s).
 - (4) Remove screws securing controller or relay(s).
- B. Install Heated Windshield Components.
 - (1) Position components on shelf and secure with screws.
 - (2) Remove tags and connect electrical wires.
 - (3) Check operation of heated windshield. Refer to Operational Test.
 - (4) Reinstall floorboard.

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DC Heated Windshield Components Installation
Figure 3

BATTERYDescription

1. One 24 volt, 25 ampere-hour, lead-acid type battery is located in a battery box in the left-hand stub wing. The battery supplies power for the engine starter system and electrical system, when the engines are not operating. Positive and negative terminals of the battery are clearly marked on the battery case adjacent to each battery post. Each cell of the battery incorporates an electrolyte level indicator to prevent overfilling the cell above the separators. Filling instructions are molded in the top of the battery case. Only distilled water should be used when servicing the battery, tap water will shorten the life of the battery. An acid resistance lift cord is permanently attached to the battery case to aid in removal and installation.

Battery failures, due to an excessive sulphated condition, low electrolyte level, inadequate charging and long idle periods in a discharged condition can be reduced by proper maintenance practices. Operators need to check electrolyte level and keep batteries charged. A specific gravity reading with a hydrometer indicates battery condition. Water consumption will increase with warmer temperatures and may require earlier inspections than the recommended 50 hour interval. If airplane is parked more than two days the circuit breakers should be pulled on the lights and frequency memory, and if parked more than two weeks the clock breaker pulled. Airplanes parked for long periods should have the battery pulled and placed on charge. A large number of the sulphated batteries can be restored to their normal working condition by long charging periods as outlined in the manufacturer's Service Manual. A malfunctioning baggage light will deplete a battery in four days.

2. Access to the battery and box is gained by removing the stub wing access panel above the battery box. A sump reservoir is incorporated in the bottom of the battery box and must be filled with 50 grams of sodium nitride (preferred) or 50 grams of sodium bicarbonate (baking soda). A drain and vent tube are incorporated on the battery box to provide drainage for fluid and vapors. The battery box is secured to the wing structure with screws. A tie-down strap is utilized and attaches to the top of the battery box to secure the battery in place.

Troubleshooting

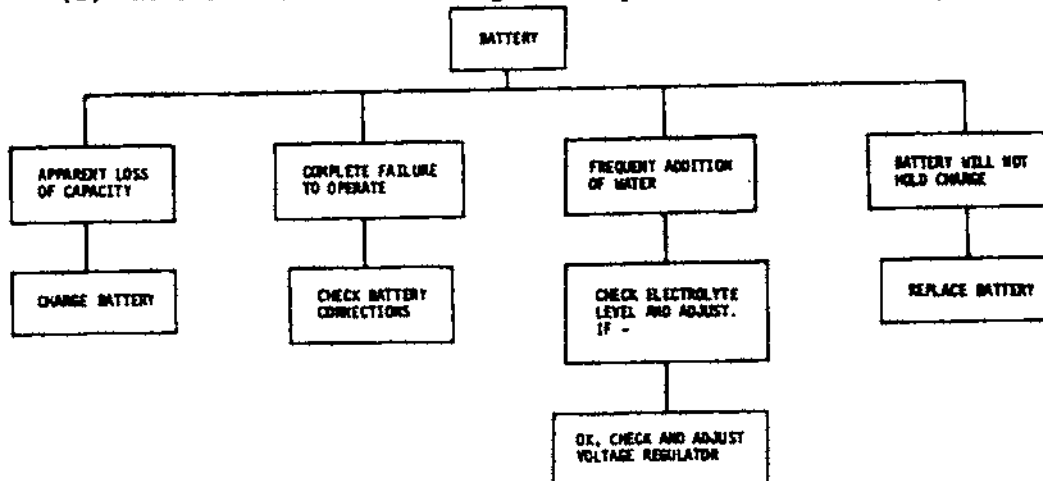
1. Troubleshooting the Battery, see Figure 1.

Maintenance Practices

1. Removal/Installation Battery (See Figure 2).

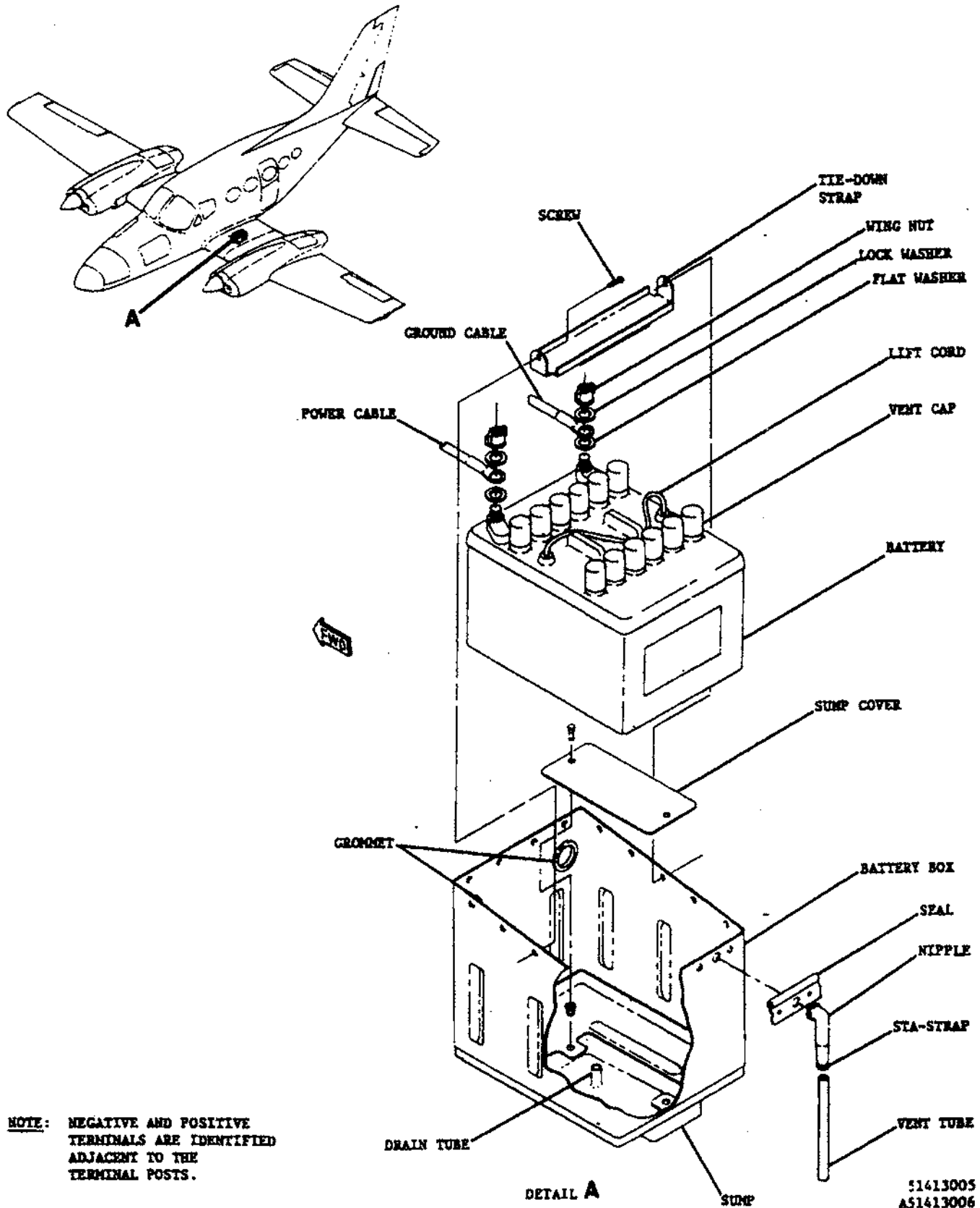
A. Remove Battery.

- (1) Remove left-hand stub wing access panel above the battery.



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Troubleshooting Chart - Battery
Figure 1



Battery and Battery Box Installation
Figure 2

- (2) Disconnect the ground cable from the negative terminal of the battery.

CAUTION: ALWAYS REMOVE THE GROUND CABLE FIRST AND INSTALL IT LAST TO PREVENT ACCIDENTAL SHORT CIRCUITS.

- (3) Disconnect the power cable from the positive terminal of the battery.
- (4) Remove the tie-down strap by removing screws.
- (5) Remove the battery from battery box.

B. Install Battery.

- (1) Position battery in battery box.
- (2) Secure the battery in position, using tie-down strap and screws.
- (3) Connect the power cable to positive terminal of battery, using wing nut, lockwasher and flat washer.

CAUTION: WHEN CONNECTING THE BATTERY CABLES TO THE BATTERY, ENSURE CABLE GROMMETS ARE PROPERLY INSTALLED OVER THE EDGE OF THE BATTERY BOX CABLE HOLES.

- (4) Connect the ground cable to negative terminal of battery, using wing nut, lockwasher and flat washer.

CAUTION: ENSURE BATTERY CABLES ARE CONNECTED CORRECTLY. REVERSE POLARITY WILL DAMAGE DIODES IN THE ALTERNATORS.

NOTE: Coat battery terminals and cable terminals with a light coating of grease.

- (5) Install access panel.

2. Removal/Installation Battery Box (See Figure 2)

A. Remove Battery Box.

- (1) Refer to Removal/Installation Battery and remove the battery.
- (2) Remove the battery cables from battery box.
- (3) Remove the screws attaching battery box to the structure.
- (4) Cut sta-strap securing nipple to vent tube.
- (5) Lift the battery box from stub wing.

B. Install Battery Box.

- (1) Align battery box drain with hole in the wing lower surface and slide box and seal into place.
- (2) Secure nipple to vent tube with a sta-strap.
- (3) Secure battery box to structure with screws. Paint screw heads with TT-L-54 Enmar Acid Proof Black Lacquer.
- (4) Install battery cables and grommets in battery box.
- (5) Install battery, refer to Removal/Installation Battery.

3. Inspection/Check Battery and Battery Box.

A. Inspect Battery and Battery Box.

- (1) Remove access panel above battery.
- (2) Refer to Chapter 2 for inspection procedures.

4. Cleaning/Painting Battery and Battery Box.

A. Cleaning Battery.

- (1) Clean battery with a mild solution of bicarbonate of soda (baking soda) and water to remove acid corrosion.

NOTE: Remove battery from aircraft before cleaning.

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- (2) Rinse with clear water and sponge off excessive water and allow battery to dry.

CAUTION

TAKE SPECIAL PRECAUTIONS TO ENSURE THAT BATTERY CELL FILLER CAPS ARE TIGHT BEFORE CLEANING THE BATTERY. ENTRANCE OF SODA WATER INTO BATTERY CELLS WILL NEUTRALIZE THE CELL ELECTROLYTE.

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.

- (3) Clean battery terminals as needed with a wire brush to brighten the terminals for good electrical contact. Coat with Petrolatum to prevent corrosion.

B. Cleaning Battery Box.

- (1) Battery box should be cleaned with a strong solution of bicarbonate of soda (baking soda) and water.
- (2) Clean hard deposits of spilled acid and corrosion products using a wire brush.
- (3) When all foreign materials have been removed from the box, flush it thoroughly with clean water.
- (4) After cleaning battery box, flush surrounding skin with clean water to ensure that all corrosive material has been removed.

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.

C. Acid Proofing Battery Box.

- (1) Clean battery box refer to cleaning battery Box.
- (2) Sand corroded area of box. Ensure all corrosion is removed.
- (3) Mix polyester resin and hardener Methyl n-Propyl Ketone Peroxide, (commercially available) per manufacture instructions.
- (4) Apply mixture to sanded area of battery box and allow to dry.

ALTERNATORS AND VOLTAGE REGULATORSDescription

1. Two engine-driven alternators, one on each engine, supply the power source to all dc load buses and to charge the storage battery. The standard alternator system includes two 50-ampere alternators, the optional system includes two 100-ampere alternators. Each alternator system consists of the alternator, voltage regulator, overvoltage relay, alternator fail sensor, alternator out indicator light on the annunciator panel and alternator switch. On airplanes 421C1233 and On, the alternator is also equipped with a noise filter as standard equipment.
2. There are two solid state voltage regulators, located adjacent to the left side console. Each voltage regulator incorporates an adjustment screw and terminal connections. The voltage regulator controls the voltage output of its respective alternator. The voltage regulators are electrically connected in parallel in the system. Once the voltage regulator is adjusted, the voltage remains almost constant, since the regulator is unaffected by either length of service, by change in temperature or by changes in the alternator output and speed. Should adjustment of a voltage regulator be required, turn adjustment screw clockwise to increase and counterclockwise to decrease voltage output.
3. There are two overvoltage relays, located inside the left side console. Each overvoltage relay, provides overvoltage protection for its respective alternator system. Each overvoltage relay will trip, disabling its alternator system when an overvoltage of $32 \pm .3$ volt is sensed at the relay. The maximum tolerance for the overvoltage relay is $32 \pm .5$ volts. The overvoltage relay can be reset by switching the respective alternator switch OFF then back to ON position.
4. Two alternator fail sensor units are utilized in the alternator system, one sensor for each alternator. The alternator fail sensor is located adjacent to its respective alternator on the engine baffle. The sensor senses alternator low voltage and activates (illuminates) the respective alternator out indicator light on the annunciator panel, when the alternator is off or an out condition occurs, caused by a failure in the alternator or by other means.

Troubleshooting

1. General

- A. Troubleshooting the alternator system is considerably simplified by the incorporation of the amp meter select switch which allows the left or right alternator and battery dc output power to be visually displayed on the voltmeter. The left and right alternator failure lights illuminate when the respective alternator is removed from the load bus.

2. Tools and Equipment

NOTE: Refer to Adjustment/Test for tools and equipment required.

3. Troubleshooting Alternators.

- A. For troubleshooting the alternator system, see Figure 1.

Adjustment/Test

1. Tools and Equipment

NOTE: Equivalent substitutes may be used instead of the following listed items.

Name	Number	Manufacturer	Use
Multimeter	Model 260	Simpson Electric Co.	Voltage and continuity checks.
Volt-Ohm-Milliammeter	Model 630	Triplett Corp.	Voltage and continuity checks.

2. Adjustment/Test Voltage Regulator (See Figure 2).

A. Adjust Voltage Regulator.

- (1) Install a 2 percent voltmeter connected to the aircraft power bus. (The power bus is considered to be between the alternator power circuit breakers and the individual circuit breakers for each system and not at the cigar lighter.
- (2) Disconnect the paralleling wire (terminal marked "PAR") from either voltage regulator and leave it disconnected.

NOTE: All adjustments are performed while operating the LH engine. (RH engine shall not be running.)

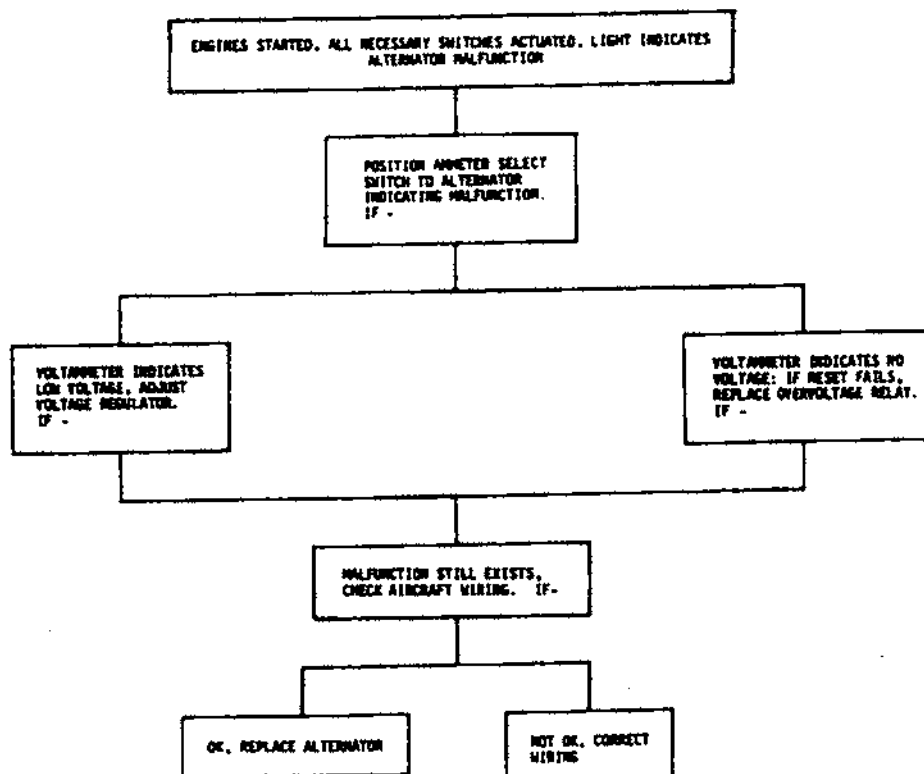
- (3) With LH engine running at 1200 prop RPM, position LH ALT switch ON. (RH ALT switch must be OFF.) Add 10 to 15 amp load to LH alternator system. Run this load for at least two minutes.

NOTE: To adjust voltage regulator, turn adjustment screw clockwise to increase and counterclockwise to decrease voltage.

- (4) Adjust LH voltage regulator to read 27.5 volts on the voltmeter, connected to the aircraft's power bus. Allow sufficient time for voltage to stabilize between adjustment.

NOTE: The aircraft's voltammeter shall not be used for voltage setting.

- (5) While continuing to operate the LH engine and alternator with the same electrical load as before, turn the RH ALT switch ON. (RH engine is still not running.)



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Troubleshooting Chart - Alternator System
Figure 1

- (6) The remaining adjustments should be made using either a Simpson 260 or a Triplet 630 VOM.

CAUTION: OBSERVE WITH CAUTION THAT THE FIELD CIRCUITS OF EITHER ALTERNATOR SYSTEM NEVER TOUCH GROUND OR OTHER ELECTRICAL CIRCUITS, EVEN FOR AN INSTANT, OR THE VOLTAGE REGULATORS MAY BE DAMAGED.

- (7) Select VOM to 0-50 V scale and connect VOM between the field terminals of the left and right voltage regulators (plus side meter to LH voltage regulator).
- (8) Now very slowly rotate the RH voltage regulator adjustment screw while observing the VOM which has been connected to the two field terminals.
- (a) If a reverse (down scale) reading is obtained, turn the RH voltage regulator adjustment counterclockwise, this should bring the meter scale up.
- (b) Then very slowly turn RH voltage regulator adjustment clockwise to the point where the field VOM will read near zero.

NOTE: A stable reading should not be expected, voltage will fluctuate.

- (c) Then using the 0-10 volt and 0-2.5 volt scales on the VOM, continue adjustment of the RH voltage regulator to a lower voltage differential. (The 0-2.5 volt scale is recommended for making the final adjustment.) The correct adjustment has been achieved when the VOM will remain briefly in the vicinity of zero, swinging both up scale and down scale.
- (9) Shutdown all power to the aircraft and disconnect VOM from field terminals.
- (10) Reconnect the paralleling wire to terminal marked "PAR" on the voltage regulator the wire was disconnected from.
- (11) After aircraft has been restored to original configuration, the RH engine should be started, both alternator switches turned ON and system should be operated at different loads to verify that paralleling is within 10 percent of load and bus voltage has remained within the 27.5 $\pm$.25 volt limit.

3. Operational Check of Alternators and Regulators

A. Operational Check.

- (1) With both engines operating at 1500 RPM and the Battery and Alternator switches ON, check the following:
- (a) Select voltage position on voltmeter and assure bus voltage is 27.5 $\pm$ 1.0 volts.
- (b) Select Battery position on voltmeter and note battery is charging; charging amperage indication will vary as the battery builds up to normal charge.
- (c) Load electrical system with all external lights, fuel pumps, pitot heat, etc., and check the alternator output; it should be positive and equal within 10 amps when loaded up to 100 amps total load.

NOTE: If total load is below 15 amps, one alternator may show little or no output. If so, turn producing alternator OFF; the other alternator should pick up the load. Also, when one alternator is not carrying any load, the corresponding light may come on or flicker ON and OFF. This is normal.

4. Operational Check of Alternator Failure Circuit

CAUTION: ON AIRPLANES 421C0601 AND ON, (WITH 100 AMP ALTERNATORS), IN THE EVENT OF AN ALTERNATOR MALFUNCTION INDICATION, AN INSPECTION OF THE ALTERNATOR AND RELATED SYSTEMS IS TO BE PERFORMED PRIOR TO THE NEXT FLIGHT, PER THE TELE-DYNE CONTINENTAL BULLETIN M80-8 AND MULTIENGINE SERVICE LETTER.

A. Operational Check.

- (1) With both engines operating at idle (475 $\pm$ 25) RPM, place Battery switch and Alternator switches to OFF, and observe that failure lights are out.
- (2) Reduce electrical load to minimum to avoid discharging the battery.
- (3) Turn ON Battery switch and observe both Alternator Failure lights illuminate.
- (4) Increase engine RPM to 1350 and ensure Failure Light remains ON.

NOTE: The reference voltage used for alternator out indication is approximately one half of whatever voltage the alternator is producing. When the alternator is turned OFF, it is capable of producing some voltage which will be a function of load and RPM of unit. At high RPM such as maximum power, the residual voltage at times can exceed the fail triggering level of the alternator fail sensor, turning the Failure lights OFF; this is acceptable.

- (5) With both alternators and battery switches ON and light electrical load of 20 amps operate both engines at idle RPM and observe that lights remain OFF without any flickering. Simultaneously increase RPM on both engines, to 1350 RPM and again observe Alternator Failure lights for any flickering.

NOTE: It is important that both engine RPM be as close to each other as possible because at light loads, the alternator which is set at higher RPM will tend to take all of the load and the alternator running at lower RPM will be at a NO load condition, which will tend to give a false alternator out indication.

5. Operational Check Alternator Warning System

A. Operational Check.

- (1) With both engines operating at 1500 RPM and normal electrical load applied, turn both alternator switches OFF. Ensure that both Alternator Failure lights are illuminated.
- (2) Turn both alternator switches ON, lights should go out.
- (3) A false alternator out indication at low engine RPM (ground idle) with low to moderate electrical loads applied may be due to a low frequency response of the alternator out sensor for isolation to a sensor problem, refer to DC Generation Manual.

Maintenance Practices

1. Tools and Equipment

Name	Number	Manufacturer	Use
Wrench	5090005-1	Cessna Aircraft Company	Hold alternator shaft.

2. Removal/Installation Alternator (See Figure 2)

NOTE: The alternator removal/installation procedure is the same for both engines and either 50 amp or 100 amp alternators.

A. Remove Alternator.

- (1) Remove engine cowlings. Refer to Chapter 7.
- (2) Disconnect and tag electrical leads and stow out of the area.
- (3) Remove nuts, lockwashers and washers securing alternator to engine.
- (4) Carefully work alternator from the engine pad.

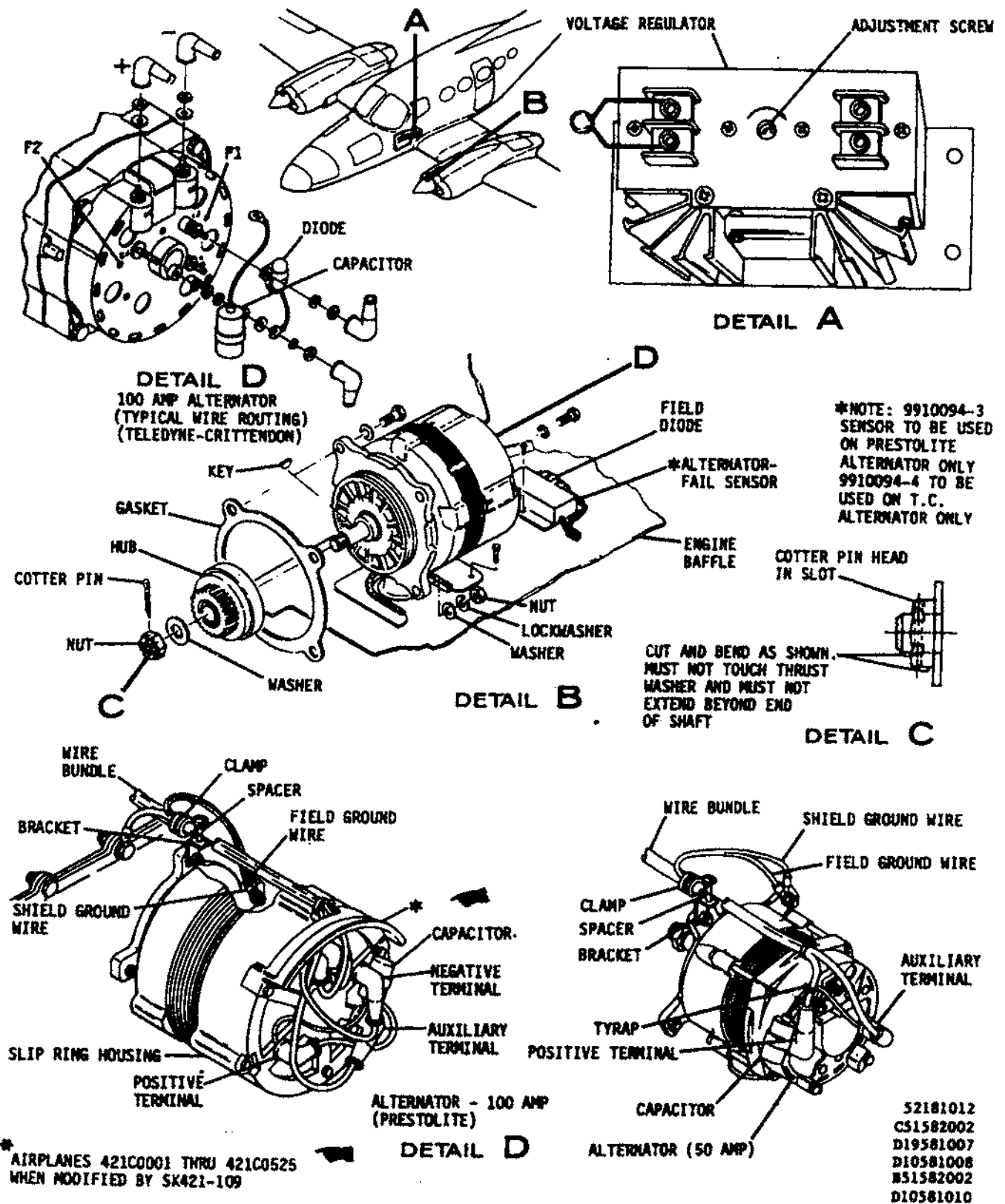
CAUTION: USE CARE WHEN REMOVING ALTERNATOR TO PREVENT DAMAGE TO SPLINES ON THE ALTERNATOR.

- (5) Install protective cover on engine pad to prevent entry of foreign material.

B. Install Alternator.

- (1) Remove protective cover from engine pad.
- (2) Make sure gasket has not been damaged. Replace if necessary.

CAUTION: BEFORE INSTALLING ALTERNATOR, ALWAYS MAKE SURE THE NUT ON THE DRIVE SHAFT OF THE ALTERNATOR IS SAFETIED WITH THE COTTER PIN INSTALLED AS SHOWN IN FIGURE 2. IF THE NUT IS NOT SAFETIED PROPERLY, DAMAGE COULD RESULT TO THE GEARS AND ALTERNATOR SHAFT.



Alternator and Voltage Regulator
Figure 2

- (3) Position alternator on engine pad.
- (4) Work alternator in position and install washers, lockwashers, and install the nuts securing alternators.
- (5) Torque nuts to 155 to 175 inch-pounds.
- (6) Connect electrical wiring.

CAUTION: ENSURE ALTERNATOR WIRING IS CONNECTED PROPERLY. REVERSE POLARITY WILL DESTROY DIODES IN THE ELECTRICAL SYSTEM.

NOTE: Ensure ground wire is connected to negative terminal and structure ground 100 amp alternator only.

- (7) Install engine cowlings. Refer to Chapter 7.

3. Alternator Hub Replacement (See Figure 2)

A. Remove Alternator Hub.

- (1) Remove alternator, refer to Removal/Installation Alternator.
- (2) Remove cotter pin, then using special wrench, P/N 5090005-1, to hold shaft from turning, remove nut and washer.
- (3) Pull alternator drive gear hub from alternator shaft using care not to damage hub assembly.

B. Install Alternator Hub.

- (1) Before replacing hub, examine hub elastomer and gear teeth for condition.
 - (a) Replace hub if damage or excessive wear is indicated. If hub requires replacement examine engine face gear for condition.
 - (b) If signs of distress or excessive wear is detected the gear should be replaced. (Refer to Engine Overhaul Manual.)
 - (c) Rotate the hub gear (by hand) relative to the hub.
 - (d) Slippage is indication of damage to the elastomer and cause for replacement of hub.
- (2) Apply clean engine oil to shaft of alternator and install key.
- (3) Slide alternator drive gear hub onto shaft and key.
- (4) Install washer on alternator shaft with bearing material (copper color) side toward the hub.
- (5) Install nut, then using a special wrench P/N 5090005-1 to hold shaft from turning, torque nut to 400 inch-pounds (dry torque, do not oil nut). If slots in nut do not align with cotter pin hole in alternator shaft, the nut may be tightened further, do not exceed 500 inch-pounds. Do not back off nut to align holes.

NOTE: Ensure wrench 5090005-1 is aligned and seated in notch of alternator drive gear hub flange so that no damage will occur when torque is applied to nut.

- (6) Install cotter pin through nut and shaft as shown in Figure 2.
- (7) Install alternator. Refer to Removal/Installation Alternator.

4. Removal/Installation Voltage Regulator (See Figure 2)

A. Remove Voltage Regulator.

- (1) Remove voltage regulator covers (aft and forward) by removing screws attaching covers to left side console.
- (2) Remove electrical wires from voltage regulator.
- (3) Remove the screws securing the regulator to the floorboard and remove voltage regulator.

B. Install Voltage Regulator.

- (1) Attach voltage regulator to floor, using screws.
- (2) Identify and connect electrical wires to voltage regulator.
- (3) Adjust the alternator system. Refer to Adjustment/Test.
- (4) Install forward and aft covers to left side console with screws.

CIRCUIT BREAKER PANEL, FUSES AND SWITCHESDescription

1. Electrical load distribution from the power source to the various using systems throughout the aircraft is accomplished by wiring, buses and circuit breakers. All circuit breakers, switch breakers and most of the electrical system switches are on the left side console. On airplanes C0201 and On, a circuit breaker panel is located on the right side of the airplane.
2. Fuses are utilized in the left and right alternator field circuits, battery ammeter circuit and battery monitor circuit to protect the systems. The alternator field circuit fuses are mounted on the left side console. The battery monitor fuse is located inside the left side console. Fuses for the battery ammeter system is located in the stub wing.

Maintenance Practices

NOTE: For identification and connections of electrical wires to components, refer to wiring diagrams of Chapter 13.

1. Removal/Installation Left Side Console (Refer to Figure 1)

- A. Remove Left Side Console.

- (1) Master battery switch OFF.

CAUTION: WHEN REMOVING THE SIDE CONSOLE THE BATTERY GROUND CABLE SHOULD BE DISCONNECTED.

- (2) Remove upholstery panel on side console.
 - (3) Remove screws attaching console to structure.
 - (4) Lift console from floor to gain access to connectors and leads. Disconnect electrical connectors. Tag and disconnect cables and leads.
 - (5) Remove console from airplane.

- B. Install Left Side Console.

- (1) Install side console and connect all electrical wiring.
 - (2) Secure side console to structure with screws.
 - (3) Install upholstery panel on side console.
 - (4) Reconnect battery ground cable.

2. Removal/Installation Side Console Circuit Breaker Panel

- A. Remove Circuit Breaker Panel.

- (1) Ensure electrical power is OFF.

NOTE: When optional electroluminescent panels are installed, these panels must be removed first, in order to gain access to circuit breaker panel attaching screws.

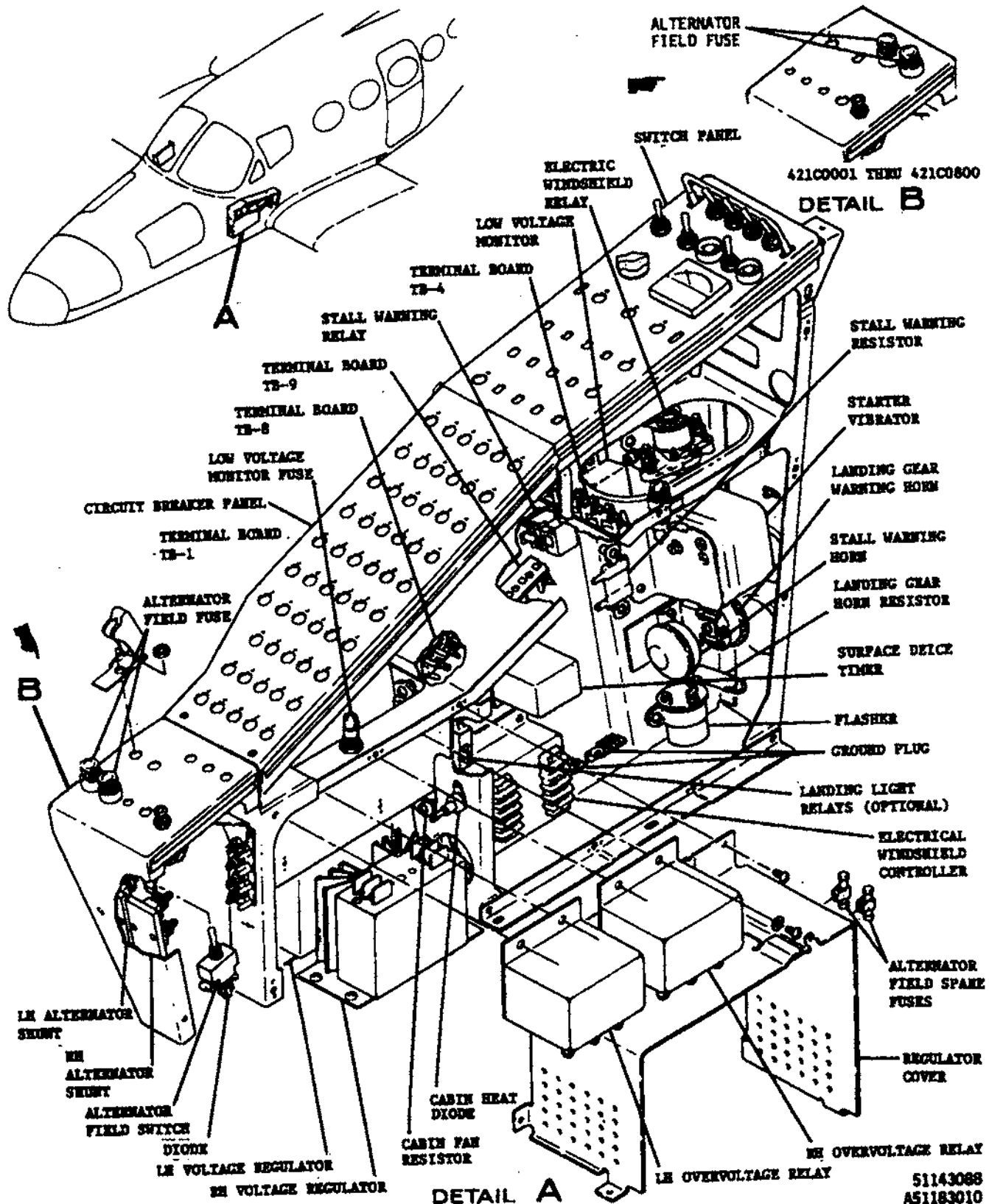
- (2) Remove the screws attaching panel, and lift panel up and out.

NOTE: Panel is still attached to console by a wire bundle assembly. Components may be removed, replaced, or installed with panel in position.

- (3) Remove and replace components as may be required.
 - (4) If electroluminescent panel is to be removed, tag and disconnect electrical leads.
 - (5) Remove panel.

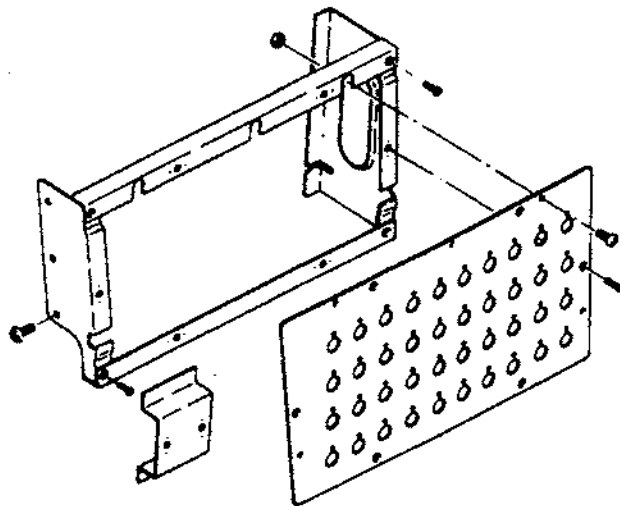
- B. Install Circuit Breaker Panel.

- (1) If electroluminescent panel is being installed, identify and connect wires.
 - (2) Secure panel to side console with screws.



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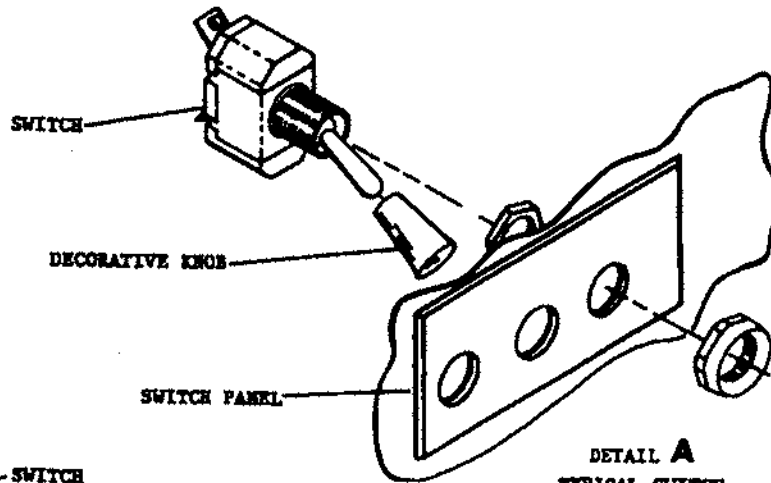
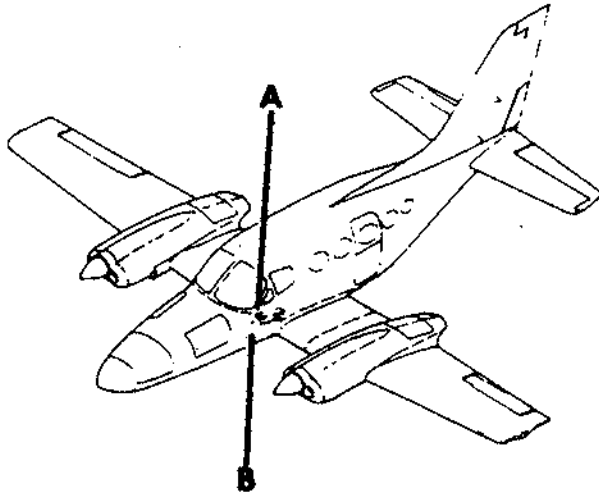
Left Side Console
Figure 1



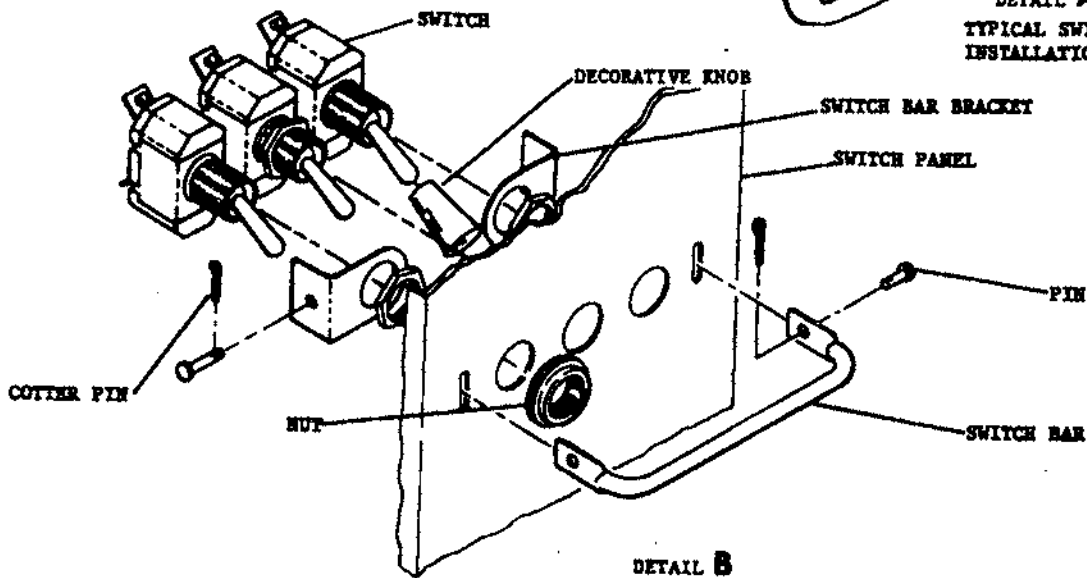
RIGHT HAND
CIRCUIT BREAKER
PANEL
421C0201 AND ON

Right Side Circuit Breaker Panel
Figure 2

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DETAIL A
TYPICAL SWITCH
INSTALLATION



DETAIL B
TYPICAL BATTERY AND ALTERNATOR
SWITCH INSTALLATION

Typical Switch and Rheostat Installation
Figure 3

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3. Removal/Installation Battery, Alternator and Ignition Switches (Refer to Figure 3)

WARNING: DURING REMOVAL OF ANY SWITCH EXCEPT THE BATTERY SWITCH, THE BATTERY SWITCH MUST REMAIN OFF. WHEN REMOVING THE BATTERY SWITCH, DISCONNECT THE BATTERY GROUND CABLE AT THE BATTERY TO PREVENT AN ACCIDENTAL SHORT CIRCUIT.

A. Remove Battery and Alternator Switches.

- (1) Master battery switch OFF.
- (2) Remove cotter pin and pin securing switch bar to switch bar bracket.
- (3) Remove nut securing switch to left side console.
- (4) Remove the wires from the switch.

B. Install Battery and Alternator Switches.

- (1) Connect the wires to the proper switches.
- (2) Insert switch in proper position in the switch panel and secure with nut. Ensure switch bar bracket is installed on applicable switch.
- (3) Install switch bar using pin and cotter pin.

4. Removal/Installation Typical Switch (Refer to Figure 3)**A. Remove Typical Switch.**

- (1) Master battery switch OFF.
- (2) Remove nut securing switch to the switch panel.
- (3) Remove switch.
- (4) Disconnect wires from switch.

B. Install Typical Switch.

- (1) Connect wires to switch.
- (2) Install switch in switch panel.
- (3) Secure switch with nut.

FUSE/FUSE LIMITER LOCATION	FUSE SILKSCREEN	FUSE QUANTITY AIRPLANE	FUSE/FUSE LIMITER PART NUMBER
In spare fuse bag on avionic junction box cover in the left nose baggage compartment	Spare Fuse Spare Fuse Spare Fuse Spare Fuse Spare Fuse	1 1 1 2 3	MDL3/4 MDL1.0 AGC3 AGC2 AGC1
Forward refreshment bar/ stereo cabinet			AGC3
Horizontal circuit breaker panel	Alternator Field	2	MDX3.0
In fuse block mounted on the battery box	Battery Ammeter Spare Fuse	2 1	AGC5 AGC5
In fuse clips on forward side of pilot's seat pedestal	Spare Alternator Field	2	MDX3.0
In fuse block mounted next to the battery box	Alternator Field Emergency Power Cabinet Light	1 1	MDX5.0 MDX5.0
Inside left wing locker - aft end	External Power Relay Coil	1	AGC5
Inside pilot's side console	Frequency Memory (Avionic Power)	1	MDX5.0

Fuse/Fuse Limiter Replacement Chart
Figure 4

EXTERNAL POWER RECEPTACLEDescription

1. The dc external power system (optional) consists of an external power receptacle, located on the aft bottom surface of the left nacelle baggage compartment and an external power relay, located in the left stub wing forward of the battery. The external power system components provide a means of connecting 28 VDC external power to the airplane's electrical system.
2. The dc external power receptacle is a three-pin receptacle, housed in a plastic material. The positive and negative pins are permanently marked on the front and rear of the receptacle. Connecting the 28 VDC external power source energizes the external power relay, connecting the external power source to the battery shunt and to the bus of the circuit breaker panel when the master switch is OFF. To conserve the battery, external power should be used for engine starting in cold temperatures and when testing electrical equipment on the ground. The external power plug pins should be lubricated periodically with petroleum jelly.

Maintenance Practices

1. Removal/Installation External Power Receptacle (See Figure 1)

CAUTION: THE BATTERY SWITCH MUST REMAIN IN THE OFF POSITION WHILE THE EXTERNAL POWER RECEPTACLE IS BEING REMOVED OR INSTALLED. IF THERE IS ANY POSSIBILITY OF THE SWITCH BEING TURNED ON DURING THIS PROCEDURE, IT IS ADVISABLE TO DISCONNECT THE GROUND CABLE FROM THE BATTERY.

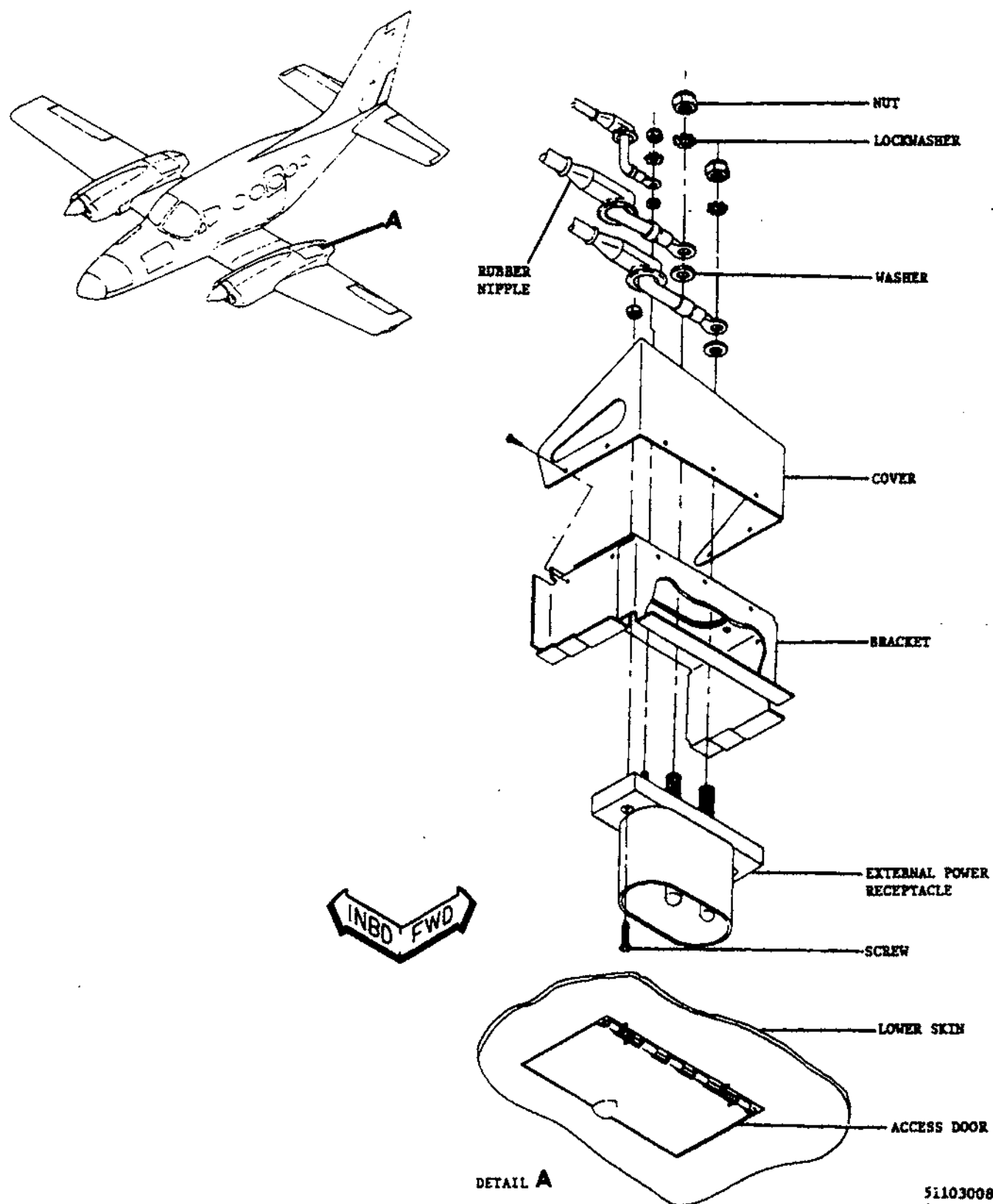
A. Remove External Power Receptacle.

- (1) Ensure Master Battery switch is positioned to OFF.
- (2) Open left-hand nacelle baggage door.
- (3) Remove cover from bracket by removing screws.
- (4) Disconnect electrical wires from external power receptacle by removing nuts and lockwashers.
- (5) Remove external power receptacle from bracket by removing attaching screws and nuts.

B. Install External Power Receptacle.

NOTE: Seal as required to prevent water leakage. Use Class I, Type B sealant applied per instructions contained in Chapter 1-80.

- (1) Position external power receptacle in bracket and secure with screws and nuts.
- (2) Identify and connect electrical wires to external power receptacle, using washers, lockwashers and nuts.
- (3) Install cover, using screws.
- (4) Replace battery ground cable, if it was disconnected.
- (5) Close baggage door.



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External Power Receptacle Installation
Figure 1

LIGHTSDescription

1. This section presents all lights on the aircraft. It is intended for use in conjunction with the wiring diagrams to maintain the lighting systems in the best operating condition. The text is supported by illustrations to provide additional assistance to the mechanic during maintenance. The major light circuits are the interior and exterior lights.
2. The light circuits require minor maintenance such as replacement of lamps or switches. Most light assemblies and components are readily accessible and can be maintained without the use of special tools.
3. When defective lamps, light assemblies and components are replaced, equipment with identical part numbers should be installed unless substitutes have been authorized. After replacing equipment, functional test should be performed to verify proper circuit operation.
4. Troubleshooting procedures are provided only as general troubleshooting, because most light circuits require the same steps to locate trouble. In most cases, inoperative lamps, open circuit breakers, blown fuses and such troubles are obvious.

Troubleshooting

1. The following troubleshooting steps are provided to augment specific circuit information found in the wiring diagrams and to serve as a basis for developing the more detailed procedures required to locate cause of infrequent light system troubles.
2. Tools and Equipment

NOTE: Equivalent substitutes may be used instead of the following item.

Name	Number	Manufacturer	Use
Multimeter	Model 260	Simpson Electric Co.	Voltage and continuity check.

3. Troubleshooting Light Circuits.

- A. When possible, investigate report of trouble at source to ascertain conditions leading to, and under which, trouble occurred and whether failure of other light circuits or electrical systems occurred simultaneously. Careful analysis of such information is often indicative of nature, and most likely location of trouble.
- B. Study circuit wiring diagrams covering affected light system and its related power supply. A thorough understanding of the function is necessary before a troubleshooting procedure can be effectively planned and executed. By combining a knowledge of applicable circuits with information gained from trouble report, an investigation usually indicates circuit, or section of circuit, in which trouble is located.
- C. Visually inspect circuit for open circuit breakers, blown fuses, broken wiring, loose wire connections, loose electrical connectors, and evidence of shorting. Observe particularly, security of connections and presences of foreign matter.
- D. Perform continuity check. A blown fuse, burned wires, or other evidence of shorting indicates that a power-on check would create a hazardous condition. With power off, isolate defective circuit and check one section at a time until shorted or open circuit section is found.

- E. Perform power-on check only when it has been determined that such a check cannot create a hazardous condition. With power on, perform operational tests to confirm report of trouble and to determine, if possible, whether cause of trouble is in light circuit or in power supply system. A voltmeter or test light may also be used for a power check at various break points in circuit, such as terminal strips and equipment input terminals, to determine if power is available at these points.
- F. Replace any light assembly or component that remains inoperative after making certain that power is available at unit and that ground connections are secured at unit.

ITEM - LOCATION	BULB QUANTITY/ AIRPLANE	BULB PART NUMBER
Exterior		
Navigation Light (Wings)	2	628
Navigation Light (Tail)	1	MS35478-305
Landing Light (Left and Right)	2	MS25241-4553
Strobe Light (Wing Tips)	2	31-2884-3
Strobe Light (High Intensity Wing Tips)	2	31-3172-11
Position Light (Wing Tips)	2	692
Taxi Light (Nose Wheel)	1	4594
Wing Dance Light (Engine Nacelle)	2	1385
Tail Floodlight	4	DA27
Nose Baggage Light	1	1252
Nacelle Baggage Light	2	1309
Interior		
Cabin Entrance Light	1	MS15570-303
Map Light (Overhead Console)	2	1309
Instrument Panel Floodlights	2	1309
Passenger Reading Lights	4 to 8	1495X
Side Console Lights	3	1864
Call Number Light	1	MS25237-327
Compass Light	1	MS25237-327
Fuel Selector Valve Lights	2	UTC161619
Landing Gear Position Lights	4	MS25237-327
Landing Gear Unlocked Lights	2	MS25237-327
Flap Position Indicator Lights	6	MS90451-6832
Engine Fire Warning Light	8	MS25327-327
Annunciator Panel Lights	8	MS25327-327
Instrument Postlight	41	MS25327-327
	(Approx.)	
Propeller Synchrophaser Light	1	7049
Autopilot Off Light	1	6839
Altitude Alert Light	1	6839
Marker Beacon Light	3	7235
Seat Belt/No Smoking Light	4	1820

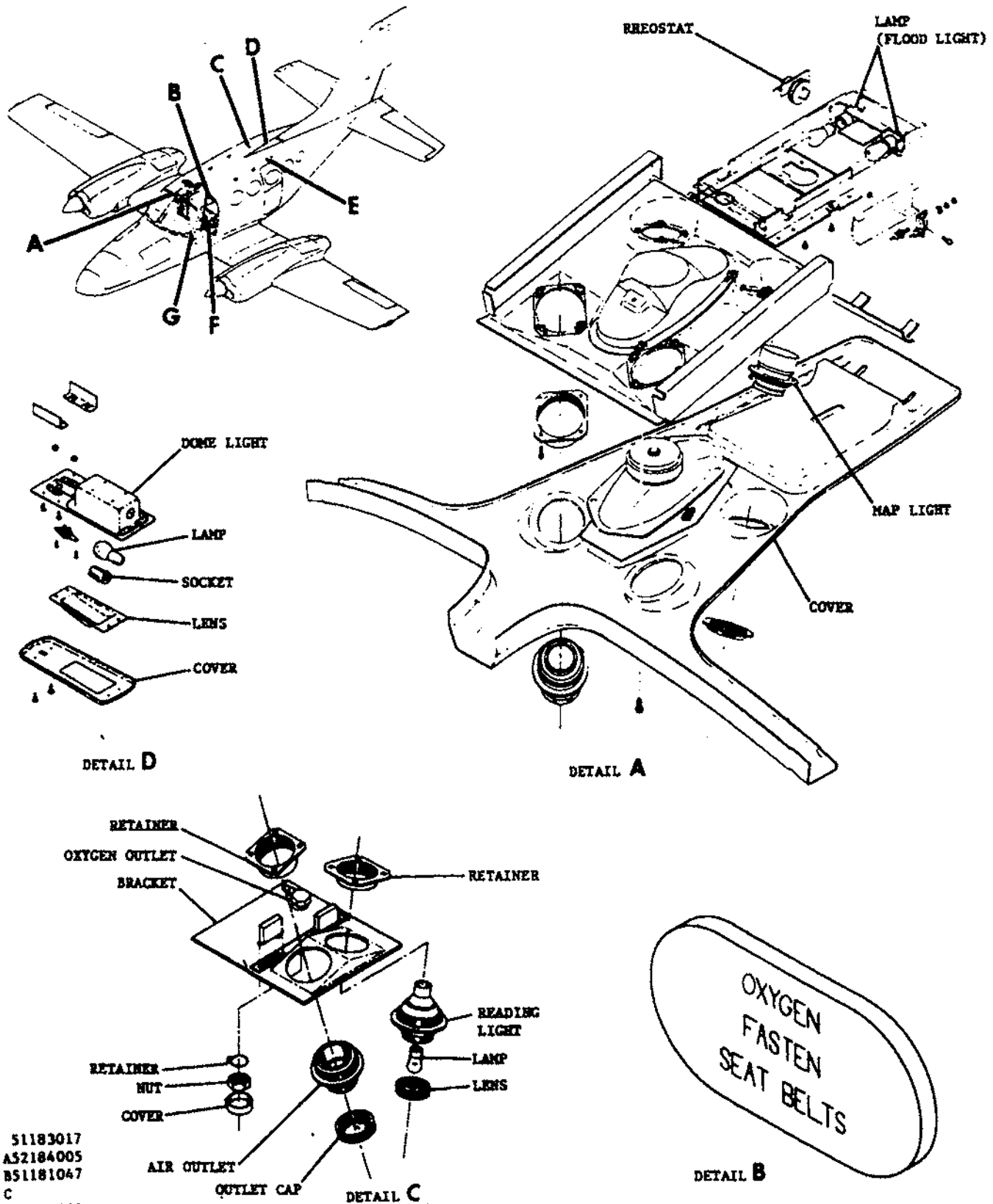
Light Replacement Chart
Figure 1

INTERIOR LIGHTSDescription

1. The interior lights consist of: overhead flood lights, cabin door light, fuel select handle lights, dome light, overhead reading lights, left-hand side console lights and instrument panel lights. The instrument panel lights consist of: the annunciator panel lights, compass light, radio call light and instrument post lights. Optional interior lights consist of: a seat belt sign, oxygen sign, post lights for optional instruments and systems and electroluminescent lighted panels. Panel lights are variable intensity and controlled by the dimming control panel located on the pedestal. Refer to 13-30 Figure 1 for lightbulb replacement chart.
 - A. On airplanes C0401 and on, an optional timer may be installed on the cabin courtesy light to automatically extinguish the light after 15 minutes, assuring the battery will not be inadvertently depleted.
2. The electroluminescent light panels (optional) emanates light from crystalline powders, or phosphors, sandwiched between two electrically conducted surfaces, of which one surface is translucent. When the panel lights are illuminated, the powders absorb electrical AC energy and convert it to light without the use of starters, or ballasts and with minimal heat. Electrical power is supplied to the panels by an inverter which converts dc electrical power to 115 volt ac electrical power. The inverter is located under the copilot's seat mounted to the floorboard. On Airplanes C0201 and On, an additional inverter is installed on the voltage regulator shelf.
3. The annunciator panel is located on the instrument panel and has the capacity to cover 22 separate systems and operations. The annunciator panel is utilized to monitor individual systems. The multi-colored lights will illuminate within a circuit to indicate operation of system in use, operational condition of systems and register a system malfunction. The annunciator panel system consists of: the annunciator panel, press-to-test light and annunciator logic assembly. The press-to-test switch, located to the left of the annunciator panel will, when pressed, illuminate all lights on the annunciator panel, along with the propeller synchronizer if installed and wing locker transfer light if installed. The annunciator logic assembly is mounted on the left-hand side of the airplane at Fuselage Station 104.33 above the floor. The logic assembly connects the annunciator panel and airplane's wiring together and utilizes a printed circuit board, transistors, diodes and electrical connector.

Maintenance Practices

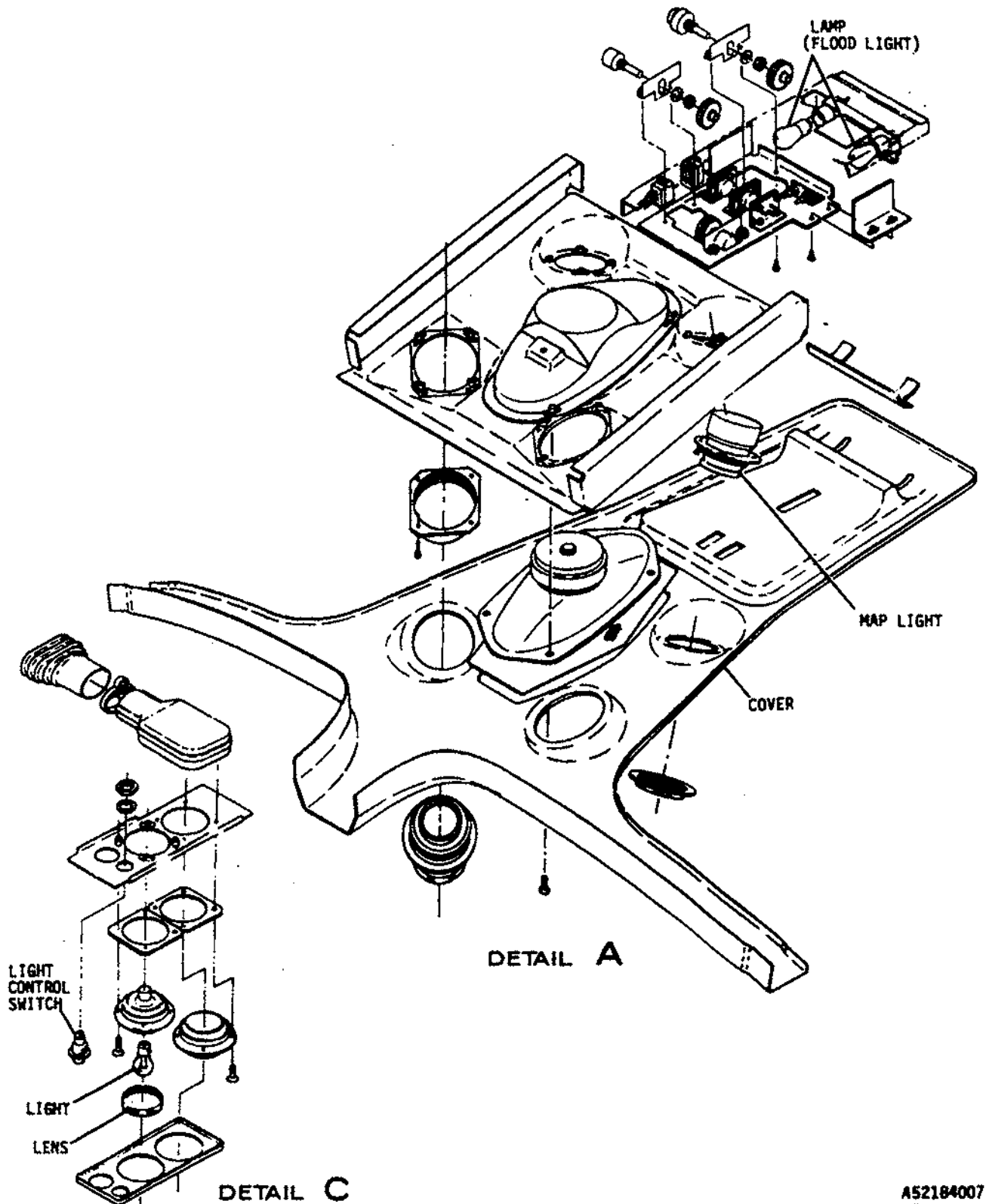
1. Removal/Installation Post Lights (Refer to Figure 1)
 - A. Remove Post Light.
 - (1) Remove connector from socket.
 - (2) Remove nut and lockwasher, securing socket to panel and remove light assembly.
 - B. Install Post Light.
 - (1) Position light assembly in panel and secure with lockwasher and nut.
 - (2) Connect connector to socket.



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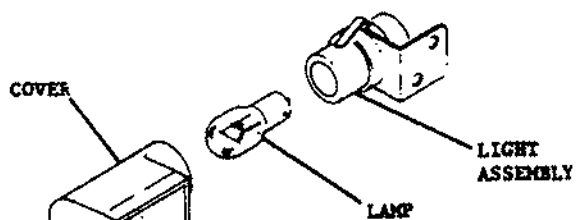
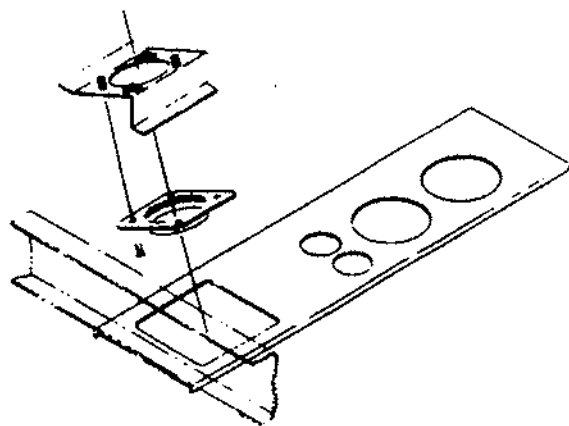
Cabin Interior Lighting Installation
Figure 1 (Sheet 1)



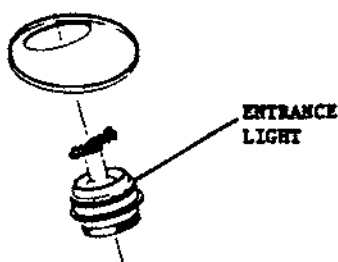
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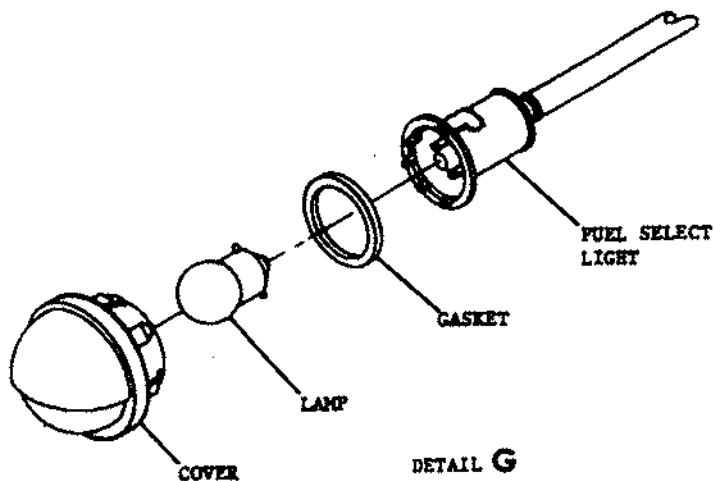
Cabin Interior Lighting Installation
Figure 1 (Sheet 2)



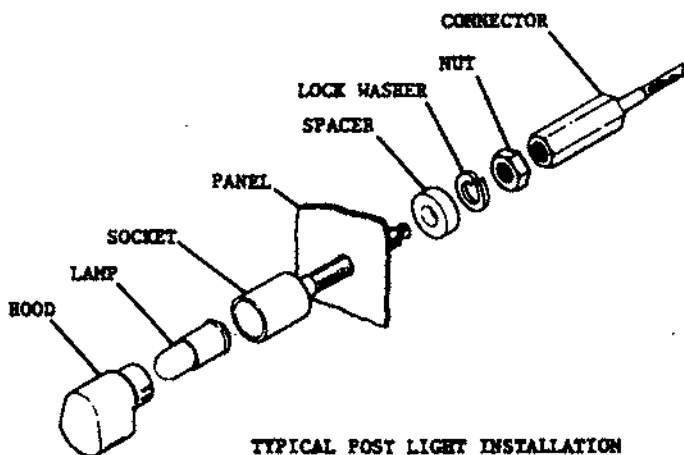
TYPICAL PILOT'S ARM REST LIGHTS
DETAIL F



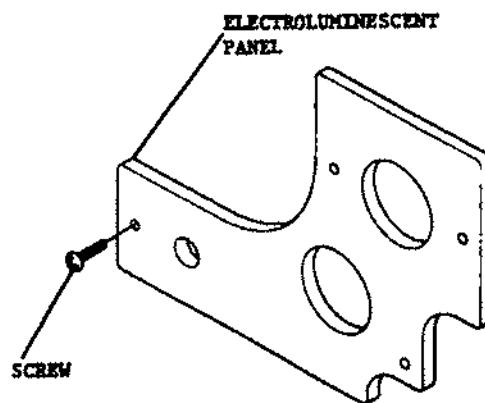
DETAIL E



DETAIL G



TYPICAL POST LIGHT INSTALLATION



TYPICAL ELECTROLUMINESCENT PANEL INSTALLATION

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Cabin Interior Lighting Installation
Figure 1 (Sheet 3)

2. Removal/Installation Electroluminescent Panels (See Figure 1)

A. Remove Electroluminescent Panels.

- (1) Turn off power.
- (2) Remove the necessary components, securing the panel.
- (3) Lift panel off, identify and disconnect electrical wires.

NOTE: Operational checks on the electroluminescent panels should be performed using 120 volt, 400 cycle AC. However, panel will operate without damage on 120 volt, 60 cycle AC.

B. Install Electroluminescent Panels.

- (1) Identify and connect panel electrical wires.
- (2) Install components to secure panel.

3. Removal/Installation Fuel Selector Handle Light (See Figure 1)

A. Remove Fuel Selector Handle Light.

- (1) To remove fuel selector light, pry light loose from seat base.

B. Install Fuel Selector Handle Light.

- (1) Ensure wire is connected and insert light into hole. Press in firmly to ensure tight fit.

4. Removal/Installation Rear Dome Light (See Figure 1)**A. Remove Rear Dome Light.**

- (1) Remove rear dome light lens by removing retaining screws.
- (2) Remove dome light.

B. Install Rear Dome Light.

- (1) Install light.
- (2) Install lens and cover and secure with screws.

5. Removal/Installation Individual Reading Lights (See Figure 1)**A. Remove Reading Light.**

- (1) Ensure cabin lights circuit breaker is pulled.
- (2) Remove light by screwing counterclockwise out of retainer.
- (3) Pull socket out, and tag and disconnect wires.

CAUTION: BEFORE DISCONNECTING WIRES FROM INDIVIDUAL READING LIGHTS, ALWAYS DISENGAGE CABIN LIGHTS CIRCUIT BREAKER. THESE LIGHTS ARE NOT CONNECTED THROUGH THE MASTER SWITCH AND DAMAGE MAY RESULT TO THE CIRCUIT WIRING.

- (4) Remove air outlet by screwing counterclockwise out of retainer.
- (5) Remove oxygen outlet cover by removing outlet cover retainer nut.
- (6) Pull escutcheon up and out of bracket.
- (7) Remove screws, securing light retainer to plate.

B. Install Individual Reading Lights.

- (1) Secure retainer to bracket with screws.
- (2) Install escutcheon.
- (3) Install oxygen outlet cover and retaining nut.
- (4) Connect electrical wires to light and screw light in retainer.
- (5) Screw air outlet into retainer.
- (6) Engage Cabin Light circuit breaker.

6. Removal/Installation Fasten Seat Belt and Oxygen Light (See Figure 1)**A. Remove Light.**

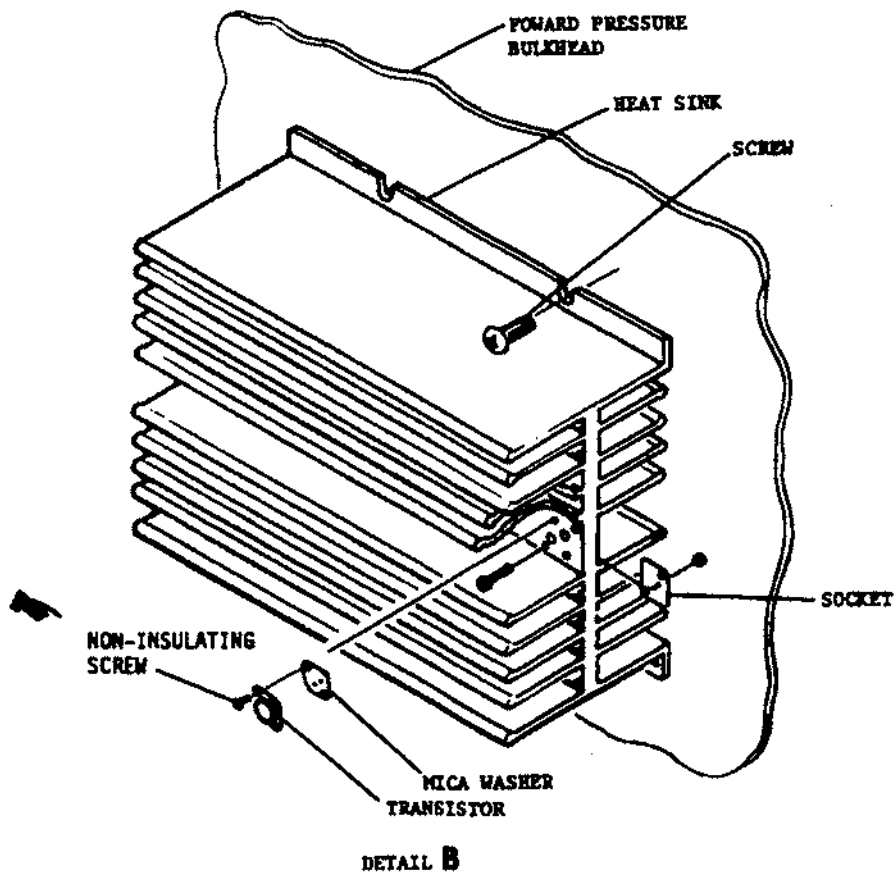
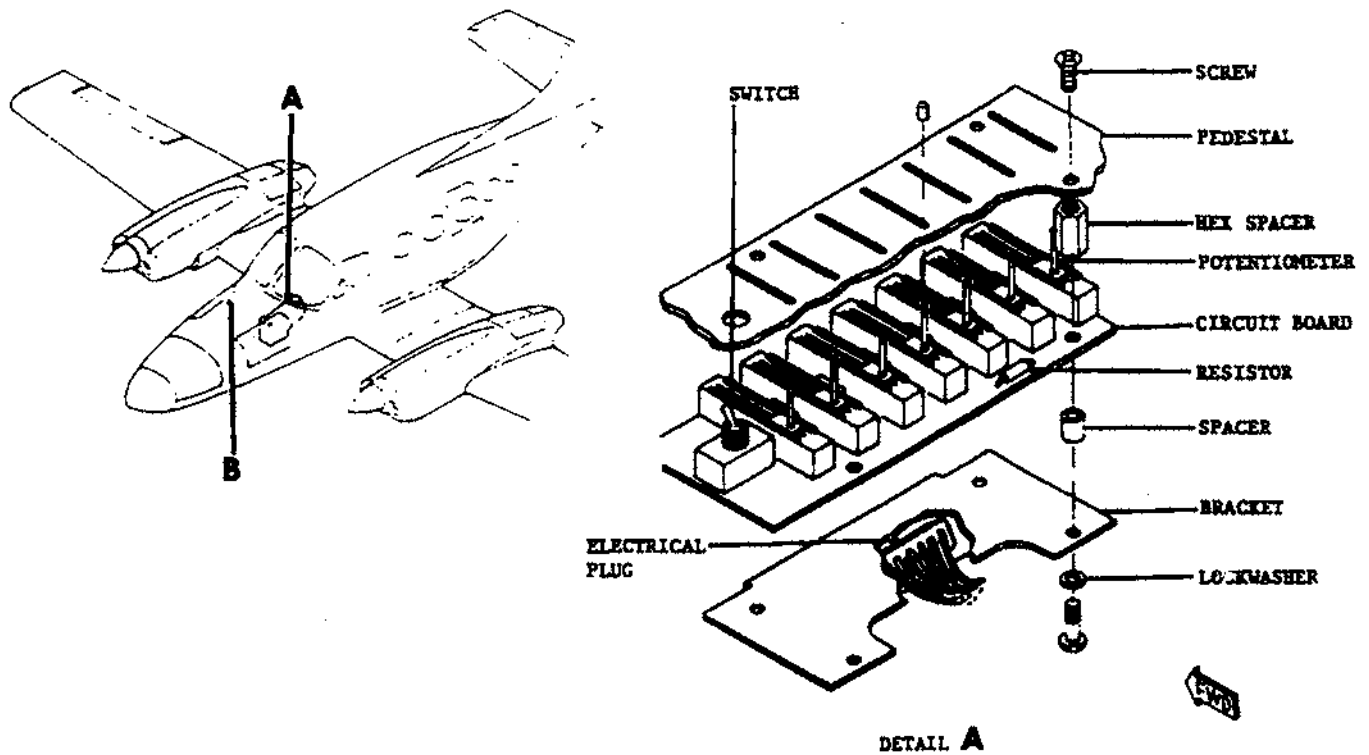
- (1) Remove the screws securing light to cabin divider.
- (2) Disconnect electrical wiring and remove light.

B. Install Light.

- (1) Connect electrical wiring to light.
- (2) Secure light to cabin divider with screws.

7. Removal/Installation Heat Sink Assembly (See Figure 2)**A. Remove Heat Sink Assembly.**

- (1) Remove RH aft baggage retainer, refer to Chapter 3.
- (2) Disconnect electrical connector from aircraft bundle.
- (3) Remove screws securing heat sink to forward pressure bulkhead and remove heat sink.



Instrument Lighting Controls
Figure 2

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B. Install Heat Sink Assembly.

- (1) Secure heat sink to forward pressure bulkhead with screws.
- (2) Connect electrical plug to aircraft's wire bundle.
- (3) Install RH aft baggage retainer, refer to Chapter 3.

8. Removal/Installation Dimming Control Assembly (See Figure 2)**A. Remove Dimming Control.**

- (1) Remove RH access cover from pedestal.
- (2) Disconnect electrical plug to dimming control.
- (3) Remove screws securing dimming control to pedestal. Remove dimming control.

B. Install Dimming Control.

- (1) Position dimming control inside pedestal and connect electrical plug.
- (2) Secure dimming control to pedestal with screws.
- (3) Install pedestal access cover.

9. Removal/Installation Annunciator (See Figure 3)**A. Remove Annunciator.**

- (1) Ensure aircraft's electrical power is OFF.
- (2) Lower left-hand instrument panel by removing mounting screws.
- (3) Disconnect electrical connector.
- (4) Remove screws securing annunciator to instrument panel.

NOTE: For annunciator internal wiring, refer to Figure 4.

B. Install Annunciator.

- (1) Secure annunciator to instrument panel using screws.
- (2) Connect electrical connector to annunciator logic assembly electrical connector.
- (3) Secure left-hand panel with screws.
- (4) Check annunciator lights using press-to-test switch.

10. Removal/Installation Annunciator Light Bulbs (See Figure 3)**A. Remove Light Bulbs.**

- (1) Push on left-hand edge of individual light. Light will swing outward for access to bulb.
- (2) Remove bulb.

B. Install Light Bulb.

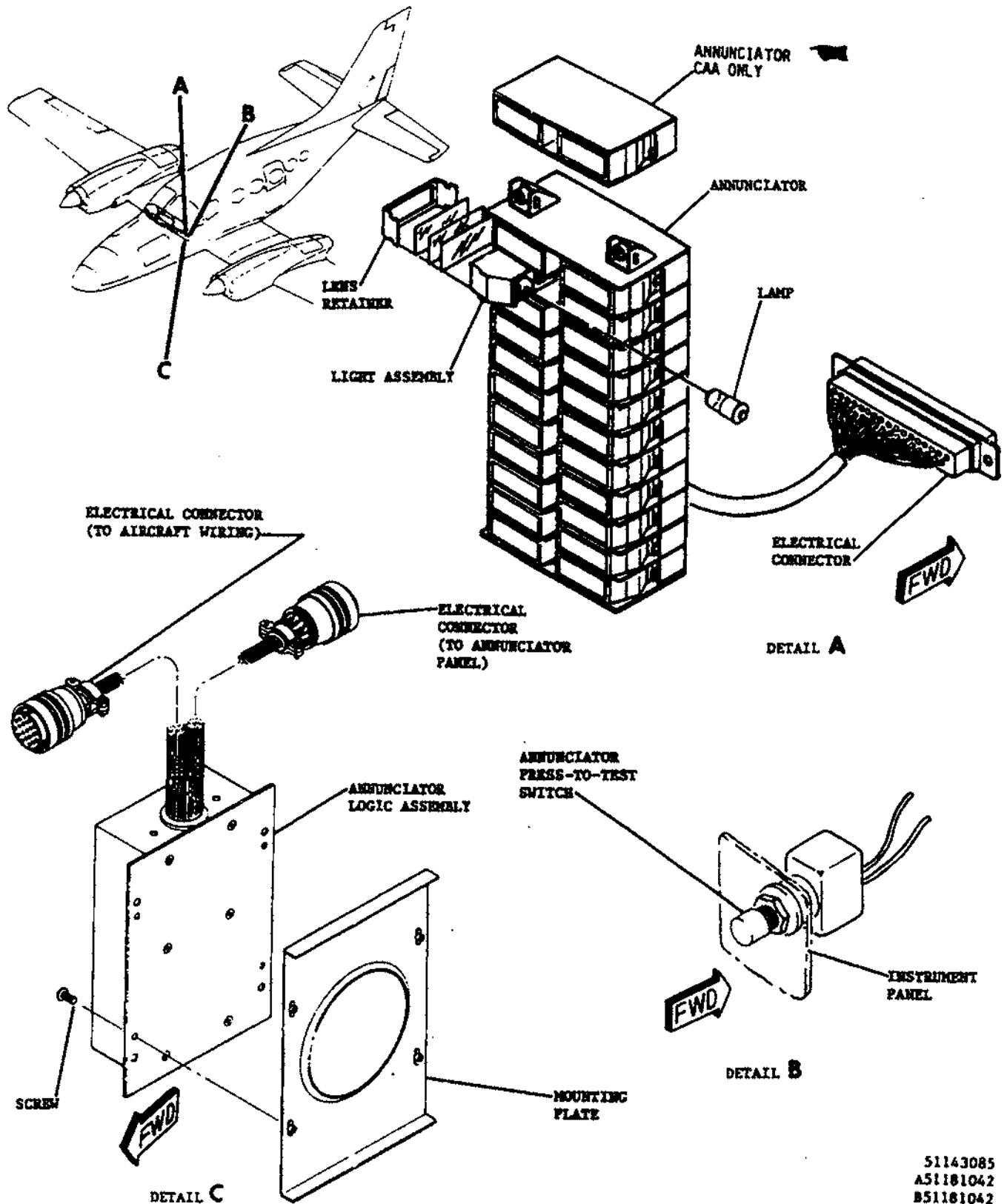
- (1) Insert bulb into light assembly.
- (2) Swing light assembly inward and press to lock.
- (3) Check annunciator light operation.

11. Removal/Installation Annunciator Logic Assembly (See Figure 3)**A. Remove Annunciator Logic Assembly.**

- (1) Aircraft's electrical power OFF.
- (2) Remove upholstery panel forward of left-hand console, refer to Chapter 12.
- (3) Disconnect electrical plugs from annunciator logic assembly.
- (4) Remove annunciator logic assembly by removing screws.

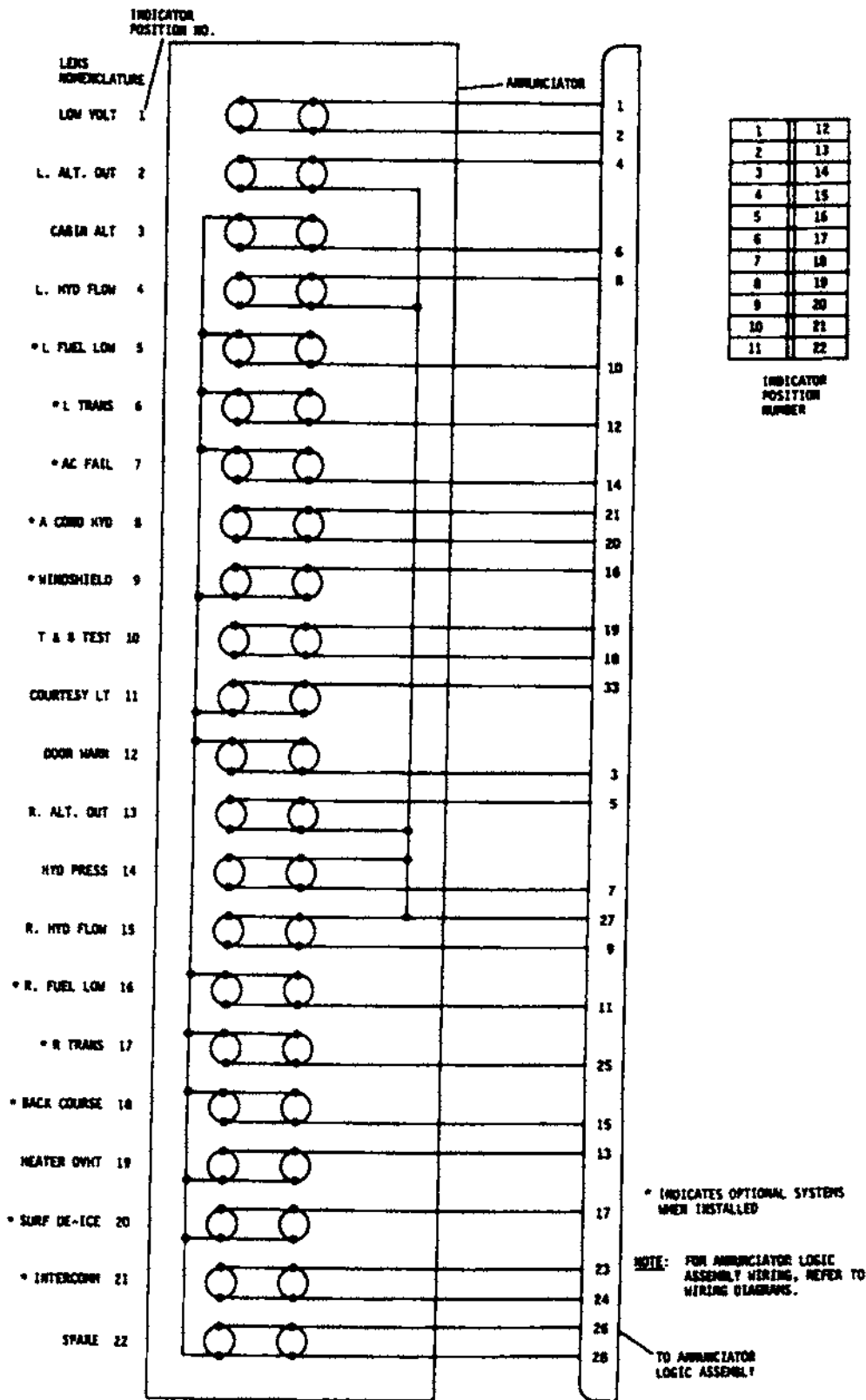
B. Install Annunciator Logic Assembly.

- (1) Install annunciator logic assembly on mounting plate and secure with screws.
- (2) Connect electrical connectors.
- (3) Install upholstery, refer to Chapter 12.
- (4) Check annunciator lights.



Annunciator Installation
Figure 3

51143085
A51181042
B51181042
C51142058



Annunciator Schematic
Figure 4

5198022

EXTERIOR LIGHTSDescription

1. The exterior lights consist of: standard navigation lights, anti-collision lights and left-hand retractable landing light. Optional exterior equipment lights include: a right-hand landing light, nose taxi light, wing deice light (left and/or right), strobe lights, and baggage compartment lights (wing and nose). Refer to 13-30 Figure 1 for light bulb replacement chart.

Maintenance Practices

1. Removal/Installation Wing Navigation and Anti-Collision Lights (Refer to Figure 1).

- A. Remove Wing Navigation and Anti-Collision Lights.

- (1) Extend landing light.
- (2) Turn off electrical power.

WARNING: HIGH VOLTAGE, WAIT 5 MINUTES AFTER ELECTRICAL POWER HAS BEEN REMOVED BEFORE DISCONNECTING CONNECTORS FROM POWER SUPPLY.

- (3) Working through landing light opening, disconnect navigation light wires and anti-collision electrical connector to power supply.
- (4) Remove screws and retainers securing lens to light assembly.
- (5) Remove screws securing light assembly to wing tip and remove.

- B. Install Wing Navigation and Anti-Collision Light.

- (1) Install light assembly and secure with screws.
- (2) Install gasket and lens and secure with retainers and screws.
- (3) Connect navigation light wires and anti-collision electrical connector to power supply. Secure wiring as necessary.
- (4) Apply electrical power and check light operations.

2. Removal/Installation Tail Navigation Light (Refer to Figure 1).

- A. Remove Tail Navigation Light.

- (1) Turn off electrical power.
- (2) Remove screws, securing the tail light assembly to the stinger.
- (3) Disconnect the electrical connector from the rear of the light assembly and remove tail light assembly.

- B. Install Tail Navigation Light.

- (1) Connect electrical connector to tail light assembly.
- (2) Position light assembly in stinger and secure with screws.

3. Removal/Installation Anti-Collision Light Power Supply (Refer to Figure 1).

- A. Remove Anti-Collision Light Power Supply.

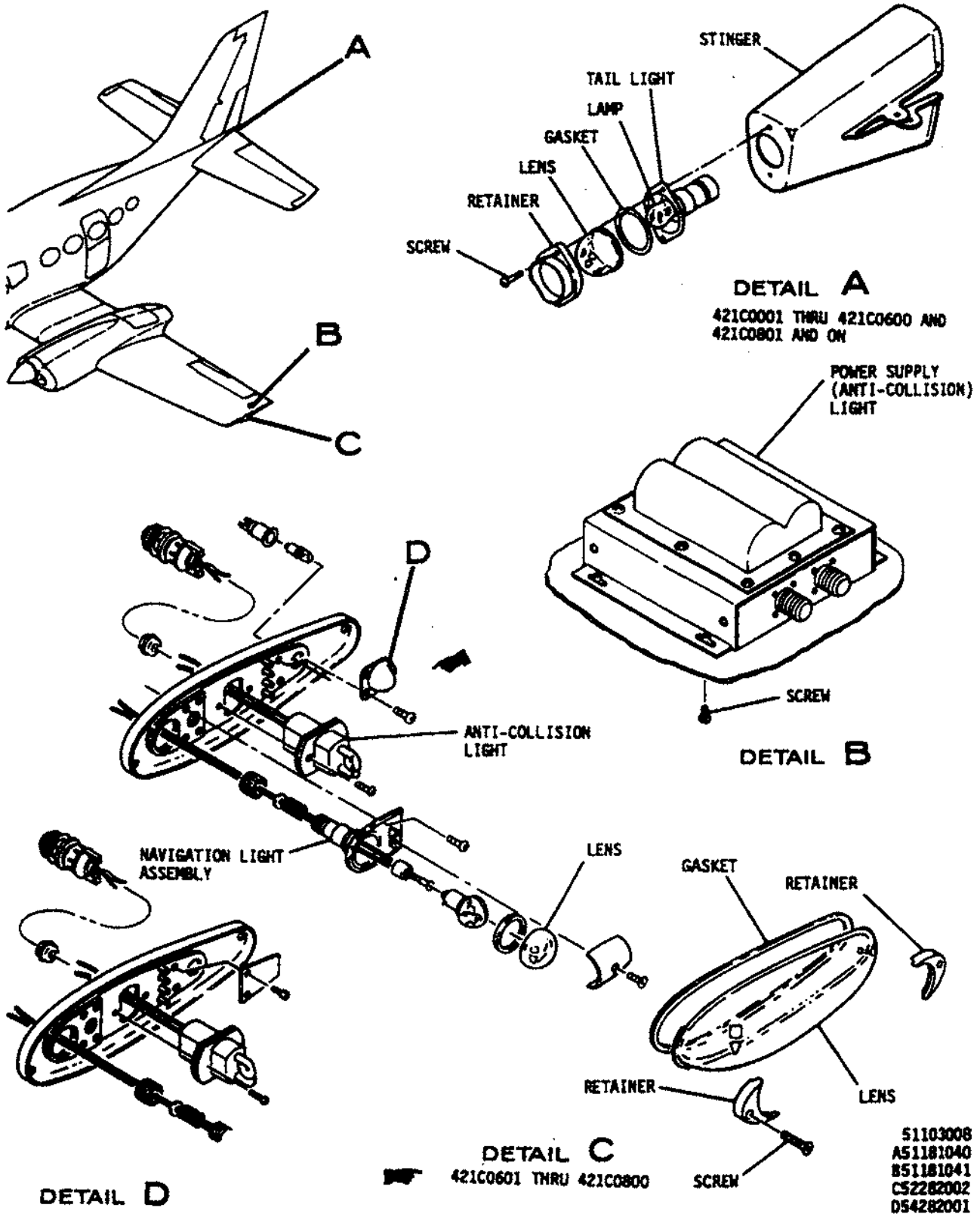
- (1) Extend landing light.
- (2) Turn off electrical power.

WARNING: HIGH VOLTAGE, WAIT 5 MINUTES AFTER ELECTRICAL POWER HAS BEEN REMOVED BEFORE DISCONNECTING CONNECTORS FROM POWER SUPPLY.

- (3) Working through landing light opening, disconnect electrical connectors from power supply.
- (4) Remove screws securing power supply and remove.

- B. Install Anti-Collision Light Power Supply.

- (1) Insert power supply in wing tip.
- (2) Connect electrical connectors to power supply.
- (3) Secure power supply with screws.



Navigation and Anti-Collision Installation
Figure 1

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4. Removal/Installation (Optional) Strobe Light (Refer to Figure 2).

A. Remove Strobe Light.

- (1) Extend landing light.
- (2) Turn off electrical power.

WARNING: HIGH VOLTAGE, WAIT 5 MINUTES AFTER ELECTRICAL POWER HAS BEEN REMOVED BEFORE DISCONNECTING CONNECTORS FROM POWER SUPPLY.

- (3) Working through landing light opening, disconnect navigation light wires and strobe light electrical connector to power supply.
- (4) Remove screws and retainers securing lens to light assembly.
- (5) Remove screws securing light assembly to wing tip and remove.

B. Install Strobe Light.

- (1) Install light assembly and secure with screws.
- (2) Install gasket and lens and secure with retainers and screws.

NOTE: If a new lens is installed, use aluminum tape (Scotch Brand Pressure Sensitive Tape #425 or equivalent) and cover forward part of lens back 1.10 inch. Use a strip of the aluminum tape horizontally on the side overlapping the retainer past the screw hole, so that the screw grounds the tape.

- (3) Connect navigation light wires and strobe light electrical connector to power supply. Secure wiring as necessary.
- (4) Apply electrical power and check light operations.

5. Removal/Installation (Optional) Strobe Light Power Supply (Refer to Figure 2).

A. Remove Power Supply.

- (1) Extend landing light.
- (2) Turn off electrical power.

WARNING: HIGH VOLTAGE, WAIT 5 MINUTES AFTER ELECTRICAL POWER HAS BEEN REMOVED BEFORE DISCONNECTING CONNECTORS FROM POWER SUPPLY.

- (3) Working through landing light opening, disconnect electrical connectors from power supply.
- (4) Remove screws securing power supply and remove.

B. Install Power Supply.

- (1) Insert power supply in wing tip.
- (2) Connect electrical connectors to power supply.
- (3) Secure power supply with screws.

6. Removal/Installation Landing Light (Refer to Figure 3).

NOTE: The rated average bulb life of the landing light bulb part number MS25241-4553 is 25 hours.

A. Remove Landing Light.

- (1) Extend landing light.
- (2) Turn off electrical power.
- (3) Disconnect electrical connector from light assembly.
- (4) Remove the screws securing light assembly to wing tip and remove.

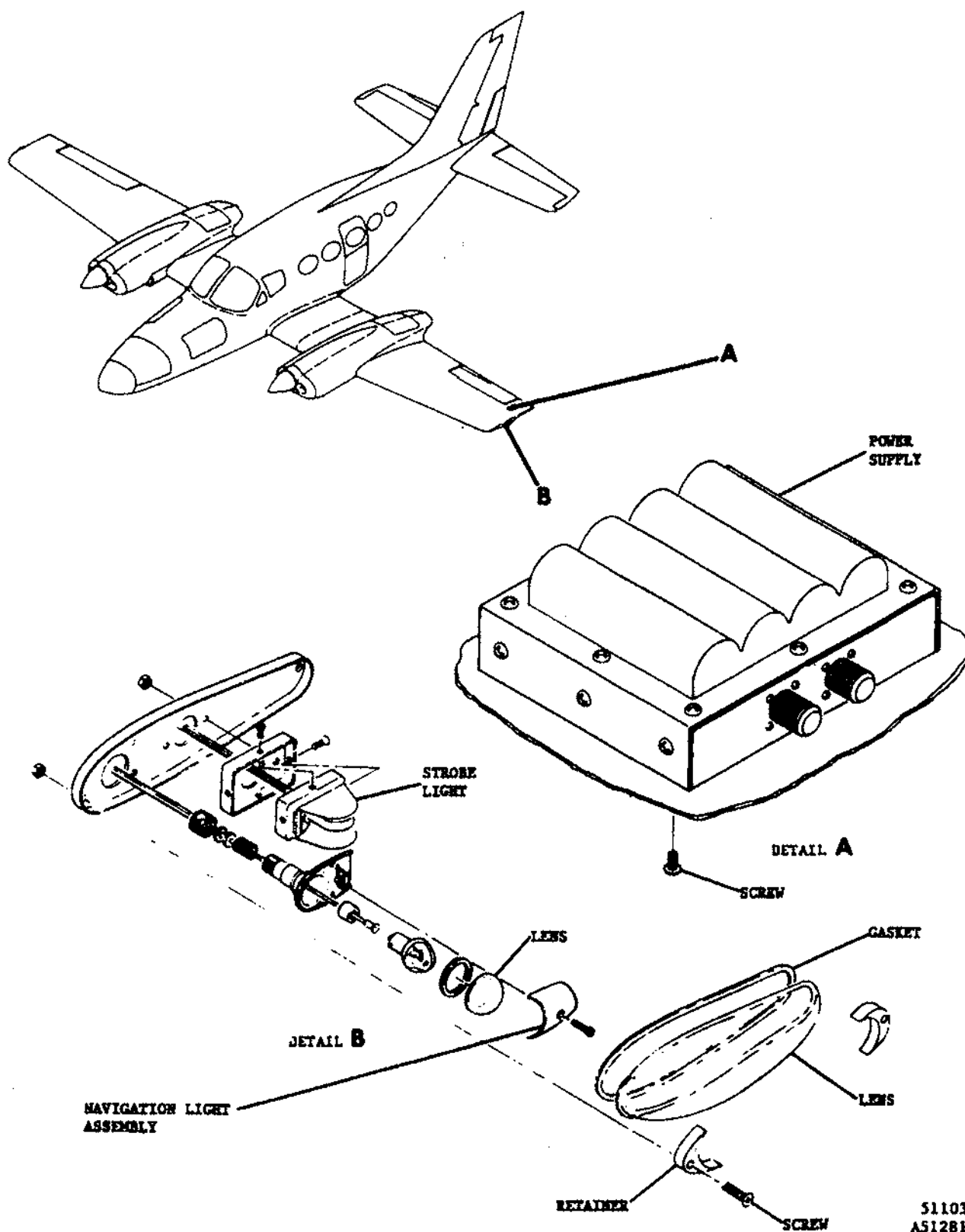
B. Install Landing Light.

- (1) Position landing light in wing tip and connect electrical connector.
- (2) Secure landing light to wing tip with screws.

7. Removal/Installation Taxi Light (See Figure 3).

A. Remove Taxi Light.

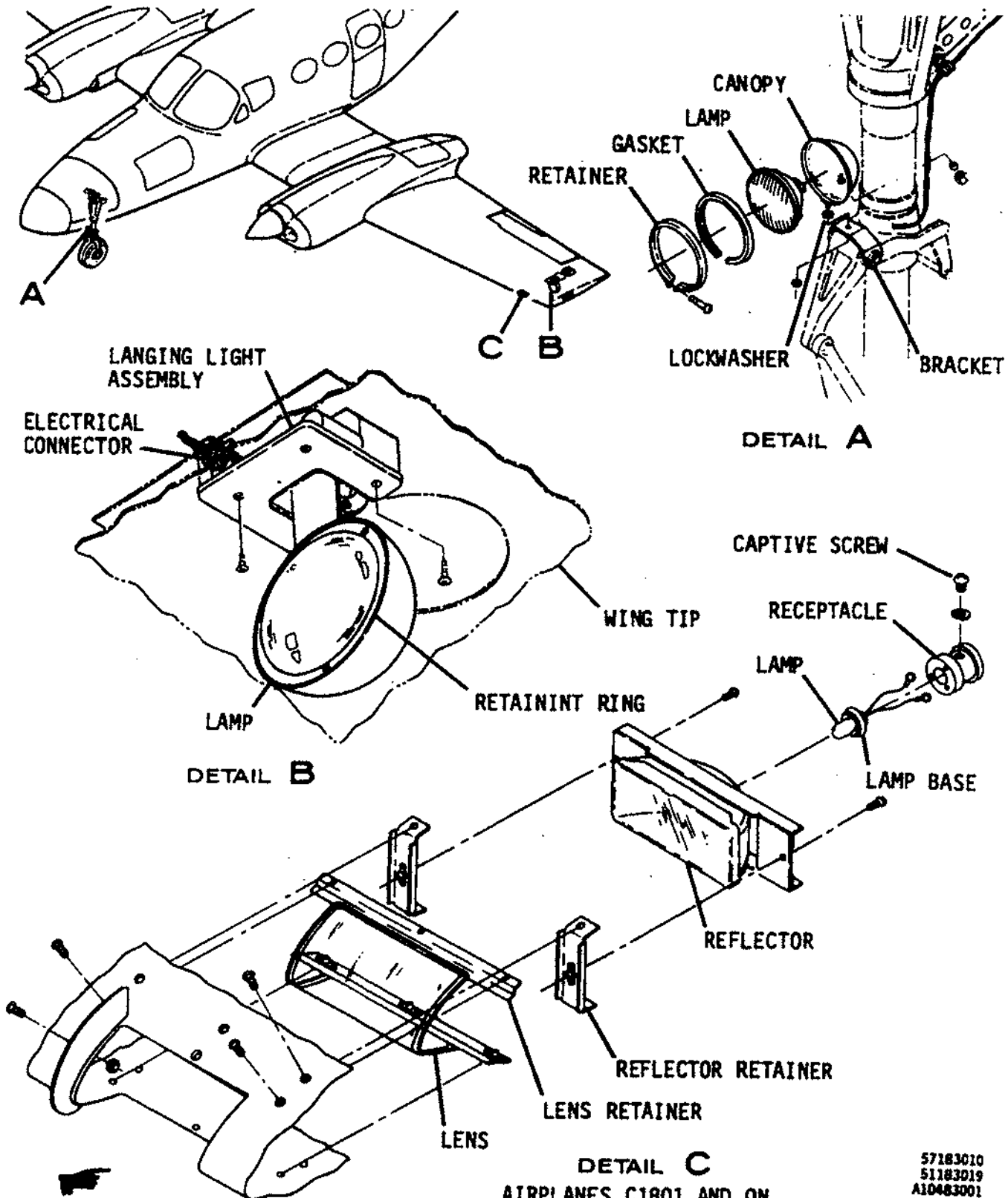
- (1) To remove lamp, remove retainer, gasket and lamp.
- (2) To remove light assembly, disconnect electrical wires to light and remove nut securing light assembly to bracket.



51103008
A51281005
851282009

Strobe Light Installation
Figure 2

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DETAIL C
AIRPLANES C1801 AND ON
Landing Recognition and Taxi Light Installation
Figure 3

57183010
51183019
A10483001
851281004
C51283001

B. Install Taxi Light.

- (1) To install lamp, install lamp in canopy and secure with gasket and retainer.
- (2) To install light assembly, position light assembly on bracket and secure with nut. Connect electrical wiring to light.

8. Removal/Installation Deice Light (Optional) (See Figure 4).

NOTE: Removal and installation procedures are typical for left and right deice light.

A. Remove Deice Light.

- (1) Remove upper cowling from engine.
- (2) Remove screw securing socket assembly and clamp holding wires.
- (3) Pull socket assembly apart from lamp shield to remove lamp.
- (4) If further disassembly is required, identify and remove wires. Remove nuts, washers and screws securing shield assembly to nacelle skin. On aircraft 421C0001 to 421C0241, it will be necessary to drill out rivets to remove shield.

B. Install Deice Light.

- (1) If removed, rivet shield assembly to nacelle skin and connect wires.
- (2) Install lamp in socket assembly. Secure lamp assembly to shield assembly using screws.
- (3) Install upper engine cowling.

9. Removal/Installation (Optional) Wing Locker Courtesy Light (See Figure 4).

A. Remove Wing Locker Courtesy Light.

- (1) Pull cabin light circuit breaker in LH stub wing.
- (2) Remove screws securing the light and remove lamp.

B. Install Wing Locker Courtesy Light.

- (1) Install lamp into socket.
- (2) Install lens, lens retainer and secure with screw.
- (3) Engage circuit breaker and check light operation.

10. Removal/Installation (Optional) Wing Locker Courtesy Light Switch (See Figure 4).

A. Remove Wing Locker Courtesy Light Switch.

- (1) Pull cabin light circuit breaker in LH stub wing.
- (2) Remove screws from switch. Identify and disconnect electrical wires.

B. Install Wing Locker Courtesy Light Switch.

- (1) Connect electrical wires to switch and secure switch with screws.
- (2) Engage circuit breaker and check light operation.

11. Removal/Installation (Optional) Nose Baggage Light (See Figure 4).

A. Remove Nose Baggage Light.

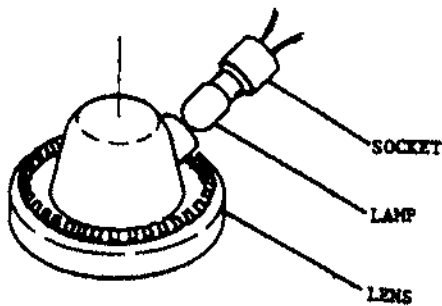
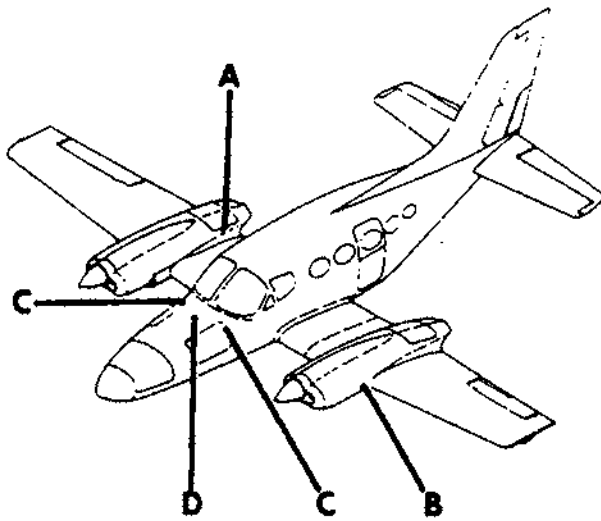
- (1) Open nose baggage door.
- (2) Pull light assembly down and lift out of mount bracket.

NOTE: Light assembly is held in place by spring tabs.

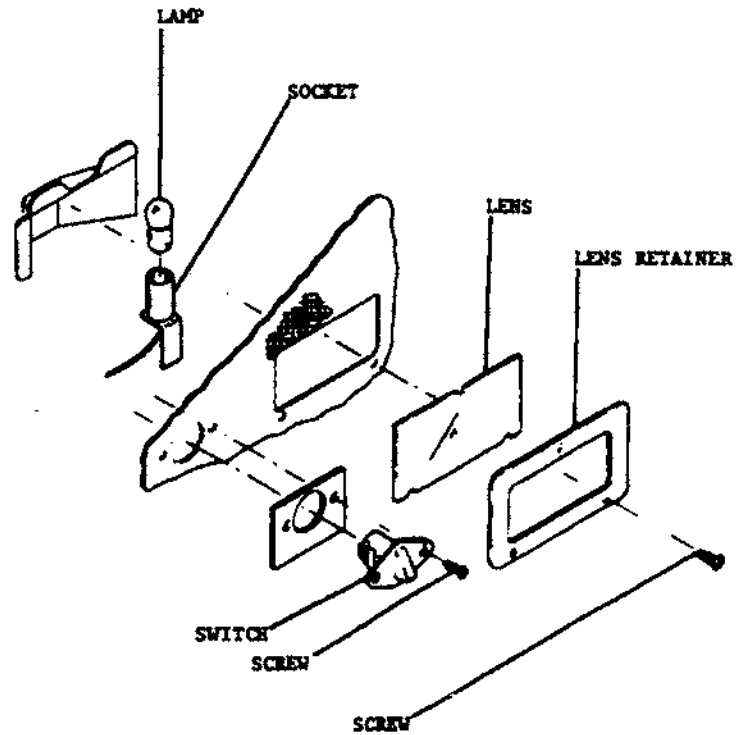
- (3) Disconnect socket assembly and remove light assembly from aircraft.
- (4) To replace light bulb, remove from socket assembly and install new bulb.

B. Install Nose Baggage Light.

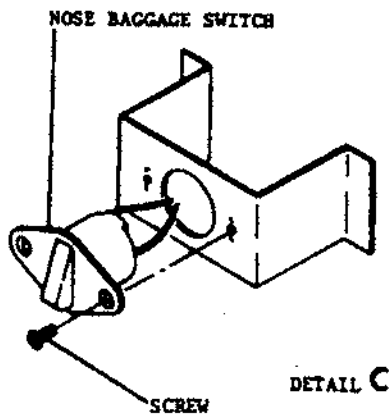
- (1) Reconnect electrical wires to socket assembly.
- (2) Insert light assembly into mount bracket.
- (3) Push light assembly with a firm even hand pressure until spring tabs latch light assembly in place.



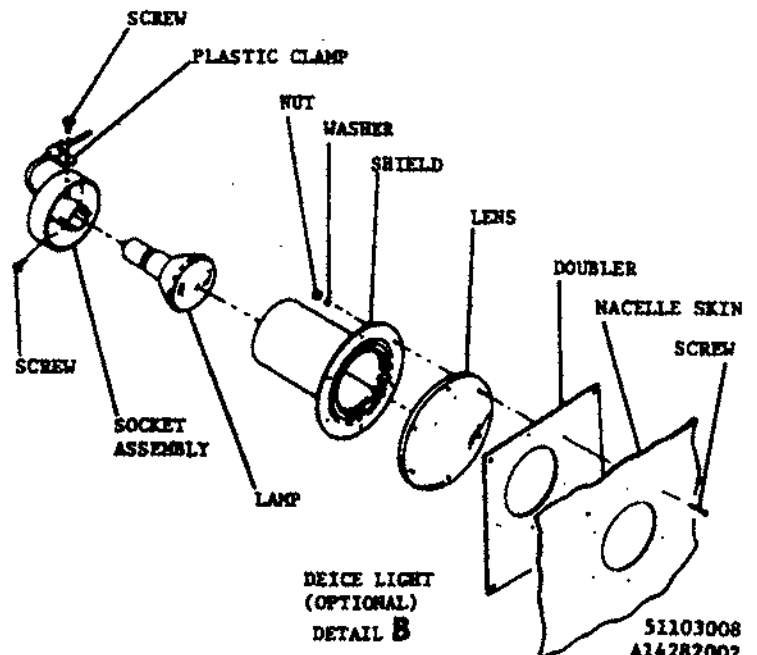
NOSE BAGGAGE LIGHT
(OPTIONAL)
DETAIL D



WING LOCKER COURTESY LIGHT
(OPTIONAL)
DETAIL A



DETAIL C



DEICE LIGHT
(OPTIONAL)
DETAIL B

Courtesy and Deice Light Installation
Figure 4

51103008
A14282002
B10281009
C52181003
D52181003

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Adjustment Landing Light

1. Retract Adjustment Landing Lights

- A. The retract position is adjustable to allow both landing light retract flush with the wing surface. To check retract operation and adjust retract limit proceed as follows:
- (1) Actuate the landing light switch to the retract position. Landing light should retract and stop when light is flush with the wing surface.
 - (2) If landing light does not stop flush with the wing surface, remove the two Phillips head screws which attach the cover plate to the bottom of the light rotating mechanism in order to expose the retract limit adjustment screw.
 - (3) Extend the lights to a position midway between retract and extend in order to adjust the retract limit.
 - (4) Adjust by turning the limit adjustment screw (1/2 turn) clockwise to lower and counterclockwise to raise the lamp assembly.
 - (5) Extend and retract the landing lights several times to check the retract adjustment. If light still will not retract flush with the wing surface repeat Steps (2) through (5).

Recognition Light

1. Replacement of Recognition Light (Refer to Figure 3)

WARNING: THIS IS A HOLOGEN CYCLE LAMP. IT IS PRESSURIZED AND MAY SHATTER. DO NOT OPERATE IN EXCESS OF RATED VOLTAGE. PROTECT AGAINST ABRASIONS, SCRATCHES AND LIQUIDS WHILE OPERATING. WEAR PROTECTIVE CLOTHING AND EYE GLASSES WHEN HANDLING AND ALLOW TO COOL BEFORE TOUCHING.

A. Remove Lamp.

- (1) Extend landing light to gain access to lamp.
- (2) Turn electrical power off.
- (3) Disconnect electrical wires at terminals.
- (4) Remove captive screw from receptacle and remove receptacle from reflector.

CAUTION: DO NOT TOUCH LAMP. HANDLE LAMP BY BASE ONLY.

- (5) Loosen screws securing lamp to receptacle. Rotate lamp by the base counterclockwise and remove lamp by the base from receptacle.

B. Install Lamp.

- (1) Install lamp in receptacle. Rotate lamp by the base clockwise and secure lamp to receptacle by tightening screws.
- (2) Install receptacle in reflector assembly and secure with captive screw.
- (3) Connect electrical wire at terminals.
- (4) Engage circuit breaker and retract landing light.

2. Removal/Installation Recognition Lights (Refer to Figure 3)

NOTE: Maintenance practices are typical for the right and left recognition lights.

A. Remove Recognition Light Assembly.

NOTE: To replace lens, recognition light must be removed.

- (1) Remove landing light (refer to landing light removal procedures).
- (2) Remove screws securing light assembly to retainer.
- (3) Disconnect electrical wires at terminal and remove recognition light assembly.
- (4) If lens replacement is required, remove screws securing lens retainer. Push lens inboard and remove through landing light access.

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SERVICE MANUAL

B. Install Recognition Light.

- (1) If lens has been removed, reinstall by applying fay sealant around edge mating with opening in wing leading edge. (Refer to Chapter 20-30 for fillet sealant procedures.)
- (2) Connect electrical wires at terminals and position recognition light assembly in wing tip.
- (3) Secure recognition light to reflector retainer with screws.
- (4) Reinstall landing light (refer to Landing Light Installation Procedures).
- (5) Engage circuit breaker and retract landing light.

Oscillating Beacon

1. Removal/Installation of Oscillating Beacon (Refer to Figure 5)

A. Remove Oscillating Beacon.

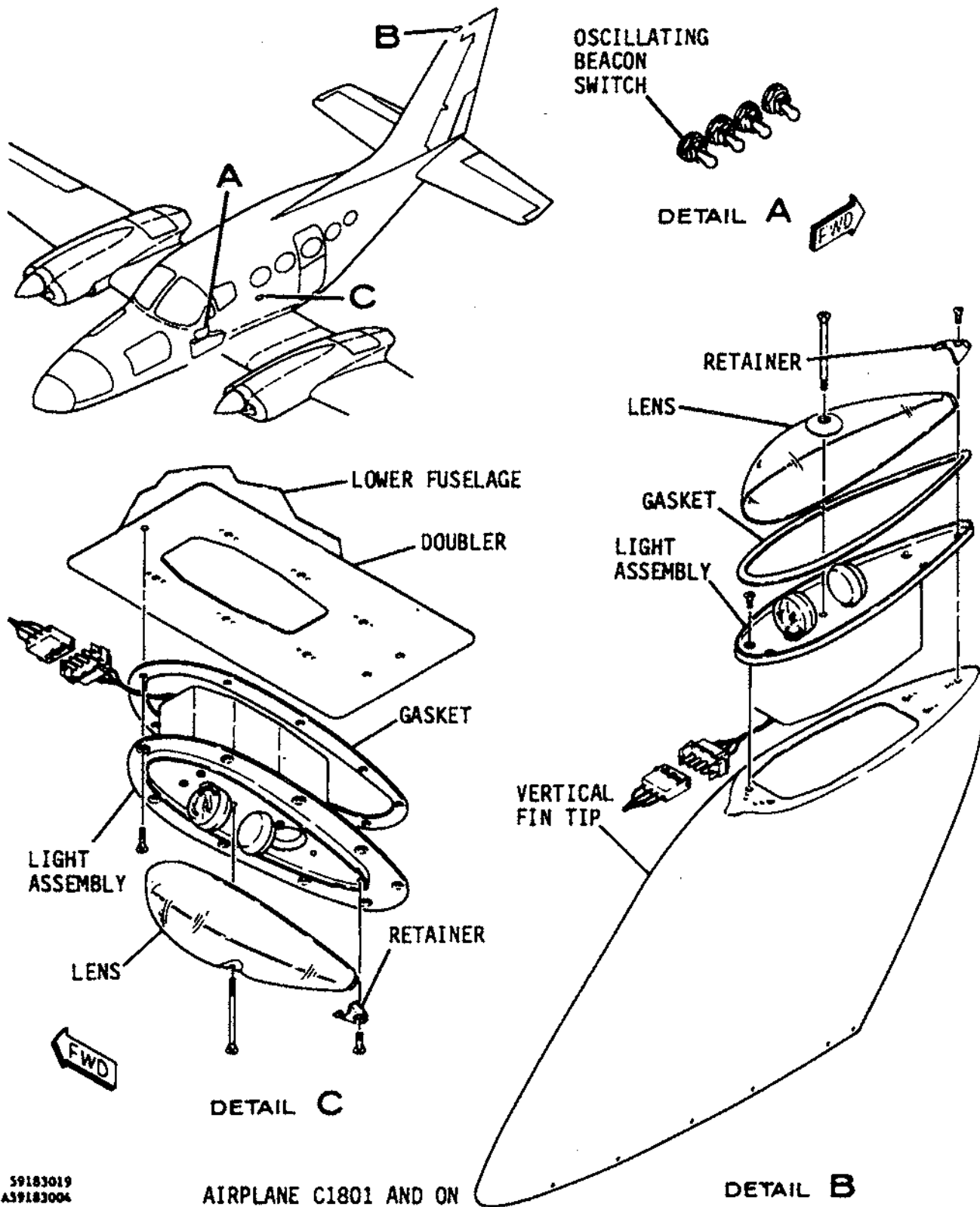
NOTE: The removal/installation procedures for fuselage and vertical stabilizer oscillating beacons are typical.

- (1) Ensure OSCILLATING BEACON switch circuit breaker is positioned to OFF.
- (2) Remove screws, retainer, lens and gasket.
- (3) If desired, remove lamp(s).
- (4) Remove light assembly by removing retaining screws.
- (5) Disconnect electrical connector, then remove light assembly from airplane.

B. Install Oscillating Beacon.

- (1) With light assembly in position, connect electrical connector.
- (2) Position light assembly to support and secure with screws.
- (3) If removed, install lamp(s) by inserting into sockets, push down and rotate until locked in place.
- (4) Install gasket, lens and lens retainer and secure with screws.
- (5) Verify proper operation of lights.

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59183019
A59183004
859182019
C59181031

AIRPLANE C1801 AND ON

Oscillating Beacon Installation
Figure 5

STALL WARNING SYSTEMDescription

1. The stall warning system consists of a warning transmitter, relay and warning horn. The stall warning horn is mounted inside the left-hand side console and the warning transmitter is mounted on the leading edge of the left wing tip. The electrical circuits of the system energizes the warning horn sounding the horn when the airplane approaches a stall. The stall warning transmitter incorporates a heater element, operated by the STALL WARN HEATER switch breaker, to prevent ice from hampering its operation.

The stall warning heater circuit is connected to the landing gear squat switch activating a low heat temperature circuit when the airplane is on the ground.

CAUTION: DO NOT ACTIVATE WITH AIRPLANE ON JACKS.

Maintenance Practices

1. Removal/Installation Stall Warning Transmitter (See Figure 1)

- A. Remove Stall Warning Transmitter.

NOTE: Before removal of stall warning transmitter, it is important that the exact fore-aft location of the vane be marked on the wing so that the replacement unit may be adjusted identically.

- (1) Turn electrical power OFF.
- (2) Remove screws attaching stall warning transmitter to wing tip skin.
- (3) Pull transmitter forward and disconnect electrical connector.

- B. Install Stall Warning Transmitter.

- (1) Connect stall warning transmitter electrical connector to airplane's wiring.
- (2) Secure transmitter to wing tip skin with screws.
- (3) Perform operational flight check of stall warning system.

2. Removal/Installation Stall Warning Horn (See Figure 1)

- A. Remove Stall Warning Horn.

- (1) Turn electrical power OFF.
- (2) Remove upholstery panel on left side console.
- (3) Identify and disconnect electrical wires from stall warning horn.
- (4) Remove screw and lockwasher securing warning horn to support and remove warning horn.

- B. Install Stall Warning Horn.

- (1) Secure warning horn to support using lockwasher and screw.
- (2) Identify and connect electrical wires to warning horn.
- (3) Perform operational ground check of stall warning system.
- (4) Install side console upholstery panel.

3. Operational Check Stall Warning System.

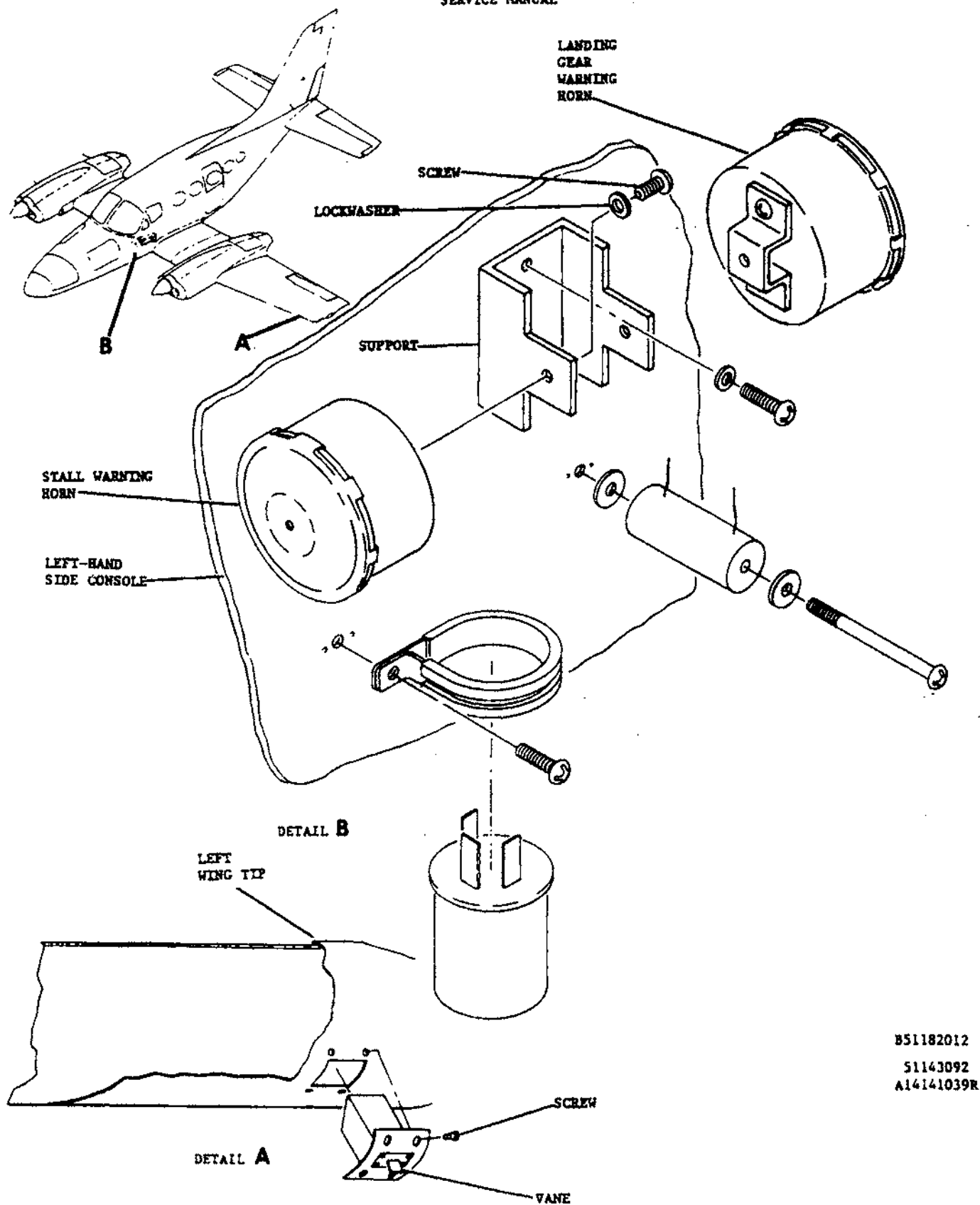
- A. Ground Check.

- (1) Turn electrical power ON.
- (2) Activate vane on stall warning transmitter and observe audible warning signal.

NOTE: The stall warning transmitter incorporates an electrical heating element which is activated by the stall warn heater switch breaker. Ensure this switch is off when checking the transmitter.

421

SERVICE MANUAL



Stall Warning System
Figure 1

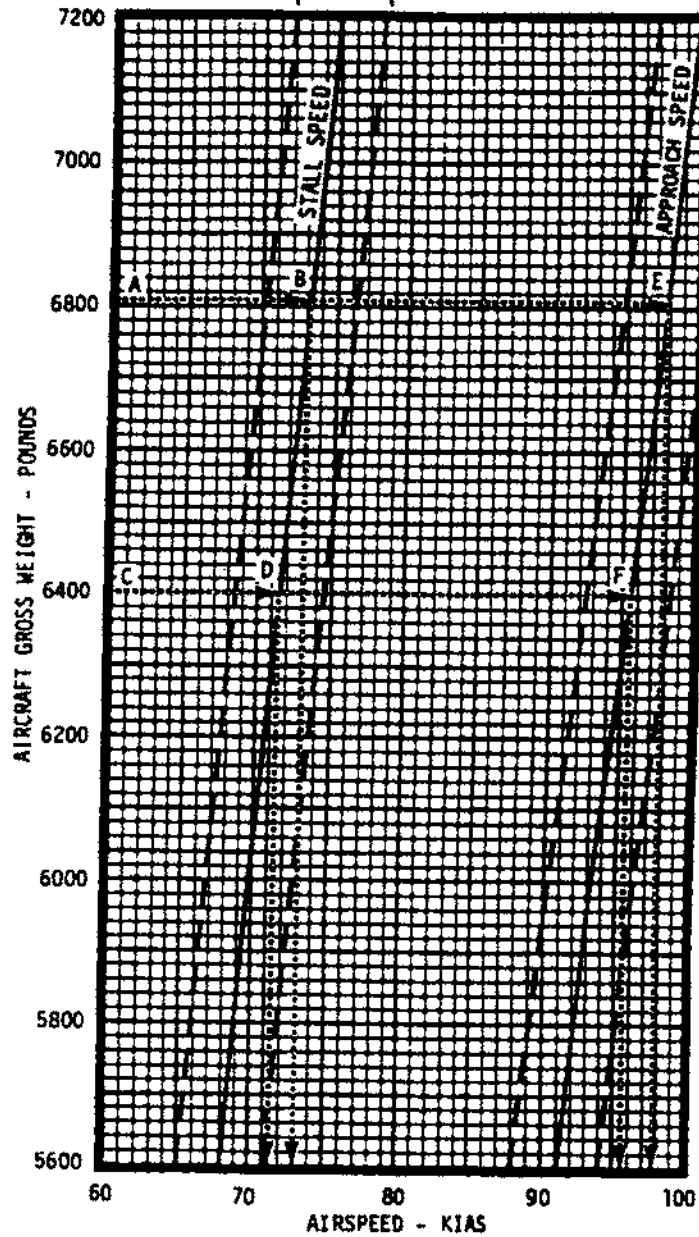
B51182012
51143092
A14141039R

TAKEOFF WEIGHT RANGE - LBS

5800 - 6700

TAKEOFF C.G. RANGE - %

17 - 22

TOLERANCE BAND +3 KNOTS
FROM STALL SPEED LINE

EXAMPLE

- "A" POINT "A" WEIGHT (HEAVY WEIGHT)
- "B" STALL SPEED AT POINT "A" WEIGHT (73.0 KIAS)
- "C" POINT "C" WEIGHT (LIGHT WEIGHT)
- "D" STALL SPEED AT POINT "C" WEIGHT (71.3 KIAS)
- "E" APPROACH SPEED AT POINT "A" WEIGHT (97.8 KIAS)
- "F" APPROACH SPEED AT POINT "C" WEIGHT (95.5 KIAS)

51986008

Approach and Stall Speed Chart
Figure 2

B. Flight Check.

- (1) Check the stall warning system in two configurations: landing gear up, flaps up and gear down, flaps full down.
- (2) Check each configuration in step (1) at 65 percent power, and at idle power, and in the weight and center-of-gravity range shown in Figure 2.
- (3) Approach the stall by reducing airspeed at a rate as close as possible to one knot per second. In the stall the airplane roll altitude should be controllable up to the time the airplane nose pitches downward or full up elevator stop is reached. The fuel should be managed to minimize asymmetric fuel prior to conducting the stall.
- (4) The indicated stall speed in the landing configuration at idle power should fall within +3 knots IAS of the stall speed line (see Figure 2).
- (5) Record the stall speed for each configuration.

4. Adjustment Stall Warning System

A. Adjust Stall Warning System.

- (1) Using the data recorded in Flight Check portion of Operational Check Stall Warning system, adjust the stall warning vane to provide a stall warning horn at 4 to 5 knots IAS prior to the idle power landing configuration stall.
- (2) Raising the stall warning vane position will increase the stall warning indication and lowering the stall warning vane will lower the stall warning indication.

ELECTRICAL LOADDescription

1. An electrical load chart is provided to give the load in amps for aircraft equipment.

CONTINUOUS ELECTRICAL LOAD CHART (Standard)

	Amps Req'd.
Fuel Pump - Auxiliary	11.00
Fuel Quantity System (2) (.10 Amp each)	0.20
Combustion Air Blower - Cabin Heater	3.00
Heater Vent Blower	11.00
Heater Fuel Valve	0.30
Heater Ignition	0.75
Heat Pump (Wing)	1.30
Stall Warning Heater	3.00
Electric Clock	0.05
Pitot Tube Heater	4.30
Flap Position Indicator (6) (.06 Amp each)	0.24
Engine Gauges (2) (.32 Amp each)	0.64
Air Temperature Indicator	0.08
Turn and Bank Indicator (LB)	0.15
Battery Relay	0.60
Navigation Lights - Wing (2) (.93 Amps each)	1.86
Navigation Light - Tail	1.02
Anti-Collision Lights (Strobes)	3.00
Map Light	0.52
Fuel Selector Lights (.03 Amps each)	0.60
Compass Light	0.04
Post Lights (.04 Amps each)	1.50
Flood Lights (2) (.52 Amp each)	1.04
Dome Light	0.51
Voltage Regulator (2) (1.0 Amp each)	2.00
Side Console Lights (3)	0.34

CONTINUOUS ELECTRICAL LOAD CHART (Optional)

Avionics Cooling Fan	0.5
400 Nav/Com	2.0
400 Automatic Direction Finder	1.00
400 Transponder	1.2
400 Glideslope	0.35
400 Marker Beacon Receiver	0.17
400 Encoding Altimeter	1.0
400 DME	1.5
400 R-Nav	0.5
800 Com	1.25
800 Nav	1.20
800 R Nav	1.10
800 Automatic Direction Finder	2.50
800 Transponder	1.2
800 Glideslope	0.35
800 RMI	1.0
800 Audio Amplifier	0.50
800 Encoding/Alerting Altimeter	1.5
400B Nav-O-Matic	5.0
Yaw Damper	1.5
400B IFCS	5.1
800B IFCS	10.7
HSI (ARC IG-832A)	1.0
Radio Altimeter, AA-215	1.5
Flitefone III	1.00
Radio Altimeter, AA-100	1.50
RDR-150	3.50
RDR-160	3.50
ASB-130 Transceiver	2.50

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CONTINUOUS ELECTRICAL LOAD CHART (Optional) (Continued)

	Amps Required
Radio Panel Lights	1.0
Air Conditioning System	36.4
Propeller Deice (Electric)	15.00
Propeller Synchronizer	1.00
Propeller Synchronous Indicator	0.04
Windshield, Plexiglass Heated	50.00
Windshield, PPG Glass Heated	
Low Power	32.00 to 39.50
High Power	47.00 to 56.00
Windshield Deice (Alcohol)	0.40
Flight Hour Recorder	0.04
Fuel Pump - Wing Locker (2) (3.0 Amps each)	6.00
Post Lights (25) (.04 per light)	1.00
Anti-Collision System (High Intensity Strokes)	3.50
Static Source Heaters (4) (.36 Amps each)	1.44
Heaters - Wing Locker Vent (2) (.29 Amps each)	0.58
*Heaters - Dual Pitot (4.30 Amps each)	4.30
Turn & Bank Indicator (RH)	0.15
Stereo Tape Player	1.00
Seat Belt Sign Lights (2) (.10 Amps each)	0.20
No Smoking Sign Lights (2) (.10 Amps each)	0.20
No Smoking Sign Switch	0.04
Reading Lights (6) (.30 Amps each)	1.80
Electronic Fuel Flow	0.60

NON-CONTINUOUS ELECTRICAL LOAD CHART

Flap Motor	13.00
Cabin Heater Overheat Indicator	0.04
Cigar Lighter (Load for 1 Lighter)	5.50
Fuel Boost Relay (0.09 Amp Each)	0.18
Landing Gear Warning System	0.60
Stall Warning	0.20
Door Warning Indicator	0.04
Door Courtesy Light	0.30
In-Transit Landing Gear Indicator	0.10
Landing Gear Down Indicator	0.20
Landing Light - LH (Lamp)	9.0
Landing Light Extension and Retraction Motor	1.25
Shaver Inverter	0.60
Map Light (Copilot)	0.52
Electric Seat (10 Amps each)	20.00
Deice Light Wing (.70 Amps each)	1.40
Intercom Call Light	0.04
Surface Deice System	6.25
Electric Trim	0.60
Taxi Light	3.64
Landing Light - RH (Lamp)	9.00
Landing Light Extension and Retraction Motor - RH	1.25
Landing Light Relay	0.20
Cabin Ventilation Blower	1.90
Flush Toilet	3.00
Hydraulic Selector Valve	1.00
Hydraulic Loading Valve	1.00

*One pitot is included in Standard load.

NOTE: Total continuous load should not exceed 80 percent of total rated alternator capacity.

WIRING, CABLES AND CONNECTORS - MAINTENANCE PRACTICESGeneral

1. The airplane wiring consists of electrical power wiring and electronic (avionics) wiring.

Wire Types and Uses

1. There are five basic categories of wire used as defined on the wiring diagram. The five categories are listed below with an example of each (as shown on the wiring diagram).

- A. Wire (Unshielded).

————— H158A20 —————

- B. High Temperature Wire (Unshielded), (Wire Number is Underlined).

————— H158A20 —————

- C. Wire (Shielded), (Shielded Wire is Shown with Split Semi-Circles).

○ ————— H158A20 ————— ○

- D. High Temperature Wire (Shielded).

○ ————— H158A20 ————— ○

- E. Color Coded Wire.

————— Red 20 GA —————

Wire Designation

1. Wire types are identified by a combination of letters and numbers that define the wire, number of cables, shield style and material and jacket material. This identification may or may not be embossed on the wire jacket.
2. Replace wires with the type specified, if defined in the applicable wiring diagram.
3. When the wire type is not defined in the applicable wiring diagram, the following procedure shall be used to determine wire designation. This wire designation is to be used to order wire for replacement purposes.

- A. Use Table 1 to determine wire designation. The following three items must be known to utilize Table 1.

NOTE: Always use the information from Table 1 to determine wire designation even if the wire being placed has a different wire designation than that shown. Due to specification changes and superseding wire designation numbers, the wire designation of the wire being replaced may not be in use any longer.

- B. Wire Category (one of five basic categories) - determined by referring to paragraph 2. Wire Types and Uses.
- C. Wire Gage - determined by referring to the wire identification number on the wiring diagram. Example, H158A20 - wire gage is 20.
- D. Number of Conductors - determined by referring to the wiring diagram.

NOTE: Most of the wires used are single (1) conductor.

Table 1. Wire Designation Table

WIRE CATEGORY

		Gage		Number of Conductors		
1. Wire (Unshielded)	M27500	-	☐ ☐	ML	☐	U00 12-25 Gage Only
	M27500	-	☐ ☐	MH	☐	U00 10 Gage Only
	M27500	-	☐ ☐	B	☐	U00 Less than 10 Gage

Example: H158A20 Wire, Single Conductor has a Wire Designation of M27500-20ML1U008.

		Gage		Number of Conductors	
2. High Temperature Wire (Unshielded)	M27500	-	☐ ☐	TA	☐ U06

Example: H158A20 Wire, Single Conductor (Shown Underlined on the Drawing) has a Wire Designation of M27500-20TA1U06.

		Gage		Number of Conductors	
3. Wire, (Shielded)	M27500	-	☐ ☐	B	☐ T08

Example: H158A20 Wire, Single Conductor (Shown with Shielding on the Drawing has a wire Designation of M2700-20B1T08.

		Gage		Number of Conductors	
4. High Temperature Wire (Shielded)	M27500	-	☐ ☐	TA	☐ N06

Example: H158A20 Wire, Single Conductor (Shown Underlined and with Shielding on the Drawing) has a Wire Designation of M27500-20TA1N06.

		Gage		Color	
5. Color Coded Wire (Shielded)	M16878E	☐ ☐		☐ ☐ ☐ ☐ ☐ ☐	

Example: Red 20 GA wire has a wire designation of

M16878E20RED

Possible Colors:

Blue	Orange
Brown	Yellow
Black	Wht. Blk
Red	Wht. Red
Green	

Wire Identification

1. See Introduction for details of wire identification.

Reidentification of Wires

2. Reidentification of a wire is required when wire runs are replaced or when existing wire is used for new purposes.
3. Tools and Equipment

NOTE: The following material or equivalent is required.

Name	Number	Manufacturer	Use
Aliphatic Naphtha	TT-N-95		Cleaning agent.
Petrolatum	VV-P-236		Wire installation.
Twine, Type P Waxed, Class II	MIL-T-713		Wire installation ties.
Sleeving	MIL-I-7444B		Wire installation.
Vinyl Tape	CT-93C	Resin Industries, Inc. Santa Barbara, CA	Wrapping cables.
Sleeving	MIL-I-7444B Type I		Insulation and protection.
Sleeving	MIL-I-7444B Type II		Identification of wires.
Lacquer	MIL-L-7178		Overcoating ties.
Fiberglass Cord	Varflex 46	Varflex Corporation Rome, NY	Wire installation ties.
Tape, Adhesive Vinyl	MIL-I-7798	Minnesota Mining & Mfg. Company	Insulation and wire repair.
Insulating Tubing	MIL-I-23053A	Rayclade Tube Redwood City, CA	Heat shrink insulation.

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WIRING DIAGRAMS

REFERENCE DESIGNATOR CODE

1. Reference designators are used in these diagrams to more quickly identify and locate a part or assembly used in any electrical system. A part is identified by reference number on a diagram. The reference number called out in wiring reference designators identifies the component and diagram sheet location.

EXAMPLE -

REFERENCE	SHEET	DESCRIPTION
B1	7	LH Starter

NOTE: When ordering spare or replacement components, refer to applicable Parts Catalog.

The wiring diagrams contained in this section clearly show the complete wiring on each item of electrical components listed in the Wiring Diagram Index. The first portion of wire number indicates the Airplane System, the center portion indicates Wire Number and the last portion indicates Wire Gage size.

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Landing Lights (Optional) (Airplanes C1247 and On)	48
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STANDARD WIRING REFERENCE DESIGNATORS

<u>DESIGNATOR</u>	<u>SHEET</u>	<u>DESCRIPTION</u>	<u>ZONE</u>
A1	5.00	Left Alternator Fail Sensor	410
A2	5.00	Right Alternator Fail Sensor	420
A501	17.00	Left Evaporator Probe	251
A502	17.00	Right Evaporator Probe	252
AR1	5.00	Left Alternator	410
AR2	5.00	Right Alternator	420
AR3	5.00	Left Alternator	410
AR4	5.00	Right Alternator	420
B1	7.00	Left Starter	410
B2	7.00	Right Starter	420
B4	10.00	Flap Motor	251E
B11	12.00	Motor	132
B12	9.00	Fuel Pump	632AB
B13	9.00	Fuel Pump	532AB

STANDARD WIRING REFERENCE DESIGNATORS (CONTINUED)

DESIGNATOR	SHEET	DESCRIPTION	ZONE
B15	12.00	Motor	132
B34	16.01	Clock	247
B501	21.00	Fuel Pump	521
B502	21.00	Fuel Pump	621
B510	17.00	Blower	241
B511	17.00	Blower	242
B512	17.00	Blower	621
B513	17.00	Temperature Controller	242
B519	17.00	Pump	621
B520	17.00	Blower	242
B521	17.00	Blower	241
B522	25.00	Probe	420
B524	25.00	Motor	262
B533	25.00	Probe	410
B535	29.00	Clock	247
BB1	5.00	Bus	245
BB2	5.00	Bus	245
BB3	5.00	Bus	245
BB4	5.00	Bus	512BT
BB5	5.00	Bus	512BT
BB6	5.00	Bus	245
BB7	5.00	Bus	512BT
BB30	6.02	Bus	245
BB31	7.00	Bus	245
BB33	9.00	Bus	245
BB34	9.00	Bus	245
BT1	5.00	Battery	512AT
CB1	7.00	Circuit Breaker	245
CB2	10.00	Circuit Breaker	245
CB3	8.00	Circuit Breaker	245
CB4	8.00	Circuit Breaker	245
CB5	10.00	Circuit Breaker	245
CB6	10.01	Circuit Breaker	245
CB7	11.00	Circuit Breaker	245
CB8	11.00	Circuit Breaker	245
CB9	11.00	Circuit Breaker	245
CB10	11.01	Circuit Breaker	245
CB11	9.00	Circuit Breaker	245
CB12	9.00	Circuit Breaker	245
CB13	12.00	Circuit Breaker	245
CB21	14.00	Circuit Breaker	245
CB22	13.00	Circuit Breaker	245
CB23	13.00	Circuit Breaker	245
CB24	13.00	Circuit Breaker	245
CB27	12.00	Circuit Breaker	245
CB30	12.00	Circuit Breaker	245
CB58	5.00	Circuit Breaker	245
CB59	5.00	Circuit Breaker	245
CB60	5.00	Circuit Breaker	245
CB61	5.00	Circuit Breaker	245
CB62	5.00	Circuit Breaker	245
CB63	5.00	Circuit Breaker	512BT
CB64	5.00	Circuit Breaker	512BT
CB87	16.01	Circuit Breaker	245
CB501	17.00	Circuit Breaker	245
CB502	17.00	Circuit Breaker	245
CB503	17.00	Circuit Breaker	245
CB504	19.00	Circuit Breaker	245
CB505	19.00	Circuit Breaker	245
CB506	21.00	Circuit Breaker	245
CB507	11.01	Circuit Breaker	245
CB508	11.01	Circuit Breaker	245

STANDARD WIRING REFERENCE DESIGNATORS (CONTINUED)

DESIGNATOR	SHEET	DESCRIPTION	ZONE
CB517	21.00	Circuit Breaker	245
CB518	21.00	Circuit Breaker	245
CB520	27.00	Circuit Breaker	245
CB560	5.00	Circuit Breaker	245
CB561	5.00	Circuit Breaker	245
CB562	5.00	Circuit Breaker	245
CB563	5.00	Circuit Breaker	245
CB567	22.00	Circuit Breaker	245
CB577	23.00	Circuit Breaker	245
CB568	26.00	Circuit Breaker	245
CB569	26.00	Circuit Breaker	245
CB570	30.00	Circuit Breaker	245
CB572	27.00	Circuit Breaker	245
CB585	20.00	Circuit Breaker	245
CB588	25.00	Circuit Breaker	245
CB589	25.00	Circuit Breaker	245
CB595	25.00	Circuit Breaker	245
CB598	28.00	Circuit Breaker	245
CB599	28.00	Circuit Breaker	512BT
CR1	5.00	Diode	512BT
CR2	5.00	Diode	512BT
CR3	5.00	Diode	512BT
CR4	5.00	Diode	245
CR5	5.00	Diode	245
CR6	5.00	Diode	410
CR7	5.00	Diode	420
CR8	6.02	Diode	245
CR9	6.02	Diode	245
CR11	9.00	Diode	245
CR12	9.00	Diode	245
CR13	9.00	Diode	245
CR14	9.00	Diode	245
CR15	14.00	Diode	249
CR16	14.00	Diode	249
CR17	16.00	Diode	243
CR18	16.00	Diode	243
CR19	16.00	Diode	243
CR20	16.00	Diode	243
CR21	12.00	Diode	245
CR24	12.00	Diode	132
CR25	5.00	Diode	245
CR28	10.00	Diode	245
CR29	10.00	Diode	245
CR30	12.01	Diode	132
CR31	8.00	Diode	247
CR32	8.00	Diode	221
CR35	12.00	Diode	262
CR36	9.00	Diode	532AB
CR37	9.00	Diode	632AB
CR38	9.01	Diode	420
CR49	10.00	Diode	245
CR104	5.00	Diode	512BT
CR105	5.00	Diode	512BT
CR506	17.00	Diode	245
CR507	17.00	Diode	245
CR520	17.00	Diode	245
CR521	17.00	Diode	410
CR533	17.00	Diode	242
CR534	17.00	Diode	245
CR560	18.00	Diode	241
CR570	17.00	Diode	621

STANDARD WIRING REFERENCE DESIGNATORS (CONTINUED)

<u>DESIGNATOR</u>	<u>SHEET</u>	<u>DESCRIPTION</u>	<u>ZONE</u>
CRA2	8.00	Diode	247
DS2	8.00	Light	247
DS3	8.00	Light	247
DS4	13.00	Light	243
DS5	13.00	Light	243
DS10	13.00	Light	242
DS11	13.00	Light	241
DS12	13.00	Light	245
DS13	13.00	Light	245
DS14	13.00	Light	245
DS15	13.00	Light	245
DS16	13.00	Light	247
DS17	13.00	Light	247
DS18	13.00	Light	247
DS19	13.00	Light	247
DS20	13.00	Light	247
DS21	13.00	Light	247
DS23	13.00	Light	247
DS24	13.00	Light	247
DS25	13.00	Light	247
DS26	13.00	Light	247
DS27	13.00	Light	247
DS28	13.00	Light	247
DS29	13.00	Light	247
DS37	13.00	Light	247
DS38	13.00	Light	247
DS39	13.00	Light	247
DS40	13.00	Light	247
DS41	13.00	Light	247
DS42	13.00	Light	247
DS43	13.00	Light	247
DS44	13.00	Light	247
DS45	13.00	Light	247
DS46	13.00	Light	247
DS47	13.00	Light	247
DS48	13.00	Light	247
DS50	13.00	Light	247
DS51	14.00	Light	251
DS52	14.00	Light	251
DS53	14.00	Light	252
DS54	14.00	Light	262
DS55	14.00	Light	261
DS56	14.00	Light	249
DS57	14.00	Light	249
DS58	14.00	Light	261
DS59	13.00	Light	243
DS61	15.00	Light	550
DS64	15.00	Light	321A
DS67	16.00	Light	249
DS68	16.00	Light	249
DS69	13.00	Light	247
DS70	14.00	Light	261
DS76	13.00	Light	247
DS77	13.00	Light	247
DS78	13.00	Light	247
DS79	13.00	Light	247
DS80	13.00	Light	247
DS81	13.00	Light	247
DS82	13.00	Light	247
DS83	13.00	Light	247
DS84	13.00	Light	247

STANDARD WIRING REFERENCE DESIGNATORS (CONTINUED)

<u>DESIGNATOR</u>	<u>SHEET</u>	<u>DESCRIPTION</u>	<u>ZONE</u>
DS85	13.00	Light	247
DS86	13.00	Light	247
DS87	13.00	Light	247
DS88	13.00	Light	247
DS89	13.00	Light	247
DS91	14.00	Light	261
DS93	15.00	Light	550
DS94	15.00	Light	650
DS501	21.00	Light	710
DS503	22.00	Light	521
DS504	22.00	Light	621
DS508	23.00	Light	247
DS509	23.00	Light	247
DS510	23.00	Light	247
DS511	23.00	Light	247
DS512	23.00	Light	247
DS513	23.00	Light	247
DS514	23.00	Light	247
DS515	23.00	Light	247
DS516	23.00	Light	247
DS517	23.00	Light	247
DS518	23.00	Light	247
DS519	23.00	Light	247
DS520	23.00	Light	247
DS521	23.00	Light	247
DS522	23.00	Light	247
DS532	22.00	Light	550AB
DS533	22.00	Light	650AB
DS534	22.00	Light	221
DS535	30.00	Light	247
DS536	30.00	Light	247
DS594	22.00	Light	650AB
DS597	27.00	Light	247
E1	5.00	Relay	245
E2	5.00	Relay	245
E501	19.00	Slip Ring	410
E502	19.00	Slip Ring	420
E503	19.00	Brush Block	410
E504	19.00	Brush Block	420
E524	27.00	Governor	410
E525	27.00	Governor	420
EL500	24.00	Electroluminescent Panel	245
EL501	24.00	Electroluminescent Panel	245
EL502	24.00	Electroluminescent Panel	245
EL503	24.00	Electroluminescent Panel	245
EL504	24.00	Electroluminescent Panel	247
EL505	24.00	Electroluminescent Panel	247
EL506	24.00	Electroluminescent Panel	247
EL507	24.00	Electroluminescent Panel	243
EL508	24.00	Electroluminescent Panel	243
EL509	24.00	Electroluminescent Panel	247
EL510	24.00	Electroluminescent Panel	247
EL511	24.00	Electroluminescent Panel	247
EL512	24.00	Electroluminescent Panel	241E
EL513	24.00	Electroluminescent Panel	241E
EL514	24.00	Electroluminescent Panel	247
EL515	24.00	Electroluminescent Panel	244

STANDARD WIRING REFERENCE DESIGNATORS (CONTINUED)

DESIGNATOR	SHEET	DESCRIPTION	ZONE
F1	5.00	Fuse	245
F2	5.00	Fuse	245
F3	5.00	Fuse	512BT
F4	5.00	Fuse	512BT
F5	5.00	Fuse	245
F10	5.00	Fuse	512BT
F11	5.00	Fuse	512BT
F501	5.00	Fuse	512BT
F506	28.00	Fuse	245
F516	18.00	Fuse	241
F560	18.00	Fuse	245
FE501	30.00	Fire Extinguisher	511
FE502	30.00	Fire Extinguisher	611
G1	7.00	Left Magneto	410
G2	7.00	Right Magneto	420
G3	7.00	Left Magneto	410
G4	7.00	Right Magneto	420
G5	7.00	Starter Vibrator	245
G6	8.00	Horn Flasher	245
G7	11.00	Left Signal Conditioner	532AB
G8	11.00	Right Signal Conditioner	632AB
HR1	12.00	Cigar Lighter	247
HR2	12.00	Cigar Lighter	252
HR3	12.00	Cigar Lighter	251
HR6	10.00	Pitot Heater	131
HR7	12.00	Cabin Heater	132
HR8	12.01	Heater	132
HR501	19.00	Heater	410
HR502	19.00	Heater	420
HR503	19.00	Heater	410
HR504	19.00	Heater	420
HR505	19.00	Heater	410
HR506	19.00	Heater	420
HR507	18.00	Heater	241
HR508	20.00	Heater	312
HR509	20.00	Heater	311
HR510	20.00	Heater	621
HR511	20.00	Heater	521
HR512	20.00	Heater	312
HR513	20.00	Heater	311
HR560	18.00	Heater	241
HS1	13.00	Heat Sink	222
INV501	24.00	Inverter	247
INV502	24.00	Inverter	247
INV503	18.00	Inverter	142
J1	3.00	Plug	511AT
J2	3.00	Plug	611AT
J3	3.00	Plug	511AT
J4	3.00	Plug	611AT
J5	3.00	Plug	245
J6	3.00	Plug	245
J8	3.00	Plug	245
J9	3.00	Plug	245
J10	3.00	Plug	231
J11	3.00	Plug	232
J12	3.00	Plug	231
J14	13.00	Plug	243
J36	16.00	Plug	247
J37	16.00	Plug	247

STANDARD WIRING REFERENCE DESIGNATORS (CONTINUED)

<u>DESIGNATOR</u>	<u>SHEET</u>	<u>DESCRIPTION</u>	<u>ZONE</u>
J42	16.00	Jack	247
J43	16.00	Jack	247
J44	16.00	Jack	247
J45	16.00	Jack	247
J46	16.00	Jack	247
J47	3.01	Feed Thru	231
J50	10.00	Plug	550AB
J53	3.01	Plug	550AB
J54	3.01	Plug	650AB
J55	3.00	Plug	231
J56	5.00	Plug	245
J101	5.00	Plug	512BT
J546	25.00	Plug	247
J574	25.00	Plug	262
J581	17.00	Plug	242
J582	17.00	Plug	241
J583	17.00	Plug	242
J599	14.00	Plug	245
K1	5.00	Relay	512BT
K2	5.00	Relay	512BT
K3	5.00	Relay	512BT
K4	10.00	Relay	245
K11	9.00	Relay	245
K12	9.00	Relay	245
K13	9.00	Relay	245
K101	5.00	Relay	512BT
K504	17.00	Relay	245
K506			
K507	22.00	Relay	245
K508	22.00	Relay	245
K509	17.00	Relay	245
K524	14.00	Relay	245
K560	18.00	Relay	241
K561	18.00	Relay	241
L1	12.00	Safety Valve	621
L2	12.00	Dump Valve	262
L5	8.00	Load Valve	221
L6	8.00	Select Valve	221
L8	9.01	Solenoid Valve	420
L9	9.01	Solenoid Valve	410
LD1	13.00	Dim Control	245
LS1	10.00	Stall Warn Horn	245
LS2	8.00	Gear Horn	245
LS3	16.00	Speaker	249
LS01	20.00	Control Valve	410
LS02	20.00	Control Valve	420
LS03	20.00	Flow Valve	511
LS04	20.00	Flow Valve	511
LS05	20.00	Flow Valve	312
M1	5.00	Volt-Ammeter	245
M2	9.00	Tachometer Indicator	247
M3	9.00	Left Engine Gage	247
M4	9.00	Right Engine Gage	247
M5	9.00	Air Temperature Indicator	247
M6	9.00	Left Turn and Bank Indicator	247
M7	11.00	Fuel Quantity Indicator	247
M8	11.01	Indicator	247
M501	19.00	Ammeter	247
M502	19.00	Timer	242
M503	29.00	Angle-of-Attack Indicator	247

STANDARD WIRING REFERENCE DESIGNATORS (CONTINUED)

DESIGNATOR	SHEET	DESCRIPTION	ZONE
M504	20.00	Timer	247
M506	19.00	Flight Hour Recorder	247
M510	25.00	Exhaust Gas Temperature Indicator	247
M511	23.00	Turn and Bank Indicator	247
M535	12.01	Hour Meter	222
M560	18.00	Controller	241
MT1	9.00	Left Oil Temperature Bulb	410
MT2	9.00	Right Oil Temperature Bulb	420
MT3	9.00	Left Cylinder Head Temperature	410
MT4	9.00	Right Cylinder Head Temperature	420
MT5	9.00	Outside Air Temperature Bulb	151
MT6	9.00	Left Tachometer Generator	410
MT7	9.00	Right Tachometer Generator	420
MT10	11.00	Fuel Probe	632AB
MT11	11.00	Fuel Probe	532AB
MT12	11.00	Fuel Probe	642AB
MT13	11.00	Fuel Probe	542AB
MT14	11.00	Fuel Probe	642BB
MT15	11.00	Fuel Probe	542BB
MT16	5.00	Monitor Assembly	245
MT17	11.01	Transducer	410
MT18	11.01	Transducer	420
MT503	29.00	Transducer	550
MT530	32.00	Transducer Assembly	247
MT531	32.00	Transducer	151
MT540	11.01	Transducer	420
MT541	11.01	Transducer	410
P1	3.00	Receptacle	511BT
P2	3.00	Receptacle	611BT
P3	3.00	Receptacle	511BT
P4	3.00	Receptacle	611BT
P5	3.00	Connector	245
P6	3.00	Connector	245
P8	3.00	Ground Plug	245
P9	3.00	Ground Plug	245
P10	3.00	Ground Plug	247
P11	3.00	Ground Plug	232
P12	3.00	Connector	231
P14	13.00	Connector	243
P15	10.00	Connector	121
P16	9.00	Connector	410
P17	9.00	Connector	420
P18	9.00	Connector	247
P19	9.00	Connector	247
P20	9.00	Connector	247
P21	9.00	Connector	151
P22	9.00	Connector	247
P23	9.00	Connector	247
P24	9.00	Connector	420
P25	9.00	Connector	410
P26	11.00	Connector	247
P27	11.00	Connector	532AB
P28	11.00	Connector	632AB
P29	11.00	Connector	532AB
P30	11.00	Connector	632AB
P36	16.00	Connector	247
P37	16.00	Connector	247
P39	9.00	Connector	247
P40	16.00	Connector	247
P41	16.00	Connector	247
P44	3.01	Connector	231
P45	3.01	Connector	221

STANDARD WIRING REFERENCE DESIGNATORS (CONTINUED)

DESIGNATOR	SHEET	DESCRIPTION	ZONE
P46	15.00	Connector	650AB
P47	15.00	Connector	550AB
P50	10.00	Connector	550BB
P53	3.01	Connector	550AB
P54	3.01	Connector	650AB
P55	3.01	Connector	231
P56	5.00	Connector	245
P521	10.01	Connector	121
P546	25.00	Connector	247
P574	25.00	Connector	262
P575	27.00	Connector	262
P581	17.00	Connector	242
P582	17.00	Connector	241
P583	17.00	Connector	242
PS1	15.00	Power Supply	550AB
PS2	15.00	Power Supply	650AB
Q1	14.00	Transistor	249
R1	5.00	Resistor	245
R2	5.00	Resistor	245
R3	5.00	Resistor	512BT
R4	5.00	Resistor	245
R6	8.00	Resistor	245
R9	12.00	Resistor	245
R11	16.00	Potentiometer	247
R12	16.00	Potentiometer	247
R13	14.00	Resistor	249
R14	14.00	Resistor	249
R15	10.00	Resistor	245
R16	13.00	Resistor	245
R516	17.00	Rheostat	247
R525	29.00	Resistor	247
R560	18.00	Resistor	241
S1	5.00	Switch	245
S2	5.00	Switch	245
S3	5.00	Switch	245
S4	5.00	Switch	245
S5	5.00	Switch	245
S6	7.00	Switch	245
S7	7.00	Switch	245
S8	7.00	Switch	245
S9	7.00	Switch	245
S10	7.00	Switch	245
S11	7.00	Switch	245
S13	8.00	Switch	720
S18	10.01	Switch	245
S19	10.00	Switch	251E
S20	10.00	Switch	251E
S21	10.00	Switch	247
S22	10.00	Switch	247
S23	8.00	Switch	243
S24	8.00	Switch	243
S25	8.00	Switch	243
S26	9.00	Switch	245
S27	9.00	Switch	245
S28	9.00	Switch	245
S29	9.00	Switch	532
S30	9.00	Switch	632
S34	13.00	Switch	243
S35	14.00	Switch	262
S36	14.00	Switch	251
S37	14.00	Switch	251
S38	14.00	Switch	252

STANDARD WIRING REFERENCE DESIGNATORS (CONTINUED)

DESIGNATOR	SHEET	DESCRIPTION	ZONE
S39	14.00	Switch	252
S40	14.00	Switch	247
S41	14.00	Switch	261
S42	15.00	Switch	245
S43	12.00	Switch	245
S44	12.00	Switch	222
S45	12.00	Switch	247
S46	12.00	Switch	247
S47	16.00	Switch	247
S48	16.00	Switch	247
S49	10.00	Switch	550
S50	12.00	Switch	247
S54	14.00	Switch	252
S55	14.00	Switch	247
S56	8.00	Switch	710
S57	8.00	Switch	720
S58	8.00	Switch	730
S59	8.00	Switch	710
S60	8.00	Switch	730
S61	8.00	Switch	720
S62	8.00	Switch	247
S63	10.00	Switch	221
S64	10.00	Switch	611CB
S65	10.00	Switch	511CB
S66	9.01	Switch	245
S67	9.01	Switch	245
S501	17.00	Switch	621
S502	18.00	Switch	262
S503	21.00	Switch	521
S504	21.00	Switch	621
S505	21.00	Switch	247
S506	21.00	Switch	247
S509	20.00	Switch	312
S510	20.00	Switch	247
S511	17.00	Switch	247
S513	17.00	Solenoid Valve	621
S515	29.00	Switch	247
S516	22.00	Switch	521AT
S517	22.00	Switch	621
S519	17.00	Switch	621BT
S525	17.00	Switch	247
S526	17.00	Switch	621
S529	17.00	Switch	241
S530	22.00	Switch	221
S531	22.00	Switch	222
S557	26.00	Switch	532AT
S558	26.00	Switch	632AT
S560	18.00	Switch	245
S574	14.00	Switch	261
S585	27.00	Switch	247
SCB2	15.00	Switch Circuit Breaker	245
SCB3	15.00	Switch Circuit Breaker	245
SCB11	20.00	Switch Circuit Breaker	245
SCB12	12.00	Switch Circuit Breaker	245
SCB501	19.00	Switch Circuit Breaker	245
SCB502	21.00	Switch Circuit Breaker	245
SCB505	22.00	Switch Circuit Breaker	245
SCB506	19.00	Switch Circuit Breaker	245
SCB507	19.00	Switch Circuit Breaker	245
SCB513	27.00	Switch Circuit Breaker	245
SCB514	28.00	Switch Circuit Breaker	245

STANDARD WIRING REFERENCE DESIGNATORS (CONTINUED)

<u>DESIGNATOR</u>	<u>SHEET</u>	<u>DESCRIPTION</u>	<u>ZONE</u>
TB1	4.00	Terminal Block	245
TB2	4.00	Terminal Block	611AT
TB3	4.00	Terminal Block	611AT
TB4	4.00	Terminal Block	245
TB5	4.00	Terminal Block	243
TB6	4.00	Terminal Block	243
TB7	4.00	Terminal Block	245
TB8	4.00	Terminal Block	245
TB9	4.00	Terminal Block	245
TB10	4.00	Terminal Block	249
TB11	4.00	Terminal Block	511AT
TB12	4.00	Terminal Block	611AT
TB515	28.00	Terminal Block	245
TD501	30.00	Thermal Detector	410
TD502	30.00	Thermal Detector	420
TD503	30.00	Thermal Detector	410
TD504	30.00	Thermal Detector	420
TD505	30.00	Thermal Detector	410
TD506	30.00	Thermal Detector	420
TP501	30.00	Test Panel	247
VR1	5.00	Left Voltage Regulator	245
VR2	5.00	Right Voltage Regulator	245
XDS35	29.00	Light	252
XDS599	32.00	Light Assembly	252

REFERENCE

SHT 1700	H301B20	1	H301B20
SHT 1700	H301B20	2	H301B20
SHT 5.00	P5A20	3	P5B20
SHT 6.00	P5A20	4	P5B20
SHT 5.00	P5B20	5	P5B20
SHT 15.00	L13B1B	6	P5A20
SHT 22.00	L32B20	7	L13A1B
SHT 7.00	K2B20	8	L32A20
SHT 5.00	P3A20	9	K2A20
SHT 5.00	P4A20	10	P3A20
SHT 5.00	P4B20	11	P4B20
SHT 22.00	L31B1B	12	L31A1B
SHT 4.00	H353B20	13	L32A20
SHT 4.00	L1B20	14	K2A20
SHT 15.00	L6B20	15	P3A20
SHT 4.00	H354B20	16	P4B20
SHT 8.00	G40B20	17	L31A1B
SHT 24.00	L37B20	18	H353B20
SHT 9.00	Q4C1B	19	L1B20
SHT 5.00	P13B1B	20	L6A20
SHT 5.00	P20B1B	21	L6A20
SHT 22.00	L340B1B	22	H354B20
SHT 9.00	Q6C1B	23	G40B20
SHT 15.00	L1B20	24	L571C20
SHT 27.00	H307A1B	25	Q4B1B
SHT 9.00	Q8C1B	26	P13A1B
SHT 12.00	H40E20	27	P20A1B
SHT 20.00	H330A20	28	L340A1B
SHT 20.00	H33A20	29	Q6B1B
SHT 20.00	H33A20	30	L1A20
SHT 20.00	H33A20	31	M309B1B
SHT 20.00	H33A20	32	Q8B1B
SHT 20.00	H33A20	33	H40D20
SHT 20.00	H33A20	34	H330C20
SHT 20.00	H33A20	35	H334C20
SHT 20.00	H33A20	36	H335C20
SHT 20.00	H33A20	37	H336C20
SHT 20.00	H33A20	38	H337C20
SHT 20.00	H33A20	39	V301A20
SHT 20.00	H33A20	40	Q3C1B
SHT 20.00	H33A20	41	Q7C1B
SHT 20.00	H33A20	42	J6C20
SHT 20.00	H33A20	43	J8B20
SHT 20.00	H33A20	44	J4A20
SHT 20.00	H33A20	45	J5C20
SHT 20.00	H33A20	46	L308B1B
SHT 20.00	H33A20	47	Q5C1B
SHT 20.00	H33A20	48	E61A20
SHT 20.00	H33A20	49	E7A20
SHT 20.00	H33A20	50	L7B1B
SHT 20.00	H33A20	51	L7A1B
SHT 20.00	H33A20	52	L35B1B
SHT 20.00	H33A20	53	K1A20
SHT 20.00	H33A20	54	Q52B1B
SHT 20.00	H33A20	55	Q53B1B
SHT 20.00	H33A20	56	L50F20
SHT 20.00	H33A20	57	L2B20
SHT 20.00	H33A20	58	H40D1B
SHT 20.00	H33A20	59	J3A20
SHT 20.00	H33A20	60	J7B20
SHT 20.00	H33A20	61	C2A20
SHT 20.00	H33A20	62	G1E20
SHT 20.00	H33A20	63	H43B20
SHT 20.00	H33A20	64	H34B1B
SHT 20.00	H33A20	65	G9020
SHT 20.00	H33A20	66	H307A20

SIDE CONSOLE LWR

INSIDE CONSOLE

REFERENCE

P5B20	1	P5B20	SHT 5.00
H313A20	2	H313B20	SHT 11.00
P5A20	3	P5B20	SHT 5.00
C3A1B	4	C3B1B	SHT 10.00
C3A20	5	C3B20	SHT 10.00
L2B20	6	L2C20	SHT 5.00
L3B20	7	L3C20	SHT 21.00
L3B20	8	L3C20	SHT 10.00
L3B20	9	L3C20	SHT 10.00
L3B20	10	L3C20	SHT 10.00
L3B20	11	L3C20	SHT 10.00
L3B20	12	L3C20	SHT 10.00
L3B20	13	L3C20	SHT 10.00
L3B20	14	L3C20	SHT 10.00
L3B20	15	L3C20	SHT 10.00
L3B20	16	L3C20	SHT 10.00
L3B20	17	L3C20	SHT 10.00
L3B20	18	L3C20	SHT 10.00
L3B20	19	L3C20	SHT 10.00
L3B20	20	L3C20	SHT 10.00
L3B20	21	L3C20	SHT 10.00
L3B20	22	L3C20	SHT 10.00
L3B20	23	L3C20	SHT 10.00
L3B20	24	L3C20	SHT 10.00
L3B20	25	L3C20	SHT 10.00
L3B20	26	L3C20	SHT 10.00
L3B20	27	L3C20	SHT 10.00
L3B20	28	L3C20	SHT 10.00
L3B20	29	L3C20	SHT 10.00
L3B20	30	L3C20	SHT 10.00
L3B20	31	L3C20	SHT 10.00
L3B20	32	L3C20	SHT 10.00
L3B20	33	L3C20	SHT 10.00
L3B20	34	L3C20	SHT 10.00
L3B20	35	L3C20	SHT 10.00
L3B20	36	L3C20	SHT 10.00
L3B20	37	L3C20	SHT 10.00
L3B20	38	L3C20	SHT 10.00
L3B20	39	L3C20	SHT 10.00
L3B20	40	L3C20	SHT 10.00
L3B20	41	L3C20	SHT 10.00
L3B20	42	L3C20	SHT 10.00
L3B20	43	L3C20	SHT 10.00
L3B20	44	L3C20	SHT 10.00
L3B20	45	L3C20	SHT 10.00
L3B20	46	L3C20	SHT 10.00
L3B20	47	L3C20	SHT 10.00
L3B20	48	L3C20	SHT 10.00
L3B20	49	L3C20	SHT 10.00
L3B20	50	L3C20	SHT 10.00
L3B20	51	L3C20	SHT 10.00
L3B20	52	L3C20	SHT 10.00
L3B20	53	L3C20	SHT 10.00
L3B20	54	L3C20	SHT 10.00
L3B20	55	L3C20	SHT 10.00
L3B20	56	L3C20	SHT 10.00
L3B20	57	L3C20	SHT 10.00
L3B20	58	L3C20	SHT 10.00
L3B20	59	L3C20	SHT 10.00
L3B20	60	L3C20	SHT 10.00
L3B20	61	L3C20	SHT 10.00
L3B20	62	L3C20	SHT 10.00
L3B20	63	L3C20	SHT 10.00
L3B20	64	L3C20	SHT 10.00
L3B20	65	L3C20	SHT 10.00
L3B20	66	L3C20	SHT 10.00
L3B20	67	L3C20	SHT 10.00
L3B20	68	L3C20	SHT 10.00
L3B20	69	L3C20	SHT 10.00
L3B20	70	L3C20	SHT 10.00
L3B20	71	L3C20	SHT 10.00
L3B20	72	L3C20	SHT 10.00
L3B20	73	L3C20	SHT 10.00
L3B20	74	L3C20	SHT 10.00
L3B20	75	L3C20	SHT 10.00
L3B20	76	L3C20	SHT 10.00
L3B20	77	L3C20	SHT 10.00
L3B20	78	L3C20	SHT 10.00
L3B20	79	L3C20	SHT 10.00
L3B20	80	L3C20	SHT 10.00
L3B20	81	L3C20	SHT 10.00
L3B20	82	L3C20	SHT 10.00

SIDE CONSOLE FWD

REFERENCE

SHT 9.00	E1A20	A	E1B20
SHT 9.00	E2A20	B	E2B20
SHT 9.00	E3A20	C	E3B20
SHT 9.00	E4A20	D	E4B20
SHT 9.00	E5A20	E	E5B20
SHT 9.00	E6A20	F	E6B20
SHT 9.00	E7A20	G	E7B20
SHT 9.00	E8A20	H	E8B20
SHT 9.00	E9A20	I	E9B20
SHT 9.00	E10A20	J	E10B20
SHT 9.00	E11A20	K	E11B20
SHT 9.00	E12A20	L	E12B20
SHT 9.00	E13A20	M	E13B20
SHT 9.00	E14A20	N	E14B20
SHT 9.00	E15A20	O	E15B20
SHT 9.00	E16A20	P	E16B20
SHT 9.00	E17A20	Q	E17B20
SHT 9.00	E18A20	R	E18B20
SHT 9.00	E19A20	S	E19B20
SHT 9.00	E20A20	T	E20B20
SHT 9.00	E21A20	U	E21B20
SHT 9.00	E22A20	V	E22B20
SHT 9.00	E23A20	W	E23B20
SHT 9.00	E24A20	X	E24B20
SHT 9.00	E25A20	Y	E25B20
SHT 9.00	E26A20	Z	E26B20
SHT 9.00	E27A20	A	E27B20
SHT 9.00	E28A20	B	E28B20
SHT 9.00	E29A20	C	E29B20
SHT 9.00	E30A20	D	E30B20
SHT 9.00	E31A20	E	E31B20
SHT 9.00	E32A20	F	E32B20
SHT 9.00	E33A20	G	E33B20
SHT 9.00	E34A20	H	E34B20
SHT 9.00	E35A20	I	E35B20
SHT 9.00	E36A20	J	E36B20
SHT 9.00	E37A20	K	E37B20
SHT 9.00	E38A20	L	E38B20
SHT 9.00	E39A20	M	E39B20
SHT 9.00	E40A20	N	E40B20
SHT 9.00	E41A20	O	E41B20
SHT 9.00	E42A20	P	E42B20
SHT 9.00	E43A20	Q	E43B20
SHT 9.00	E44A20	R	E44B20
SHT 9.00	E45A20	S	E45B20
SHT 9.00	E46A20	T	E46B20
SHT 9.00	E47A20	U	E47B20
SHT 9.00	E48A20	V	E48B20
SHT 9.00	E49A20	W	E49B20
SHT 9.00	E50A20	X	E50B20
SHT 9.00	E51A20	Y	E51B20
SHT 9.00	E52A20	Z	E52B20
SHT 9.00	E53A20	A	E53B20
SHT 9.00	E54A20	B	E54B20
SHT 9.00	E55A20	C	E55B20
SHT 9.00	E56A20	D	E56B20
SHT 9.00	E57A20	E	E57B20
SHT 9.00	E58A20	F	E58B20
SHT 9.00	E59A20	G	E59B20
SHT 9.00	E60A20	H	E60B20
SHT 9.00	E61A20	I	E61B20
SHT 9.00	E62A20	J	E62B20
SHT 9.00	E63A20	K	E63B20
SHT 9.00	E64A20	L	E64B20
SHT 9.00	E65A20	M	E65B20
SHT 9.00	E66A20	N	E66B20
SHT 9.00	E67A20	O	E67B20
SHT 9.00	E68A20	P	E68B20
SHT 9.00	E69A20	Q	E69B20
SHT 9.00	E70A20	R	E70B20
SHT 9.00	E71A20	S	E71B20
SHT 9.00	E72A20	T	E72B20
SHT 9.00	E73A20	U	E73B20
SHT 9.00	E74A20	V	E74B20
SHT 9.00	E75A20	W	E75B20
SHT 9.00	E76A20	X	E76B20
SHT 9.00	E77A20	Y	E77B20
SHT 9.00	E78A20	Z	E78B20
SHT 9.00	E79A20	A	E79B20
SHT 9.00	E80A20	B	E80B20
SHT 9.00	E81A20	C	E81B20
SHT 9.00	E82A20	D	E82B20
SHT 9.00	E83A20	E	E83B20
SHT 9.00	E84A20	F	E84B20
SHT 9.00	E85A20	G	E85B20
SHT 9.00	E86A20	H	E86B20
SHT 9.00	E87A20	I	E87B20
SHT 9.00	E88A20	J	E88B20
SHT 9.00	E89A20	K	E89B20
SHT 9.00	E90A20	L	E90B20
SHT 9.00	E91A20	M	E91B20
SHT 9.00	E92A20	N	E92B20
SHT 9.00	E93A20	O	E93B20
SHT 9.00	E94A20	P	E94B20
SHT 9.00	E95A20	Q	E95B20
SHT 9.00	E96A20	R	E96B20
SHT 9.00	E97A20	S	E97B20
SHT 9.00	E98A20	T	E98B20
SHT 9.00	E99A20	U	E99B20
SHT 9.00	E100A20	V	E100B20

LH WING - P1 J1 FUSELAGE J2 P2 RH WING

SHT 5.00	P60A20N	A
SHT 15.00	L80A1B	B
SHT 22.00	L87A1B	C
SHT 5.00	P23A1B	D
SHT 22.00	L58A1B	E
SHT 10.00	C17A20N	F
SHT 22.00	L58A1B	G
SHT 5.00	P36A20N	H
SHT 5.00	P39A20N	I
SHT 200	J90A20N	J
SHT 20.00	H57B20N	K
SHT 13.00	L61A20N	L
SHT 10.00	BLK	M
SHT 5.00	P60A20N	N
SHT 15.00	L80A1B	O
SHT 22.00	L87A1B	P
SHT 5.00	P23A1B	Q
SHT 22.00	L58A1B	R
SHT 10.00	C17A20N	S
SHT 22.00	L58A1B	T
SHT 5.00	P36A20N	U
SHT 5.00	P39A20N	V
SHT 200	J90A20N	W
SHT 20.00	H57B20N	X
SHT 13.00	L61A20N	Y
SHT 10.00	BLK	Z

SIDE CONSOLE GND PLUG FWD

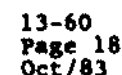
REFERENCE

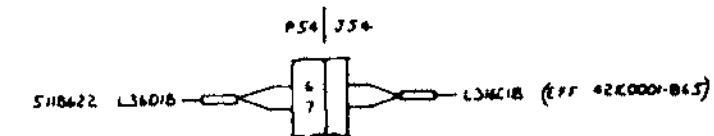
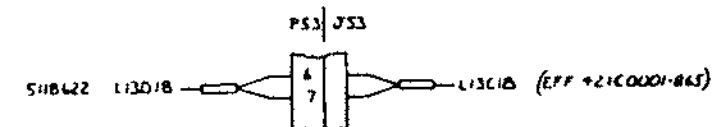
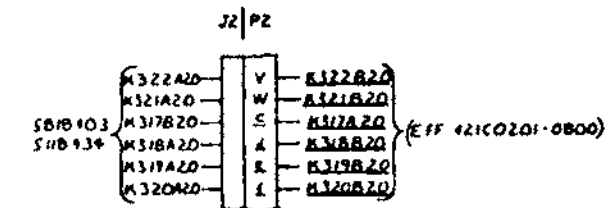
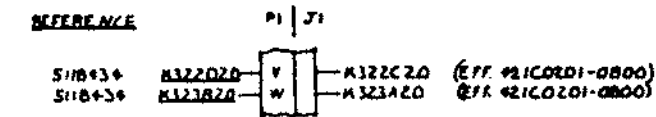
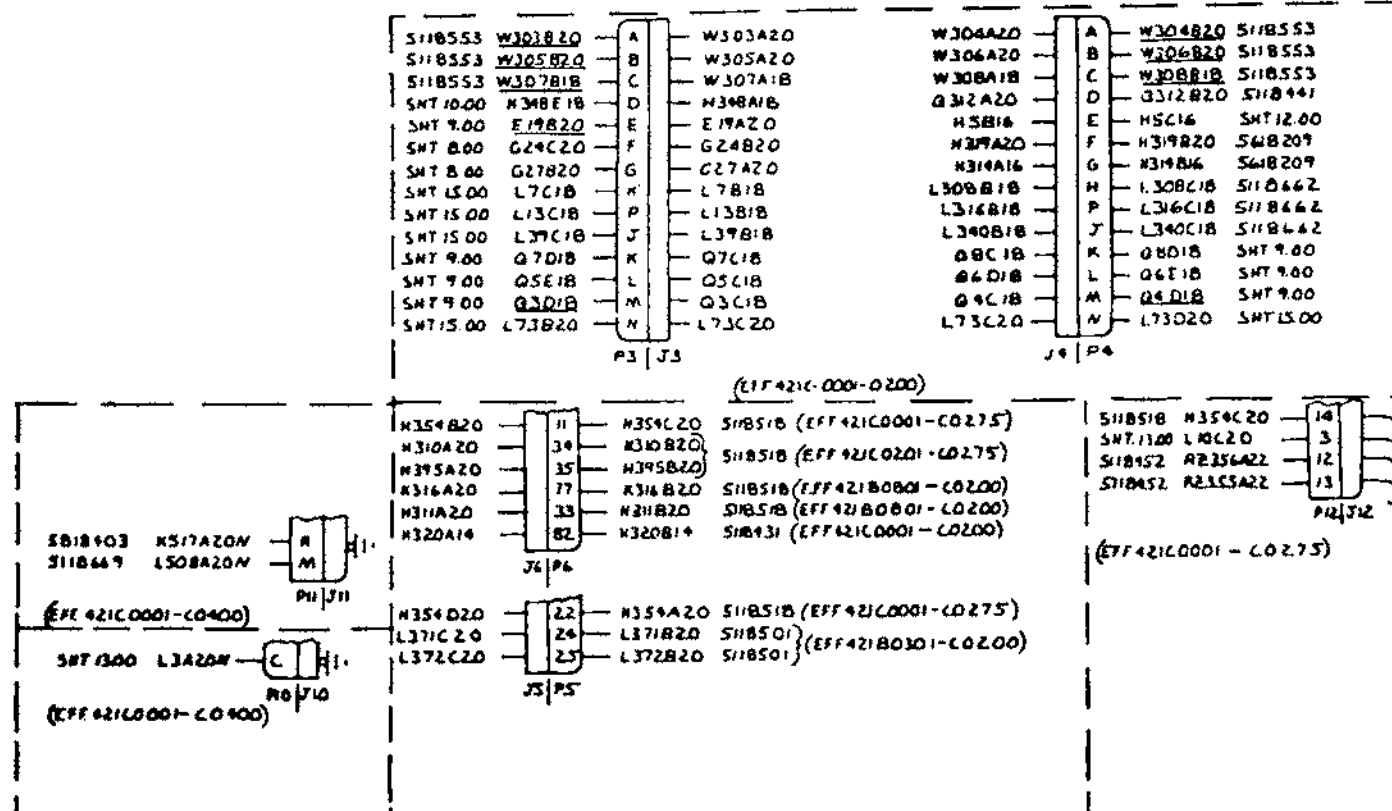
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SHT 14.00	L32C20	2	WHT/RED
SHT 14.00	L46A20	3	BROWN
SHT 16.01	L50G20	4	RED
SHT 16.01	L68B20	5	YELLOW
SHT 16.01	L67B20	6	BLUE

OVERHEAD LT CONN

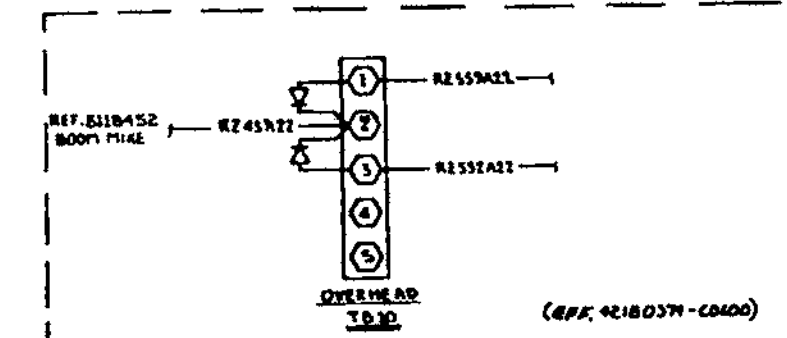
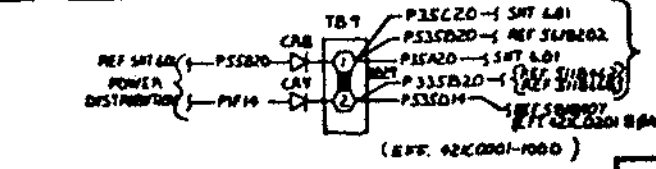
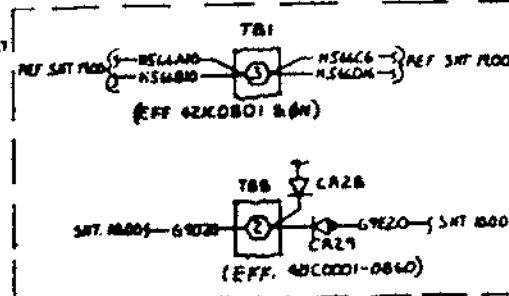
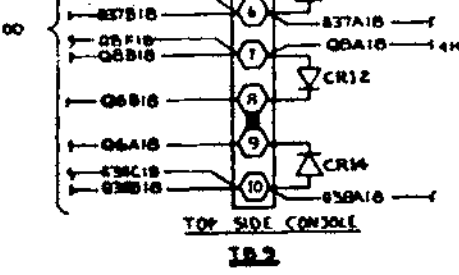
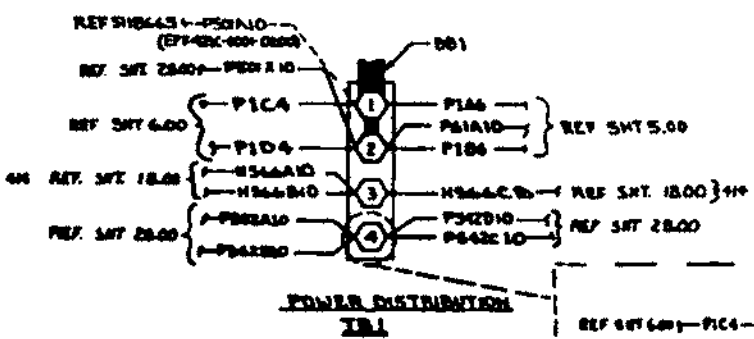
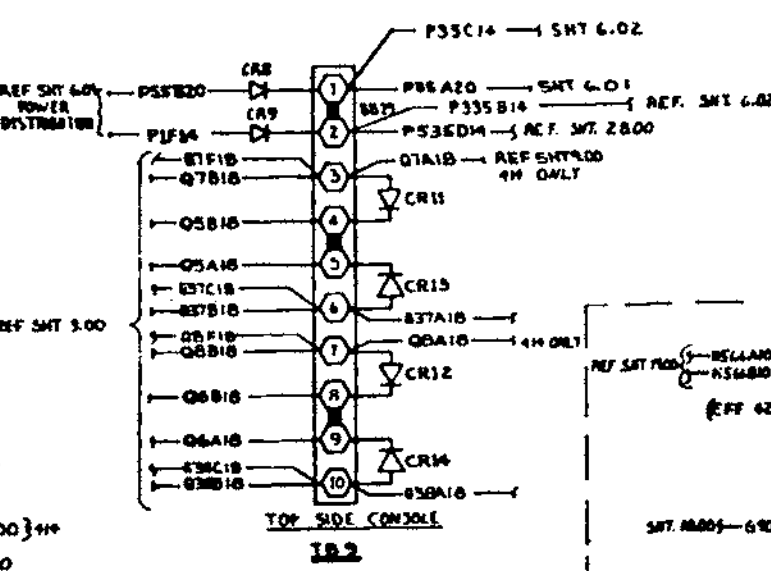
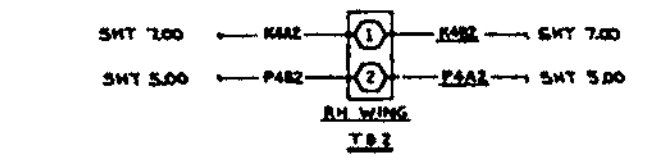
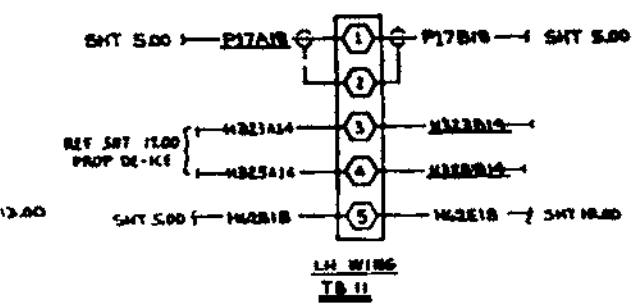
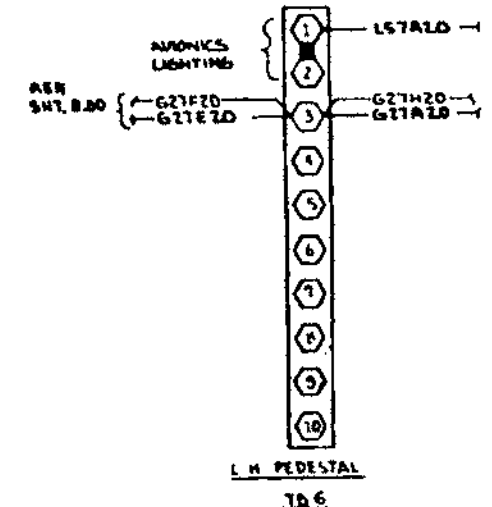
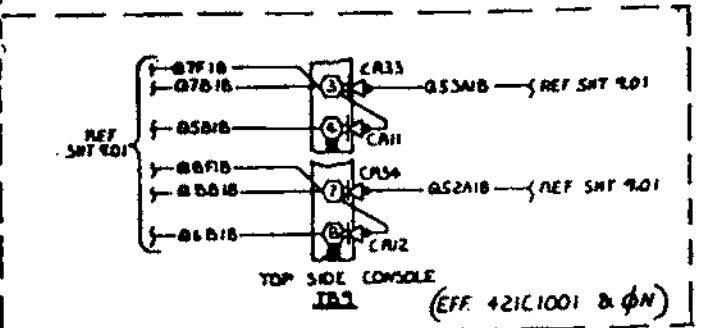
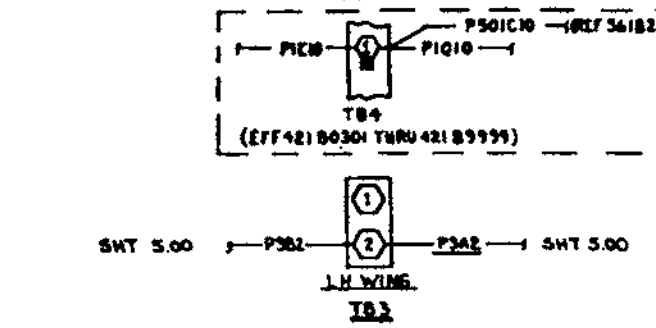
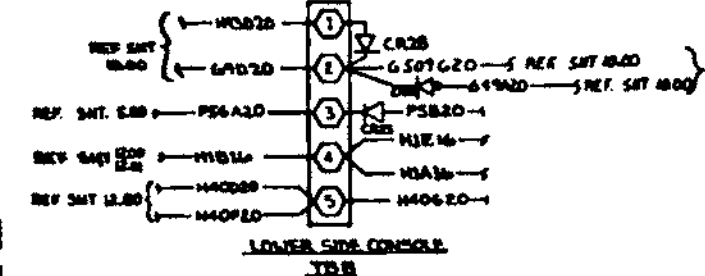
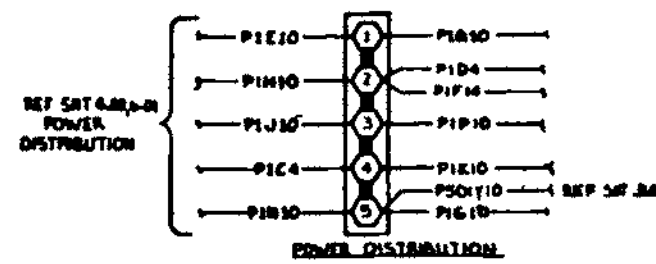
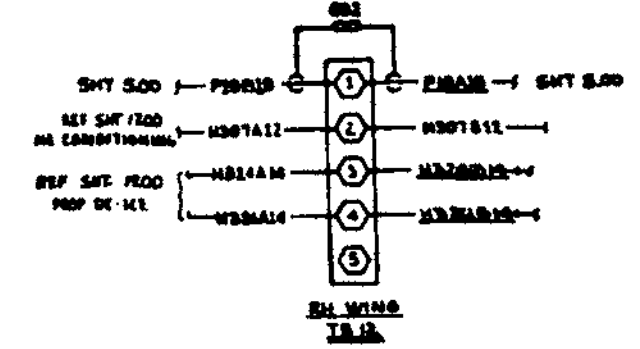
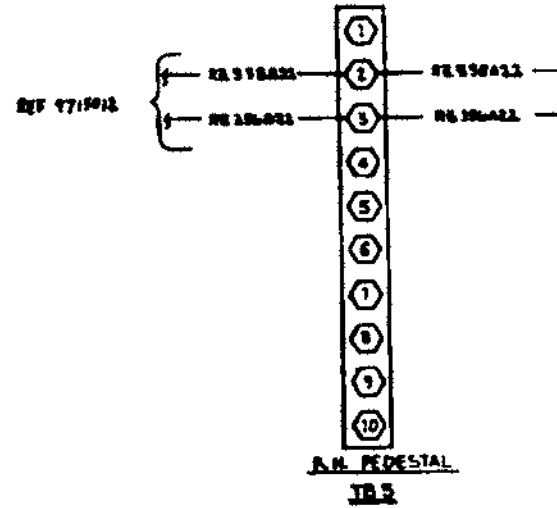
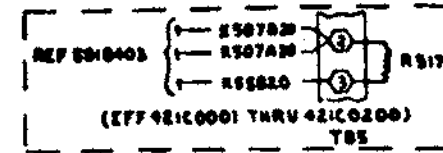
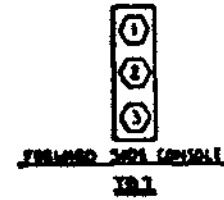
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Q	SHT 2.00
Q	SHT 3.00
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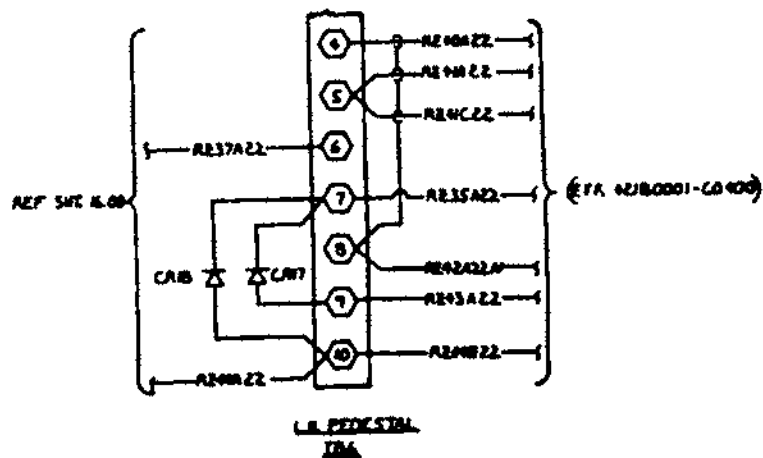


Cessna		AIRCRAFT CO.		P. O. BOX 770 WILLAGE SPRING OKLAHOMA 74064-0770	
TITLE CONNECTORS					
REV.	71379	QUANTITY	5118620		
REV. D		302 OF 500			

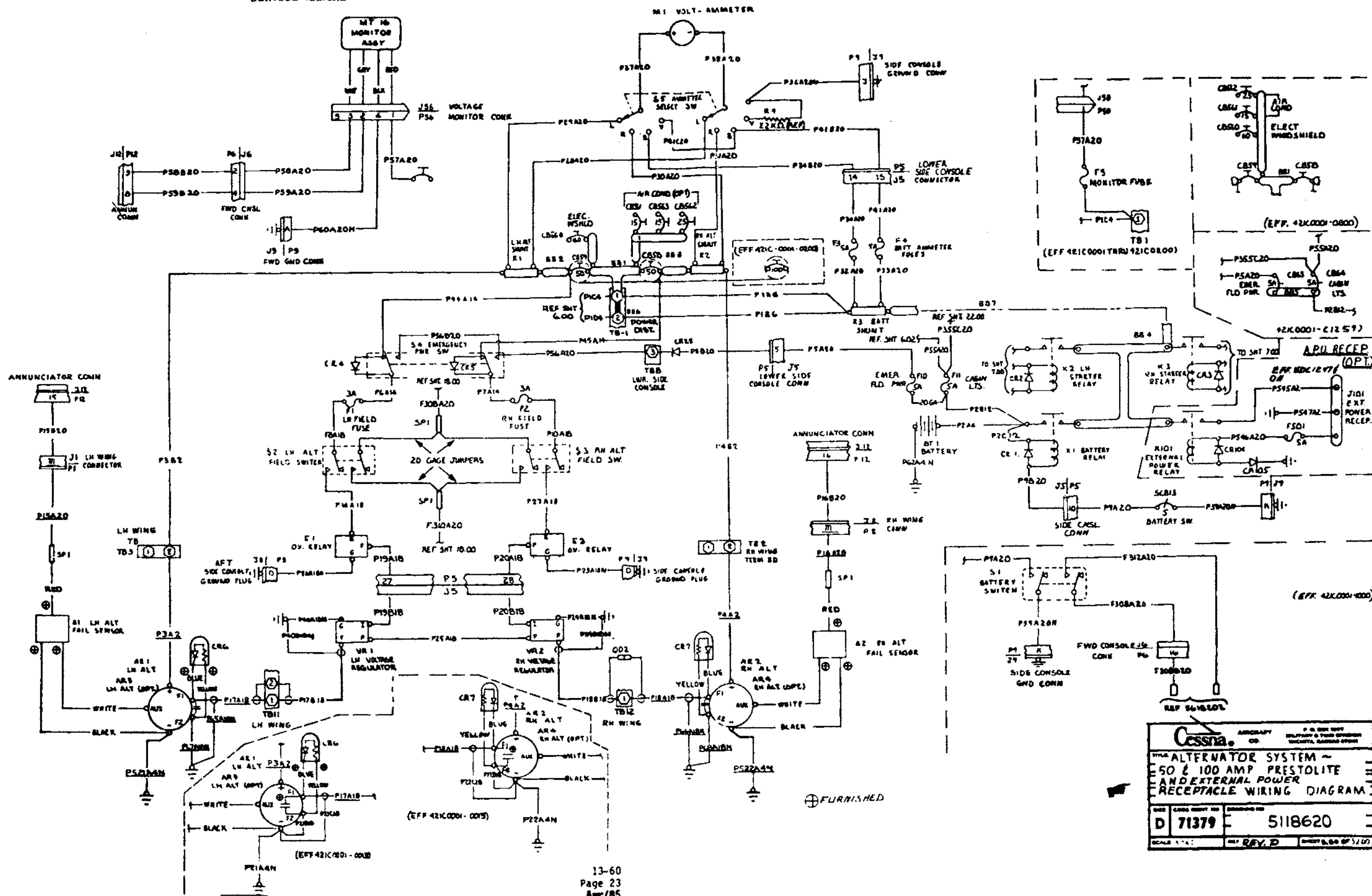


CESSNA AIRCRAFT COMPANY	
TERMINAL BOARDS	
DATE	5118620
REV	71379
BY	REV. D

SERVICE MANUAL



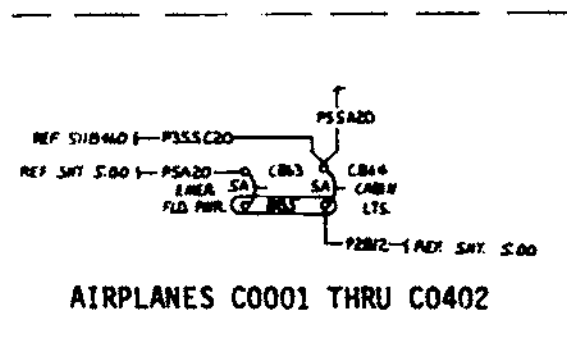
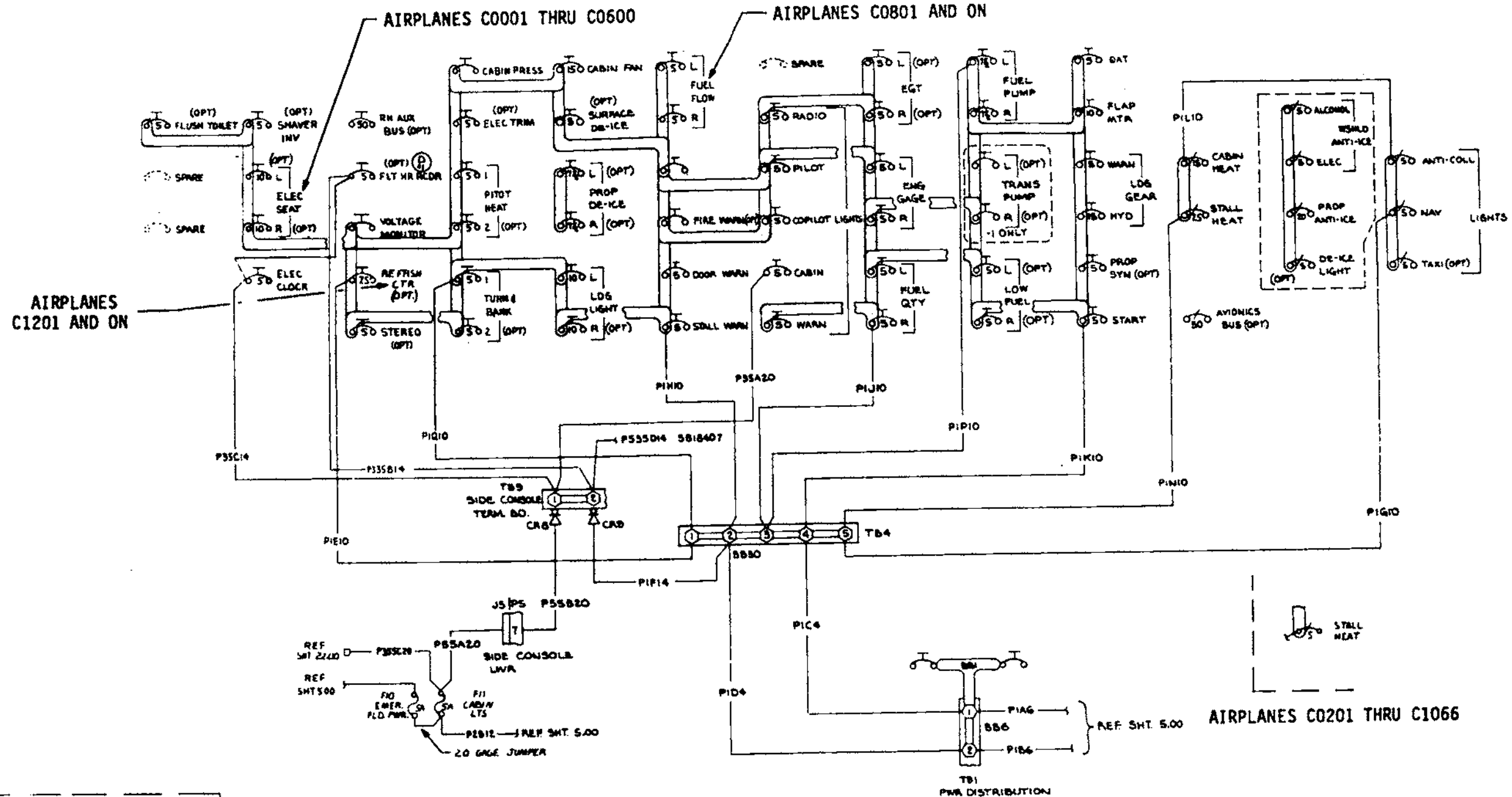
CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL



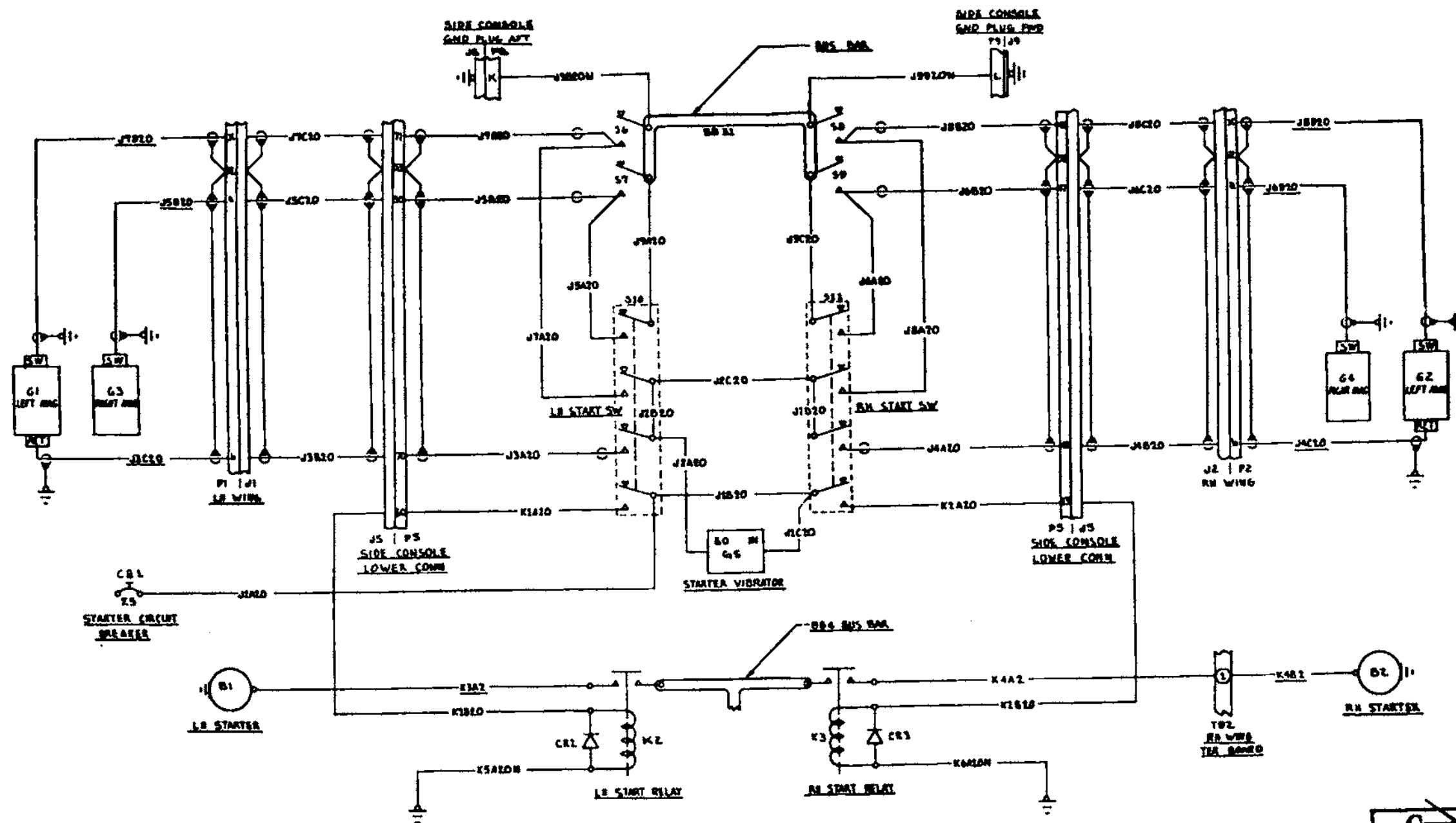
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CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL



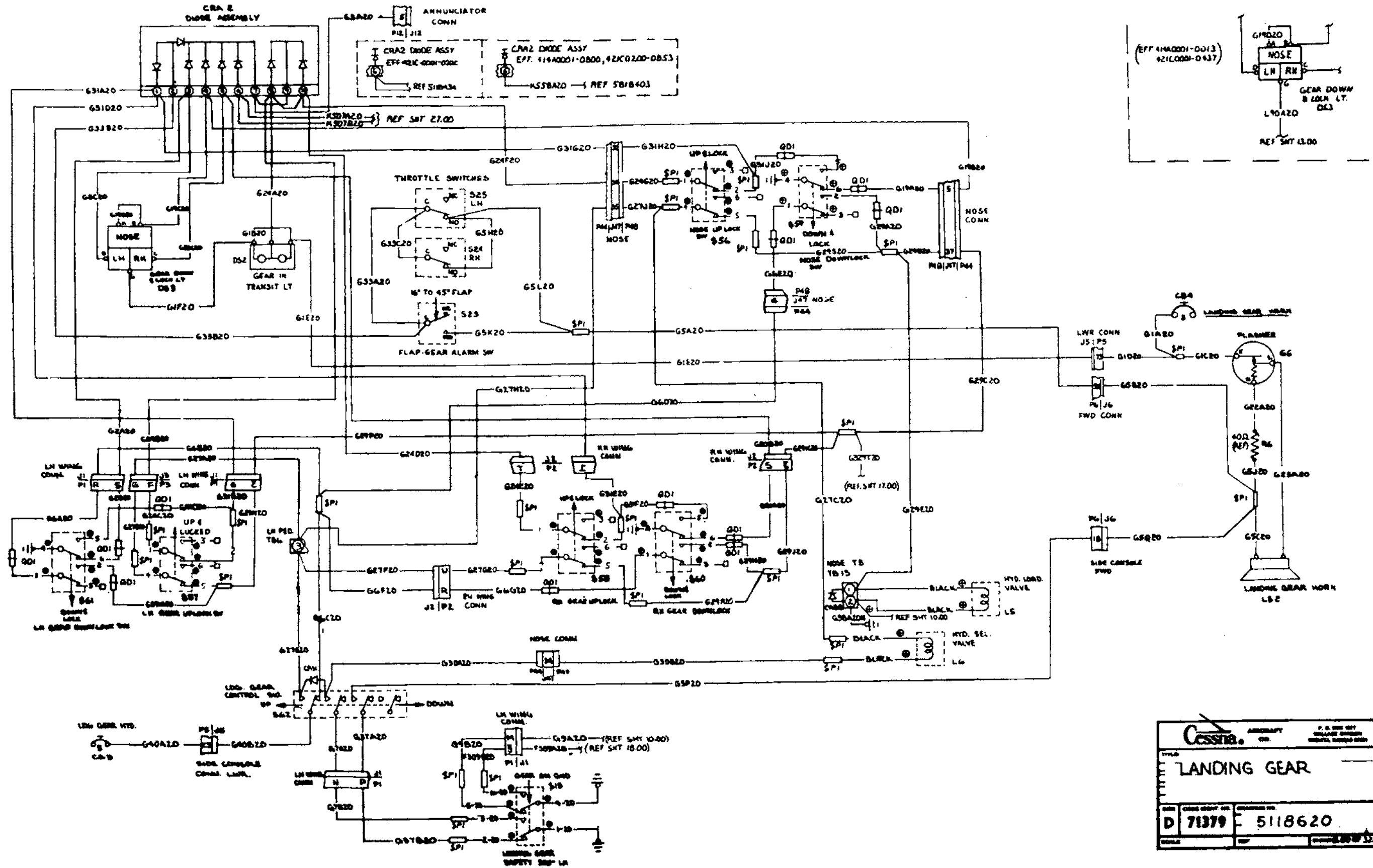
Cessna		AIRCRAFT CO.		A. B. BOWEN VILLAGE GREEN CHESHAM, CHESHIRE	
POWER DISTRIBUTION BUS WIRING DIAGRAM					
DATE	CODE	REVISION	NO.	DRAWING NO.	
D	71379			5118620	
SCALE		REV		SHEET 6 OF 32	



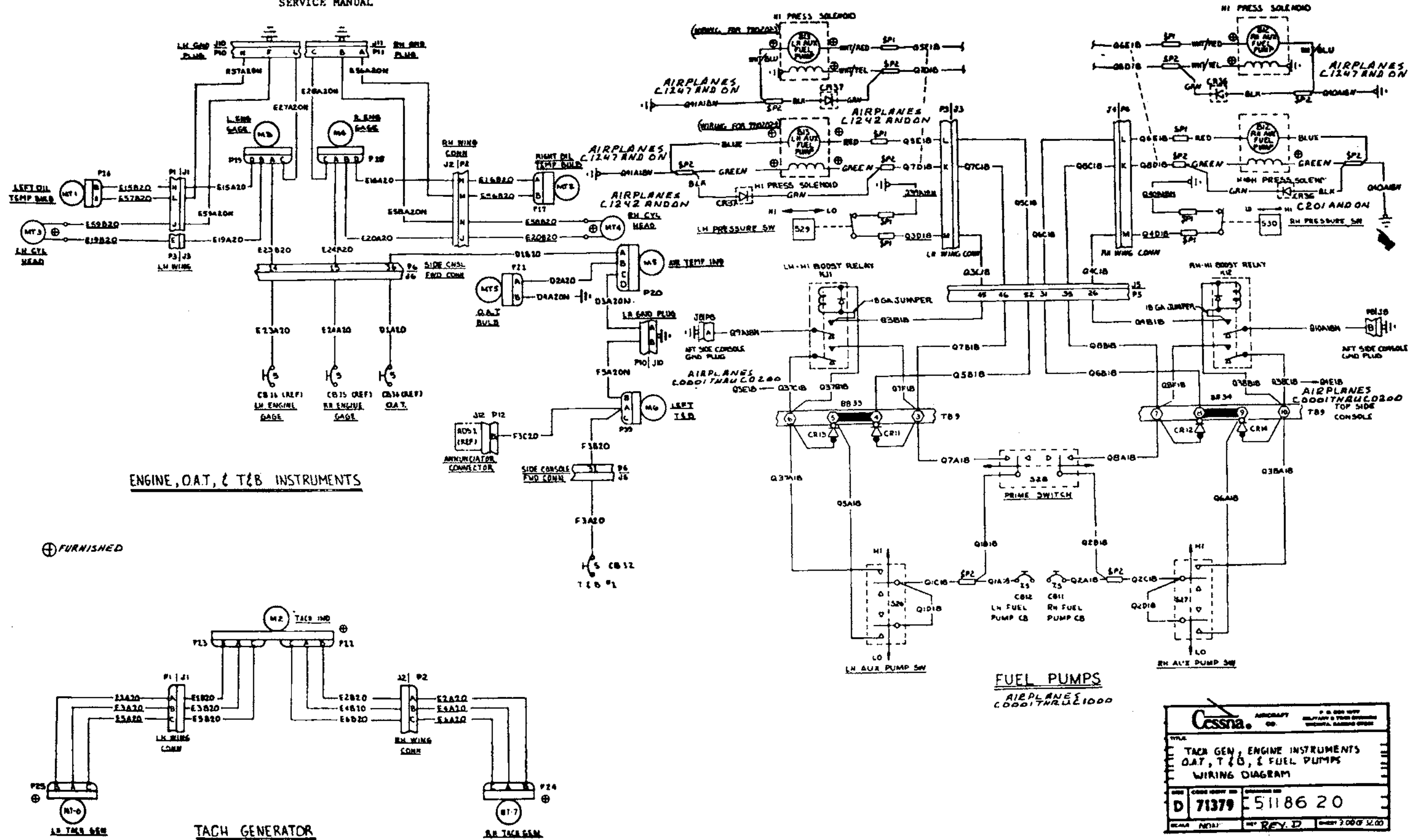
STARTER-IGNITION

Cessna		AIRCRAFT CO.	
STARTER-IGNITION WIRING DIAGRAM			
DATE	71379	REVISION	5118620
SCALE	NONE	REV.	1.00 08/22/00

CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL



CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL



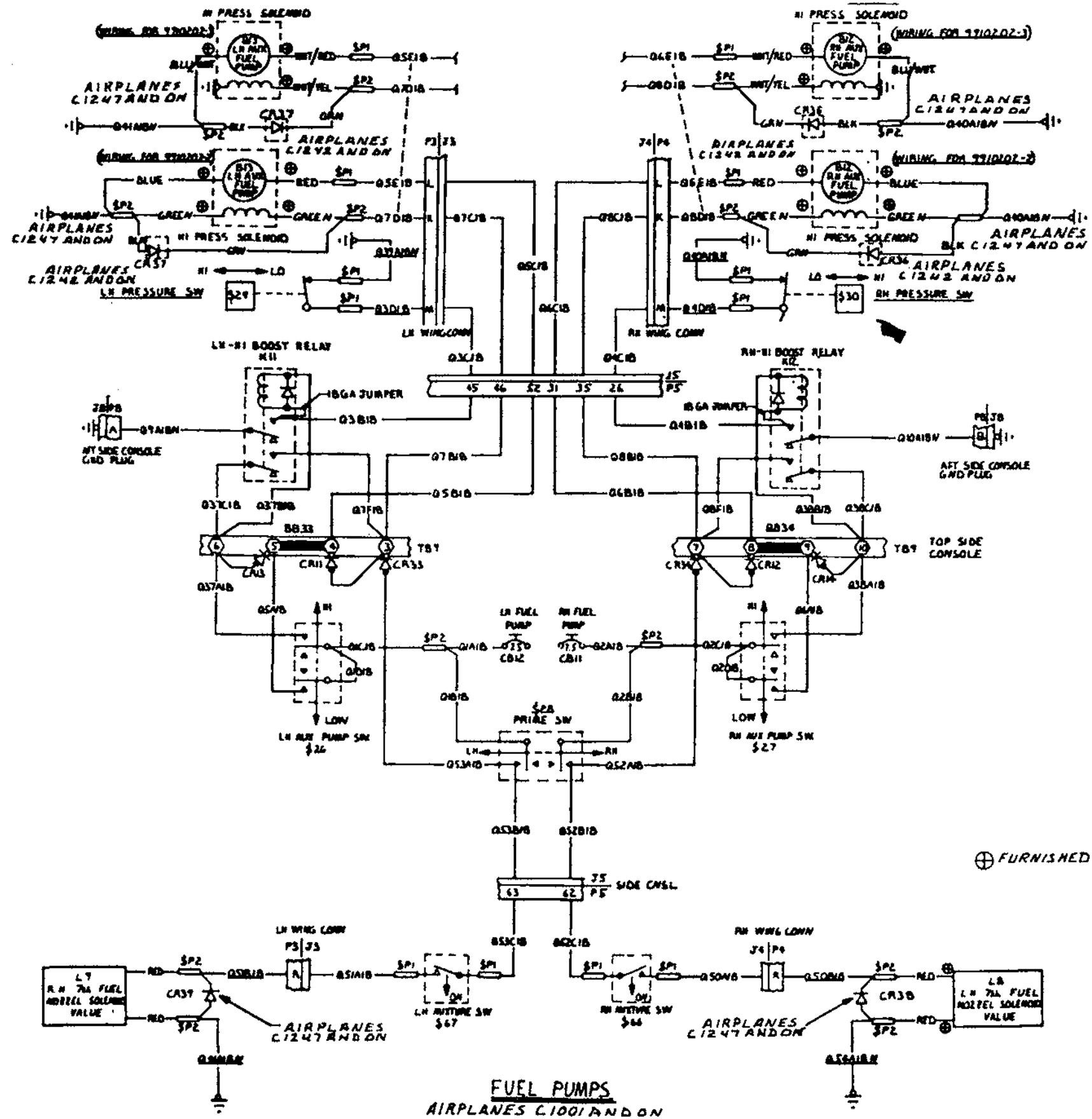
ENGINE, OAT, & T&B INSTRUMENTS

⊕ FURNISHED

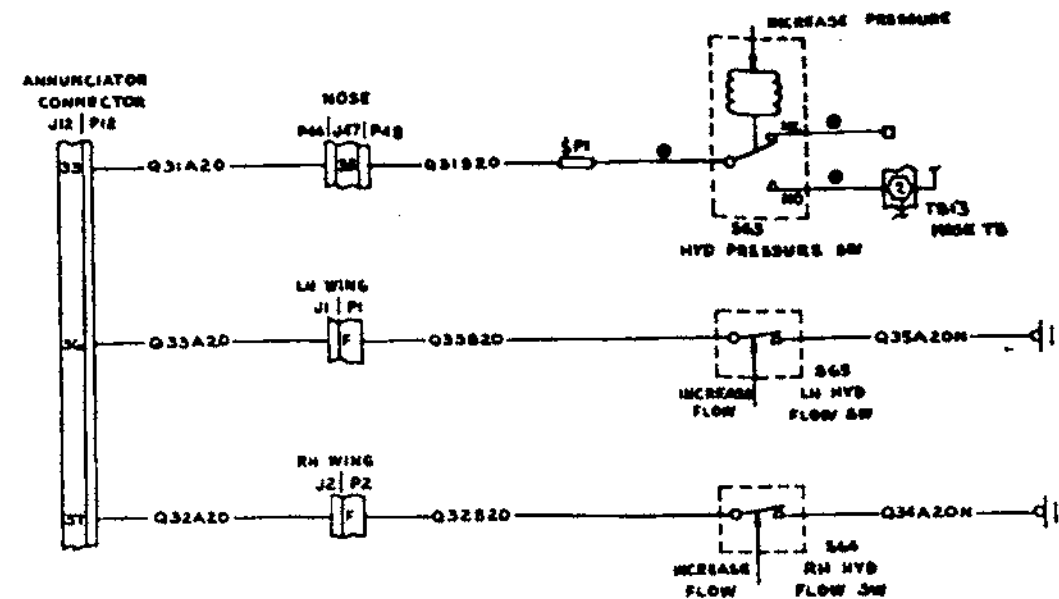
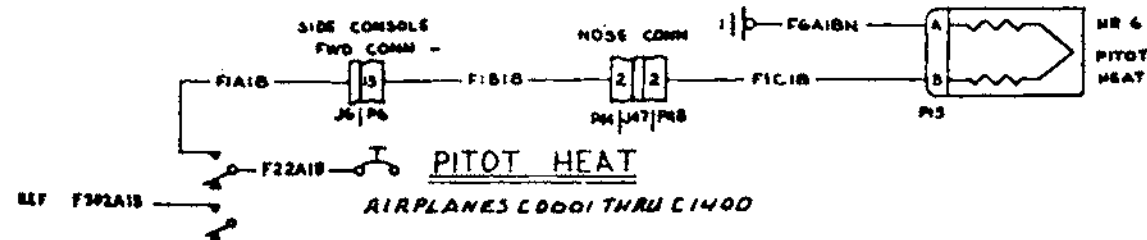
FUEL PUMPS

TACH GENERATOR

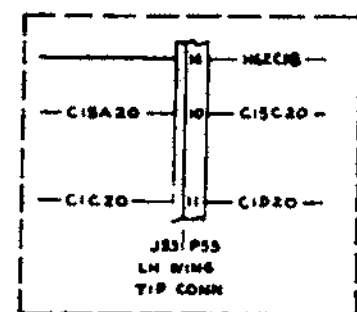
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TYPE			
TACH GEN, ENGINE INSTRUMENTS			
OAT, T&B, & FUEL PUMPS			
WIRING DIAGRAM			
DATE	CODE IDENT. NO.	REVISION NO.	
D	71379	51186 20	
REVISION	NOTES	REV. D	ISSUED 3.00 OF 32.00



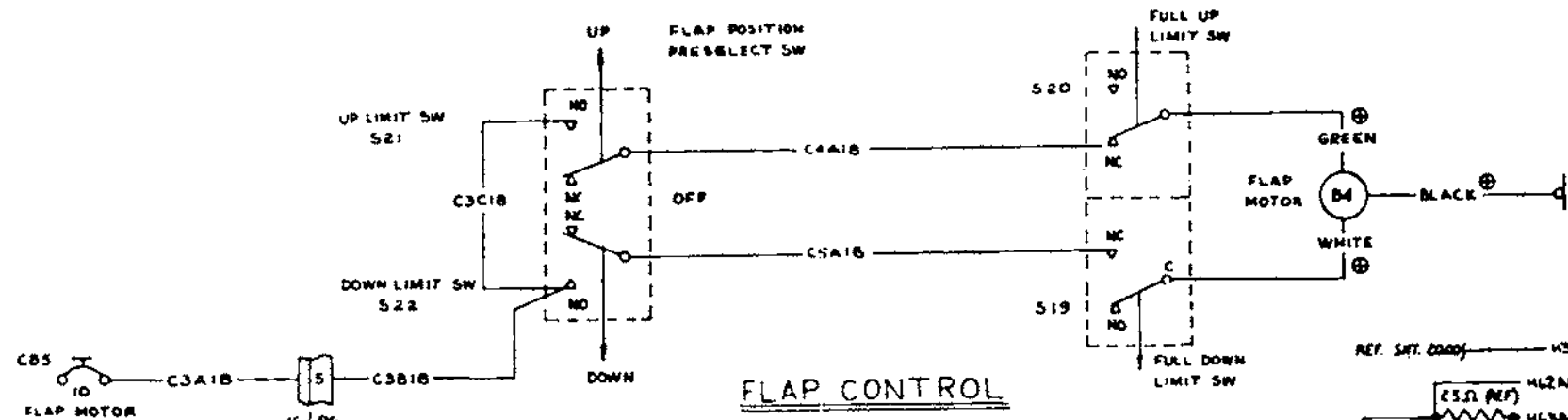
Cessna		AIRCRAFT CO.		P. O. BOX 700 WILLIAMSBURG, INDIANA, 46783-0700	
FUEL PUMPS					
DATE	ENGINE IDENT. NO.	CHARTERED NO.			
D	71379	5118620			
REV. 20		9.01 OF 32.00			



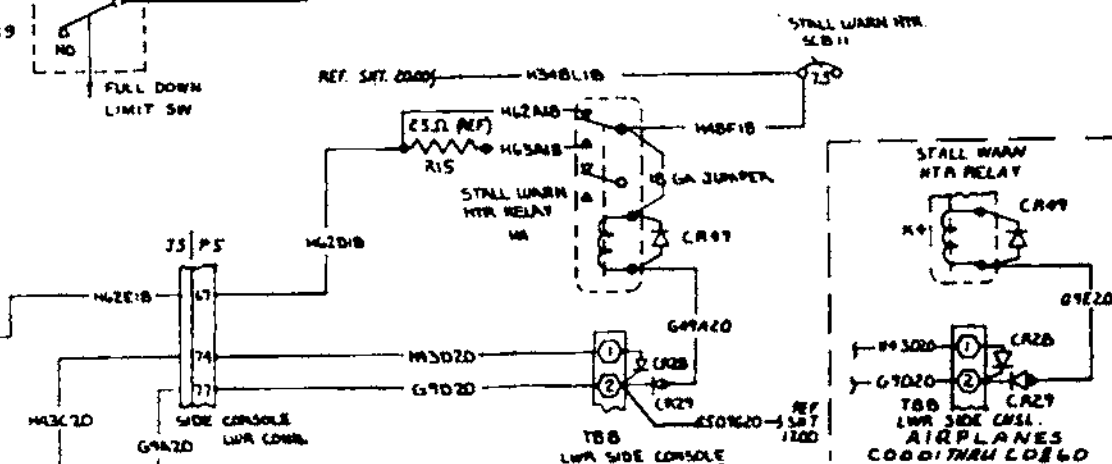
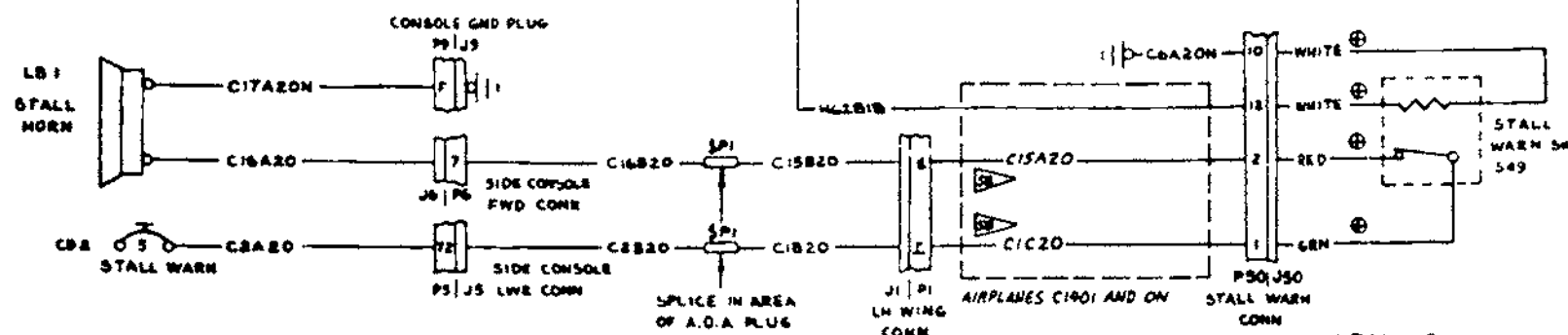
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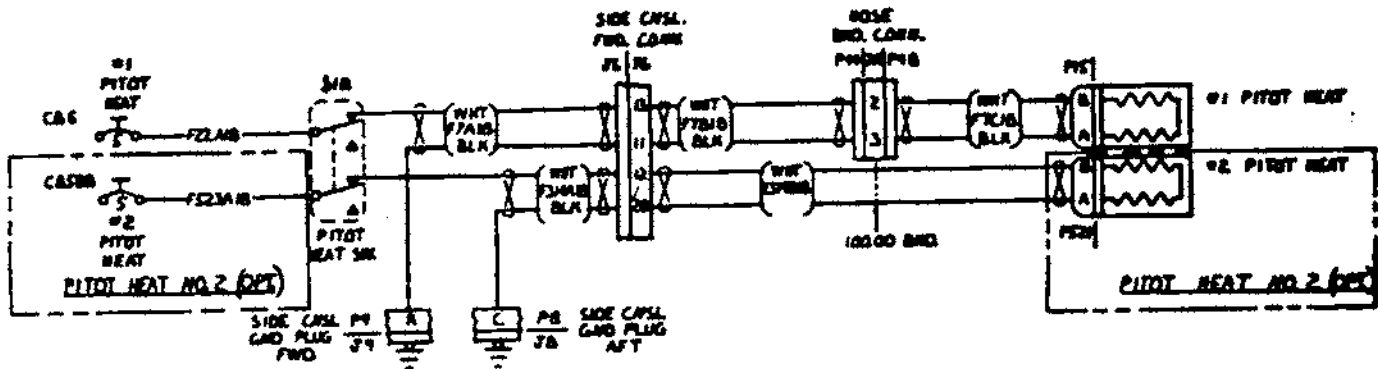
AIRPLANES C1001 THRU C1400



AIRPLANES C1001 THRU C1066

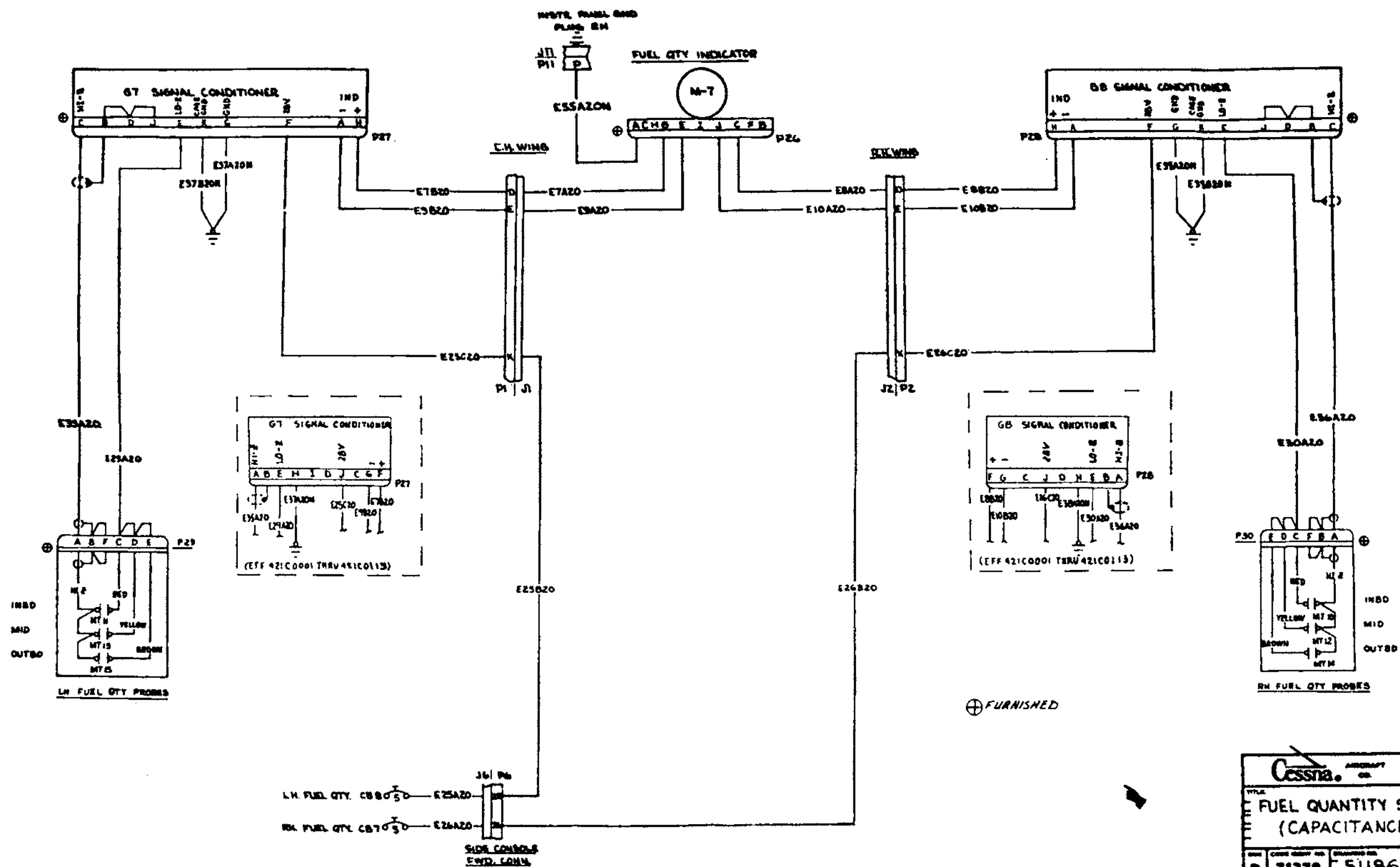


Cessna		AIRCRAFT CO.	
PITOT HEAT, FLAP CONTROL, STALL & HYDRAULIC WARNING WIRING DIAGRAM			
DATE	CODE REVISION	REVISION NO.	
D	71379	5118620	
SCALE	REV	REV	REV
	REV	REV	REV

PITOT HEAT

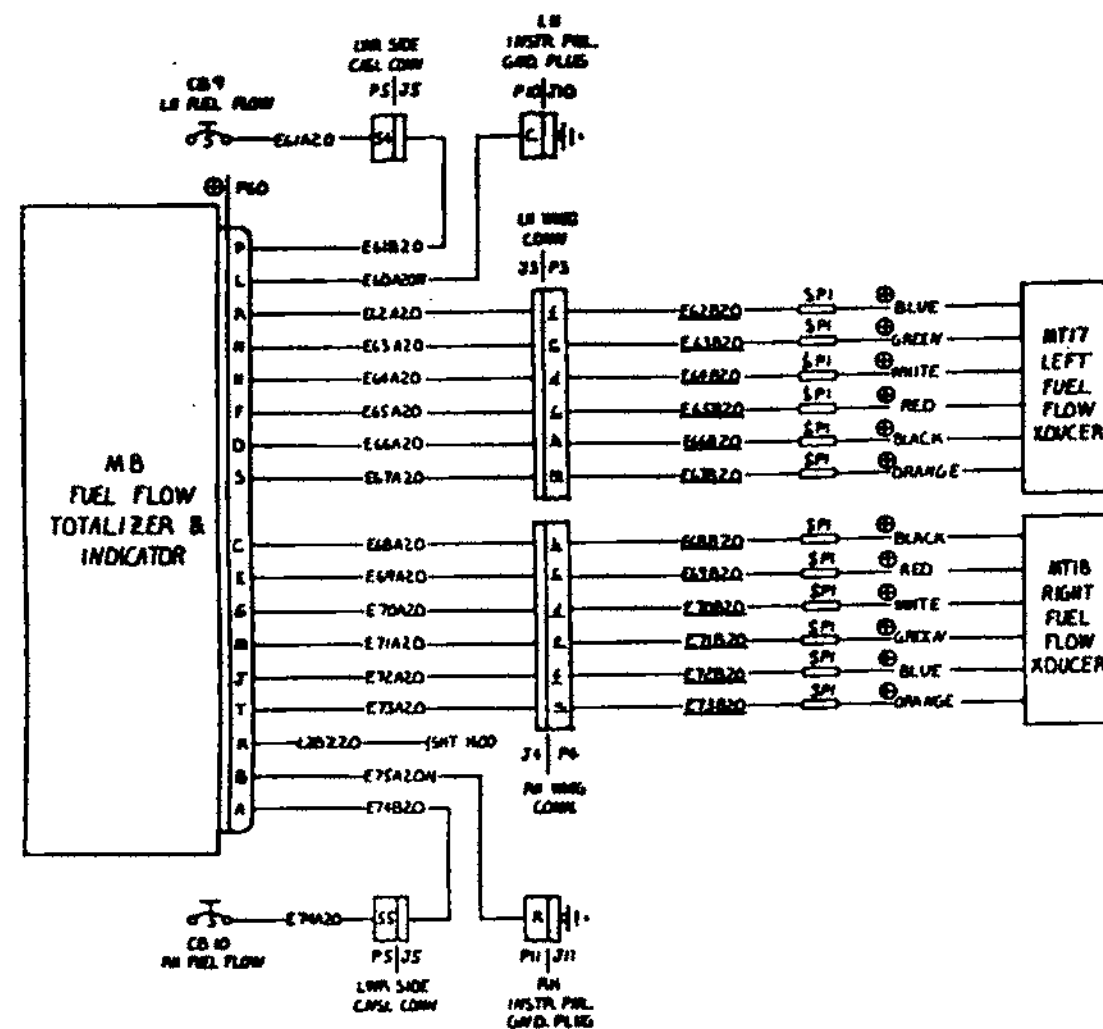
421C 1461 AND ON

Cessna		AIRCRAFT CO.		P. O. BOX 700 TULSA, OKLA. 74101	
PITOT HEAT					
DATE	ORDER NO.	Drawing No.			
D	71379	5118620			
		REV. D		10.01 OF 12.00	



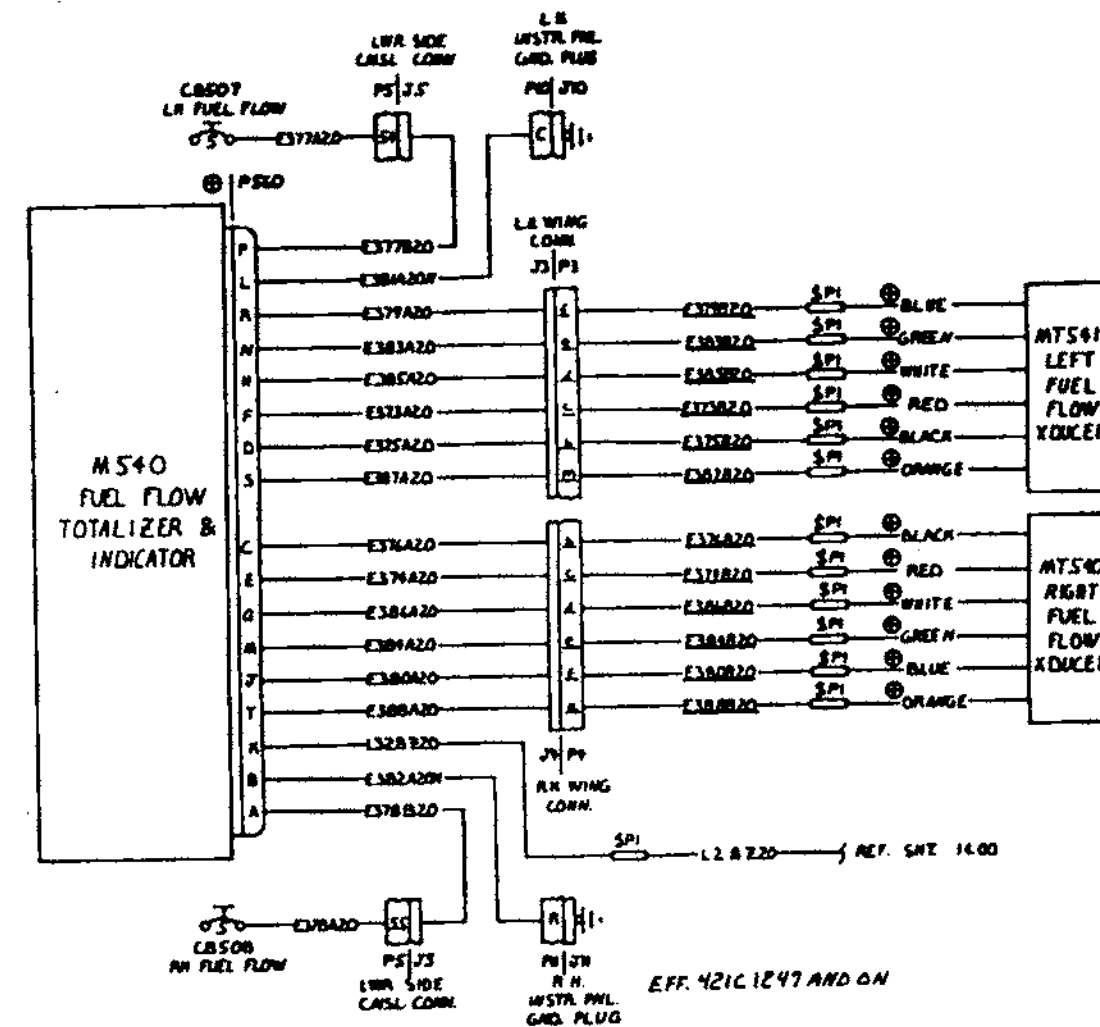
FUEL QUANTITY SYSTEM

Cessna		AIRCRAFT CO.		P. O. BOX 1077 WILSONVILLE, OREGON 97150	
FUEL QUANTITY SYSTEM (CAPACITANCE)					
DATE	71379	REVISION	5118620		
SCALE	NONE	REV	REV. 3	SHEET 11 OF 31	



FUEL FLOW
(EFF. 421C0801 & ON)

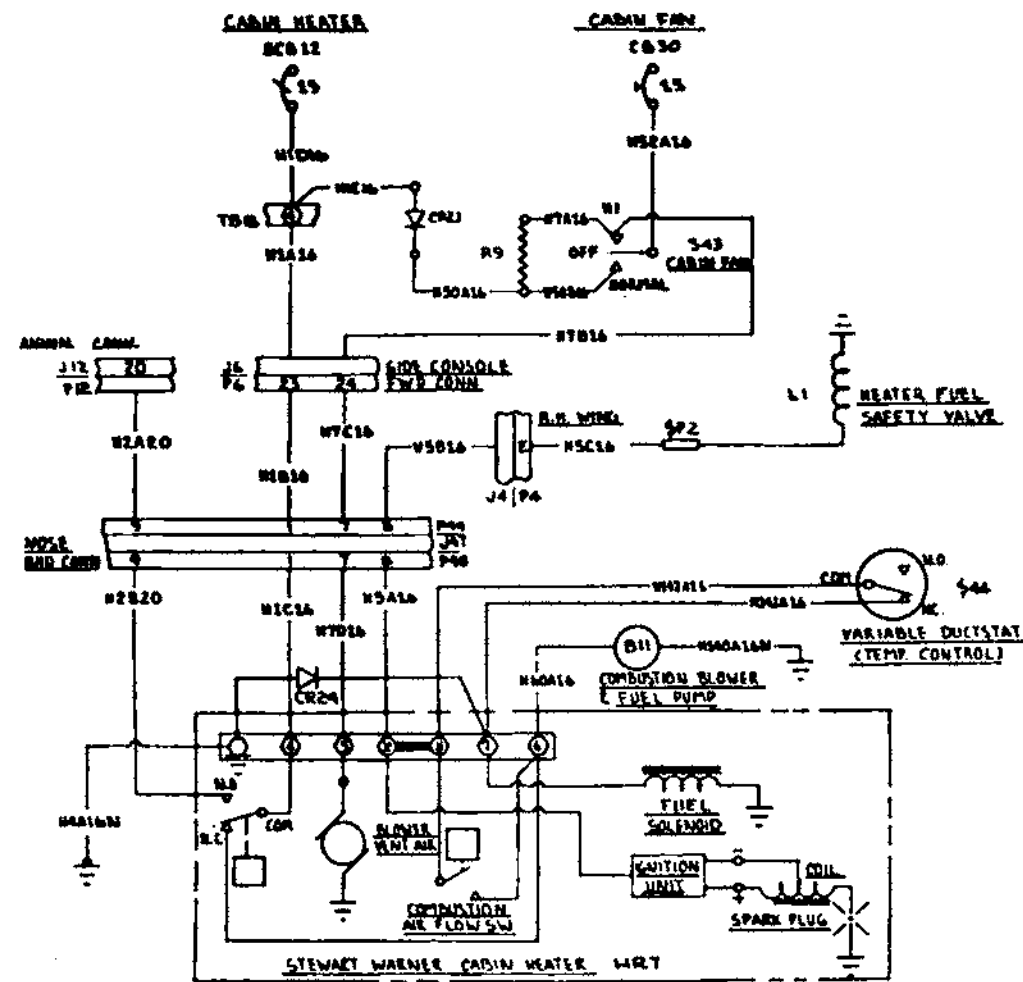
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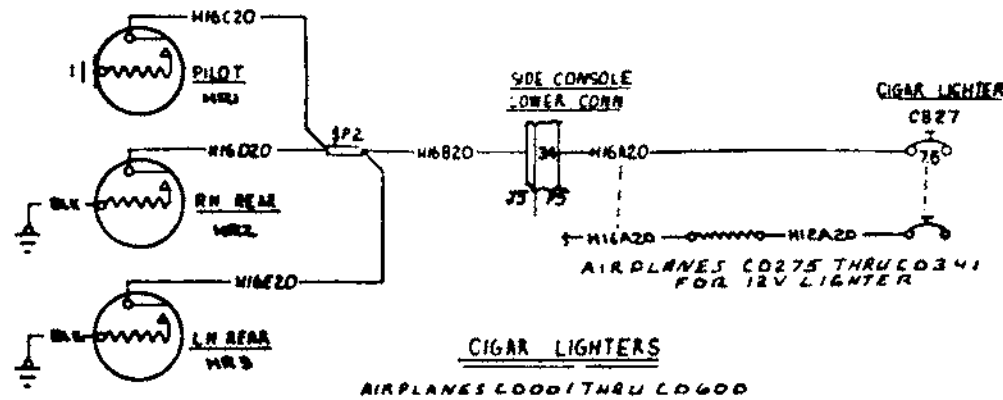
FUEL FLOW (OPT)

Cessna		AIRCRAFT CO.		P. O. BOX 100 TOLSON, MISSOURI 65150	
TITLE FUEL FLOW					
DATE D	CHANGE NUMBER 71379	DATE E	CHANGE NUMBER 5118620		
REV. D				11.01 OF 32.00	

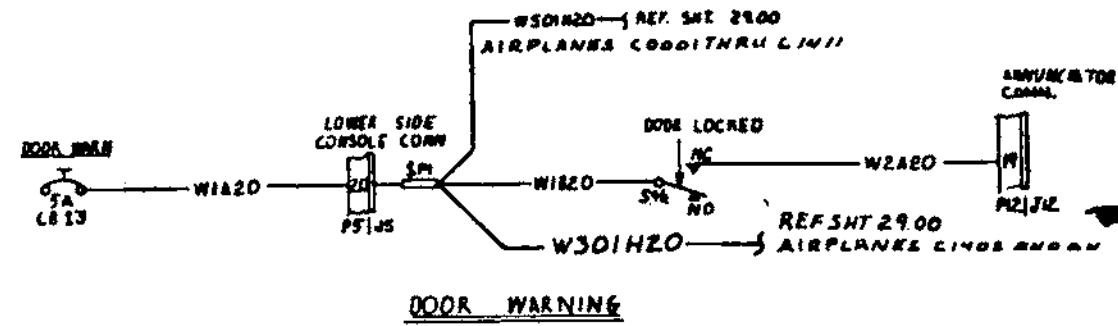
CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL



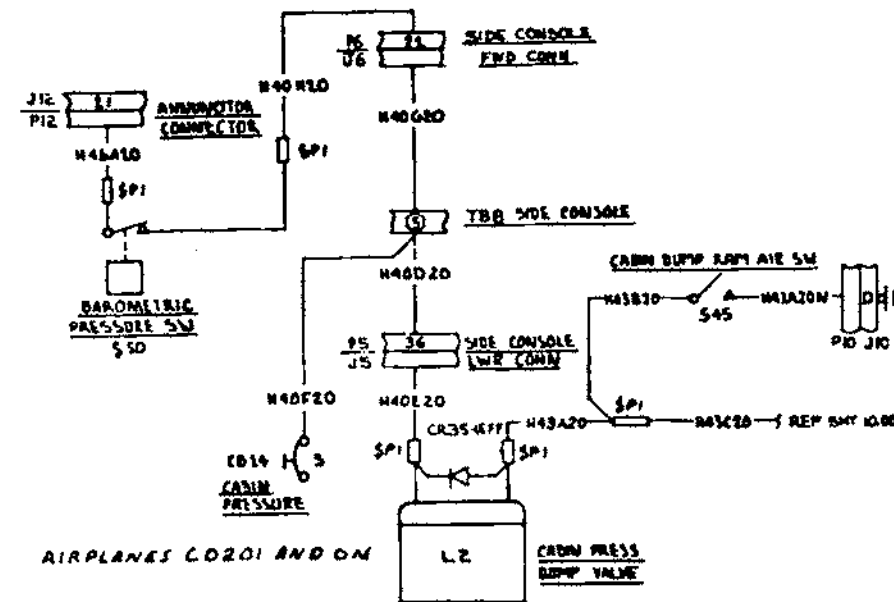
CABIN HEATER
AIRPLANES C0001 THRU C0200



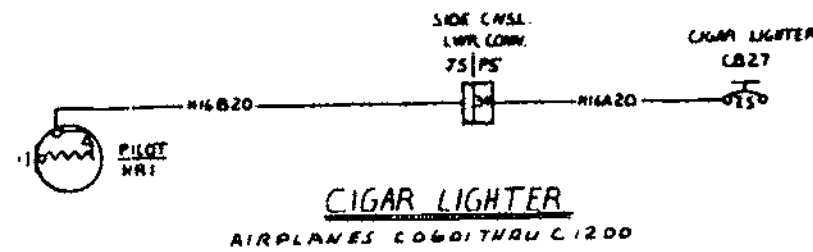
CIGAR LIGHTERS
AIRPLANES C0001 THRU C0600



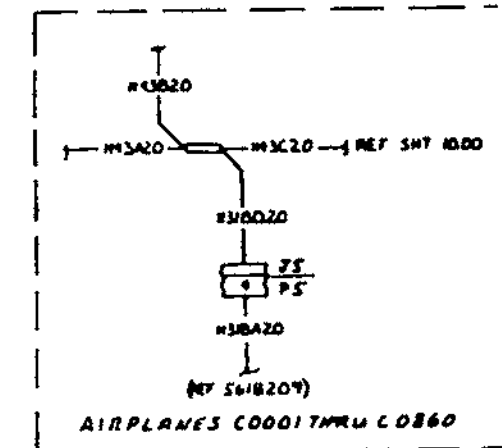
DOOR WARNING



CABIN PRESSURE



CIGAR LIGHTER
AIRPLANES C0601 THRU C1200

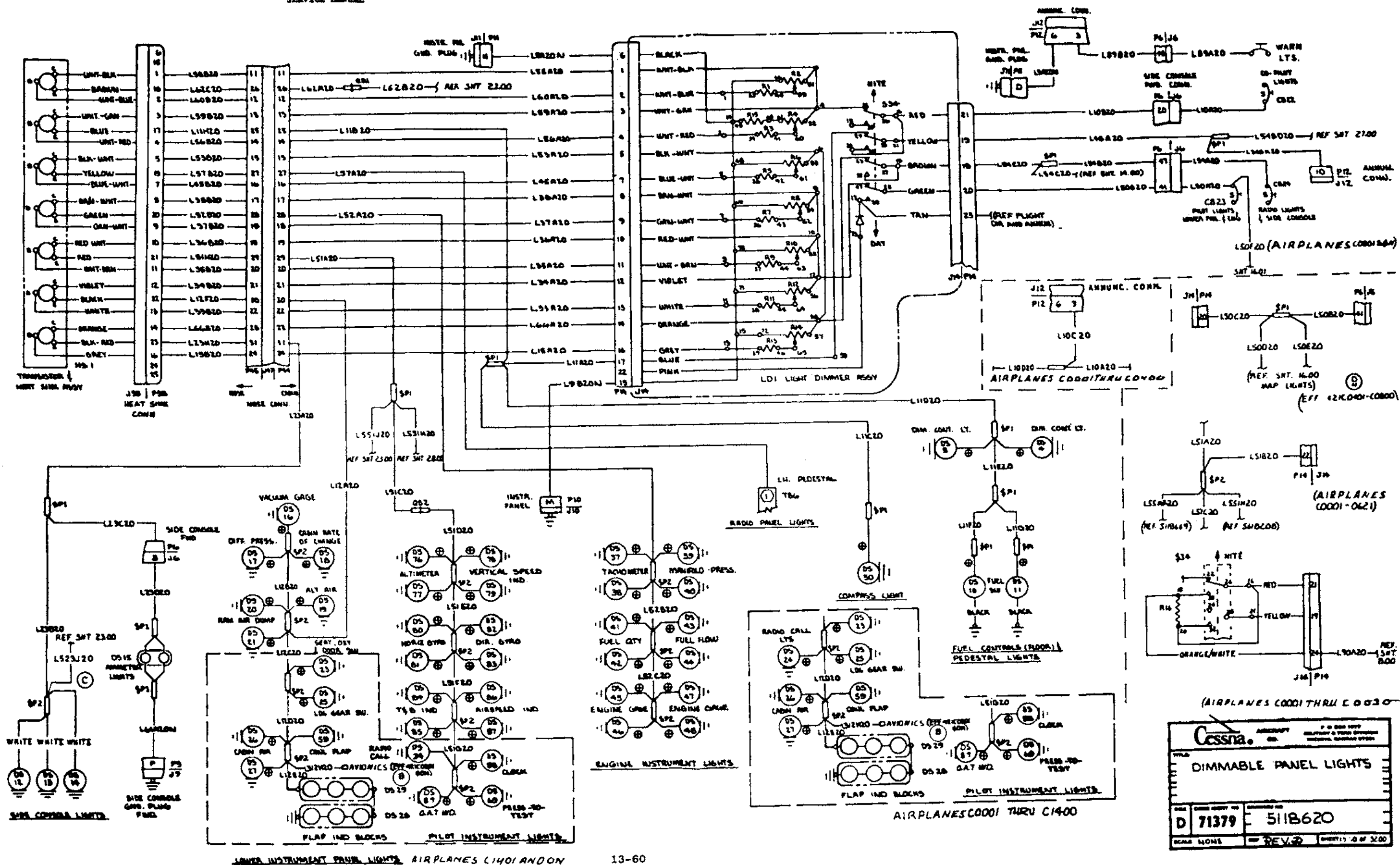


AIRPLANES C0001 THRU C0860

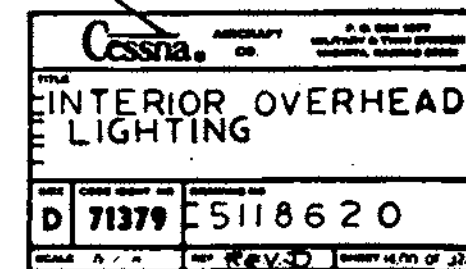
Cessna		AIRCRAFT CO.	
P. O. BOX 1000 MILWAUKEE, WISCONSIN 53201			
TITLE CABIN PRESSURE, CABIN HEAT, CIGAR LIGHTERS & DOOR WARNING WIRING DIAGRAM			
DATE D	DATE REVISION 71379	QUANTITY 5118620	
SCALE NONE	REV 2	BY V. J.	CHANGED BY 12 20 OF 32 00



Cessna.		AIRCRAFT	P.O. BOX 1077 TULSA, OKLAHOMA 74101
MODEL		CD.	ORIGINAL, REPAIR, REBUILD
CABIN HEATER ~ WIRING DIAGRAM			
QTY	CD# IDENT NO	REPAIR NO	
D	71379	5118620	
		REV. D	120101E120



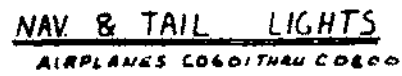
Cessna	
DIMMABLE PANEL LIGHTS	
Part No. D 71379	Part No. 5118620
Scale NONE	Rev. 20



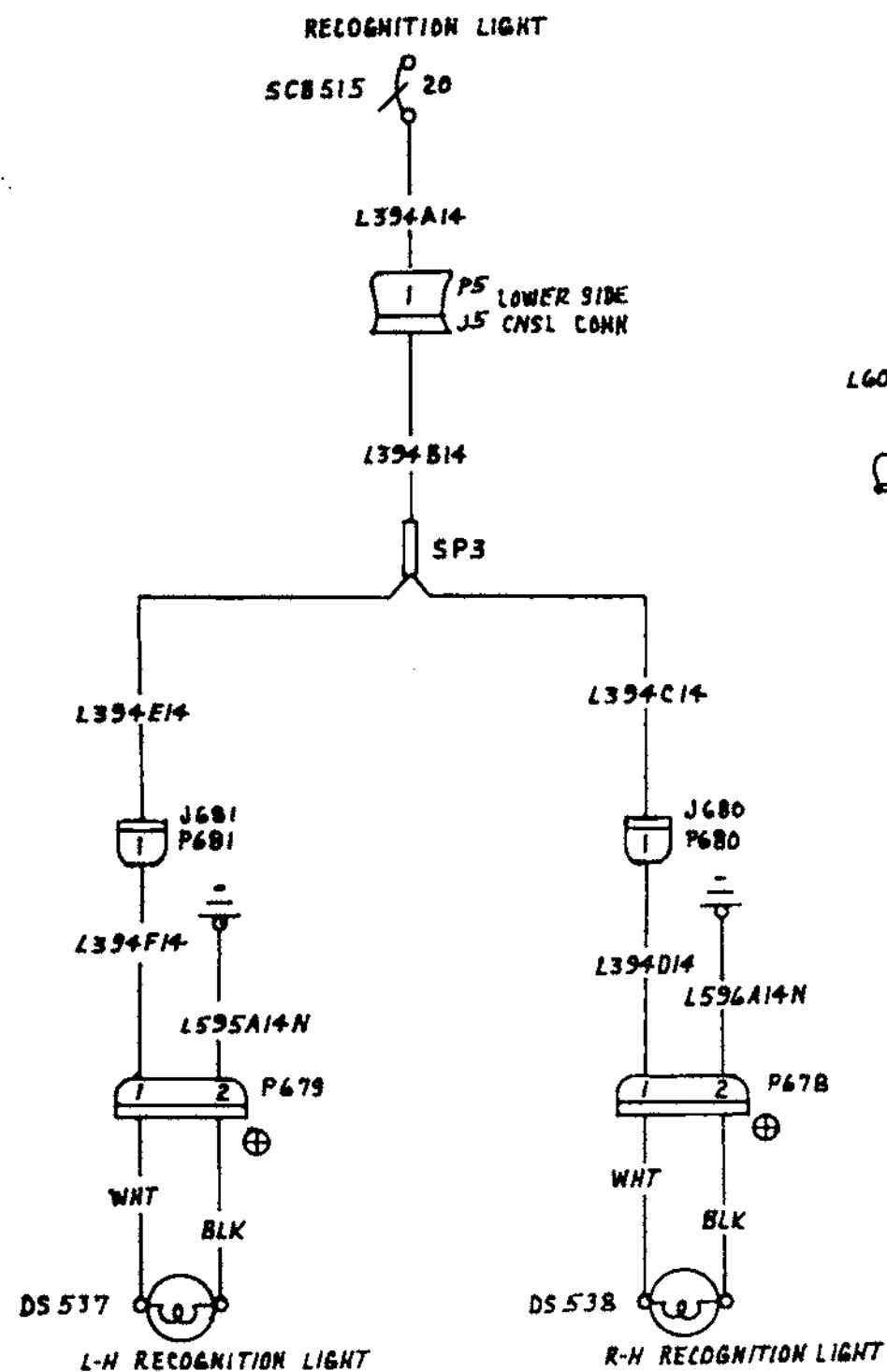
AIRPLANES C0001 THRU C1400



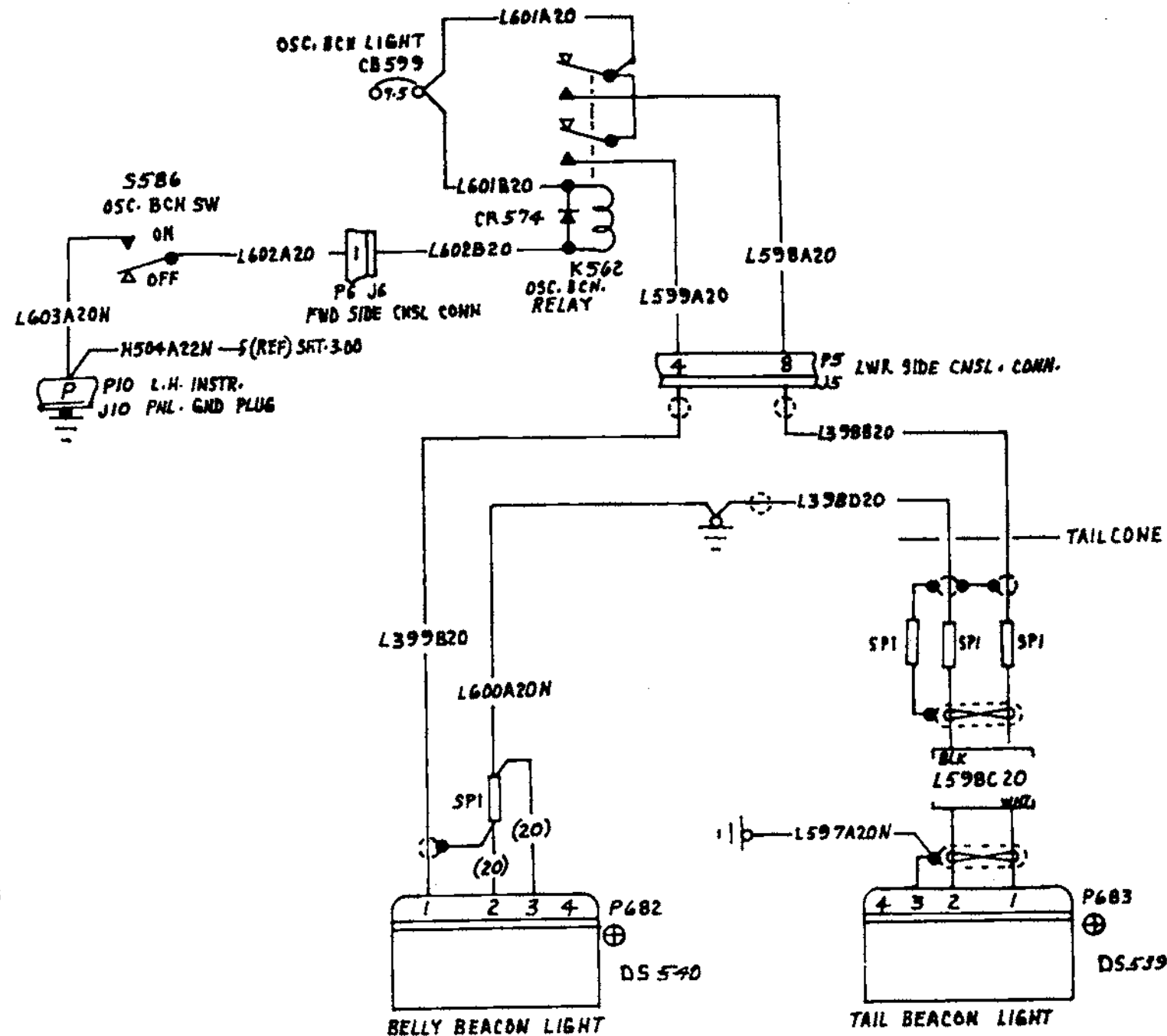
		AIRCRAFT NO.		P. O. BOX 1077 TAMPA, FLORIDA 33601	
TITLE					
ANTI COLL & NAV LIGHT					
S/N D	DATE BUILT 71379	EQUIPMENT NO. 5118620			
SCALE 80%	NAME NAV	WEIGHT 15.00 OF 32			



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Apr/85



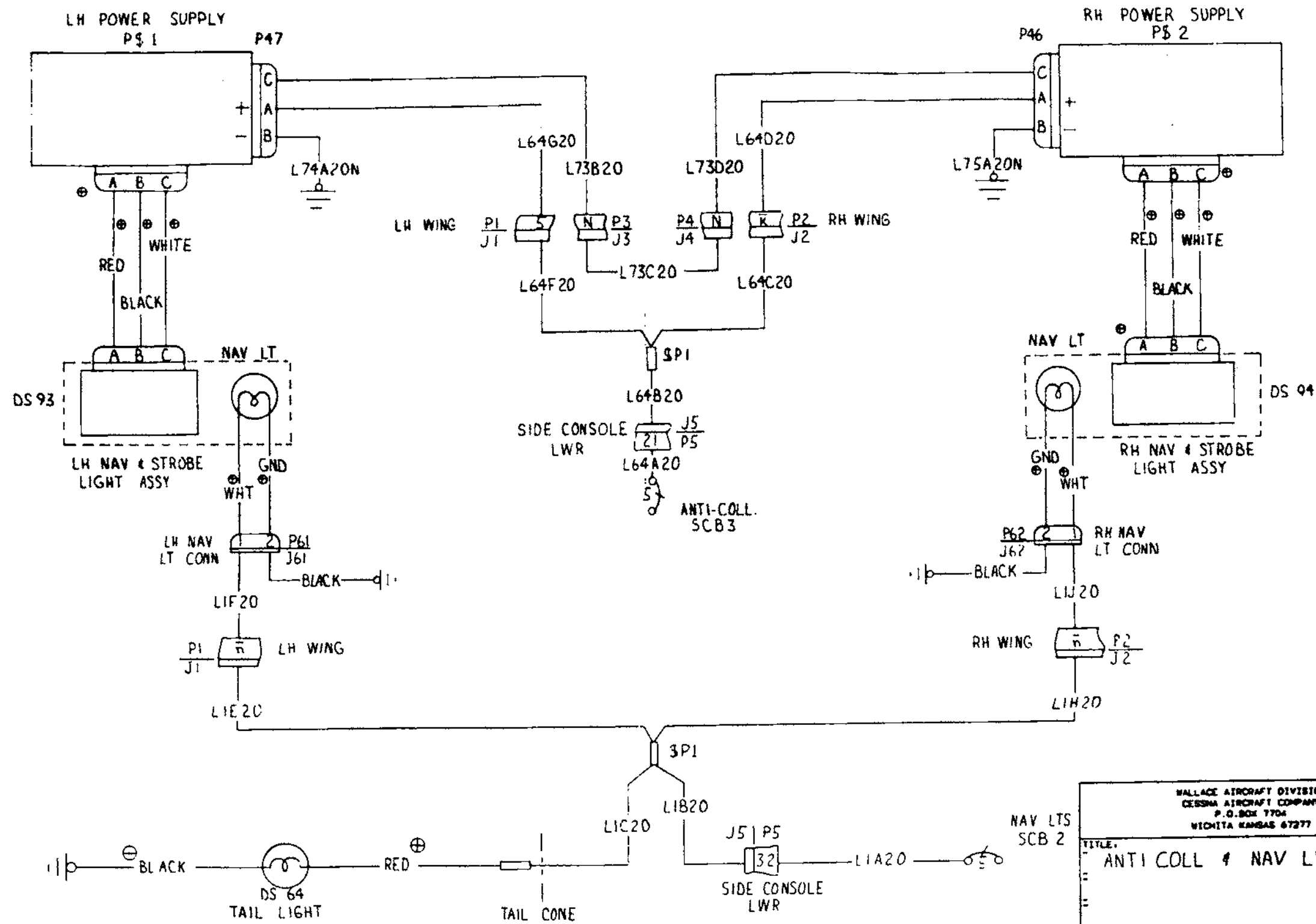
RECOGNITION LIGHTS



OSCILLATING BEACON LIGHTS
AIRPLANES C1801 AND ON

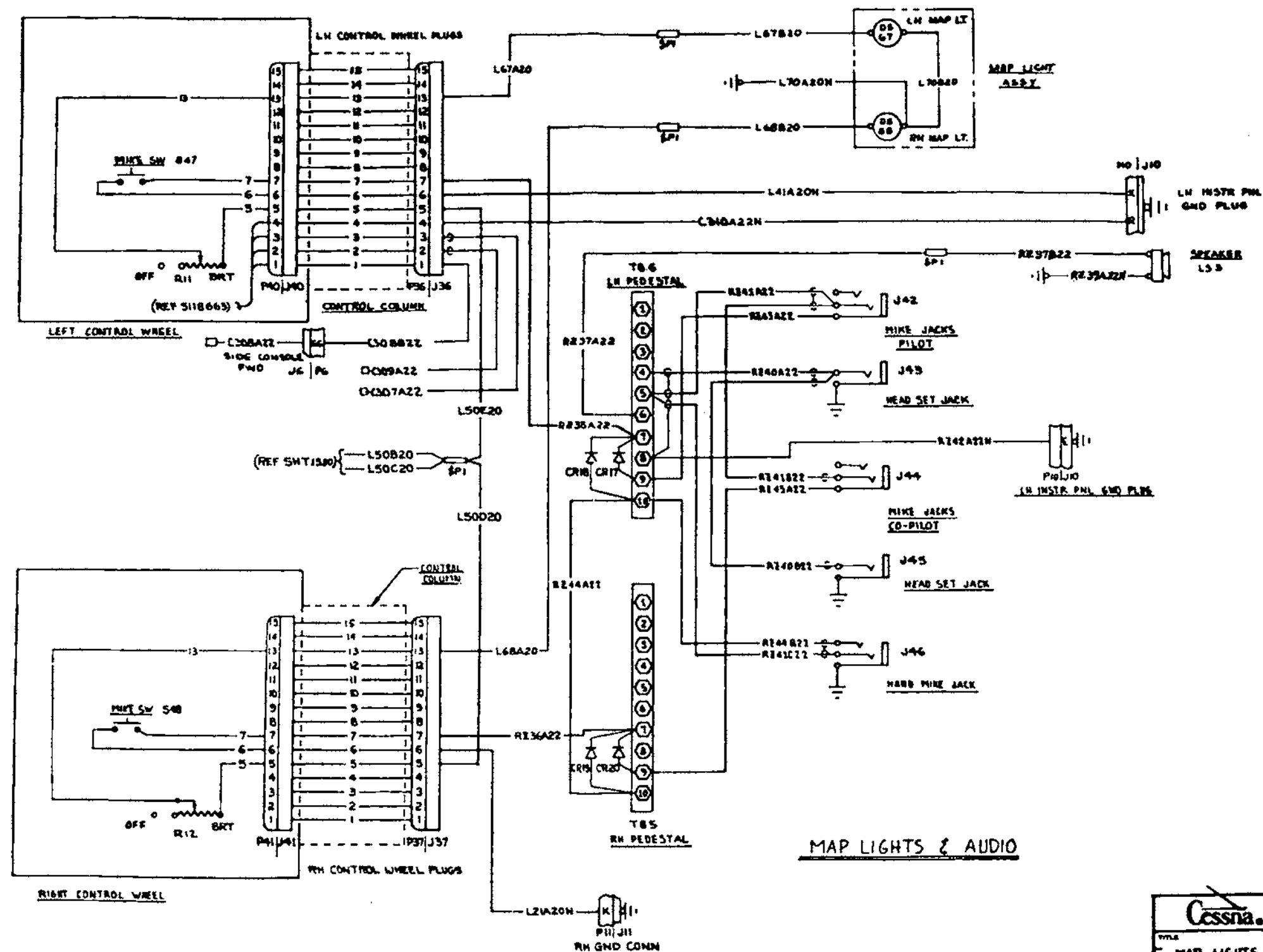
ILLUSTRATION DIVISION CESSNA AIRCRAFT COMPANY P.O. BOX 7704 MICHIGAN 48107		
TITLE: RECOGNITION LIGHTS & OSCILLATING BEACON LIGHTS		
SIZE	DATE IDENT. NO.	DRAWING NO.
D	71379	5118620
SCALE	SHEET 15.02	

CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL



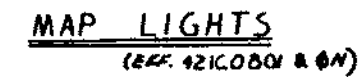
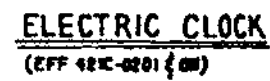
ANTI COLL & NAV LIGHTS

WALLACE AIRCRAFT DIVISION CESSNA AIRCRAFT COMPANY P.O. BOX 1704 WICHITA KANSAS 67277			
TITLE: ANTI COLL & NAV LIGHTS			
SIZE D	CODE IDENT. NO. 71379	DRAWING NO. 5118620	
SCALE: NONE		SHEET 15.03	



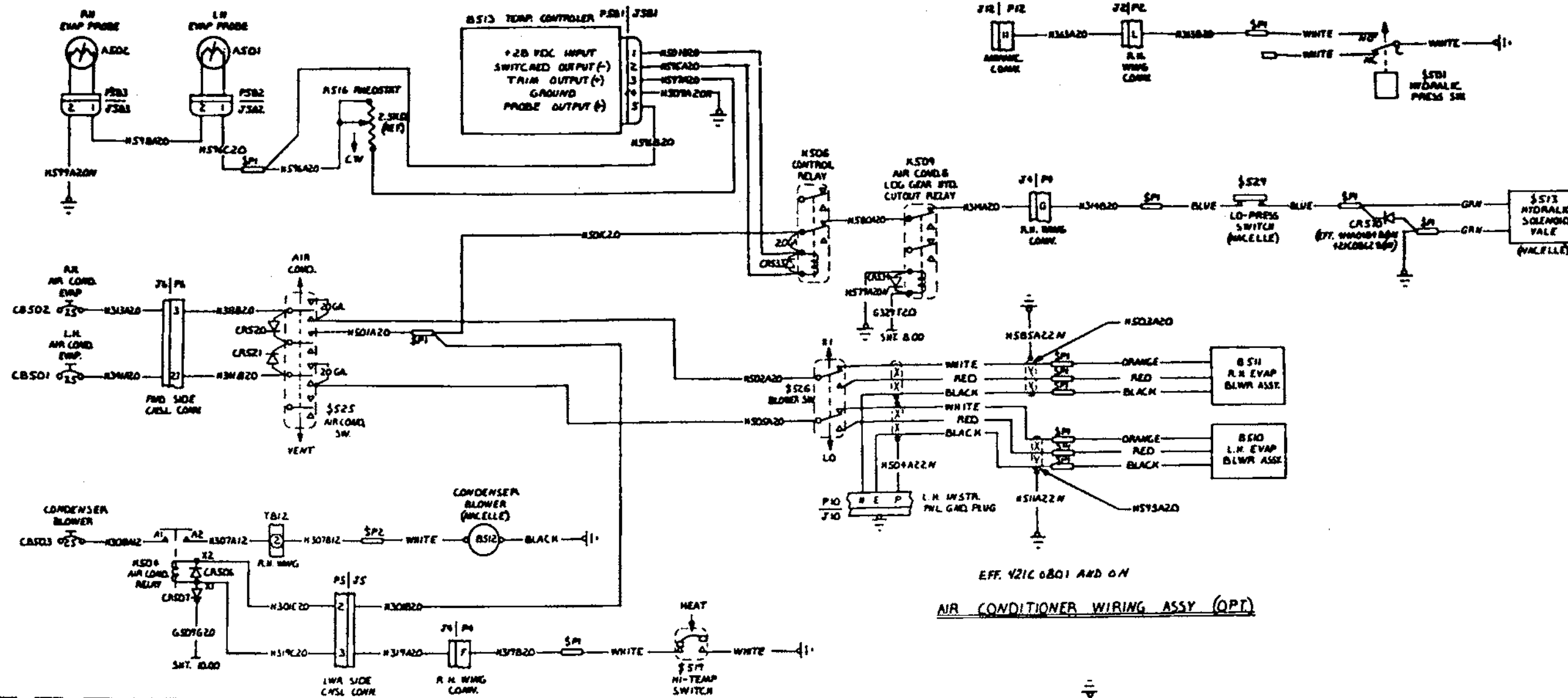
AIRPLANES COODI THRU CO400

Cessna		AIRCRAFT CO.		P. O. BOX 1077 MILWAUKEE, WISCONSIN 53210	
TITLE					
MAP LIGHTS & AUDIO					
WIRING DIAGRAM					
DATE	CHG. NO.	REV.	BY	DATE	BY
D	71379			5118620	
SCALE	1/100	REV.	REV. D	DATE	11/77

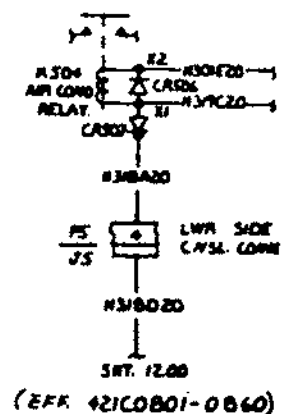


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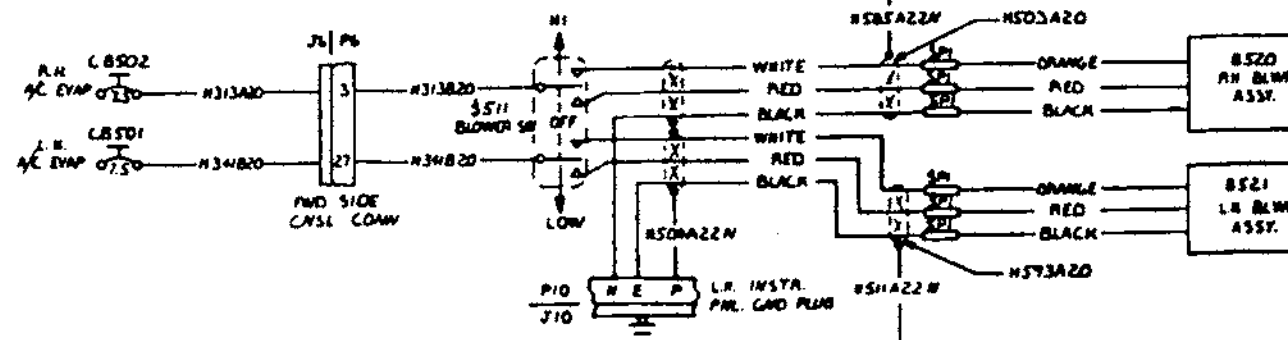
CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL



EFF. 421C0801 AND ON
AIR CONDITIONER WIRING ASSY (OPT)



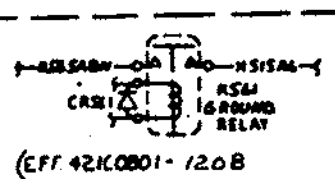
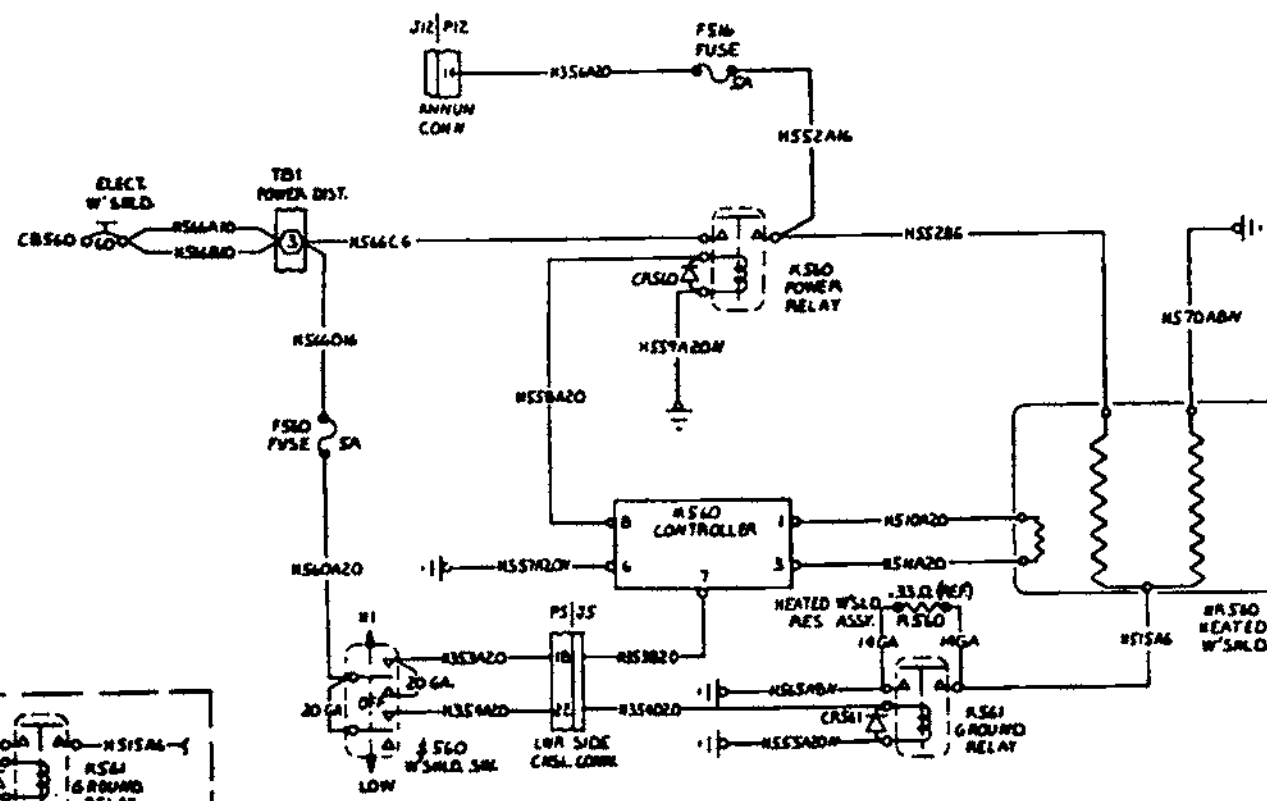
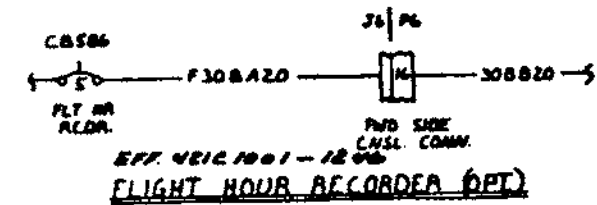
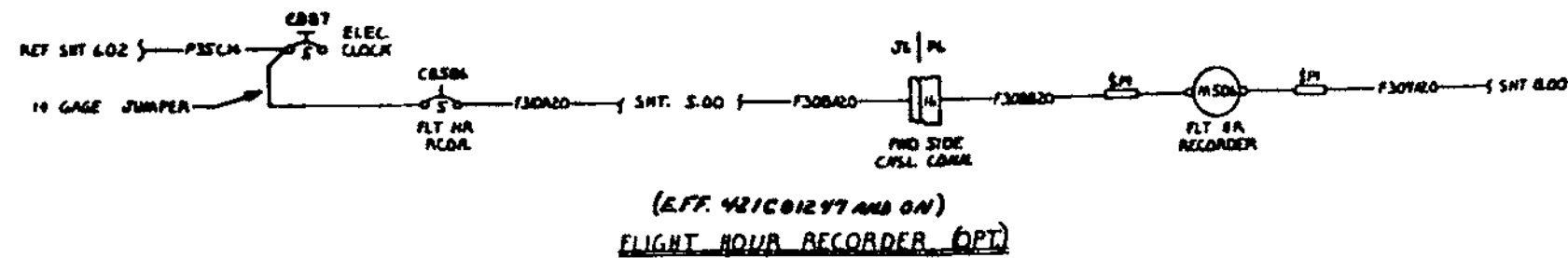
(EFF. 421C0801-0860)



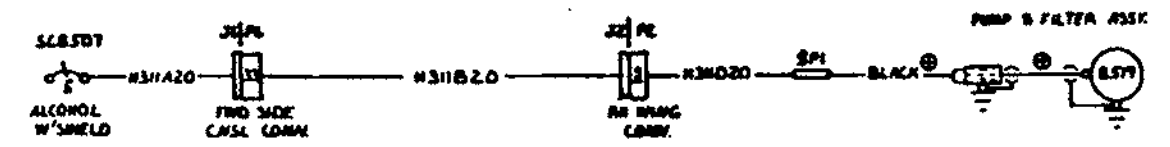
AIRPLANES C0801 AND ON
AUX CABIN VENT WIRING (OPT)

Cessna		AIRCRAFT CO.		P. O. BOX 100 WILLIAMSBURG, VIRGINIA 23180	
AIR CONDITIONER & AUX CABIN VENT					
DATE	71379	QUANTITY	5118620		
REV. D				17 OF 3200	

CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL

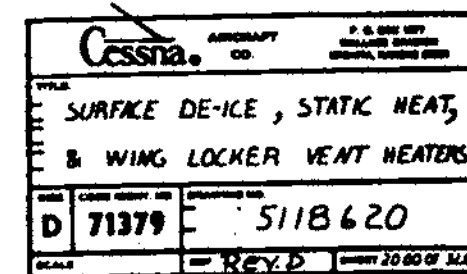


Cessna		AIRCRAFT CO.	
TITLE			
FLIGHT HOUR RECORDER & HEATED WINDSHIELD			
DATE	CHANGE NO.	REVISION NO.	REVISION NO.
D	71379	5118620	
REV. E		SHT 18.00 OF 32.00	

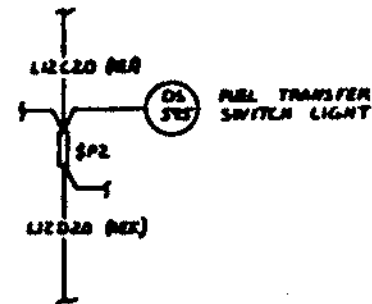


PROP ANTI-ICE WIRING (OPT)

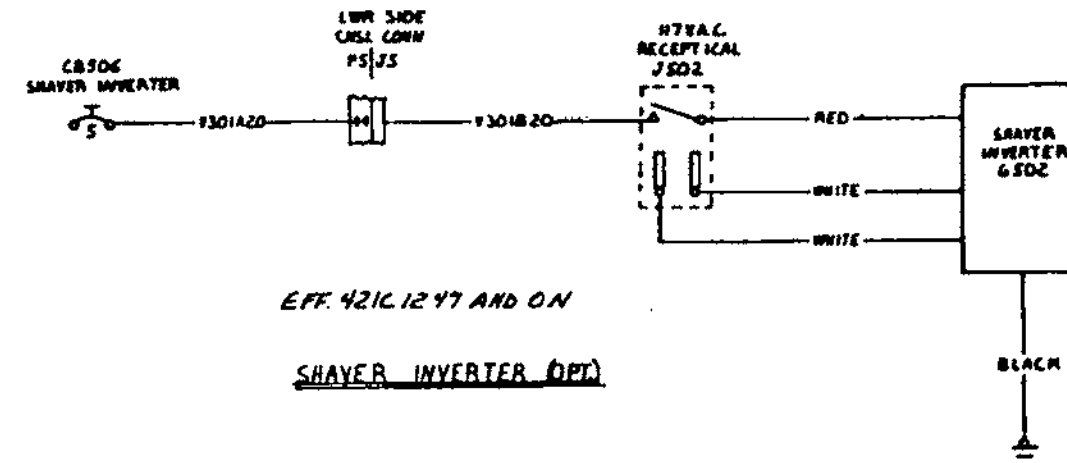
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421
SERVICE MANUAL

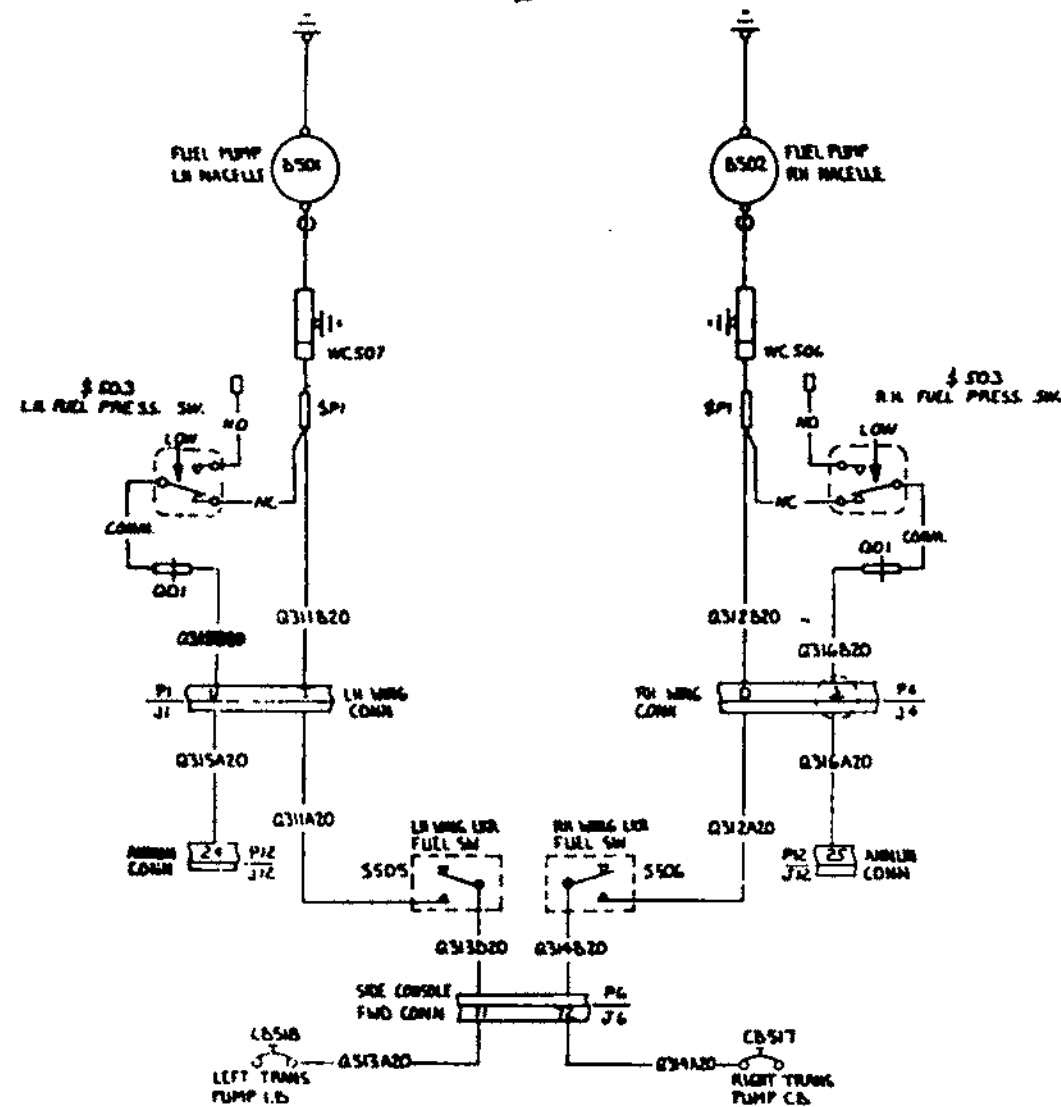


TAXI LIGHT (OPT)
EFF. 421C1247 AND ON



EFF. 421C1247 AND ON

SHAYER INVERTER (OPT)



LH WING LOCKER
FUEL TRANSFER
PUMP (OPT)

EFF. 421C1247 AND ON

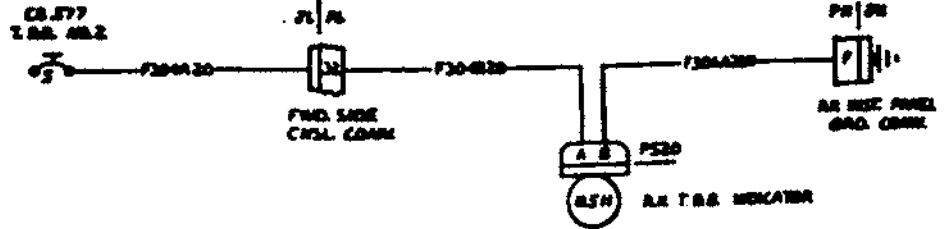
RH WING LOCKER
FUEL TRANSFER
PUMP (OPT)

EFF. 421C1247 AND ON

Cessna		AIRCRAFT CO.		P.O. BOX 1007 WILLIAMSBURG PENNSYLVANIA 16098	
WING LOCKER FUEL TRANSFER PUMP, TAXI LIGHT, & SHAYER INVERTER					
DATE	QUANTITY	REVISION	PART NO.		
D	71379		5118620		
REV. D			SPT 2180 OF 3200		

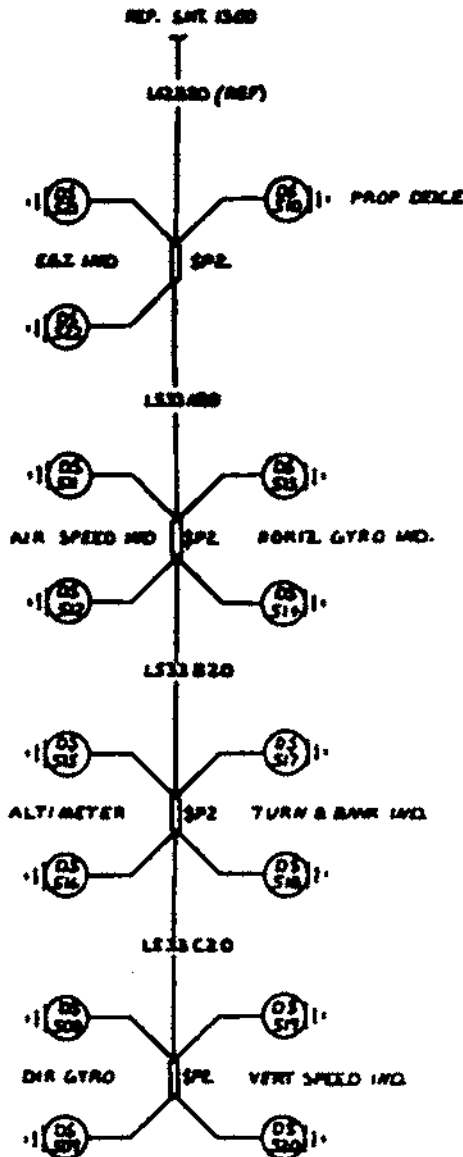
Cessna.		AIRCRAFT	P. & SIZE WFT MAXIMUM WEIGHT WINGSPAN, HEIGHT, WING
TITLE			
R.H. LANDING LIGHT, L.H. & R.H. DE-ICE LIGHTS, & NOSE & MACELLE COURTESY LTS.			
DATE	COMP. QUOT. NO.	SHIPPING NO.	
D	71379	5118620	
SCALE	REV. KEY. D		CHART 22 00 OF 32

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EFF. 421C 1247 AND ON

R.H. TURN & BANK (OPT)



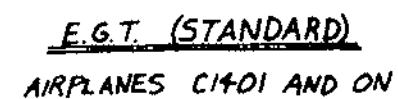
EFF. 421C 1247 AND ON

CO-PILOT INSTRUMENT LIGHTS (OPT)

Cessna		AIRCRAFT CO.		P.O. BOX 1000 WILSON, MISSOURI 65309	
TITLE					
CO-PILOT INSTRUMENT LIGHTS R.H. TURN & BANK					
DATE	CHANGE NO.	REVISION NO.	5118620		
D	71379		REV. D		
			SHEET 2300 OF 3200		



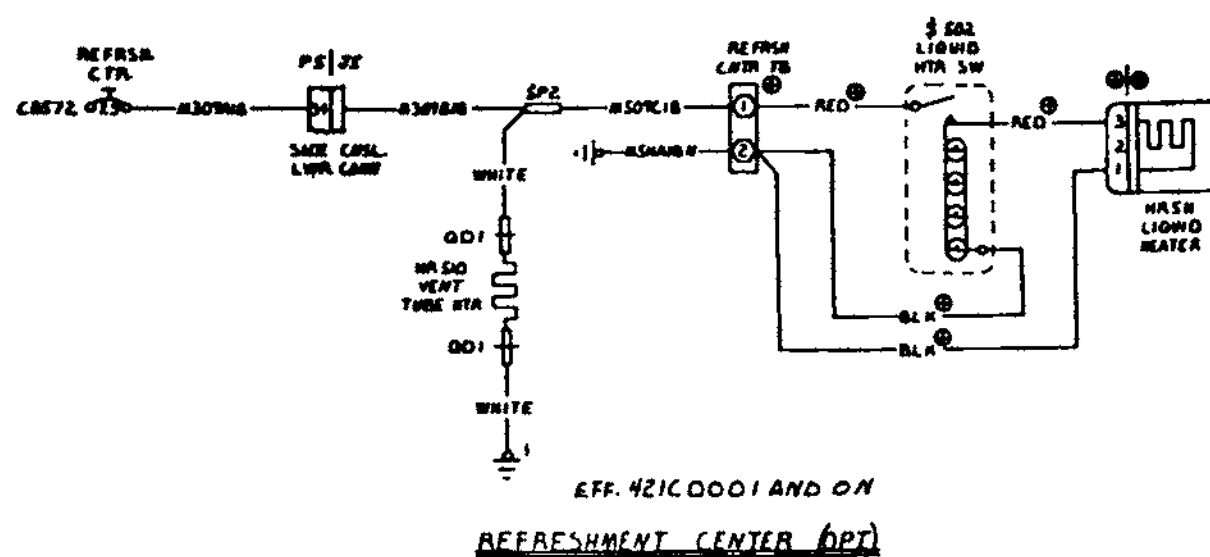
Cossma.	AIRCRAFT	P. O. BOX 1077
	CO.	CHALGATE BRIDGE MONTREAL, QUEBEC H3H 1R1
TITLE		
ELECTROLUMINESCENT PANELS~WIRING ASSY		
Q442	CAGE IDENT NO	QUANTITY NO
D	71379	5118620
	REV. D	INT 2480 OF 32



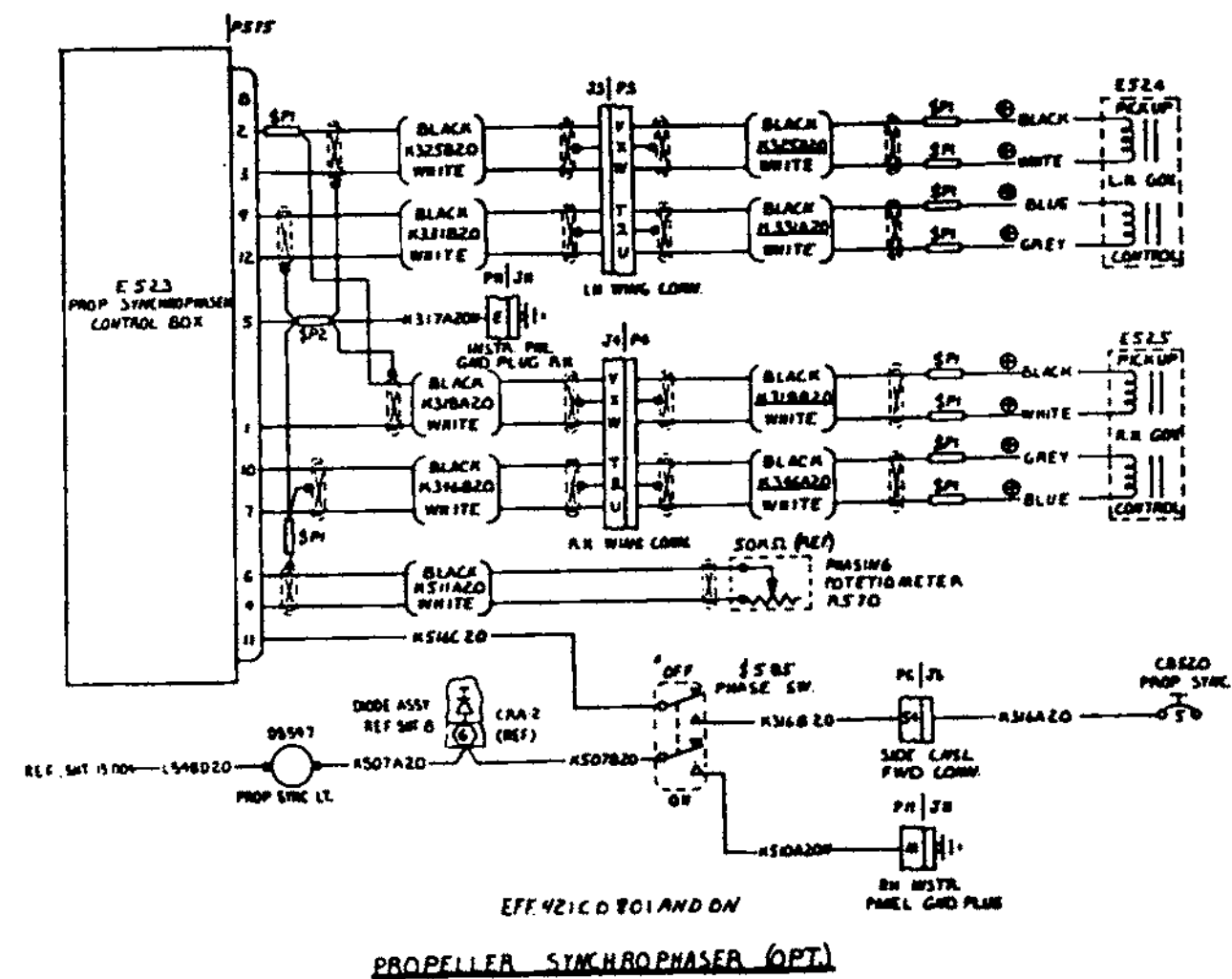
Cessna.		AIRCRAFT CO.		P. O. BOX 1077 WILLARD, OHIO 44890 WILLARD, OHIO 44890	
TWA					
E. G. T.					
& FLUSH TOILET					
MODEL	ENGINE TYPE, NO.	SERIAL NO.			
D	71379	5118620			
SCALE	REV. D		WEIGHT 2500 LBS.		



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⊕ FURNISHED



Cessna. AIRCRAFT CO. U. S. PAT. 2710
TRADE MARK
NORMAL, STABLE CRAFT

TYPE:

PROP. SYNC. &
REFRESHMENT CENTER

DATE	CASE NO. / CASE NO.	EXAMINER NO.
D	71379	5118620
	REV. 15	SAT 2100 OF 12.00

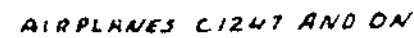


AVIONICS BUS (OPT)
AIRPLANES C1247 AND ON

Cessna.		AIRCRAFT		P. O. BOX 897	
C/O.		C/O.		WILLIAM STREET	
				WILSON, ALABAMA 36680	
TITLE					
AVIONICS BUS					
QTY	CASE HISTORY NO.	SERIAL NO.			
D	71379	5118620			
SCALE	REF 965.5		SPRINT 28.00 OF 11		



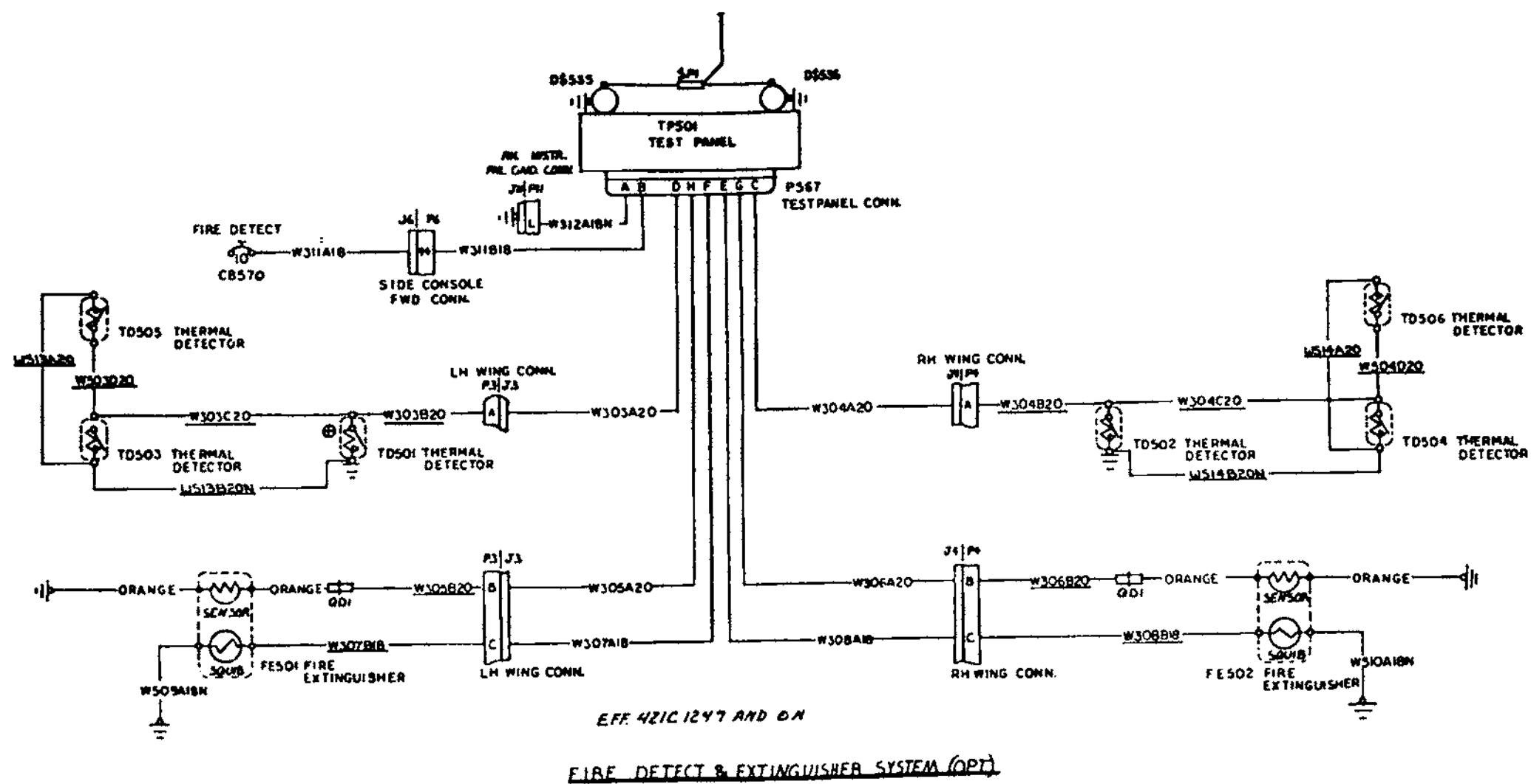
Diagram of a 5-pin connector for the AIRPLANES 0001 THRU 04-00. The pins are labeled: 11 - C1C20, 10 - C15A20, 12 - C30B20, 13 - C30B20, and 14. Pin 14 is connected to a P52-153 LM 7808 5V regulator, which is connected to a 162.048V source and a 1000 ohm resistor.



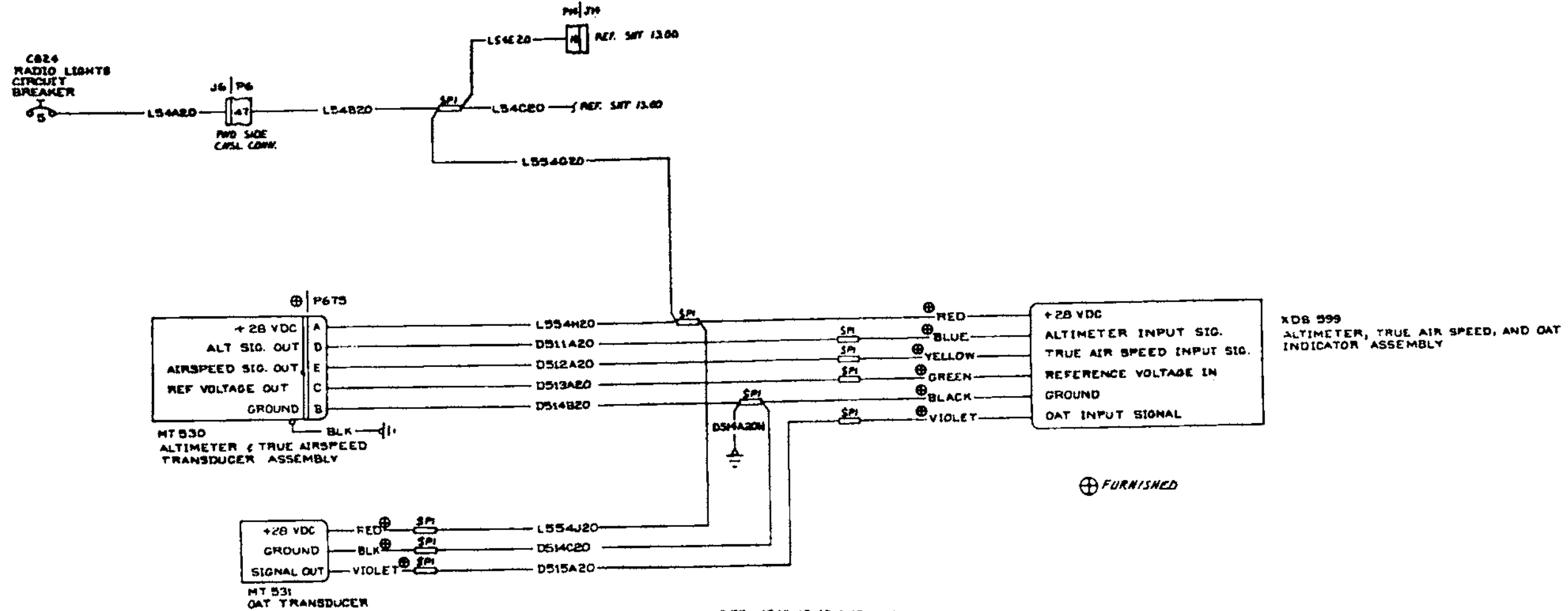
AIRPLANES C1412 AND ON

DIVIDER CLOCK DEL

		AIRCRAFT CO.		P. O. BOX 1077 WILLIAMSBURG VIRGINIA 23187	
TITLE:					
ANGLE OF ATTACK , DIGITAL 8 DIVIDER CLOCK					
QTY D	QTY UNIT IN 71379	SHIPPING NO. 5118620			
SCALE		REF REV D		QUANTITY 2100 OF 3128	



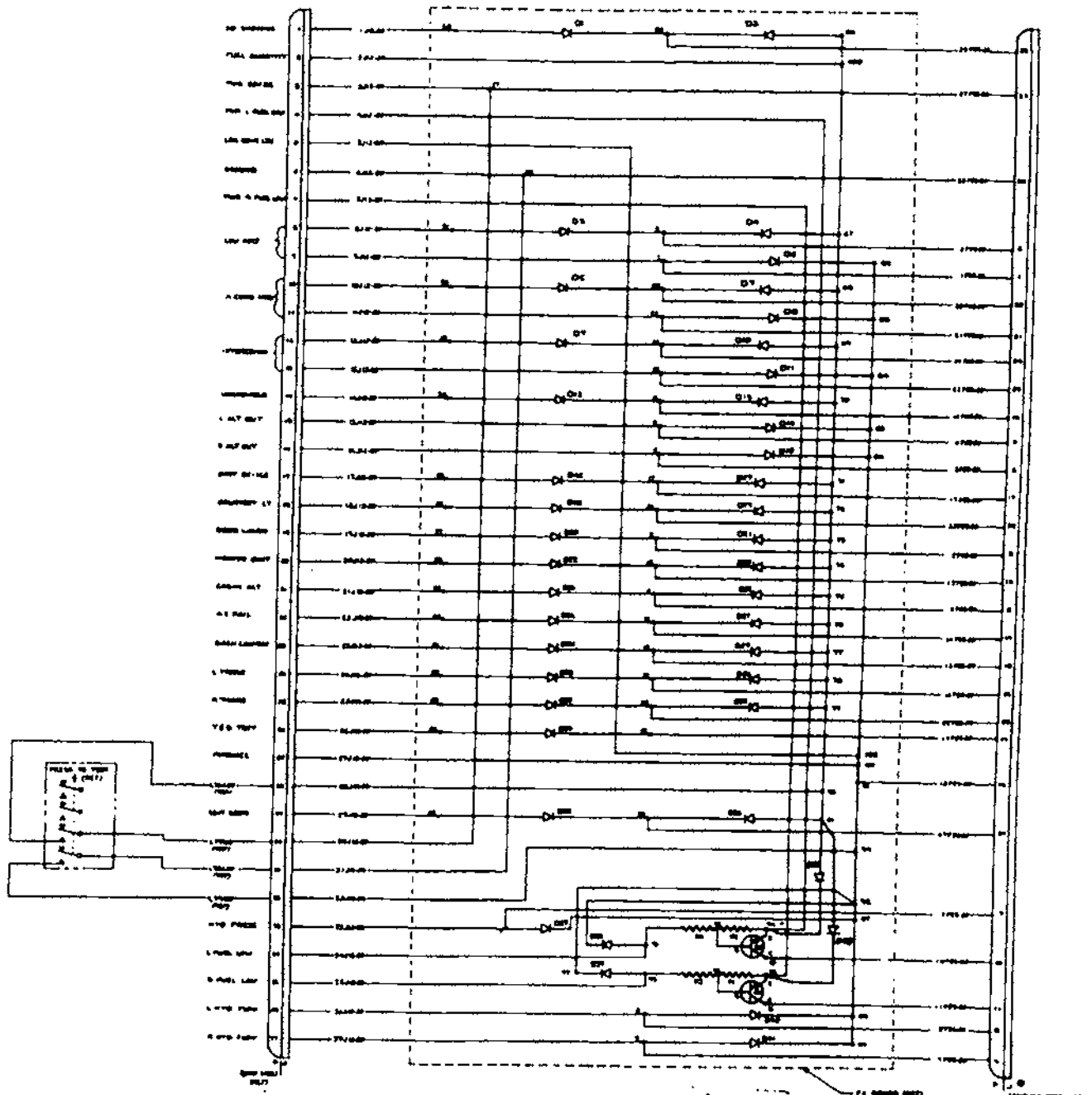
		AIRCRAFT CO.		P. O. BOX 1007 WILLIAMSBURG MISSISSIPPI 39370	
TITLE					
FIRE DETECT & EXTINGUISHER SYSTEM					
QNTY	CAGE CODE	QNTY	QNTY	QNTY	QNTY
D	71379			5118620	
SCALE		REV. D		PAGE 5000 OF 322	



EFF. 421C/247 AND ON

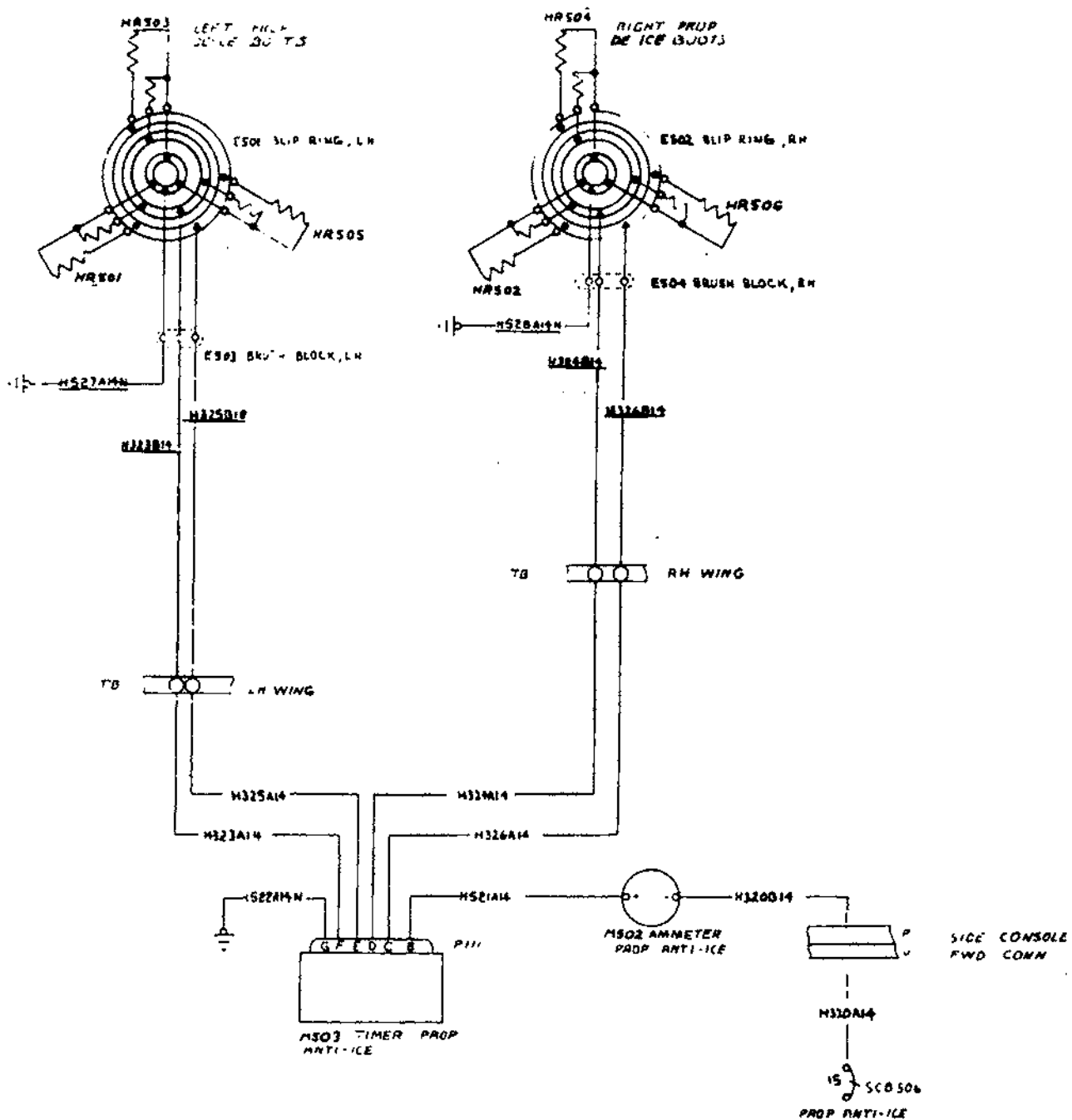
DIVIDER DISPLAY (OPT)

Cessna		P.O. BOX 607 WILSON, TEXAS 75070	
TITLE DIVIDER DISPLAY			
QCS	CONTROL IDENT. NO.	REVISION NO.	
D	71379	5118620	
REV. D		SMT 32.00 OF 32.00	



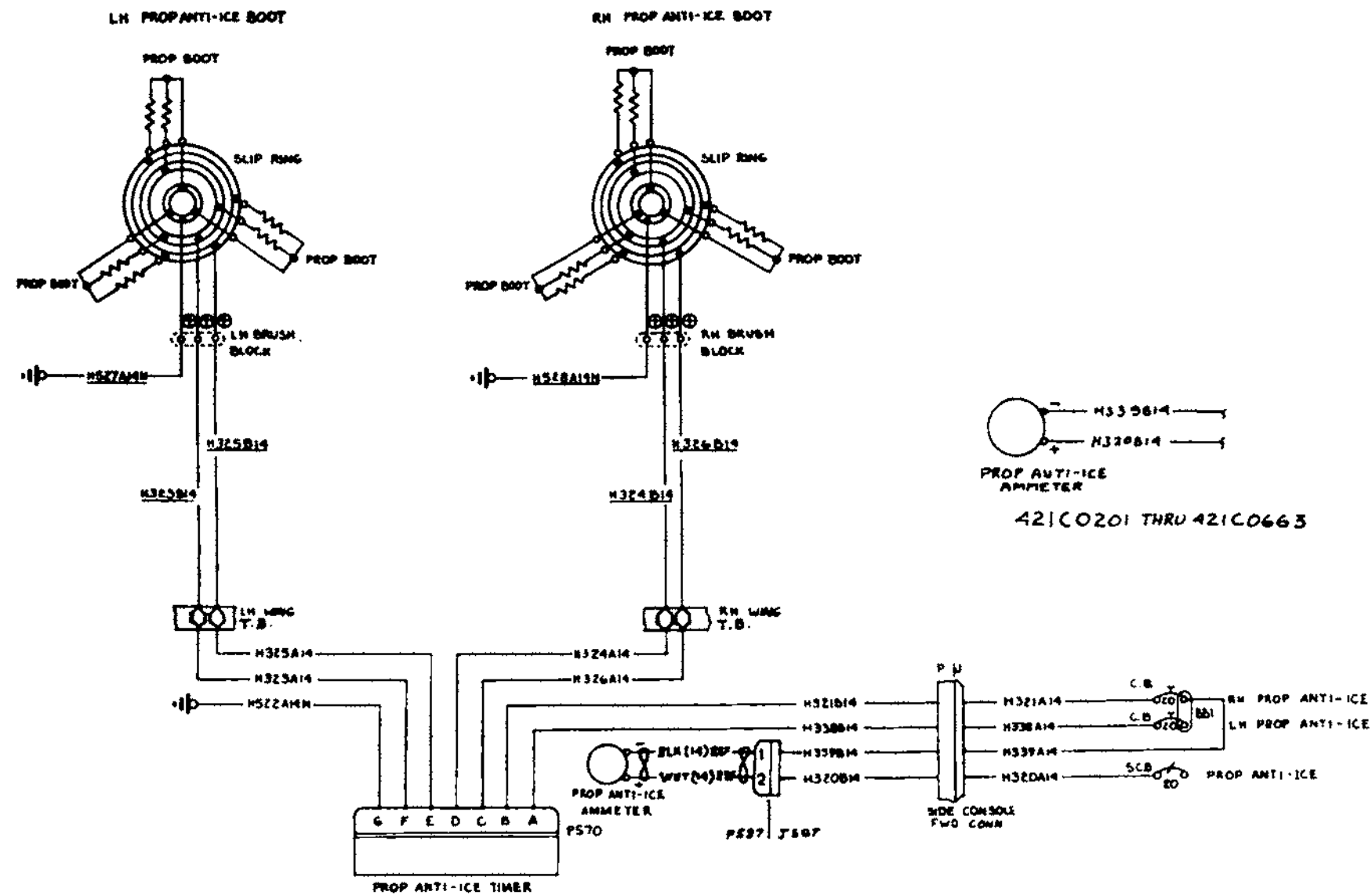
		AIRCRAFT CO. P. O. BOX 1077 MOUNTAIN VIEW, OKLAHOMA 73454
TITLE LOGIC BOARD ASSEMBLY - AMMUNITION		
QTY D	CODE IDENT. NO. 71379	DRAWING NO. 5118629
SCALE 	REV DCN 3	SHEET

CESSNA AIRCRAFT COMPANY
MODEL 421
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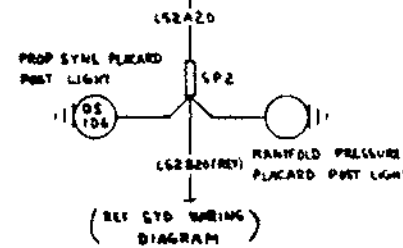
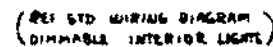
AIRPLANES C0001 THRU C0200

Cessna		AIRCRAFT CO.	P. O. BOX 1077 MILWAUKEE, WISCONSIN 53211
TYPE PROPELLER DE-ICE WIRING DIAGRAM (OPT)			
SER.	CODE IDENT. NO.	DRAWING NO.	
D	71379	5118431	
SCALE	NONE	REV	C
		PRINT	1 OF 1

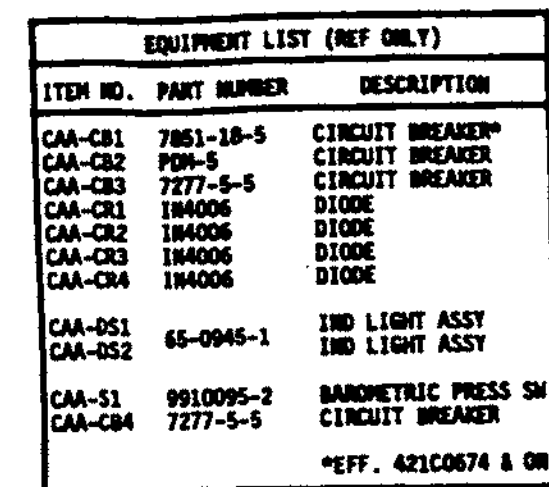


421C0201 THRU 421C1246
PROP ANTI-ICE WIRING

Cessna		AIRCRAFT CO.		H. & H. 1000 WINDMILL DRIVE WINDMILL, WINDMILL, OHIO	
PROPELLER ANTI-ICE WIRING DIAGRAM (OPT)					
71379	5818404				
D		71379			
D		71379			
D		71379			

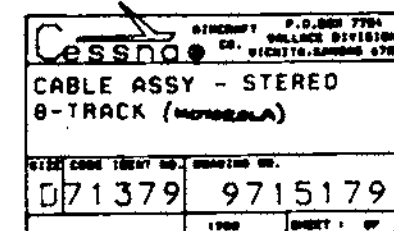


Cessna.

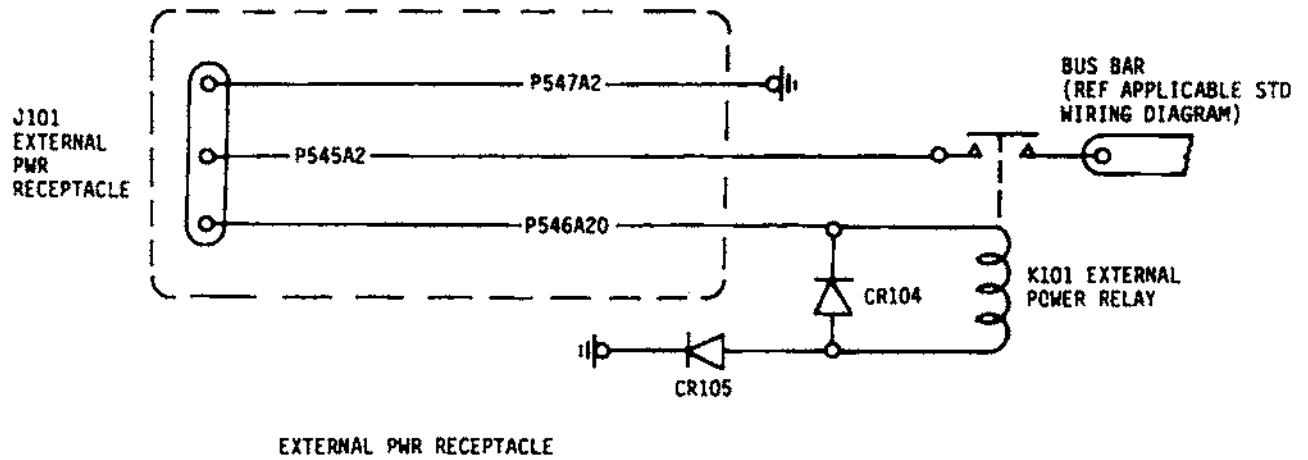




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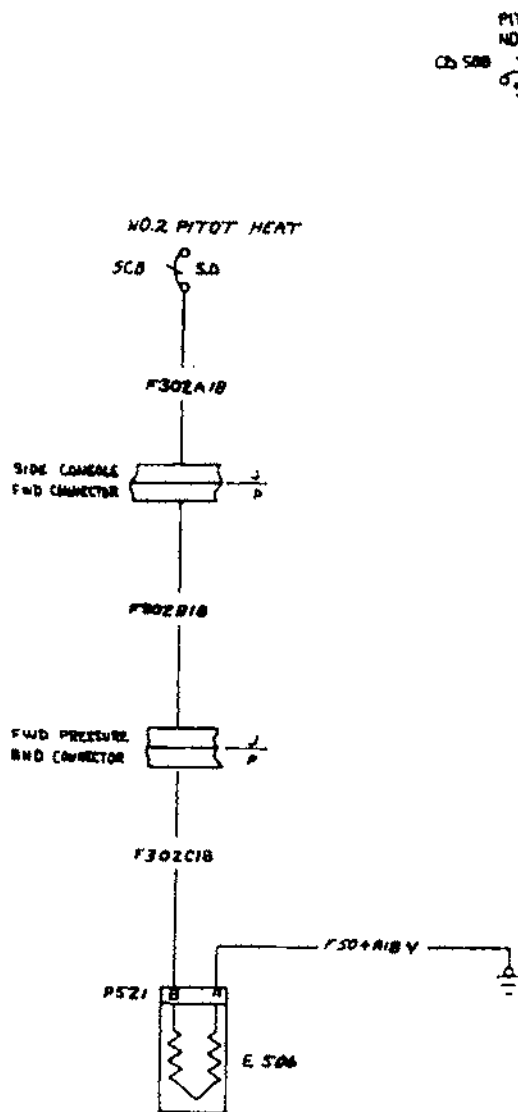
58746001

421C0001 THRU 421C1246

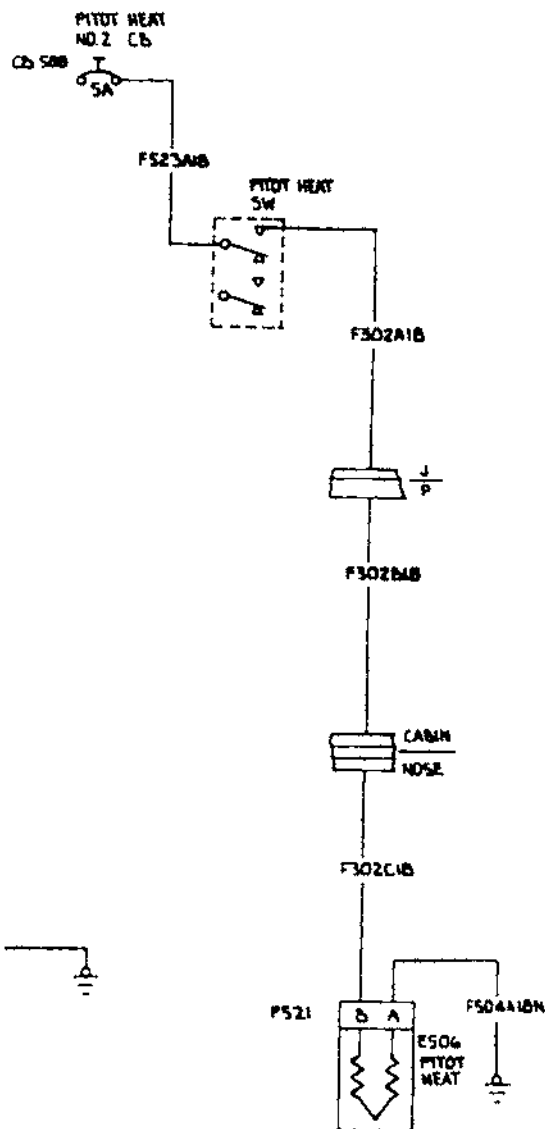
Cessna		AIRCRAFT CO.		P. O. BOX 1077 MILWAUKEE, WISCONSIN 53210	
TITLE					
EXTERNAL PWR RECEPTACLE WIRING ASSY. (OPT)					
REV.	QORR. REVISION NO.	DRAWING NO.		D	
C	71379	5118438			
SCALE: NONE		SHEET 1 OF 1			

CESSNA AIRCRAFT COMPANY

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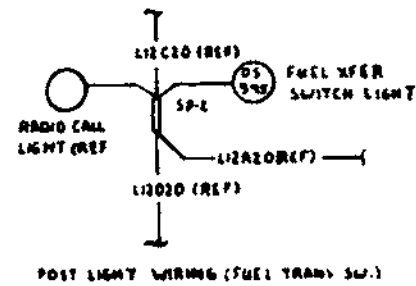


421C0001 THRU 421C0200

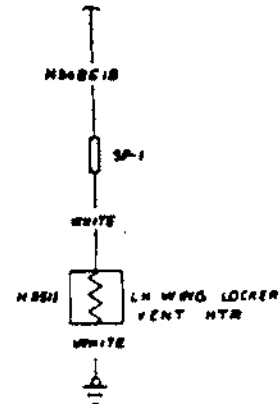


421C0201 THRU 421C1400

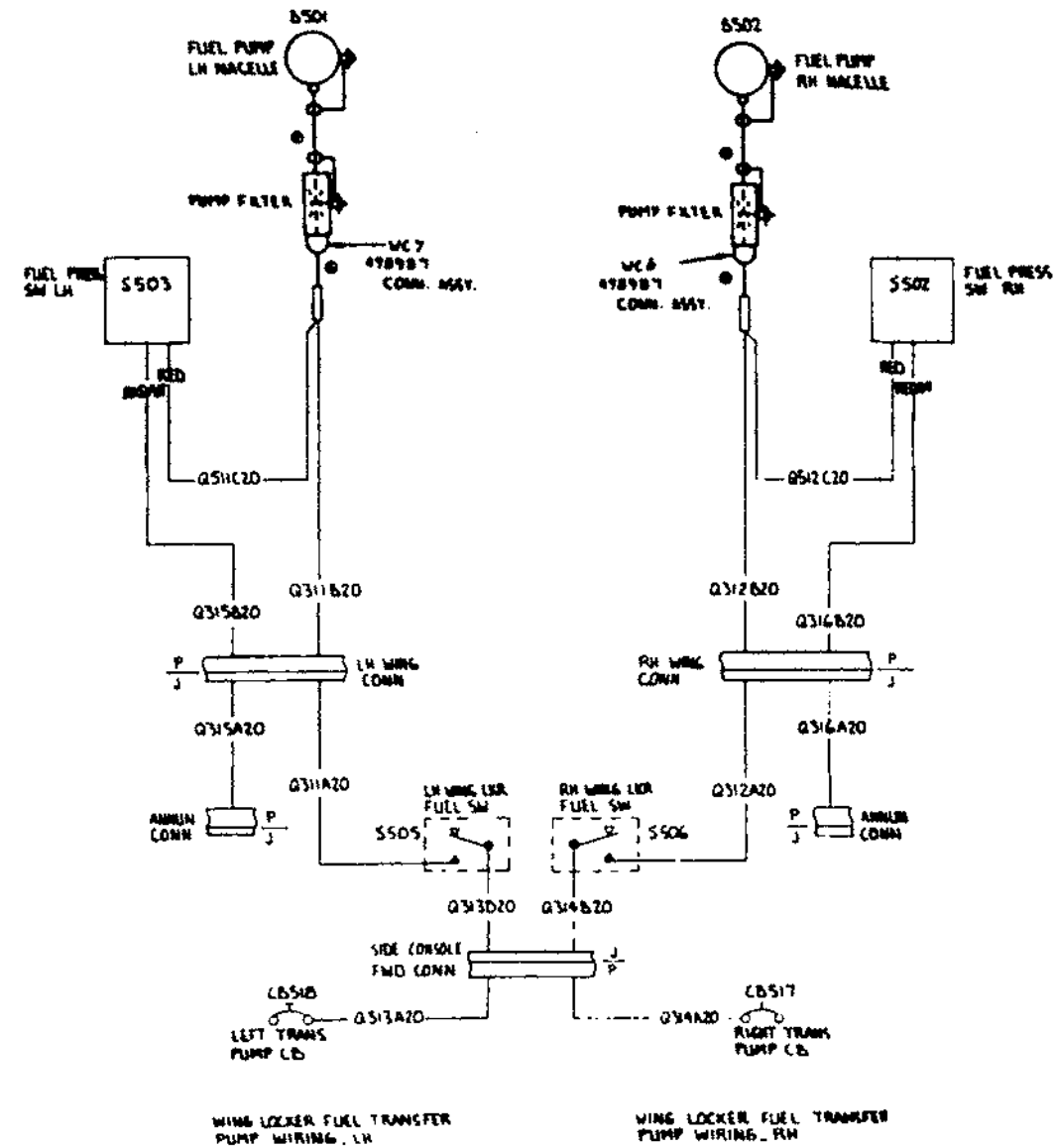
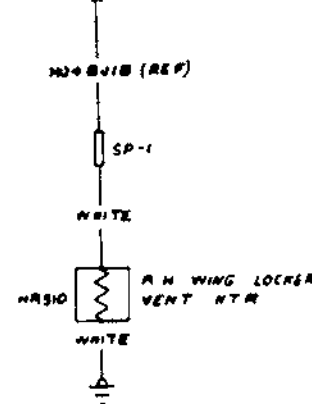
Cessna		AIRCRAFT CO.		P. O. BOX 1007 WILMINGTON, OHIO 45397	
TITLE					
NO. 2 PITOT HEAT WIRING DIAGRAM					
REV	CODE IDENT. NO.	DRAWING NO.			
D	71379	5118440			
SCALE	NONE	REV	SHEET		



STALL & VENT MERT
(REF APPLICABLE STANDARD)
WIRING DIAGRAM

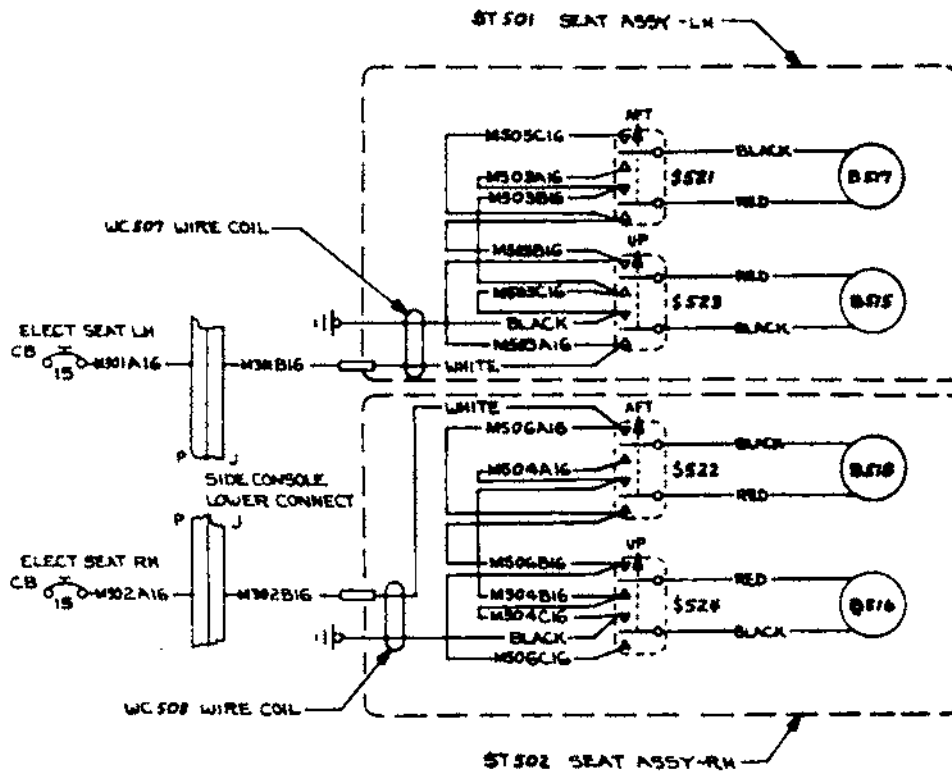


STALL & VENT MERT
(REF APPLICABLE STANDARD)
WIRING DIAGRAM



4210001 THRU 4210246

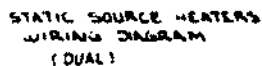
CESSNA AIRCRAFT CO.		P. O. BOX 1077 MELBURN, VICTORIA, AUSTRALIA 3061	
WING LOCKER FUEL TRANSFER PUMP & VENT NTR (OPT) WIRING DIAGRAM			
DATE	71379	REVISION NO.	5118441
SCALE	AS SHOWN	REV	REV 2
		SHEET 1 OF 1	



4210001 THRU 4210600

Cessna		P. O. BOX 1000 MILWAUKEE, WISCONSIN 53101	
AIRCRAFT CO.			
TITLE			
ELECTRIC SEATS WIRING DIAGRAM (OPT)			
REV	DATE	BY	CHKD
D	71379	5118442	
SCALE: NONE		SHEET 1 OF 1	

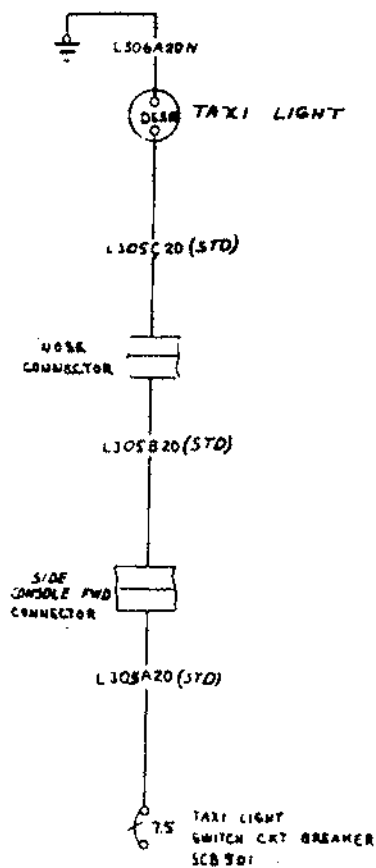
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SERVICE MANUAL



STATE SOURCE HEATERS WIRING DIAGRAM

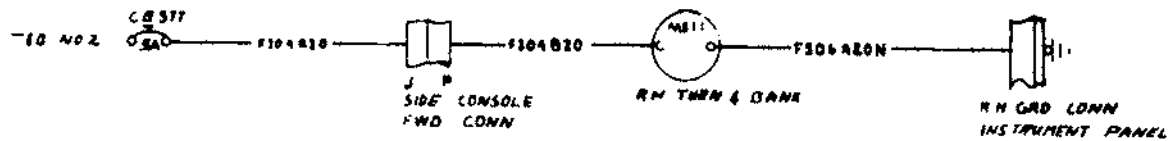
4210001 THR 42101246

Cessna.		AIRCRAFT CO.		P O BOX 10779 MILFAYT & TOWN SQUARES SPRINGDALE, ARKANSAS 72761	
TITLE					
STATIC SOURCE HEATERS WIRING ASSY (OPT)					
SOLD		CODE IDENT NO		DRAWING NO	
D		71379		5118443 E	
SCALE NONE		REV		SHEET 1 OF 1	

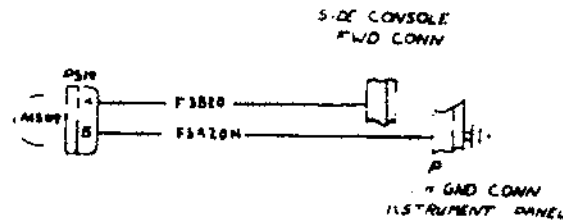


421C0001 THRU 421C1246

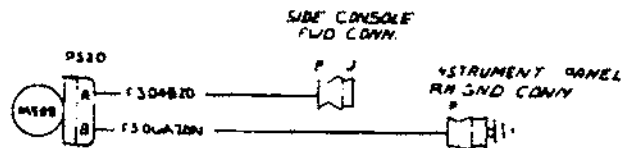
Cessna.		AIRCRAFT CO.		P. O. BOX 1077 MILWAUKEE, WISCONSIN 53211	
TITLE					
TAXI LIGHT (OPT) WIRING DIAGRAM					
REV	DATE	BY	CHKD	APPROVED	
C	71379			5118447	
SCALE: NONE		SHEET		1 OF 1	



RH TURN & BANK

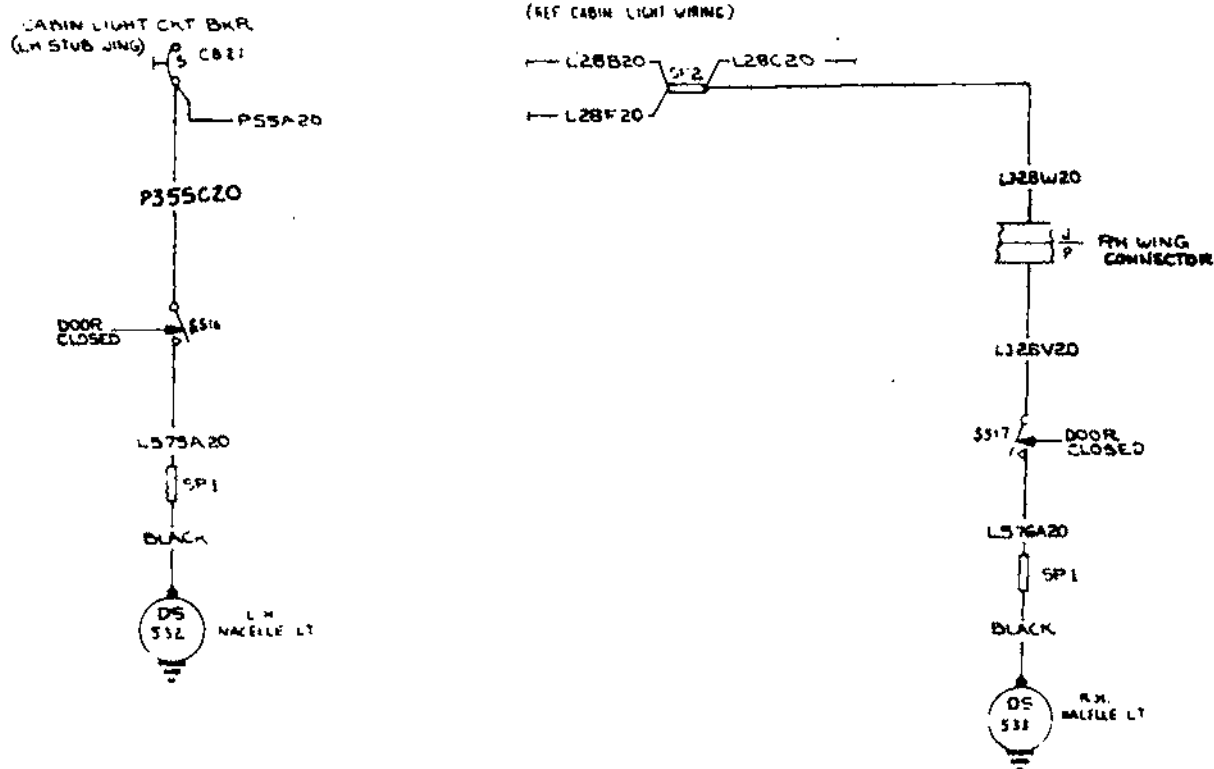


LH TURN COORDINATOR

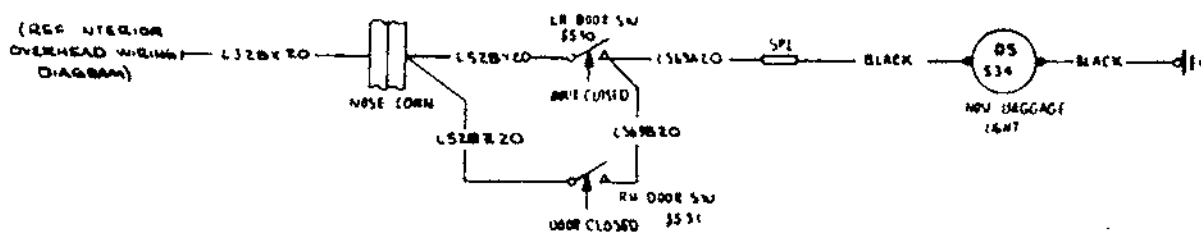
RH TURN COORDINATOR
(RH T/B INDICATOR)

4210001 THRU 4211246

Cessna		AIRCRAFT CO.	P. O. BOX 1077 MILWAUKEE, WISCONSIN 53211
TITLE			
RH T/B LEFT & RIGHT HAND TURN COORDINATOR WIRING (OPT)			
REV	CONTRACT NO.	DRAWING NO.	
D	71379	5118449	
SCALE	NONE	REV	SHEET 1 OF 1



NACELLE COURTESY LIGHTS, WIRING ASSY

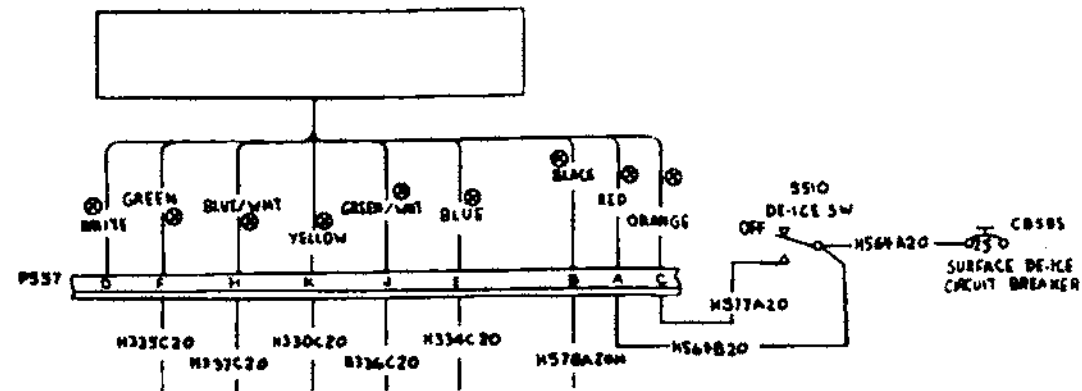


NOSE BAGGAGE COURTESY LIGHT, WIRING ASSY

421C0001 THRU 421C1246

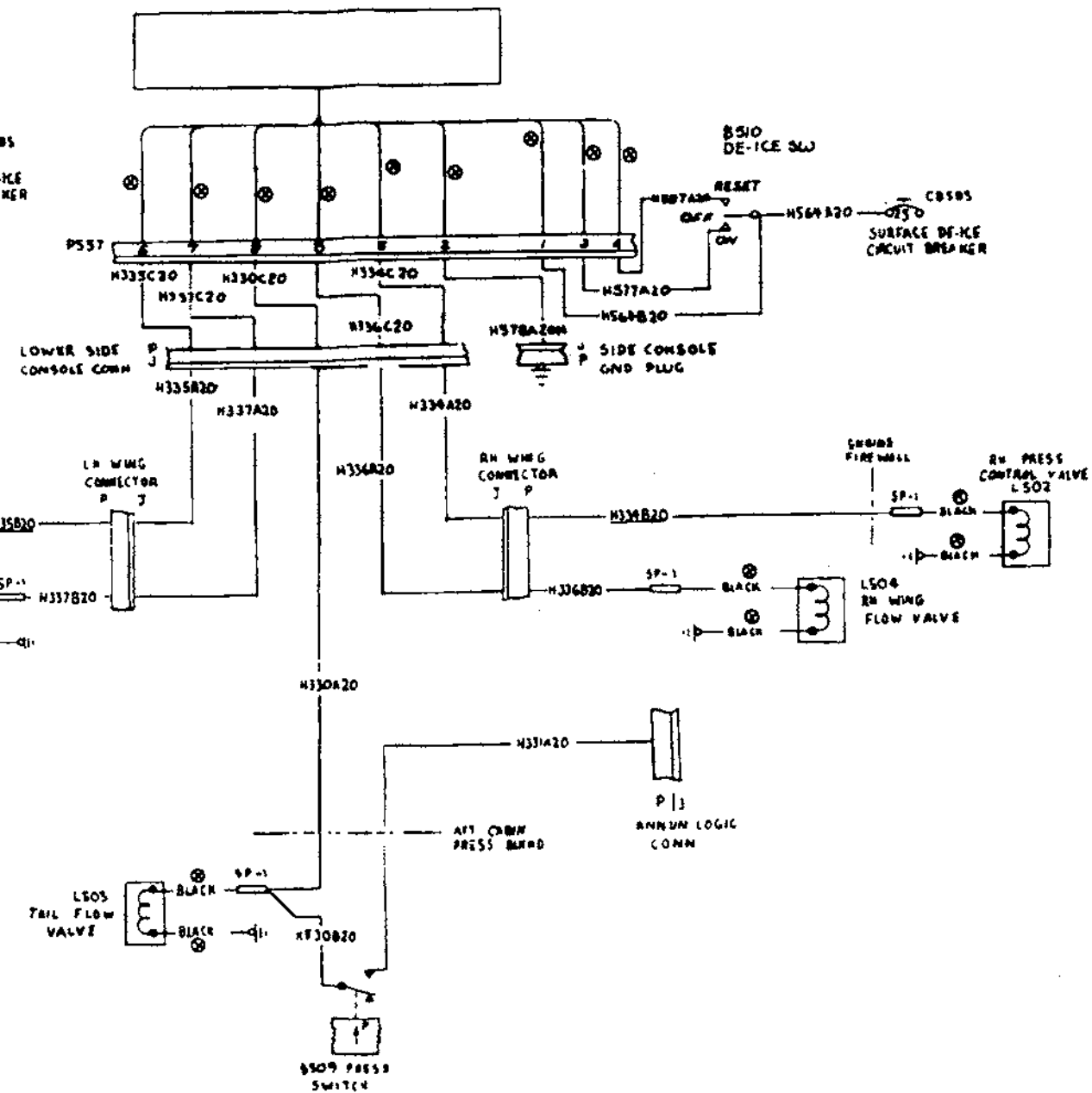
Cessna		AIRCRAFT CO	P. O. BOX 1077 MILWAUKEE, WISCONSIN 53201
TITLE			
NACELLE-NOSE COURTESY LIGHT WIRING DIAGRAM			
SIZE	CODE IDENT NO	DRAWING NO	
D	71379	5118460	
SCALE	NOTE	REV	SHEET 1 OF 1

MODA SURFACE DE-ICE ASS'Y



421C-0001 thru 421C-0200

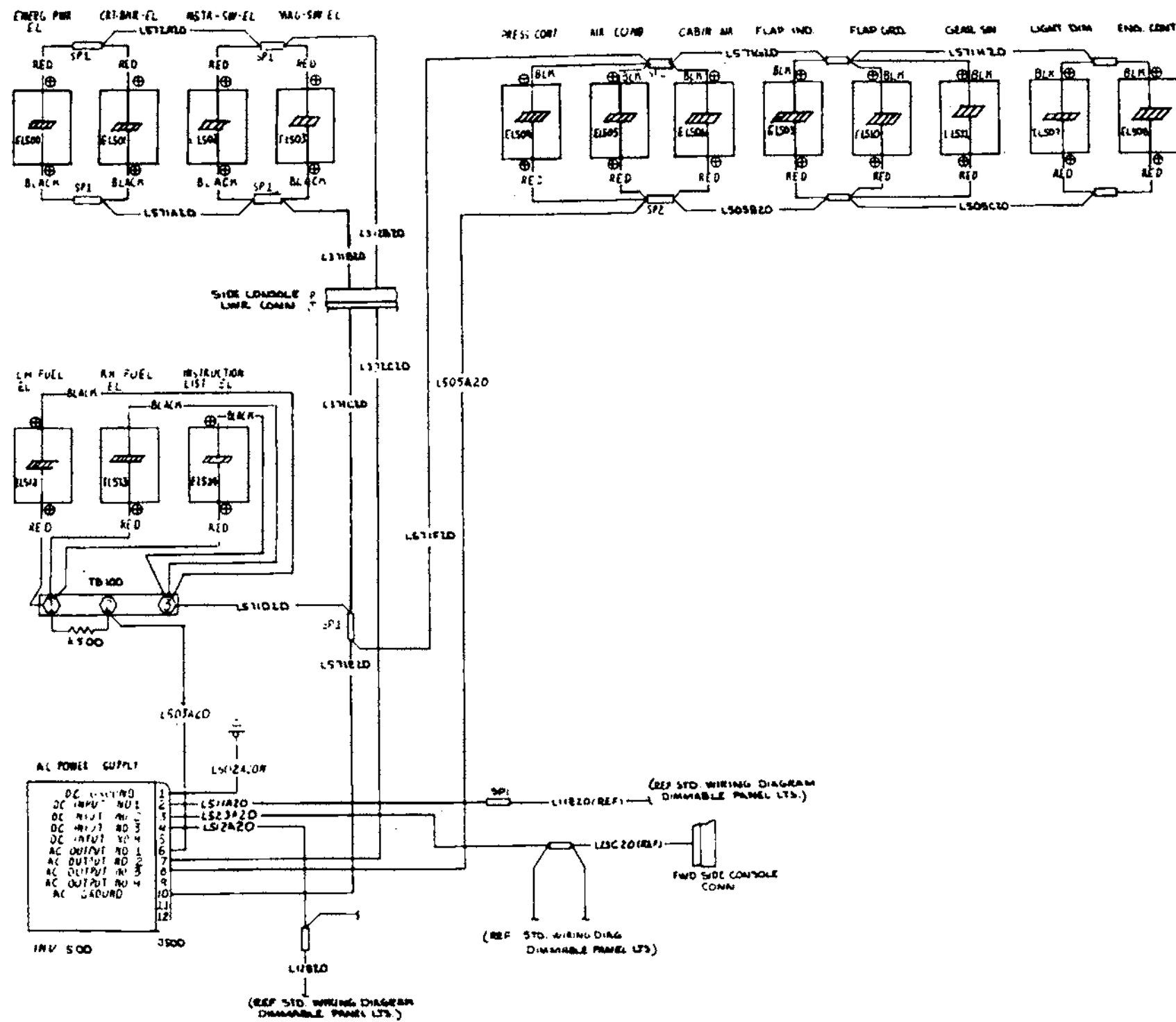
MODA SURFACE DE-ICE ASS'Y



SURFACE DE-ICE WIRING ASS'Y

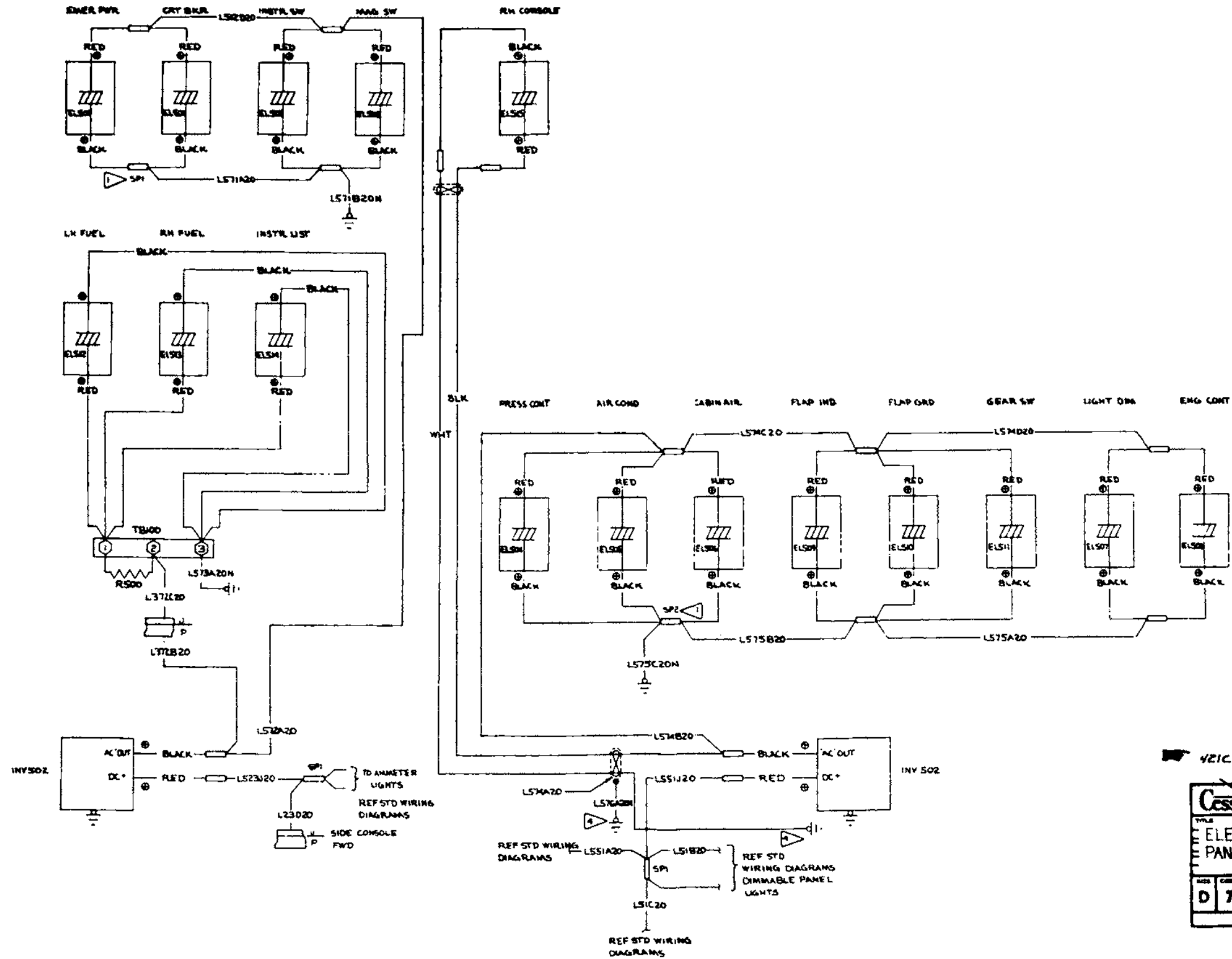
421C0201 THRU 421C1246

Cessna		AIRCRAFT CO.		P.O. BOX 607 WILLOUGHBY, OHIO 44094	
TITLE WIRING ASSY - SURFACE DE-ICE (OPT)					
QTY	QTY	QTY	QTY	QTY	QTY
D	71379	5118463	D		
QTY	NONE	QTY	1001	QTY	1001



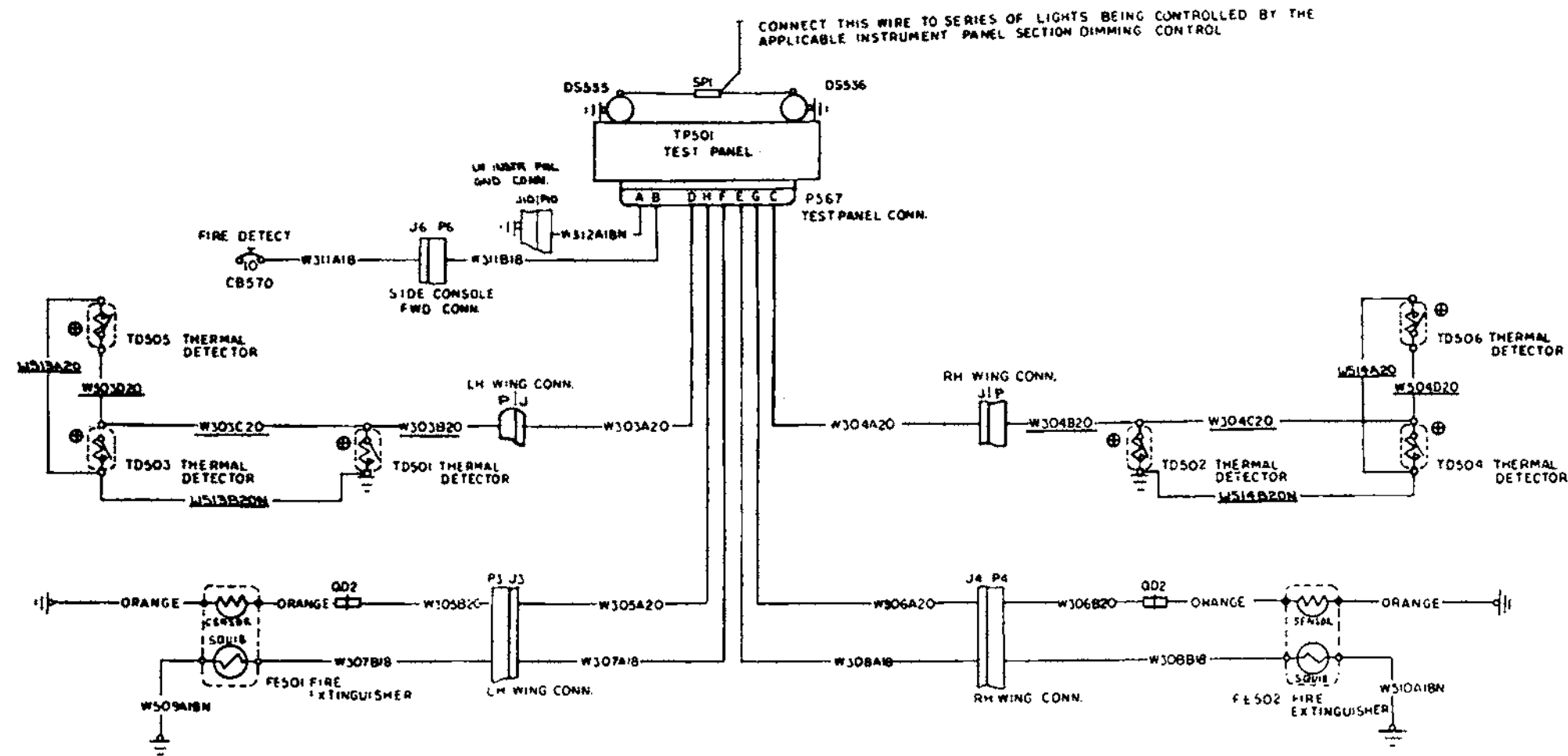
4210001 THRU 4210200

Cessna AIRCRAFT CO.		P. & S. NEW CITY WALLACE WILSON RECEIVED, LAMPS OPEN	
TITLE ELECTROLUMINESCENT INSTR. PANEL WIRING ASS'Y OPTIONAL			
REV	CODE	REV	CODE
D	71379		5118501
REMARK	NONE	REV	SHEET 2 OF 2



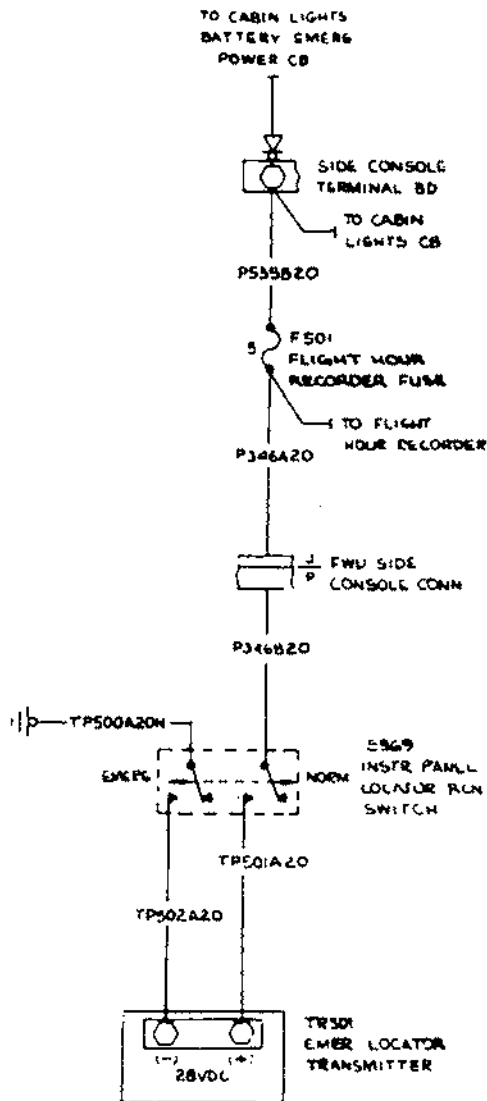
4210201 THRU 4210206

Cessna		AIRCRAFT CO.	
ELECTROLUMINESCENT PANELS-WIRING ASSY			
REV	DATE	REV	DATE
D	71379	5118669	
		1 OF 1	

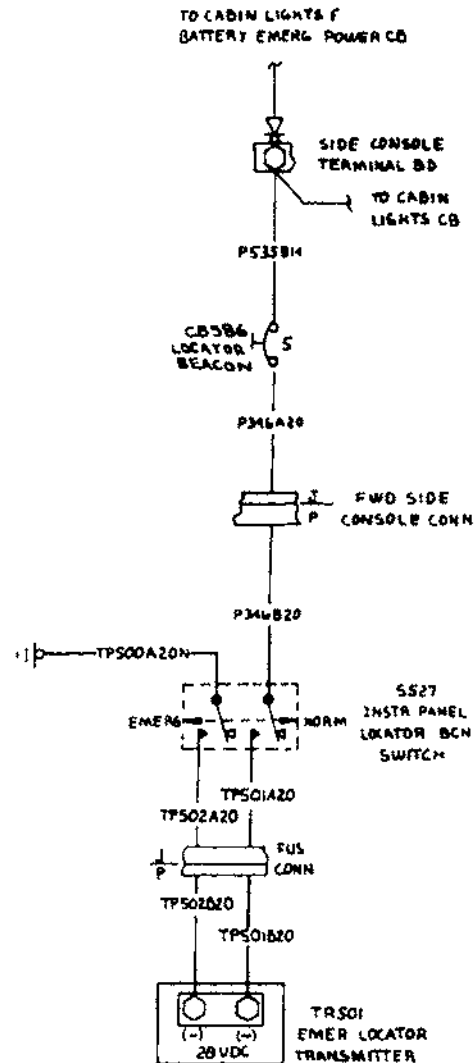


421C0001 THRU 421C1246

Cessna		AIRCRAFT CO.		P. O. BOX 1071 TOLSON, IOWA 50081	
TITLE FIRE EXTINGUISHER WIRING ASSY (OPTION)					
DATE D	CODE 71379	REVISION 5118553			
SCALE NONE	REP	SHEET 1 OF 1			

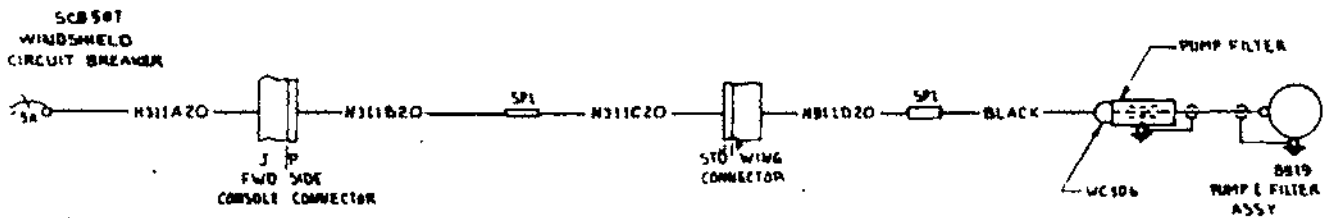


421C0001 THRU 421C0200
EMERGENCY LOCATOR BEACON WIRING ASSY



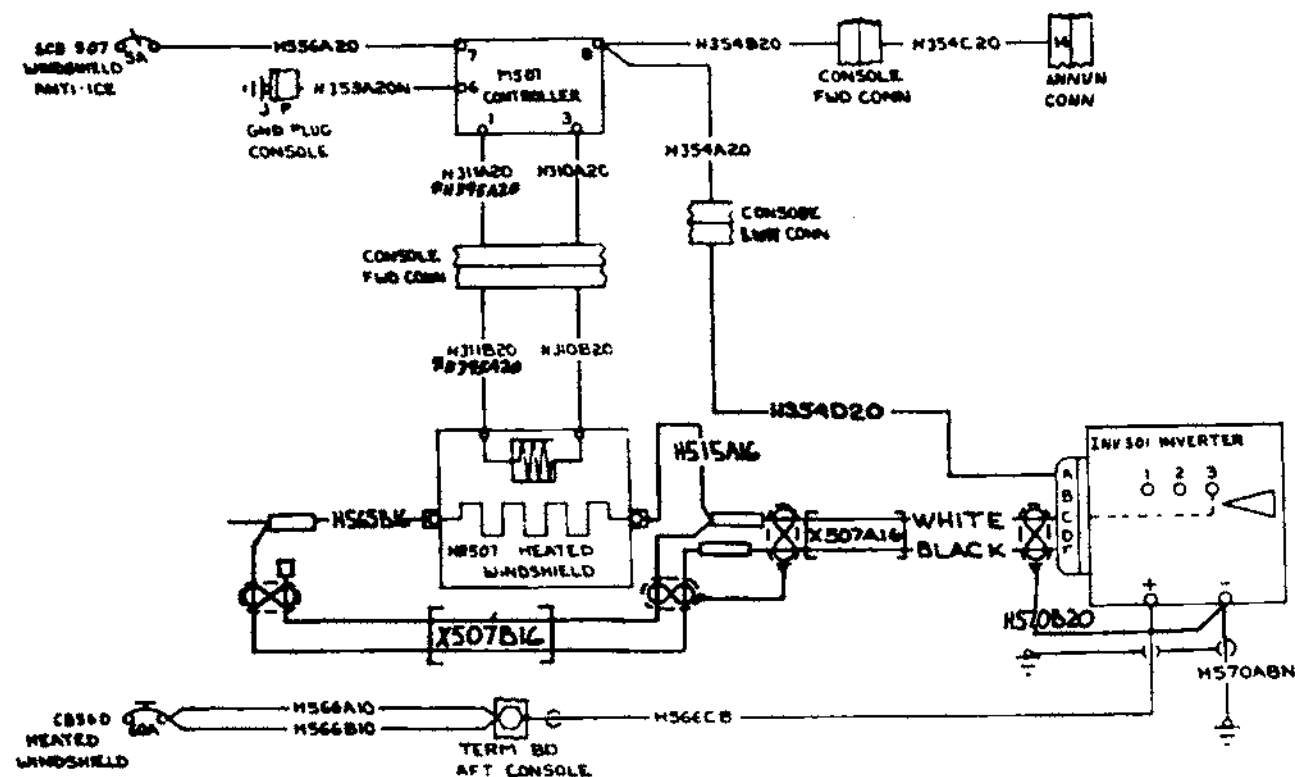
421C0201 THRU 421C0600
EMERGENCY LOCATOR BEACON WIRING ASSY

CESSNA		AIRCRAFT CO.		P. O. BOX 1077 MILWAUKEE, WISCONSIN 53210	
TITLE					
WIRING ASSY-EMERGENCY LOCATOR BEACON					
QTY	CORE UNIT NO	BRANCH NO			
D	71379	5118462			
REMARKS	DATE	BY	CHECKED		
NOTE			1 OF 2		

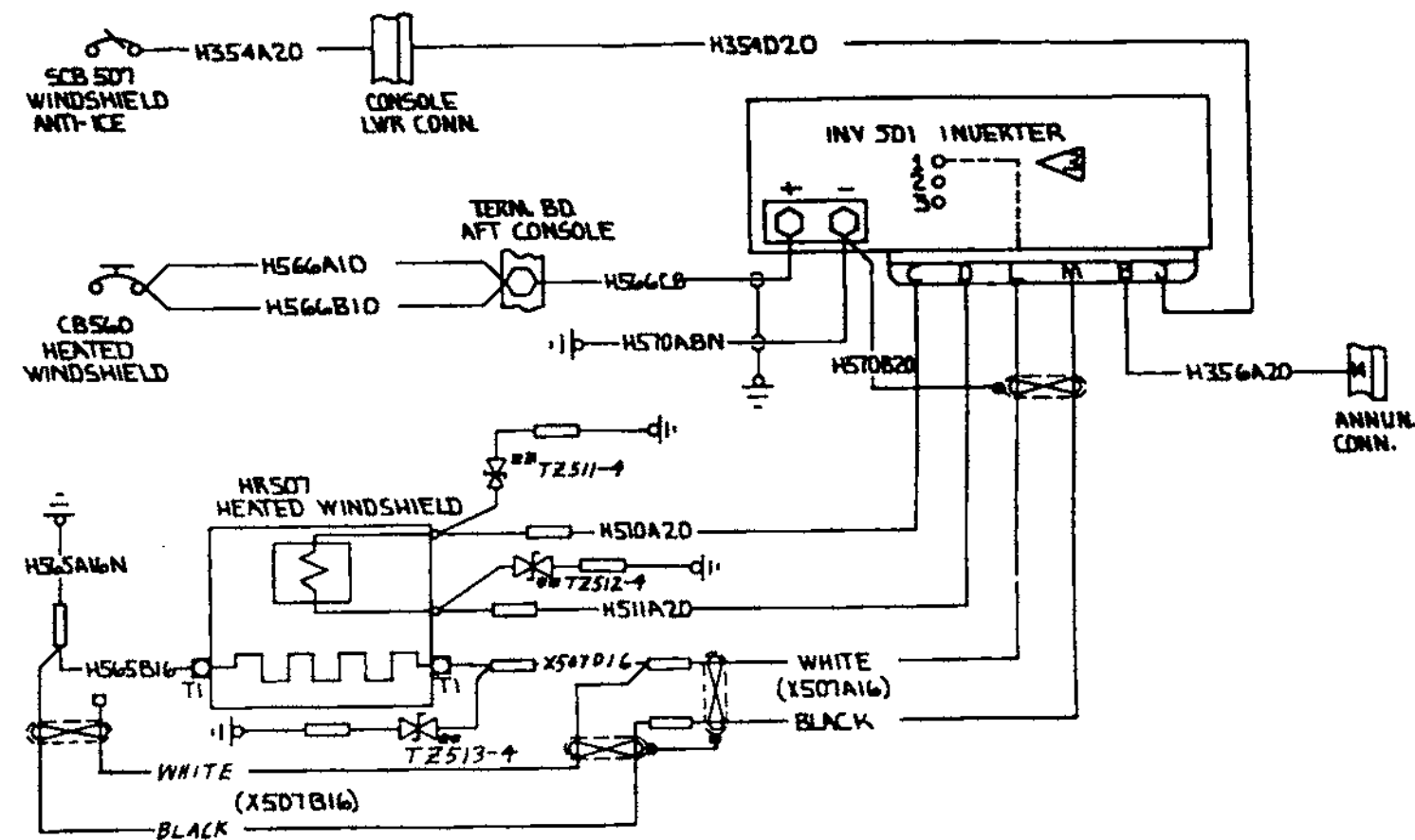


421C0001 THRU 421C1246

Cessna.		AIRCRAFT CO.		P. O. BOX 10777 MILWAUKEE, WISCONSIN 53211-0777	
TITLE:					
WIRING ASSY - ALCONOL WINDSHIELD DE-ICE					
REV.	CODE (REV) NO.	DRAWING NO.			
D	71379	5118464			
SCALE 80 NT		REV.	SHEET 1 OF 1		



421C0001 THRU 421C0274
EXCEPT AIRPLANES INCORPORATING SK421-81
*421C0001 THRU 421C0200



421C0275 AND ON
AND AIRPLANES INCORPORATING SK421-81
**421C0513 AND ON (ADDED)

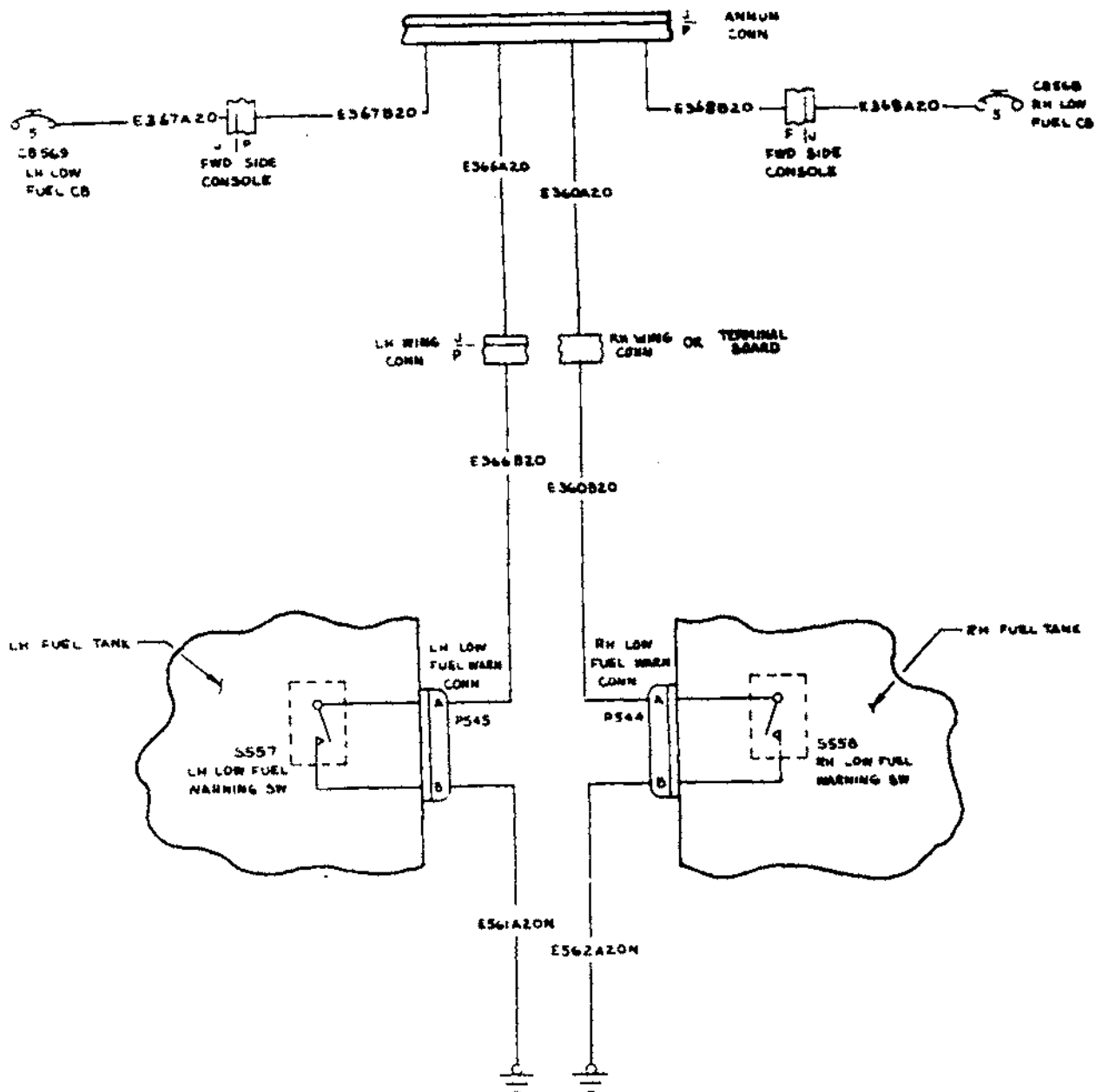
TO DETERMINE THE CORRECT AC VOLTAGE TAP TO USE
FOR A PARTICULAR INSTALLATION, USE THE
FOLLOWING PROCEDURE:

1. NOTE THE WINDSHIELD RESISTANCE VALUE
STAMPED ON THE WINDSHIELD IDENTIFICATION
DECAL ON THE LOWER LEFT-HAND CORNER OF
THE WINDSHIELD.
2. DETERMINE FROM THE TABLE BELOW THE PROPER
TERMINAL TO USE: (INSIDE THE INVERTER)

W/S RESISTANCE RANGE	TERMINAL NO.
31.4 TO 33.45 OHMS	# 1 (LOW)
33.45 TO 35.75 OHMS	# 2 (MED)
35.75 TO 38.06 OHMS	# 3 (HI)

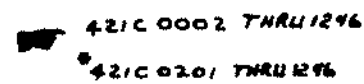
421C0001 THRU 421C0800

CESSNA		AIRCRAFT		P.O. BOX 1007 MILWAUKEE, WISCONSIN 53210	
TITLE HEATED WINDSHIELD WIRING ASSY (OPT)					
DATE	CODE	REVISION	NO.	5118518	PC12L
D	71379			5818408	PC140
SCALE	NONE	REV		SHEET 1 OF 1	



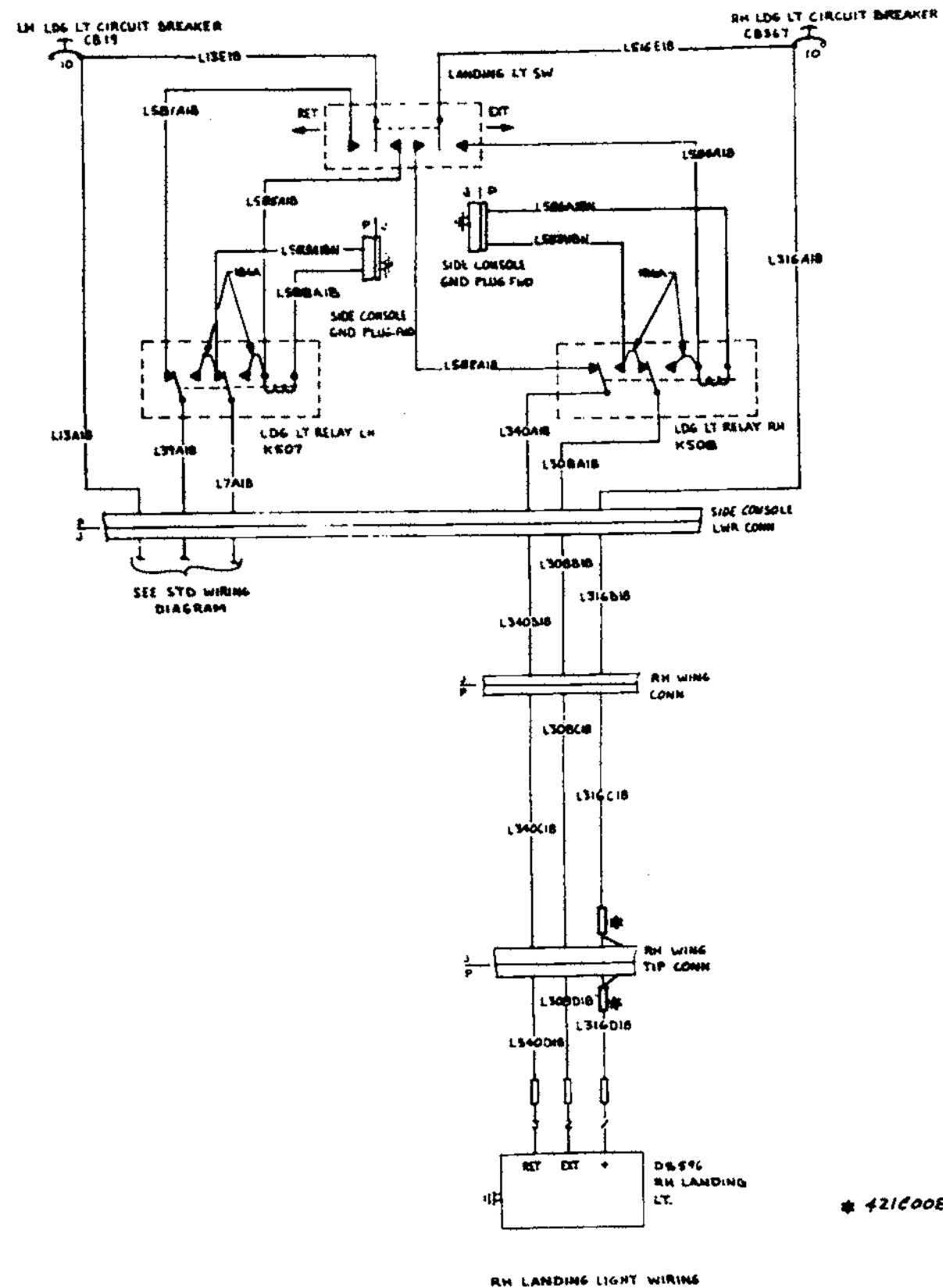
421C0001 THRU 421C1246

Cessna. AIRCRAFT CO.		P. O. BOX 1077 MILWAUKEE, WISCONSIN 53213
TITLE LOW FUEL WARNING WIRING ASSY (OPT)		
QTY D	QTY 71379	QTY 5118661
PRICE NONE	QTY 1	QTY 1 OR 1

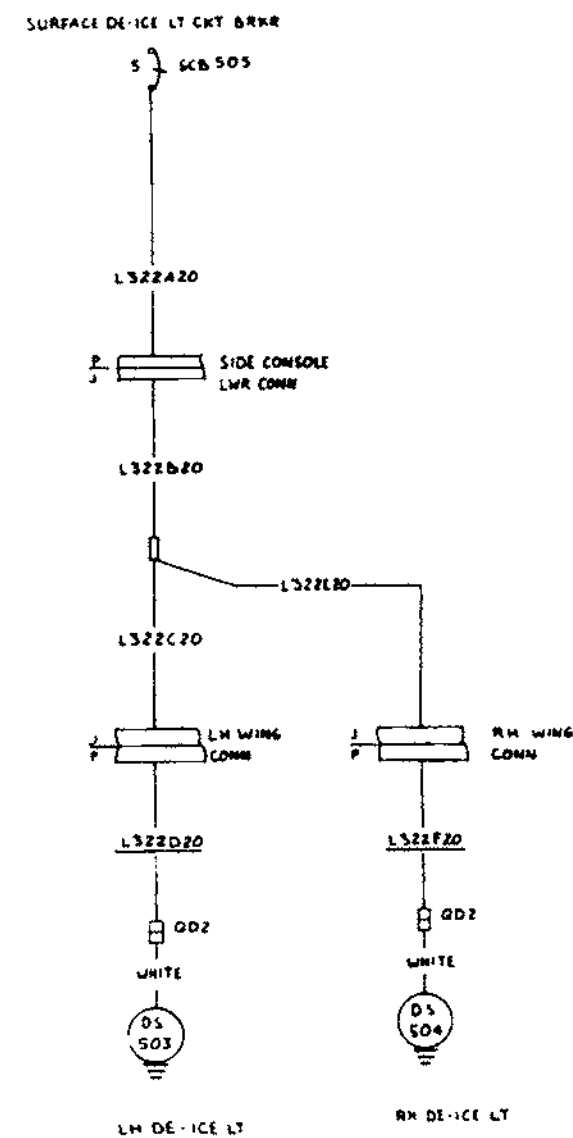


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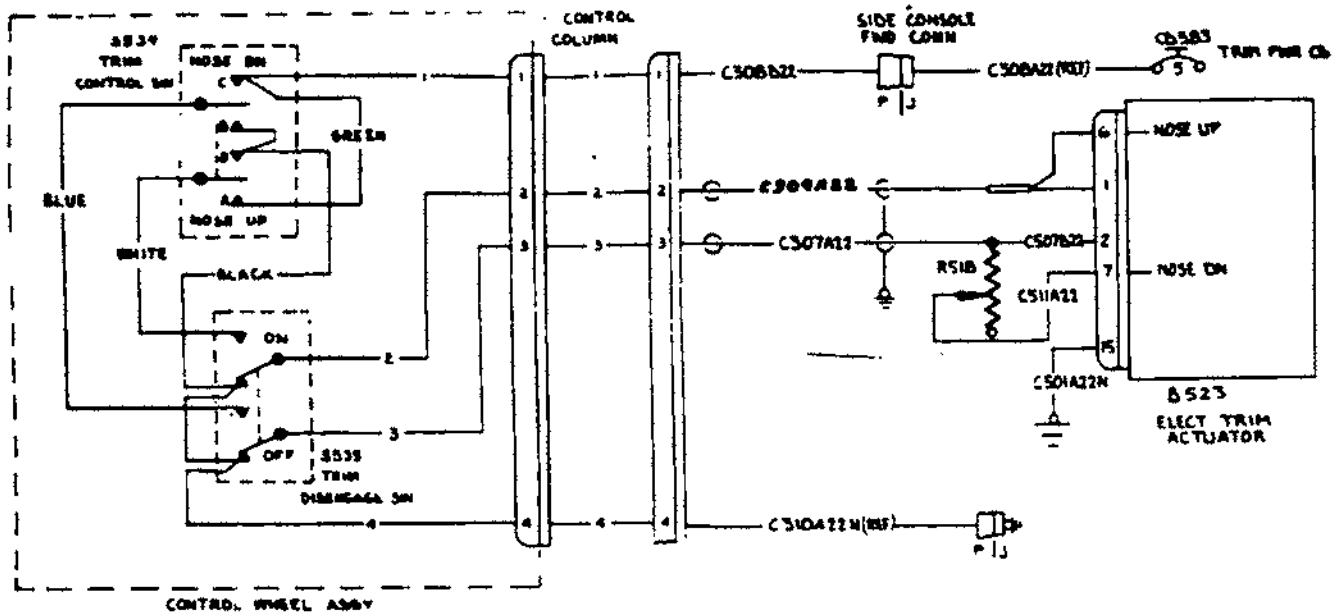
* 4210083 AND ON



4210001 THRU 4210246

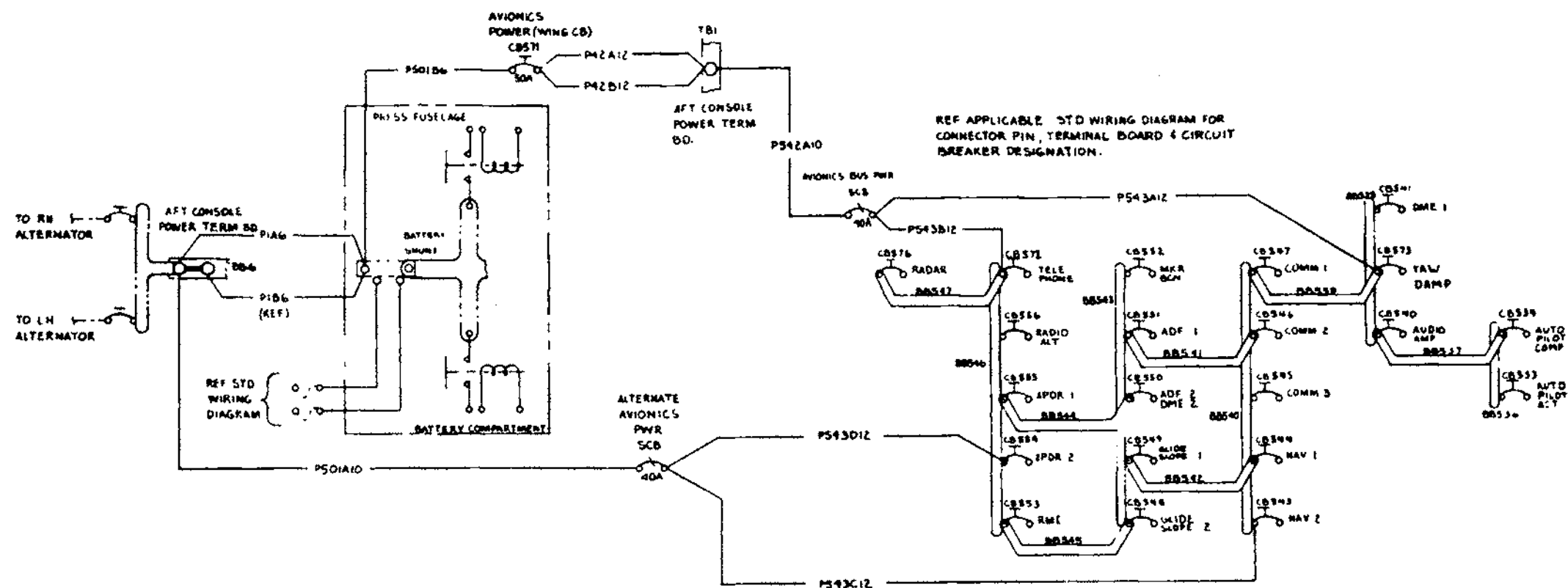
Cessna		AIRCRAFT CO.	
TITLE			
RH LDG LT AND SURFACE DE-ICE LTS. (OPT) WIRING DIAGRAM			
REV	71379	REV	5118662
QTY	NONE	QTY	1

CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL



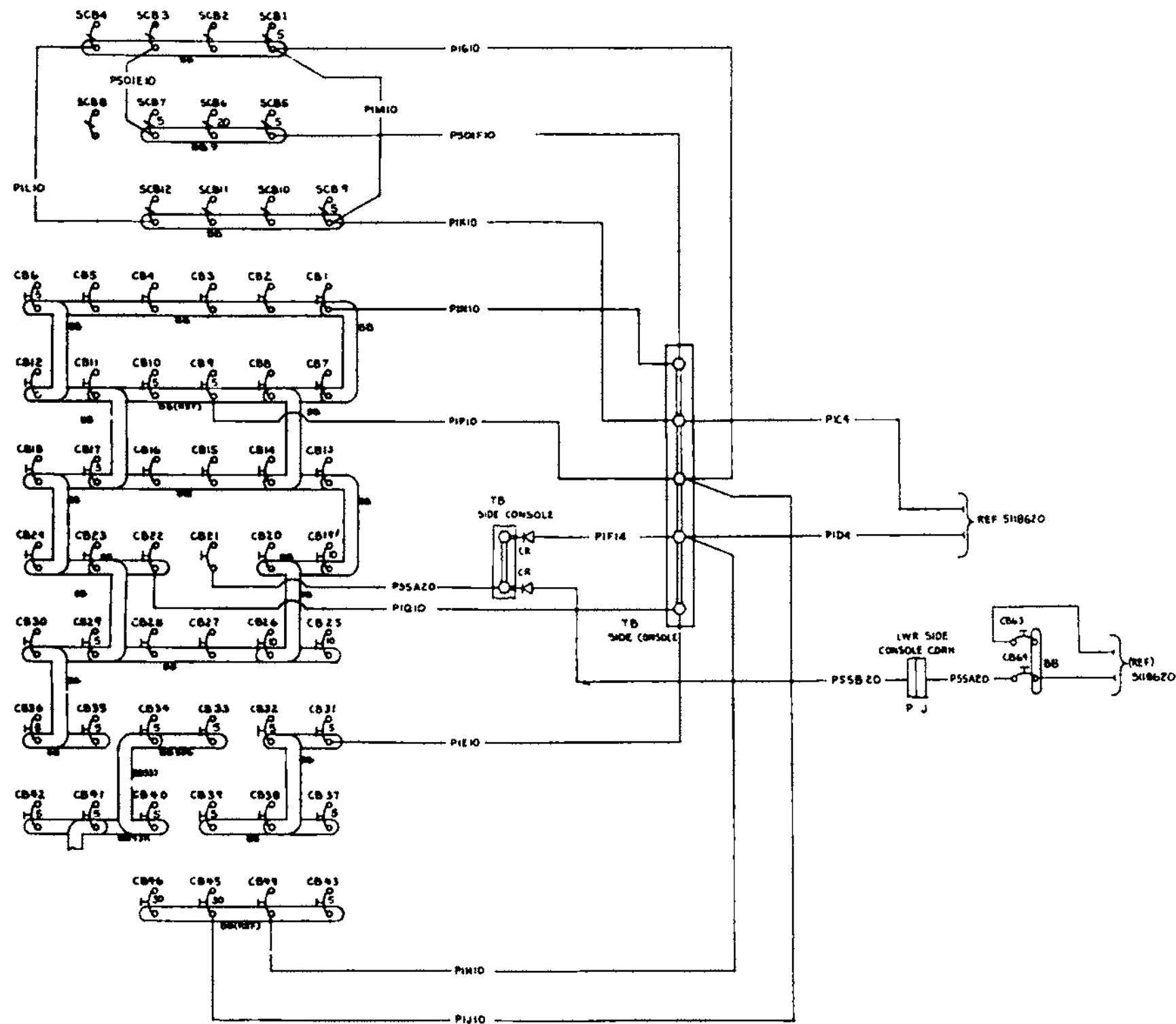
AIRPLANES C0001 THRU C0800

Cessna		AERONAUTICAL CORP.		P. O. BOX 1077 WILLOW GROVE, ILLINOIS 60091	
ELECTRIC ELEVATOR TRIM WIRING ASSY (OPT)					
QTY	QTY	QTY	QTY	QTY	QTY
D	71379		5118663		
SCALE	NONE	REV		SHEET	1 OF 1





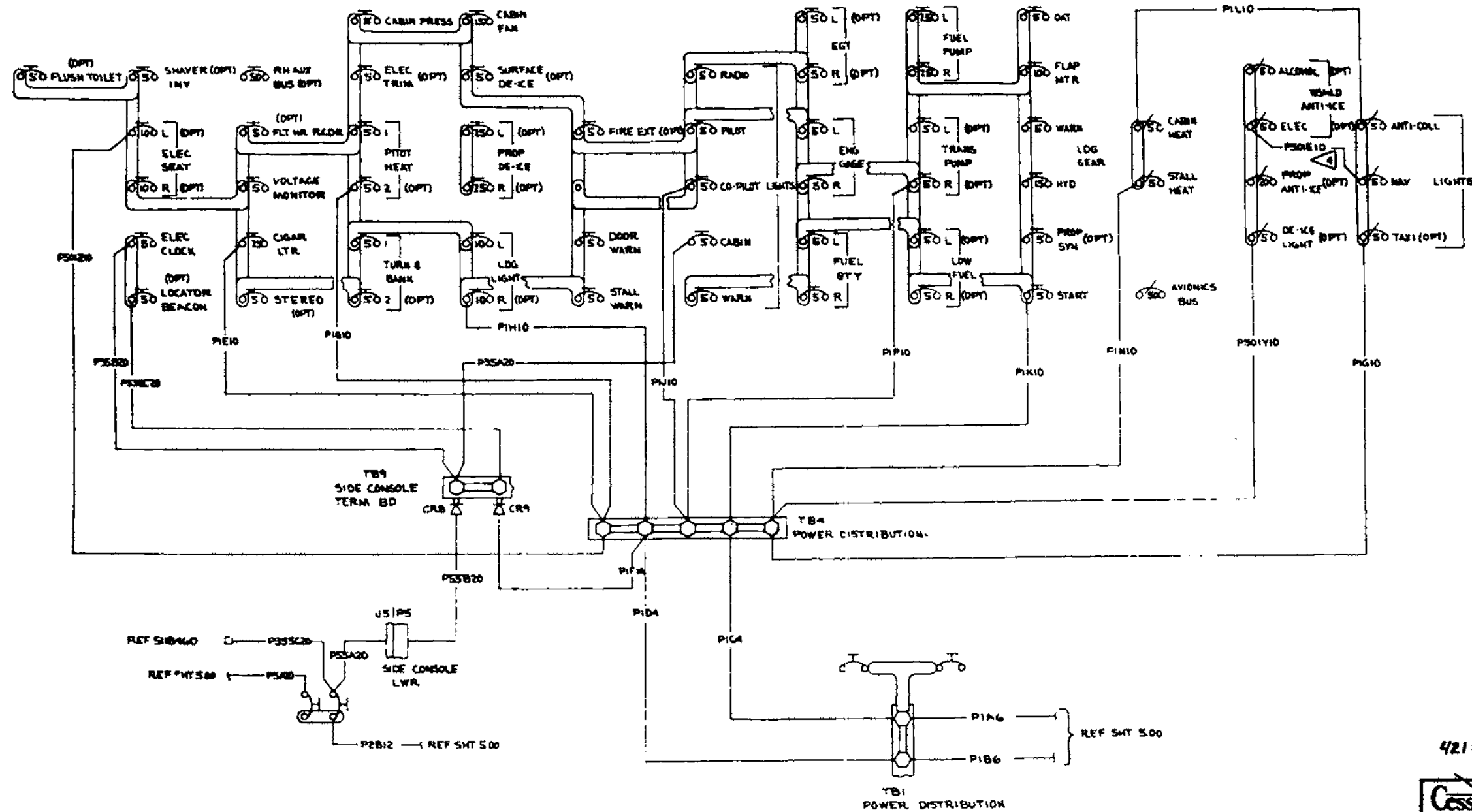
13-60
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Oct/82



CB IDENTIFICATION TABLE		
PART NAME	CB LOCATION	REF DEG
AUX PUMP R (OPT)		
AUX PUMP L (OPT)		
TELEPHONE (AV)		
MXR BCN (AV)		
RADIO ALT		
STARTER	CB 1	CB 1
PROP SYNC	CB 2	CB 2
LDG GEAR HYD	CB 3 HYD	CB 3 HYD
LDG GEAR WARN	CB 4	CB 4
FLAP MOTOR	CB 5	CB 5
SURFACE DE-ICE (OPT)	CB 6	CB 6
FUEL QTY R	CB 7	CB 7
FUEL QTY L	CB 8	CB 8
FUEL LOW R (OPT)	CB 9	CB 9
FUEL LOW L (OPT)	CB 10	CB 10
FUEL PUMP R	CB 11	CB 11
FUEL PUMP L	CB 12	CB 12
STALL WARN	CB 13	CB 13
CABIN PRESS	CB 14	CB 14
ENG GAGE R	CB 15	CB 15
ENG GAGE L	CB 16	CB 16
TRANS PUMP R (OPT)	CB 17	CB 17
TRANS PUMP L (OPT)	CB 18	CB 18
LDG LTS R (OPT)	CB 19	CB 19
LDG LTS L	CB 20	CB 20
CABIN LTS	CB 21	CB 21
CO-PILOT LTS	CB 22	CB 22
PILOT LTS	CB 23	CB 23
RADIO LTS	CB 24	CB 24
ELECT SEAT R (OPT)	CB 25	CB 25
ELECT SEAT L (OPT)	CB 26	CB 26
OAT	CB 27	CB 27
DOOR WARN	CB 28	CB 28
FIRE WARN	CB 29	CB 29
CABIN FAN (OPT)	CB 30	CB 30
GYRO POWER 2 (AV)	CB 31	CB 31
GYRO POWER 1 (AV)	CB 32	CB 32
AUTO-PILOT REL (AV)	CB 33	CB 33
AUTO-PILOT COMP (AV)	CB 34	CB 34
ELECT TRIM (OPT)	CB 35	CB 35
EGT (OPT)	CB 36	CB 36
TURN (BANK 2) (OPT)	CB 37	CB 37
TURN (BANK 1)	CB 38	CB 38
ALT	CB 39	CB 39
AUDIO AMP (AV)	CB 40	CB 40
YAW DAMP (AV)	CB 41	CB 41
DME 1 (AV)	CB 42	CB 42
STEREO (SHAPER) (OPT)	CB 43	CB 43
CIG LTR	CB 44	CB 44
EQUIP FAN (AV)	CB 45	CB 45
AC INV (OPT)	CB 46	CB 46
GLIDE SLOPE (AV)	CB 47	CB 47
TAXI LT (OPT)	SCB 1	SCB 1
NAV LTS	SCB 2	SCB 2
ANTI-COLL	SCB 3	SCB 3
BEACON LTS		
STROBE LTS (OPT)	SCB 5	SCB 5
DE-ICE LT (OPT)	SCB 6	SCB 6
PROP ANTI-ICE (OPT)	SCB 7	SCB 7
W/S ANTI-ICE (OPT)	SCB 8	SCB 8
AVIONICS MASTER	SCB 9	SCB 9
PILOT HEAT 2 (OPT)	SCB 10	SCB 10
PILOT HEAT 1	SCB 11	SCB 11
STALL (VENT HT)	SCB 12	SCB 12
CABIN HTR		

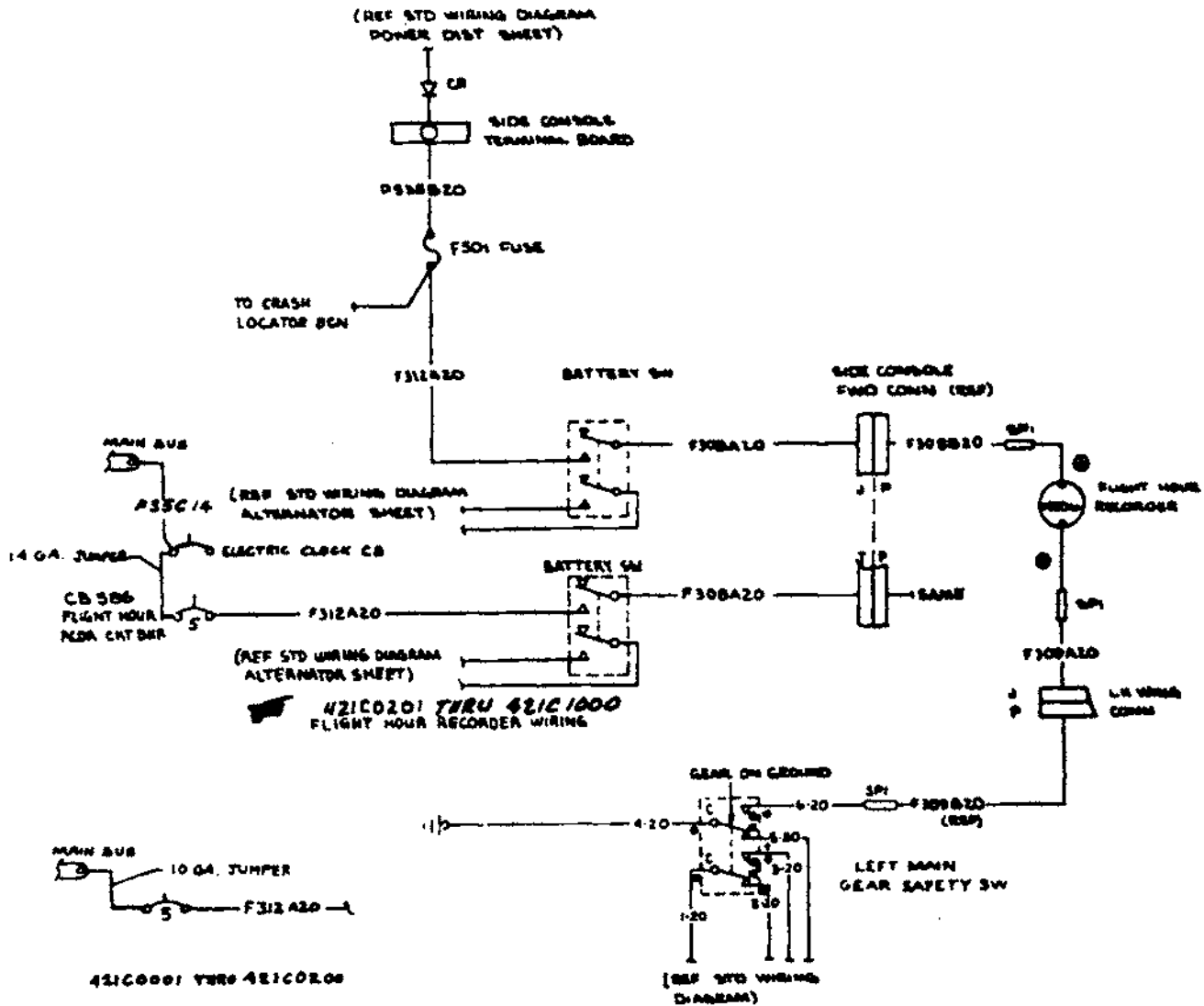
421C0001 THRU 421C0200

Cessna		AIRCRAFT CO.	
POWER DISTRIBUTION WIRING ASSY SIDE CONSOLE (OPT)			
DATE	QUANTITY	REVISION	REVISION
D	71379	5118667	
QUANTITY	NOTE	REVISION	REVISION
			OF 2



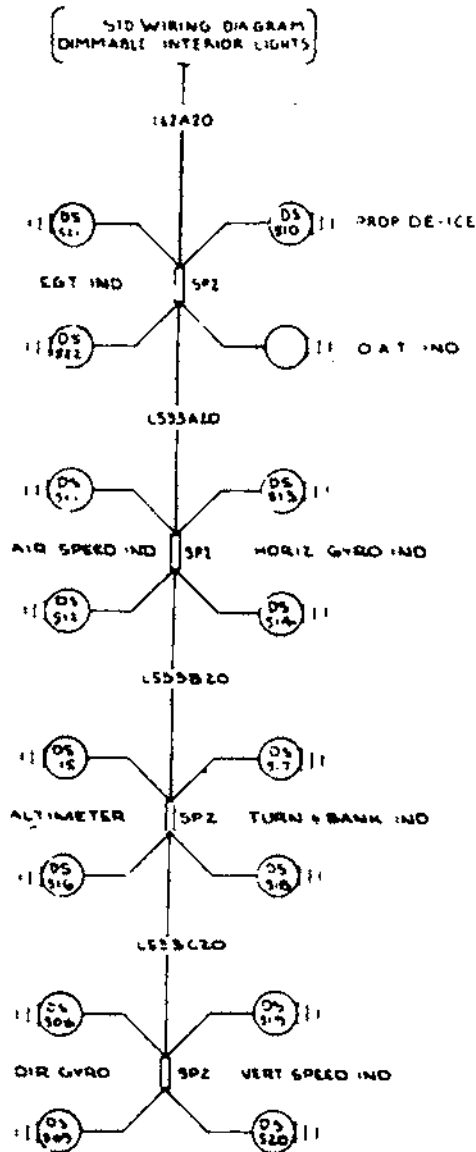
421C0201 THRU 421C1246

Cessna		AIRCRAFT CO.		P.O. BOX 107 WILSON, GEORGIA 30699	
POWER DISTRIBUTION - OPTIONAL					
DATE	CODE	REVISION NO.	REVISION NO.		
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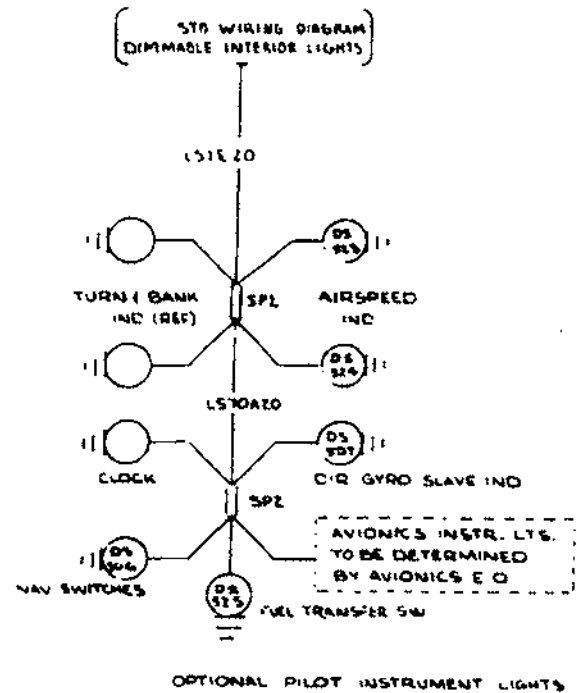


421C0001 THRU 421C1000

CESSNA		AIRCRAFT CO.		P.O. BOX 1000 MILWAUKEE, WISCONSIN 53210	
FLIGHT HOUR RECORDER WIRING ASSY (OPT.)					
QTY	QTY	QTY	QTY	QTY	QTY
D	71379	QTY	5618202	QTY	
QTY	NONE	QTY		QTY	1 (OPT)

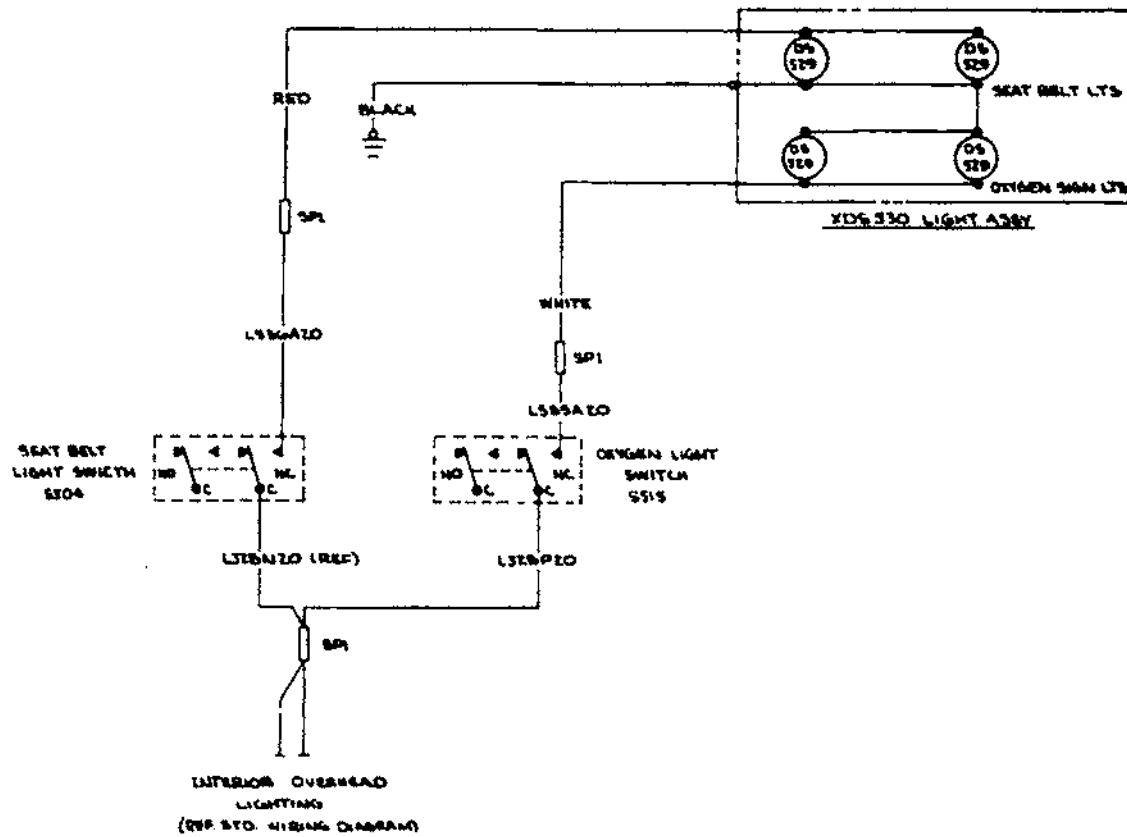


OPTIONAL CO-PILOT INSTRUMENT LIGHTS



4210001 THRU 4210246

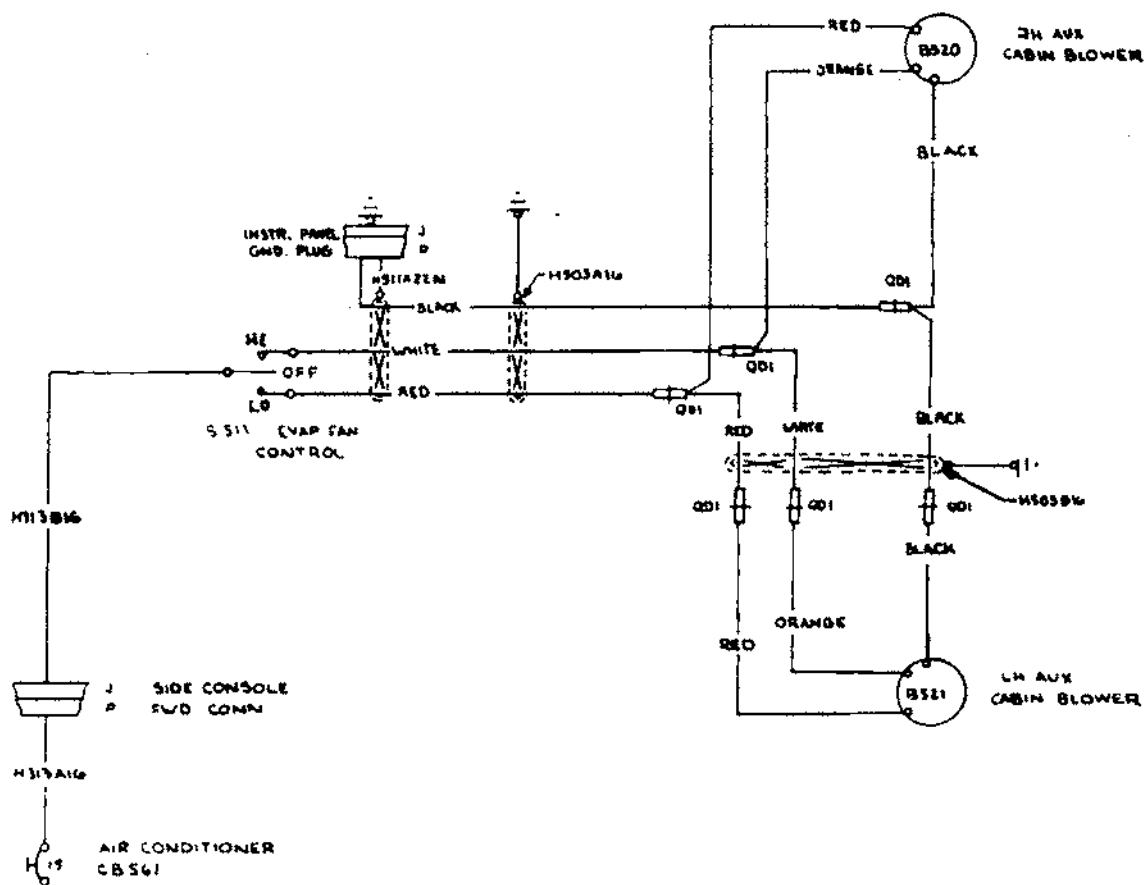
Cessna		AIRCRAFT CO.		P.O. BOX 1007 MILWAUKEE, WISCONSIN 53211	
TITLE					
OPTIONAL PILOT INSTRUMENT LIGHTS					
OPTIONAL CO-PILOT INSTRUMENT LIGHTS					
WIRING ASSY					
REV	DATE	BY	APP	DRAWING NO	
D	7/13/79			5618203	
SCALE		NONE		SHEET 1 OF 1	



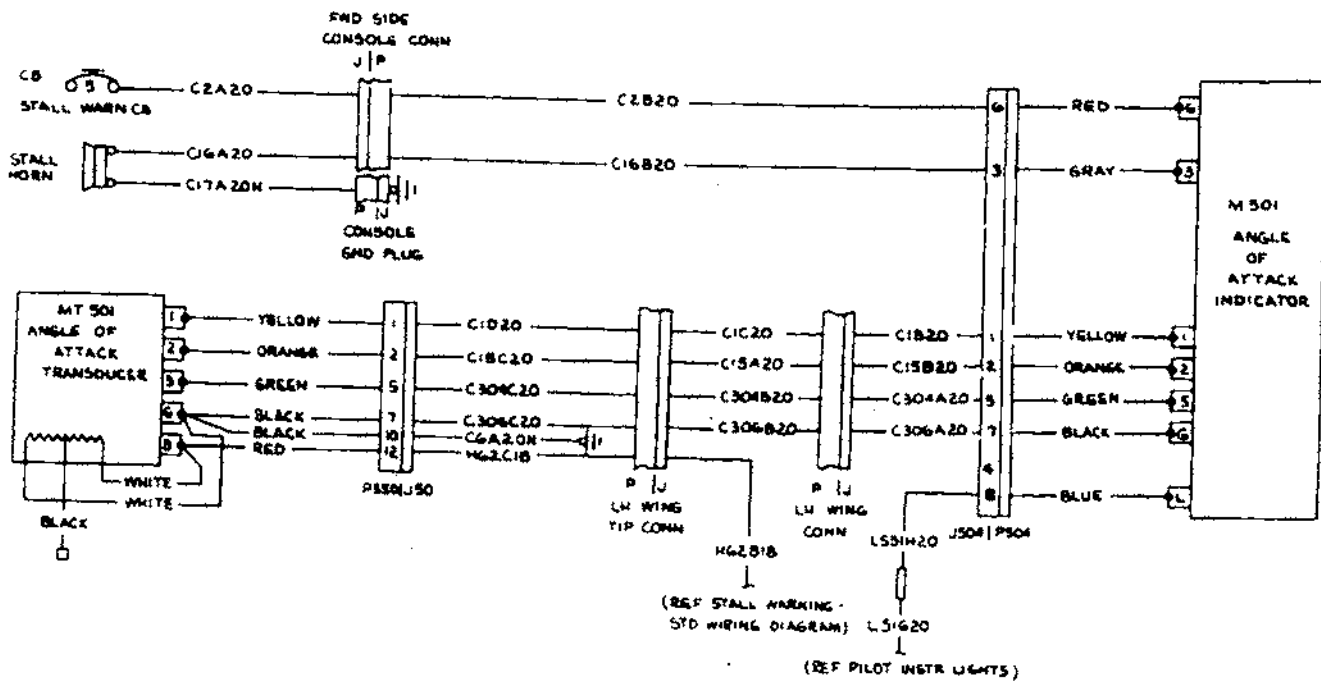
4210001 THRU 4210246

Cessna		AIRCRAFT CO.		P. O. BOX 1077 MILWAUKEE, WISCONSIN 53201	
TITLE					
OXYGEN, SEAT BELT & SMOKING L.T.S. WIRING ASSY. (OPT.)					
SIZE	CODE	REVISION NO.	DRAWING NO.		
D	71379		5618206		
SCALE	NONE	REF	SHEET 1 OF 1		

AIRPLANES C0001 THRU C0800

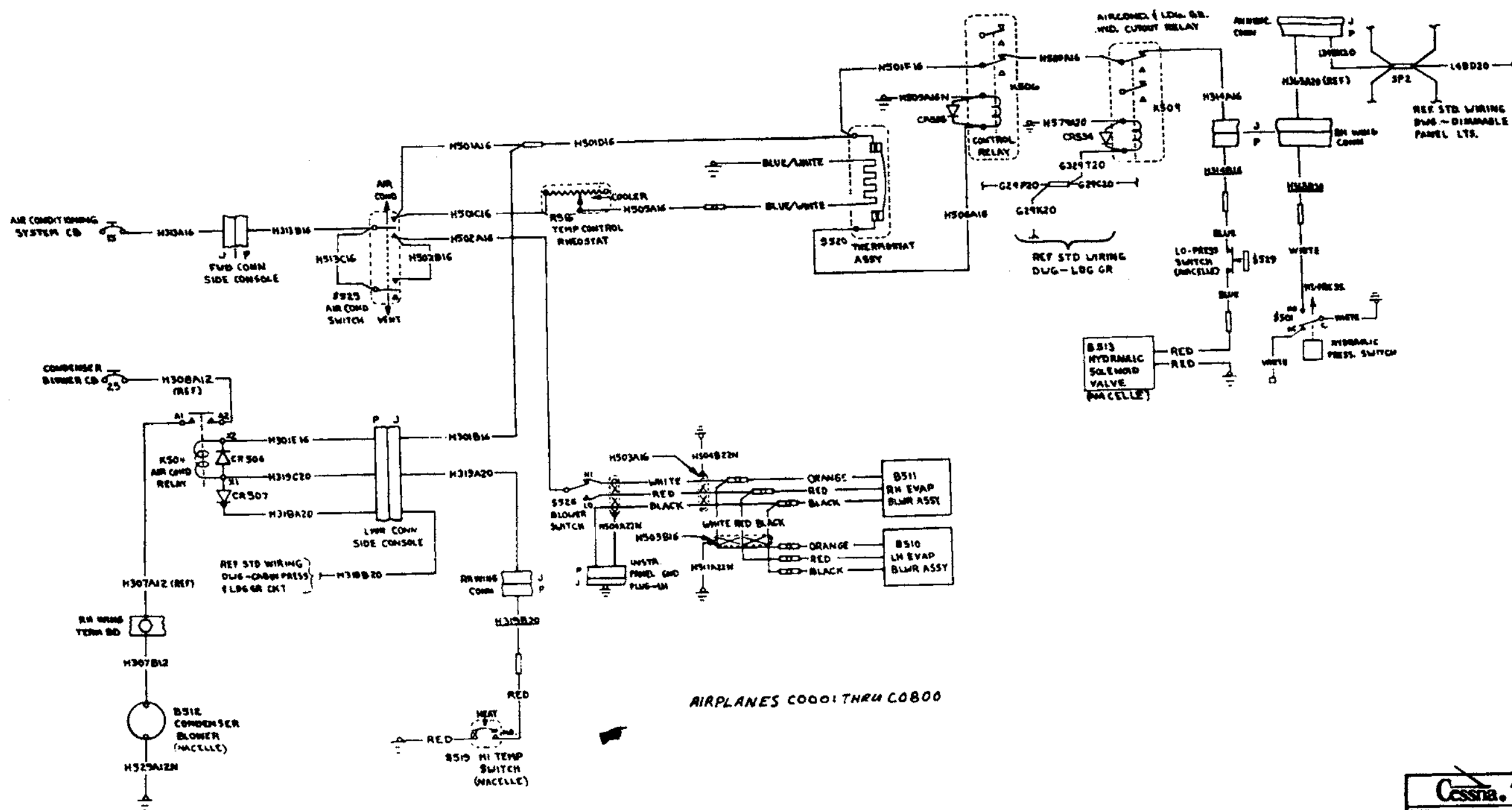


		AIRCRAFT CO.		P. O. BOX 1077 WALLACE, IDAHO 83474, KAMING 0701	
TITLE:					
AUX CABIN VENTILATING SYSTEM WIRING ASSY					
SIZE D	CODE IDENT. NO. 71379	QUANTITY NO. 5618207			
SCALE NONE	REV	SHEET 1061			



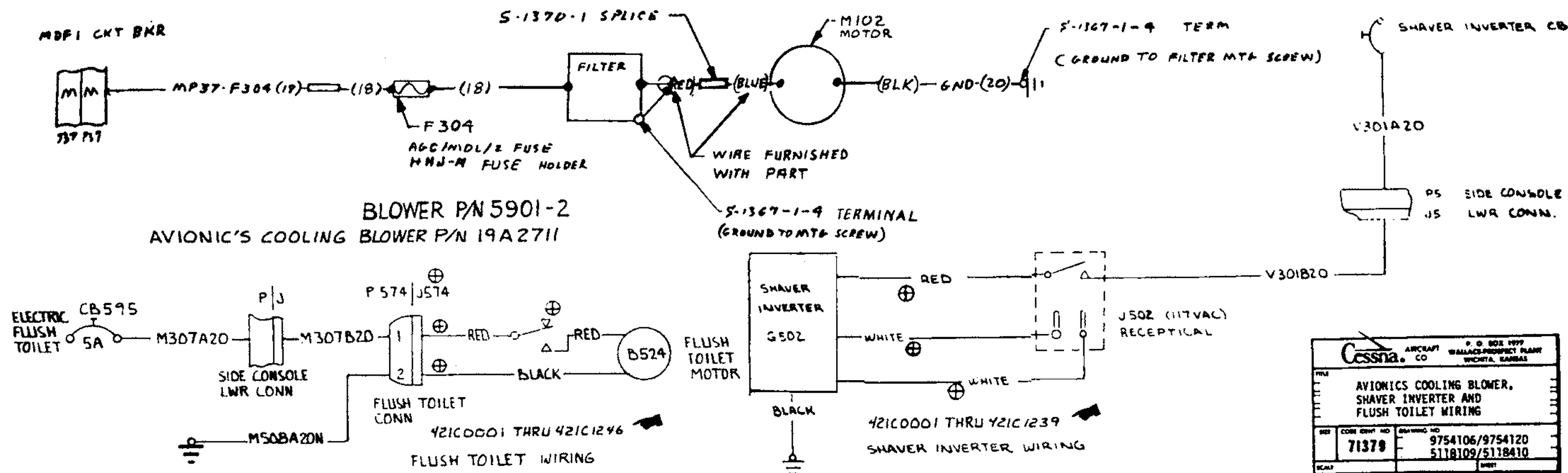
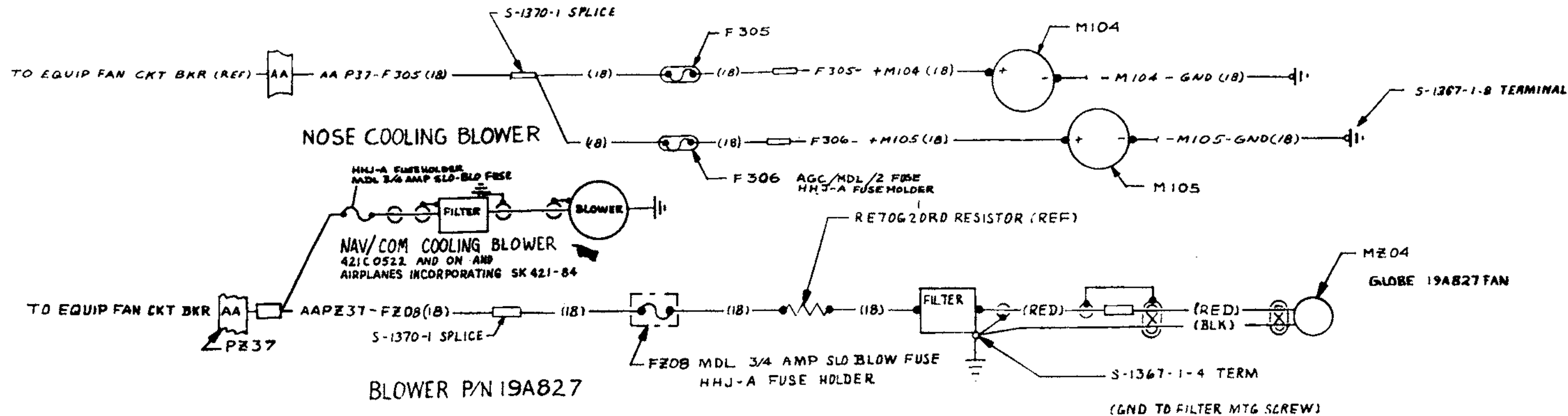
421C0001 THRU 421C1246

Cessna		AIRCRAFT CO.		P.O. BOX 407 WILLACE, MINN. 55389	
TITLE WIRING ASSY ANGLE OF ATTACK					
AGE	DATE	REV. NO.	REV. NO.	REV. NO.	
D	71379		5618208		
SCALE	NONE	REV.		SHEET 2 OF 2	

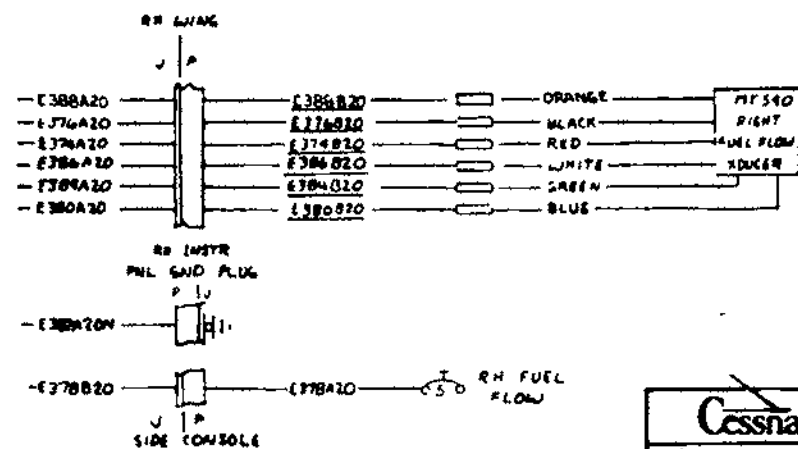
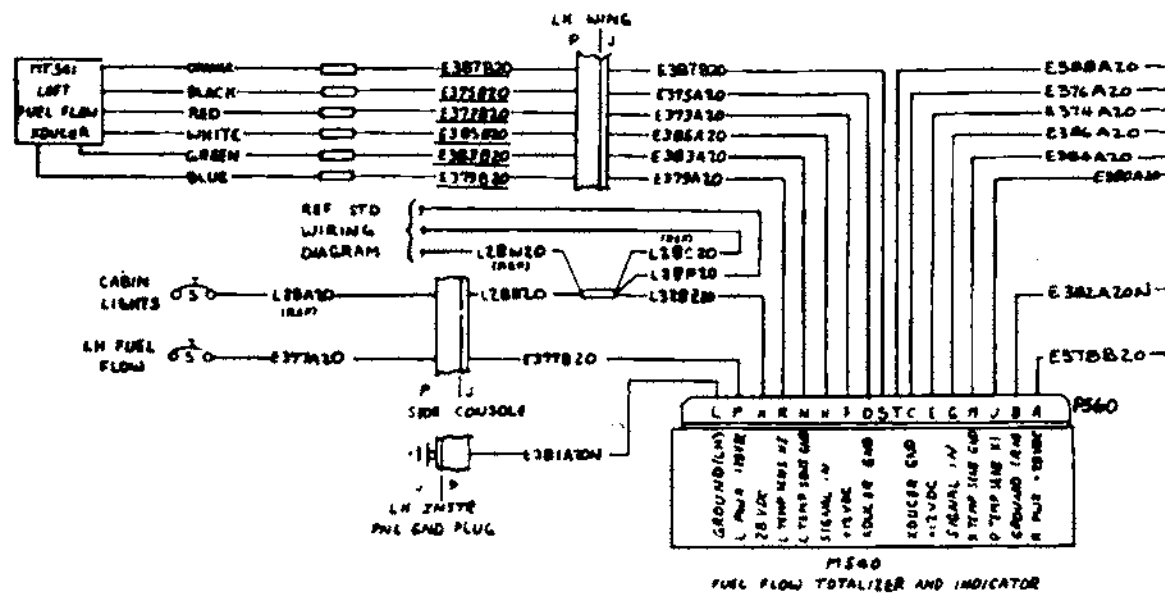


AIRPLANES 00001 THRU 00800

Cessna		AIRCRAFT CO.		P. O. BOX 1071 WILLOW GROVE, ILLINOIS 60091	
TITLE AIR CONDITIONER WIRING ASSY (OPT)					
REV	QUANTITY	DATE	REV	QUANTITY	DATE
D	71379			5618209	
SCALE	NO. OF	REV	NO. OF	REV	NO. OF

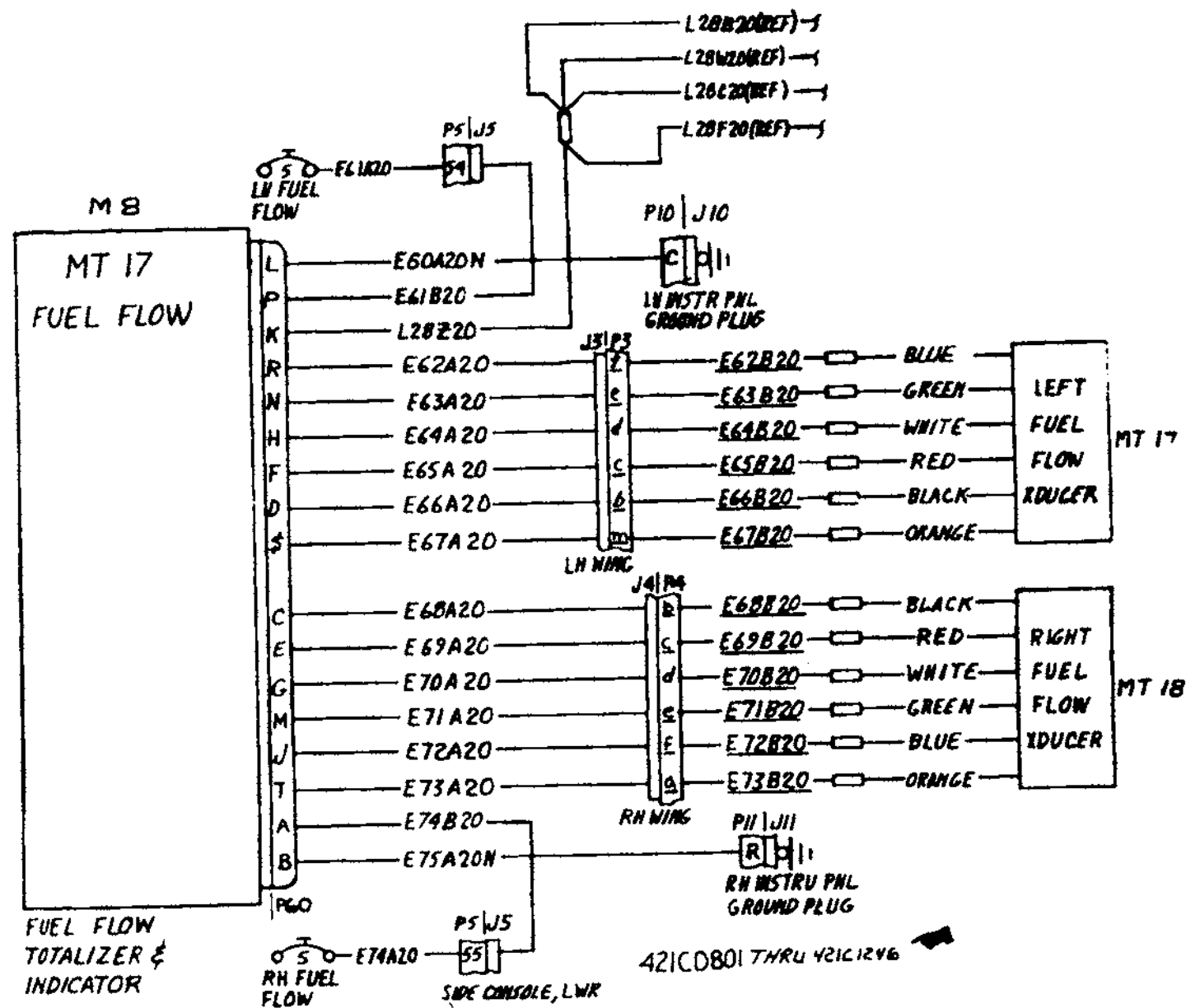


 AIRCRAFT CO		P. O. BOX 1977 WALLACE PROPERTY PLANT WICHITA, KANSAS	
TITLE AVIONICS COOLING BLOWER, SHAVR INVERTER AND FLUSH TOILET WIRING			
SER	CORE IDENT AND	DRAWING NO	
	71378	9754106/9754120 5118109/5118410	
SCALE			UNIT

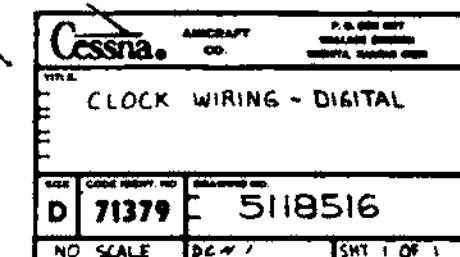


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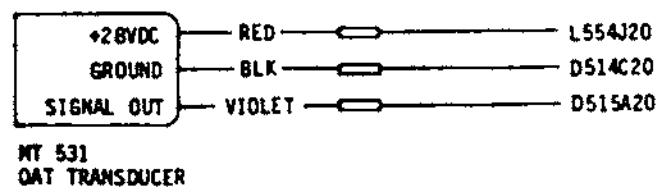
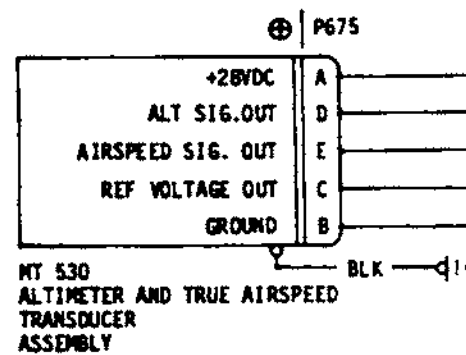
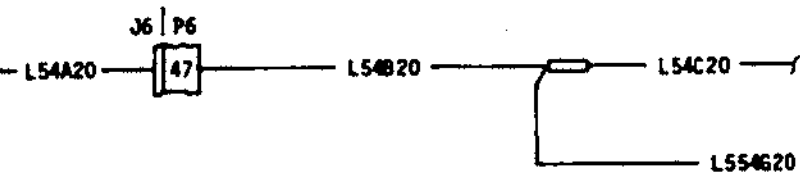
CESSNA		AIRCRAFT CO.		P. O. BOX 1077 WALLACE-PROSPECT PLANT WICHITA, KANSAS 67201	
TITLE FUEL FLOW WIRING					
SIZE	CODE IDENT NO	DRAWING NO			
D	71379	5618400			
SCALE	NOTE	REV	SHEET		



CESSNA		AIRCRAFT CO.		P. O. BOX 1077 WALLACE-PROSPECT PLANT WICHITA, KANSAS 67201	
TITLE FUEL FLOW WIRING					
SIZE	CODE IDENT NO	DRAWING NO			
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SCALE	NOTE	REV	SHEET		

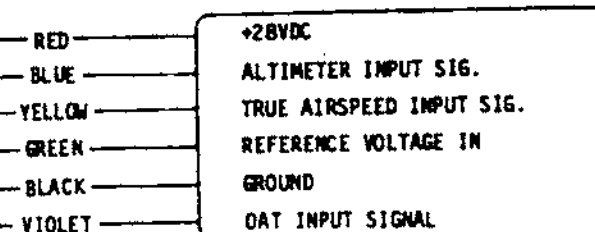
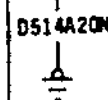


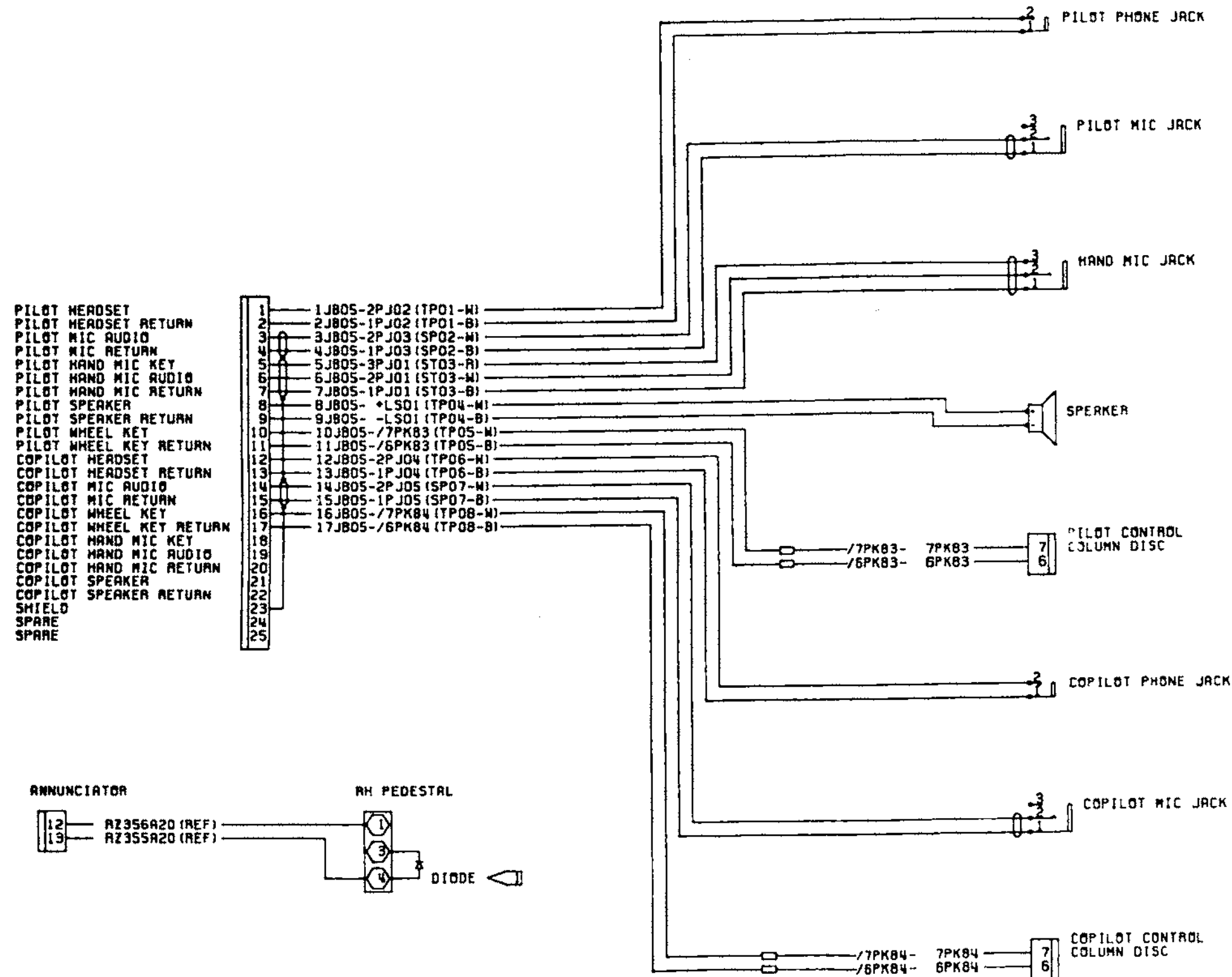
RADIO LIGHTS
CIRCUIT
BREAKER (REF)



DIVIDER DISPLAY WIRING

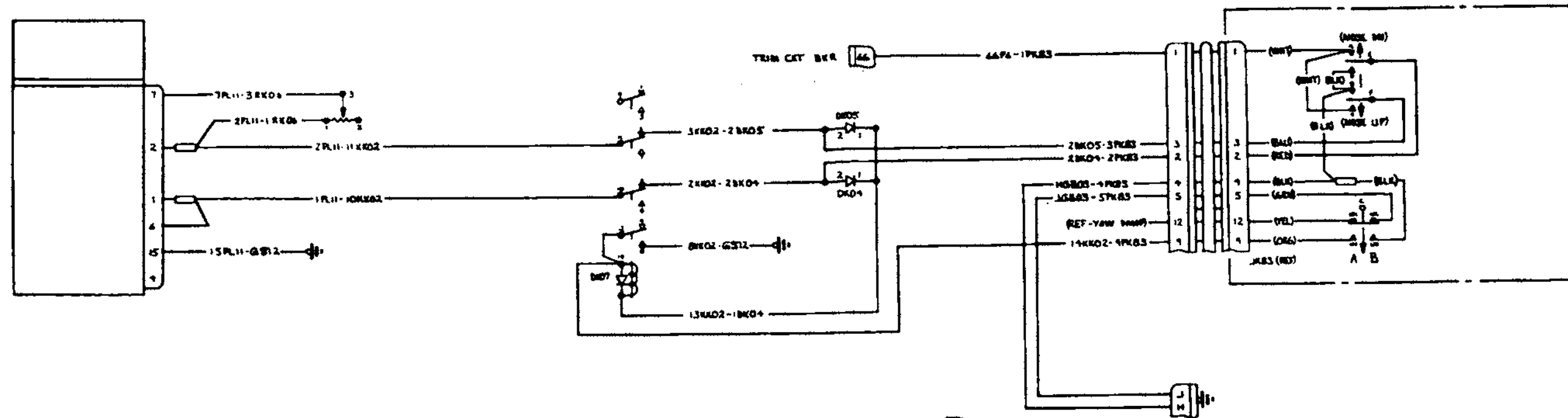
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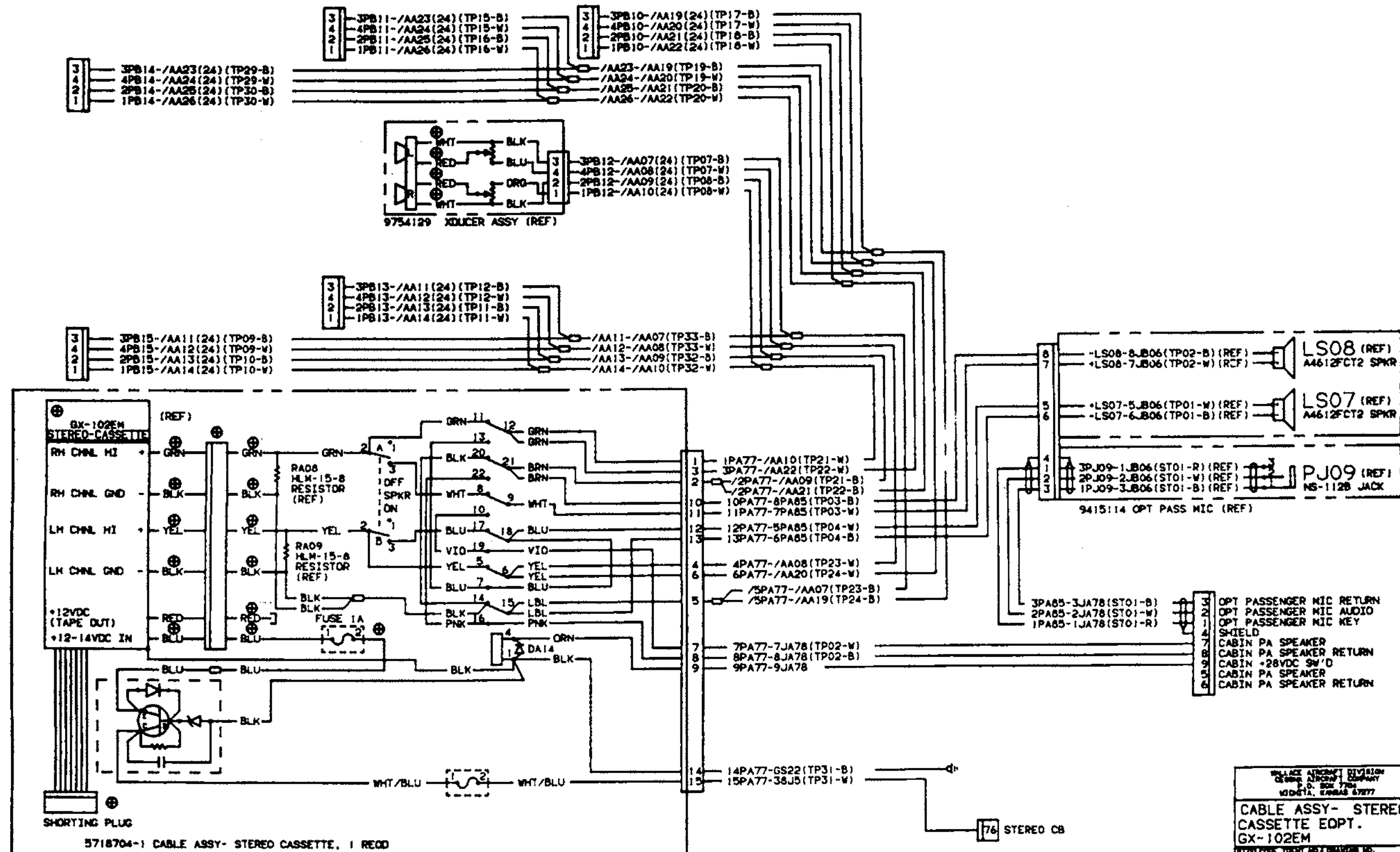
CESSNA		P.O. BOX 7708 WALLACE DIVISION CH. NICHITA, KANSAS 67277	
CABLE ASSY - AUDIO STANDARD			
SIZE	CODE	IDENT NO.	DRAWING NO.
		9715182 (1980)	9715207 (1981)

**CESSNA AIRCRAFT COMPANY
MODEL 421
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AIRPLANES C0801 AND ON

DATE 4-8-77		CROSSHA. AIRCRAFT CIN.		U.S. GOVT PROPERTY EXCLUDED FROM AUTOMATIC DOWNGRADING	
COUNTRY MEXICAL REP		TITLE CABLE ASSY - ELECTRIC ELEVATOR TRIM			
GROUP F 2611					
CIRCUIT 1000 100					
APP 2.3.14					
FABRICATE PER DES 3088		DOW		CLASSIFIED BY	
MATERIAL FOR WHICH		D 71379		9712367	
PROCESS 17-3000/12				1980	
				SPT 1 OF 1	



CESSNA AIRCRAFT COMPANY

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CHAPTER

14

AVIONICS

CESSNA AIRCRAFT COMPANY
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SERVICE MANUAL

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COMPONENT LOCATION TABLE
Avionics System

Component	Location
Autopilot Airspeed Switch	Part of Pitot Static System
Autopilot Attitude Gyro	Left Instrument Panel
Autopilot Altitude Sensor	Trim Tab Actuator, Tailcone
Emergency Locator Switch	Forward of F.S. 321 in Tailcone
Stall Warning Relay	Lower Left Console

AVIONICSDescription

1. Avionics systems in this chapter pertain to the Autopilot System, Integrated Flight Control system, audio control panel, flight phone system, emergency locator transmitter, cooling blower, slaved directional gyro system, radar system and the antenna installations. Refer to the applicable avionics system wiring diagram furnished with the aircraft for the various (optional) factory-installed avionics. Optional avionics shelves are located in the nose section of the aircraft, refer to Chapter 3. Access to the avionics shelves are gained by removing the nose cap and/or opening the nose baggage door. The avionics junction box is located on the pressure bulkhead.
2. Electrical power to the (factory-installed) avionics bus is supplied by the avionics circuit breaker, located in the left wing outboard of the engine nacelle. Electrical power is routed from the wing circuit breaker to the AVIONICS Master switch/breaker, which controls the ON and OFF electrical power at the avionics bus. An ALTERNATE AVIONICS POWER switch/breaker is provided on the circuit breaker panel for backup, electrical power in the event the wing circuit breaker, master switch or their associated circuits become inoperative.
3. Radio Noise.
 - A. Radio noise is a problem of great importance to the aircraft industry. A noisy radio system may actually imperil the safety of the aircraft occupants. The performance of radio navigation equipment can be completely erroneous if radio noise is excessive. For this reason, radio installations should be made only by persons who are qualified. Radio noise is not generated in a properly operating radio set, but is merely presented to the listener in an audible form exactly the same way that a radio station is received. Many forms of noise can exist in any particular aircraft and, ironically, sometimes certain aircraft can be amazingly quiet. This condition is unusual and even though the aircraft is quiet without noise suppression, it cannot be released without proper suppression. A quiet aircraft without suppression may degenerate into a noisy aircraft with changes in age, temperature, and humidity. Common radio noise is generated by ordinary electrical devices in the aircraft such as flap motors, navigation light flashers and ignition or alternator systems. By properly installing capacitive and inductive devices in these circuits, the noise can usually be reduced to a tolerable level. A more difficult type of noise to suppress, is that generated by friction between two components or by rectification. Another difficult problem is noise that is carried to sensitive areas by grounding loops. The following paragraphs contain solutions that have been effective for the factory. It is important to remember that each aircraft may present a slightly different problem and, therefore, a "fix" on one aircraft will not necessarily be effective in all cases.
4. Alternator Noise.
 - A. While the alternators are relatively free from radio noise, there is the possibility the alternators will produce an audible noise in the radio and electronic systems. Inside the alternator a three-phase AC voltage is applied to a full wave rectifier assembly, thus converting the AC voltage to DC. During the rectification, an AC ripple appears on top of the DC voltage, thus the bus voltage is actually fluctuating. While the battery acts as a capacitance, it is also necessary to have additional filtering. This is accomplished by the use of a capacitor from the output terminal to ground at the alternator. The use of solid state regulators reduces the possibility of regulator noise to a minimum and will not require filtering.
5. Ignition Noise.
 - A. The sound of ignition noise is easily identified because of its timing. The aircraft has a shielded magneto ignition system. Each secondary lead from the magneto to the plug is a shielded wire. Double shielded wiring is used in the primary circuit with a special suppressor in series with the switch lead. The suppressor is constructed coaxially with a shielded lead coming out of the end which is connected to the magneto cigarette cartridge. The double shielded wire is connected to the terminal end of the filter (the shield is grounded). The double shielded wire enters the cabin area through connectors in the wing root rib to prevent noise transfer to the junction box wiring. The double shielding is continued to the inside of the cabin to the magneto switch. The magneto switches are enclosed in a shielded case to which the

double shield of the wire is grounded. If ignition noise is prevalent in the radio system, the entire magneto system should be checked for tight connections, especially in the root rib connectors and at the switch and suppressor. All ground connections in the circuit are critical and any oil or dirt accumulation should be cleaned from the connection and the metal should be brightened to provide the best possible ground. Ignition harness should be replaced if the shielding becomes questionable.

6. Flap Motor Noise.

- A. During a landing approach, an unfiltered motor in the flap circuit can produce a startling volume of noise which is very distracting. There is also the possibility of the noise blanketing a message from the tower during the approach. It is possible that sufficient noise could be created through these circuits to blanket an ILS signal, creating a hazardous situation. For these reasons, the circuits have a filter section built into the motor. The filter should be very effective if the unit is properly grounded. If noise becomes excessive with good grounding, a motor overhaul or replacement may be necessary.

7. Auxiliary Fuel Pump Noise.

- A. Coaxial type capacitors produce effective results when installed on the base of the fuel boost pumps. Because of the location of the fuel pump and capacitors, the connections must be kept tight to avoid any possible arcing. When proper filtering and grounding do not produce the desired filtering results, a new pump should be tried.

8. Lighting Circuit Noise.

- A. All lighting components on the aircraft have internal filters and usually do not require external capacity. The light wiring, however, because of its route to the extremities of the aircraft can, in unusual cases, conduct noise to vital areas. The light wires and electrical wiring bundles should be routed away from the antenna and loop antenna cables to prevent picking up noise in the radio systems. Shielding should be properly grounded.

Troubleshooting

1. Troubleshooting Electronic Interference Guide.

NOTE: The following general troubleshooting information is presented as a guide to determine the system or systems producing the interference.

2. Troubleshooting General.

- A. Pinpoint the particular system causing the noise by the process of elimination.
- B. Once the system causing a particular noise is isolated, investigate the particular system or systems to determine which component or components are causing the noise, by observing which components are actually operating when the noise occurs.
- C. Check the component for proper operation or damage.
- D. Check wiring connections and wiring coming in contact with moving parts.
- E. Check wire routing for proper separation.
- F. Check wire shielding where applicable.
- G. Check all system grounds.

3. Troubleshooting Alternator Noise.

NOTE: If alternator noise is experienced and it is determined it is coming from the output of the alternator, the following troubleshooting should be accomplished before attempting additional filtering.

- A. Check attenuator output bypass filter for broken leads or inadequate ground.
- B. Check the lead attaching to alternator power (+) terminal is as short as possible or approximately 1 to 2 inches long.
- C. Check alternator ground wire for any damage or improper contact or corrosion between terminal and grounding point.
- D. Check alternator brushes for damage that could be arcing.
- E. Check alternator brush tension for proper seating.

4. Troubleshooting Voltage Regulator Noise.

NOTE: If regulator noise is present and traced to the regulator and its associated control leads the following checks should be made before attempting to add additional filtering.

- A. Check regulator adjustment for proper setting (27.25 to 27.75 volts).
- B. Check regulator noise filter for damage, loose wires, broken leads, or improper connections.
- C. Check shield wire on regulator to alternator field wires for proper termination (single point ground) and shield damage. Check for adequate coverage at termination ends.
- D. Check alternator for brush arcing.

5. Troubleshooting Electroluminescent Panels Inverter Noise.

- A. In most cases noise produced by the E.L. inverter could be due to the light capacitive load on the inverter. When this problem occurs, it can be eliminated by the addition of .01 to .05 ufd 200 WV capacitor to the output terminals of the inverter. If the noise cannot be eliminated, it should be determined whether the noise is due to one of the following:
 - (1) Radiation from AC wiring, requiring shielding.
 - (2) Noise conducted to the power bus by the DC input, requiring filtering.
 - (3) Radiation from DC power leads requiring shielding.
 - (4) Radiation from inverter, necessitating replacement of inverter.
 - (5) If the aircraft has an ADF installed, the following guidelines may be used to locate electroluminescent inverter noise:
 - (a) Tune ADF to a low frequency band.
 - (b) Place all panel light controls in the lowest position.
 - (c) Turn each panel control fully on one at a time and listen for a high pitched buzzing sound similar to an electric drill motor.
 - (d) After isolation of the noise control, check panels on that control for operation.
 - (e) If the inverter has a capacitor across its output terminals, check the capacitor for damage or substitute a capacitor known to be good.

6. Troubleshooting Electric Elevator Trim Motor Noise.

- A. In the event of noise difficulties caused by the trim system motors, the following should be checked to ensure standard noise suppression equipment is properly installed.
- B. Check that motor frame and actuator assembly are properly grounded.
- C. Check capacitors inside of motor for broken leads or damage.
- D. Check to make sure shielded wires are properly grounded at the actuator assembly and that the shields are not shorted to structure in other areas which could create noise loops.
- E. If the filters are good and noise is not totally eliminated, the following procedures should be attempted to eliminate the noise.
 - (1) Change C_1 to .05 microfarad.
 - (2) Add a 1.0 microfarad feed-thru capacitor with shielded lead to (+) lead of the side producing the noise. Attach the housing or capacitance ground to the actuator housing assembly.
 - (3) Make sure shielding wire and motor frame are making good ground.
 - (4) If the motor is noisy in both directions of rotation add a 1.0 microfarad feed-thru capacitor to both leads and ensure that shield and housing or capacitor ground are attached to the actuator housing assembly.
 - (5) The addition of larger capacitors, inductors or RF chokes is not recommended; experience has proven no significant change in additional filtering.

7. Troubleshooting Auxiliary Fuel Pump Noise.

- A. If auxiliary fuel pump noise is experienced in the audio system, check for the following:
 - (1) Ensure that wiring is properly shielded.
 - (2) Ensure shields are properly grounded.
 - (3) Check loose wiring connections for looseness and breaks.

NOTE: If the cause of the noise cannot be eliminated, a .47 microfarad 50 WVDC feed-thru capacitor should be installed in the power (At) lead as close to the pump as possible and ensure the case of the capacitor is properly grounded to the airframe.

8. Troubleshooting Wing Locker Transfer Pump Noise.

- A. If the wing locker transfer pump is causing noise in the audio system, check the following:
- (1) Check capacitor case ground.
 - (2) Check capacitor for damage, open circuit, short circuit, loose wiring and damaged shielding.
 - (3) Substitute a capacitor of the same value known to be good in place of the original capacitor.

9. Troubleshooting Anti-Collision Lights.

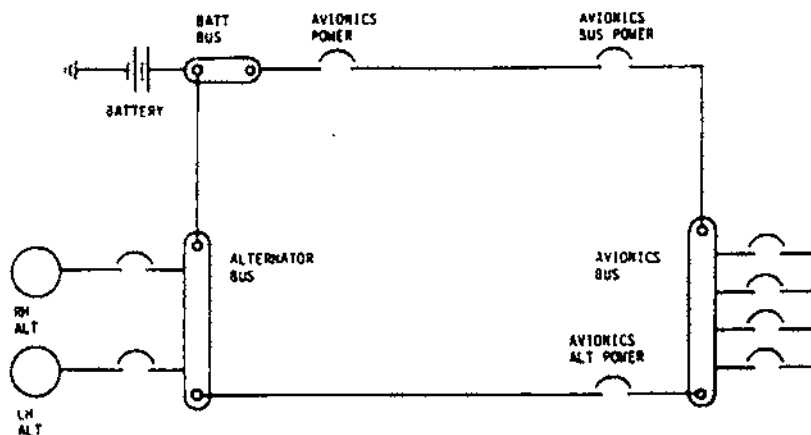
- A. If the anti-collision lights are causing noise in the audio system, the following should be checked:
- (1) Filter for proper ground.
 - (2) Lamp circuit for loose connections and wiring.
 - (3) Bulb for loose socket.
 - (4) Internal filter for damage.
 - (5) External light for proper ground to frame or structure of aircraft.

10. Troubleshooting Strobe Light Noise.

- A. If the strobe lights are causing noise in the audio system from radiation or in-line interference, the following should be checked:
- (1) Make sure all power supply units are grounded properly to the airframe.
 - (2) Ensure the shielded wires and twisted pairs from the tail light are grounded.

NOTE: Grounds must be terminated at the power supply.

- (3) Ensure tail Nav light is adequately grounded.



Avionics Bus Schematic
Figure 1

AUTOPILOTDescription

1. The Cessna 400B Nav-O-Matic Autopilot (optional) is a two-axis automatic flight control system that governs the positions of the ailerons and elevators. Lateral stability, heading hold, command turn, automatic intercept and/or tracking to any VOR radial are provided about the roll axis. In addition to holding the wings level and compensating for rotation about the roll axis, the autopilot provides command pitch, attitude hold, aircraft altitude hold, automatic pitch trim and an optional ILS coupler.
2. The system consists of: one each vacuum directional gyro, attitude gyro, controller, roll actuator, computer amplifier, pitch actuator, pitch trim follow-up actuator, altitude sensor, airspeed switch, autopilot disengage switch and associated electrical cables and wiring.
3. The altitude sensor separate from the computer amplifier incorporates an altitude switch for High-Low gain sensitivity. The airspeed switch provides pitch channel gain to the pitch trim actuator. The slaved directional gyro is offered as an option, replacing the standard directional gyro to provide autopilot heading information.
4. Refer to Cessna 400B Nav-O-Matic Autopilot Service/Parts Manual for additional information of components, troubleshooting, computer alignment procedures and wiring diagrams.

CAUTION: PRIMARY AND SECONDARY FLIGHT CONTROL CABLES, PUSH-PULL TUBES, BELLCRANKS AND MOUNTINGS USE DUAL LOCKING FASTENERS. THE LOCKNUTS FOR THESE FASTENERS INCORPORATE A FIBER LOCK, AND ARE CASTELLATED FOR SAFETYING WITH A COTTER PIN. WHEN ANY OF THESE AREAS ARE DISCONNECTED ON ANY AIRCRAFT, NEW DUAL LOCKING FASTENERS SHOULD BE INSTALLED. SEE THE AIRCRAFT PARTS CATALOG FOR PART NUMBERS AND LOCATION OF THESE FASTENERS.

Adjustment/Test

1. Tools and Equipment

NOTE: Equivalent substitutes may be used instead of the following listed items.

Name	Number	Manufacturer	Use
Tensiometer	TS-2002-101	Pacific Scientific Co.	To measure cable tension.
400B Nav-O-Matic Service/Parts Manual		Aircraft Radio and Control Div.	Adjustment/test procedure.

2. Rigging 400B Nav-O-Matic Autopilot Control Cables (See Figure 1).

NOTE: Cable tension should be adjusted when ambient temperature is 65°F to 95°F. Allow aircraft temperature to stabilize for a period of four hours.

- A. Rigging Autopilot Aileron Control Cables.

- (1) Verify that aileron control system is properly rigged. Refer to Chapter 5.
- (2) Use clamp or other locking device to lock ailerons in the neutral position.
- (3) Ensure chain is evenly distributed over aileron roll actuator sprocket.
- (4) Ensure cables are properly routed over pulleys and guard pins are properly installed.
- (5) Rig aileron autopilot roll actuator control cable tension by tightening turnbuckle. Refer to Chapter 1.
- (6) Remove locking device from aileron control surfaces and move aileron through entire travel. Observe chain over sprocket of roll actuator for sufficient remaining chain links at the extreme travel limits.
- (7) Safety turnbuckle.

B. Rigging Autopilot Elevator Control Cables.

- (1) Verify that elevator control system is properly rigged. Refer to Chapter 5.
- (2) Using clamp or other locking device, lock elevator in the neutral position.
- (3) With elevator control surface in neutral position, center chain on elevator servo sprocket.
- (4) Rig pitch actuator cable tension by tightening turnbuckle. Refer to Chapter 1.
- (5) Remove locking device from elevator control surfaces and move elevator up and down through entire travel. Observe chain over sprocket of pitch actuator for sufficient remaining chain links at the extreme travel limits.
- (6) Safety turnbuckle.

C. Rigging Autopilot Elevator Trim Control Cables.

NOTE: Before rigging elevator trim control cables, ensure cables are installed properly on actuator drum, refer to Chapter 5.

- (1) Verify trim tab system is properly rigged, refer to Chapter 5. Cable tension shall be in accordance with Chapter 1.
- (2) Operate trim tab through entire travel and observe cable on actuator drum.
- (3) Install safety wire.

3. Operational Check

- A. Refer to 400B Nav-O-Matic Service/Parts Manual for operational check procedures.

Maintenance Practices

1. Removal/Installation Roll Actuator (See Figure 1).

A. Remove Roll Actuator.

- (1) Turn electrical power OFF.
- (2) Remove necessary seats, carpet and floorboards to gain access.
- (3) Remove safety and loosen turnbuckle at aileron quadrant to relieve cable tension.
- (4) Disconnect electrical connection.
- (5) Remove screws securing actuator to mounting bracket and remove from actuator from aircraft.

B. Install Roll Actuator

- (1) Position actuator on mounting bracket and install screws.
- (2) Install chain evenly over actuator sprocket.

NOTE: Aircraft ailerons should be clamped in neutral position and the chain centered on the sprocket.

- (3) Rig roll actuator cables. (Refer to Adjustment/Test).
- (4) Connect electrical connector.

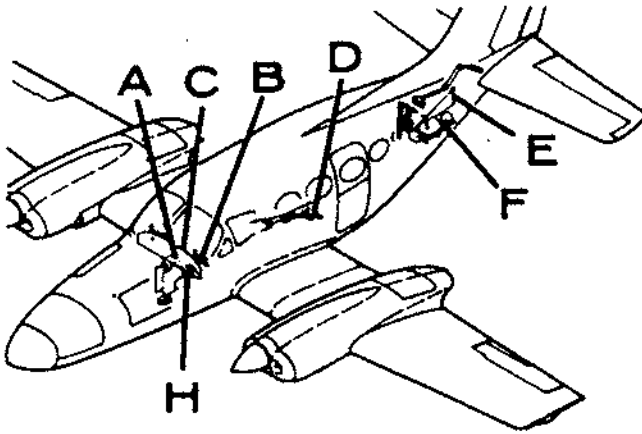
CAUTION: Verify that ailerons respond in the correct direction relative to control wheel with autopilot operating.

- (5) Install turnbuckle safety.
- (6) Install floorboards, carpet and seats.

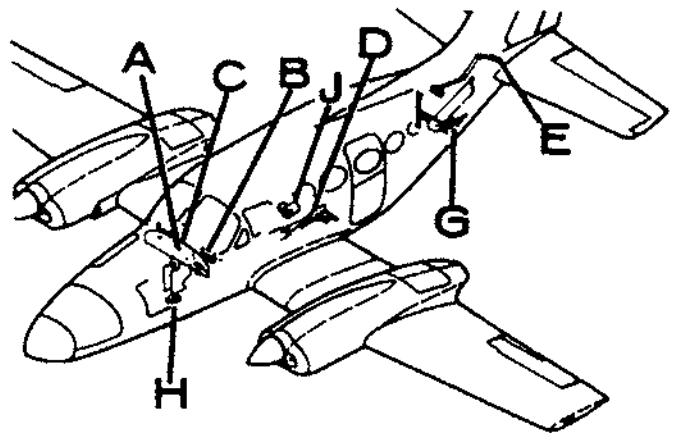
2. Removal/Installation Roll Actuator Cables (See Figure 1).

A. Remove Roll Actuator Cables.

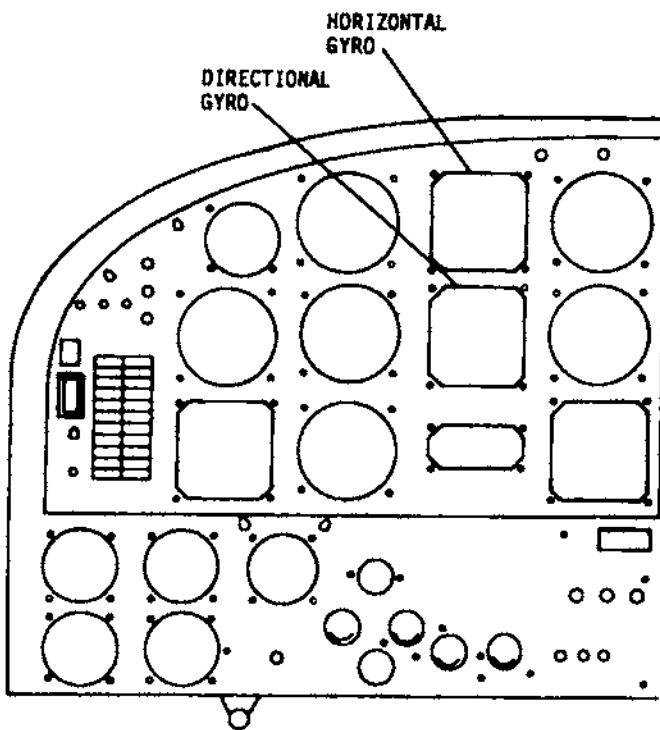
- (1) Turn electrical power OFF.
- (2) Remove necessary seats, carpet and floorboards to gain access.
- (3) Remove safety and relieve tension on cable by loosening turnbuckle at aileron quadrant.
- (4) Disconnect cable fittings from aileron quadrant links by removing cotter pin, nut, washer and clevis bolt.
- (5) Remove cable guard pins and pulleys from bracket.
- (6) Pull cable aft and out through actuator opening into cabin area.



421C0001 THRU 421C1255

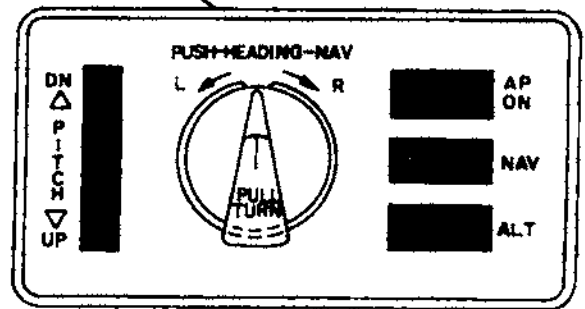


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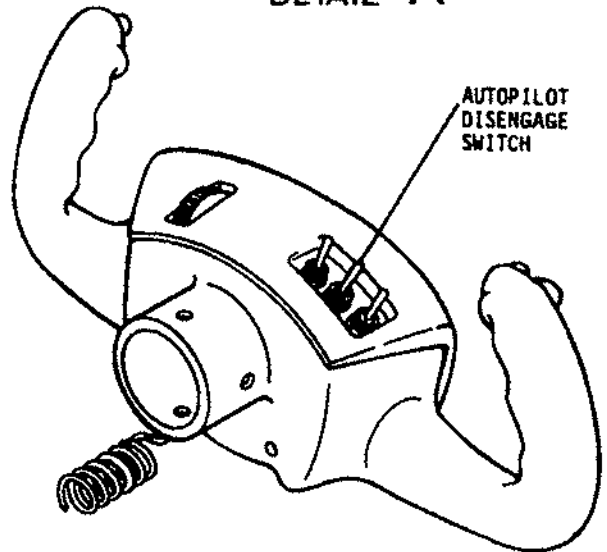


DETAIL C

CONTROLLER



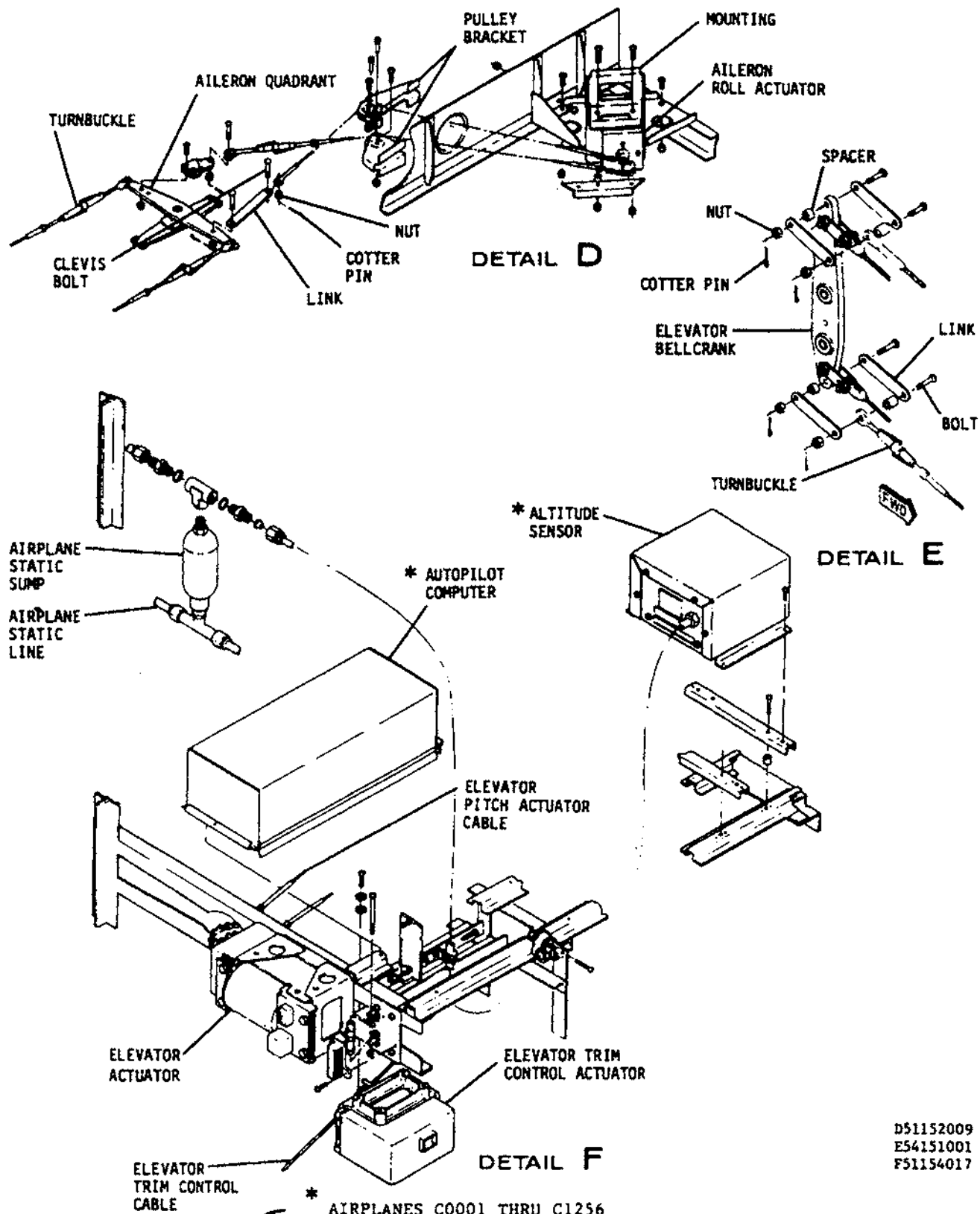
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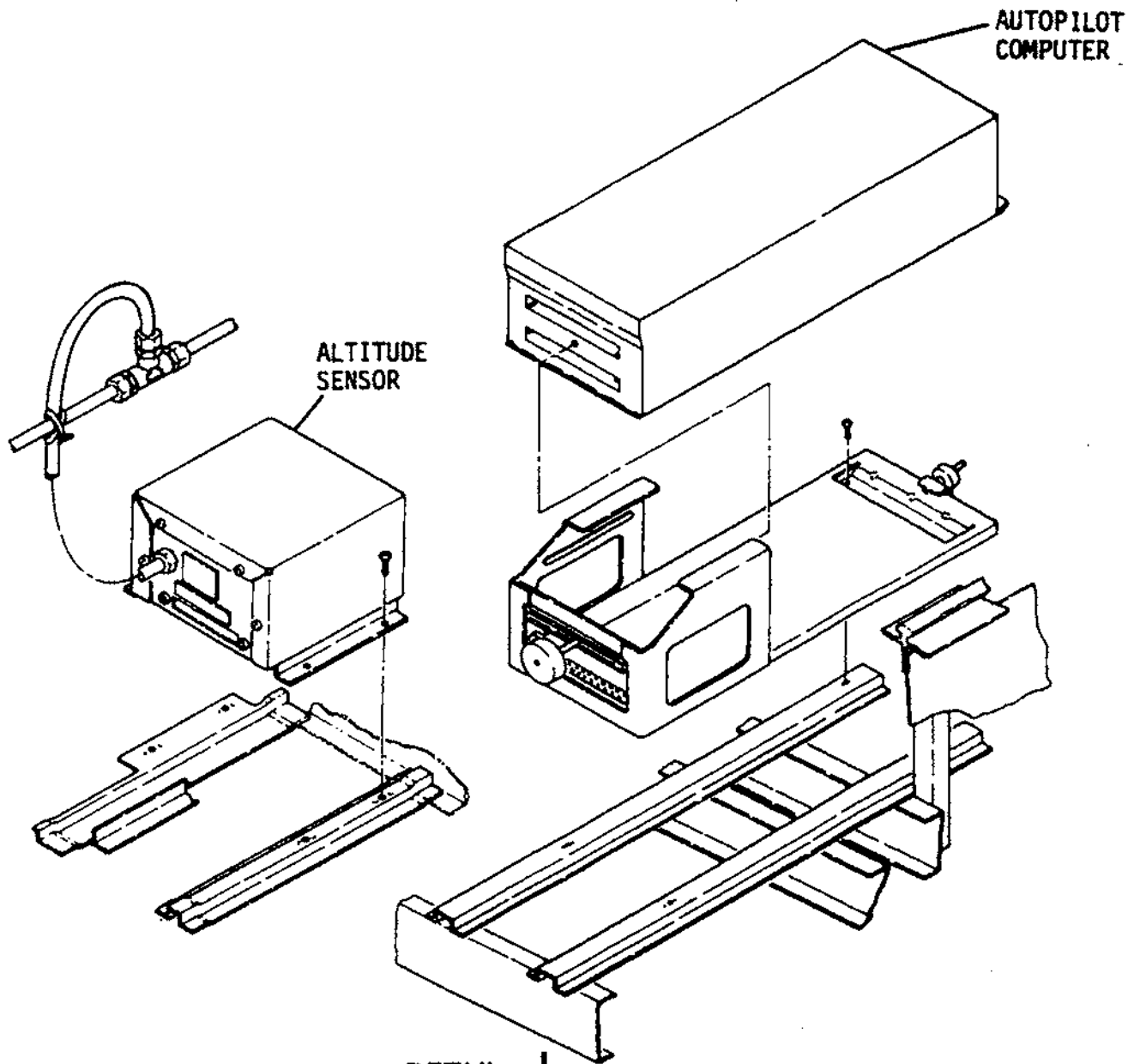
DETAIL B

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CS1142097

400B Navomatic Autopilot Installation
Figure 1 (Sheet 1)



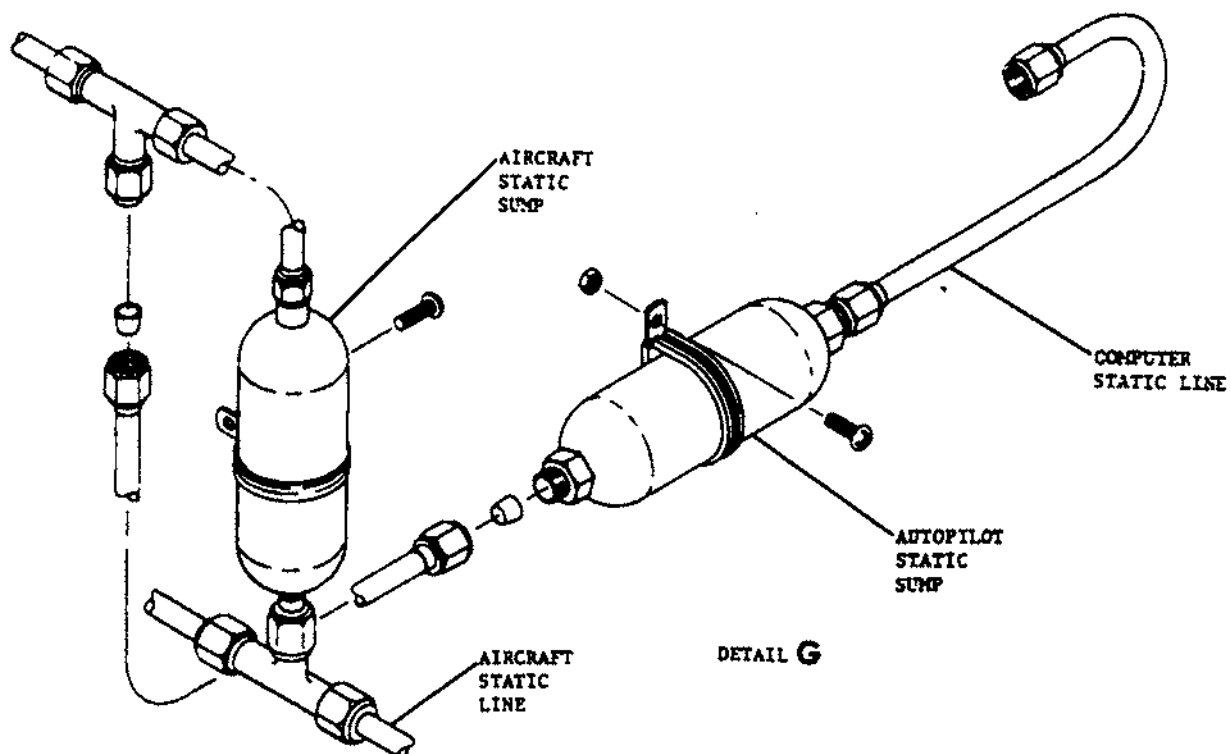
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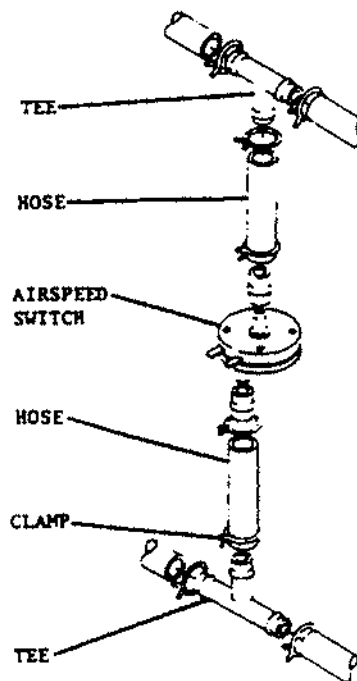
DETAIL J
AIRPLANES C1257 AND ON

400B Nav-O-Matic Autopilot Installation
Figure 1 (Sheet 3)

J51152011
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DETAIL G



DETAIL H

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400B Nav-O-Matic Autopilot Installation
Figure 1 (Sheet 4)

B. Install Roll Actuator Cables.

- (1) Route cables through actuator opening through pulley brackets and connect to links on aileron quadrant with clevis bolts, washers, nuts and cotter pins. Start turnbuckle but do not tighten.
- (2) Install pulleys and cable guard pins.
- (3) Engage chain on actuator sprocket evenly with ailerons in neutral.
- (4) Rig roll actuator cables. Refer to Adjustment/Test.
- (5) Safety turnbuckle.

CAUTION: VERIFY THAT AILERONS RESPOND IN THE CORRECT DIRECTION RELATIVE TO CONTROL WHEEL WITH AUTOPILOT OPERATING.

- (6) Install floorboards, carpet and seats previously removed.

3. Removal/Installation Computer (Refer to Figure 1)

A. Remove Computer.

- (1) Turn electrical power OFF.
- (2) On airplanes C0001 thru C1256, remove tailcone access panel to gain access to autopilot computer.
- (3) On airplanes C1257 and On, remove seats, carpet and floorpanels as required to gain access to autopilot computer.
- (4) Disconnect static line and cap fitting and open static line.
- (5) Disconnect electrical connector.
- (6) Remove computer from mount by removing nuts, washers, lockwashers and screws.

B. Install Computer.

- (1) Install computer to mount with screws, washer, lockwashers and nuts.
- (2) Connect electrical connectors.
- (3) Remove caps and plug from static line and connect to computer and perform static test. Refer to Chapter 10, Adjustment/Test.
- (4) Verify computer operates properly.
- (5) Install tailcone access panel or floorpanels, carpet and seats as applicable.

4. Removal/Installation of Altitude Sensor.

A. Remove Altitude Sensor.

- (1) Turn all electrical power OFF.
- (2) On airplanes C0001 thru C1256, remove tailcone access panel to gain access to altitude sensor.
- (3) On airplanes C1257 and On, remove seats, carpet and floorpanels as required to gain access to altitude sensor.
- (4) Disconnect static line and cap fitting and open static line.
- (5) Disconnect electrical connector.
- (6) Remove altitude sensor from mount by removing nuts, lockwashers, washers and screws.

B. Install Altitude Sensor.

- (1) Install altitude sensor to mount with screws, washers, lockwashers and nuts.
- (2) Connect electrical connections.
- (3) Remove cap and plug from static line and connect to altitude sensor.
- (4) Perform static leak test. Refer to Chapter 10, Maintenance Practices.
- (5) Connect electrical connector.
- (6) Check operation of altitude sensor.
- (7) Install tailcone access panel or floorpanels, carpet and seats as applicable.

5. Removal/Installation Airspeed Switch (Refer to Figure 1).

A. Remove Airspeed Switch.

- (1) Turn all electrical power OFF.
- (2) Disconnect electrical connection at airspeed switch.
- (3) Loosen clamps and remove switch by removing switch from fittings.
- (4) Plug and cap open lines and fittings.

B. Install Airspeed Switch.

- (1) Remove plugs and caps from lines and install airspeed.
- (2) Secure clamps.
- (3) Perform pitot static leak check, refer to Chapter 10, Maintenance Practices.
- (4) Check switch operation.

6. Removal/Installation Pitch Actuator (Refer to Figure 1).

A. Remove Pitch Actuator.

- (1) Turn electrical power OFF.
- (2) Remove necessary seats, floorboards, tailcone access panel and elevator bellcrank access plate.
- (3) Tag and disconnect electrical wiring.
- (4) Remove safety, relieve tension on pitch actuator cables and disengage chain from sprocket.
- (5) Remove pitch actuator from mount by removing nuts, lockwashers, washers and bolts.

B. Install Pitch Actuator.

- (1) Install pitch actuator to mount using bolt washers, lockwashers and nuts.
- (2) Engage chain evenly over sprocket and rig cable. Refer to Adjustment/Test.
- (3) Connect electrical connector.

NOTE: Verify that elevators respond in the correct direction relative to control wheel. Assist the movement of the elevators by pulling back on the control wheel. This will aid in overcoming the counterbalance of the elevator bobweight.

- (4) Safety turnbuckle.
- (5) Install access plates, tailcone access panel, floorboards and seats.

7. Removal/Installation Pitch Actuator Cables (Refer to Figure 1).

A. Remove Pitch Actuator Cables.

- (1) Turn electrical power OFF.
- (2) Remove necessary seats, floorboards, tailcone access panel and elevator bellcrank access plate.
- (3) Remove safety and relieve tension on cable by loosening turnbuckle at elevator bellcrank.
- (4) Disconnect pitch actuator cables from elevator bellcrank links by removing bolts, washer, nut and cotter pin.
- (5) Disengage chain from pitch actuator sprocket and remove from tailcone.

B. Install Pitch Actuator Cables.

- (1) Engage chain evenly over pitch actuator sprocket and route cables aft to elevator bellcrank.
- (2) Connect cables to elevator bellcrank links using bolt, washer, nut and cotter pin.
- (3) Rig pitch actuator cables. Refer to Adjustment/Test.

NOTE: Verify that elevators respond in the correct direction relative to control wheel. Assist the movement of the elevators by pulling back on the control wheel, this will aid in overcoming the counterbalance of the elevator bobweight.

- (4) Safety turnbuckle.
- (5) Install access plates, tailcone access panel floorboards and seats.

8. Removal/Installation Elevator Trim Control Actuator (Refer to Figure 1).**A. Remove Elevator Trim Control Actuator.**

- (1) Turn electrical power OFF.
- (2) Remove necessary seats floorboards, tailcone access panel and elevator trim tab actuator access plate.
- (3) Remove safety and relieve tension on trim cables.
- (4) Unwrap cable from actuator.
- (5) Remove actuator from mount by removing screws, lockwashers and washers.
- (6) Disconnect electrical connection.

B. Install Elevator Trim Control Actuator.

- (1) Connect electrical connection.
- (2) Position actuator in place on mount and install washers, lockwashers and screws.
- (3) Install elevator trim control cable as follows:
 - (a) Position elevator trim tab up (full nose down position).
 - (b) Start cable wrap from the inboard side of the airplane on the capstan, wrap cable three full turns.

NOTE: Cable must travel forward from the bottom of the inboard groove and aft from the outboard groove on the capstan.

- (c) Allow enough slack in cable to rotate capstan and rotate capstan until ball on the cable is in the horizontal groove provided.
 - (d) Connect turnbuckle and tighten.
 - (e) Rig trim control cable. Refer to Chapter 5, Adjustment/Test.
 - (f) Operate electric elevator trim through entire travel and observe that cable remains in the groove and the swagged ball on the cable does not move out of the horizontal groove.
- (4) Install safety on turnbuckle.
- (5) Install tailcone access panel, elevator trim tab access plate, seats and floorboards.

9. Removal/Installation Elevator Trim Control Actuator Cables (Refer to Figure 1).

- A.** Refer to Chapter 5, Maintenance Practices, for removal and installation of elevator trim control actuator cables.

10. Removal/Installation Gyros.

- A.** Refer to Chapter 10, Maintenance Practices, for typical instrument removal/installation.

11. Removal/Installation Switches.

- A.** Refer to Chapter 13, Maintenance Practices, for typical switch removal/installation.

12. Removal/Installation Controller (Refer to Figure 1).**A. Remove Controller.**

- (1) Turn electrical power OFF.
- (2) Remove controller from retainer by loosening screw in face of controller and sliding out.

B. Install Controller.

- (1) Insert controller in retainer and tighten screw.
- (2) Check operation of controller, refer to 400B Nav-O-Matic Autopilot Service/Parts Manual.

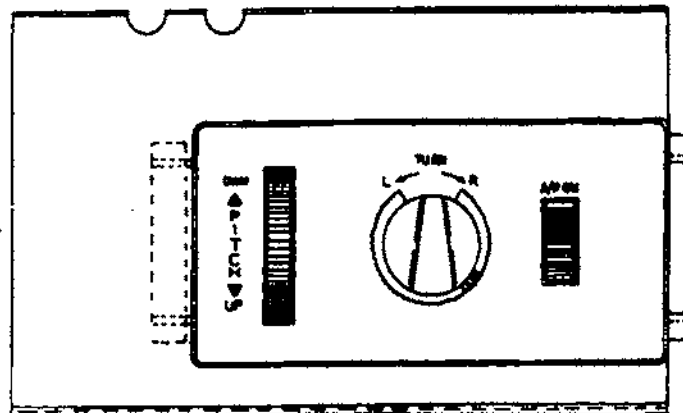
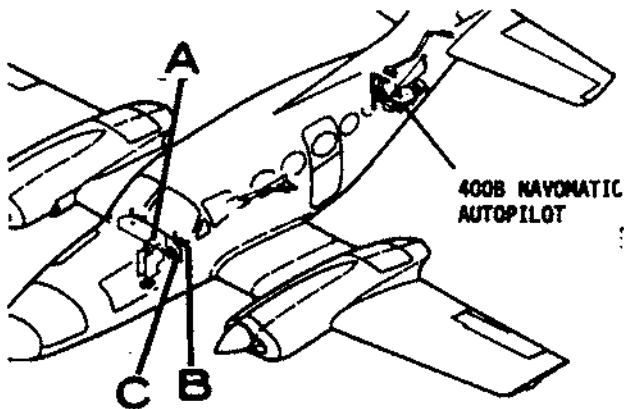
INTEGRATED FLIGHT CONTROL SYSTEMDescription

1. The Integrated Flight Control System (optional) is a two-axis (aileron and elevator automatic flight control system consisting of the autopilot and flight director). Either the flight director or the autopilot may be used separately or as a combination. As an autopilot, in addition to holding the wings level and compensating for rotation about the pitch axis, the autopilot provides an automatic intercept and track of any magnetic heading or VOR radial. Also included is an automatic pitch trim, turn command, pitch command, altitude hold and an ILS approach feature. As a flight director, the integrated flight control system provides steering information, visually presented on the attitude director indicator (ADI), for climb, cruise, descent and altitude hold. Heading, VOR navigation, glideslope and ILS approaches are visually presented on the horizontal situation indicator (HSI), mode selection is visually presented on the mode selector for mode of flight selected.
2. Two integrated flight control systems are offered as options; the 400B and 800B series.
3. 400B Series Integrated Flight Control System.
 - A. The 400B Integrated Flight Control System consists of the Nav-O-Matic autopilot and flight director, ILS coupler, slaved directional gyro, pitch synchronization and associated avionics. Simultaneous or independent operation of the autopilot and flight director is provided and in addition to the autopilot features, the flight director includes pitch synchronization go-around commands as selected by the pilot. The 400B Integrated Flight Control System includes a vacuum, slaved directional gyro with ADF presentation and a horizontal situation indicator (HSI). Nav 1 is connected to the HSI, and Nav 2 is connected to an individual course indicator.
4. 800B Series Integrated Flight Control System.
 - A. The 800 Integrated Flight Control System consists of 400B Nav-O-Matic autopilot and flight director, with yaw damper, altitude hold, automatic pitch trim, pitch synchronization, heading preselect, omni/ILS couplers and turn and pitch command. Simultaneous or independent operation of the autopilot and flight director is provided and in addition to the autopilot features, the flight director includes pitch synchronization and go-around commands as selected by the pilot. The 800 Integrated Flight Control System includes a vacuum, slaved directional gyro with ADF presentation and an horizontal situation indicator (HSI). Nav 1 is connected to the HSI and Nav 2 is connected to an individual course indicator. 400 or 800 avionics system may be used with the 800B Integrated Flight Control System.
5. For additional description, installation adjustments, troubleshooting, schematic and parts listing, refer to Cessna Integrated Flight Control System Service/Parts Manual.

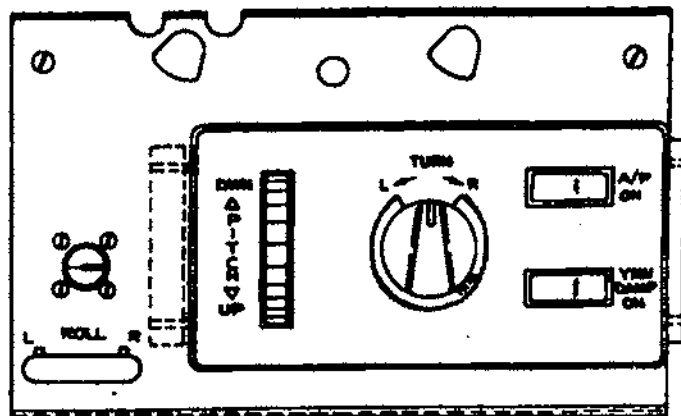
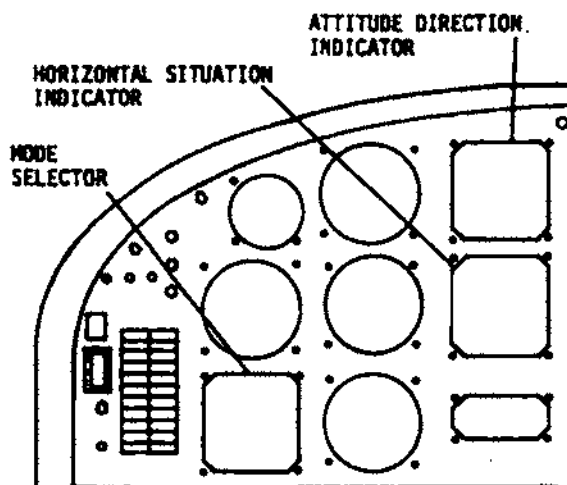
CAUTION: PRIMARY AND SECONDARY FLIGHT CONTROL CABLES, PUSH-PULL TUBES, BELLCRANKS AND MOUNTINGS USE DUAL LOCKING FASTENERS. THE LOCK NUTS FOR THESE FASTENERS INCORPORATE A FIBER LOCK, AND ARE CASTELLATED FOR SAFETYING WITH A COTTER PIN. WHEN ANY OF THESE AREAS ARE DISCONNECTED, NEW DUAL LOCKING FASTENERS SHOULD BE INSTALLED. SEE THE AIRCRAFT PARTS CATALOG FOR PART NUMBERS AND LOCATION OF THESE FASTENERS.

Maintenance Practices

1. Refer to Autopilot Maintenance Practices for removal/installation of 400B Nav-O-Matic Autopilot.
2. Refer to Autopilot Adjustment/Test for rigging the 400B Nav-O-Matic component cables.
3. Refer to Chapter 10, for typical instrument removal/installation.
4. Refer to Chapter 13, for typical electrical switch removal/installation.
5. Refer to Chapter 5, for Yaw Damper System Maintenance Practices.
6. Refer to Chapter 5, for Electric Elevator Trim Control System Maintenance Practices.

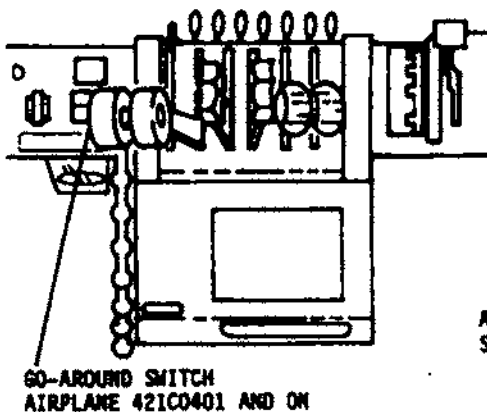


400B IFCS CONTROLLER

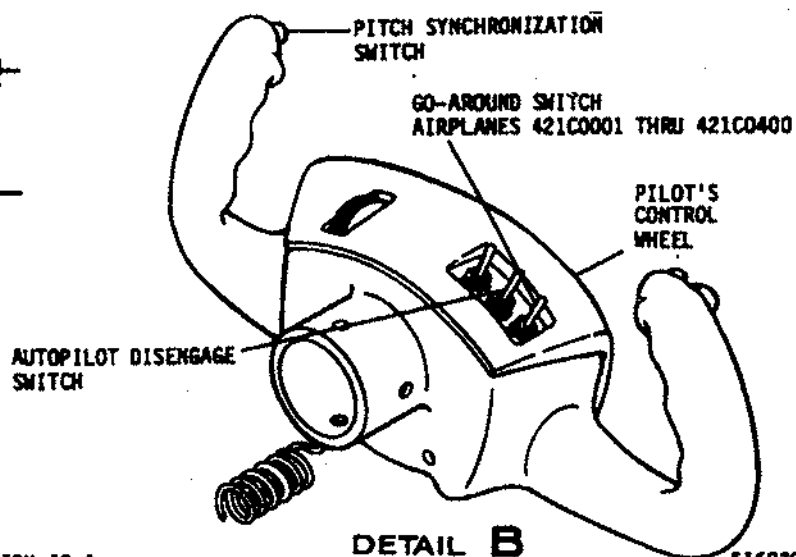


800B IFCS CONTROLLER

DETAIL A



DETAIL C



DETAIL B

NOTE: THIS INSTRUMENT PANEL ILLUSTRATION IS A "TYPICAL" INSTRUMENT LOCATION ARRANGEMENT. PANEL ARRANGEMENT IS OPTIONAL.

Integrated Flight Control System
Figure 1

51603005
A14141048
A52141048
B14151028
C51142097
C51142097

AUDIO CONTROL PANEL

Description

1. The audio control panel installed on the instrument panel, provides transmission and reception selection for communications and navigation equipment installed in the aircraft.
 - A. The MIC SEL switch applies power to the audio control panel and provides selection of one of three systems for communications operation. Selecting a specific transmitter automatically selects the relative receiver audio which will be presented by way of the speaker or phone depending on the position of the AUTO SPKR/PH switch. The INT and the PA positions on the MIC SEL switch are used for interphone and cabin PA.
 - B. The SPEAKER/PHONE switches enable the operator to select one or more audio signals at the same time. Audio signals may be received in the phone position with the MIC SEL switch OFF. Inactive audio control panel switches available for equipment not installed in a specific aircraft are fitted with dark boots.
 - C. The DME ON/OFF switch applies power to the DME system. If not required for a specific DME system, the switch will have a dark boot.
 - D. The MEB HI/LO switch applies power to the marker beacon receiver, in addition to selecting Hi or Low receiver sensitivity.
 - E. On CAA-equipped aircraft, the isolation amplifier and relay is mounted on the aft side of 100:00 bulkhead forward of the instrument panel and to the right of center line. The installation is incorporated into the audio system to provide a hot microphone between the pilot and copilot at the same time audio signals are received from the aircraft audio amplifier.
 - F. On CAA-equipped aircraft, the I/C ON/OFF switch applies power to the live microphone in addition to selecting communication or intercom transmission.
2. To activate the audio system, rotate MIC SEL switch to the desired position.
 - A. Receive - The three-position SPEAKER/OFF/PHONE switches select received audio for presentation by speaker or phone. Audio volume is controlled at the respective transceiver.

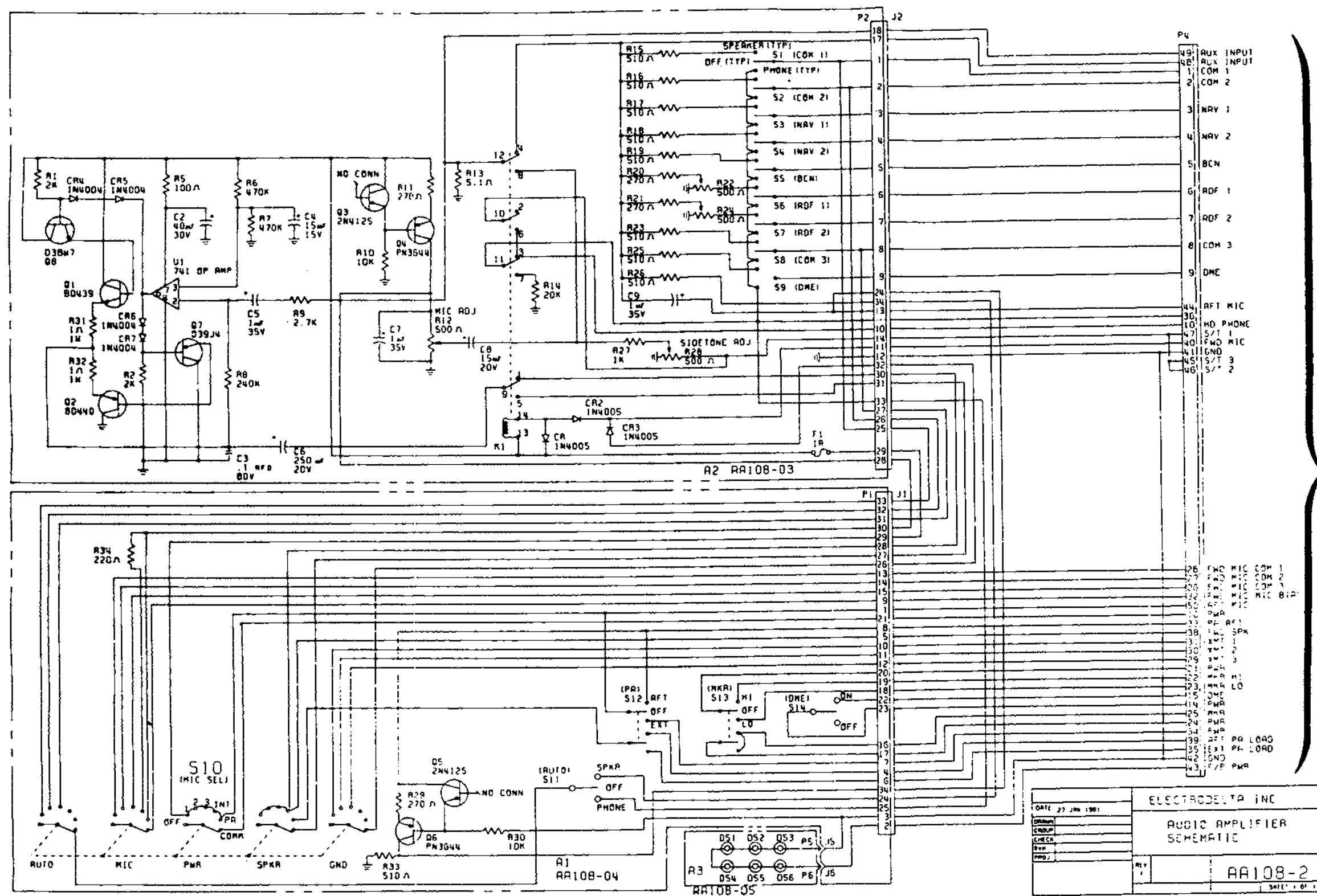
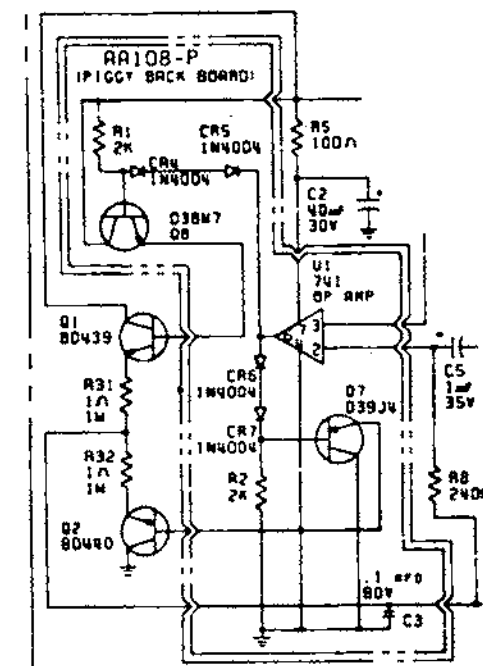
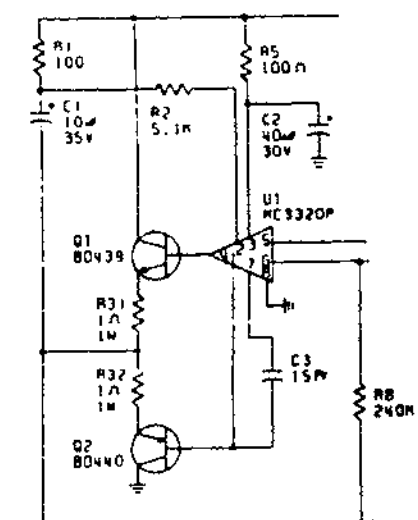
Troubleshooting

1. Troubleshooting of the audio control panel includes checking of communications and navigation radios for complete operational system.
2. Tools and Equipment.

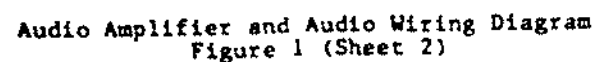
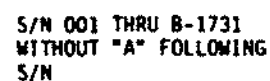
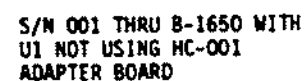
NOTE: Equivalent substitutes may be used for the following listed items.

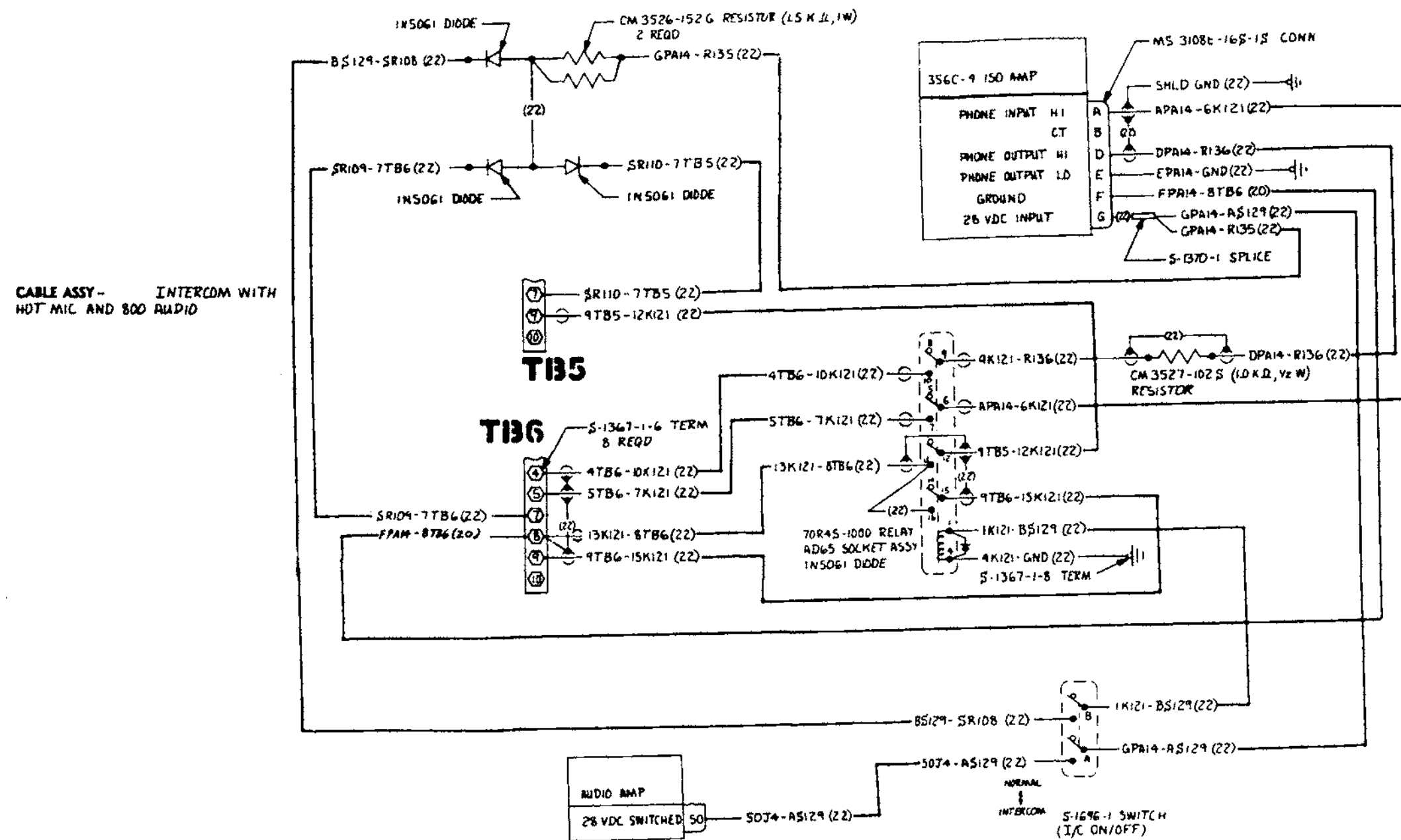
Name	Number	Manufacturer	Use
Multimeter	Model 260	Simpson Electric Co.	Checking circuitry.

CAUTION: REPLACEMENT OF A 400 NAV/COM MAY RESULT IN A MAGNETIC COMPASS ERROR. IT WILL BE NECESSARY TO ASSURE CORRECT COMPASS CALIBRATION FOLLOWING RADIO REPLACEMENT.

Audio Amplifier and Audio Wiring Diagram
Figure 1 (Sheet 1)S/N B-1651 THRU B-1731 AND S/N 001
THRU B-1650 WITH MODIFICATION
INDICATED BY LETTER "A" FOLLOWING
SERIALTO J4 MATING CONNECTOR
AIRPLANE WIRINGS/N 001 THRU B-1650 WITH
U1 USING MC-001 ADAPTER
BOARD

SCHEMATIC S/N B-1732 & ON





Audio Amplifier and Audio Wiring Diagram
Figure 1 (Sheet 3)

3. Troubleshooting Audio Control Panel.

- A. For troubleshooting the audio control panel, refer to Figure 2.
- B. For wiring diagram, see Figure 1.

NOTE: Audio control panel wiring diagram should be used with communications and navigation wiring diagrams furnished with aircraft as an aid in troubleshooting.

Adjustment/Test

1. Audio Control Panel Operational Check.

- A. Turn on battery switch or connect external power unit. Turn all radios on and tune to a transmitting frequency.
- B. Turn microphone select switch to Com 1 and then to Com 2 positions, communicate with another station on both radios.
- C. Move each speaker/phone switch to speaker and phone positions. Each radio should be heard in the speaker and phone as switches are moved.
- D. Turn off each speaker/phone.
 - (1) Turn microphone selector switch to Com 1, Com 2 or Com 3 (if installed) communicate with another station or radios.
 - (2) Move automatic speaker/phone switch to speaker and phone positions. Each radio should be heard in the speaker and phone as microphone select switch is moved.

NOTE: If radio speaker/phone switch was left in speaker position and automatic receiver switch is in headphone position, audio will be heard at speaker and phone or vice versa.

Maintenance Practices

1. Removal/Installation Audio Control Panel.

- A. Remove Audio Control Panel.
 - (1) Turn electrical power off.
 - (2) Remove screws, securing audio control panel to instrument panel.
 - (3) Pull audio control panel aft and disconnect electrical plug.
- B. Install Audio Control Panel.
 - (1) Connect electrical plug to audio control panel.
 - (2) Position audio control panel in instrument panel and secure with screws.
 - (3) Perform operational check, refer to Adjustment/Test.

2. Removal/Installation Isolation Amplifier (CAA-Equipped Aircraft).

- A. Remove Isolation Amplifier.
 - (1) Turn electrical power OFF.
 - (2) Identify and remove connector.
 - (3) Remove screws securing amplifier to channels.
 - (4) Remove amplifier from aircraft.
- B. Install Isolation Amplifier.
 - (1) Position amplifier on channels and secure with screws.
 - (2) Identify and install connector.
 - (3) Perform operational test on system. Refer to Adjustment/Test.

FLIGHT PHONE SYSTEMDescription

1. The flight phone system consists of an RT-18 transceiver, an AT-460 antenna, a phone handset, and associated wiring and cables.
2. The transceiver, and antenna are located below the aft fuselage baggage compartment. The phone handset is normally located below the aft RH passenger seat.

Maintenance Practices

1. Removal/Installation Flight Phone System (See Figure 1).

A. Remove flight phone system.

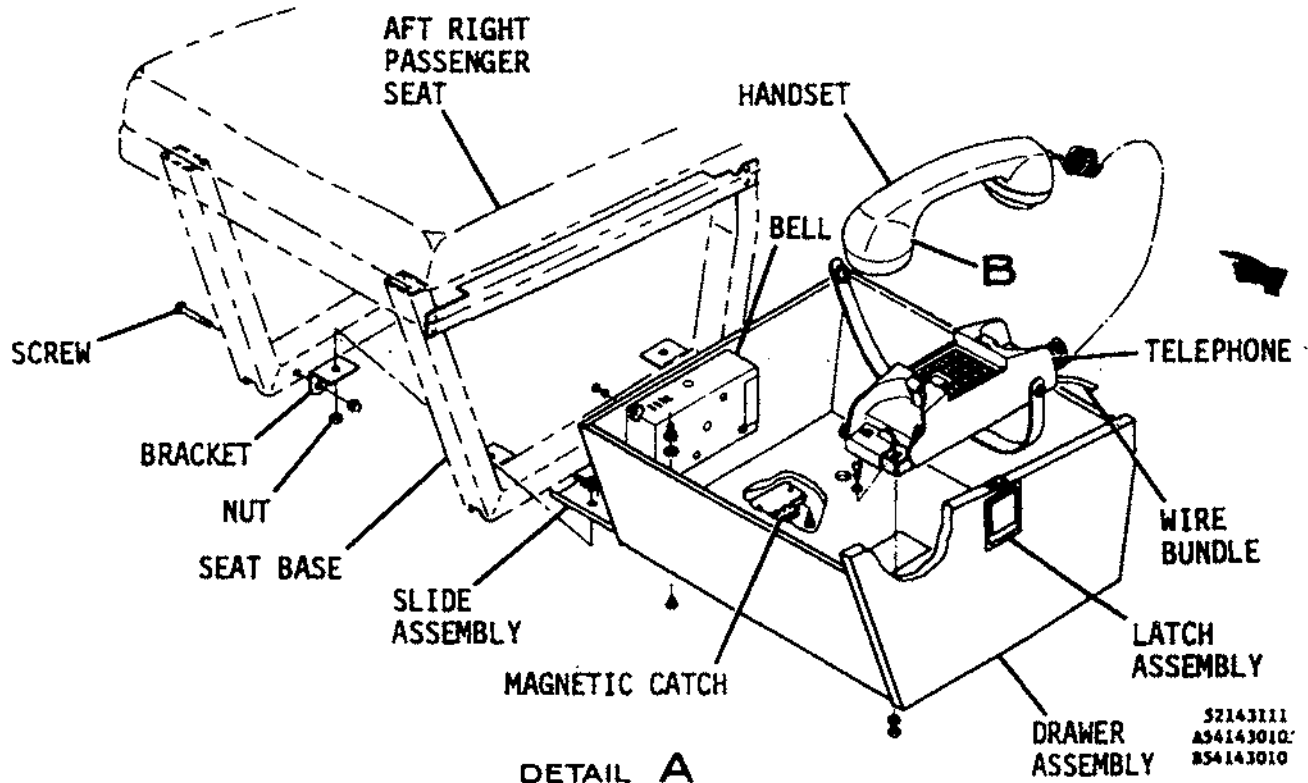
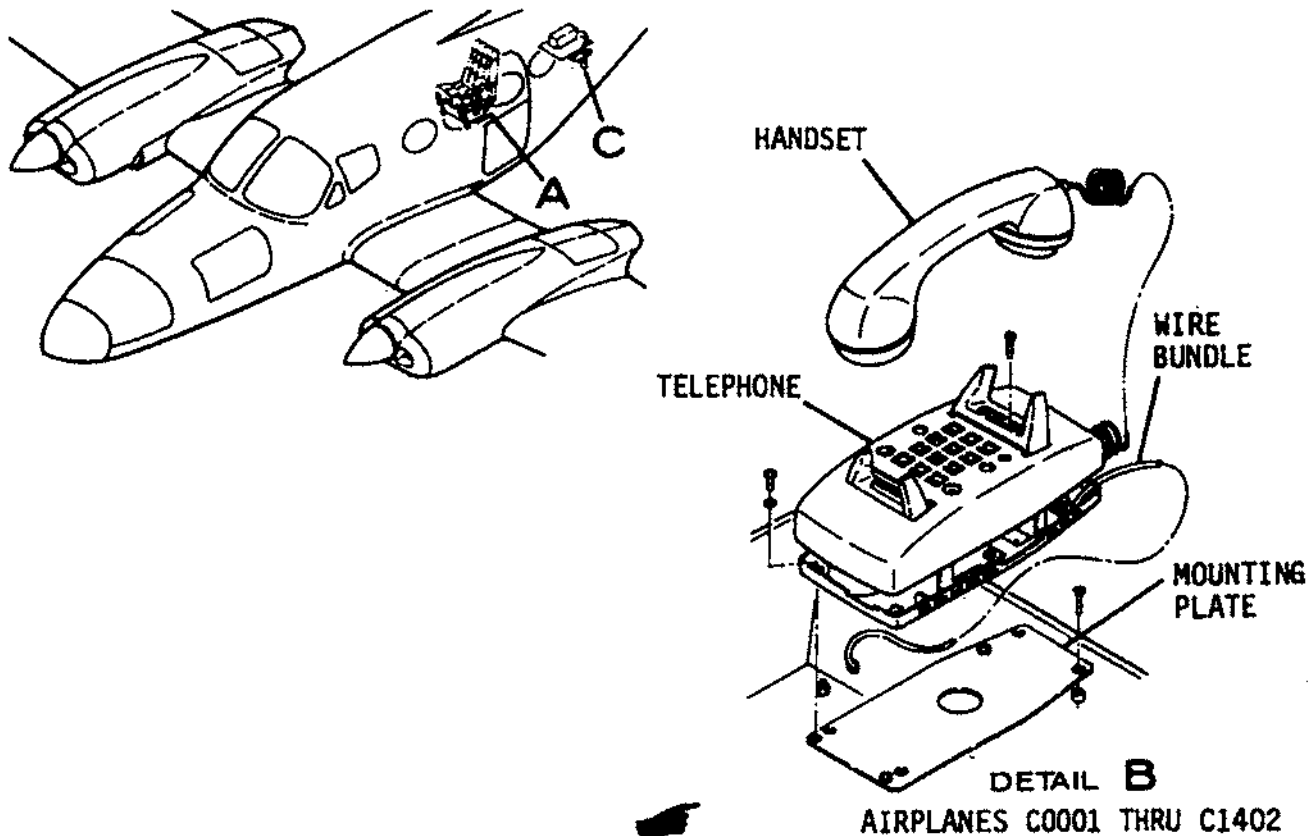
- (1) Open drawer assembly; remove phone from base (2), tag wires and disconnect wire bundle (1).
- (2) Remove phone from draw assembly by removing screws, washers and nuts.
- (3) Remove nuts, washers and screws securing drawer assembly to slide assembly (3); remove drawer from seat base.
- (4) Remove slides from seat base by removing nuts and bolts securing brackets (5) to seat base (4).
- (5) Remove carpet and aft floorboard as required to gain access to flight phone transceiver and antenna.
- (6) Tag and disconnect wire bundle (1) and coax cable (9) from transceiver (6) and antenna (8).
- (7) Remove transceiver from its mounting plate and remove mounting plate from brackets (7) by removing attaching screws.
- (8) Remove antenna from airplane by removing attaching screws.

B. Install Flight Phone System.

- (1) Install antenna on airplane with attaching screws.

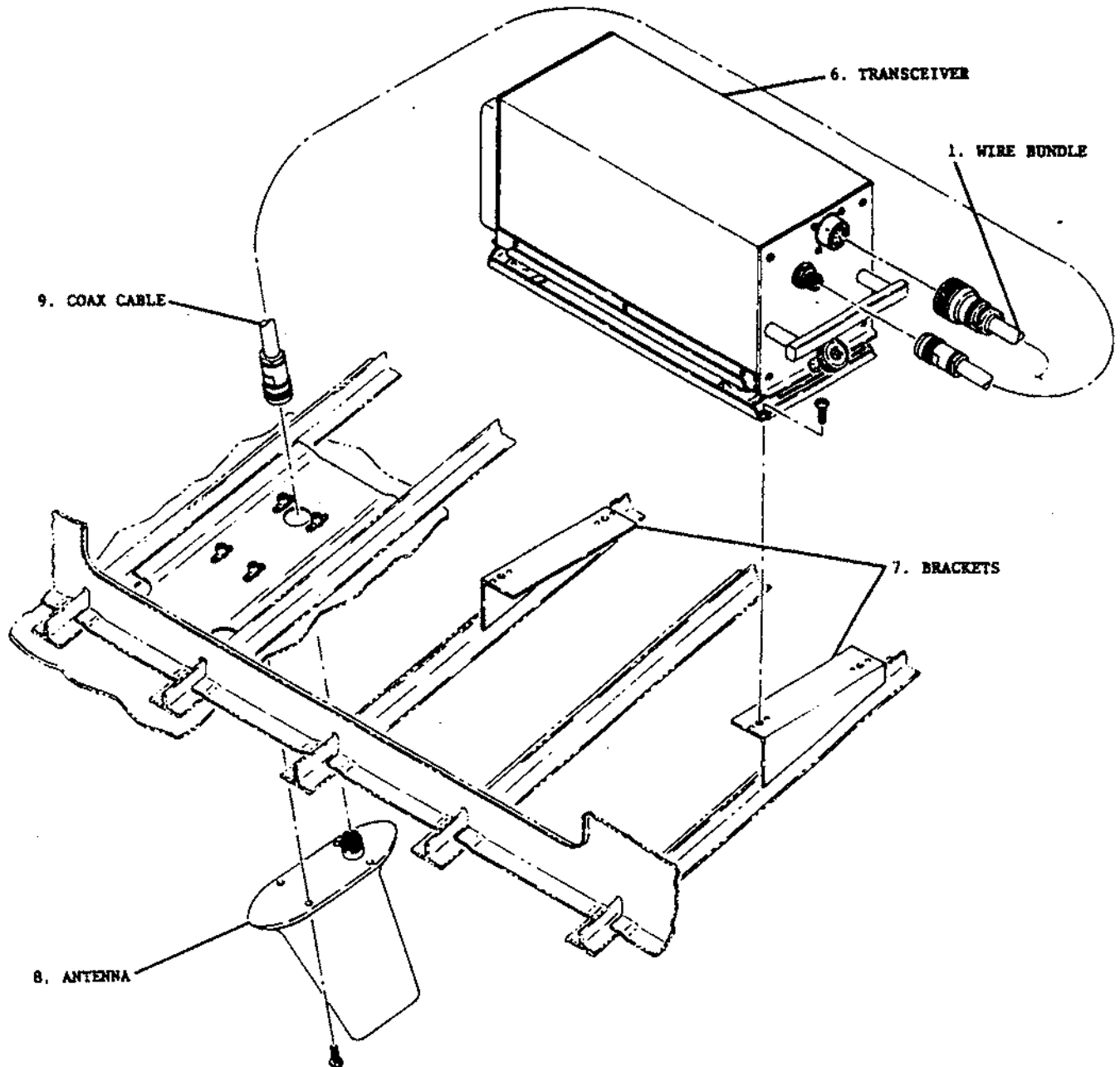
NOTE: When replacing AT460 antenna with AT460A antenna, modification of mount must be made in accordance with Chapter 15.

- (2) Install transceiver mounting on brackets with attaching screws and attach transceiver to mounting.
- (3) Install slide assembly (3) by securing with nuts and bolts to brackets (5) on seat base (4).
- (4) Secure drawer assembly to slide assembly with nuts, washers and screws.
- (5) Install phone in drawer assembly by screws, washers and nuts.
- (6) Install phone on base (2).
- (7) Connect wire bundle (1) from phone to transceiver and connect coax cable (9) from transceiver to antenna.
- (8) Replace carpet and floorboard; close drawer assembly.



Flight Phone Installation Cabin
Figure 1 (Sheet 1)

52143111
A34143010
B54143010



DETAIL B

851143073

Flight Phone Installation Cabin
Figure 1 (sheet 2)

2. Removal/Installation Flight Compartment Station (Refer to Figure 2)**A. Remove Control.**

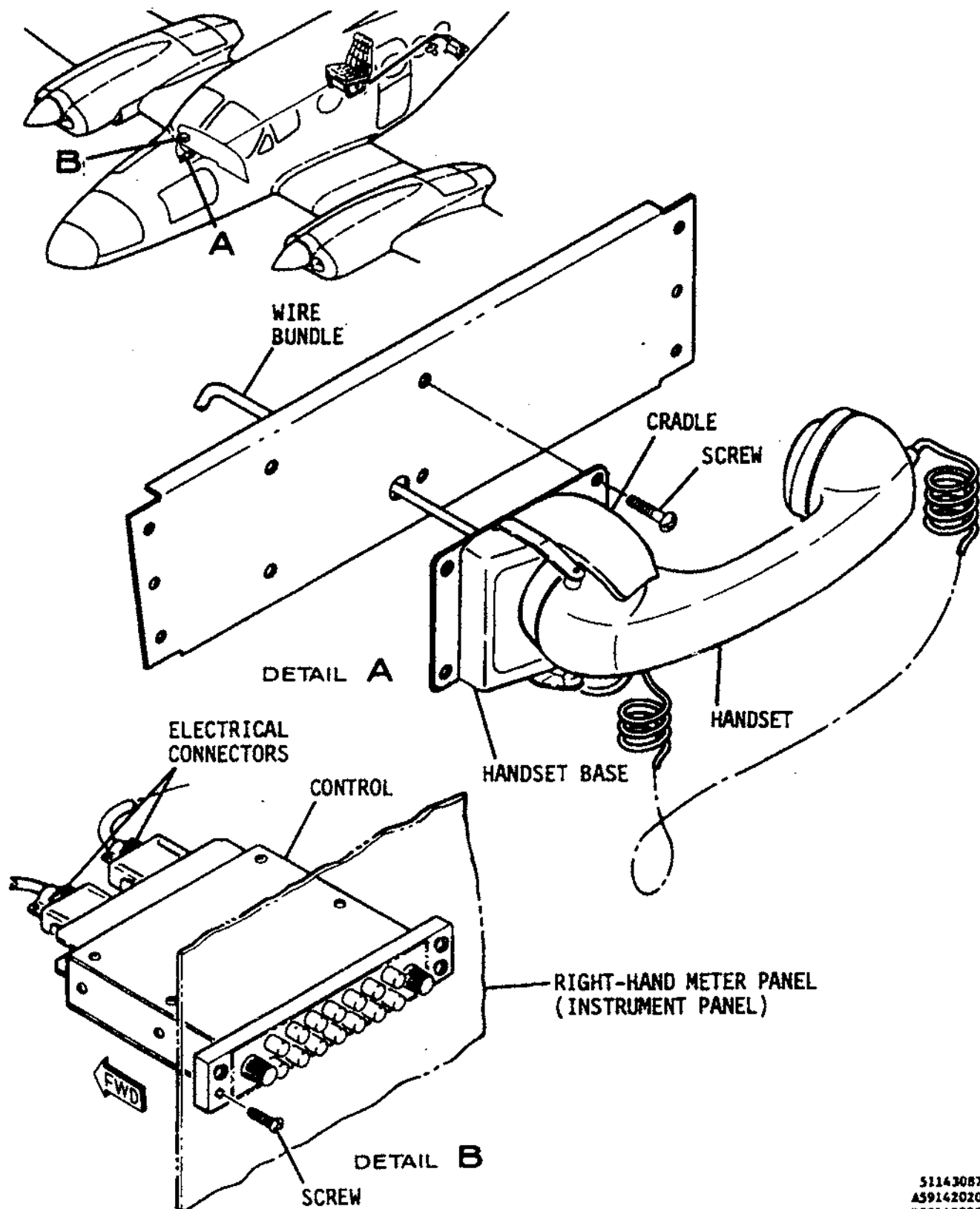
- (1) Remove power from radiotelephone system (open circuit breaker).
- (2) Loosen dzus fasteners and pull control from panel.
- (3) Disconnect electrical connectors from control.

B. Install Control.

- (1) Connect electrical connectors to control.
- (2) Slide control into panel and secure dzus fasteners.
- (3) Close circuit breaker.

C. Remove Hand-Set Assembly.

- (1) Remove power from radiotelephone system (open circuit breaker).
- (2) Remove screws securing Hand-Set assembly.
- (3) Identify wires and disconnect wires at cradle. Remove Hand-Set assembly.
- (4) Engage circuit breaker.



Flight Phone Installation Cockpit
Figure 2

51143087
A59142020
B59142020

EMERGENCY LOCATOR TRANSMITTERDescription

1. The emergency locator transmitter (ELT) is a self-contained, solid-state unit, having its own power supply with an external mounted antenna. The transmitter is designed to transmit a dual emergency frequency of 121.5 and 243.0 megahertz simultaneously. The SHARC-7/DMELT-6 emergency locator transmitter is mounted in the tailcone on the side of the fuselage. The CIR 10 emergency locator transmitter is located in the leading edge of the dorsal fin at approximately fuselage station 309.56 and water line 125.00. The antenna is also enclosed in the dorsal.

NOTE: The SHARC-7K and DMELT-6C are basically the same as the SHARC-7 and DMELT-6, with one exception: they operate on VHF frequencies only. Maintenance procedures are the same for either engine.

2. The SHARC-7/DMELT-6 transmitter is entirely portable, operating on the power supplied by a battery pack. The battery pack service life is placarded on the batteries and also on the outside of the cover on the end of the transmitter. On the CIR 10 transmitter, power is supplied from the airplane system through a switch on the instrument panel or the battery pack located inside the transmitter.
3. The transmitter broadcast tone is audio modulated in a swept manner over the range of 1600 to 300 Hz and is a distinct, easily recognized distress signal for reception by search and rescue personnel and others monitoring the emergency frequencies.
4. Under favorable conditions, a distress signal from the ELT can be intercepted at a distance of 100 miles. It exhibits line of sight transmission characteristics which correspond approximately to 100 miles at a search altitude of 10,000 feet.
5. When battery inspection and replacement schedules are adhered to, the transmitter will broadcast an emergency signal at rated power for a continuous period of at least 48 hours at temperatures from +55°C to -20°C after actuation. The battery pack contains an alkali battery on all models from 421C601 and on. This battery replaces the previous lithium battery, and is used for spares in existing SHARC-7K and DMELT-6 Transmitters.
6. The 121.5 MHz frequency is monitored by the general aviation airplane as well as C.A.P., D.O.T., F.A.A. and some commercial airplane. The military monitors 243.0 MHz.
7. The three-position switch on the forward end of the unit, controls operation. Placing the switch in the "ON" position will energize the unit to start transmitting emergency signals. In the "OFF" position, the unit is inoperative. Placing the switch in the "ARM" position will set the unit to start transmitting emergency signals only after the unit has received a 5G (tolerances are +2G and -0G) impact force. On emergency locator transmitter P/N CIR10-4, a remote EMER-NORM switch on the instrument panel is provided in addition to the switch located on the front end of the transmitter.

Troubleshooting

1. Should the ELT fail the periodic or 100 hours performance checks, refer to Chapter 2. It is possible to a limited degree to isolate the fault to a particular area of the equipment.

CAUTION: IN ORDER TO PROTECT YOUR WARRANTY, TROUBLESHOOTING SHOULD BE CONDUCTED WITHOUT REMOVING THE UNIT COVER.

2. In performing the following troubleshooting procedure to test, peak effective radiated power, you will be able to determine if battery replacement is necessary or if your unit should be returned to your dealer for repair.

CAUTION: DO NOT LEAVE THE EMERGENCY LOCATOR TRANSMITTER IN THE "ON" POSITION LONGER THAN 10 SECONDS. THIS COULD INITIATE DOWNED AIRPLANE SEARCH PROCEDURES BY C.A.P., D.O.T., OR F.A.A. PERSONNEL.

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3. Tools and Equipment

NOTE: EQUIVALENT SUBSTITUTES MAY BE USED INSTEAD OF THE FOLLOWING LISTED ITEMS.

Name	Number	Manufacture	Use
Multimeter	Model 260	Simpson Electric Co.	To measure voltage.
Ammeter	Model 1223	Simpson Electric Co.	To measure battery current.
Jack Plug	P/M 750	Switchcraft Inc.	Connect to remote jack of ELT.

4. Troubleshooting Emergency Locator Transmitter.

A. For troubleshooting the emergency locator transmitter, (See Figure 2 or 3).

LOCATOR BEACON SYSTEM - MAINTENANCE PRACTICES

1. General

- A. The locator beacon system transmitter is installed in the tailcone on the left side.
- B. When battery inspection and replacement schedules are followed, the transmitter will broadcast an emergency signal at rated power for a continuous period of at least 48 hours at temperatures from +55°C to -20°C after actuation.

2. Servicing

- A. Servicing the locator beacon system is limited to replacing the battery pack. Time interval and criteria for battery replacement is described in Chapter 2 or 3.
- (1) Replace Battery Pack.
- (a) Remove locator beacon transmitter. Refer to removal procedures.
 - (b) Remove case covering transmitter and battery pack.
 - (c) Disconnect and remove old battery. Visually check for corrosion and evidence of damage.
 - (d) Before installing new battery pack, check to ensure that its voltage is 10.8 volts or greater.
 - (e) Install new battery, connect battery and install case covering transmitter and battery pack.
 - (f) Record the battery expiration date on the data plate; also, enter the expiration date in the maintenance record for future inspection/maintenance reference.
 - (g) Install transmitter and battery pack. Refer to installation procedures.
 - (h) Check operation. Refer to adjustment/test.

3. Removal/Installation Locator Beacon Components

A. Locator Beacon Antenna. (Refer to Figure 1)

- (1) Remove Antenna.
- (a) Remove tailcone access panel.
 - (b) From inside tailcone, disconnect coax connector from antenna.
 - (c) Remove nut securing antenna to structure and remove antenna.
- (2) Install Antenna.

NOTE: INSURE THAT THE OFF-ON-ARM SWITCH (FUNCTION SWITCH) IS POSITIONED TO THE ARM POSITION. THE FUNCTION SWITCH IS LOCATED ON THE TRANSMITTER.

- (a) Position antenna to structure and secure with nut.
- (b) Connect coax connector to antenna.
- (c) Install tailcone access panel.

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(d) Check operation to verify antenna installation. Refer to Adjustment/Test.

B. Locator Beacon Transmitter.

(1) Remove Transmitter.

- (a) Remove tailcone access panel.
- (b) Position the transmitter function switch to OFF.
- (c) Disconnect the coax connector from the transmitter.
- (d) Remove screws securing transmitter to shelf and remove transmitter.

(2) Install Transmitter.

- (a) Position transmitter in shelf and secure with screws.
- (b) Connect coax connector to transmitter.
- (c) Check operation to verify proper transmitter installation. Refer to Adjustment/Test.

**NOTE : INSURE THAT THE OFF-ON-ARM SWITCH (FUNCTION SWITCH) IS
POSITIONED TO THE ARM POSITION AFTER OPERATIONAL
TEST. THE FUNCTION SWITCH IS LOCATED ON THE
TRANSMITTER.**

(d) Install tailcone access panel.

4. Adjustment/Test Locator Beacon System

A. Operational test of controls and G switch (this test satisfies requirements of FAR 91.207 paragraph (d) (3)).

(1) Request permission from control tower and flight service station to monitor locator beacon.

**CAUTION : PRIOR APPROVAL FROM CONTROL TOWER AND
FLIGHT SERVICE STATION MUST BE OBTAINED WHEN
CHECKING THE OPERATION OF THE LOCATOR
BEACON.**

- (2) Remove the plug button on left side of tailcone. Position the function switch to ON.
- (3) Remove transmitter from mount.
- (4) Connect a 50 ohm RF load to the RF OUTPUT connector.
- (5) Tune a VHF receiver to 121.5 MHz.
- (6) Switch the ELT master switch to the ON position.
- (7) Verify that the down sweeping ELT signal is heard on the VHF receiver.
- (8) Place the master switch in the AUTO position and press the RESET button.
- (9) While holding transmitter in one hand, sharply strike the end of the case in the direction of activation indicated on the case of the transmitter.
 - (a) Verify that the LED lamp illuminates and a signal is heard on the VHF receiver.
- (10) Press the RESET button to restore the unit to the armed condition.
- (11) Reinstall locator beacon unit, and if not equipped with a cockpit mounted remote switch, remove 50 ohm load from coax connector and connect antenna.
- (12) If airplane is equipped with a cockpit mounted remote switch, perform the following:
 - (a) Set the remote switch to the ON position and verify that the LED illuminates and a signal is heard on the VHF receiver.
 - (b) Apply airplane battery power to the transmitter, and place the locator beacon master switch to the ON position.
 - 1) Verify that the LED lamp illuminates and a signal is heard on the VHF receiver.
 - (c) Set the remote switch to the OFF position and verify that the signal stops, but the LED remains illuminated.
 - (d) Set the locator beacon master switch and cockpit switch to AUTO.
 - (e) Remove airplane power from transmitter.
 - (f) Remove 50 ohm load from coax connector and connect antenna.
 - 1) Verify that LED is not illuminated and no signal is heard on the VHF receiver.

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B. Check for the presence of a sufficient signal radiated from antenna (this satisfies requirements of FAR 91.207 paragraph (d) (4)).

(1) Operational test.

(a) Verify that test is performed within the first five minutes after any hour.

(b) Position a small hand held AM radio, tuned to any unused frequency, with volume set to maximum, within six inches of the emergency locator beacon antenna.

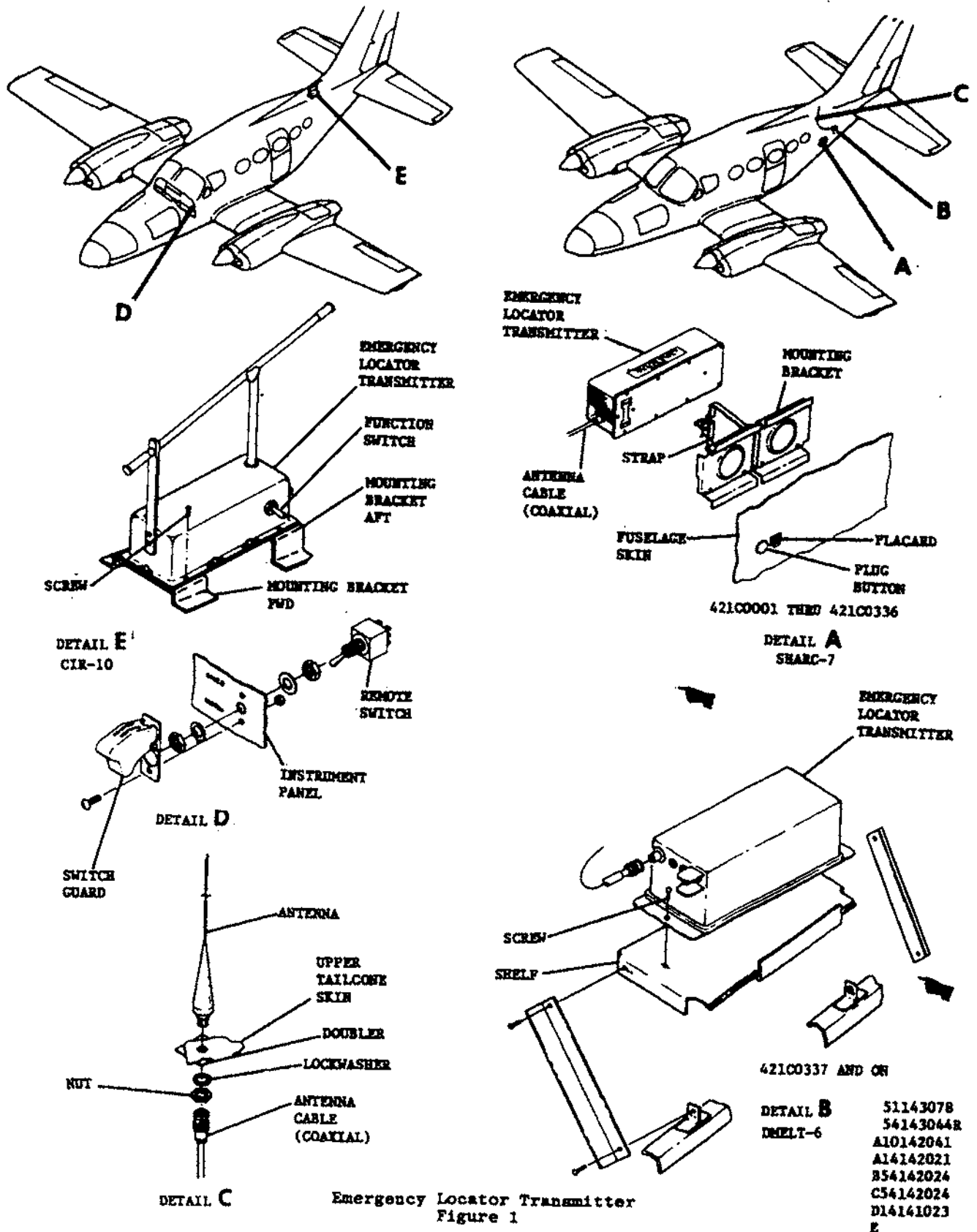
NOTE: USING THE VHF RECEIVER OR ADF ON THE AIRPLANE WILL NOT PROPERLY CHECK POWER OF THE RADIATED SIGNAL.

(2) Activate emergency locator beacon system for no more than three sweeps of audio signal.

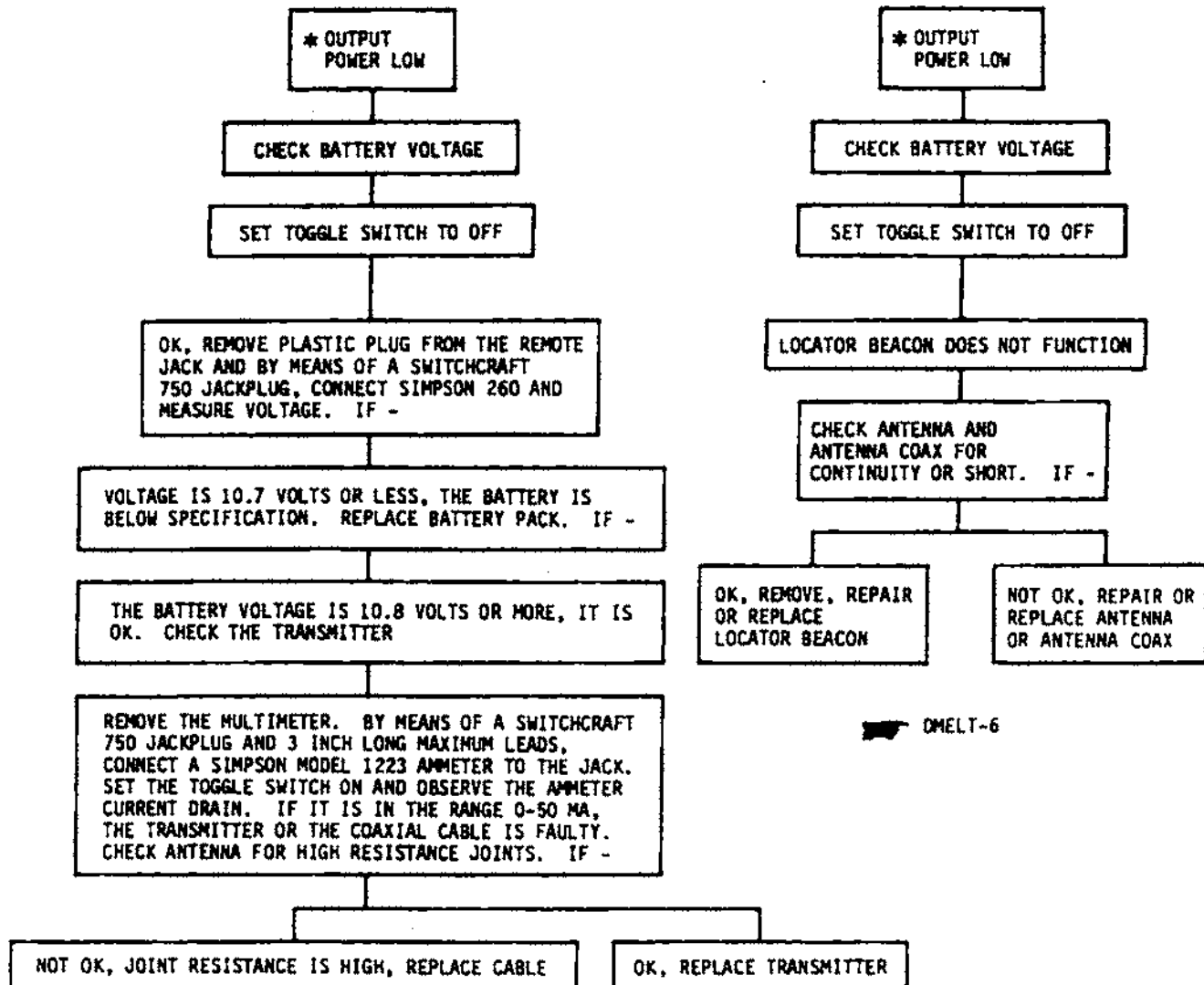
(a) Verify that the signal has been detected on the AM radio.

(3) Restore switches to normal.

NOTE: IF EMERGENCY LOCATOR TRANSMITTER IS DETERMINED TO BE UNSERVICEABLE OR UNUSABLE, A TYPE TSO-C91A ELT MUST BE INSTALLED.



Emergency Locator Transmitter
Figure 1



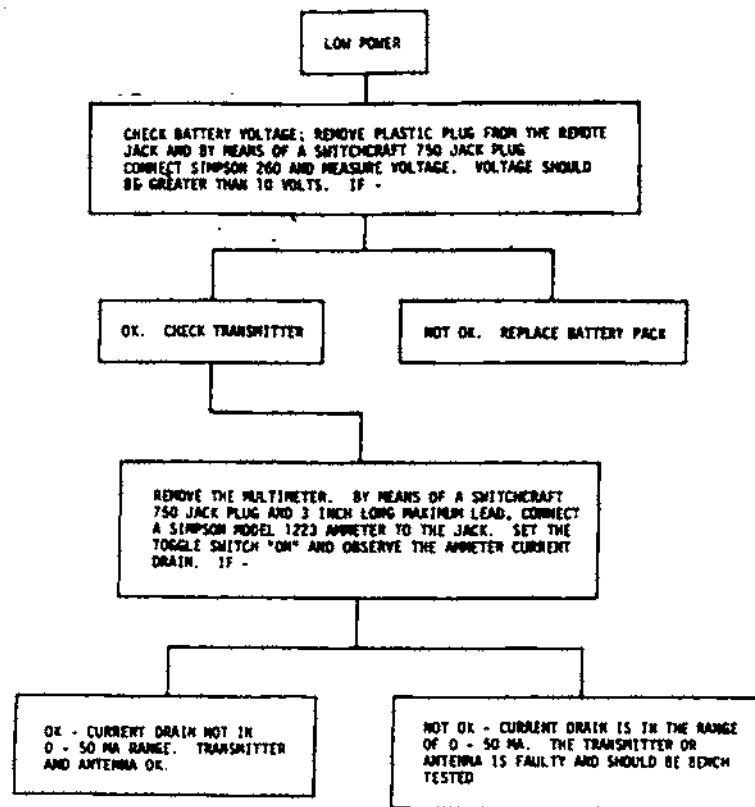
DMELT-6

SHARC-7

* USE ANTENNA COAXIAL CABLE, PROVIDED WITH TRANSMITTER

51987013

Troubleshooting Chart - Emergency Locator Transmitter
Figure 2



Troubleshooting Chart - Emergency Locator Transmitter (CIR10)
Figure 3

3. Removal/Installation of Battery Pack.

A. Removal of Battery Pack.

- (1) Remove emergency locator transmitter in accordance with removal procedure.
- (2) Remove screws attaching the cover to the case and remove cover. Remove rubber gasket to gain access to battery pack.
- (3) Disconnect and remove battery pack from case.

B. Installation of Battery Pack.

NOTE: Lithium battery packs originally used in the emergency locator transmitter are no longer in use. When replacing the lithium battery pack with the alkaline battery pack, refer to Service Kits SK421-86 and SK421-89.

- (1) Before installing new battery pack, check to ensure that its voltage is 10.8 volts or greater.
- (2) Install battery pack in case and connect ensuring the plastic connectors are completely mated.
- (3) Replace the transmitter cover by positioning the rubber gasket on the cover and pressing the cover and case together and attach with nine screws. Care should be taken to avoid trapping the gasket and overtightening screws.
- (4) Remove the old battery placard from the end of transmitter and replace with new battery placard supplied with the new battery pack.

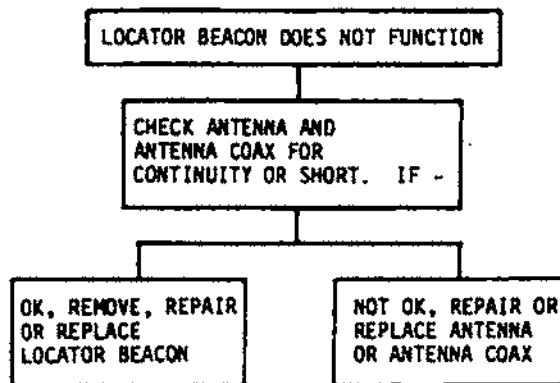
NOTE: Be sure to enter the new battery pack expiration date in the airplane records.

- (5) Install transmitter, refer to Removal/Installation.
- (6) Check operation of the emergency locator transmitter, refer to Chapter 2.

CAUTION: DO NOT LEAVE THE EMERGENCY LOCATOR TRANSMITTER IN THE ON POSITION LONGER THAN 10 SECONDS. THIS COULD INITIATE DOWNED AIRPLANE SEARCH PROCEDURES BY C.A.P., D.O.T., OR F.A.A. PERSONNEL.

Inspection/Check

1. For the CIR 10 emergency locator transmitter removal of the emergency locator transmitter access door permits inspection.
2. For the SHARC-7 emergency locator transmitter, removal of tailcone access door permits inspection.



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➤ Troubleshooting Chart - Locator Beacon
Figure 4

AVIONICS COOLING SYSTEMDescription

1. The instrument panel avionics cooling system is mounted in the control pedestal. The cooling system, which is optional, consists of a blower, filter, fuse holder, and electrical wiring. The blower is utilized to cool the avionics equipment mounted on the radio panel of the instrument panel.
2. The supplemental avionics cooling system is mounted in the forward nose avionics bay. The cooling system consisting of two fans is installed when the 800 Avionics System, 800 Avionics System plus 400 DME or when it is requested as an option. One fan is installed when only the 400 DME is installed. The fans are utilized to cool avionics located in the forward avionics bay.
3. A third cooling blower specifically for the Nav/Com Transmitter/Receiver is located beneath the floorboards just forward of the pilot's seat. Air ducts lead from the blower to the Nav/Com units.

Maintenance Practices

1. Removal/Installation of Avionics Cooling System (Instrument Panel)
 - A. Remove Avionics Cooling System (Instrument Panel).
 - (1) Ensure electrical power is OFF.
 - (2) Remove RH side panel from control pedestal as required to gain access to work area.
 - (3) Identify and disconnect blower ground wire (black) from structure; disconnect blower wire (blue) at splice.
 - (4) Remove blower and bracket from side panel of control pedestal by removing screws.
 - (5) Remove clamp from blower and bracket.
 - B. Install Avionics Cooling System (Instrument Panel).
 - (1) Position clamp on blower and secure clamp to bracket with bolt, washer and nut.

NOTE: Clamp is to be positioned against stop block. Install blower with flow arrow pointing up.
 - (2) Install blower and bracket to inside side panel of the control pedestal by screws.
 - (3) Identify and connect blower ground wire (black) to structure; connect blower wire (blue) at splice.

NOTE: Ensure ground wire is properly grounded.
 - (4) Replace RH side panel to control pedestal.
2. Removal/Installation of Avionics Cooling System (Forward Nose Avionics Bay)
 - A. Remove Avionics Cooling System (Forward Nose Avionics Bay).
 - (1) Ensure electrical power is OFF.
 - (2) Remove forward nose bay access as required to gain access to work area.

NOTE: Note direction of airflow of fans and direction of deflectors on both fan installation.
 - (3) Identify and disconnect electrical wires from both nose cooling fans.
 - (4) Remove lower cooling fan and deflector by removing screws, washers and spacers.
 - (5) Remove upper cooling fan, deflector and finger guard from avionics shelf by removing screws, washers, spacers and nuts.

B. Install Avionics Cooling System (Forward Nose Avionics Bay).

- (1) Properly position upper cooling fan, deflector and finger guard on avionics shelf and secure with screws, washers, spacers and nuts.
- (2) Properly position lower cooling fan and deflector and secure with screws, washers and spacers.
- (3) Identify and connect electrical wires to both nose cooling fans.
- (4) Perform operational test.
- (5) Install forward nose bay access.

3. Removal of NAV/COM and DME Cooling System (See Figures 2 and 3).

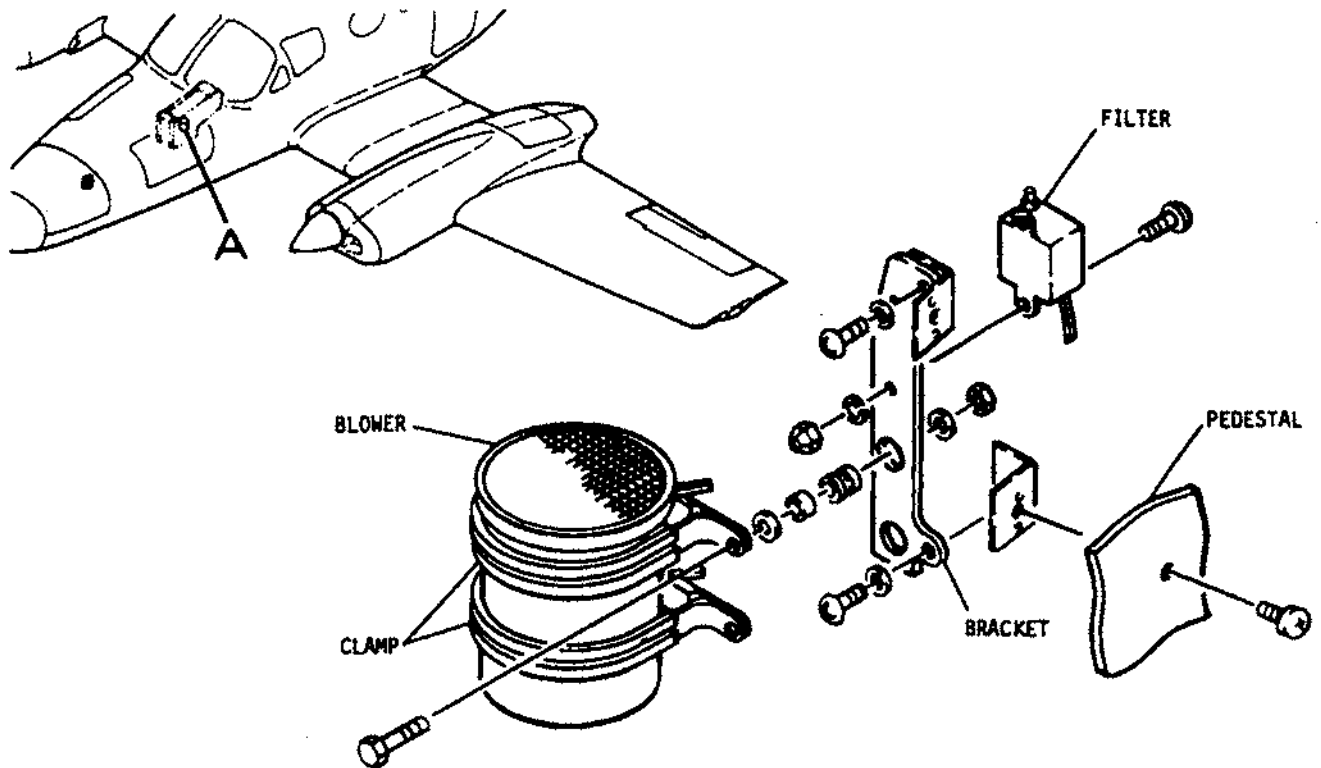
- A. Verify that electric power is off for all systems in access area. (This area is small and crowded and access involves reaching through other systems, electrical and mechanical linkage.)
- B. Remove pilot's seat.
- C. Lift carpet and remove floor panels just forward of pilot's seat pan.
- D. Tag and disconnect wiring leads.
- E. Remove tee straps (1) to disconnect ducts (2).
- F. Remove screws securing bracket (3). Lift blower and bracket assembly from airplane.
- G. The blower (4) and filter (5) can be disassembled from the bracket at bench.

4. Installation of NAV/COM and DME Cooling System.

- A. Attach bracket (3) and filter (5) to blower (4) prior to installing in airplane.
- B. Attach to mounting plate with screws.
- C. Reconnect ducts (2) and replace stays (1).
- D. Reconnect wiring and remove tags.

NOTE: Check operation of blower prior to replacing floor panels and carpet.

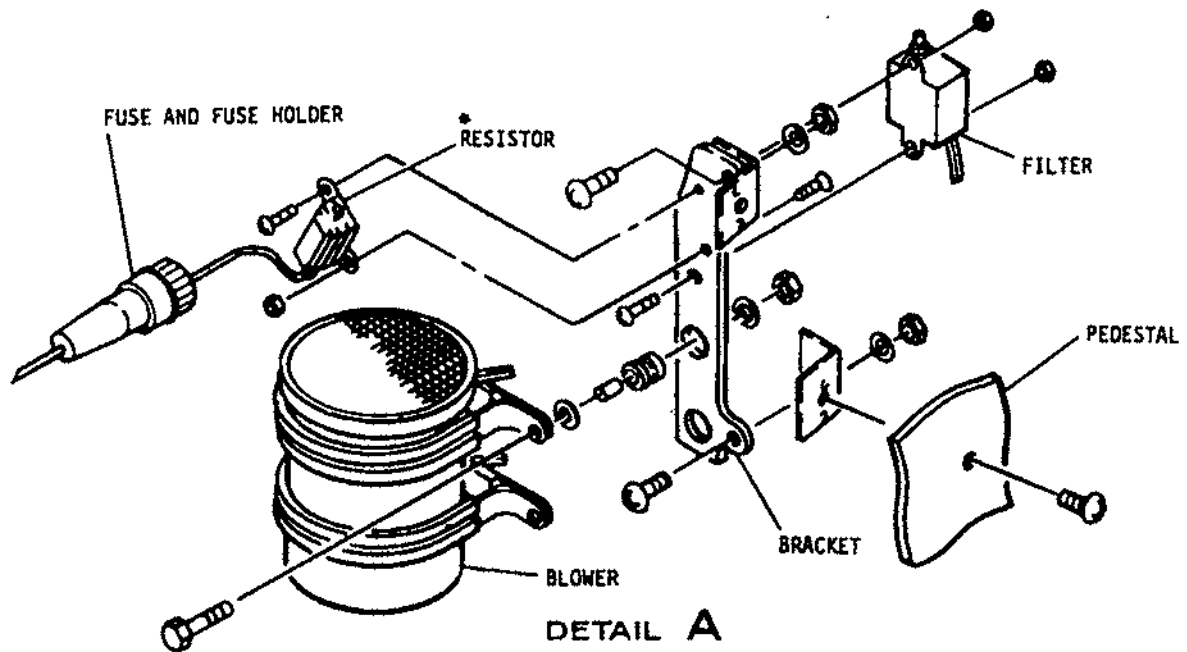
- E. Replace pilot's seat.



DETAIL A

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* RESISTOR NOT REQUIRED WITH
MOTOR NO. 19A2711, 421C0690 AND ON

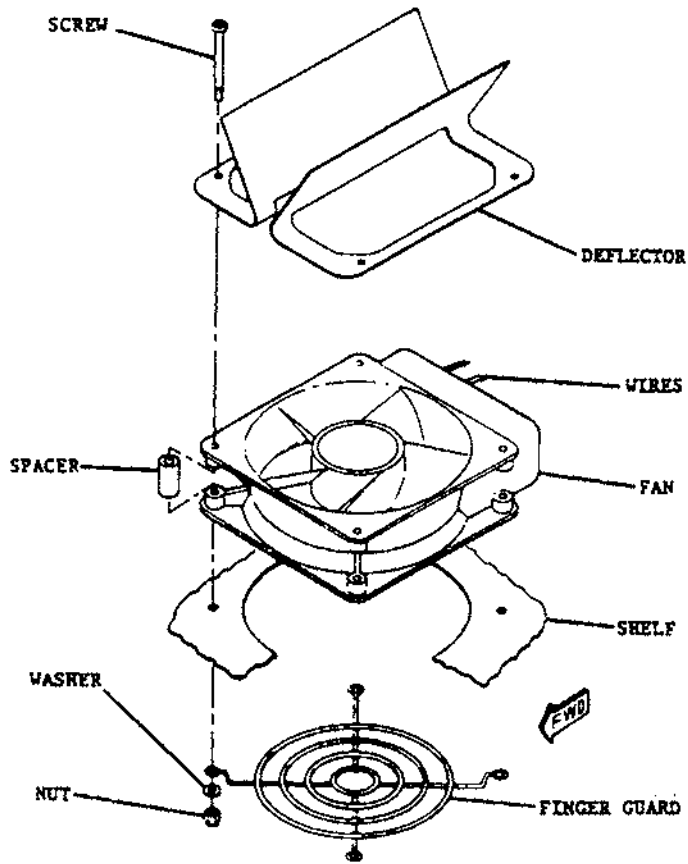
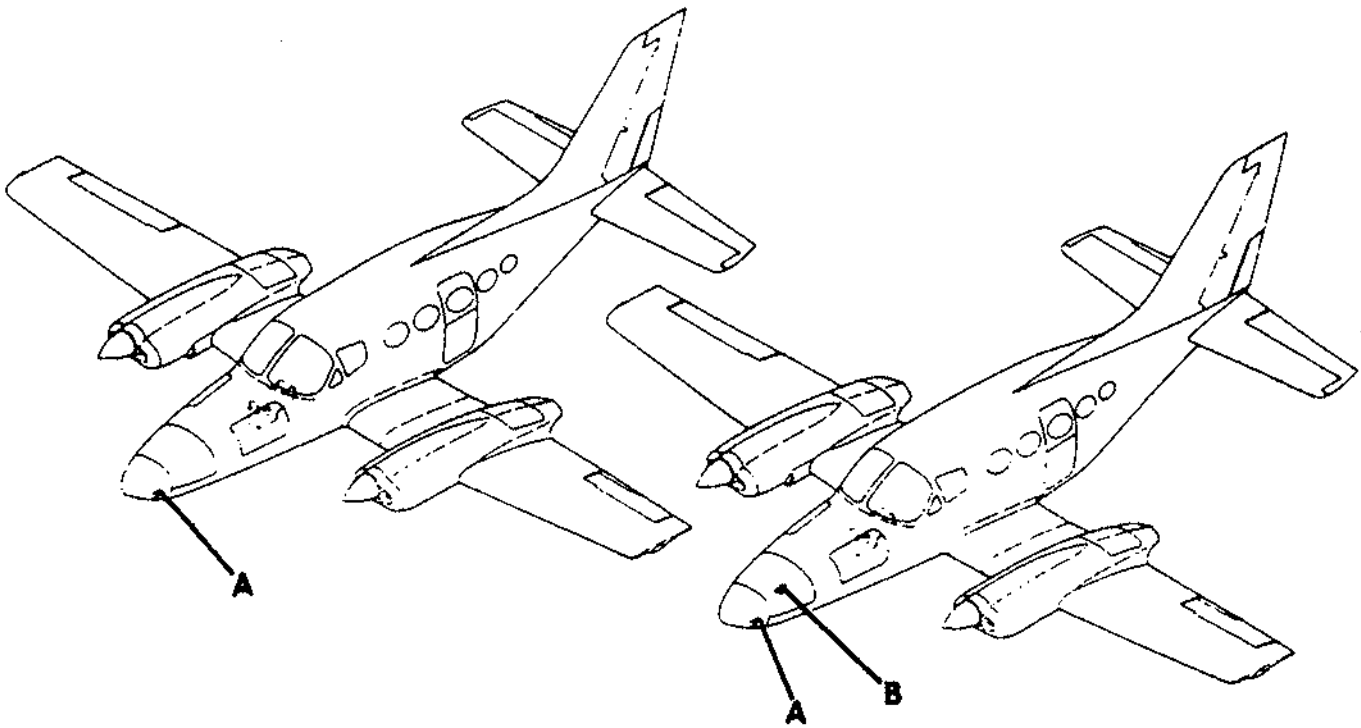


DETAIL A

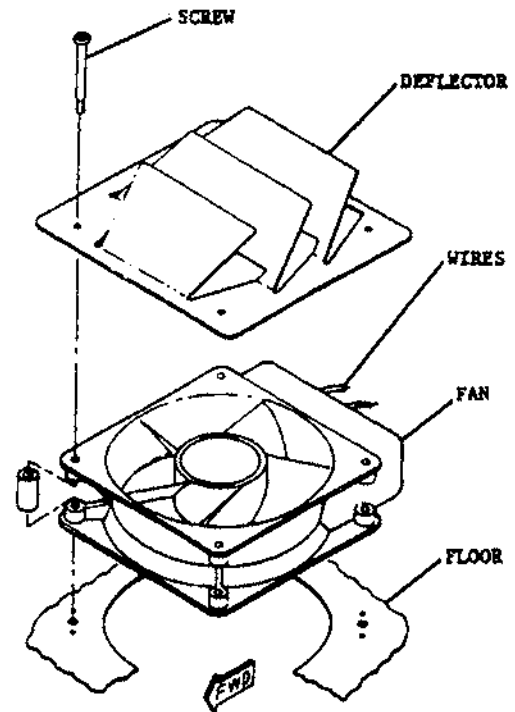
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Avionics Cooling Blower Installation - Pedestal
Figure 1 (Sheet 1 of 2)

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A51141161
A51141123



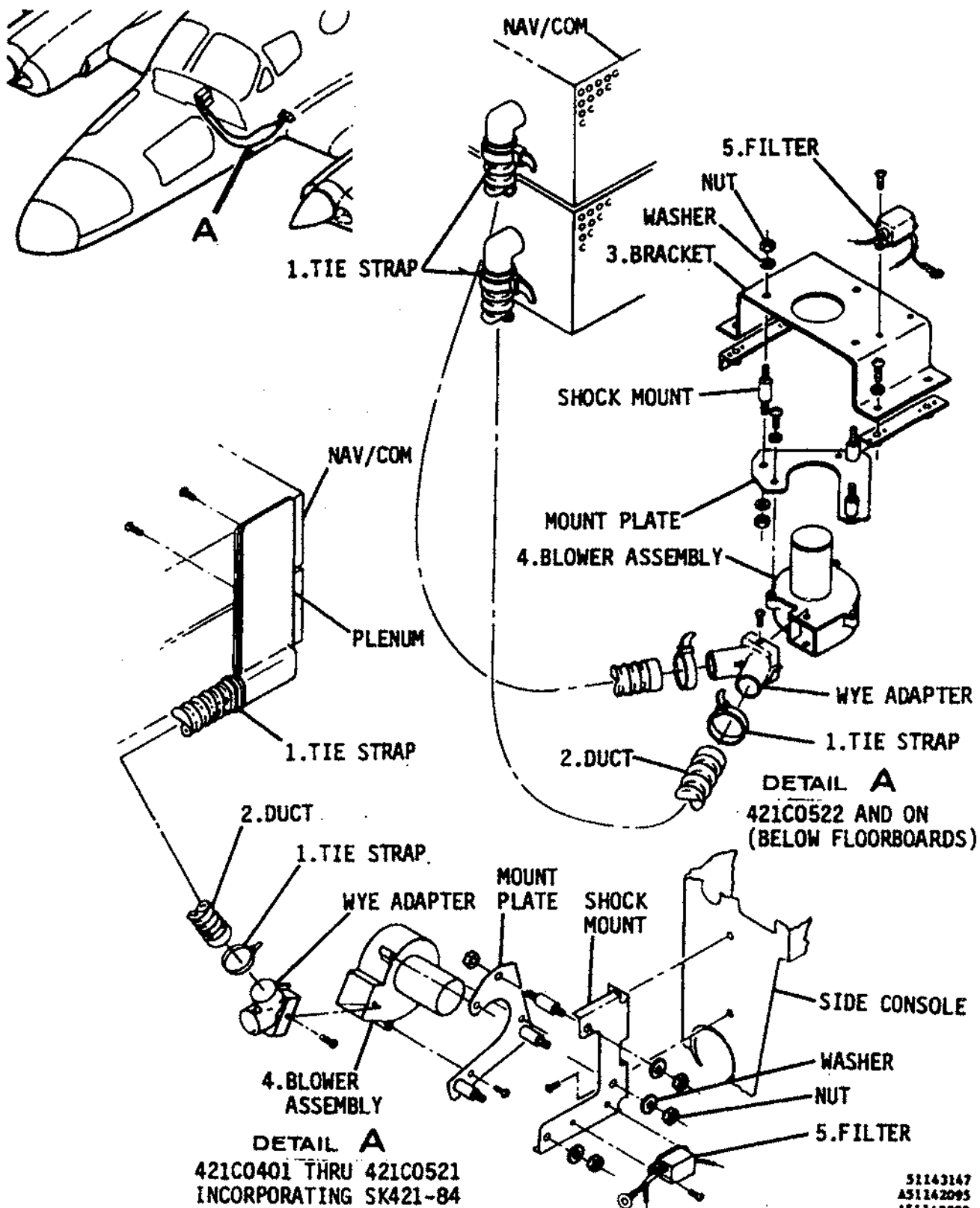
DETAIL B



DETAIL A

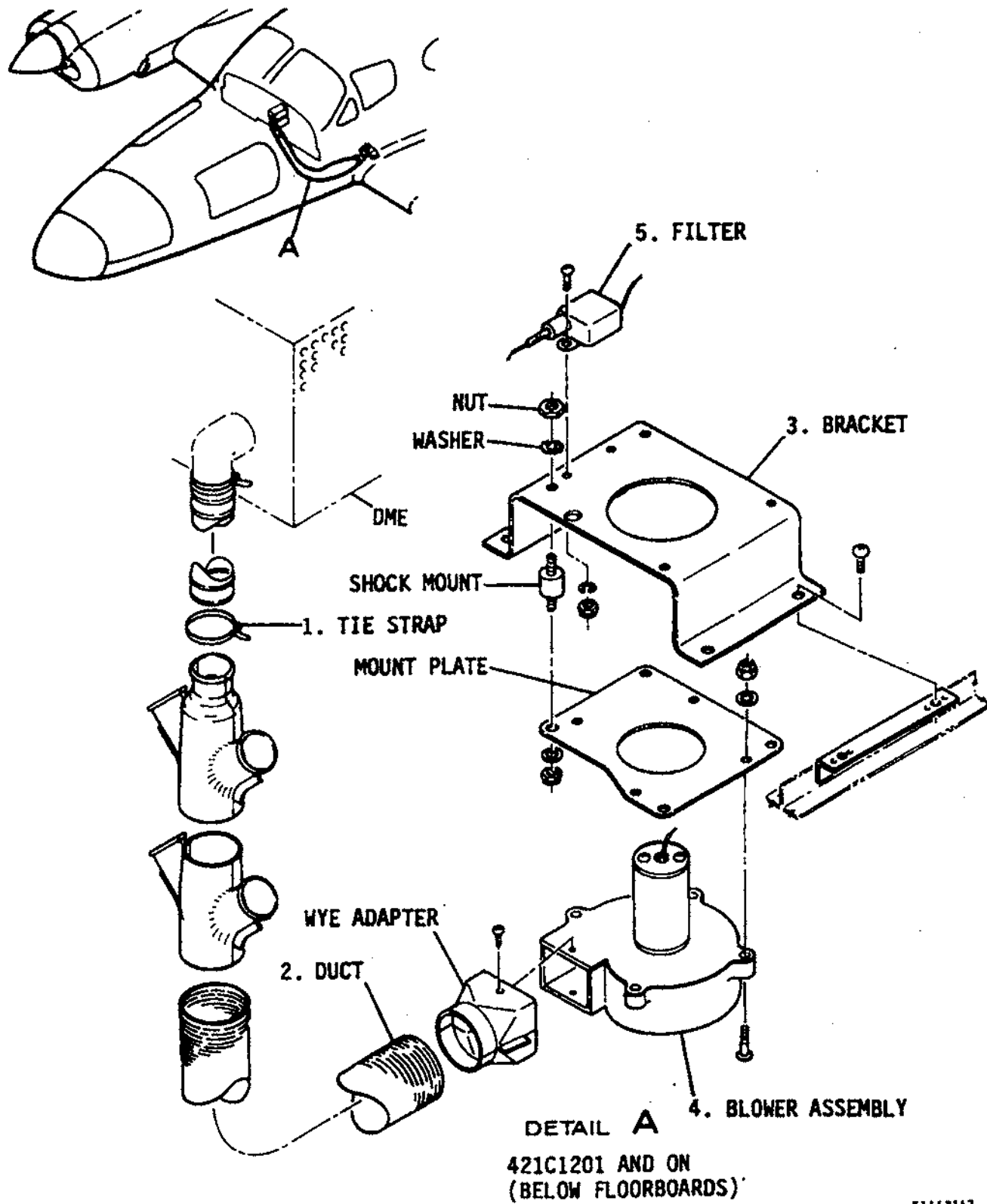
Avionics Cooling Blower Installation
Figure 1 (Sheet 2)

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A51143130
851143129



Nav/Com Cooling System Installation
Figure 2

51143147
A51142095
A51142092
A14141072



DME Cooling System Installation
Figure 3

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AS1142095A

SLAVED DIRECTIONAL GYRO AND FLUX DETECTORDescription

1. The slaved directional gyro, includes a single, synchro-driven pointer and in some gyros, a dual pointer for use with ADF/VOR inputs to provide continuous indication of the bearing to specific ground stations. The slaved directional gyro operates with a slaving meter and a flux detector to produce input to the electronic compass circuit in the gyro.
2. The slaving meter is a zero-center-scale meter mounted on the instrument panel, used to monitor heading displacement between a slaved directional gyro and a flux detector. When an error exists between the two heading signals, the slaving meter deflects in either direction depending on the polarity of the error. As the gyro slaving circuit acts to correct the error, the needle slowly returns to the center position of the meter. A null position of the meter needle indicates that the gyro heading indication is correct.
3. The flux detector is a remotely mounted device mounted in the horizontal or vertical stabilizer, depending on the avionics package. The flux detector furnishes long-term information to maintain the slaved directional gyro position properly with the earth's magnetic field. The flux detector is a sealed unit. When the unit is installed in the aircraft and aligned with the line of flight, it usually requires no further servicing. Electrical interface with the unit is provided by an attached cable and connector plug. Slotted cutouts in the mounting flange are used for mounting.

Adjustment/Test

1. Adjustment Slaved Direction Gyro.

- A. Compass Alignment.

NOTE: The compass alignment shall be performed on a calibrated compass rose.

- (1) Ensure compensator adjustments are set to neutral position. The compensators are located on the flux detector.
- (2) Using a hand-held magnetic compass, check all ferrous materials parts for magnetism near the flux detector.
- (3) Degauss any parts within two feet which cause greater than 10° deflection of the magnetic compass, and any part within four feet which cause greater than 90° deflection of the magnetic compass.
- (4) Ensure that each of the applicable systems are controlled from the proper circuit breakers, and the corresponding "HDG" flag appears when the circuit breaker is disengaged.
- (5) Ensure slave meter is operative.
- (6) Ensure the systems fast slave circuitry is operational.
- (7) Ensure all electrical instruments for the aircraft are installed and operative.
- (8) Ensure other aircraft and vehicles are a safe out of the way distance.
- (9) Position aircraft on the 270° heading of the compass rose.
- (10) With both engines running 1000 RPM, turn on the following:
 - (a) All circuit breakers.
 - (b) Inverters.
 - (c) All lights except landing lights and reading lights.
 - (d) All avionics systems.
 - (e) All electrical systems except pitot heat, stall and static heaters.
 - (f) Allow slaved gyro system to stabilize (stabilization speed may be increased by using fast slave).
 - (g) Record the slaved gyro system error in degrees and direction with the slave meter nulled.

NOTE: High readings are positive errors, low readings are negative errors.

- (h) Position aircraft on the 360° heading of the compass rose and repeat Steps (a) through (g).
- (i) Position aircraft on the 90° heading of the compass rose and repeat Steps (a) through (g).
- (j) Position aircraft on the 180° heading of the compass rose and repeat Steps (a) through (g).

B. Index Error Alignment.

NOTE: This alignment should ensure that the compass system flux detector is positioned for minimum index error.

- (1) Algebraically sum the four cardinal heading errors obtained in paragraph A Steps (10), (a) through (g).
- (2) Divide the sum obtained by four. This result is the index error correction and direction of rotation of the flux detector.
- (3) Rotate flux detector the direction and amount of the flux detector is required to correct a positive error.

NOTE: Approximately five degrees rotation equals approximately 1/8 inch distance measured on the outer circumference of the flux detector.

- (4) Repeat compass alignment procedure Step (10), (a) through (g).
- (5) The remaining error at the cardinal headings as received in Step (4) should equal the difference between the initial cardinal heading errors obtained originally in Compass Alignment procedure Step (10), (a) through (g).
- (6) Recalculate error and assure the remaining error is 0 $\pm$ 0.5 degrees.

C. Compensation Adjustment.

- (1) If the corrected error as calculated in Index Error Alignment paragraph Step (1) is greater than $\pm 2^\circ$ the compensators must be adjusted. The errors obtained in the compass alignment procedure Step (10), (a) through (g) will be used to determine the required amount and degree of compensation.

D. Compensation Calculations.

- (1) Using cardinal heading errors calculated in Index Error Alignment Step (5), algebraically sum the north and south errors, divide this sum by two and change the sign of the result. The resulting number is the amount and direction of north/south compensator adjustment.
- (2) Repeat Step (1) for east/west errors.

E. Compass Compensation.

- (1) At one cardinal heading, adjust the appropriate compensator and amount calculated in the Compensation Calculations Paragraph Step (1).
- (2) Rotate the aircraft 90° and adjust the appropriate compensator the amount calculated.
- (3) Rotate the aircraft to the next two cardinal headings and ensure that no errors greater than two degrees are present.
- (4) With normal aircraft power, all electrical systems on, rotate the aircraft to 30° heading (including cardinals). Stop on each heading long enough to allow the gyro to stabilize and the slave meter to null.
- (5) Observe and record the headings indicated by the slaved gyro system.
- (6) There shall be no error greater than two degrees at any heading indicated by the slaved gyro.

Maintenance Practices

1. Removal/Installation Flux Detector (See Figure 1).

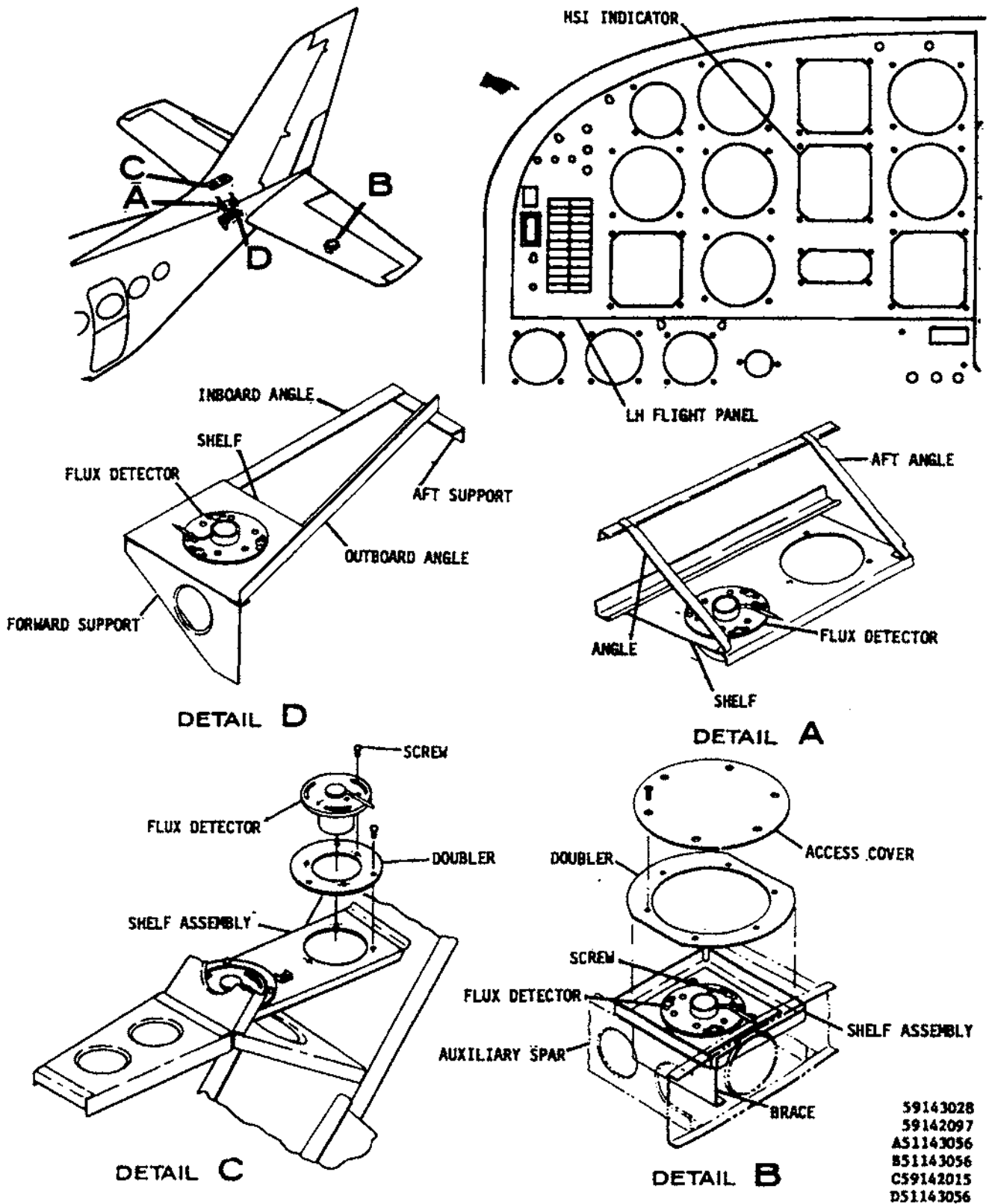
NOTE: Removal/Installation procedures are the same for all installations.

A. Remove Flux Detector.

- (1) Remove access cover from stabilizer.
- (2) Disconnect electrical cable from flux detector.

NOTE: Mark position of flux detector for reinstallation.

- (3) Remove screws securing flux detector.
- (4) Remove flux detector.



Slave Directional Gyro Installation
Figure 1

B. Install Flux Detector.

- (1) If new flux detector is not being installed, align flux detector to index mark and secure with screws.
- (2) Connect electrical cable to flux detector.
- (3) If new flux detector is being installed, refer to Adjustment/Test.
- (4) Install access cover.

AVQ-47 WEATHER RADAR SYSTEMDescription

1. The AVQ-47 weather radar system consists of three replaceable units: The radar transceiver, indicator and antenna. The AVQ-47 is an X-band radar that operates in the 9300 to 9500 MHz frequency band. Primary power for the system is drawn from the aircraft 28-VDC source. Besides transmitting and receiving, the transceiver supplies synchronizing signals and power to operate both the indicator and the antenna.
2. The AVQ-47 provides a visual display of storm cell cross-sections on the front panel of the indicator. This display relates the range and azimuth of storm cells to the aircraft heading through a forward sector of 90 degrees. Because the antenna can be tilted downward by means of the tilt control on the indicator, the radar functions in the ground-mapping mode, enabling a pilot who is knowledgeable in radar interpretation to recognize land masses or features of the terrain with which he is familiar.

Maintenance Practices

1. Removal/Installation AVQ-47 Radar Indicator (See Figure 1)

A. Removal AVQ-47 Radar Indicator.

- (1) Ensure function/range switch is OFF and radar circuit breaker is open.
- (2) Identify and disconnect power/control wire bundle from back of indicator.
- (3) Remove screws, washers and nuts from strap assembly and remove strap assembly.
- (4) Remove the screws to the left and right of the indicator screen. Remove the indicator unit through the instrument panel.

B. Install AVQ-47 Radar Indicator.

- (1) Install indicator unit through the instrument panel and secure with screws to the right and left of indicator screen.
- (2) Install strap assembly and secure with screws, washers and nuts. Ensure strap assembly is supporting the weight of the indicator.
- (3) Identify and connect power/control wire bundle to the back of the indicator.

2. Removal/Installation AVQ-47 Radar Transceiver (See Figure 1)

A. Removal AVQ-47 Radar Transceiver.

- (1) Ensure function/range switch is OFF and radar circuit breaker is open.
- (2) Remove forward nose avionics bay access door.
- (3) Identify and disconnect power/control wire bundle from lower center of transceiver.
- (4) Identify and disconnect wave guide assembly by removing screws and lockwashers.
- (5) Loosen wing nuts and swing studs clear. Slide transceiver forward on rack to disengage pins and remove transceiver.

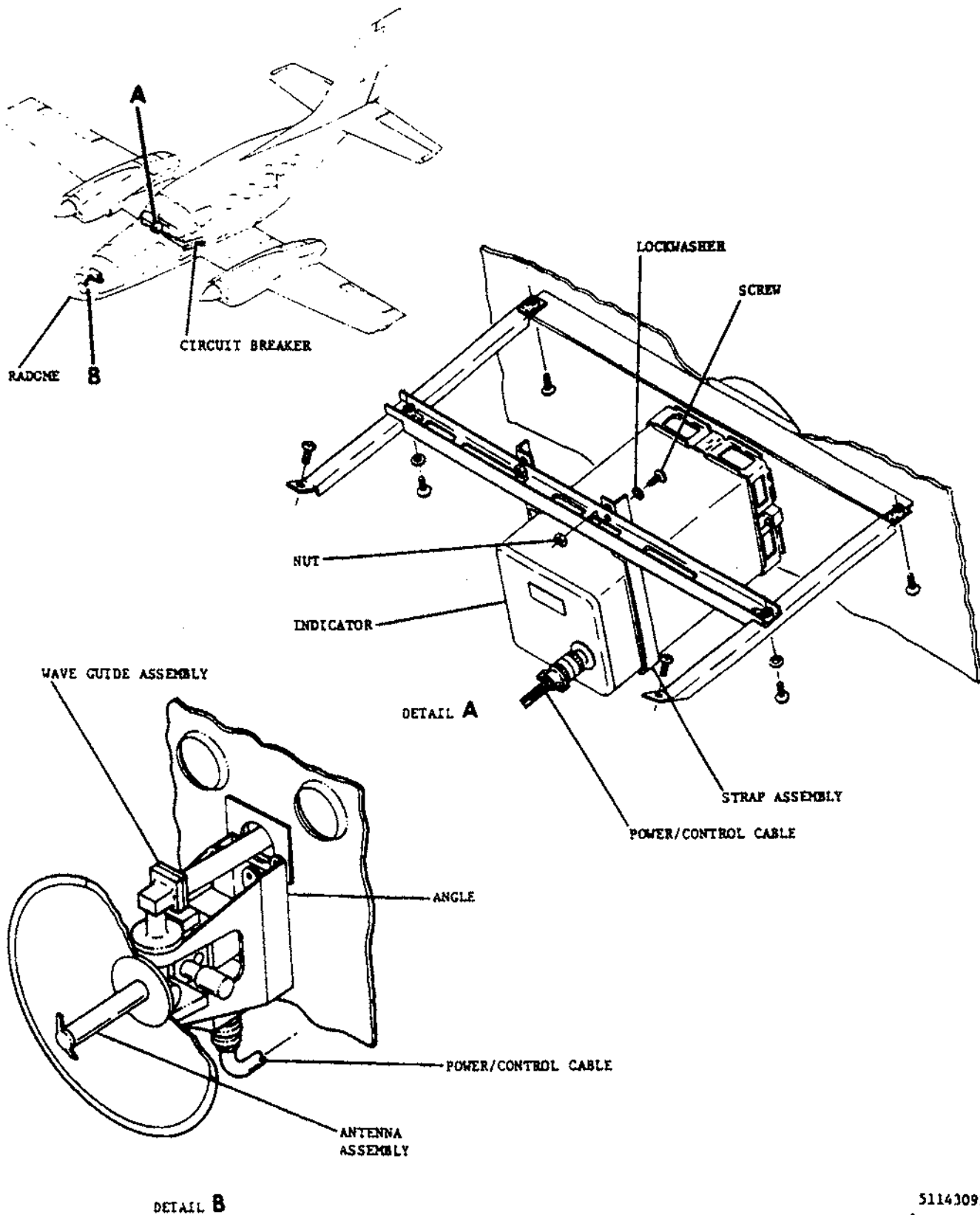
B. Install AVQ-47 Radar Transceiver.

- (1) Place transceiver on rack and slide back to engage pins. Rotate wing nut studs up and tighten wing nuts and safety wire.
- (2) Identify and connect wave guide assembly and secure with screws and lockwashers.
- (3) Identify and connect power/control wire bundle to lower center of transceiver.
- (4) Replace forward nose avionics bay access door.

3. Removal/Installation AVQ-47 Radar Antenna (See Figure 1)

CAUTION: IN HANDLING THE ANTENNA, DO NOT EXERCISE THE REFLECTOR TILT OR FEED SCAN EXCURSIONS BY HAND AS DAMAGE TO THE ANTENNA COULD RESULT. TILT AND SCAN MOVEMENT CAN BE MADE ONLY BY THE ANTENNA ITSELF WHEN DRIVEN BY THE PROPER ELECTRICAL POWER OUTPUT.

THE REFLECTOR IS A PRECISELY-CALCULATED PARABOLOID, DO NOT BEND IT OR DISTORT IT IN ANY WAY TO DO SO MAY RESULT IN DEGRADED RADAR PERFORMANCE.



AVQ-47 Weather Radar Installation
Figure 1

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A. Removal AVQ-47 Radar Antenna.

- (1) Ensure function/range switch is OFF and radar circuit breaker is open.
- (2) Remove radome assembly.
- (3) Identify and disconnect power/control wire bundle from antenna.
- (4) Identify and disconnect wave guide assembly by removing screws and lockwashers.
- (5) Remove antenna assembly from angles by removing bolts and lockwashers.

B. Install AVQ-47 Radar Antenna.

- (1) Install antenna assembly on angles and secure with bolts and lockwashers.
- (2) Identify and connect wave guide assembly with screws and lockwashers.
- (3) Identify and connect power/control wire bundle to antenna.
- (4) Install radome assembly.

RDR-130/RDR-150 WEATHER RADARDescription

1. The RDR-130/RDR-150 weather radar system consists of three replaceable units: the receiver transmitter, the radar indicator and the radar antenna. The RDR-130/RDR-150 operates on a center frequency of 9375 MHz with a peak pulse power output of 8 KW (typical).
2. The IN-2026A (optional indicator) provides a color display depicting three discrete levels of weather intensity. Each level is represented by a separate contrasting color. The panel controls are shown with functional characteristics identified in Figure 2.
3. Built-in test circuits provide rapid checkout of system performance. A "Test" function is incorporated on the indicator panel to validate the systems operation. If the RDR-130/RDR-150 system is operating normally, energizing the "Test" function causes a predetermined test pattern to appear on the indicator.
4. The antenna is a flat-plate phased array with standard or inverted mounting. The antenna is remotely controlled to tilt the position of the beam between 15 degrees above and 15 degrees below the zero-degree (horizontal) attitude.

Adjustment/Test

1. Refer to vendor installation manual.

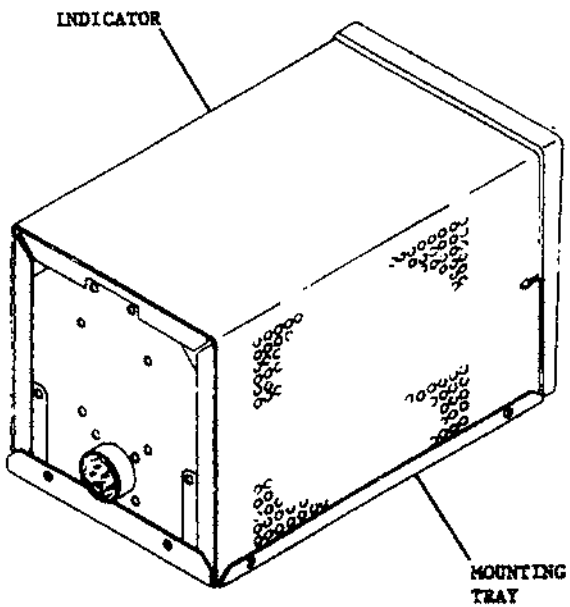
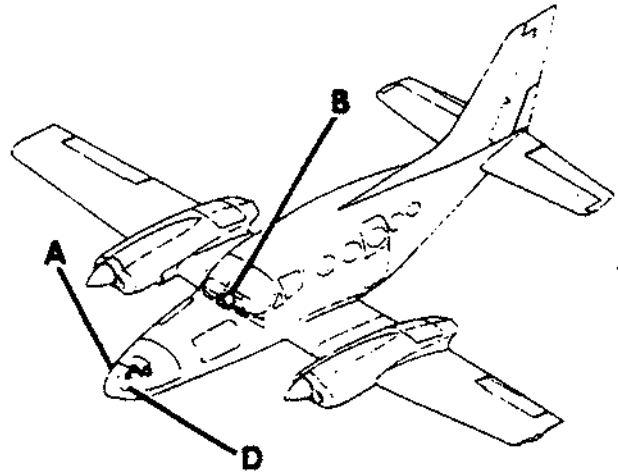
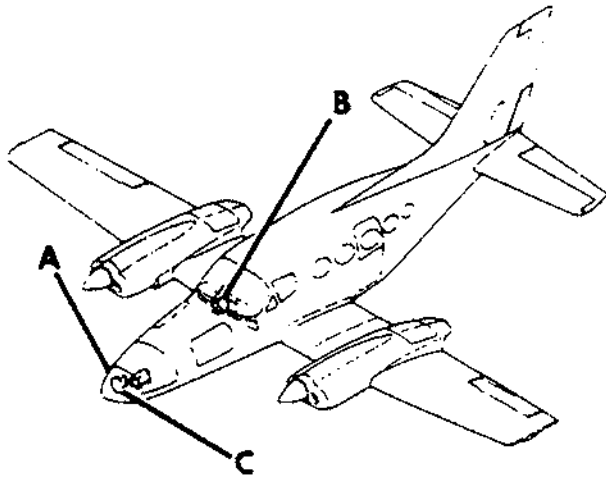
WARNING: DO NOT OPERATE THE RADAR SYSTEM WITHIN 15 FEET OF GROUND PERSONNEL OR CONTAINERS HOLDING FLAMMABLE OR EXPLOSIVE MATERIAL. DO NOT OPERATE THE RADAR SYSTEM DURING FUELING OPERATIONS. WHEN PREFLIGHTING THE RADAR SYSTEM, ENSURE THAT THE AIRPLANE IS FACING AWAY FROM BUILDINGS OR LARGE METAL STRUCTURES THAT ARE LIKELY TO REFLECT SIGNIFICANT AMOUNTS OF RADAR ENERGY BACK INTO THE SYSTEM.

Tools and Equipment

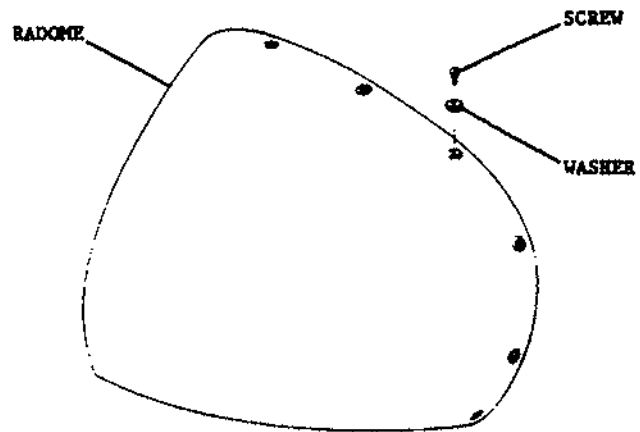
Name	Number	Manufacturer	Use
Installation Manual	I.B. 2150	Bendix Avionics Division	Adjusting/testing RDR-150 radar.
Installation Manual	I.B. 2130	Bendix Avionics Division	Adjusting/testing RDR130 radar.

Maintenance Practices

1. Removal/Installation RDR-130/RDR-150 Radar Indicator (See Figure 1).
 - A. Removal RDR-130/RDR-150 Radar Indicator.
 - (1) Ensure OFF/STBY/TEST switch is OFF and radar circuit breaker is open.
 - (2) Disconnect wire bundle connector from rear of indicator.
 - (3) Turn locking screw counterclockwise until stop is reached.
 - (4) Slide indicator out from mounting tray through instrument panel hole.
 - B. Install RDR-130/RDR-150 Radar Indicator.
 - (1) Slide indicator into mounting tray through instrument panel.
 - (2) Lock into position by turning screw clockwise until stop is reached.
 - (3) Connect wire bundle connector at rear of indicator.
 - (4) Check operation. Refer to vendor installation manual.



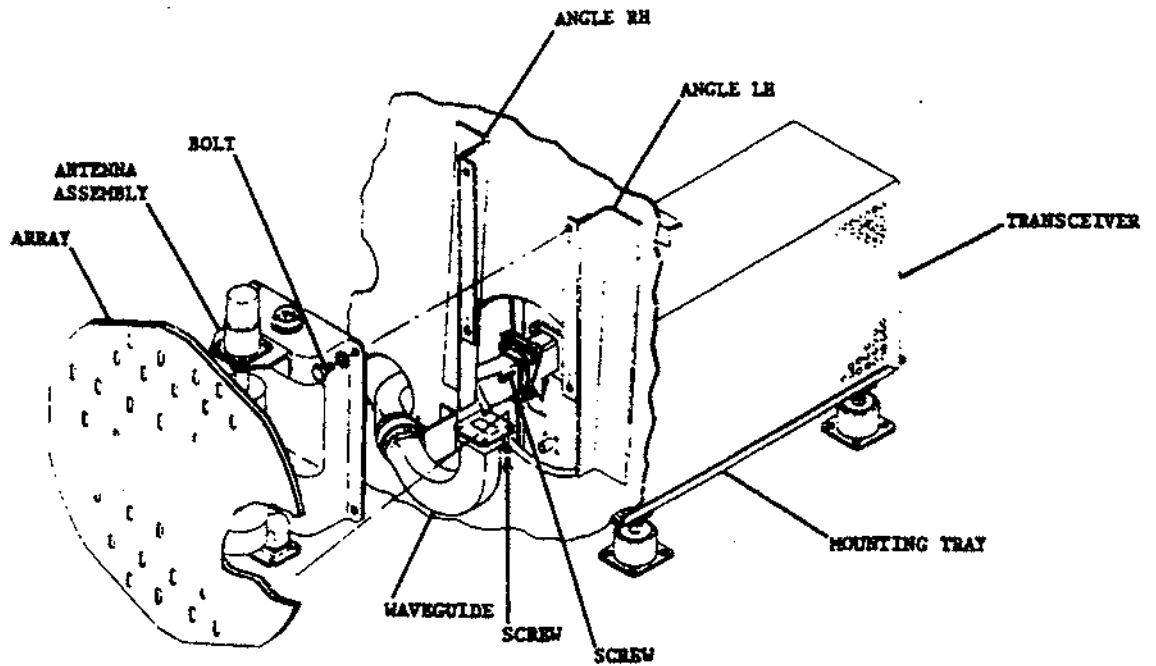
DETAIL B



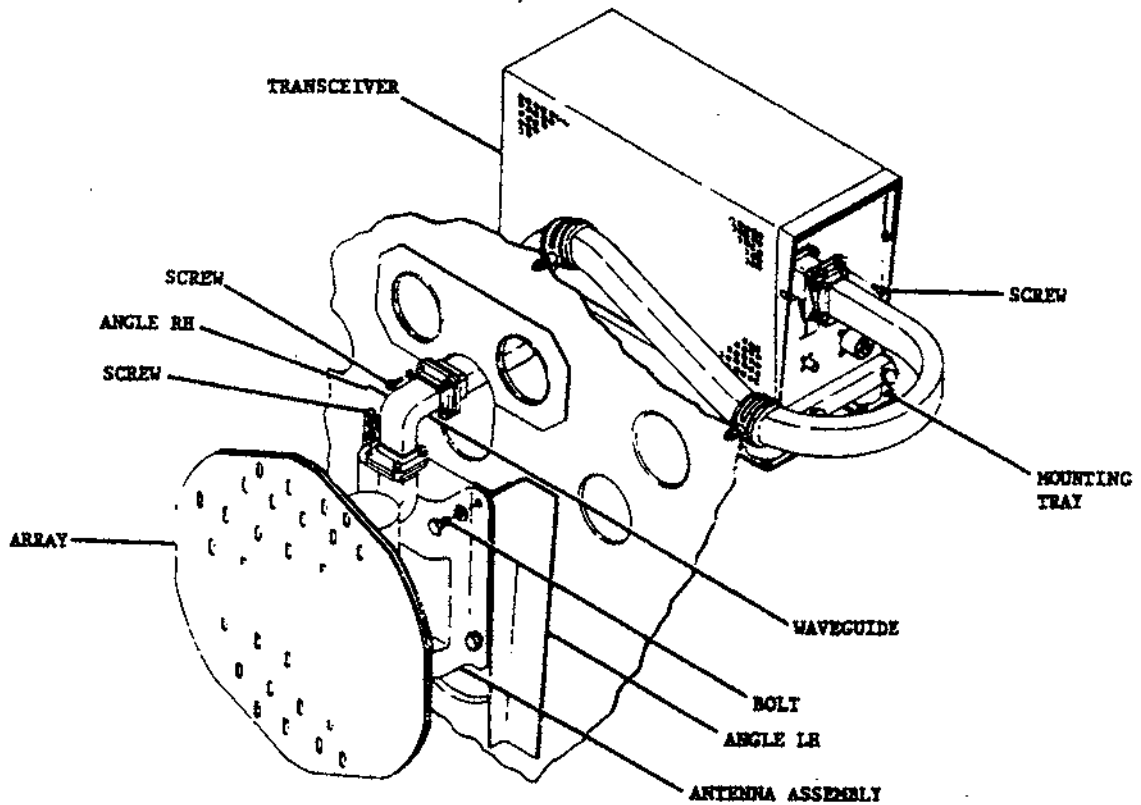
DETAIL A

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A51131007
B51142051

RDR 130 Weather Radar Installation
Figure 1 (Sheet 1 of 2)



DETAIL C



DETAIL D

C51143069
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RDR 130 Weather Radar Installation
Figure 1 (Sheet 2)

2. Removal/Installation RDR-130/RDR-150 Receiver-Transmitter.

A. Remove RDR-130/RDR-150 Receiver-Transmitter.

- (1) Ensure OFF/STBY/TEST switch is OFF and radar circuit breaker is open.
- (2) Remove forward nose avionics bay access door.
- (3) Disconnect electrical wire bundles at connector.
- (4) Disconnect wave guide at receiver-transmitter.
- (5) Loosen locking screws and slide receiver-transmitter out of mount.

B. Install RDR-130/RDR-150 Receiver-Transmitter.

- (1) Slide receiver-transmitter into mount and tighten locking screws.
- (2) Connect wave guide at receiver-transmitter.
- (3) Connect electrical wire bundles at connector.
- (4) Check operation. Refer to vendor installation manual.
- (5) Install forward nose avionics bay access door.

3. Removal/Installation RDR-150 Radar Antenna.

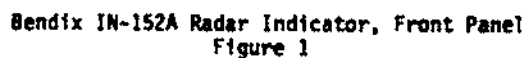
A. Removal RDR-150 Radar Antenna.

- (1) Ensure OFF/STBY/TEST switch is OFF and radar circuit breaker is open.
- (2) Remove radome assembly.
- (3) Disconnect wave guide from antenna.
- (4) Disconnect electrical wire bundle at connector.
- (5) Remove screws securing antenna to mounting and remove from airplane.

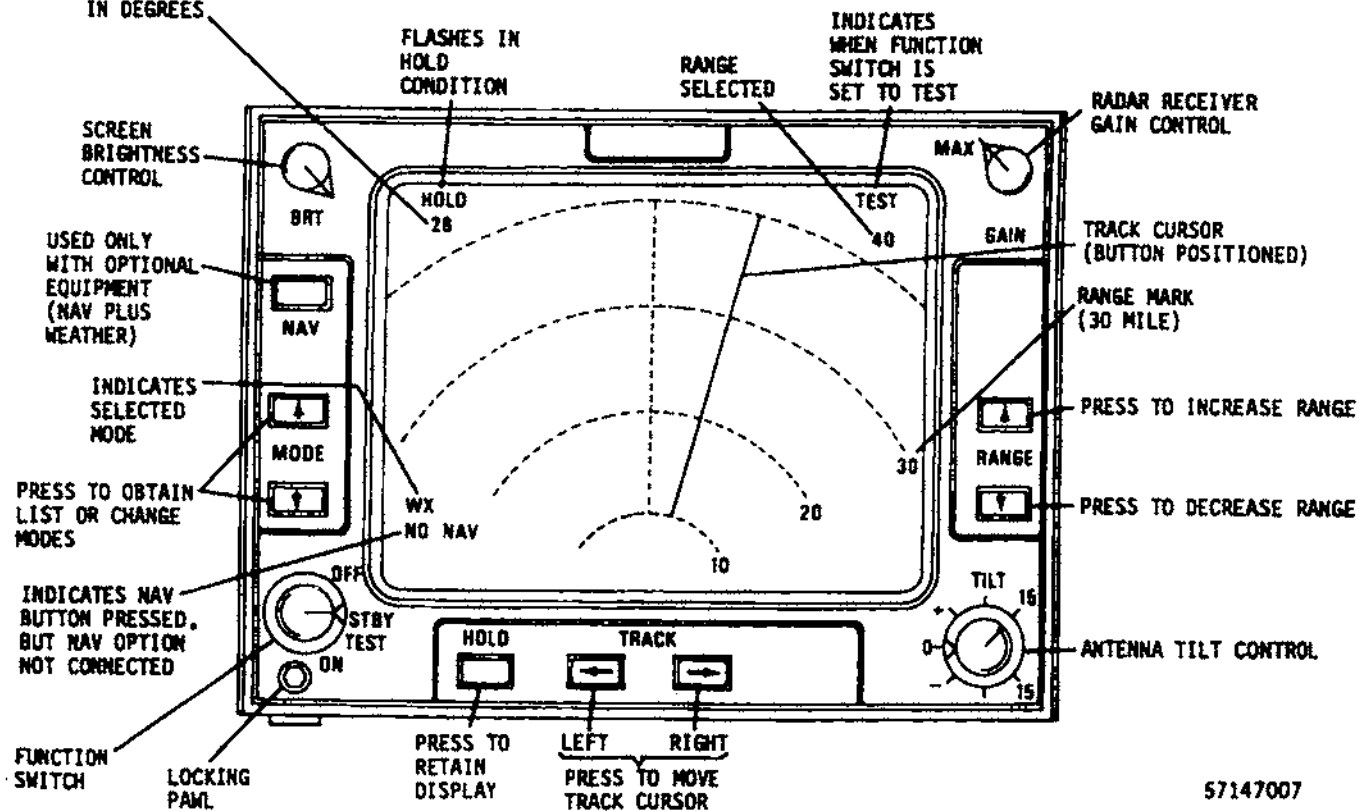
B. Install RDR-130/RDR-150 Radar Antenna.

- (1) Install antenna to mount with screws, washers and nuts.
- (2) Connect wave guide at the antenna.
- (3) Connect electrical wires at connector.
- (4) Check operation. Refer to vendor installation manual.
- (5) Install radome assembly.

SERVICE MANUAL



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Bendix IN - 2026A Color Radar Indicator, Front Panel

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RDR-160 WEATHER RADAR SYSTEMDescription

1. The RDR-160 weather radar system consists of two replaceable units: the radar transceiver-antenna unit, and the indicator unit. The RDR-160 is an X-band radar that operates in the 8825-9275 MHz frequency band. Primary power for the system is drawn from the aircraft 28 VDC source. Besides transmitting and receiving, the transceiver-antenna unit supplies synchronizing signals and power to operate the indicator.
2. A built-in test circuit provides rapid checkout of system performance. A "Test" function is incorporated on the indicator panel to validate the system operation. If the RDR-160 system is operating normally, energizing the "Test" function causes a predetermined test pattern to appear on the indicator.
3. The antenna is a parabolic dish array. The transceiver-antenna unit is mounted to angles on the forward-most bulkhead. The feed horn of the antenna is remotely controlled to tilt the beam 30° (15° mechanically and 15° electrically) above and below the horizontal attitude. The unit also scans a 90° (45° mechanically and 45° electrically) sector forward.

Adjustment/Test

1. Refer to vendor installation manual.

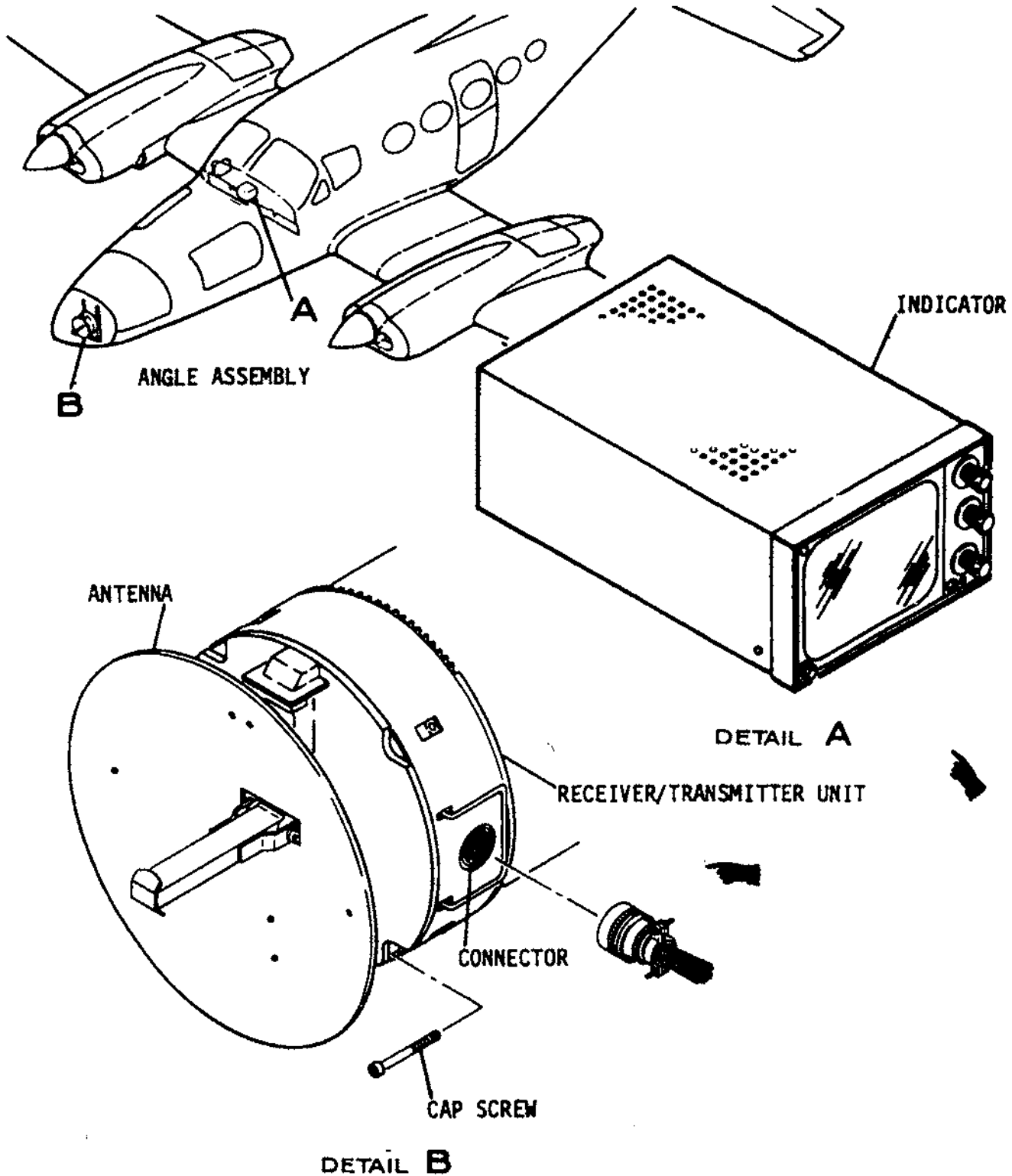
Tools and Equipment

Name	Number	Manufacturer	Use
Installation	I.B.	Bendix Avionics Division Ft. Lauderdale, Fla.	Adjustment/test RDR-160 radar.

Maintenance Practices

1. Removal/Installation RDR-160 Radar Indicator (See Figure 1).
 - A. Remove RDR-160 Radar Indicator.
 - (1) Ensure OFF/STBY/TEST switch is OFF and radar circuit breaker is OPEN.
 - (2) Disconnect wire bundle connector from rear of indicator.
 - (3) Turn locking screw counterclockwise until stop is reached.
 - (4) Slide indicator out from mounting tray through instrument panel.
 - B. Install RDR-160 Radar Indicator.
 - (1) Slide indicator into mounting tray through instrument panel.
 - (2) Lock indicator into position by turning screw clockwise until stop is reached.
 - (3) Connect wire bundle connector to rear of indicator.
 - (4) Check operation. Refer to vendor installation manual.
2. Removal/Installation RDR-160 Transceiver-Antenna Unit.
 - A. Remove RDR-160 Transceiver-Antenna Unit.
 - (1) Ensure OFF/STBY/TEST switch is OFF and radar circuit breaker is OPEN.
 - (2) Remove radome by removing screws and washers. Disconnect glide slope antenna if installed in radome.

CAUTION: IN HANDLING THE ANTENNA, DO NOT EXERCISE THE FEED HORN TILT OR SCAN BY HAND AS DAMAGE TO THE ANTENNA COULD RESULT. TILT AND SCAN MOVEMENT CAN ONLY BE MADE BY THE ANTENNA ITSELF WHEN DRIVEN BY THE PROPER ELECTRICAL POWER OUTPUT.



RDR-160 Weather Radar
Figure 1

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- (3) Disconnect the wire bundle connector from the transceiver unit.
- (4) Remove cap screws securing transceiver-antenna unit to angles and remove from aircraft.

B. Install RDR-160 Transceiver-Antenna Unit.

- (1) Position transceiver-antenna unit on aircraft and secure to aircraft with cap screws.
- (2) Connect wire bundle connector to the transceiver unit.
- (3) Check operation. Refer to vendor installation manual.
- (4) Position radome on aircraft and connect glide slope antenna. Secure radome with washers and screw.

RADIO ALTIMETER SYSTEMDescription

1. The radio altimeter system (optional) consists of the receiver/transmitter, indicator, antennas, horn and the associated electrical connections and cables. The radio altimeter is an independent system or may be coupled to the 400B Nav-O-Matic or IFCS systems. The indicator incorporates a test function, DH (Decision Height) indicator light and the HD SET knob. The warning horn is used to alert the pilot when the aircraft is out of the DH range on the indicator.

Adjustment/Test

1. Refer to vendor operations and installation manual.

Tools and Equipment

Name	Number	Manufacturer	Use
Operations Installation Manual	15-3321-02	Sperry Rand, Inc. Phoenix, Arizona	Testing radio altimeter.

Maintenance Practices

1. Removal/Installation of Radio Altimeter System.
 - A. Remove Radio Altimeter Indicator.
 - (1) Ensure electrical power is OFF.
 - (2) Tag and remove electrical connectors.
 - (3) Remove screws securing indicator to instrument panel.
 - B. Install Radio Altimeter Indicator.
 - (1) Install indicator in instrument panel.
 - (2) Connect electrical connections.
 - (3) Perform preflight test (refer to vendor operation and installation manual).
 - C. Remove Receiver/Transmitter.
 - (1) Ensure electrical power is OFF.
 - (2) Remove necessary seats, carpet and floorboard access plates.
 - (3) Tag and disconnect electrical connections.
 - (4) Remove screws securing receiver/transmitter to shelf. Lift receiver/transmitter from aircraft.
 - D. Install Receiver/Transmitter.
 - (1) Position receiver/transmitter on mount and install screws.
 - (2) Connect electrical connections.
 - (3) Assure radio altimeter functions properly.
 - (4) Install floorboards, access plates, carpet and seats.
 - E. Remove Antenna.

NOTE: Procedures apply to either antenna.

 - (1) Ensure electrical power is OFF.
 - (2) Remove necessary seats and tailcone access panel.
 - (3) Remove coax cable and electrical connector.
 - (4) Remove screws securing antenna to belly skin and remove antenna.

F. Install Antenna.

- (1) Position antenna in place in the tailcone and install screws.
- (2) Connect electrical connector and coax cable.
- (3) Ensure radio altimeter functions properly, refer to Adjustment/Test procedures.
- (4) Install tailcone access and floorboards.

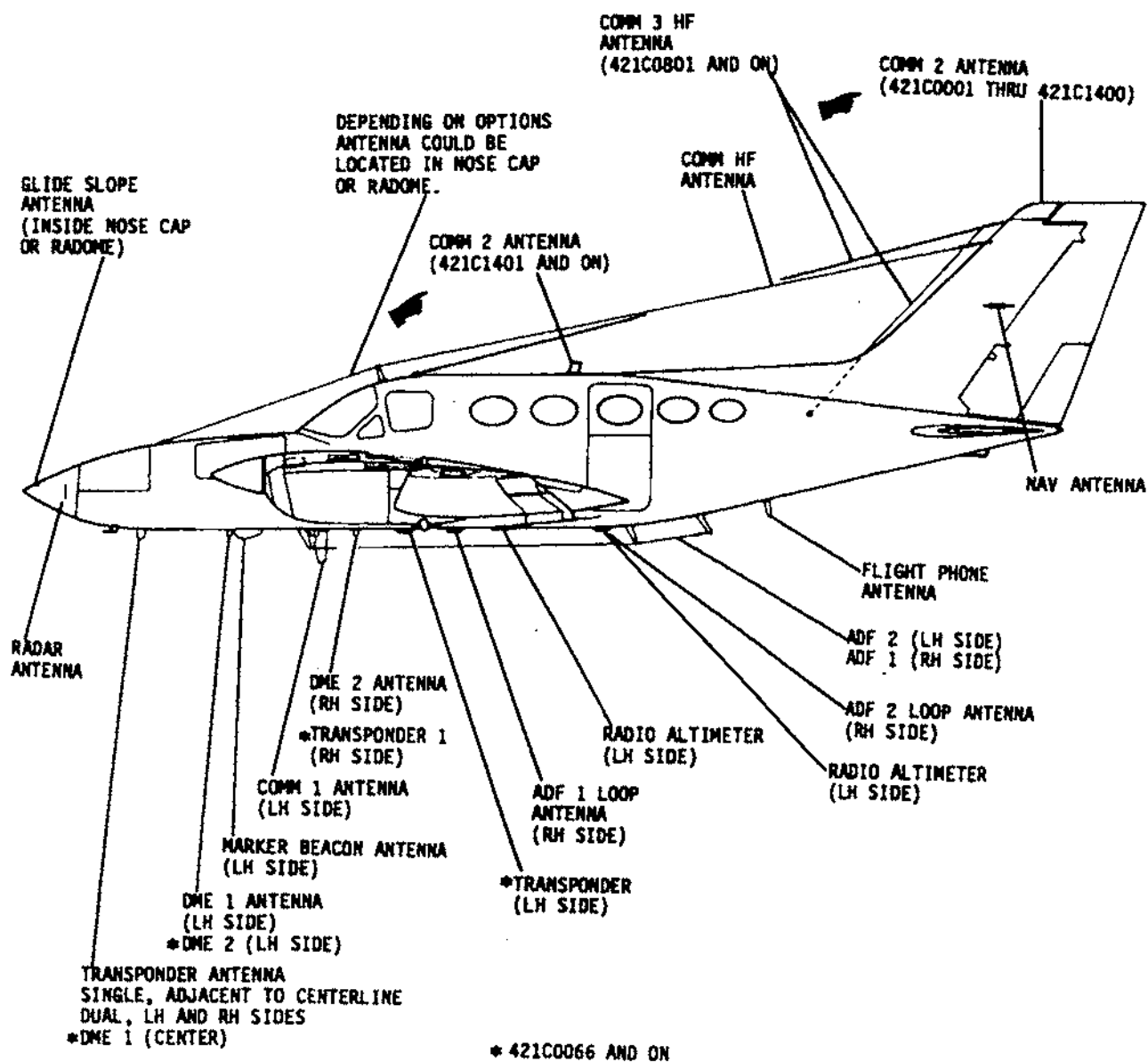
Inspection/Check

1. Inspection/Check of Radio Altimeter.

- A. Remove floorboards, carpet and tailcone access panel.

ANTENNA LOCATIONSDescription

1. Antennas are provided for navigation and communications systems which are installed as optional equipment. For identification and approximate location of antennas as provided, refer to Figure 1.



Antenna Locations
Figure 1

51143080

1000 AREA NAVIGATION (TYPE RN-1079A) SYSTEMGeneral

1. The 1000 Area Navigation System (RNAV) features ten programmable waypoints, easily selected via keyboard entry with memory storage and a "keep alive" circuit to retain memory when the system is OFF. The active, or any memory-stored waypoint, can be selected for display showing frequency, bearing and distance information in LED read-outs. Waypoint bearing and distance information is programmed from the VORTAC (VOR/DME) station to the waypoint.
NOTE: Memory will be lost if the airplane battery is disconnected or RNAV equipment is removed.
2. The 1000 Area Navigation System includes the RNAV computer (Type RN-1079A), NAV receiver (Type R-1048A), DME receiver/transmitter (Type RTA-1077A/B), DME control unit (Type C-1077B) and course indicator (Type IN-1048AC/IN-1049 AC).

Operation

1. The area navigation has three modes of operation:
 - A. VOR/DME - Regular VOR/DME operation. Distance, ground speed and time-to-station information on the DME display and course information on the course indicator are relative to the VORTAC (VOR/DME) station.
 - B. RNAV ENROUTE - Distance, ground speed and time-to-station information on the DME display and course information on the course indicator are relative to the active "FLY" waypoint.
 - C. RNAV APPROACH - Distance, ground speed and time-to-station information on the DME display and course information on the course indicator are relative to the active "FLY" waypoint. Course width is narrowed for more accurate navigation.
2. During RNAV operation, a course scalloping suppressor circuit suppresses spurious navigation signal phases to provide stable waypoint information which enhances autopilot operation. This feature may be used to advantage during VOR tracking by programming a waypoint directly over the associated VORTAC (VOR/DME) at (000.0°/000.0 NM) and using RNAV for course smoothing enroute.
3. The LPP (load present position) feature allows storage of the current airplane position as a waypoint.
4. The RNAV operates from signals provided by a DME and NAV system. The interfacing systems must be operating for the RNAV to operate.
5. The RNAV system control display panel contains displays and switches for system operation (see Figure 1). For additional information on RNAV computer operation, refer to Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

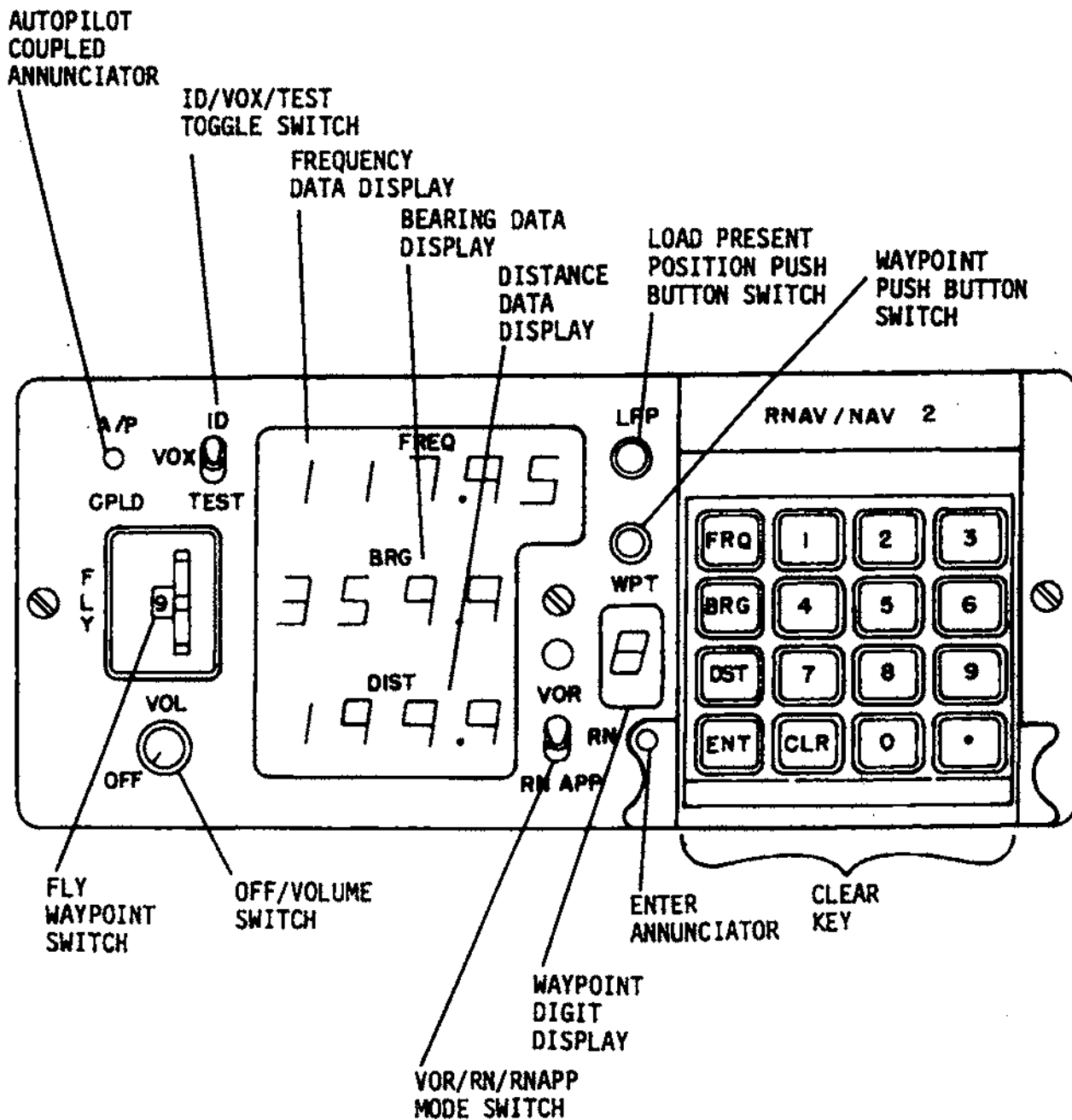
Troubleshooting

1. The area navigation system operates in conjunction with DME, NAV receiver and IFCS. To troubleshoot the system, check that these systems have normal power supplied and are working properly.
2. Tools and Equipment.

NOTE: Equivalent substitutes may be used for the following item:

Name	Number	Manufacturer	Use
Multimeter	Model 260	Katy Industries, Inc. Simpson Electric Co. 853 Dundee Ave. Elgin, IL 60120	General

3. For wiring diagram to aid in troubleshooting system, refer to figure 3.

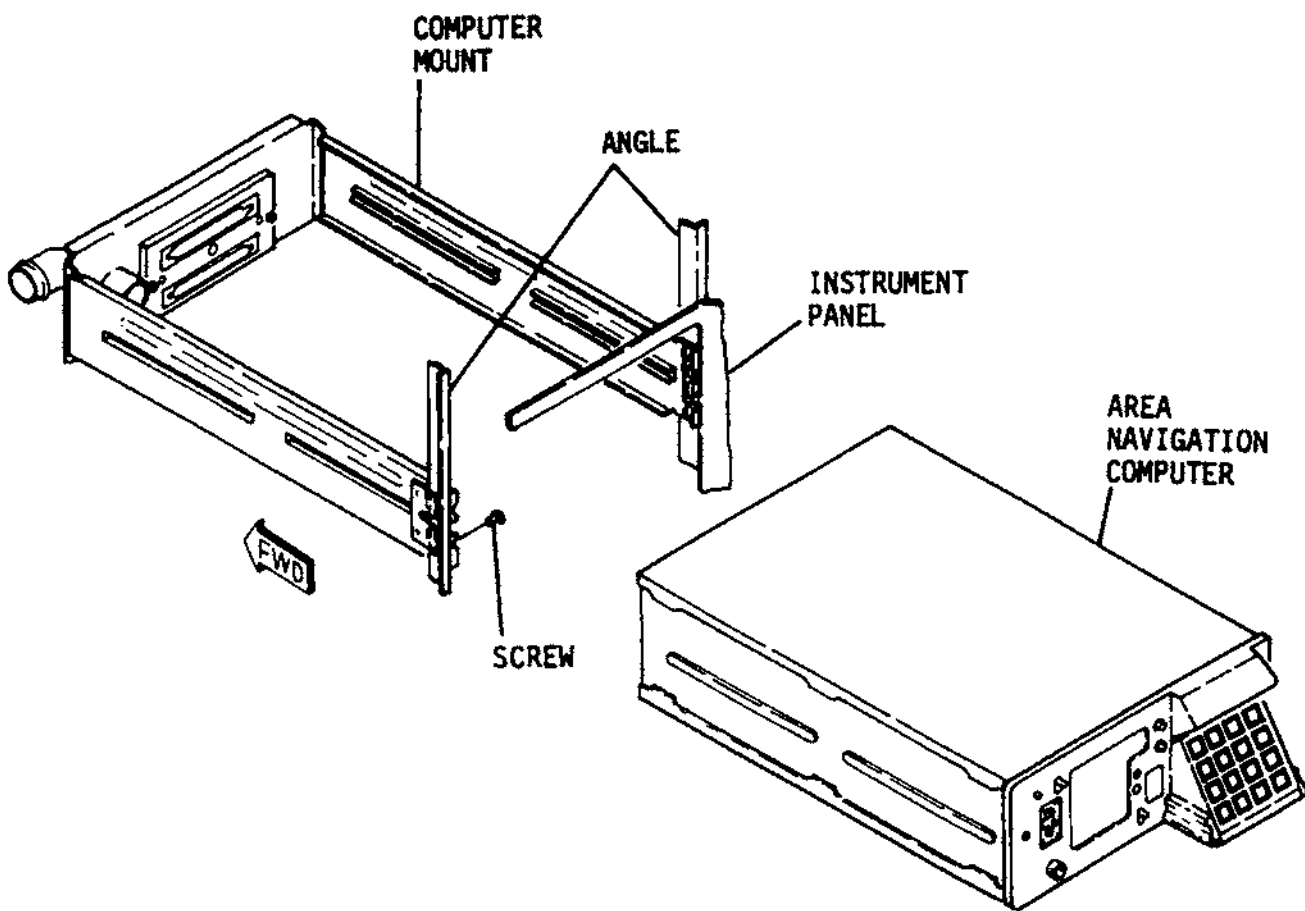


59181025

Area Navigation Front Panel Display
Figure 1

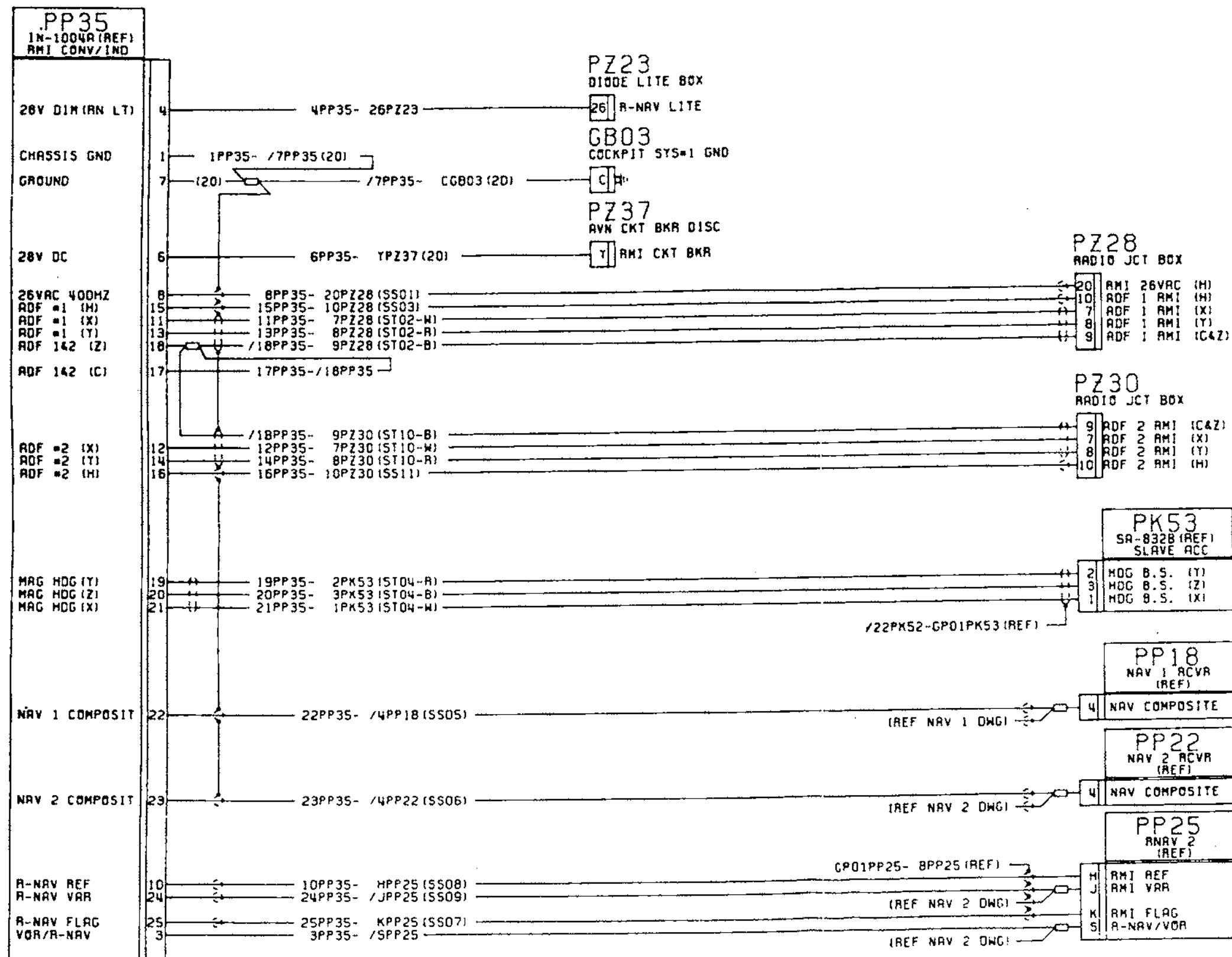
Removal/Installation of Area Navigation Computer (See Figure 2)

1. For Maintenance of Area Navigation System Components, Refer to Cessna 1000 Series RNAV (Type RN-1079A) Service/Parts Manual.
2. Remove Area Navigation Computer.
 - A. Ensure electrical power is OFF; pull system circuit breaker.
 - B. Disconnect electrical connectors from the computer.
 - C. Remove locking pawl cap from face of computer.
 - D. Turn locking pawl counterclockwise and remove computer from the mount.
3. Install Area Navigation Computer.
 - A. Slide computer into mount and secure with locking pawl.
 - B. Install cap on face of computer.
 - C. Connect electrical connectors to computer.
 - D. Engage system circuit breaker.
4. Adjustment/Test.
 - A. For operating and test procedures, refer to Cessna 1000 series RNAV (Type RN-1079A) Service/Parts Manual.



Area Navigation Computer Installation
Figure 2

57162034

1000 RNAV
Figure 3

CESSNA		P.O. BOX 7708 WALLACE DIVISION CH. WICHITA, KANSAS 67277	
CABLE ASSY - 1000 RMI W/ 1000 NAVS. ADF 2 AND R-NAV 2			
SIZE	CODE	IDENT NO.	DRAWING NO.
D71379			9709248
		SHEET 1 OF 1	

400 AREA NAVIGATION (TYPE RN-479A) SYSTEMGeneral

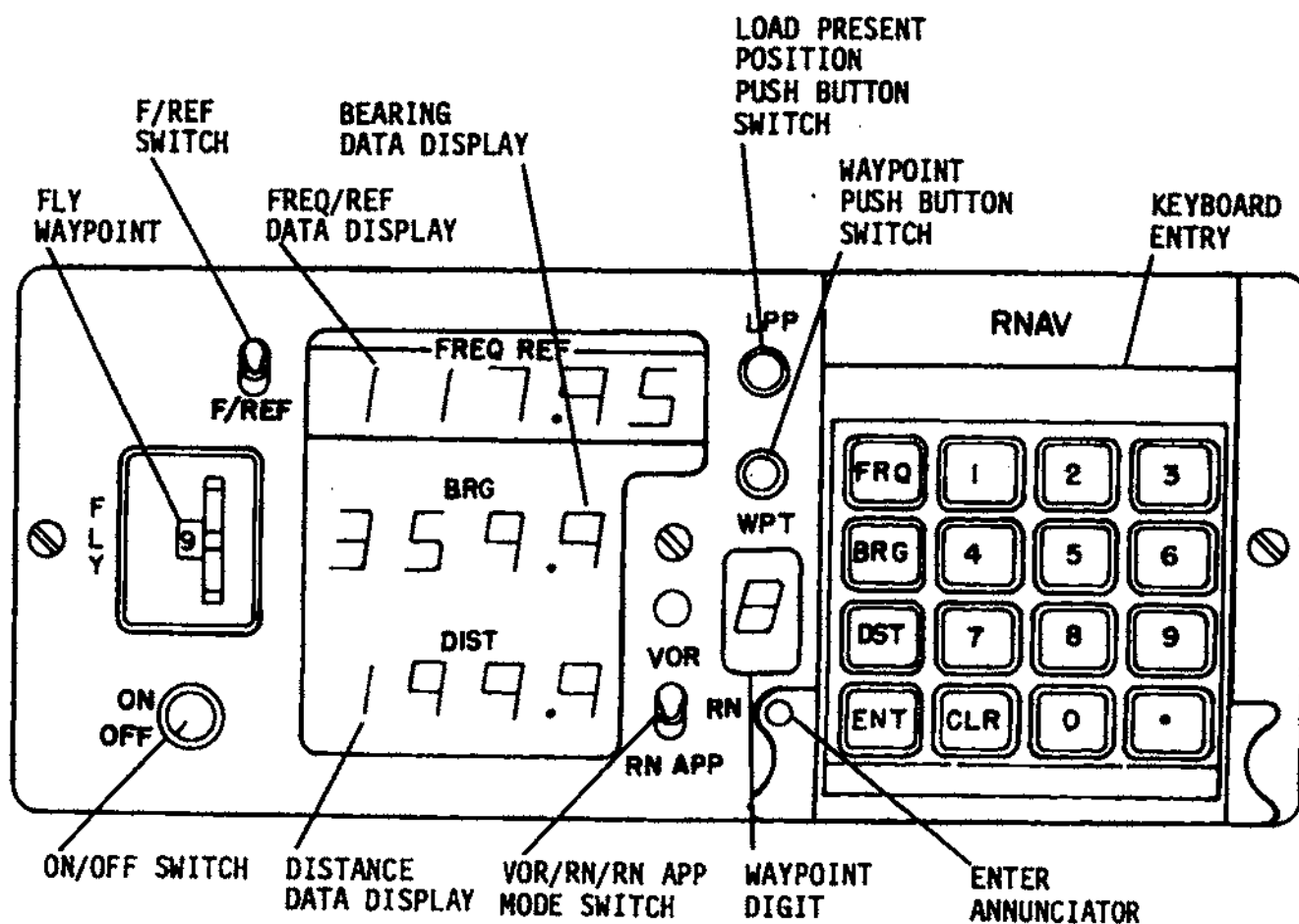
1. The 400 Area Navigation System (RNAV) features ten programmable waypoints, easily selected via keyboard entry with memory storage and a "keep alive" circuit to retain memory when the system is OFF. The active, or any memory-stored waypoint, can be selected for display, showing frequency, bearing and distance information in LED readouts. Waypoint bearing and distance information is programmed from the VORTAC (VOR/DME) station to the waypoint.

NOTE: Memory will be lost if the airplane battery is disconnected, or RNAV equipment is removed.

2. The 400 Area Navigation System includes the RNAV Computer (Type RN-479A), RNAV Receiver (Type RT-485B), DME Receiver/Transmitter (Type RTA-477A), DME Control Unit (Type C-477A), and Course Indicator (Type IN-483AC). For information about the navigation receiver, DME receiver/transmitter, DME control unit and course indicator, refer to Chapter 14.

Operation

1. The area navigation has three modes of operation.
 - A. VOR/DME - Regular VOR/DME operation. Distance, ground speed and time-to-station information on the DME display and course information on the course indicator are relative to the VORTAC (VOR/DME) station.
 - B. RNAV ENROUTE - Distance, ground speed and time-to-station information on the DME display and course information on the course indicator are relative to the active "FLY" waypoints.
 - C. RNAV APPROACH - Distance, ground speed and time-to-station information on the DME display and course information on the course indicator are relative to the active "FLY" waypoint. Course width is narrowed for more accurate navigation.
2. During RNAV operation, a course scalloping suppressor circuit suppresses spurious navigation signal phases to provide stable waypoint information which enhances autopilot operation. This feature may be used to advantage during VOR tracking by programming a waypoint directly over the associated VORTAC (VOR/DME) at (000.0°/000.0 MN) and using RNAV for course smoothing enroute.
3. The LPP (load present position) feature allows storage of the current airplane position as a waypoint.
4. The RNAV operates from signals provided by DME and NAV system. The interfacing systems must be operating for the RNAV to operate.
5. The RNAV system control display panel contains displays and switches for system operation. Refer to Figure 4. For additional information on RNAV computer operation, refer to Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.



52181027

Area Navigation Front Panel Display
Figure 4

Troubleshooting

1. The area navigation system operates in conjunction with DME, NAV receiver and IFCS. To troubleshoot the system, check that these systems have normal power supplied and are working properly.

Tools and Equipment

NOTE: Equivalent substitutes may be used for the following listed item.

NAME	NUMBER	MANUFACTURER	USE
Multimeter	Model 260	Katey Industries, Inc. Simpson Electric Company 853 Dundee Ave. Elgin, IL 60120	General

1. For wiring diagram, refer to Avionics Wiring Diagram Manual furnished with the airplane.

Maintenance Practices

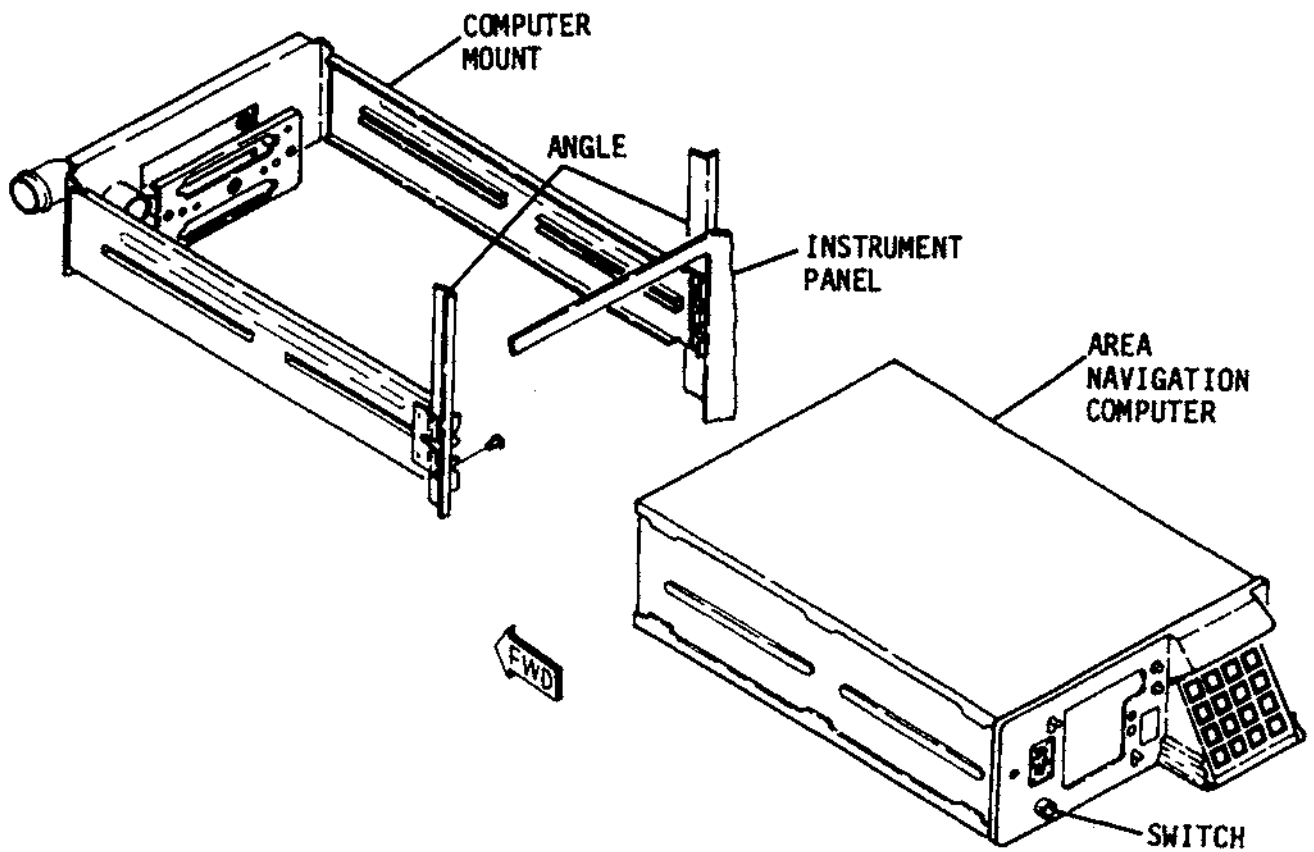
1. For maintenance of area navigation system components, refer to Cessna 400 series RNAV (Type RN-479A) Service/Parts Manual.

Removal/Installation of Area Navigation Computer (Refer to Figure 5)

1. Remove Area Navigation Computer.
 - A. Ensure electrical power is OFF; pull system circuit breaker.
 - B. Disconnect electrical connectors from the computers.
 - C. Remove locking pawl cap from face of computer.
 - D. Disconnect electrical connectors from the computer.
2. Install Area Navigation Computer.
 - A. Slide computer into mount and secure with locking pawl.
 - B. Install cap on face of computer.
 - C. Connect electrical connectors to computer.
 - D. Engage system circuit breaker.

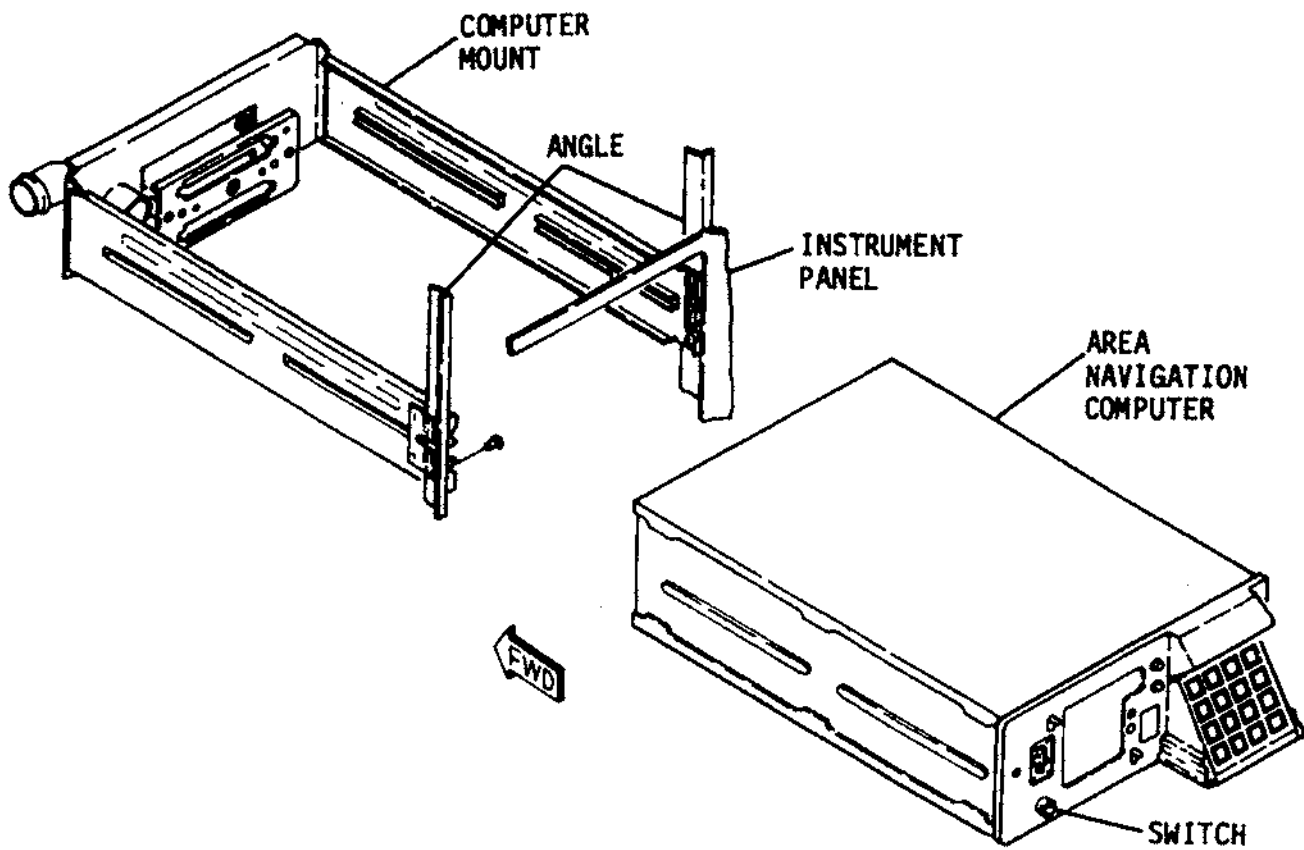
Adjustment/Test

1. For operating and test procedures, refer to Cessna 400 series RNAV (Type RN-479A) Service/Parts Manual.



52182005

Area Navigation Computer Installation
Figure 5



52182005

Area Navigation Computer Installation
Figure 5

1000 DME (TYPE RTA-1077B) SYSTEMGeneral

1. The DME System (421C1201 and On) consists of a receiver-transmitter, control unit and antenna. The equipment is used with the 1000 Navigation (NAV) and/or 1000 Area Navigation (RNAV) Systems. The DME is dependent on the NAV or the RNAV system for frequency channel selection. The DME provides continuous, accurate, slant range, ground speed and time to station information to the selected VORTAC (VOR/DME) ground station. In the RNAV mode, this information is computed to the FLY waypoint.
2. The airplane may be equipped with a single DME or dual DME.
3. The 1000 DME is compatible with and must be connected to the 1000 area navigation (RNAV) system in order for the DME to operate in the RNAV mode.

Description

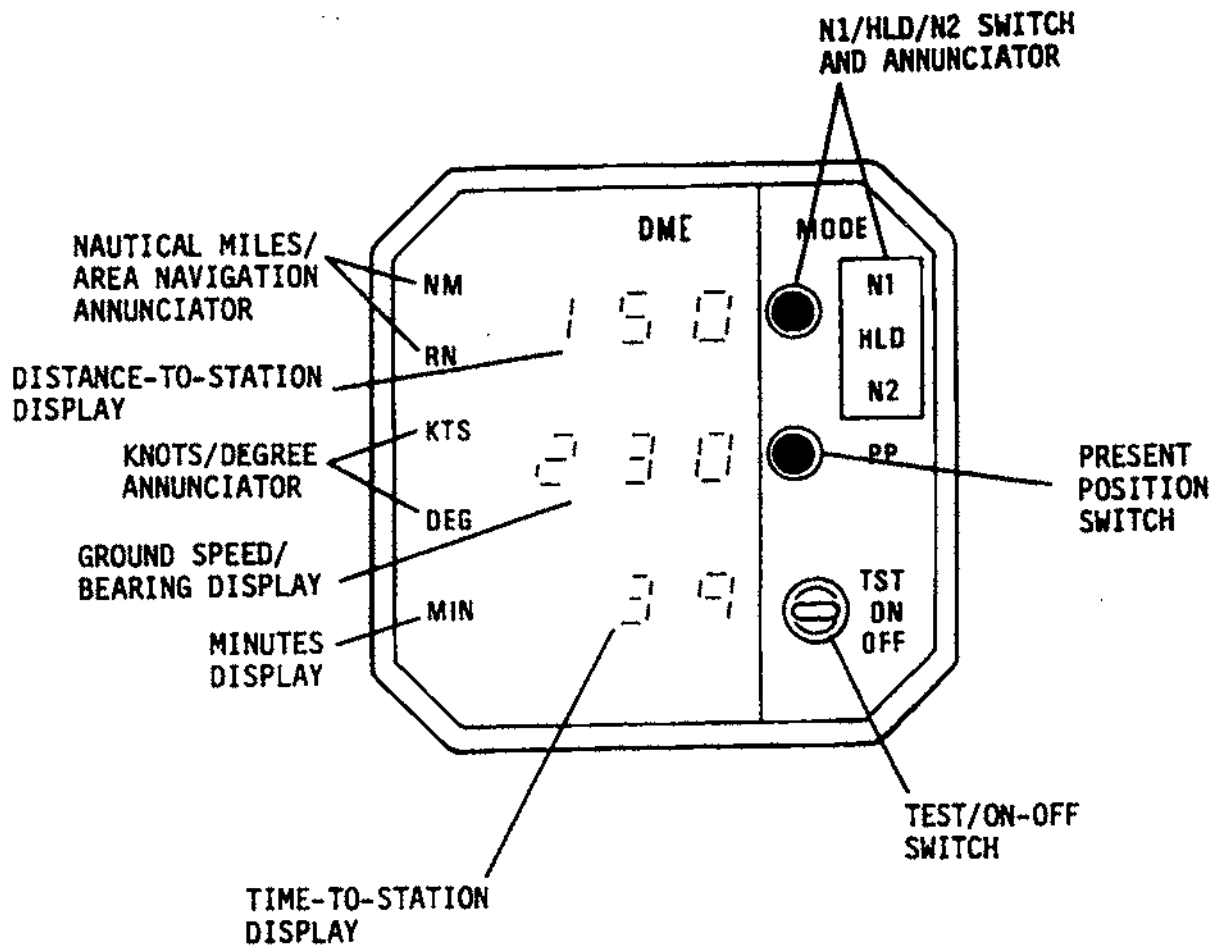
1. Receiver-Transmitter.
 - A. One of two receiver-transmitters may be mounted on an avionics shelf in the nose compartment of the airplane. The receiver-transmitter transmits interrogation pulses on any of the 100 channels between 1041 MHz and 1150 MHz; it receives return ground-to-air pulses between 988-1087 MHz and 1104-1213 MHz.
 - B. The operating channel is automatically selected by the VHF navigation set frequency selector control.
2. Control Unit.
 - A. One or two control units may be mounted on the instrument panel. The control unit contains the analog circuitry for computing ground speed/bearing and time-to-station, the control switches and displays for the DME and the associated control and display circuits. The control unit digitally displays distance up to 300 nautical miles and either ground speed/bearing or time-to-station information as selected.
3. Operating Controls and Displays.
 - A. Since many airplanes could be simultaneously interrogating the same station, the airborne DME must be able to recognize and accept only the pulses which are replies to its own transmissions. This is accomplished by varying the time interval between DME transmissions in a random manner; thus, replies for other airplanes will not be in synchronism with the originating DME.
 - B. Front panel controls are shown in Figure 1 and provide the following corresponding functions:

Item	Panel Designation	Function
Time-to-Station Display (0-999 minutes)		In VOR mode, readout is relative to VORTAC (VOR/DME) station. In RNAV (RN-RN APP) mode, readout is relative to FLY waypoint. Blank when PP (present position) switch is pressed.
Minutes Annunciator	MIN	Illuminates with Time-to-Station display.
Ground Speed/Bearing Display		Displays ground speed in knots. When PP is pressed, displays bearing to VORTAC (VOR/DME) station (0.0 to 359°)
Knots/Degree Annunciator	KTS	Illuminates to indicate ground speed in knots.
	DEG	Illuminates to indicate bearing to VORTAC (VOR/DME) station.

Item	Panel Designation	Function
Distance-to-Station		Distance to station in nautical miles (00.0 to 300 nautical miles).
NM/RN Annunciator	NM	Always illuminated - indicates that distance-to-station display is in nautical miles for all modes of operation.
	RN	Not illuminated - distance-to-station display is to VORTAC (VOR/DME) station.
		Illuminated - distance-to-display is to FLY (RNAV) waypoint.
N1/HLD/N2 Mode Switch and Annunciator		This switch inoperative in the RNAV mode.
	N1	Selects and indicates navigation receiver one (1)
	HLD	Holds the frequency of navigation receiver N1 or N2, whichever was last selected, so that it may be used for DME operation. N1 and N2 become independent of DME operation and may be used for other purposes.
	N2	Selects and indicates navigation receiver two (2).
PP Push Button Switch		Present position feature; operational in systems with an RNAV only; Distance to VOR station display (refer to distance-to-station display). Radial from VOR station display (refer to ground speed/ bearing display). Degree annunciator KTS/DEG illuminated to indicate ground speed/bearing is a radial. Time-to-station display blanked.
TST/ON-OFF Switch	ON	Controls power to receiver-transmitter and control unit. NAV 2 is automatically selected at POWER ON in most configurations.
	TST	Self tests for the receiver-transmitter and control unit. Momentary depression of the TST switch causes all annunciator lights to illuminate. Approximately one second after release of the TST switch all 8's will appear in the digital readout windows for a few seconds and then normal DME operation will resume.

Operating Procedures

1. To test the receiver-transmitter and control unit, proceed as follows:
 - A. Momentarily depress the TST switch. All annunciator lights should illuminate. Approximately one second after release of the TST switch all 8's will appear in the digital readout windows for a few seconds and then normal DME operation will resume.



DME Operating Controls and Displays
Figure 1

59186006

2. DME Operation.

- A. Test/ON-OFF switch ON.
- B. DME channel selection. Channel selection for the NAV 1 and/or NAV 2 receivers may be accomplished by one or both of the following methods:
 - (1) Channel selection using a NAV receiver control unit.
 - (2) Channel selection using an RNAV system; the FLY waypoint selector selects one of the ten possible programmed VOR channels.
- C. These two methods are reflected in the following avionic configurations:
 - (1) An RNAV system is not included in the avionics configuration. Channel selection is an exclusive function of the NAV receiver control unit(s). Select W1, HLD or W2 as appropriate.
 - (2) One RNAV system is included in the avionics configuration. The RNAV computer selects the channel frequency for the NAV receiver slaved to the RNAV system. A decal on the display panel of the RNAV computer indicates which receiver is slaved to RNAV system. If two NAV receivers are included in the configuration one is controlled by the RNAV and one by a NAV control unit.
 - (3) Two RNAV's are included in the avionics configuration. Each RNAV has a NAV receiver slaved to it with an appropriate decal on the front panel display.

Troubleshooting

1. Troubleshooting the DME System is identifying and isolating the malfunction. Verify that associated equipment (navigation receiver frequency selector, area navigation, etc.) are functioning normally if the DME malfunction occurs in that particular mode of operation.

Tools and Equipment

NOTE: Equivalent substitutes may be used for the following item:

Name	Number	Manufacturer	Use
Multimeter	Model 260	Katy Industries, Inc. Simpson Electric Co. 853 Dundee Ave. Elgin, IL 60120	General

- A. For wiring diagram, refer to Figure 3.

Maintenance Practices

1. Removal/Installation (See Figure 2).

- A. Remove Receiver-Transmitter.

NOTE: One or two DME receivers may be installed in the airplane. Removal/Installation procedures are typical for both receiver-transmitter.

- (1) Remove electrical power from the system; pull circuit breaker(s).
- (2) Remove baggage shelf from avionics compartment.
- (3) Disconnect electrical connectors and coax connector.
- (4) Remove screws securing receiver-transmitter to mount.
- (5) Slide receiver-transmitter from mount.

B. Install Receiver-Transmitter.

- (1) Slide receiver-transmitter in mount and secure with screws.
- (2) Connect electrical connectors and coax connector.
- (3) Install baggage shelf.
- (4) Engage system circuit breaker(s).

C. Remove Display and Control Assembly.

NOTE: One or two DME display and control assemblies may be installed in the airplane. Removal/ Installation procedures are typical for both display and control assemblies.

- (1) Remove electrical power from system; pull circuit breaker(s).
- (2) Disconnect electrical connector.
- (3) Loosen clamp adjustment screws.
- (4) Pull display and control assembly from clamp.

D. Install Display and Control Assembly.

- (1) Slide display and control assembly into clamp.
- (2) Tighten clamp adjustment screws.
- (3) Connect electrical connector to display and control assembly.
- (4) Engage system circuit breaker(s).

E. Remove DME 1 Antenna.

- (1) Remove screws securing antenna to structure.
- (2) Pull antenna down and disconnect coax adapter.

NOTE: Secure coax adapter with a clamp or wire to prevent adapter feedback into nose section.

F. Install DME 1 Antenna.

- (1) Remove holding device from coax adapter.
- (2) Connect coax adapter to antenna.
- (3) Secure antenna to structure with screws.

G. Remove DME 2 Antenna.

- (1) Remove screws securing antenna to structure.
- (2) Pull antenna down and disconnect coax adapter.

NOTE: Secure coax adapter with clamp or wire to prevent adapter feedback into nose section.

H. Install DME 2 Antenna.

- (1) Remove holding device from coax adapter.
- (2) Connect coax adapter to antenna.
- (3) Secure antenna to structure with screws.

Adjustment/Test

1. Operational Test.

A. Apply external power to the airplane.

B. To operate DME, refer to Operating Procedures.

- (1) Perform the following: Display and Indicator Test as described in Operating Procedures.

C. Tune the corresponding navigation receiver to a local VOR/DME frequency and allow a few seconds to stabilize.

- (1) If the DME station is within range, the system should lock on.
- (2) If the DME station is not within range, a ramp tester may be used.

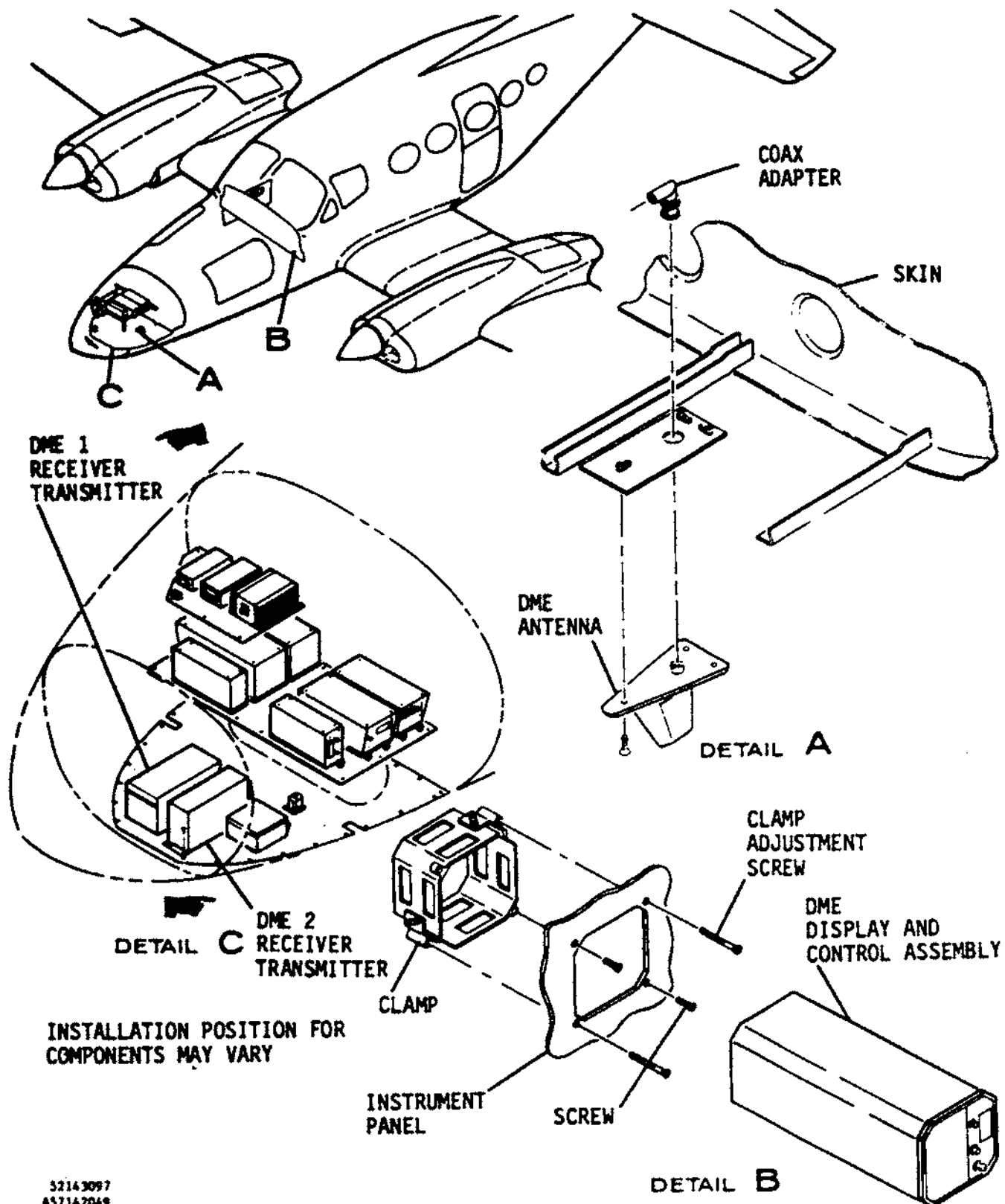
Inspection/Check

1. Visual.

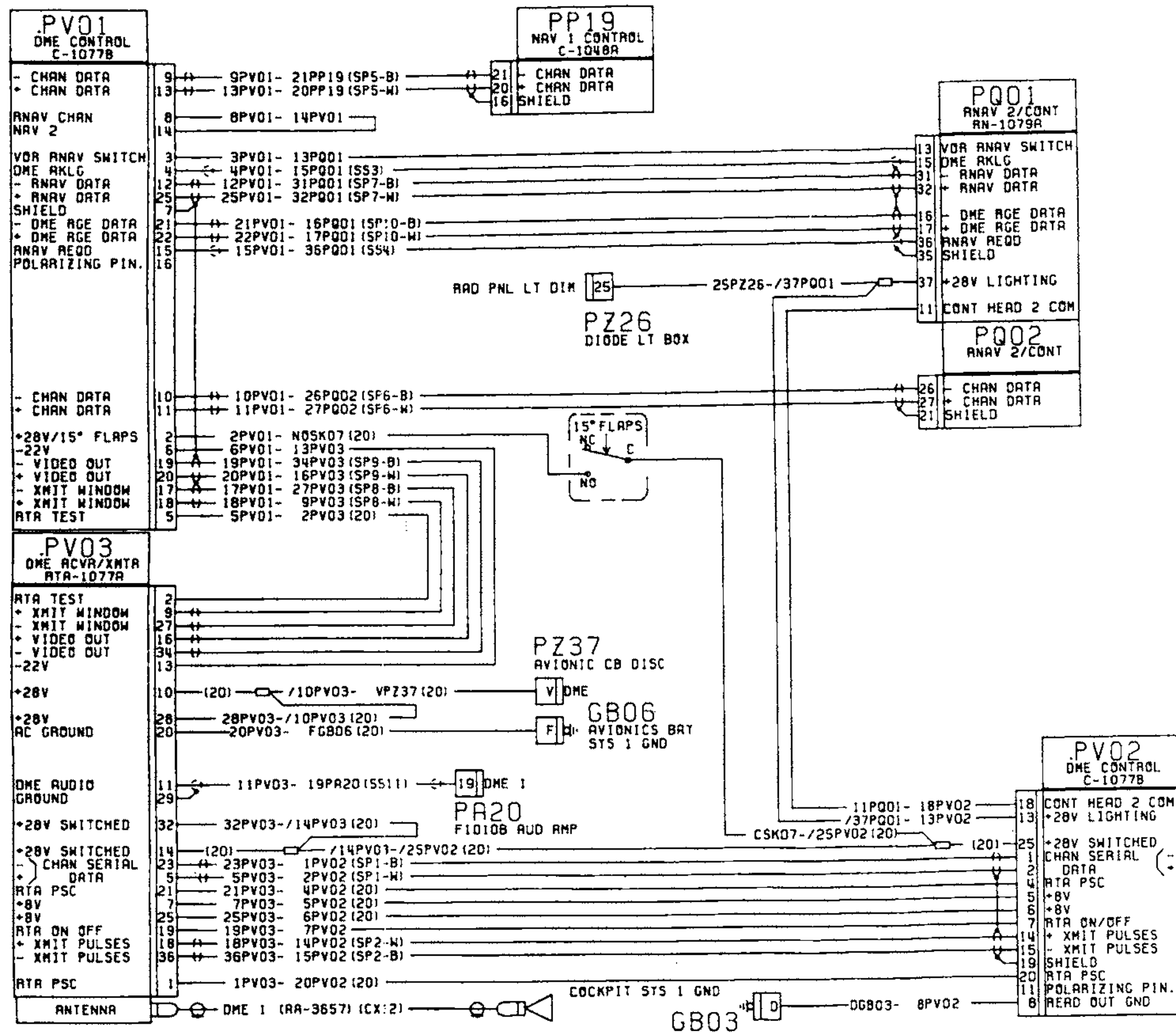
- A The receiver-transmitter shall be visually checked for security, bent pins, evidence of arcing in the electrical connectors, dents in the dust case and evidence of damage.
- B. The receiver-transmitter mount shall be visually checked for security.
- C. Visually check the antenna for security, cracks and evidence of damage.
- D. The display and control assembly shall be visually checked for security, bent pins, evidence of arcing in the electrical connector, dents in the case, cracked glass, evidence of damage and the unused electrical connector shall be capped (RHAV not installed).

2. Power On.

- A. Check operation of the individual controls and presentation on the display and control assembly.

DME Installation
Figure 2

52143097
A57142049
B57142050
C52142065

1000 DME
Figure 3

CESSNA		AIRCRAFT P.O. BOX 7700 WALLACE DIVISION CO. WICHITA, KANSAS 67277	
CABLE ASSY - 1000 DME W/1000 ANAV 2			
SIZE	CODE	IDENT NO.	DRAWING NO.
D71379		9707244	
			SHEET 1 OF 1

400 DME (TYPE RTA-477A) SYSTEMGeneral

1. The DME system (airplanes C1401 and On) consists of a receiver-transmitter, control unit and antenna. The equipment is used with the 400 Navigation (NAV) and/or 400 Area Navigation (RNAV) systems. The DME is dependent on the NAV or the RNAV system for frequency channel selection. The DME provides continuous, accurate, slant range, ground speed, and time-to-station information to the selected VORTAC (VOR/DME) ground station. In the RNAV mode this information is computed to the FLY waypoint.
2. The airplane may be equipped with a single DME or dual DME.
3. The 400 DME is compatible with and must be connected to the 400 Area Navigation (RNAV) system in order for the DME to operate in the RNAV mode.

Description

1. Receiver-Transmitter.
 - A. One or two receiver-transmitters may be mounted on an avionics shelf in the nose compartment of the airplane. The receiver-transmitter transmits interrogation pulses on any of the 100 channels between 1041 MHz and 1150 MHz; it receives return, ground-to-air pulses between 978-1087 MHz and 1104-1213 MHz.
 - B. The operating channel is automatically selected by the VHF navigation set frequency selector control.
2. Control Unit.
 - A. One or two control units may be mounted on the instrument panel. The control unit contains the analog circuitry for computing ground speed and time-to-station, the control switches and displays for the DME and the associated control and display circuits. The control unit digitally displays distance up to 300 nautical miles and either ground speed or time-to-station information, as selected.
3. Operating Controls and Displays.
 - A. Since many airplanes could be simultaneously interrogating the same station, the airborne DME must be able to recognize and accept only the pulses which are replies to its own transmission. This is accomplished by varying the time interval between DME transmissions in a random manner; thus, replies for other airplanes will not be synchronism with the originating DME.
 - B. For operating controls and displays, refer to Pilot's Operating Handbook and FAA Approved Flight Manual.

Operating Procedures

1. To test the receiver-transmitter and control unit, proceed as follows:
 - A. Momentarily depress the TST Switch. All annunciator lights should illuminate. Approximately one (1) second after release of the TST switch all 8's will appear in the digital readout windows for a few seconds and then normal DME operation will resume.
2. DME Operation.
 - A. Test/ON-OFF Switch ON.
 - B. DME channel selection. Channel selection for the NAV 1 and/or NAV 2 receivers may be accomplished by one or both of the following methods:
 - (1) Channel selection using a NAV receiver control unit.
 - (2) Channel selection using an RNAV system. The FLY waypoint selector selects one of the ten possible programmed VOR channels.

- C. These two methods are reflected in the following avionic configuration. Channel selection is an exclusive function of the NAV receiver control unit(s). Select N1, HLD or N2 as appropriate.
- (1) One RNAV system is included in the avionics configuration. The RNAV computer selects the channel frequency for the NAV receiver slaved to the RNAV system. A decal on the display panel of the RNAV computer indicates which receiver is slaved to the RNAV system. If two NAV receivers are included in the configuration one is controlled by the RNAV and one by the NAV control unit.
 - (2) Two RNAV's are included in the avionics configuration. Each RNAV has a NAV receiver slaved to it with an appropriate decal on the front panel display.

Troubleshooting

NOTE: Equivalent substitutes may be used for the following items:

NAME	NUMBER	MANUFACTURER	USE
Multimeter	Model 260	Katey Industries, Inc. Simpson Electric Company 853 Dundee Ave. Elgin, IL 60120	General

1. For applicable wiring diagram, refer to Avionics Wiring Diagram Manual furnished with the airplane.

Maintenance Practices

1. Maintenance for the DME system consists of removal/installation procedures.
2. The airplane may be equipped with a single DME or dual DME (optional).

Removal/Installation (Refer to Figure 4)

1. Remove Receiver-Transmitter.

NOTE: One or two DME receivers may be installed in the airplane. Removal/installation procedures are typical for both receiver-transmitters.

- A. Remove electrical power from the system; pull circuit breaker(s).
- B. Remove forward baggage shelf from nose section.
- C. Disconnect electrical connectors and coax connector.
- D. Remove screws securing receiver-transmitter to mount.
- E. Slide receiver-transmitter from mount.

2. Install Receiver-Transmitter.

- A. Slide receiver-transmitter in mount and secure with screws.
- B. Connect electrical connectors and coax connector.
- C. Install forward baggage shelf.
- D. Engage system circuit breaker(s).

3. Remove Display and Control Assembly.

NOTE: One or two DME display and control assemblies may be installed in the airplane. Removal/installation procedures are typical for both display and control assemblies.

- A. Remove electrical power from system; pull circuit breaker(s).
- B. Loosen clamp adjustment screws.
- C. Pull display and control assembly from clamp.
- D. Disconnect electrical connector.

4. Install Display and Control Assembly.
 - A. Connect electrical connector to display and control assembly.
 - B. Slide display and control assembly into clamp.
 - C. Tighten clamp adjustment screws.
 - D. Engage system circuit breaker(s).
5. Remove DME 1 Antenna.
 - A. Remove screws securing antenna to structure.
 - B. Pull antenna down and disconnect coax adapter.

NOTE: Secure coax adapter with a clamp or wire to prevent adapter feeding back into nose section.
6. Install DME 1 Antenna.
 - A. Remove holding device from coax adapter.
 - B. Connect coax adapter to antenna.
 - C. Secure antenna to structure with screws.
7. Remove DME 2 Antenna.
 - A. Remove screws securing antenna to structure.
 - B. Pull antenna down and disconnect coax adapter.

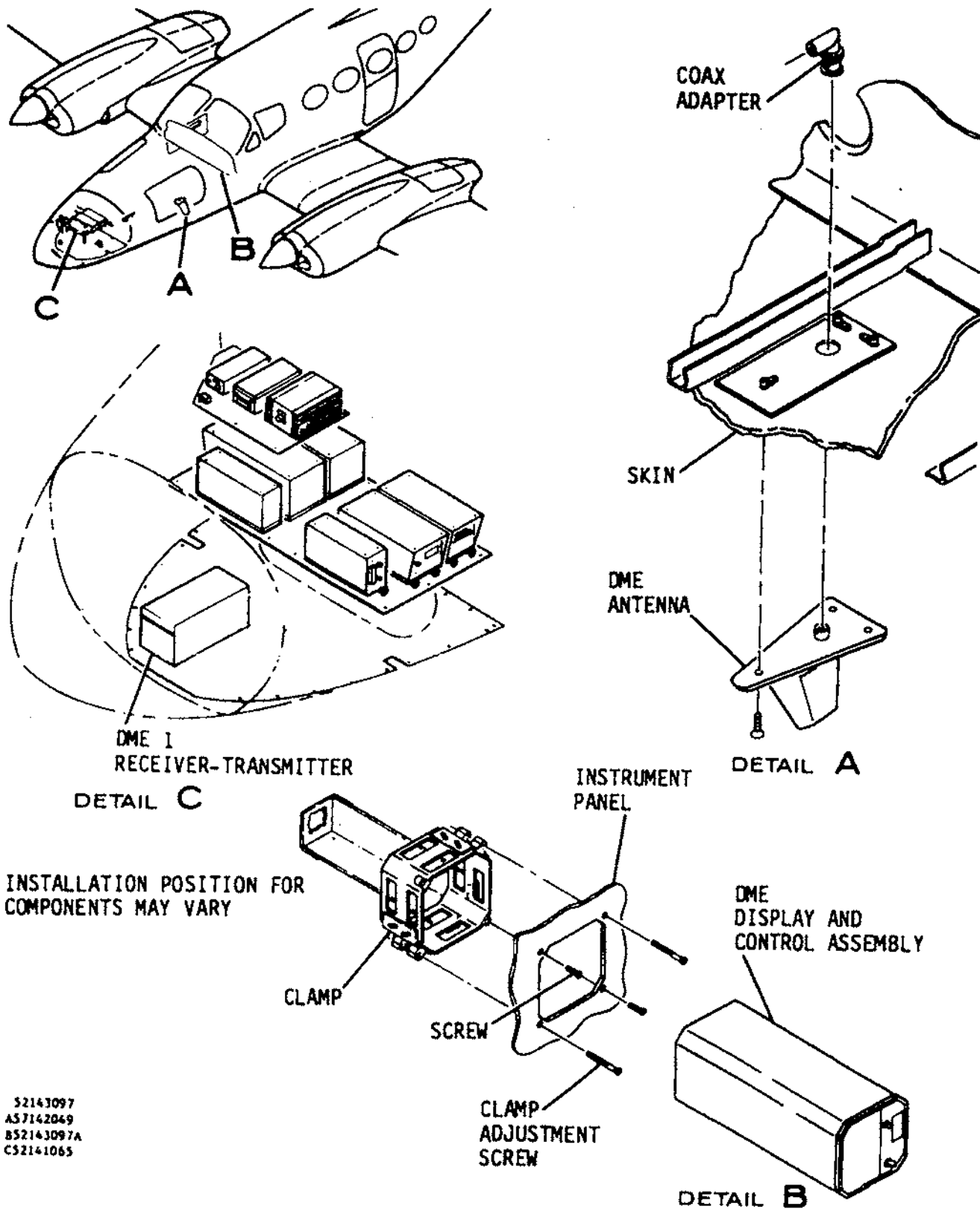
NOTE: Secure coax adapter with clamp or wire to prevent adapter feedback into nose section.
8. Install DME 2 Antenna.
 - A. Remove holding device from coax adapter.
 - B. Connect coax adapter to antenna.
 - C. Secure antenna to structure with screws.

Adjustment/Test

1. Operational Test.
 - A. Apply external power to the airplane.
 - B. Refer to Description and Operation for operating procedures.
 - (1) Perform the following: Display and Indicator Test as described in Description and Operation.
 - C. Tune the corresponding navigation receiver to a local VOR/LOC frequency and allow a few seconds to stabilize.
 - (1) If the DME station is within range, the system should lock on.
 - (2) If the DME station is not within range, a ramp tester may be used.

Inspection/Check

1. Visual.
 - A. The receiver-transmitter shall be visually checked for security, bent pins, evidence of arcing in the electrical connectors, dents in the dust case and evidence of damage.
 - B. The receiver-transmitter mount shall be visually checked for security.
 - C. Visually check the antenna for security, cracks and evidence of damage.
 - D. The display and control assembly shall be visually checked for security, bent pins, evidence of arcing in the electrical connector, dents in the case, cracked glass, evidence of damage and the unused electrical connector shall be capped (RNAV not installed).
2. Power On.
 - A. Check operation of the individual controls and presentation on the display and control assembly.



Area Navigation Front Panel Display
Figure 4

52143097
AS7142049
852143097A
CS2141065

BENDIX RDR-230HP WEATHER RADAR SYSTEM - DESCRIPTION AND OPERATIONGeneral

1. The RDR-230HP, Weather Radar System (Optional 421C1401 and On) provides in-flight weather information and storm detection up to a distance of 240 nautical miles. The system is equipped with a color radar indicator. The primary purpose is to provide enroute weather information relative to cloud formation, rainfall rate, thunderstorms and icing conditions. The system can also be used, day or night, for ground mapping even under adverse weather conditions; thus, providing a terrain avoidance feature.
2. The system employs a combined radar antenna-receiver-transmitter and a color radar indicator. The system operates on 28 volts direct current (VDC) and transmits on a frequency of 9375, +35, -35 MHz (X-band) at a power of 5 kilowatts (KW) peak power.
3. A TEST function is located on the radar indicator, function switch. Selection of the TEST mode disables the transmitter causing the antenna to scan in azimuth, and causing a distinctive test pattern to be displayed on the indicator.
4. The weather radar antenna-receiver-transmitter unit is located in the nose section of the airplane. Access is gained by removing the radome. The indicator is located on the center panel of the instrument panel.

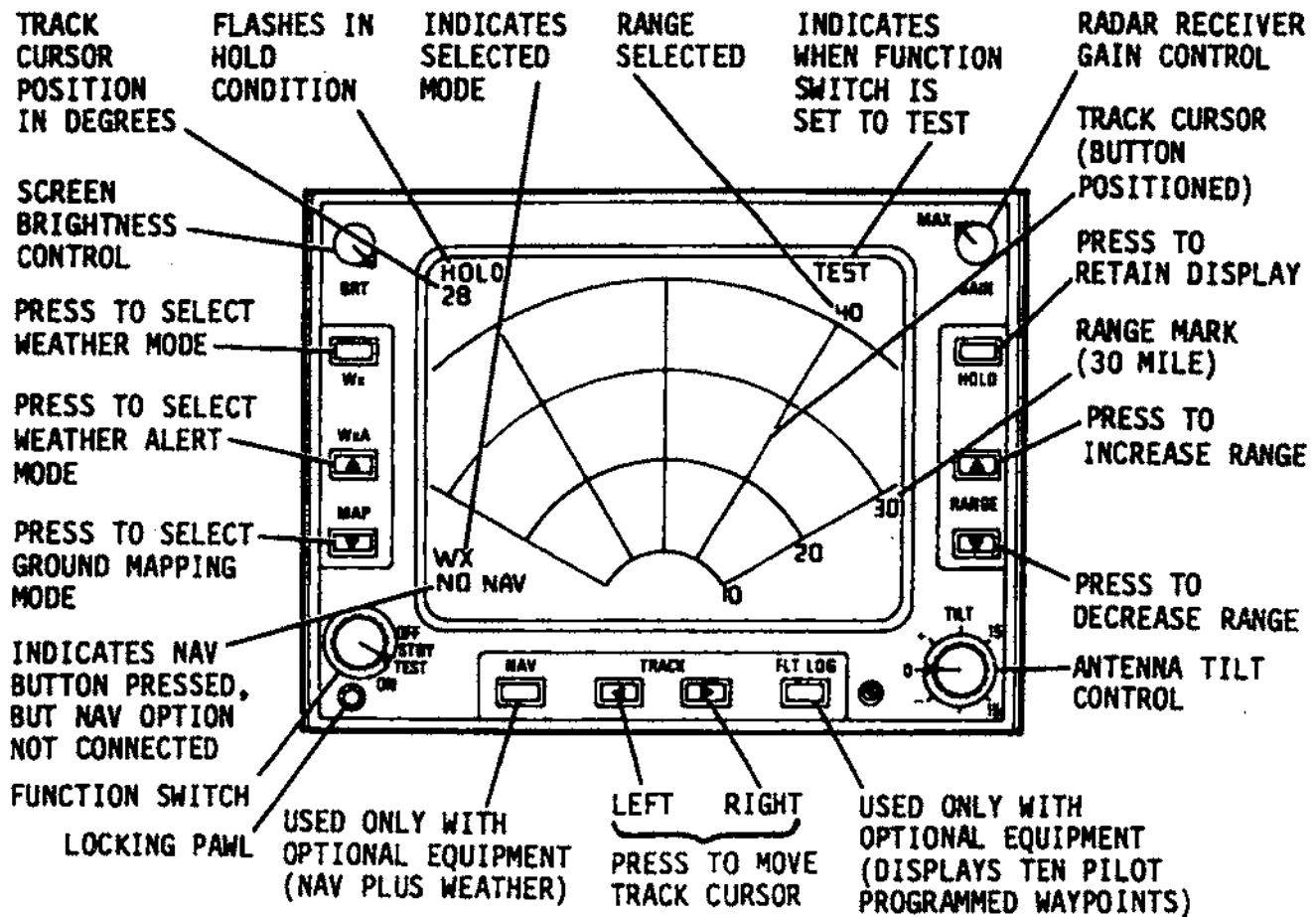
Description

1. Antenna-Receiver-Transmitter.

- A. The antenna-receiver-transmitter unit, located in the nose section of the airplane, is housed in a single nonpressurized package.
 - (1) The transmitter section receives system trigger pulses from the color radar indicator to actuate the transmitter. The transmitter operates by emitting very short, intense pulses of microwave energy from the antenna. Any object having reflective characteristics and within the range of the radar system, will reflect a portion of the radiated microwave energy back to the antenna along the same general path.
 - (2) The reflected microwave energy to the antenna is routed through the antenna to the receiver where it is converted into digital data that is representative of the target density. The digital data is then routed to the color radar indicator where it is processed to give a visual presentation of the target in a combination of colors representing the target density.
 - (3) The antenna section is controlled by the color radar indicator. The indicator supplies signals for controlling the azimuth drive and tilting of the antenna.
 - (4) The color radar indicator also controls the gain of the receiver during the MAP mode to control strong ground returns.

2. Color Radar Indicator.

- A. The color radar indicator provides a three-color (green, yellow, red) display of weather and ground targets within the area scanned by the radar. Internally generated range marks appear as evenly spaced blue segmented concentric circles (arcs) on the display to assist in determining range of the targets.
- B. A yellow track cursor may be moved either left or right with slew button controls to assist in determining azimuth bearing of targets. The cursor moves slowly at about 15 degrees per second while one of the yellow TRACK buttons is held pressed and stops when the button is released. The degrees away from the airplane heading will be indicated in the upper left corner of the display. Within about 10 to 15 seconds after the button is released, the track cursor and the numerics will disappear from the display.
- C. The indicator mode is selected by pushbuttons. The TEST mode cannot be selected by the pushbuttons, but is selected by the function switch. If the system is operating normally, placing the function switch in the TEST position causes a predetermined test pattern to appear on the indicator. In the TEST position, the transmitter is not operational.



Bendix IN-232A Color Radar Indicator, Front Panel
Figure 1

- D. The indicator is located in the center panel of the instrument panel. The front panel provides a mounting base for the operating controls. Front panel controls are shown in Figure 1. For additional information on indicator control operation, refer to Pilot's Operating Handbook and FAA Airplane Approved Flight Manual.

- (1) With additional equipment, the color radar indicator can be expanded to display multifunction digital data including NAV and RNAV information, flight log information and checklist information.

Troubleshooting

1. Tools and Equipment.

- A. Equivalent substitutes may be used for the following listed items:

Name	Number	Manufacturer	Use
Multimeter	Model 260	Katy Industries, Inc. Simpson Electric Co.	General.
Installation Manual	I.B. 2230	Bendix Avionics Div.	Adjustment/testing RDR-230HP radar.

2. For Troubleshooting of Weather Radar System, see Figure 2.
3. For an Electrical Wiring Diagram, refer to Avionics Wiring Diagram Manual furnished with the airplane.

Precautions

1. If the radar system is to be operated on the ground in any mode other than STBY or TEST, direct the nose of the airplane such that the nose is free of large metallic objects, such as hangars or other airplanes, for a distance of 600 yards and tilt the antenna upward 15 degrees.
2. Do not operate the radar during refueling of the airplane. Do not operate the radar except in the STBY mode during any refueling operation within 600 yards.
3. Do not allow personnel within 15 feet of area being scanned by antenna when system is transmitting.

WARNING: OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF EXTREMELY HIGH VOLTAGES THAT ARE DANGEROUS TO LIFE. DO NOT MAKE ADJUSTMENTS OR CHANGE COMPONENTS WHEN WEATHER RADAR CIRCUIT BREAKERS ARE CLOSED.

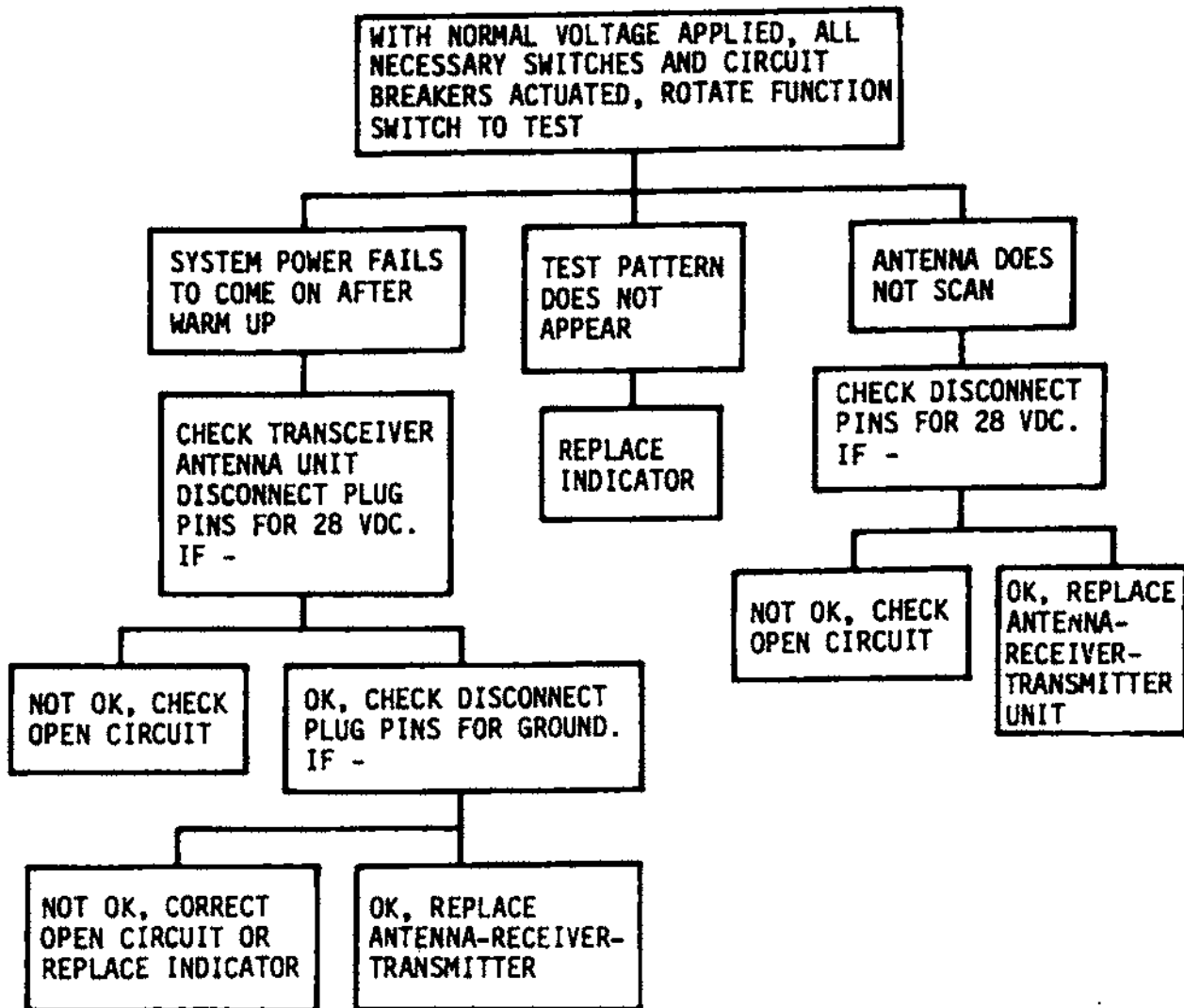
Removal/Installation Weather Radar System

1. Antenna-Receiver-Transmitter Unit (See Figure 3).

A. Removal.

- (1) Open weather radar system circuit breaker and tag with warning sign:

WARNING: DO NOT CLOSE THIS CIRCUIT BREAKER: MAINTENANCE IN PROGRESS.



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Troubleshooting Chart RDR-230HP Weather Radar System
Figure 2

- (2) Remove radome.

CAUTION: IN HANDLING THE ANTENNA, DO NOT EXERCISE TILT OR SCAN OF ANTENNA BY HAND AS DAMAGE TO THE ANTENNA COULD RESULT. TILT AND SCAN MOVEMENT CAN ONLY BE MADE BY THE ANTENNA ITSELF WHEN DRIVEN BY THE PROPER ELECTRICAL POWER OUTPUT.

- (3) Disconnect electrical connector from antenna-receiver-transmitter unit.
- (4) Remove cap screws securing antenna-receiver-transmitter unit and remove from airplane.

B. Installation.

- (1) Position antenna-receiver-transmitter unit to mounting structure and secure unit with cap screws.
- (2) Connect electrical connector to the antenna-receiver-transmitter unit.
- (3) Install radome.
- (4) Remove tag and close circuit breaker.

2. Indicator.

A. Removal.

- (1) Open weather radar system circuit breaker and tag with warning sign:

WARNING: DO NOT CLOSE THIS CIRCUIT BREAKER: MAINTENANCE IN PROGRESS.

- (2) Turn locking pawl counterclockwise until stop is reached.
- (3) Slide indicator out from mounting tray through instrument panel.
- (4) Disconnect electrical connector from indicator.

B. Installation.

- (1) Connect electrical connector to indicator.
- (2) Slide indicator into mounting tray.
- (3) Lock indicator into position by turning locking pawl clockwise until stop is reached.
- (4) Remove tag and close circuit breaker.

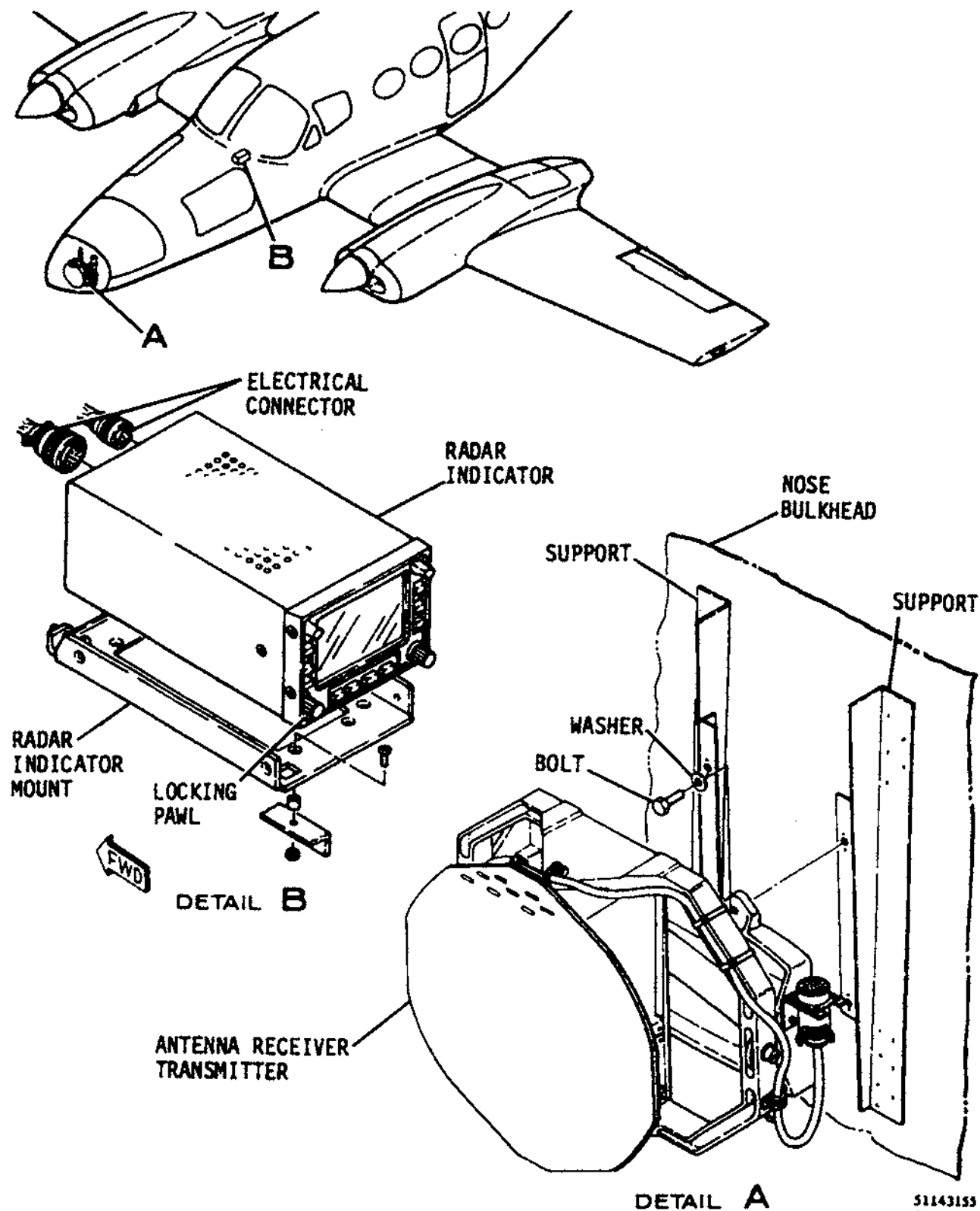
Adjustment/Test Weather Radar System

1. Operational Test.

- A. Connect auxiliary power unit to airplane and apply power.
- B. Ensure radar circuit breaker is engaged.
- C. Set function switch to TEST.
- D. Set the mode to Wx, the brightness (BRT) control to midrange, the antenna TILT control to any position and the range to 40 miles.
- E. The test pattern should appear on the indicator screen. Adjust BRT again as required.

NOTE: The width of the test pattern bands is not critical nor is the position of the bands relative to the range marks.

- (1) The test pattern should display five (5) colored bands. Starting with the closest band to the origin, the bands will be green, yellow, red, yellow and green. The red band represents the most intense level. All range marks will be visible and displayed in blue letters.



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 RDR 230HP Weather Radar System Installation
Figure 3

- (2) The update action may be observed as a small "ripple" or small movement along the outer green band indicating that the antenna is scanning the full 90 degrees.
 - (3) Sequence the mode to the WxA mode. The red band should alternate from red to black approximately once per second.
 - (4) Return the mode to Wx.
 - (5) Push ON the HOLD button. The update "ripple" should disappear and the test pattern should remain stable. The word HOLD should flash in the upper left corner.
 - (6) Push OFF the HOLD button and verify that update resumes.
- F. Set the function switch to the STBY position.
- CAUTION: FOR THE FOLLOWING OPERATIONAL TESTS, THE AIRPLANE MUST BE OUTSIDE AND AWAY FROM HANGARS OR OTHER ENCLOSURES, NO METAL BUILDINGS OR AIRPLANES, ETC. IN FRONT OF THE AIRPLANE, NO AIRPLANES BEING FUELED IN THE VICINITY AND NO PERSONNEL WITHIN 15 FEET OF THE AREA BEING SCANNED BY THE ANTENNA.
- G. Rotate the function switch to the ON position. The indicator should be in the Wx mode and in the 40-mile range. Make sure that the HOLD button is in the push-off position.
- H. Adjust the TILT control up (+degrees) in small increments until a clear picture develops of any local weather. Close-in ground targets may also appear in the display. At maximum (+12 degrees), no ground targets should appear on the display.
- I. Repeat TILT control adjustment to check remaining ranges.
- J. Turn function switch to OFF.
- K. Disconnect auxiliary power unit.

STATIC DISCHARGINGGeneral

1. Trailing edge dischargers are installed at the airplane extremities to dissipate static electricity with a minimum of radio interference.
2. Static wick dischargers showing deterioration should be replaced.

Static Discharge Wick Assembly Replacement

NOTE: Airplanes C0001 thru C1257 not incorporating SK421-116, the static discharge wick assemblies (mount base and discharger wick) should be replaced when the discharge wick becomes deteriorated or damaged. Refer to the Illustrated Parts Catalog for the replacement static discharge wick assembly.

1. Replace Static Discharge Wick Assembly

- A. Remove screws securing static wick base to structure and remove static wick assembly from airplane.
- B. Clean/remove exterior finish as necessary to ensure good electrical contact between mounting base and structure.
- C. Drill replacement static wick base to match existing holes and/or rivnuts.

NOTE: The mounting base threaded end is to be flush with the surface trailing edge, +0.10, -0.10 inch.

- D. Secure mounting base to structure with screw(s), rivets, or screws and nuts as applicable to the location.
- E. With lockwasher on static wick, screw static wick into mounting base hand tight.
- F. When static discharge mounting base is replaced on control surfaces, the control surface must be balanced.

Static Discharge Wick Removal/Installation

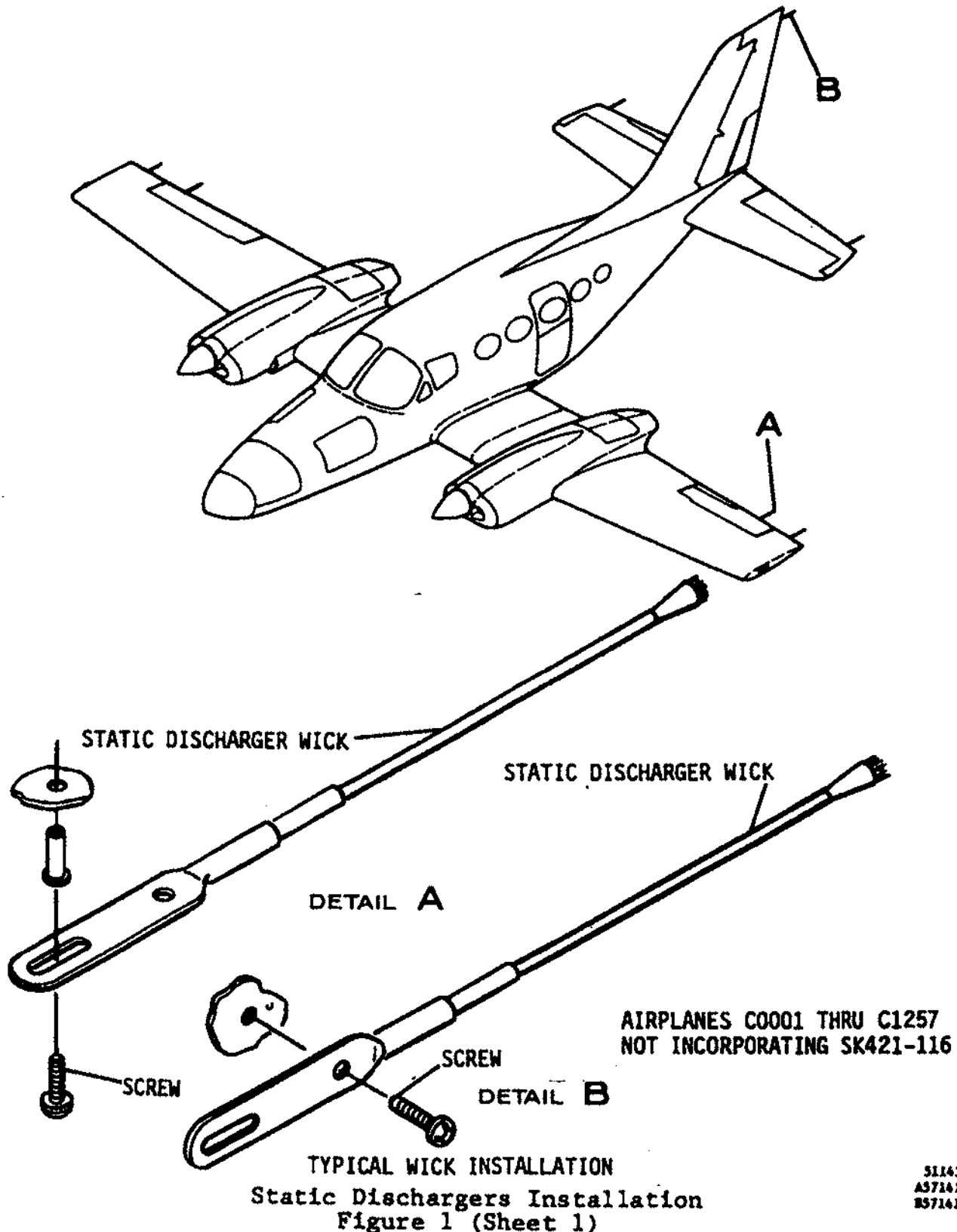
1. Remove Static Discharge Wick (Refer to Figure 1.)

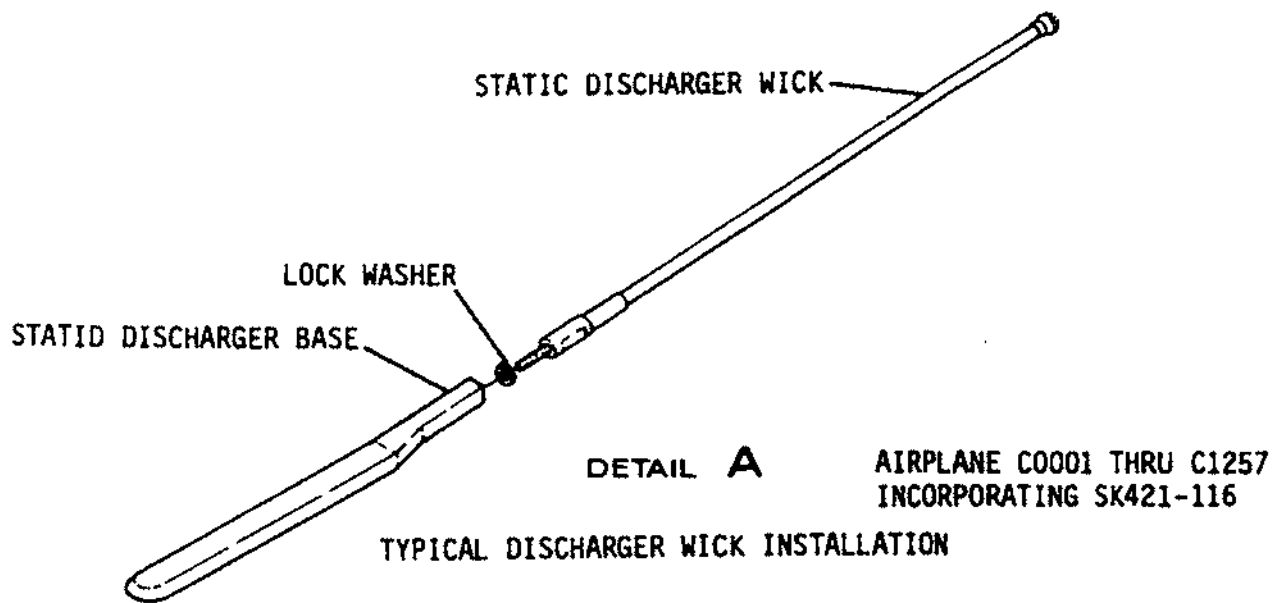
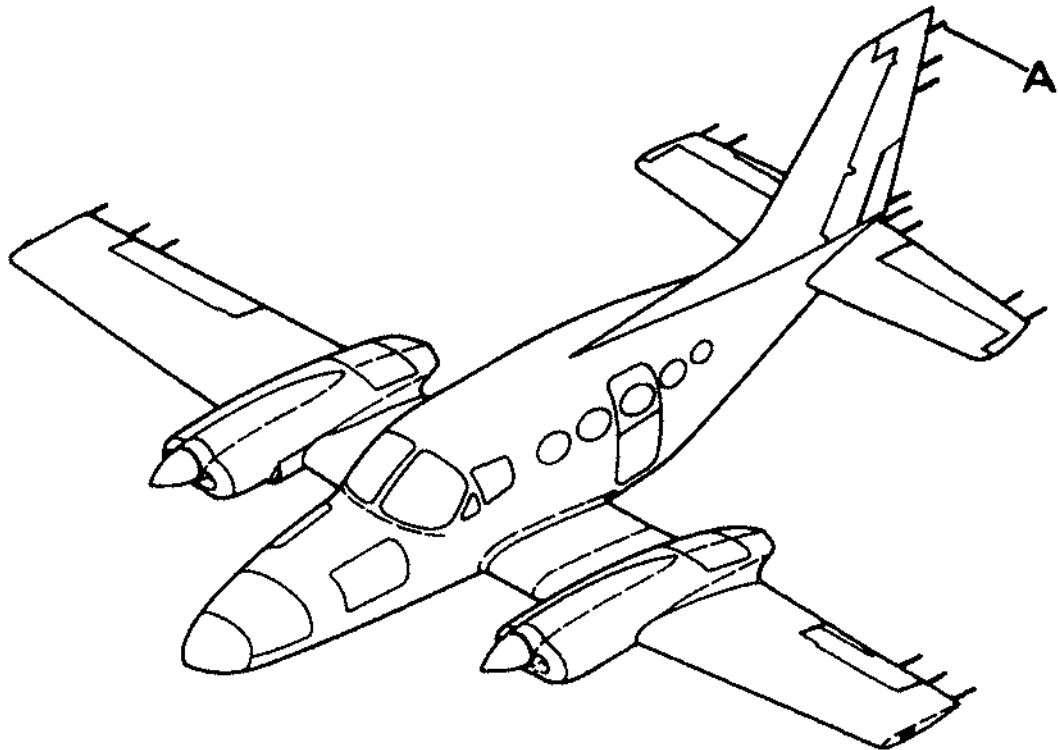
NOTE: Airplanes C0001 thru C1000 not incorporating SK421-116, the static discharge wick assemblies (mount base and discharge wick) should be replaced when the discharge wick becomes deteriorated or damaged. Refer to Static Discharge Wick Assembly Replacement above.

- A. Unscrew the discharge wick from the mounting base.

2. Install Static Discharge Wick (Refer to Figure 1)

- A. Position lockwasher on discharge wick and screw wick in mounting base. Secure hand tight only.





Static Dischargers Installation
Figure 1 (Sheet 2)

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CHAPTER

15

STRUCTURAL REPAIR

CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL

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CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL

<u>SUBJECT</u>	<u>CHAPTER/ SECTION</u>	<u>PAGE</u>	<u>FICHE/ FRAME</u>
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GENERAL1. Description

- A. The airplane is all-metal semimonocoque type construction with the skin carrying a portion of all structural loads. The fuselage is comprised of a forward cabin section and a tailcone. It is constructed of formed bulkheads, stringers, and stiffeners all of which are riveted to the external skin. The wing, horizontal stabilizer and vertical fin are built up around two main spars, with ribs, formers and skin forming the basic structure. Torsional stiffness of this structure is afforded by the skin closure of areas between the spars forming enclosed "boxes". Each movable surface consists of a hinge support spar with ribs, formers and riveted outer covering skin. Typical repair illustrations are shown in this Chapter.

2. Ground Handling

- A. Leveling, jacking and other ground handling details are covered in Chapter 1.

3. Investigation of Damage

- A. After a thorough cleaning of the damaged area, all structural parts should be carefully examined to determine the extent of damage. Frequently the force causing the initial damage is transmitted from one member to the next, causing strains and distortions. Abnormal stresses incurred by shock or impact forces on a rib, bulkhead or similar structure may be transmitted to the extremity of the structural member, resulting in secondary damage such as sheared or stretched rivets, elongated bolt holes, canned skins or bulkheads. Points of attachment should be examined particularly for distortion and security of fastenings in the primary and secondary damaged areas.

4. Damage Classification.

- A. Damage, as considered in this manual, is any cross-sectional area change or permanent distortion of a structural member.
- B. Use good judgment in determining the type of damage to flat stock structural material. The terms: dent, crease, abrasion, gouge, nick, scratch, crack and corrosion referred to elsewhere in the manual, are defined below as a guide for this determination, particularly with respect to the external skin of the airplane.

- (1) Dent - A dent is normally a damage area which is depressed with respect to its normal contour. There is no cross-sectional area change in the material. Area boundaries are smooth. Its form is generally the result of contact with a relatively smoothly contoured object.

NOTE: A dent-like form of damage to skin in nonpanel areas (or thick skin in panel areas) may be the result of the peening action of a smoothly contoured object contacting it. Consider that such damage results in a local cross-sectional area change, if the inner surface of skin shows no contour change.

- (2) Crease - A damage area which is depressed or folded back upon itself in such a manner that its boundaries are sharp or well defined lines or ridges. Consider it to be the equivalent of a crack.
- (3) Abrasion - An abrasion is a damage area of any size which results in a cross-sectional area change due to scuffing, rubbing, scraping or other surface erosion. It is usually rough and irregular.
- (4) Gouge - A gouge is a damage area of any size, which results in a cross-sectional area change. It is usually caused by contact with a relatively sharp object which produces a continuous, sharp or smooth channel-like groove in the material.
- (5) Nick - A nick is a local gouge with sharp edges. Consider a series of nicks, in a line pattern, to be the equivalent of a gouge.
- (6) Scratch - A scratch is a line of damage of any depth in the material and results in a cross-sectional area change. It is usually caused by contact with a very sharp object.

- (7) Crack - A crack is a partial fracture or complete break in the material with the most significant cross-sectional area change. In appearance, it is usually an irregular line and is normally the result of fatigue failure.
- (8) Corrosion - Corrosion, due to a complex electro-chemical action, is a damage area of any size and depth which results in a cross-sectional area change. Depth of such pitting damage must be determined by a clean-up operation. Damage of this type may occur on surfaces of structural elements.
- C. Use good judgment in the determination of significant cross-sectional area changes by proper visual measurement of both depth and length of any type (or combinations) of damage.
- D. Repairable Damage - Typical.

CAUTION: EXERCISE CARE WHEN OPERATING POWER TOOLS TO PREVENT DAMAGE TO STRUCTURAL SURFACES BY OVERHEATING OR SCUFFING.

NOTE: All replaceable structural components, which are considered suitable for field replacement, are listed in the airplane parts catalog.

- (1) Any skin damage, such as scratches, rivet set marks, cuts, pits and abrasions, no greater than 15 percent of the skin thickness, can be repaired by blending and polishing. Refer to Chapter 15-40 for polishing repairs.
- (2) Corrosion requires rework to determine its depth of penetration into the structural member prior to determining the repair technique. Refer to Chapter 1-80 for chemical cleaners.
- (3) Any skin damage, such as scratches, rivet set marks, cuts, pits, and abrasions greater than 15 percent of the skin thickness and any skin cracks can be repaired by patching. Refer to Chapter 15-40 for typical repairs.
- E. Damage Requiring Replacement of Part.
 - (1) Where damage repair is impractical, the entire part should be replaced.
- F. Assembly Procedure for Dissimilar Metal Contact.
 - (1) Dissimilar Metal Contact with Magnesium.
 - (a) Interior application.
 - 1) Contacts between magnesium alloy and other dissimilar metals which do not reach a service temperature in excess of 300°F shall be insulated by four (4) coats of nonchromated primer on each contacting faying surface or one (1) coat of epoxy primer on the magnesium part and three (3) coats of nonchromated primer or one (1) coat of epoxy primer on the contacting faying surface. In addition to the paint insulation, the magnesium part shall be insulated with a pressure sensitive tape (Number 473, Minnesota Mining and Manufacturing Co.) or Type 1, Class B sealant.
 - 2) Magnesium dissimilar metal joints which reach a temperature (300-500°F) shall be insulated by two (2) coats of heat-resistant enamel on the magnesium part and two (2) coats of heat-resistant enamel on the contacting faying surface and separated by tape, Mystik 7010 (Mystik Tape Inc.) or silicone glass cloth tape P-211 (Permacel Tape Co.) or sealant Q93-006-6 (Dow Corning Corporation).
 - 3) Magnesium dissimilar metal joints which reach a service temperature in excess of 500°F shall receive two (2) coats of silicone enamel on both the magnesium part and the contacting faying surface. The painted faying surface shall be separated by silicone glass cloth tape P-211 (Permacel Tape Co.).
 - (b) Exterior application.
 - 1) Exterior magnesium dissimilar metal joints which do not reach a service temperature in excess of 320°F shall be sealed with Type 1, Class B sealant.

- 2) Exterior magnesium dissimilar metal joints which reach a service temperature in excess of 320°F shall be sealed with Q93-006-6 sealant (Dow Corning Corporation). Where the use of sealant on the contacting faying surface is not feasible, such as a part which must be assembled by sliding it into another part, use tape, Mystik 7010 (Mystik Tape Co.), or silicone glass cloth tape, P-211 (Permacel Tape Co.), to insulate the faying surface. The mold line butt joint shall be sealed with Q93-006-6 sealant. The tape applied to the faying surface shall not protrude into the mold butt joint and interfere with the sealant application.
- (2) Dissimilar metals contact other than magnesium.
 - (a) Interior and exterior application.
 - 1) Dissimilar metal contact other than magnesium shall receive a minimum of two (2) coats of nonchromated primer on each contacting faying surface if the service temperature does not exceed 300°F.
 - 2) Parts which reach a service temperature between 300-500°F shall receive two (2) coats of heat-resistant enamel on both mating surfaces.
 - 3) Parts which reach a service temperature in excess of 500°F shall receive two (2) coats of silicone enamel on both mating surfaces.
- (3) Dissimilar Metal Contact in Presence of Phosphate Esters and Synthetic Turbine Oil.
 - (a) Parts which require dissimilar metal contact protection subject to phosphate esters and synthetic turbine oil shall receive one (1) coat of epoxy primer on each contacting surface.

5. Preparing Damaged Area for Repairs.

- A. To prepare an area for repair, examine and classify the damage. Make a thorough check before beginning repairs. In some cases a damaged part may be classified as needing replacement; however after removal, closer inspection indicates the part may be repaired. Take more time for the damage estimate and save man-hours on repairs. To prepare a damaged area for patch or inserting repairs:
 - (1) Remove all ragged edges, dents, tears, cracks, punctures and similar damages.
 - (2) Leave edges, after removal of damaged area, parallel to any square or rectangular edges of the unit.
 - (3) Round all corners.
 - (4) Smooth out abrasions and dents.
 - (5) Brush Iridite all aluminum parts which have rough edges and scratches with a solution of Iridite mixed in a ratio of 1 ounce of Iridite to 1 gallon of water and rinse thoroughly.
 - (6) Apply two coats of nonchromated primer to all internal surfaces and edges lapping over another.

NOTE: Damage adjacent to a previous repair requires removal of the old repair and inclusion of the entire area in the new repair. Repairs in the cabin section that affect the pressure seal must be sealed, refer to Sealing Procedures Chapter 1.

6. Rivets

- A. The following rivets are commonly used in airplane structures: standard solid shank, hi-shear, and blind. Rivets used in airplane construction are most generally fabricated from aluminum alloys. In special cases monel, corrosion-resistant steel, mild steel, copper and iron rivets are used.
- B. Types.
 - (1) Standard solid shank rivets are those generally used in airplane construction. They are fabricated in the following head types: roundhead, flat-head, countersunk-head, and brazier-head. Roundhead rivets are generally used in the interior of airplane except where clearance is required for adjacent members. Flathead rivets are generally used in the interior of the airplane where head clearance is required. Countersunk-head rivets are used on the exterior surfaces of the airplane to minimize turbulent airflow. Brazier-head rivets are used on the exterior surfaces of the airplane where strength requirements necessitate a stronger rivet head than that of the countersunk-head rivet. Both the brazier-head and the countersunk-head rivets are used on the exterior of the airplane where head clearance is required.

- (2) Hi-shear rivets are special patented rivets having a high shear strength equivalent to that of the standard AN bolts. They are used in special cases in locations where high shear loads are present, such as spars, wings and heavy bulkhead ribs. The rivet consists of a cadmium plated pin of alloy steel and a collar of aluminum alloy. The installed rivet can be readily identified by the presence of the attached collar in place of the formed head on standard rivets.
- (3) Blind rivets are used, where strength requirements permit, when one side of the structure is inaccessible making it impossible or impractical to drive standard solid shank rivets.

C. Substitution of Rivets.

- (1) Standard solid shank rivets.
 - (a) In the replacement of rivets in installations which require the raised head rivets it is desirable to use rivets identical to the type of rivet removed.
 - (b) Countersunk head rivets are to be replaced by rivets of the same type and degree of countersink.
 - (c) When rivet holes become enlarged, deformed, or otherwise damaged, use the next larger size as replacement.
 - (d) Replacements shall not be made with rivets of lower strength material.
- (2) Hi-shear rivets. When hi-shear rivets are not available, replacement of sizes 3/16 or greater shall be made with bolts of equal or greater strength than the rivet being replaced and with self-locking nuts of the same diameter. The flush-type hi-shear rivet may be temporarily replaced by like diameter flush-type steel screws of equal or greater strength and self-locking nuts provided the threaded part of the screw does not extend into the material being fastened together. This latter procedure is temporary only and replacement with the hi-shear flush-type rivet must be accomplished as soon as they become available.

NOTE: Cherry Max rivets are an allowable substitute for all like applications of NAS1398 and NAS1399 rivets. Cherry Max rivets are manufactured by Cherry Rivet Division of Townsend, Santa Anna, California.

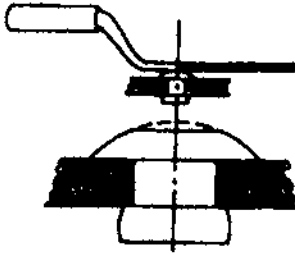
- (3) Blind rivets. Blind rivets have higher deflection rates in shear than standard solid rivets. For this reason, it is not advisable to replace any considerable number of solid rivets in a given joint by blind rivets because this may result in over-stressing the remaining solid rivets. The following specific instructions apply.
 - (a) The hollow blind rivet shall not be used.
 - (b) The blind rivet used shall be of the same or greater strength and one size larger than the rivet it replaces, except that blind rivets may be replaced size for size.
 - (c) In cases of dimpled assembly, the rivet holes shall be drilled after the sheets are dimpled.
 - (d) When possible, the exposed end of each clipped plug shall be coated with a 10 per cent chromic acid solution or with zinc chromate primer.
 - (e) Blind rivets shall not be used in tanks except in cases of absolute necessity and must be sealed.
 - (f) If blind fasteners other than the blind rivets are encountered, it is recommended that replacements be made by identical fasteners.

D. Diameters.

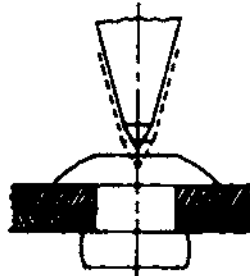
- (1) Rivet diameters range from 3/32 inch to 3/8 inch. The 1/8, 5/32 and 3/16 inch sizes are the most frequently used.
- (2) Since smaller rivets lack the proper structural qualities and larger rivets may dangerously reduce the splice or patch area, care must be exercised before substituting other than the specified sizes of rivet diameter.

E. Lengths

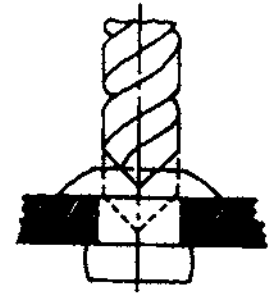
- (1) The proper length of rivet is an important part of the repair. Should too long a rivet be used, the formed head will be too large, or the rivet may bend or be forced between the sheets being riveted. Should too short a rivet be used, the formed head will be too small or the riveted material will be damaged.



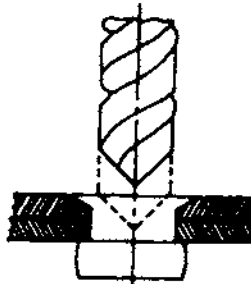
1. FILE A FLAT ON THE MANUFACTURED HEAD



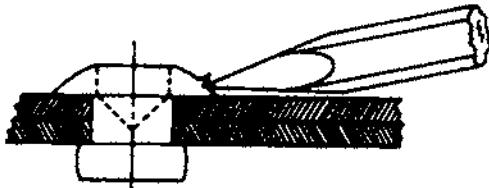
2. CENTER PUNCH THE FLAT



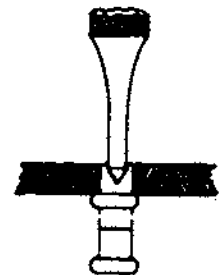
3. DRILL THROUGH HEAD USING DRILL ONE SIZE SMALLER THAN RIVET SHANK



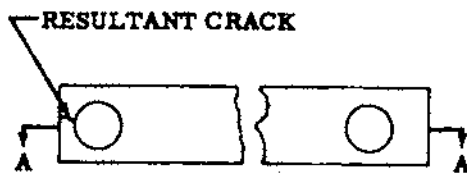
4. DRILL THROUGH DIMPLE COUNTER-SUNK OR COUNTERSUNK HEAD USING DRILL ONE SIZE SMALLER THAN RIVET SHANK



5. REMOVE WEAKENER HEAD WITH SHARP CHISEL



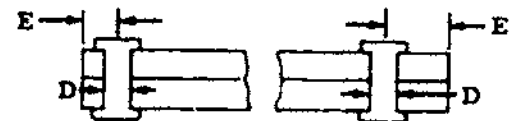
6. PUNCH OUT RIVET WITH MACHINE PUNCH



SAFE

DISTANCE "E" SHOULD EQUAL TWICE THE RIVET DIAMETER

SECTION A-A



INCORRECT - TOO CLOSE TO EDGE

CORRECT
 $E = 2D$

Rivet Removal and Rivet Edge Distance
Figure 1

- (2) If proper length rivets are not available, longer rivets may be cut off to equal the proper length (not grip).
- (3) The rivet length is based on the grip.

F. Removal of Solid Rivets (See Figure 1).

- (1) When it becomes necessary to replace rivets, great care should be taken in their removal so that the rivet hole will retain its original size and not acquire replacement with a larger size rivet.
- (2) To remove a rivet, file a flat on the manufactured head. It is always preferable to work on the original head rather than on the one that is bucked over since the former will always be more symmetrical about the shank. Indent the flat surface with a counter-punch so the drill may be correctly centered. A drill slightly less in diameter than the rivet shank should be used to drill and weaken the head. Take care that the rivet shank does not turn with the drill and cause a tear. If the other end of the rivet is supported, the head may be sheared off with a sharp chisel. This cutting should always be done along the direction of the plate edge. If the shank is unduly tight after the removal of the head, the rivet should be drilled out completely. It may be forced out with a counterpunch of a smaller diameter than the rivet, provided the sheet is properly supported from the opposite side; however, there is greater danger of damaging the sheet and enlarging the hole when using this method. This procedure will also apply to flush rivets.

G. Riveting Installation (See Figure 1).

- (1) Riveting procedure. A large percentage of the riveting of airplane structures is done on thin gage aluminum alloy and the work must be so accomplished that the material is not distorted by hammer blows or injured with riveting tools. All airplane power riveting is done by upsetting or heading the rivets against a bucking bar instead of striking the shank with a hammer.
 - (a) To prevent deforming of its head a rivet set must be selected to fit each type. The depth of this set must be such that it does not touch the material being riveted.
 - (b) Parts which are to be heat-treated should be heat-treated before riveting since heat treating after this process causes warping. This is also necessary when assemblies are heated in a salt bath as the salt cannot be entirely washed out of the cracks.
 - (c) Rivets of a diameter smaller than three thirty-seconds inch must not be used for any structural parts, control parts, wing covering, cowling or similar sections of airplane except where they are identical replacements.
 - (d) Rivets through hollow tubes, which are loaded only in shear, should be hammered just enough to form a small head. No attempt should be made to form the standard round head as the amount of hammering required often causes the rivet to buckle inside the tube, with resultant injury to the member.
 - (e) Aluminum alloy rivets must never be used in tension for structural, control, or other critical parts of airplane. Whenever such an installation is required, bolts should be used.
 - (f) The use of hollow rivets in joining highly stressed parts is not permitted. When rivets cannot be driven because of the inaccessibility of the end for bucking or driving, the next size larger self-plugging cherry rivet may be used.
 - (g) The selection of the proper rivet and proper number of rivets is very important.
 - (h) The rivets must be of the proper length for the total thickness of the pieces being riveted. Ordinarily, from 1-1/2 to 2 times the diameter of the rivet is about the right amount for the rivet shank to protrude through the material to form the head. For heavy material such as plates or fittings, from 2 to 2-1/2 diameters may be used.
 - (i) The rivet should not be too loose in the hole as this condition will cause it to bend over while being headed, and the shank will not be sufficiently expanded to completely fill the hole. A drill from 0.002 to 0.004 inch larger than the rivet should be used for sheet and plate riveting.
 - (j) Pieces should be held firmly together by clamps, screws or bolts while they are being drilled and riveted.

- (k) Where rivets are headed on the inside of the structure, the bucking bar is held against the end of the rivet shank. Care must be exercised doing this operation to prevent unseating the rivet by the application of too much pressure. For the first few blows the bucking bar should be held lightly against the rivet shank so that it will receive the impact of the blow through the rivet. The bucking bar must be held square with rivet to produce uniform upsets.
- (l) Only a sufficient number of blows should be struck to properly upset a rivet. The blows must be as uniform as possible.
- (2) Spacing and diameter of rivets. There are no specific rules which are applicable to every case or type of riveting. There are, however, certain general rules which should be understood and followed.
 - (a) The edge distance of rivets should not be less than two diameters of the rivet measured from the edge of the sheet or plate to the center of the rivet hole (See Figure 1).
 - (b) The spacing between rivets, when in rows, depends upon several factors, principally the thickness of the sheet, the diameter of the rivets and the manner in which the sheet will be stressed. This spacing is seldom less than four diameters of the rivet, measured between the centers of the rivet holes. Rivets spaced four diameters apart are found in certain seams of semimonocoque fuselages, webs or built-up spars, various plates or fittings.
 - (c) Where there are two rows of rivets, they are usually staggered. The transverse pitch or distance between rows should be slightly less than the pitch of the rivets, 75% of the rivet pitch being the usual practice.
 - (d) An average spacing or pitch of rivets in the cover or skin of most structures, except at highly stressed joints, will be from 6 to 12 diameters of the rivet.
 - (e) The best practice in repair jobs is to make the pitch of the rivets equal to those in the original structure.

H. Loose or Working Rivets in Inboard Section of Wing.

- (1) Loose or working rivets attaching skin to upper and lower front spar cap may be repaired by adding MS20470AD4 or equivalent rivets midway between and in line with existing working rivets and four rivets beyond the last loose rivet.

NOTE: Care must be taken to avoid damage to lines and wiring.

I. Loose or Working Rivets.

- (1) Rivets which appear to be loose shall be checked by the use of a 0.002 feeler gage by inserting the gage around the head of the rivet in question. If the feeler gage can be inserted to the shank of the rivet, it shall be classified as a loose rivet and shall be replaced.
- (2) If the feeler gage can be inserted approximately half-way to the shank for 30% of the circumference of the rivet head, it shall not be classified as a loose rivet.
- (3) The feeler gage shall be used to check the shear section between the riveted members, such as skin to spar or different sections of skins in a similar manner to that used around the rivet head.

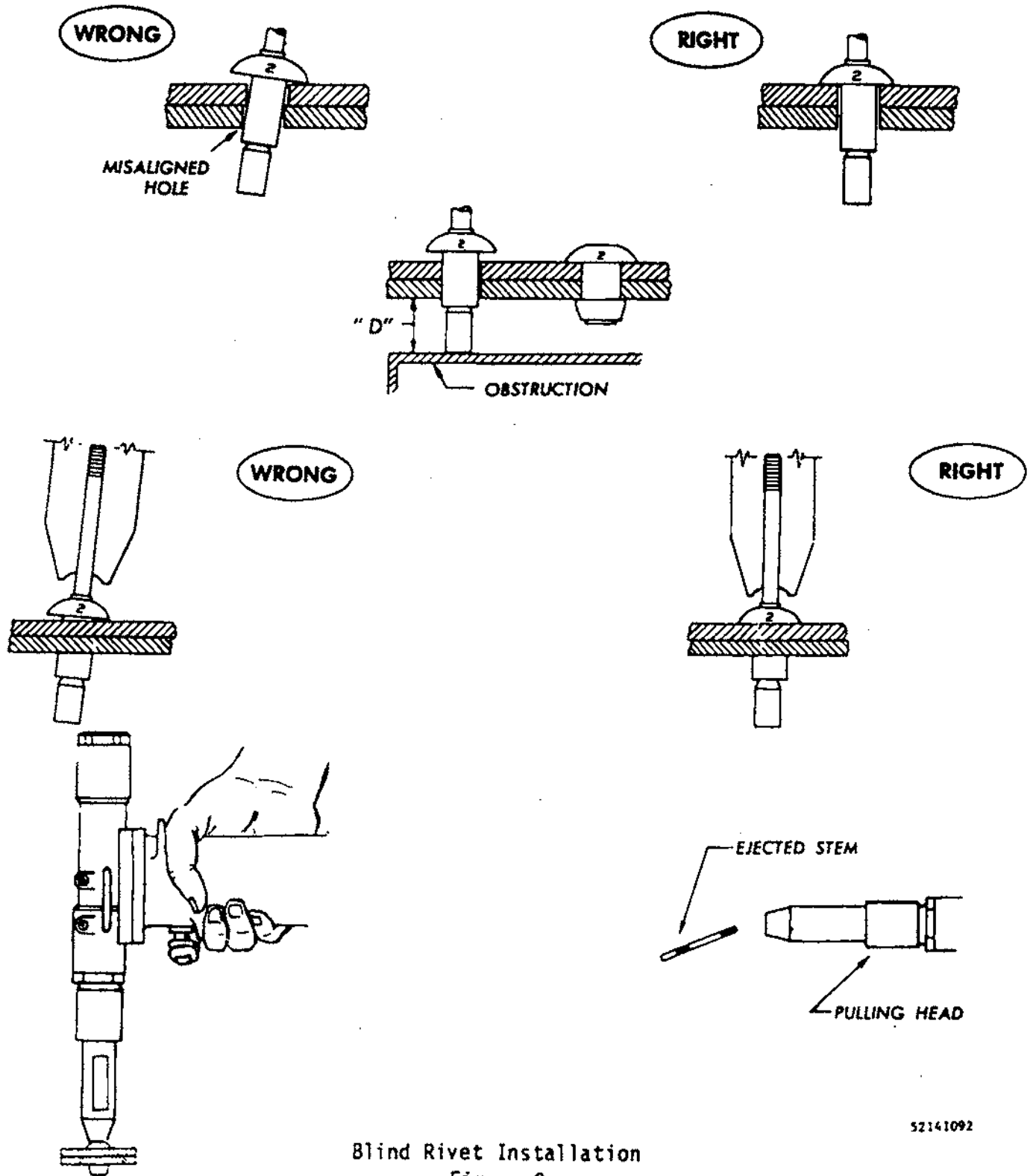
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- (4) If the skin around the brazier head or countersunk rivet can be moved by depressing the skin with finger pressure around the rivet, the rivet shall be replaced.
- (5) If rivets are found to turn by applying a rotating load to the head of the rivet, they should be replaced.
- (6) In areas where exterior paint has been applied to rivet heads, the paint may harden due to aging processes and show hairline cracks around the edge of the rivet heads. This should not be used as a basis for determining whether the rivet is loose or not. The hardened paint may crack at times and collect dirt or exhaust fumes which will appear as discoloration. It is not possible to detect loose rivets visually.
- (7) When replacing rivets, it is desirable to replace them with like size and type. In some instances, it will be necessary to go to the next size larger diameter. For general repair practices, the spacing between the centerlines of adjacent rivet holes shall be four diameters or greater. In areas where the spacing between rivets prohibits the use of the next size larger rivets, special repair instructions and procedures shall be utilized.

J. Blind Rivets

- (1) General.
 - (a) Blind rivets are intended for use where access is only available to one side of the work.
- (2) Installation. (Refer to Figure 2.)
 - (a) Blind rivets are installed with special tools, in holes of specific size and edge distance. After insertion, the rivet should be checked for correct installation.
- (3) Checking. (Refer to Figure 3.)
 - (a) After installation, if the rivet stem and collar are flush within the limits described in Figure 3, it may be concluded that the rivet is correctly installed with as satisfactory blind head and lock formed.
- (4) Removal. (Refer to Figure 4.)
 - (a) Obtain a drill bit of correct size for blind fastener to be removed.
 - (b) Place drill bushing over stem so that it rests squarely on lock collar.
 - (c) Using a drill of 1250 RPM maximum, drill to collar depth.
 - (d) Drive stem from sleeve using pin punch of correct diameter.
 - (e) Remove any remaining portion of lock collar.
 - (f) Adjust micro-limit tool to within 0.005 to 0.015 inch less than dimension X.
 - (g) Press anti-rotation cap of tool firmly against head of fastener sleeve.
 - (h) Counter stem to required depth.
 - (i) Drive sleeve out using punch having same diameter as fastener's nominal diameter.
 - (j) If fastener was countersunk head type, remove head from countersink.

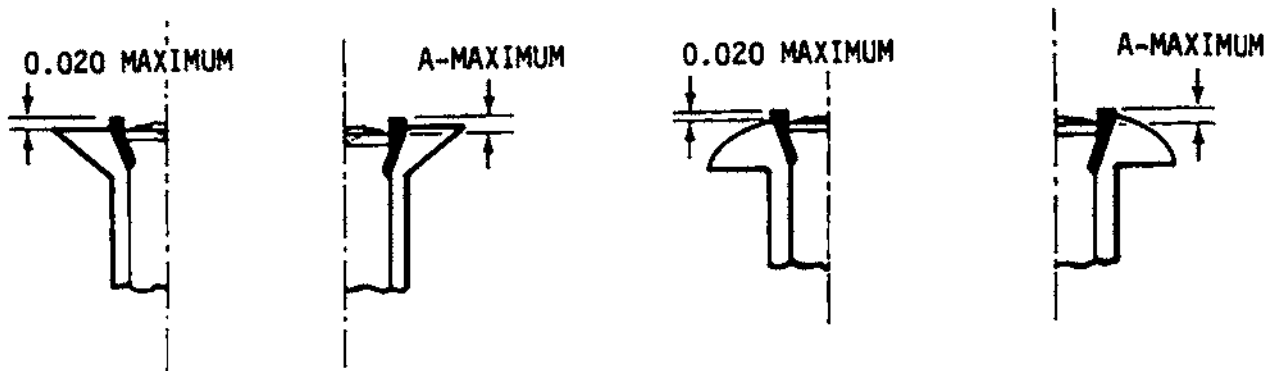
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Blind Rivet Installation
Figure 2

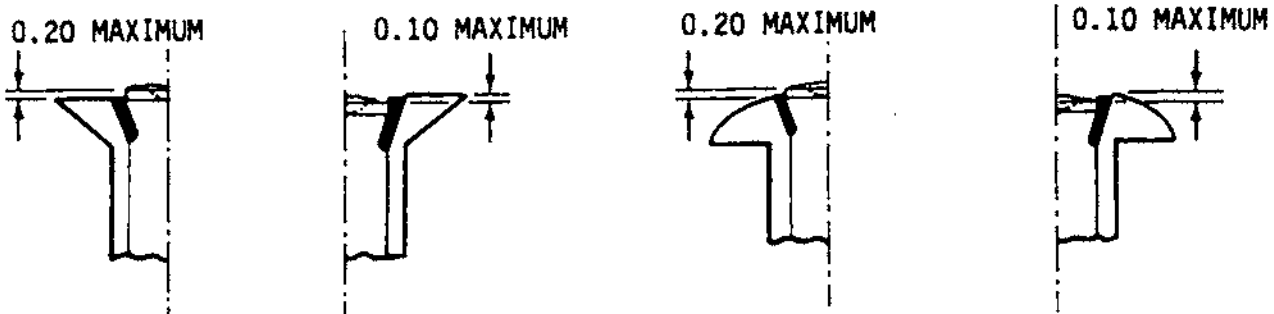
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COLLAR PROTRUSION LIMITS

RIVET SIZE	-4	-5	-6
A MAXIMUM	0.015 INCH	0.020 INCH	0.025 INCH



STEM PROTRUSION LIMITS

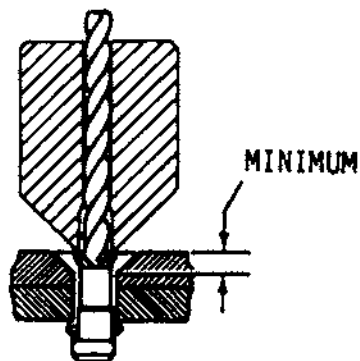
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Checking Blind Rivets for Collar and Stem Flushness
Figure 3

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BLIND BOLT REMOVAL

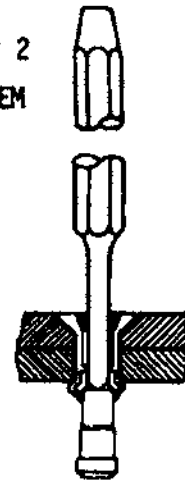
STEP 1
DRILL STEM



FASTENER NOMINAL DIAMETER	DRILL SIZE (INCHES)	MINIMUM DEPTH* (INCHES)
5/32	0.0980	0.050
3/16	0.1200	0.070
1/4	0.1562	0.090
5/16	0.1875	0.105
3/8	0.2280	0.130

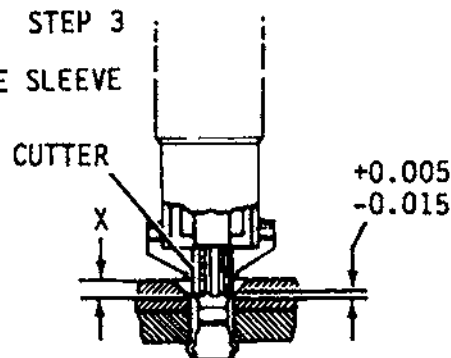
*MAXIMUM DEPTH = MINIMUM DEPTH + 0.020

STEP 2
KNOCK OUT STEM



FASTENER NOMINAL DIAMETER	PUNCH DIAMETER
5/32	3/32
3/16	3/32
1/4	5/32
5/16	3/16
3/8	7/32

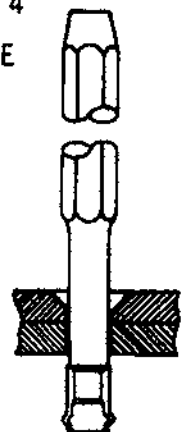
STEP 3
COUNTERBORE SLEEVE



NOTE: TOOLS MAY BE PURCHASED AS A KIT
FROM HUCK MANUFACTURING COMPANY
900 WATSON CENTER ROAD
CARSON, CA 90745

FASTENER NOMINAL DIAMETER	CUTTER DIAMETER	HEAD HEIGHT (X)	
		PROTRUDING HEAD (INCHES)	COUNTERSUNK HEAD (INCHES)
5/32	5/32	0.070	0.070
3/16	3/16	0.135	0.080
1/4	1/4	0.140	0.105
5/16	5/16	0.140	0.135
3/8	3/8	0.205	0.165

STEP 4
KNOCK OUT SLEEVE



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Removal of Protruding Head and Countersunk Head Blind Fasteners
Figure 4

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K. Tools and Equipment.

Name	Number	Manufacturer	Use
Structural Adhesive	EA9309	Hysol Division The Dexter Corporation Pittsburg, CA 94565	Bonding wing skin to front spar lower aft cap during blind rivet replacement.

L. Front Spar Loose or Working Blind Rivets Bonding Procedure.

- (1) Blind rivets in the front spar cap that have become loose or have been working may be repaired by removing the affected rivets, lifting up the skin and cleaning the skin contact area with naphtha applying EA9309 adhesive and installing new blind rivets.
- (2) It will be necessary to remove at least two (2) rivets on both sides of the affected rivets to raise the skin high enough to install adhesive material.
- (3) Allow the bonded area to cure approximately 24 hours prior to flight.

7. Hi-Lock Fasteners.

- A. Hi-Lok fasteners are commonly used throughout the airplane structure. The hi-lok is basically a threaded fastener which combines the best features of a rivet and a bolt. It consists of two parts, a threaded pin and a threaded collar.

CAUTION: TAKE PRECAUTION TO PREVENT ENLARGING OR ELONGATING HOLES WHEN REMOVING FASTENERS.

- B. Removal of hi-lok fasteners in noninterference fit holes is easily accomplished by using standard hand tools similar to removing a nut from a bolt. Use an allen wrench to prevent the pin from rotating while collar is being unscrewed with pliers as shown.

In inaccessible areas, it is permissible to center punch the flathead of the hi-lok fastener pin, drill through the head using an undersize drill bit, then punch out fastener using a machine punch.

- C. For proper hole size and tolerance, refer to Table 1.

- D. Install proper sized hi-lok fastener by inserting pin in the hole and manually threading the hi-lok collar onto the pin, approximately two threads. Insert the proper size allen hex wrench (open end or boxed) wrench on the collar hex. This prevents rotation of the pin while the collar is being installed. Hold the allen wrench hex until the collar wrenching device has been torqued off, completing the hi-lok fastener installation. For complete installation instructions, refer to Installation Manual 2-1520-13 which can be ordered through Cessna Dealer Organization.

8. Cotter Pins.

- A. Refer to Table 2 for cotter pin application.

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TABLE 1.

HI-LOK FASTENER HOLE SIZE AND TOLERANCE

<u>NOMINAL FASTNER DIAMETER</u>	<u>HOLE SIZE TOLERANCE</u>
5/32	0.1625 to 0.1645
3/16	0.1885 to 0.1905
1/4	0.2485 to 0.2505
5/16	0.3105 to 0.3135
3/8	0.3730 to 0.3760
7/16	0.4355 to 0.4385
1/2	0.4980 to 0.5010

NOTE: Deburr under head of fastener to allow head to seat.

TABLE 2. COTTER PIN APPLICATION

<u>COTTER PIN PART NUMBER</u>	<u>TEMPERATURE</u>	<u>SERVICE</u>
MS24665 Cotter Pins (Carbon Steel)	Ambient Temperatures Up to 450°F	Normal atmospheres Cotter Pins contacting cadmium plated bolts or nuts
MS24665 (Corrosion Resistant Steel)	Ambient Temperatures Up to 800°F	Non-Magnetic requirements Cotter Pins contacting corrosion resistant steel bolts or nuts Corrosive atmospheres

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9. Sheet Metal Materials.

A. Most sheet metal stock used in the structure of the airplane is aluminum alloy; however, significant amounts of sheet stock corrosion resistant steel alloys, and steel alloys are also used.

B. When repairing the airplane structure, all bare metal parts, including surfaces exposed by cutting or drilling, shall be coated using protective treatment.

C. Aluminum Alloys.

- (1) Aluminum alloys are designed by symbols of the Aluminum Association's new standard four-digit index system.
- (2) The heat-treat condition of the material is indicated by a "T" number that follows the alloy designation. "0" following the alloy designation indicates that the material is in the annealed condition.
- (3) The word "clad" preceding the material designation indicates that a protective coating of pure aluminum has been applied prior to completion of the final rolling process of the material.
- (4) The most commonly used aluminum alloy sheet materials are 2024-T3 and are generally formed in the heat-treated condition.

D. Magnesium Alloys.

WARNING: Small particles and fine shavings of magnesium ignite easily and present an extreme fire hazard. Magnesium dust is highly flammable, and in the proper concentration, may cause an explosion. Water in contact with molten magnesium presents a steam explosion hazard. Extinguish fires of magnesium with absolutely dry talc, calcium carbonate, sand or graphite by applying the powder to a depth of 1/2 inch or more over the burning metal. Do not use foam, water, carbon tetrachloride or carbon dioxide.

- (1) Magnesium alloys are similar in appearance to aluminum alloys. Magnesium weighs 2/3 as much as aluminum; for this reason, magnesium alloys are used in the structure in certain low stress applications with resultant saving in weight of the airplane.
- (2) Magnesium alloys can be machined with tools designated for use on steel or brass, provided cutting edges are sharp.
- (3) Magnesium alloys must not be used where contact with methyl alcohol is possible. Do not use magnesium parts in integral fuel tank areas.
- (4) Use Type B rivets (5056-F aluminum alloy) in magnesium alloy parts and use clad 2024-T3 aluminum alloy for repair parts.

E. Corrosion Resistant Steel.

- (1) Corrosion resistant steel plating is used in some areas of the airplane structure where high strength is required.
- (2) Steel is cathodic to magnesium and aluminum and must be insulated from them when making repairs.

WINGS

1. Description

- A. The wings are all-metal, full cantilever, semimonocoque type construction, utilizing two main spars. Each wing consists of a wing panel, aileron, flaps, engine nacelle, wet wing fuel tank, and main landing gear. The landing gear is attached to and retracts into the wing.

2. Wing Skin

- A. All wing, aileron and flap skin thickness and temper are listed in Figure 1.

B. Repairable Damage - Wing Fuel Tank Area.

- (1) To reduce the possibility of an explosion during repair, nonsparking tools, air motors, plastic scrapers, vapor-proof lights, etc., must be used. The wing tank must be completely drained, allowed to air dry and all fuel vapors exhausted prior to repair.
- (2) Damage that is extensive to the bonded fuel tank area should be repaired by replacing the entire skin panel, and all skins and rivets sealed. When the waffle ribs are damaged, the skin must be replaced.

C. Damage Requiring Replacement of Parts.

- (1) Where damage repair is impractical, the entire part should be replaced.

3. Wing Ribs

- A. Flanged upper and lower edges of all ribs serve as cap-strips in addition to providing rigidity to the rib. The skin riveted or bonded directly to each rib flange provides the cellular strength for each successive rib bay. The nose, center and trailing edge rib segments are riveted together through the front and rear spars to form the basic airfoil sections. Spanwise alclad stringers stiffen the skin between ribs.

- B. Repairable Damage - Refer to Chapter 15-40 for typical damage repair to wing ribs.

4. Wing Spars.

- A. Repair of spar damage affecting the alignment of the wing spar should not be attempted in the field.
- B. Repair of spar damage caused by exhaust corrosion should be done in accordance with Figure 1A.

5. Flaps and Ailerons.

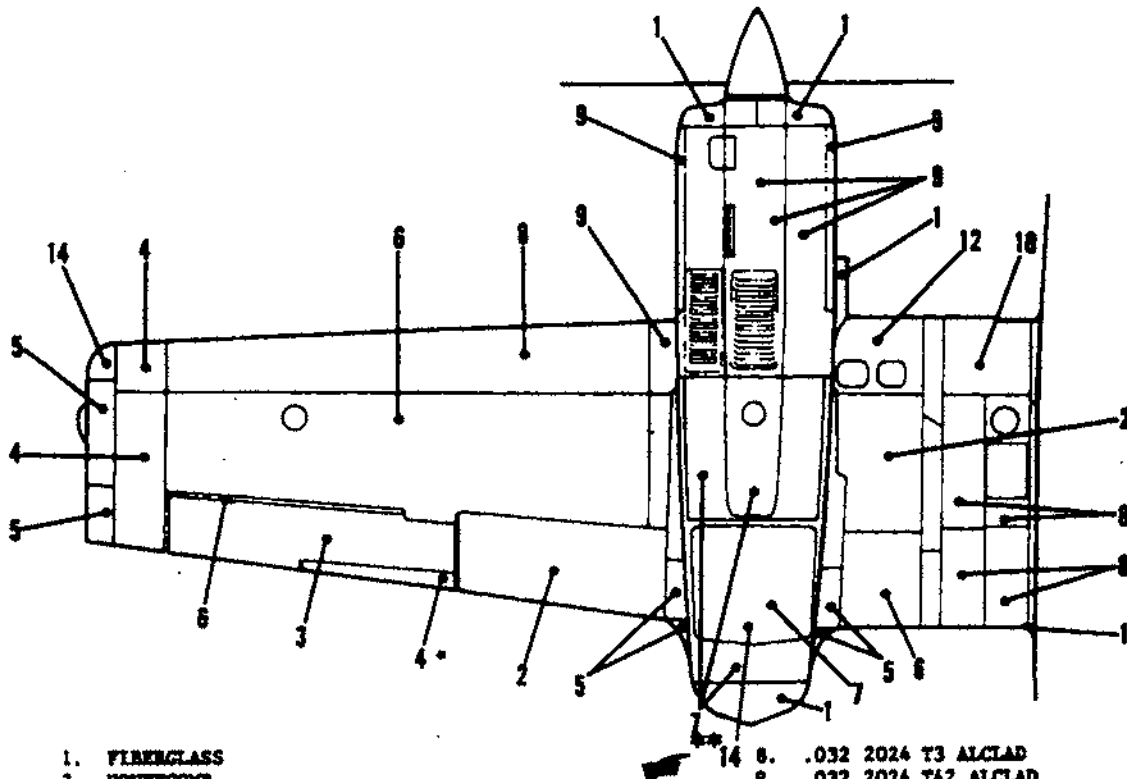
A. Flap Repairable Damage.

- (1) Any skin damage, such as scratches, set marks, cuts, pits and abrasions no greater than 15 percent of the skin thickness, can be repaired by blending and polishing. Refer to Skin Repairs, Chapter 15-40.
- (2) Any skin damage, such as scratches, set marks, cuts, pits and abrasions greater than 15 percent of the skin thickness and skin cracks, can be repaired by patching. Refer to Special Repairs, Chapter 15-40.
- (3) Hinges should be replaced.

NOTE: Replaceable items are items which can be ordered from the parts catalog.

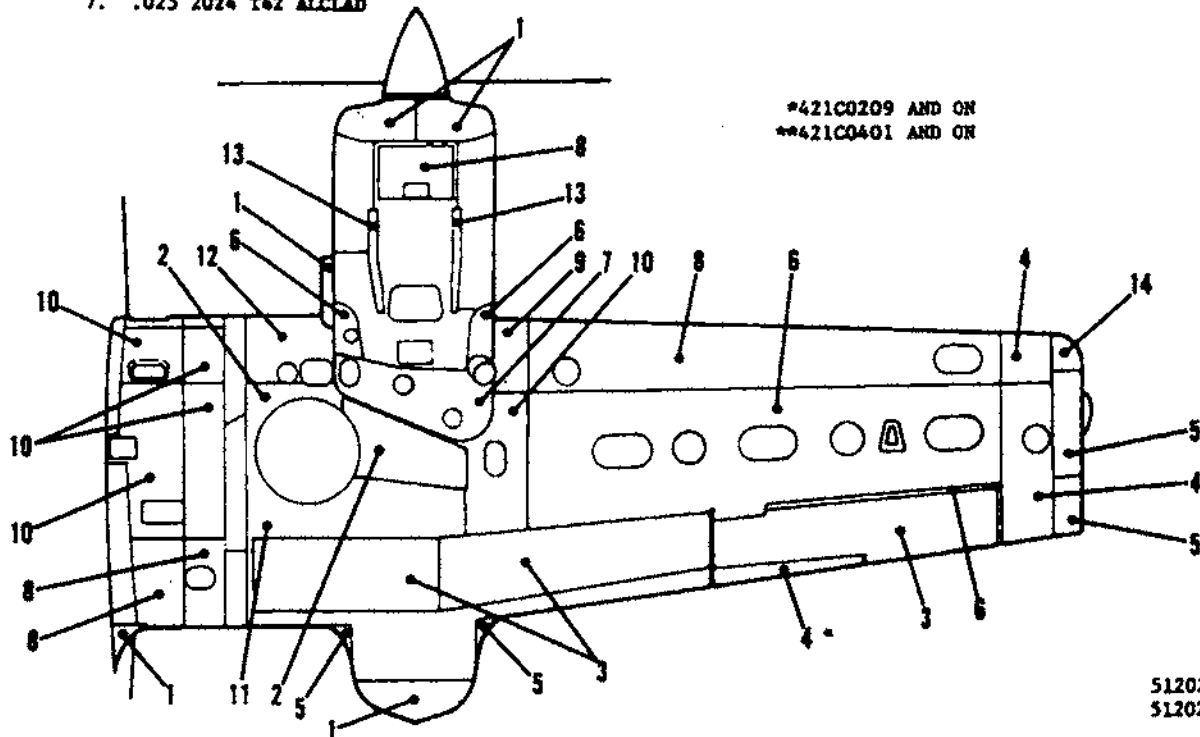
B. Aileron Repairable Damage.

- (1) Any skin damage, such as scratches, set marks, cuts, pits and abrasions no greater than 15 percent of the skin thickness, can be repaired by blending and polishing. Refer to Skin Repairs, Chapter 15-40.



1. WINDSHIELD
2. COWLING
3. .016 2024 T3 ALCLAD
4. .020 2024 T3 ALCLAD
- 4*. .016 2024 T3 ALCLAD
5. .020 2024 T42 ALCLAD
6. .025 2024 T3 ALCLAD
7. .025 2024 T42 ALCLAD

8. .032 2024 T3 ALCLAD
9. .032 2024 T42 ALCLAD
10. .040 2024 T3 ALCLAD
11. .040 2024 T42 ALCLAD
12. .050 2024 T42 ALCLAD
13. .071 2024 T42 ALCLAD
14. .032 6061 T62 ALCLAD



*421C0209 AND ON
**421C0401 AND ON

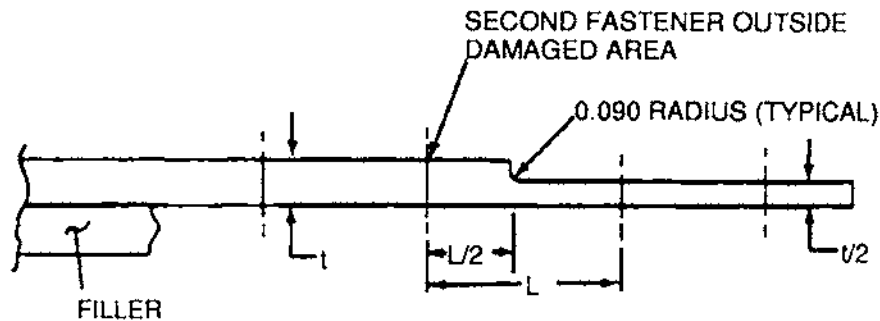
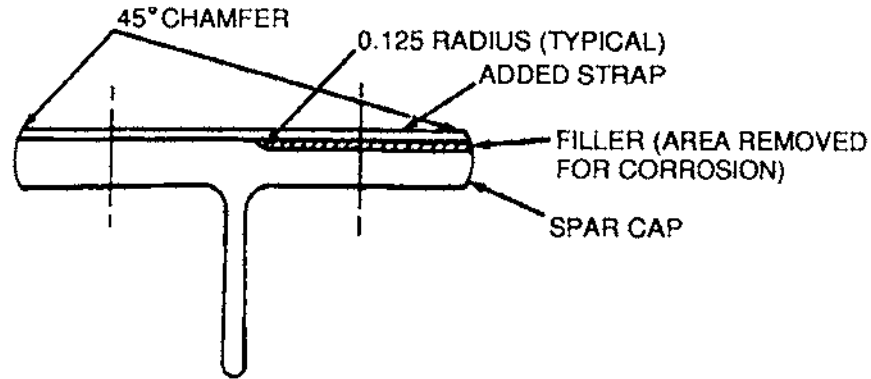
Wing Skin
Figure 1

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A52252

TYPICAL SPAR CAP REPAIR FOR FRONT AND REAR,
UPPER AND LOWER SPAR CAPS.



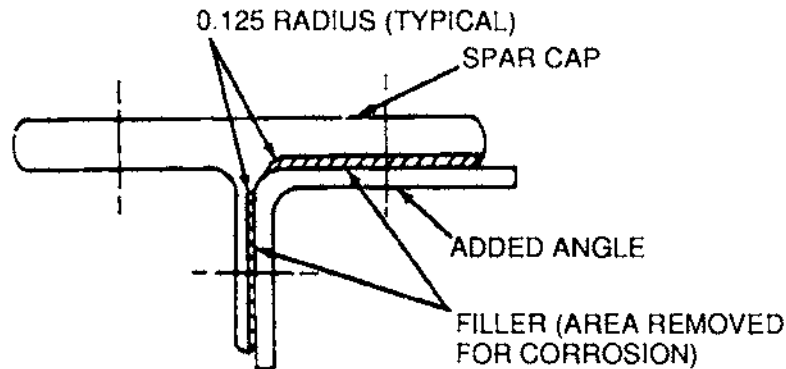
IF THE BLENDED OUT REPAIR AREA DOES NOT EXCEED THE REWORK LIMITS AND THE SPAR CONDUCTIVITY IS IN THE ACCEPTABLE RANGE, APPLY CORROSION RESISTANT PRIMER TO BLENDED AREA. ADD A STRAP AND FILLER AS SHOWN FOR DAMAGE IN INDICATED AREA. STRAP SHALL HAVE A MINIMUM THICKNESS OF 0.050 INCH, BUT NOT TO EXCEED 0.063 INCH. LENGTH OF THE STRAP SHALL BE DETERMINED BY THE REQUIREMENT TO PICK UP SIX EXISTING FASTENERS PER FLANGE ON EITHER SIDE OF DAMAGED AREA. STRAP AND FILLER SHALL BE MADE FROM 2024-T3 OR 7075-T73 WITH GRAIN DIRECTION PARALLEL TO SPAR. THE SAME TYPE AND SIZE FASTENERS ARE TO BE USED AT ALL LOCATIONS UNLESS REQUIRED TO GO TO THE NEXT SIZE DIAMETER. A MINIMUM EDGE DISTANCE OF 1.5 TIMES DIAMETER IS TO BE MAINTAINED. ALL FAYING SURFACES SHOULD BE CLEANED WITH NAPHTHA AND BONDED WITH EA9309 ADHESIVE. APPLY CORROSION RESISTANT PRIMER TO STRAP AFTER INSTALLATION.

14142040

Repair for Exhaust Gas Corrosion on Wing Spar Caps
Figure 1A (Sheet 1)

A52253

TYPICAL SPAR CAP REPAIR FOR FRONT AND REAR,
UPPER AND LOWER SPAR CAPS.



IF THE BLENDED OUT REPAIR AREA DOES NOT EXCEED THE REWORK LIMITS AND THE SPAR CONDUCTIVITY IS IN THE ACCEPTABLE RANGE, APPLY CORROSION RESISTANT PRIMER TO BLENDED AREA. ADD ANGLE, AS SHOWN, FOR DAMAGE IN INDICATED AREA. THE FILLER SHALL REPLACE MATERIAL REMOVED AND BE MADE FROM THE SAME MATERIAL AS ANGLE.

GRAIN DIRECTION OF ANGLE SHALL BE PARALLEL TO THE SPAR. LENGTH OF ANGLE IS DETERMINED BY THE REQUIREMENT TO PICK UP SIX EXISTING FASTENERS PER FLANGE BEYOND THE DAMAGED AREA AT BOTH ENDS OF THE ANGLE. FORMED ANGLE SHALL BE BENT WHILE IN THE ANNEALED CONDITION (2024-0) TO A BEND RADIUS OF 0.16 INCH; THEN HEAT TREATED TO THE T42 CONDITION. THE SAME TYPE AND SIZE FASTENERS ARE TO BE USED AT ALL LOCATIONS UNLESS REQUIRED TO GO TO THE NEXT SIZE DIAMETER. A MINIMUM EDGE DISTANCE OF 1.5 TIMES DIAMETER IS TO BE MAINTAINED. ALL FAYING SURFACES SHOULD BE CLEANED WITH NAPATHA AND BONDED WITH EA9309 ADHESIVE. APPLY CORROSION RESISTANT PRIMER TO ADDED ANGLE AFTER INSTALLATION.

14142040

Repair for Exhaust Gas Corrosion on Wing Spar Caps
Figure 1A (Sheet 2)

- (2) Any skin damage, such as scratches, set marks, cuts, pits and abrasions greater than 15 percent of the skin thickness and any skin cracks or trailing edge damage, can be repaired by patching. For repairs, refer to Special Repairs, Chapter 15-40.
- (3) Hinge brackets should be replaced.

NOTE: Flight control surfaces must be balanced in accordance with balancing procedures after repair or painting. Refer to Chapter 1-90.

NOTE: Replaceable items are items which can be ordered from the parts catalog.

6. Landing Gear

- A. The main gears are carried by the wings and are housed within the wing wheel wells when retracted. The nose gear retracts into the fuselage nose wheel well. Doors covering the wells are regarded as parts of the landing gear assemblies but the wells are structural features of the wings and fuselage.
- B. Repairs of Landing Gear.
 - (1) The landing gear assemblies are composed of parts that are not regarded as repairable. Minor repairs are permissible on the doors but when they are reinstalled there must be no distortion that will prevent perfect operation.

7. Engine Firewall

A. Repair of Stainless Steel Firewall.

- (1) The firewall may be repaired by using the clear-of-structure-type patch, as shown in Figure 20, 15-40, providing the patch is of the same thickness as the firewall and monel rivets are used. Maximum diameter of holes that can be patched is 2 inches. The holes should be routed and repaired. Cracks should be stop drilled and repaired. Parts having cracks extending to the edge of the part must be replaced. Maximum allowable length of cracks to be repaired is 3 inches.

8. Engine Firewall Sealing

A. The engine firewall should be sealed with pro-seal #700 (Coast Pro-Seal Company) using the following procedures:

- (1) Clean area on surface to be sealed with solvent.
- (2) Mix 1 part of Pro-seal #700 curing agent with 100 parts of Pro-seal #700 sealant.

NOTE: Sealant should be mixed by weight. It is important that accelerator be completely and uniformly dispersed throughout the base compound.

- (3) Using a spatula, caulking gun, or flow gun, apply a fillet of sealer along cracks, seams, joints and row of rivets.

NOTE: If the sealing is applied before the parts are mated, use enough sealing compound to completely fill the joint and wipe away the excess after parts are mated.

NOTE: If the sealant is applied with a brush or a brush flow gun, more than one coat of sealant will be necessary on very porous material. The sealant should be allowed to air dry 10 minutes between coats.

- (4) Pro-seal #700 is the only sealant authorized for the stainless steel firewall. If sealant other than pro-seal #700 has been used it should be removed from the firewall and resealed using only the recommended sealant.

9. Engine Mount.

- A. Replacement of mount is the only recommended procedure.

9A. Repair of Exhaust Gas Corrosion on Wing Spar Caps (Refer to Figure 1A)**A. Wing spar caps damaged by exhaust gas corrosion can be repaired within the following limits:**

- (1) Removal of up to 20 percent of the upper spar cap flange thickness is permissible. If the repair requires removal of more than 20 percent of the upper spar cap flange material or if the corrosion is in the vicinity of the rear spar splice, spar cap replacement will be required. For an alternative to spar cap replacement, contact Cessna Propeller Product Support for an evaluation of the corrosion damage prior to replacement. An alternative repair may be possible.
- (2) Removal of up to 10 percent of the lower spar cap flange thickness is permissible. If the repair requires removal of more than 10 percent of the lower spar cap flange material or if the corrosion is in the vicinity of the rear spar splice, spar cap replacement will be required. For an alternative to spar cap replacement, contact Cessna Propeller Product Support for an evaluation of the corrosion damage prior to replacement. An alternative repair may be possible.

B. Repair Instruction.

- (1) Remove corrosion including pits, using 320 grit sandpaper or equivalent material while maintaining limits in Steps A.(1) and A.(2). Blend the damaged area to get a smooth length-to-depth ratio between the corrosion damage and immediate surrounding area. Remove all corrosion. Make sure that only enough material is removed to get a lengthwise blending transition ratio of 20 to 1 and along the width with a blending length-to-depth ratio of 5 to 1. Polish the blended area to a high luster.

Example: If corrosion depth equals 0.005 inch:

Length of blended area = 0.005 inch X 20 = 0.1 inch

Width of blended area = 0.005 inch X 5 = 0.025 inch

- (2) Perform electrical conductivity calibration and testing of repaired wing spar.

(a) Instrument calibration shall reflect the conductivity range of the components to be inspected.

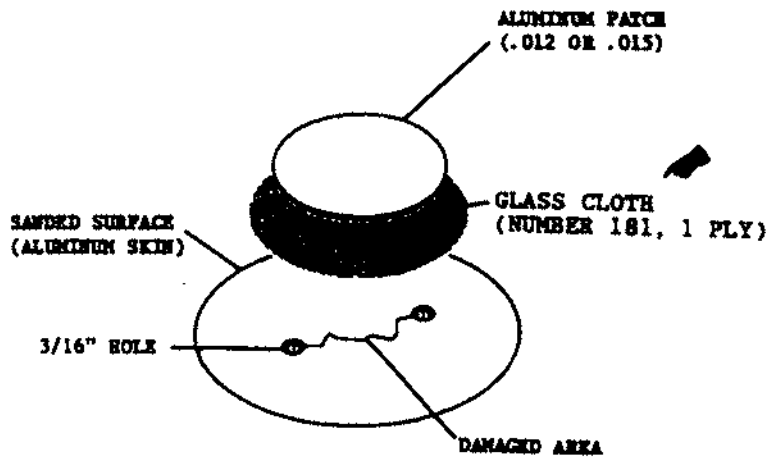
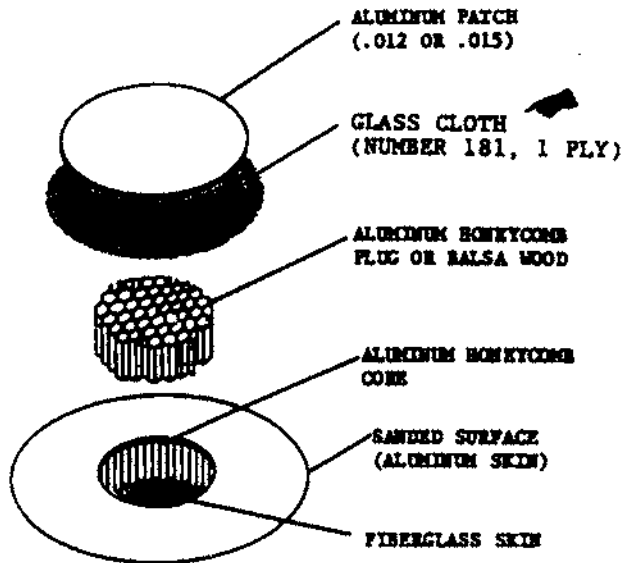
- 1) Calibration shall be accomplished using low and high conductivity standards possessing conductivity ranges of 25.0% to 32.0% International Annealed Copper Standard (I.A.C.S.) and 38.0% to 62.0% International Annealed Copper Standard (I.A.C.S.), respectively.
- 2) The ambient temperature differential of the area to be inspected and the test system (test instrument, probe and standards) shall not exceed plus 5° Fahrenheit or minus 5° Fahrenheit prior to calibration and inspection.

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- 3) Instrument calibration shall be in accordance with the manufacturer's instructions.
 - 4) Instrument calibration shall be verified after completion of the inspection.
- (b) Perform conductivity inspection of repaired wing spar. (Refer to Mil-Std-1537, Electrical Conductivity Test for Measurement of Heat Treatment of Aluminum Alloy, Eddy Current Method.)
- 1) Record values of conductivity mapping in the repaired areas.
 - 2) With a properly calibrated instrument, obtain electrical conductivity values on the wing spar in the repaired area. This value should fall between 30.0% and 35.0% IACS. If the value does not fall within this range, obtain another measurement from an adjacent area. If the second value is below 30.0% or above 35.0% IACS, mark the area, spar cap replacement will be required. For an alternative to spar cap replacement, contact Cessna Propeller Product Support for an evaluation of the corrosion damage prior to replacement. An alternative repair may be possible.

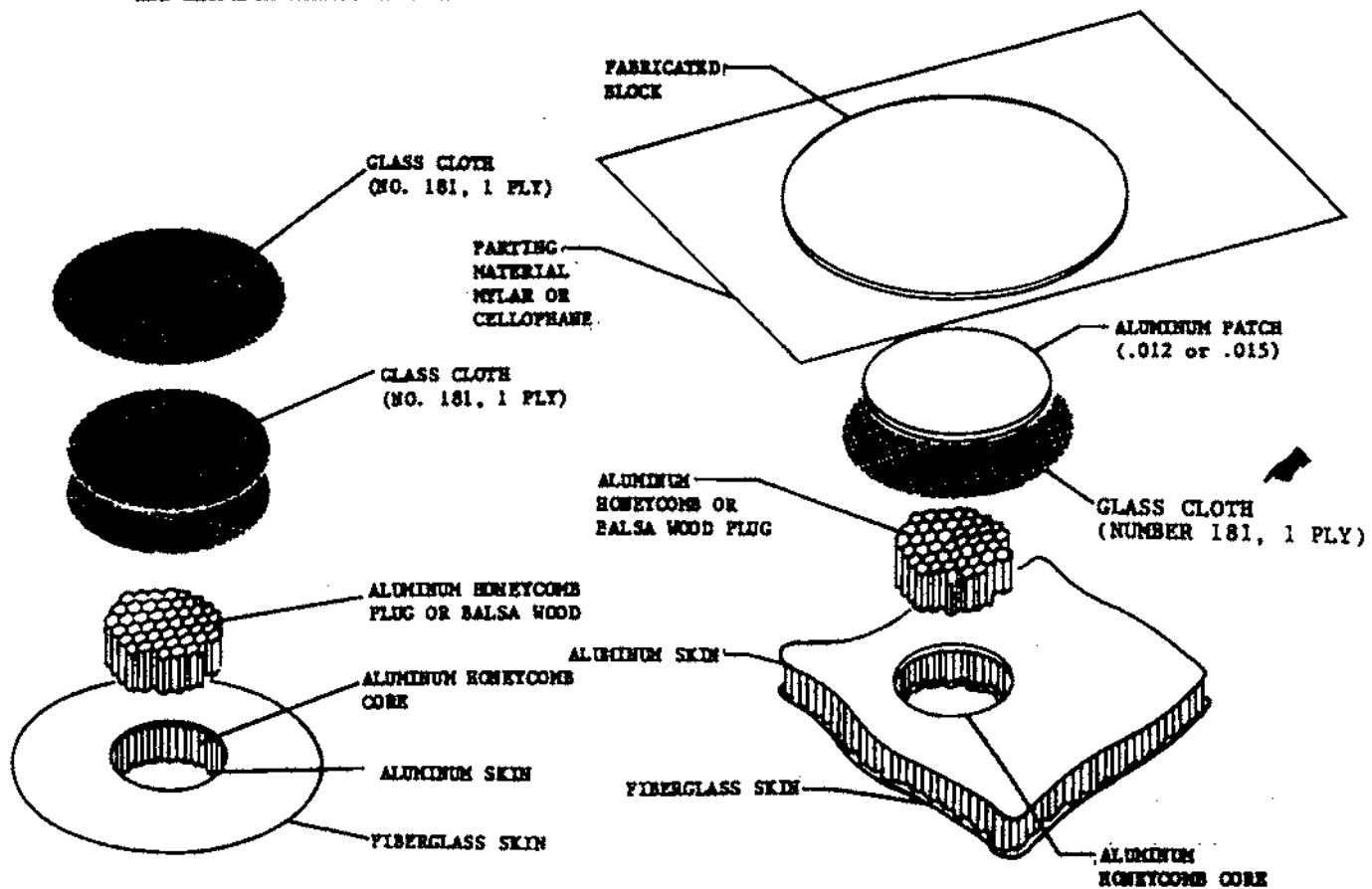
Tools and Equipment

Number	Item	Manufacturer	Use
AutoSigma 3000	Conductivity Instrument and 0.5" diameter 60kHz probe	Krautkramer, Inc. 50 Industrial Park Rd P.O. Box 350 Lewis Town, PA 17044 Phone: 717-242-0327 Fax: 717-242-2606	Perform Conductivity Inspection
See Step B.(2)(a) for requirements	Calibration Standards	Any	Calibrate instrument



CLASS 1: DAMAGE RESULTING IN CRACK

CLASS 2: DAMAGE THROUGH ALUMINUM OUTER SKIN AND ALUMINUM HONEYCOMB CORE



CLASS 2: DAMAGE THROUGH FIBERGLASS INNER SKIN AND ALUMINUM HONEYCOMB CORE

CLASS 3: DAMAGE THROUGH ALUMINUM HONEYCOMB CORE, ALUMINUM AND FIBERGLASS SKINS

Repair of Honeycomb Skin
Figure 2

10808003
10801006

§10. Repair of Engine Cowling

- A. Skin, if damaged extensively, should be repaired using rivets with a section of original manufacture. Small damaged areas should be reinforced with a doubler installed on the inner side. Material selected should be of the same thickness and characteristics as the original part.

§11. Repair of Cowling Reinforcement.

- A. Cowling reinforcements, if damaged, should be replaced using rivets. Due to their small size and complex angles they are easier to replace than to repair.

§12. Repair Procedures for Bonded Honeycomb (See Figure 2).

- A. Skins using a sandwich type honeycomb construction may sometime during the life of the airplane have damage to the skin and/or honeycomb which will require repairs. In the event damage does occur, the following repair procedures have been developed with the objective of equaling, as nearly as possible, the strength of the original part with a minimum loss of aerodynamic characteristics, electrical properties and minimize increase in overall weight.
- B. Damages to sandwich honeycomb construction are divided into classes according to severity and possible effect upon the airframe structure. Damage classifications are as follows:

- Class 1. Dents, scars, scratches, cracks, etc., in the facings not accomplished by a puncture or a fracture.
- Class 2. Punctures or fractures on one facing only, possibly accompanied by damage to the honeycomb core but without damage to the opposite facing.
- Class 3. Holes or damage extending completely through the sandwich, affecting both facings and the core.
- Class 4. Adhesive voids between skin and honeycomb core.

WARNING: SOLVENTS USED MUST BE STORED IN, TRANSPORTED IN, AND USED FROM SAFETY CONTAINERS. ADEQUATE VENTILATION MUST BE PROVIDED IN STORAGE AND USAGE AREAS. THE SOLVENTS SPECIFIED ARE FLAMMABLE AND CAUTION TO PREVENT FIRES MUST BE TAKEN. NO SMOKING, SPARKS OR OPEN FLAMES SHALL BE PERMITTED IN THE IMMEDIATE AREA WHERE THE SOLVENTS ARE BEING USED. STORAGE AND USAGE AREAS SHALL BE FREE FROM EXCESSIVE HEAT, SPARKS, AND OPEN FLAMES WHEN POSSIBLE AND PRACTICAL, RUBBER GLOVES SHALL BE WORN WHEN PERFORMING SOLVENT OPERATIONS.

- C. Repair of Class 1 damage shall be as follows:

- (1) Class 1 damage resulting in a hole not exceeding 1-1/2 inches diameter, dents, scratches or scars of .030 inch deep shall be repaired as follows:
 - (a) Remove paint to bare metal using either 400 or 600 grit wet sandpaper.
 - (b) Mask area adjacent to sanded area.
 - (c) Mix thoroughly equal portions, by volume, of Epon 828 and Versamid 125. Add aluminum powder until a thick non-flowing paste is obtained.

NOTE: Prepare only that quantity of material that will be used in 30 minutes.

- (d) Fill damaged area with mix and smooth with a putty knife or spatula.
- (e) Allow the mix to cure at room temperature until hard (approximately 4 hours).
- (f) Wet sand the repaired area with 400 grit wet sandpaper until smooth.
- (g) Clean the repaired area with a clean cloth moistened with Isopropyl Alcohol, Naphtha or Toluene. Allow to air dry.
- (h) Brush a minimum of two coats of nonchromated primer over the repaired area, allowing each coat to dry.
- (i) Refer to Chapter 1 and paint in accordance with applicable finish specifications.
- (2) Class 1 damage resulting in cracks shall be repaired as follows:
 - (a) Stop drill crack at both ends with 3/16 inch diameter holes.
 - (b) Prepare a circular external patch, which will extend one inch beyond damage area from .012 or .015 aluminum.

- (c) Remove all paint and primer around damage area by sanding with 400 or 600 grit wet sandpaper.

NOTE: Sanded area must be approximately 1/2 inch wider than aluminum patch.

- (d) Lightly sand entire damage area with 400 grit sandpaper until a satin finish is obtained. Mask off around damage area.
- (e) Wipe damage area with a clean cloth moistened with Isopropyl Alcohol, Naphtha or Toluene. Wipe dry with a clean cloth.
- (f) Mix thoroughly 100 parts (by weight) Epon VIII Adhesive with 6 parts (by weight) of curing agent "A".

NOTE: Prepare only that quantity of material that will be used in two hours.

- (g) Work some of the prepared adhesive in the crack and drilled holes. Apply a thin film over sanded surface.
- (h) Prepare a one-ply No. 181 glass cloth or similar scrim cloth 1/8 inch wider than aluminum patch.
- (i) Apply a thin film of the adhesive on the aluminum patch and, then place cloth between patch and damaged assembly and apply sufficient pressure to assure positive contact.
- (j) Using mylar or cellophane over aluminum patch, place a clamping device on patch to insure complete contact of all bonding surfaces.
- (k) Remove excess adhesive with a clean cloth dampened with Naphtha or Toluene.
- (l) Cure at 150° to 200°F using heat lamps or oven.
- (m) Remove clamps, pressure pads, etc., and sand away remaining excessive adhesive.
- (n) Brush a minimum of two coats of nonchromated primer over the repaired area, allowing each coat to dry.
- (o) Refer to Chapter 1, and paint in accordance with applicable finish specifications.

D. Repair of Class 2 damage shall be as follows:

- (1) Class 2 damage to skin resulting in damages that extend completely through the aluminum outer skin and into the aluminum honeycomb core but without damage to the inner skin:
 - (a) Carefully trim out skin to a circular or oval shape with a hole saw or fly cutter removing honeycomb core completely to the opposite skin.

CAUTION: EXTREME CARE SHOULD BE TAKEN NOT TO DAMAGE THE INNER SKIN.

- (b) Remove completely all the damaged honeycomb core.
- (c) Prepare either an aluminum honeycomb core or balsa wood replacement plug as follows:
 - 1) If balsa wood is used, fabricate plug so that the grain will be perpendicular to the skins.
 - 2) Lightly sand balsa plug with 400 grit sandpaper and wipe off dust with a clean cloth.

NOTE: Do not touch the bare surface with bare hands after sanding. If the balsa wood is cut too short, the distance between shall be shimmed up until positive contact is made with all surfaces.

- 3) Wrap balsa plug in clean waxed paper until ready for use.
- 4) When aluminum honeycomb plug is used, the core shall be the approximate density of the original core.
- 5) Cut aluminum honeycomb plug so that the top edge will be even with the adjacent skins and completely fills the damaged area.
- (d) Remove all paint and primer (approximately 1-1/2 inches larger in diameter than cutout) from around damage area with either 400 or 600 grit wet sandpaper.
- (e) Mask around sanded area and cut out area.

- (f) Mix thoroughly 100 parts (by weight) Epon VIII adhesive with 6 parts (by weight) of curing agent "A".

NOTE: Prepare only that quantity of material that will be used in two hours.

- (g) If balsa plug is being used, spread the adhesive lightly over all surfaces. If aluminum plug is being used, brush or trowel adhesive on the internal side of the existing skin and where the plug will make contact with core.
- (h) Position balsa wood or aluminum plug into place.
- (i) Prepare a circular external patch, which will be one inch larger than plug hole, from .012 or .015 aluminum.
- (j) Prepare a one-ply circular Number 181 glass cloth or similar scrim cloth 1/8 inch larger than plug hole.
- (k) Apply a thin film of adhesive over sanded surface and place the Number 181 glass cloth or similar cloth over the plug.
- (l) Clean the bond surface of aluminum patch and coat with adhesive.
- (m) Assemble patch over glass cloth and plug and apply sufficient pressure to assure positive contact.

NOTE: Care should be taken to insure that plug and glass cloth remain in place.

- (n) Using mylar or cellophane over aluminum patch, place a clamping device on patch to insure complete contact of all bonding surfaces.
- (o) Remove excessive adhesive with a clean cloth moistened with Naphtha or Toluene.
- (p) Cure at 150° to 200°F using heat lamps or oven.
- (q) Remove clamps, pressure pads, etc., and sand away excessive adhesive.
- (r) Brush a minimum of two coats of nonchromated primer over the repaired area, allowing each coat to dry.
- (s) Refer to Chapter 1, and paint in accordance with applicable finish specifications.
- (2) Class 2 damage to skin resulting in damage which extends completely through the fiberglass inner skin and into aluminum honeycomb core but without damage to the outer aluminum skin.
- (a) Carefully trim out skin to a circular or oval shape with a hole saw or fly cutter removing aluminum honeycomb core completely to opposite skin.
- (b) Prepare a balsa wood or aluminum honeycomb plug as stated in step (1)(c) above.
- (c) Sand undamaged fiberglass skin lightly approximately 2 inches out from around the hole.

CAUTION: DO NOT SAND THROUGH FIBERGLASS SKIN.

- (d) Prepare two No. 181 glass fabric patches, 1/8 inch larger than hole diameter.
- (e) Mix thoroughly 100 parts (by weight) Epon 828 and 10 parts (by weight) Diethylenetriamine (DTA).
- (f) Coat plugs with Epon 828 and DTA mix as described in step (1)(g).
- (g) Impregnate the two No. 181 glass patches with mixture to the content of approximately 50% and assemble patches over plug.

NOTE: Smooth out all wrinkles.

- (h) Prepare one No. 181 glass fabric patch large enough to cover sanded area and impregnate with mixture.
- (i) Assemble third patch over the two previous layers and remove all wrinkles as before.
- (j) Using mylar or cellophane, cover patches and apply a clamping device.
- (k) Cure assembly at 150° to 200°F for approximately 90 minutes.
- (l) Remove clamps, pressure pads, etc., and sand smooth to original contour.
- (3) Class 2 damage to skin which extends completely through aluminum skin and the aluminum honeycomb core shall be repaired as follows:
- (a) Repair damage as described under step (1)(d), except use Bloomingdale's BT-424 or Narmco's Matbond 302 adhesives.

- (b) The cure time for adhesives described in step (a) above, will be a minimum of 5 hours.
- (4) Class 2 damage to skin which extends completely through fiberglass skin and aluminum honeycomb core shall be repaired as follows:
 - (a) Repair damage as described under step (2)(d), except, use either Bloomington's HT-424 or Harnco's Metibond 302 adhesives.
 - (b) The skins shall be fabricated from either Cordo's Pyroreg AC, U.S. Polymeric's Poly Preg 502, or Harnco's 506 (color black).
 - (c) The reinforcement shall be 181-150 Valan.
 - (d) Cure time for adhesives described in step (a) above, will be a minimum of 5 hours.

E. Repair of Class 3 damage is as follows:

- (1) Class 3 damage to skin resulting in damage to both aluminum and fiberglass skins having a minimum damage size of 1.0 inch or maximum damage size of 4 inches.
 - (a) Prepare surfaces, plugs and patches as described in step D.
 - (b) Fabricate a temporary mold or block to hold the plug in place while aluminum outer skin is being repaired.
 - (c) Repair outer aluminum skin in accordance with step D.
 - (d) Remove temporary mold or block and repair fiberglass skin in accordance with step D, and flare in patch with existing skin contour.

F. Repair of Class 4 damage is as follows:

- (1) Class 4 repairs are those repairs needed to fill voids between aluminum core and skin surfaces.
 - (a) Drill sufficient 1/8 inch holes in the fiberglass inner skin adjacent to voids.
 - (b) Remove all burrs around drilled holes.
 - (c) Mix thoroughly 100 parts (by weight) Epon 828 with 10 parts (by weight) curing agent "D".

NOTE: Prepare only that quantity that can be used in one hour.

- (d) Using a syringe or pressure gun, inject resin mix into the aluminum honeycomb cells until they become filled.
- (e) Wipe off excess resin with a cloth that has been dampened with MIBK or MEK and cover the holes with masking tape.
- (f) Position the structure so that both skins will be in positive contact with resin.
- (g) Cure adhesive for 2 hours at 150° to 200°F.
- (h) Remove masking tape and sand away excess resin.

13. Repair of Bonded Skins, Doublers and Doors

- A. Bonded skins, doublers and doors that have negligible damage should be repaired with a skin or doubler of the same thickness and characteristics as the original part. Rivets may be used for the repair instead of bonding. If sealing is required, refer to Chapter 1-80.

14. Repair of Delamination of Bonded Skins and Doublers

- A. Delaminations or damaged skins and doublers may be repaired by installing rivets equally spaced as shown. Refer to Figure 29 thru 31, Chapter 15-40.

EMPENNAGE

1. Description.

- A. The all-metal tail group is of full cantilever design, consisting of the conventional arrangement of vertical stabilizer and rudder, horizontal stabilizer and elevators. The right elevator and the rudder both contain flight adjustable trim tabs, actuated by a system of cables and pulleys controlled from the pilot's tab control wheels.

2. Vertical Stabilizer and Dorsal Group.

- A. The vertical stabilizer and dorsal area are constructed jointly to form a single unit. Basically the unit consists of formed sheet metal spars and ribs to which the outer skin is attached. The front spar is reinforced at its root end and drilled to facilitate the installation of two attachment bolts. Stiffness to the entire stabilizer and dorsal assembly is provided by the attachment of the skins and the forward leading edge skin.

B. Repairable Damage.

- (1) Any skin damage such as scratches, set marks, cuts, pits and abrasions no greater than 15 percent of the skin thickness, can be repaired by blending and polishing. Refer to Skin Repairs, Chapter 15-40.
- (2) Any skin damage, such as scratches, set marks, cuts, pits and abrasions greater than 15 percent of the skin thickness and any skin cracks, can be repaired by patching. For repairs, refer to Special Repairs, Chapter 15-40.
- (3) Hinge brackets should be replaced.

NOTE: Replaceable items are items which can be ordered from the parts catalog.

3. Rudder.

A. Repairable Damage.

- (1) Any skin damage, such as scratches, set marks, cuts, pits and abrasions no greater than 15 percent of the skin thickness, can be repaired by blending and polishing. Refer to Skin Repairs, Chapter 15-40.
- (2) Any skin damage, such as scratches, set marks, cuts, pits and abrasions greater than 15 percent of the skin thickness and any skin cracks can be repaired by patching. For repairs, refer to Special Repairs, Chapter 15-40.
- (3) Hinge brackets and torque tube should not be repaired. These items should be replaced.

NOTE: Replaceable items are items which can be ordered from the parts catalog.

NOTE: Flight control surfaces must be balanced in accordance with balancing procedures after repair or painting. Refer to Chapter 1-90.

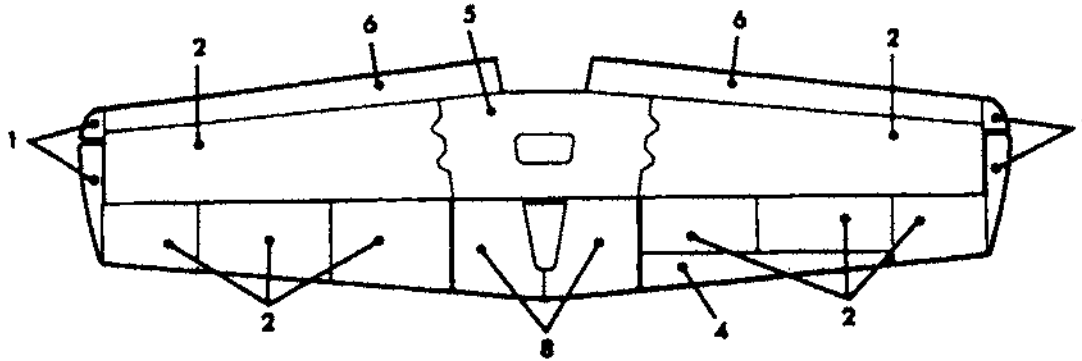
4. Horizontal Stabilizer.

- A. The horizontal stabilizer is constructed from rib caps, stringer, doublers and skins.

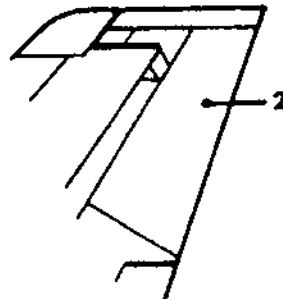
B. Repairable Damage.

- (1) Any skin damage, such as scratches, set marks, cuts, pits and abrasions no greater than 15 percent of the skin thickness, can be repaired by blending and polishing. Refer to Skin Repairs, Chapter 15-40.
- (2) Any skin damage, such as scratches, set marks, cuts, pits and abrasions greater than 15 percent of the skin thickness and any skin cracks, can be repaired by patching. For repairs, refer to Special Repairs, Chapter 15-40.
- (3) Hinge brackets should be replaced.

NOTE: Replaceable items are items which can be ordered from the parts catalog.



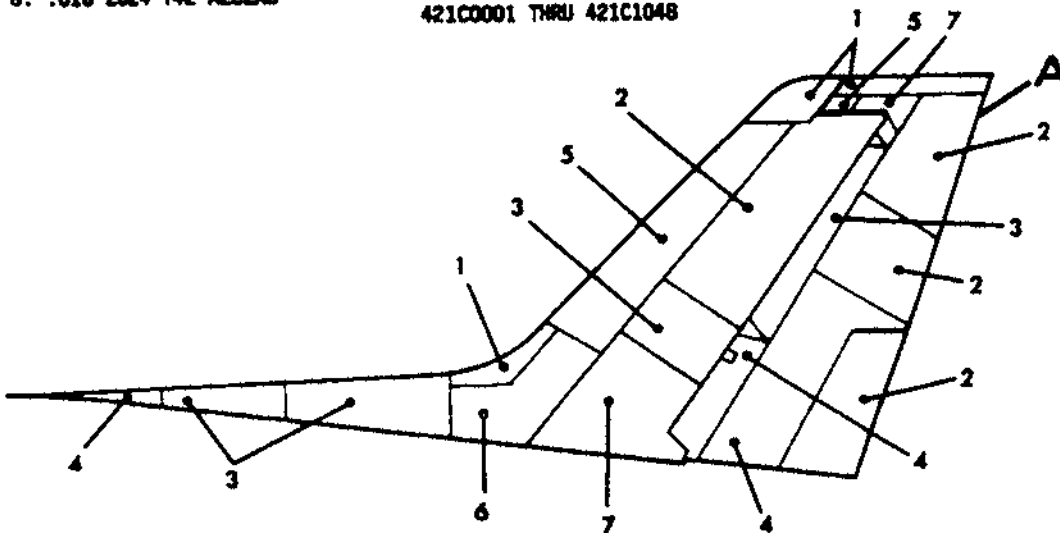
STABILIZER & ELEVATOR TOP VIEW



DETAIL A

421C0001 THRU 421C1048

1. FIBERGLASS
2. .016 2024 T3 ALCLAD
3. .020 2024 T3 ALCLAD
4. .020 2024 T42 ALCLAD
5. .025 2024 T3 ALCLAD
6. .025 2024 T42 ALCLAD
7. .032 2024 T3 ALCLAD
8. .016 2024 T42 ALCLAD



FIN & RUDDER LEFT SIDE
421C1049 AND ON

51302001
A51302001
51302003

Empennage Skin
Figure 1

5. Elevators.

A. Repairable Damage.

- (1) Any skin damage such as scratches, set marks, cuts, pits and abrasions no greater than 15 percent of the skin thickness can be repaired by blending and polishing. Refer to Skin Repairs, Chapter 15-40.
- (2) Any skin damage, such as scratches, set marks, cuts, pits and abrasions greater than 15 percent of the skin thickness and any skin cracks, can be repaired by patching. For repairs, refer to Special Repairs, Chapter 15-40.
- (3) Hinge brackets and torque tube should not be repaired, these items should be replaced.

NOTE: Replaceable items are items which can be ordered from the parts catalog.

NOTE: Flight control surfaces must be balanced in accordance with balancing procedures after repair or painting. Refer to Chapter 1-90.

FUSELAGE

1. Description

- A. The fuselage is of semimonocoque construction consisting of formed bulkheads, longitudinal stringers, reinforcing channels and skin. The fuselage forward section consists of all the fuselage structure from the nose to fuselage Station 100.00. The cabin structure consists of the fuselage structure from fuselage Station 100.00 to fuselage Station 289.94 and is pressurized to the skin. The tailcone section consists of the structure from fuselage Station 289.94 to 373.56. Formed bulkhead channels and extrusions constitute the frame members of the cabin section. Drilling or any type of repairs on the pressurized cabin must be accomplished in a manner that will not change structural integrity or the pressurization capabilities of the airplane. The following instructions should be followed in repairing the cabin section:

- (1) Skin patches should be of same gage as the original skin. Back up doublers should be of the next heavier gage material.
- (2) All lap joints and skin patches should have two rows of staggered rivets. Spacing not to exceed 0.75 inches.
- (3) Lay seal doublers and patches in accordance with sealing procedures.
- (4) All repair parts must be free of metal chips, burrs or scratches.
- (5) Rivets used should be of the same type and size as used in the original structure.
- (6) Do not countersink deeper than 75% of the material thickness.
- (7) The forward cabin pressure bulkhead at Fuselage Station 100.00 and the aft cabin pressure bulkhead at Fuselage Station 289.94 are fabricated of 0.040 2024-T3 material. Standard repairs may be made using material of same gage heat treat and alloy. Backup doublers should be of next heavier gage material.

2. Repairable Damage

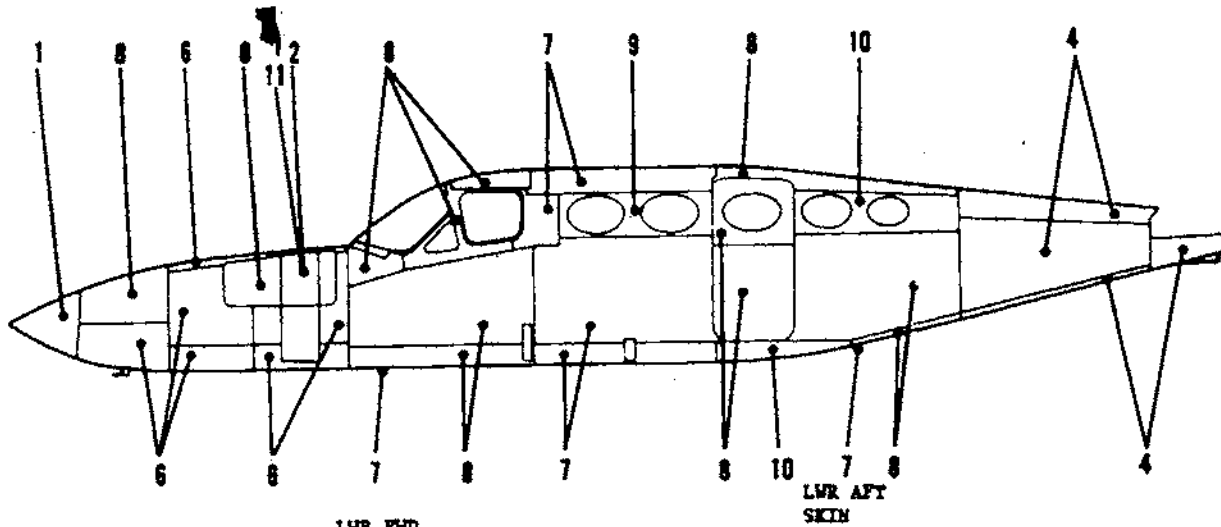
- A. Mild wrinkles occurring in the upper or lower skin panels in the bay forward of the horizontal stabilizers and which extend through the corners (shoulder areas) may be repaired by the addition of a stringer. A wrinkle, which is hand removable, should be reinforced by a 1/2 x 1/2 x .050 inch 2024-T42 extruded angle. The angle should be inserted fore and aft across the center of the wrinkle and should extend to within 1/16 to 1/8 inch of the fuselage bulkheads at the ends of the bay. If the wrinkles cannot be removed by hand, the damaged area should be repaired. Typical methods of repair of skins, bulkheads, stringers and channels are given in the back Chapter 15-40. Before repairing is attempted, all cracks or deep scratches must be stop drilled with a Number 30 drill and all sharp corners and ragged edges must be trimmed and deburred.
- B. All forgings and castings (made of any material) and structural parts (made of steel) must be replaced if damaged. Structural members of complicated construction that have been distorted or wrenched should be replaced. Major skin damage should be repaired by replacing the entire damaged sheet.

NOTE: Replaceable items are items which can be ordered from the parts catalog.

3. Cracked Bulkhead Webs or Flanges

- A. Acceptable methods of repairing various types of cracks occurring in service are shown in Special Repair, 15-40. Small holes (3/32-inch) should be drilled at the extreme ends of the cracks to prevent further spreading. Reinforcement should be added to carry the stresses across the damaged portion and stiffen the joints. The condition causing such cracks to develop at a particular point may be stress concentration at that point, in conjunction with repetition of stress (such as produced by vibration of the structure). The stress concentration may be due to defects such as nicks, scratches, tool marks and initial stresses or cracks from forming or heat treating operations.

NOTE: An increase in sheet thickness alone is usually beneficial but does not necessarily remedy the conditions leading to cracking. Patch type repairs are generally employed and are usually satisfactory in restoring the original material strength characteristics.



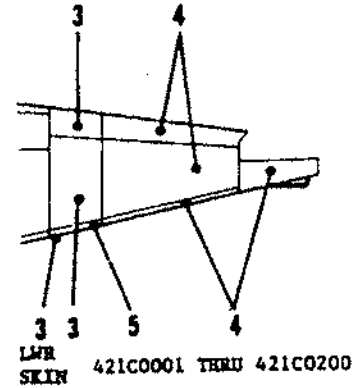
LWR FWD
SKIN

LWR AFT
SKIN

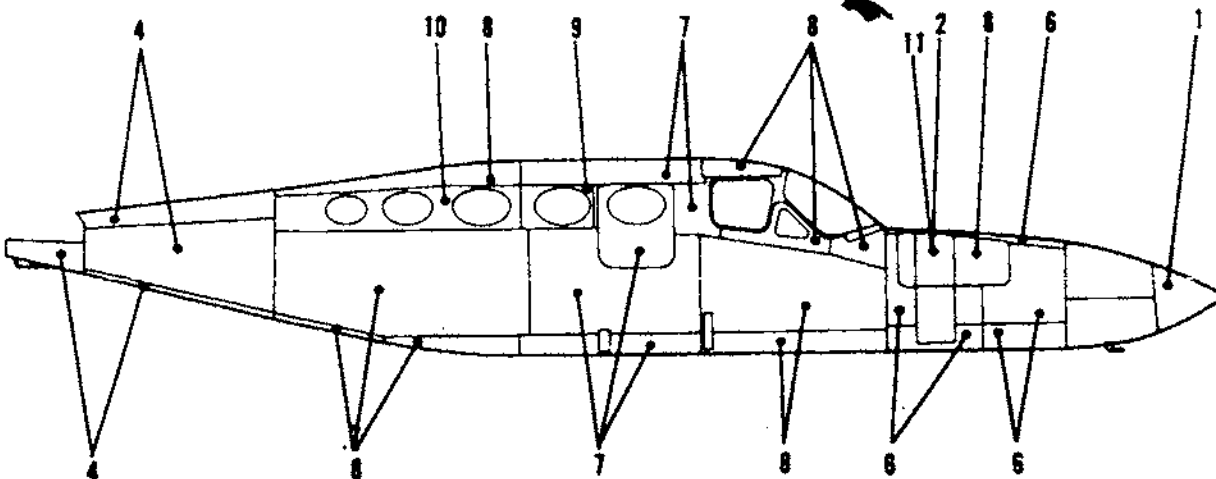
FUSELAGE LEFT SIDE

1. FIBERGLASS
2. POLYCARBONATE
3. .016 2024 T3 ALCLAD
4. .020 2024 T3 ALCLAD
5. .025 2024 T3 ALCLAD

6. .025 2024 T42 ALCLAD
7. .032 2024 T3 ALCLAD
8. .032 2024 T42 ALCLAD
9. .040 2024 T3 ALCLAD
10. .040 2024 T42 ALCLAD
11. KEVLAR (421C0401 AND ON)



LWR
SKIN 421C0001 THRU 421C0200



FUSELAGE RIGHT SIDE

Fuselage Skin
Figure 1

51103009
51103006
51103010

4. Severely Bent, Kinked or Torn Channels

- A. If practical, severely bent, kinked or torn portions of bulkheads should be removed and a replacement section installed and joined at the original splice joint. If this is not justified, cutting away the damaged portion and inserting a trimmed portion of the original section, adequately reinforced by splice plates or doublers, will prove satisfactory. This is known as an insertion type repair.

CESSNA AIRCRAFT COMPANY

MODEL 421

SERVICE MANUAL

SPECIAL REPAIRS

1. Fiberglass, ABS, PBC, PVPC and Graphite Parts.

- A. Repair kits for Fiberglass, ABS, PBC, PVPC and Graphite parts are available from Cessna Aircraft Company. Refer to Parts catalog for applicable repair kit.
- B. Fiberglass Parts Repair (Refer to Figure 1).
 - (1) The engine cowling nose caps, tail stringer, tail surface tips, fairings, heater ducts, and other parts of the aircraft are made of fiberglass.
 - (2) Repairable Damage.
 - (a) Damaged fiberglass parts may be repaired as shown in Figure 1. Cut and trim the area just beyond the noticeable damage. If the parts are painted, remove paint and sand clean an area at least two inches beyond the edge of the cutout. Prepare the necessary size and number of patches of glass cloth. Mix a sufficient amount of resin in accordance with the manufacturer instructions.

WARNING

ALWAYS FOLLOW THE MANUFACTURER MIXING INSTRUCTIONS CAREFULLY AS THE MIXING OF PEROXIDE AND COBALT TOGETHER WILL RESULT IN A SPONTANEOUS FIRE.

- (b) Be sure that your hands are free from oil, grease, and dirt. Apply an even coat of resin on the sanded area. Impregnate all the glass cloth patches by laying them on a clean paper and working the resin through the fabric with a small brush. Place the larger patch over the cutout area, working out all air bubbles and wrinkles. If the cutout is large enough to cause the patch to sag, place a suitable support behind the repair area. Coat the support with automobile wax or wax paper to prevent the resin from adhering to the support. Apply a second patch over the first patch, etc., working out all wrinkles and air bubbles. After all the patches have been applied, brush the area with an even coat of resin and allow to cure. Smooth the patch area with fine sandpaper until the desired finish is obtained. Repaint the finished area with matching paint.
 - (3) Damage Necessitating Replacement of Parts.
 - (a) When the fiberglass parts are torn or cracked over a large area or show signs of strain through the appearance of small cracks or shows signs of loss of rigidity, the parts shall be replaced.
2. Repair of Plastic Window Surfaces.
- A. Damaged window panels and windshield on this aircraft are replaced if damaged.

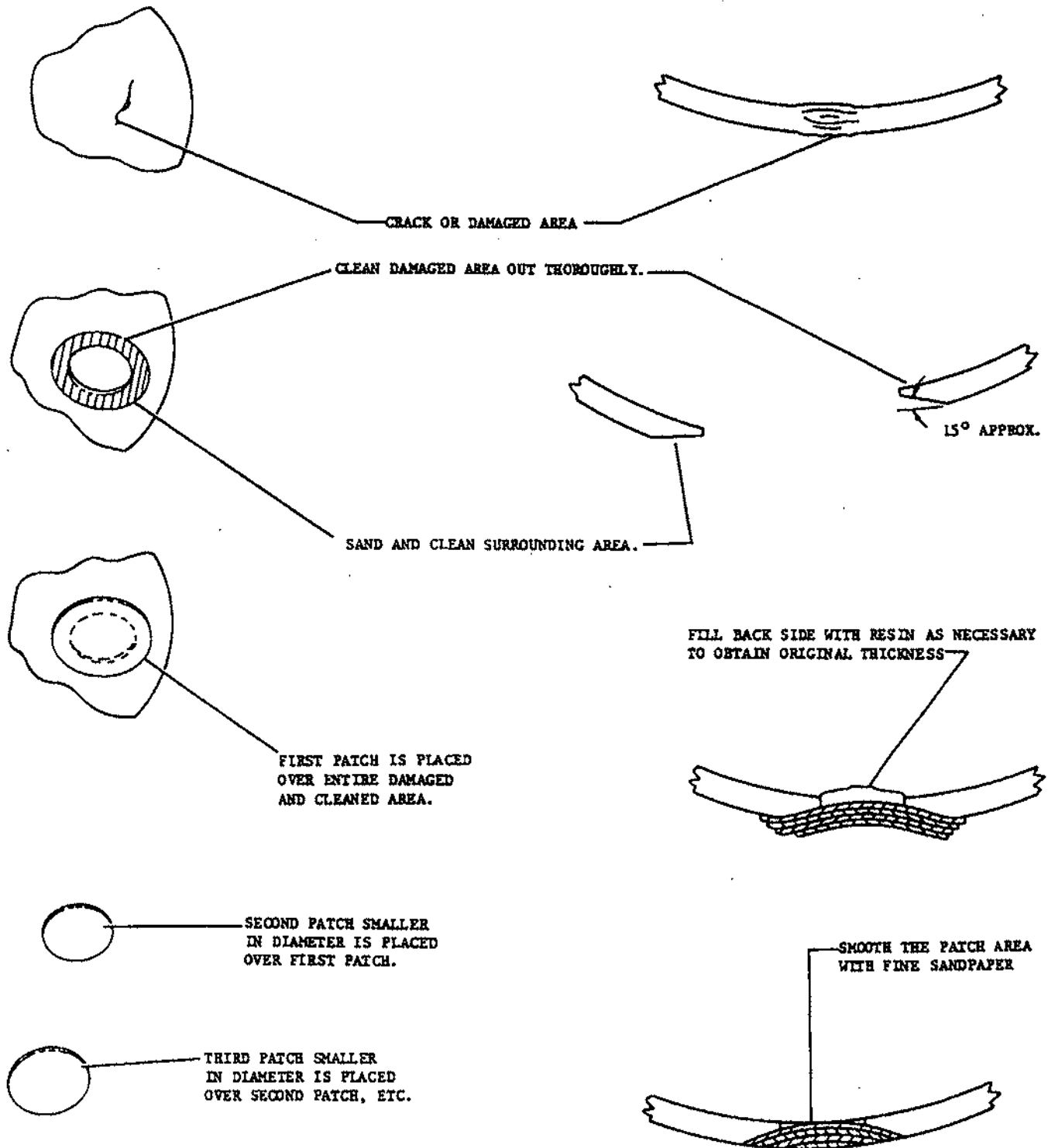
CAUTION

AIRCRAFT MUST BE OPERATED IN THE UNPRESSURIZED MODE UNTIL REPLACEMENT OF WINDOW OR WINDSHIELD CAN BE MADE.

3. Radome Repair Procedures

- A. Airplane C1801 and On have an abrasion film installed on the nose of the radome, which will have to be replaced when the radome is damaged in this area. Refer to abrasion film replacement. Remove radome in accordance with Chapter 3. Repair procedures are developed with the objective of equaling as nearly as possible the electrical and strength properties of the original part with a minimum increase in weight. This can only be accomplished by repairing damaged parts with approved materials and working techniques. For convenience in presentation and for clarity in designating repair procedures to be used, damages to radomes in this procedure shall be divided into classes according to severity, as follows:
 - (1) Class I Repair. Surface scratches, scars or erosion not penetrating through the first ply of fabric.
 - (2) Class II Repair. Punctures, delamination, contaminates, or fractures extending through the first ply.
 - (3) Class III Repair. Damage extending completely through face plys.
- B. Repair Techniques.
 - (1) Class I Repair. Surface scratches, scars or erosion not penetrating through the first ply shall be repaired as follows:
 - (a) Clean damage area thoroughly and carefully using a clean cloth saturated with Methyl n-Propyl Ketone or another approved cleaning agent.

NOTE: SEE FIBERGLASS PARTS PARAGRAPH
BEFORE ATTEMPTING A FIBERGLASS
REPAIR.



Fiberglass Repair
Figure 1

10802001

CESSNA AIRCRAFT COMPANY
MODEL 421
SERVICE MANUAL

- (b) Lightly sand the damage area, using No. 280 grit sandpaper and clean the sanded surface thoroughly using Methyl n-Propyl Ketone, Specification TTM-261.
- (c) Apply one or two coats (depending on severity of the abrasion) of the following material to the abraded surface:

Composition

Bostik 464-3-1 Surfacer
CA-142 Catalyst
TL-52 Thinner

Vendors

Bostik-Finch, Boston Street, Middleton, Mass.

Mixing Procedure

Mix in a ratio of 3 parts by volume 464-3-1 base to one Part CA-142 catalyst. Surfacer may be thinned with TL-52 to approximately 25 seconds #2 Zahn cup.

Bench Life

Approximately 30 minutes at room temperature.

- (d) Material may be applied by spray gun. The coating will dry to sand in 3 hours at normal temperatures. Sand with 320 grit sandpaper and reapply paint.
- (2) Class II Repair. Punctures, delamination extending through the outside face ply.
 - (a) Punctures outside the radar window, not exceeding one inch in diameter.
 - 1) Mix EA960F and apply to core area of damage. Allow to harden, sand smooth and paint.
 - (b) Punctures inside the radar window, not exceeding 1/2 inch in diameter.
 - 1) If face sheet and core are damaged beyond use, fill core area with EA960F, allow to harden, sand smooth and paint.
 - 2) If face sheet and core are not damaged beyond use, bond back together with the following adhesive mix:

Composition

EA9309 Adhesive Mix

Vendor

Hysol Division - The Dexter Corporation,
Olean, New York 14760.

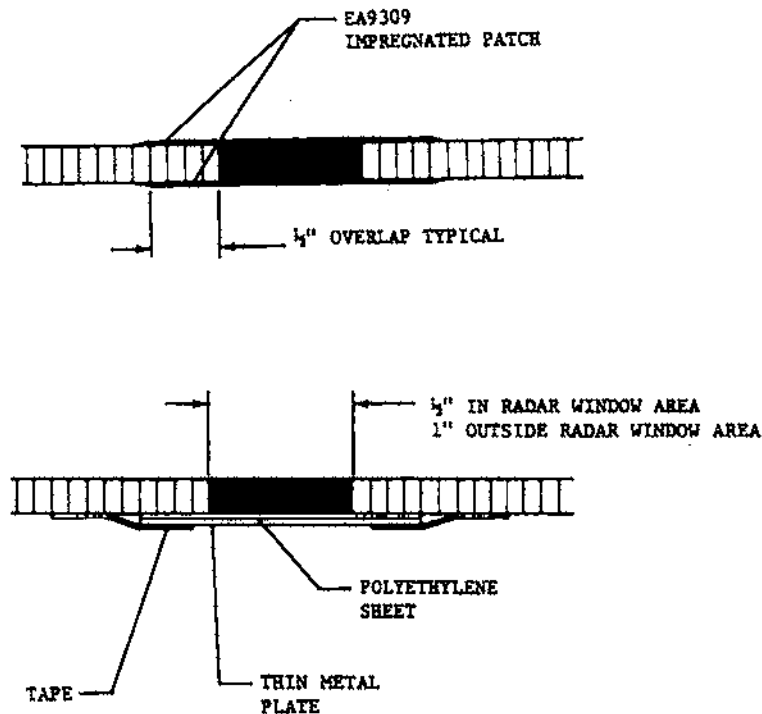
Mixing Procedures

Combine 100 parts "A" with 23 parts "B" by weight and mix thoroughly.

Bench Life

Approximately 40 minutes for one pound mass at 75° Fahrenheit.

- 3) Sand, paint and gloss surface at least 1/2 inch around damaged area. Apply sufficient adhesive to face sheet to rebond to core. Impregnate a patch of 181 or 1581 dry glass cloth with the EA9309 adhesive mix. The patch should be 1/2 inch larger than the damaged area. Apply this patch to damaged area. Over this tape a sheet of polyethylene until adhesive hardens. Remove, sand lightly and paint.
- (c) Delamination in the edge bond. Delamination in the attachment edge bond may be bonded back together with EA9309 adhesive. If several plies of glass cloth are damaged, remove and replace with equal number of 181 or 1581 glass. Impregnate the glass cloth with EA9309, apply and allow to harden. Sand to shape or fit and repaint.



10131005

Typical Class III Radome Repair
Figure 2

- (2) Class III Repair (See Figure 3). Damage through both face sheets. This damage covers 1/2 inch diameter in the radar window area and one inch outside the window area. Damage beyond these limits should require replacement of the radome.

(a) Remove damaged portion of face ply. Apply polyethylene sheet to core and backup with a thin sheet of metal. Tape in place. Apply EA960F to fill core flush. Allow to harden and remove sheet metal and polyethylene backup. Apply EA9309 impregnated patches over damaged area overlapping by 1/2 inch all around. Tape a polyethylene sheet over impregnated patches and rub polyethylene sheet to smooth the adhesive and remove air from patch. Allow to harden, remove polyethylene sheet and sand lightly.

4. Repair of Ice Protection Panels

A. The following repair procedures should be used for repairing the polycarbonate type ice protection panels. The illustrations in the figure show two types of cracks and method of repair.

B. Repairing Crack in Ice Protection Panel (See Figure 3)

- (1) Route the crack using router bit. Route material approximately 1/32 wide and 1/2 the depth of the panel thickness.
- (2) Clean routed crack with isopropyl or ethyl alcohol.
- (3) Fill crack with Epibond 1331 in accordance with manufacturer's instructions. Epibond 1331 may be procured from Furane Plastics, 4514 Brazil Street, Los Angeles, Calif. 90039.

C. Repairing Combination of Cracks in Ice Protection Panel (See Figure 4)

- (1) Cracks which do not extend to the outer edge of the ice protection panel shall be drilled through the ice protection panel with a Number 40 drill.
- (2) Fill the stop drilled hole with Epibond 1331 per manufacturer's instructions.

NOTE: Bondtite or Ditzler DX-666 may be used as an alternate for Epibond 1331.

NOTE: Normal finishing, priming and painting shall be accomplished following repairs. Refer to Chapter 1.

5. Cabin Door Seal Repair (421C0001 Thru 421C0350) (See Figure 5).

- A. When repairing the cabin door seal the work area must be clean and dirt free. The cabin door seal need not be removed from the cabin door, only remove enough seal in the damaged area to allow installation of rubber mold.

NOTE: Seals with damaged area of holes or gaps in excess of six inches in length should not be repaired. The seal should be replaced.

- (1) The following equipment will be necessary before attempting to repair the cabin door seal.
 - (a) SK421-2A available from Cessna Service Parts Center.
 - (b) Three each small "C" clamps.
 - (c) Blunt plastic tool (for removing and installing seal in cabin door retainer).
 - (d) Spatula.
- (2) Mark seal and seal retainer to insure proper reinstallation of seal in seal retainer.
- (3) Remove damaged seal from retainer.

CAUTION: USE EXTREME CARE IN REMOVING SEAL FROM SEAL RETAINER. USE ONLY PLASTIC TOOLS WITH BLUNT ENDS TO PREVENT ADDITIONAL DAMAGE TO SEAL.

- (4) Using buffing wheel or other suitable means, buff seal area to be repaired slightly and as required to obtain a smooth repairable surface.
- (5) If a large hole or gap exists in the seal, fill the void with a piece of foam rubber as shown in Detail B to help support the repair material.

NOTE: Make sure the sponge rubber extends at least 0.50 inch beyond ends of hole or gap and trimmed to mate inside surface of damaged area of seal.

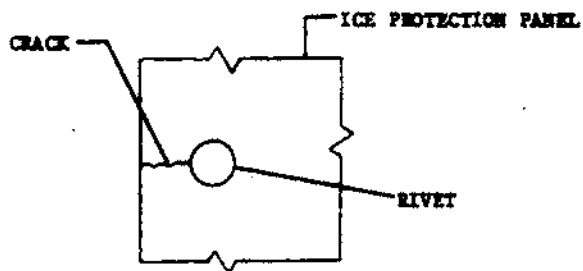
NOTE: Insure only enough sponge rubber (R411N closed cell rubber) is used to support the seal material, for each applicable repair. Excess sponge rubber results in cabin door being difficult to close.

- (6) Cut a piece of CM507 material - Dacron Fabric (included in SK421-2A) the width to extend 0.50 inch beyond ends of hole or gap in seal and long enough to wrap around seal as shown in Figure 5, Detail C.
- (7) Cut a piece of extrusion rubber mold (included in SK421-2A) long enough to cover and overlap ends of CM507 material - Dacron Fabric Patch as shown in Figure 5, Detail C.

NOTE: Fabricate (4) four metal plates 0.06 thickness same length and width as rubber mold.

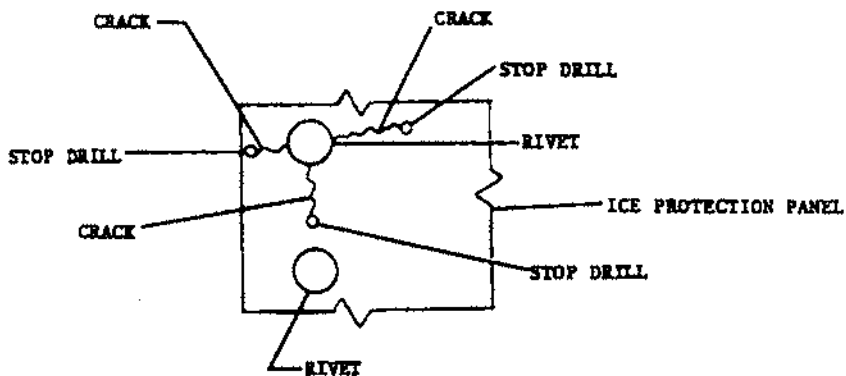
- (8) Clean the entire surface area to be repaired with alcohol and let dry.
- (9) Remove cellophane lines from cut piece of CM507 material - Dacron Fabric.
- (10) Apply a coat of Silastic Silicone Rubber 140 Adhesive approximately 0.005 thick to cleaned surface of seal and to cut piece of fabric spatula.
- (11) Allow applied Silastic Silicone Rubber 140 Adhesive to dry until tacky, but no longer, transfer to the knuckles when touched, (usually between 5 and 30 minutes).

NOTE: Use the back of the knuckle to touch the adhesive surface instead of finger tips to minimize contamination.



CRACK IN ICE PROTECTION PANEL

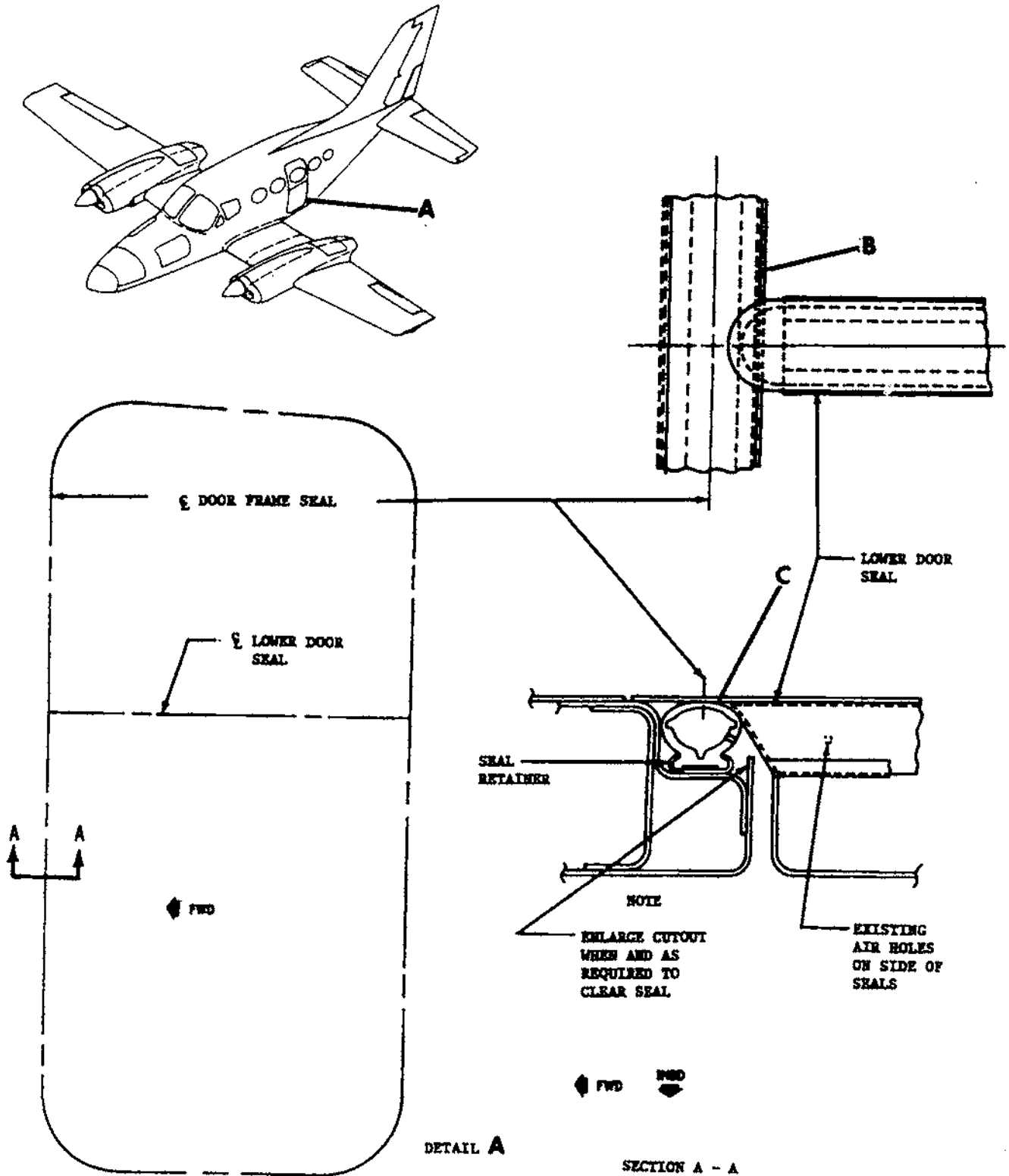
Repair of Cracks in Ice Protection Panel
Figure 3



COMBINATION OF CRACKS IN ICE PROTECTION PANEL

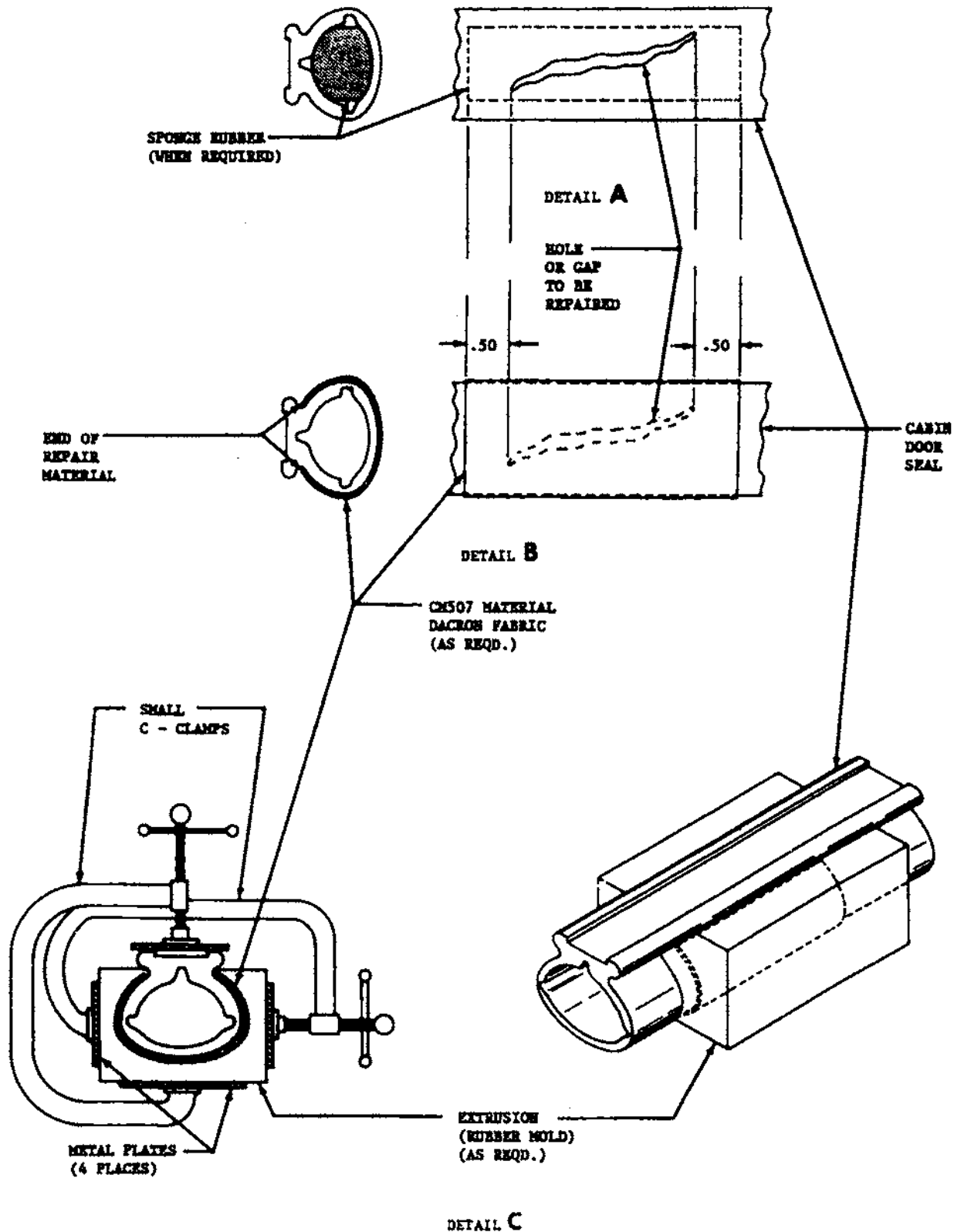
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Repair of Combination Cracks in Ice Protection Panel
Figure 4



Cabin Door Seal Repair (421C0001 Thru 421C0350)
Figure 5 (Sheet 1 of 2)

51103008
A



Cabin Door Seal Repair (421C0001 Thru 421C0350)
Figure 5 (Sheet 2)

- (12) Install CM507 material - Dacron Fabric Patch on seal with the adhesive surface mating and positioned over hole or gap per dimensions as shown in Figure 5, Detail B.
- (13) Insure that seal retains its symmetrical size and shape and that no wrinkles exist in patch or seal.
- (14) Apply a thin coat of parting agent (soap stone or talcum powder) to extrusion rubber mold to prevent seal sticking to rubber mold.
- (15) Place extrusion rubber mold over installed fabric patch as shown in Figure 5, Detail C.
- (16) Apply light pressure to fabric patch during curing of adhesive, using fabricated metal plates and small "C" clamps as shown in Figure 5, Detail C.

NOTE: When seal is only partially removed from retainer to make repair, support the seal and clamped rubber mold to prevent distortion of cabin door seal.

- (17) Allow adhesive to cure a minimum of 24 hours under pressure clamp before removing from rubber mold.
- (18) Remove seal from rubber mold.
- (19) Position seal on seal retainer with marks aligned and reinstall seal, using a blunt tool and talcum powder or water as required to facilitate installation.
- (20) For Troubleshooting and Maintenance Practices, refer to Chapter 3.

NOTE: Insure that door frame seal is installed with existing air holes in seal toward door opening and lower door seal with holes toward the top of door. Pressurized air from inside cabin enters the holes, inflating the seal to form a pressurized seal.

B. Pressure Drain Seals.

- (1) The pressure drain seals, located on the lower skin of the fuselage, provide a drain should moisture accumulate between the lower skin and floorboards. When the pressure cabin is in the unpressurized mode, the seals will allow moisture to drain.

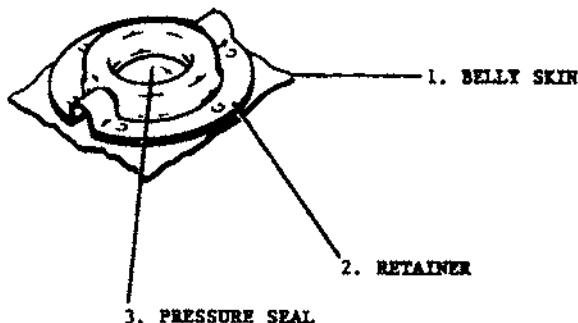
C. Removal of Pressure Seals (See Figure 6).

- (1) Removal of the pressure seals is not recommended unless the seal has been punctured or the seal has been damaged rendering it inoperative.
 - (a) Using the proper size drill, remove rivets.
 - (b) Remove seal and discard.

D. Installation of Pressure Seals (See Figure 6).

- (1) Position seal in place.
- (2) Secure with proper rivets using good shop practice.

CAUTION: NEVER INSERT A SHARP OBJECT IN DRAIN HOLE, THIS WILL PUNCTURE THE SEAL.



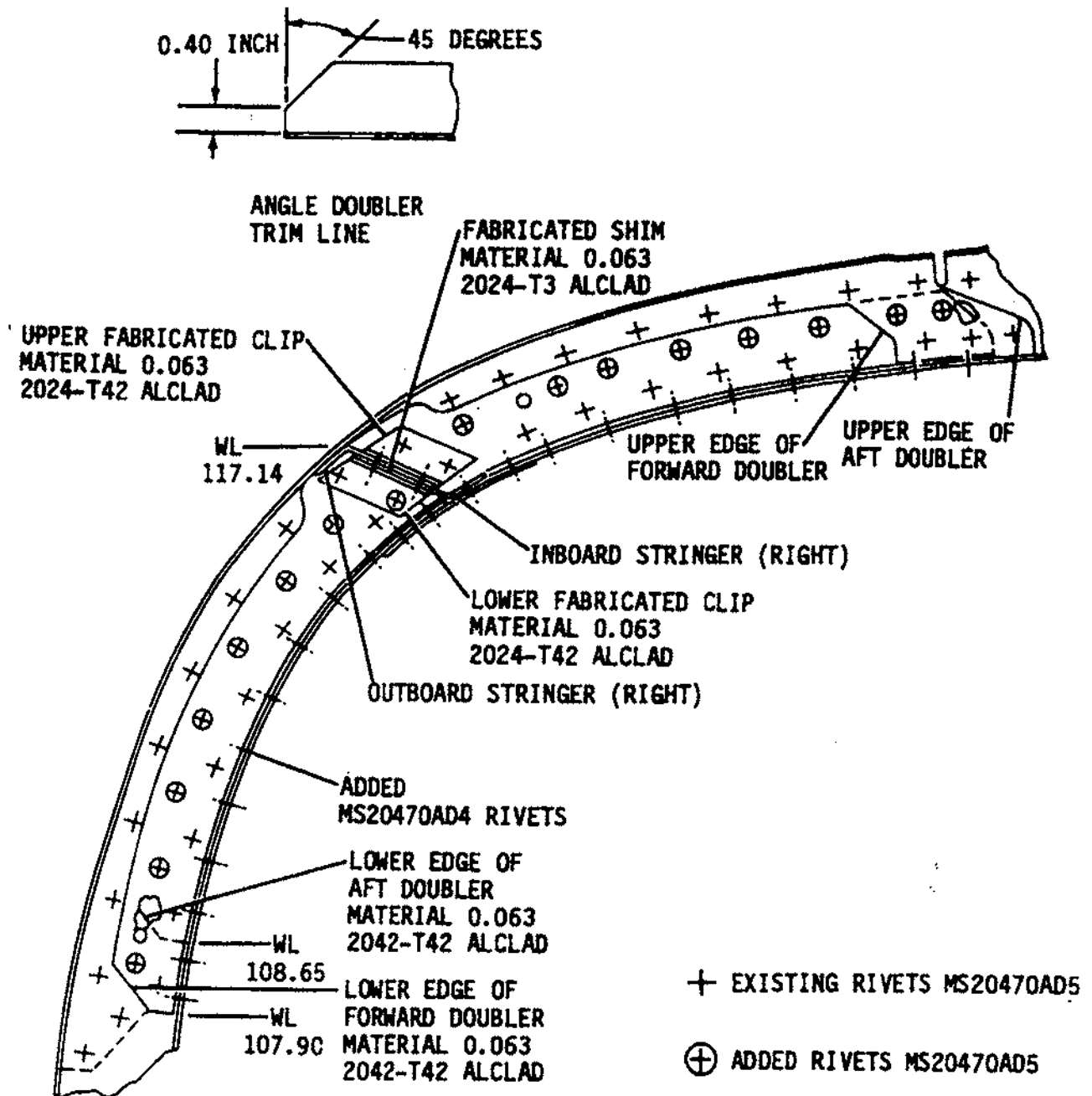
Typical Pressure Drain Seal
Figure 6

6. Bulkhead Web Repair (FS 255.00) Due to Fastener Installation.

- A. Remove the 5111302-85 doubler, 5111302-78 and 5111302-80 angles from the discrepant location at approximately WL 117.00, FS 255.00. Trim off the inboard portion of the 5111302-66, -68, -74 and -76 stringers where they tie into the inboard flanges of the discrepant bulkhead starting at the beginning of the joggle and tapering toward the bulkhead, leaving the outboard flange of the 5111302-74 and -76 stringers tied to the outboard flange. Smooth the edges and prime with nonchromated primer Type I-P per Chapter 20.
- B. Fabricate a forward angle doubler from the same material as the bulkhead to extend from approximately WL 107.40 up and over to approximately RBL 13.00. If a section of another bulkhead is used, trim off the outboard flange just inside the radius. Trim off outboard edge of web portion just enough to clear existing rivet heads and butts of the outboard row of rivet locations except for approximately 1.00 inch and 1.00 inch below longeron (enough to pick up one outboard rivet above and one below longeron), per Figure 6A.
- C. Fabricate an aft angle doubler from same material as the bulkhead to extend from approximately WL 108.65 up and over to approximately BL 11.00. If a section of another bulkhead is used, trim off the outboard flange just inside of the radius. Trim off outboard edge of web portion just enough to clear rivet heads and butts of the outboard row of existing rivet locations except for approximately 1.00 inch above and 1.00 inch below longeron (enough to pick up one outboard rivet above and one rivet below longeron), per Figure 6A.
- D. Trim all four ends of doubler per Figure 6A.
- E. Nest these angle doublers against the bulkhead web and inboard flanges so that the tabs notch and pick up the outboard rivet locations (one above and one below the stringers). Pick up the inboard existing rivets through the webs with 0.25 minimum edge margin per Figure 6A, plus, add a row of MS20470AD5 rivets in a staggered pattern in relation to the existing rivets with 0.25 minimum edge margin (alter pattern as required to miss cooling holes; maintaining 0.25 minimum edge margin).
- F. Install a row of MS20470AD4 rivets through angle doubler flanges and bulkhead flanges with 0.25 minimum edge margin and approximately 0.75 inch spacing above and below the 5111302-85 doubler. Add angle doublers to pick up existing rivet locations common to the 5111302-85 doubler.
- G. Fabricate new angle clips, similar to the existing clips except the horizontal flanges, to extend forward and aft enough to overlap the stringers by a minimum of 0.6 inch, and install MS20470AD5 rivets through stringers with 0.25 edge margin.
- H. Fabricate angle clips opposite the fabricated clips to install on the lower side of stringers with 0.063 inch thick, 2024-T3 material shims, between the clips and the stringer. These clips to pick up the rivets through stringers common to the upper clips, and the outboard rivets common to the angle doubler tabs and bulkhead webs. Add one MS20470AD5 rivet through bulkhead web and lower clips with 0.25 minimum edge margin.

7. Modification of Flight Phone Antenna Mount.

- A. Removal/Installation Flight Phone Antenna (See Figure 33).
 - (1) Remove access covers as necessary to gain access to flight phone antenna.
 - (2) Disconnect coax cable from antenna connector.
 - (3) Remove retaining screws from existing AT460, part number 121-0001, antenna and discard antenna.
 - (4) Remove the two aft nutplates used to install the existing AT460 antenna by drilling out attaching rivets.
 - (5) Place new AT460A, part number 121-0007, antenna against skin with antenna connector centered in existing hole in skin. Locate the four new mounting screw holes.
 - (6) Drill the four new 0.193 diameter antenna mounting screw holes through the skin and doubler.

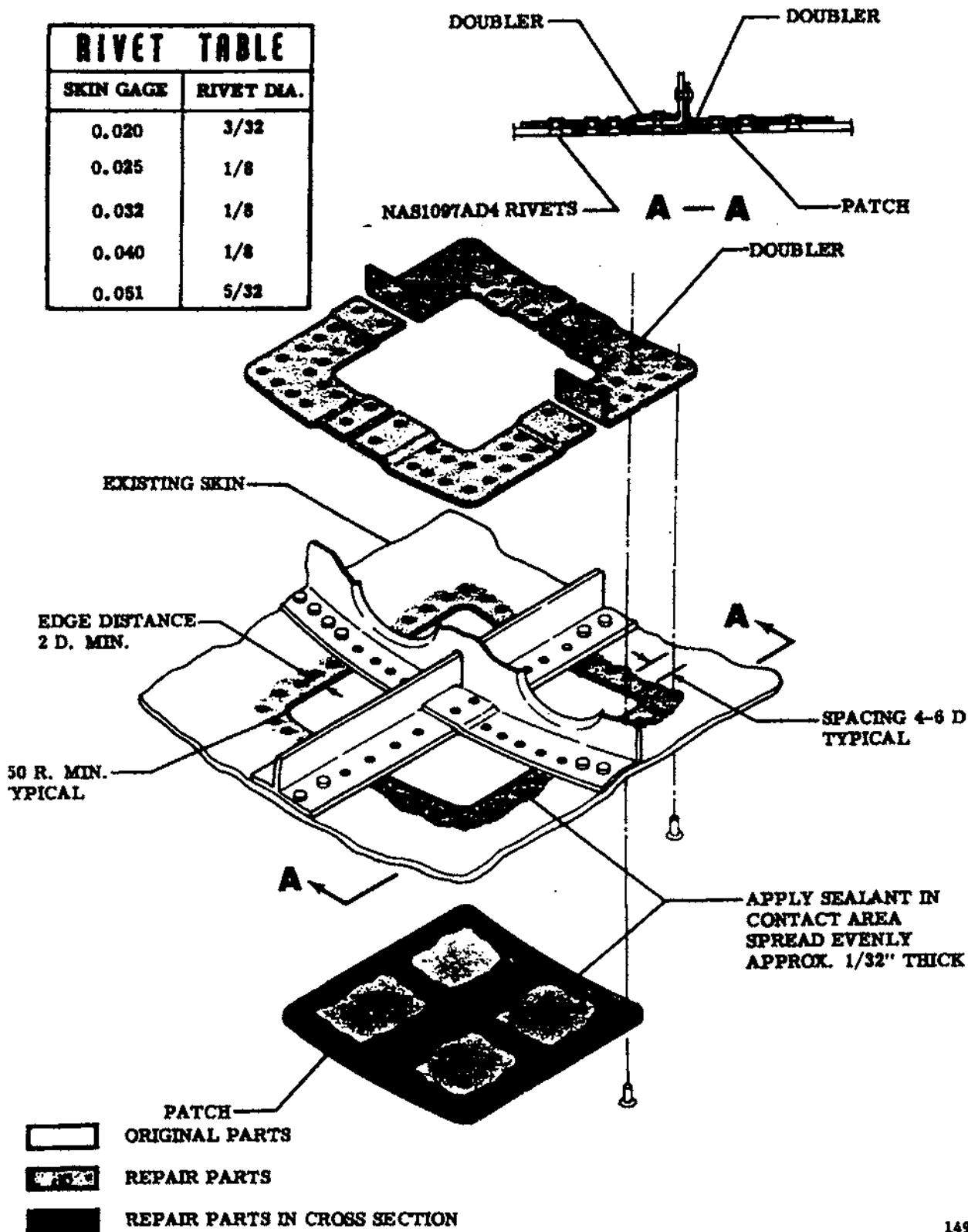


UP INBD

(VIEW LOOKING
AFT AT RIGHT SIDE)

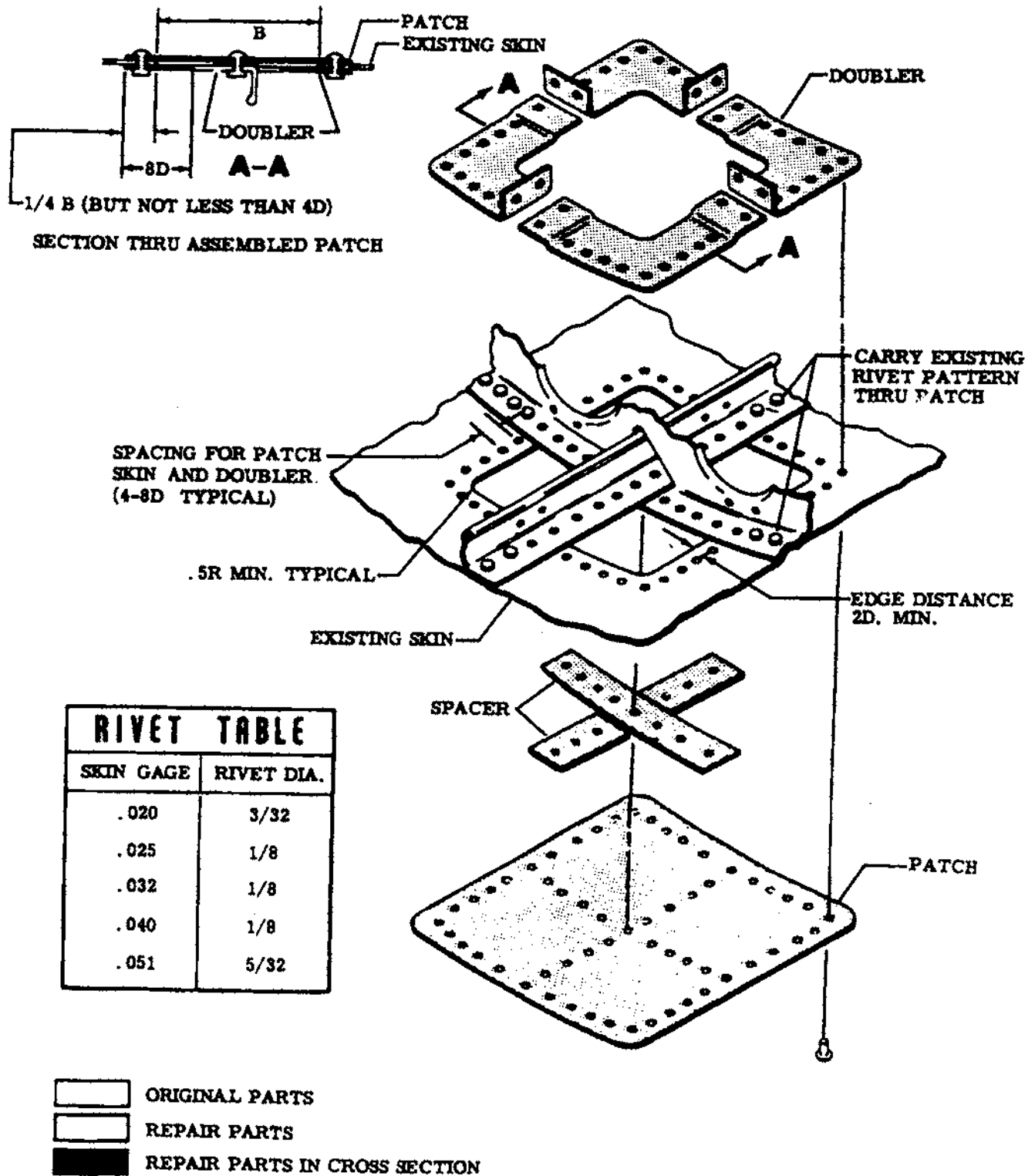
FS 255.00 Bulkhead Web Repair
Figure 6A

RIVET TABLE	
SKIN GAGE	RIVET DIA.
0.020	3/32
0.025	1/8
0.032	1/8
0.040	1/8
0.051	5/32

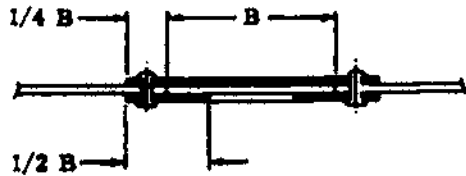


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Typical Over-Structure Skin Repair of Pressure Cabin Section
Figure 7

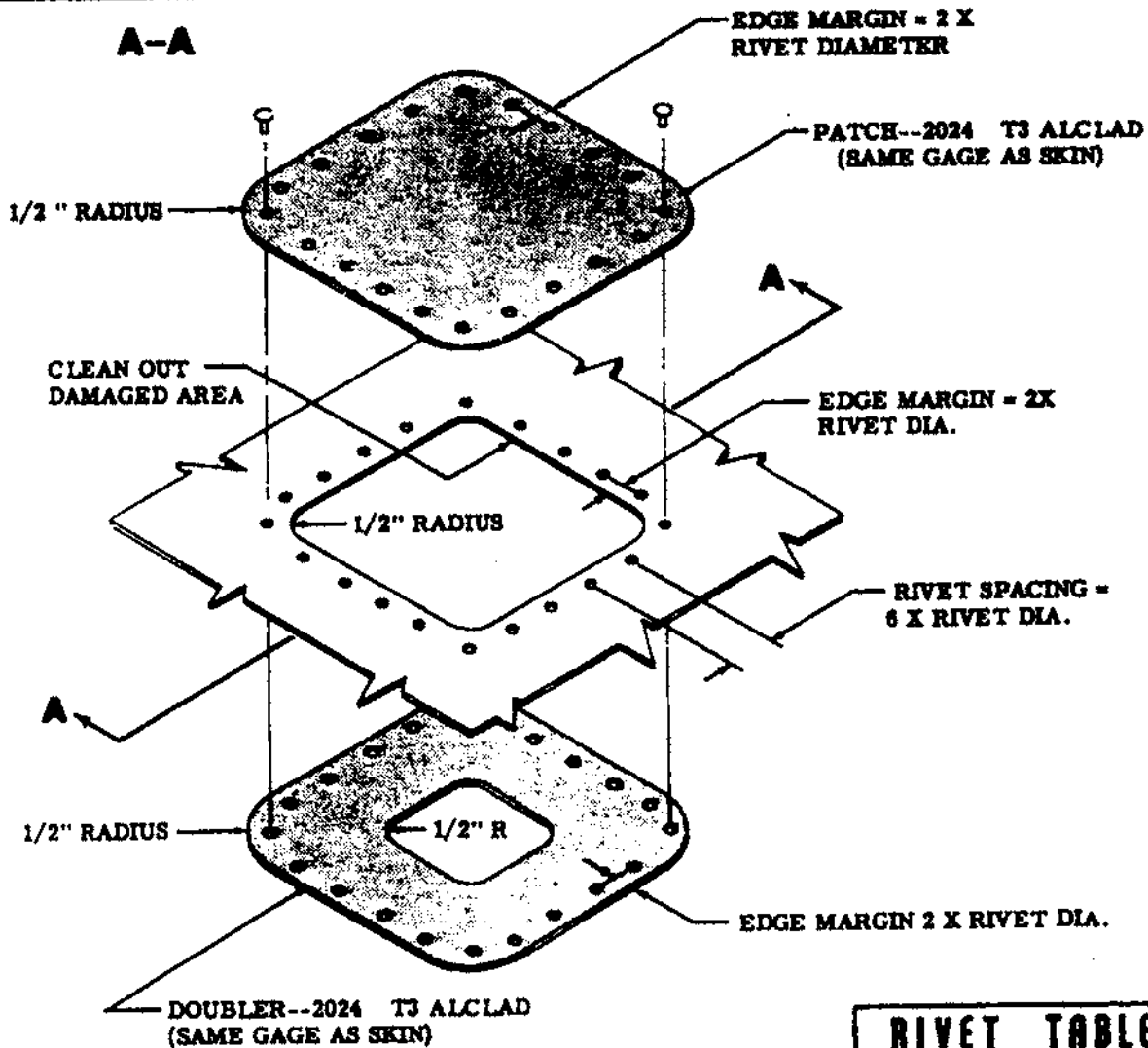


Typical Overstructure Skin Repair
Figure 8



SECTION THRU ASSEMBLED PATCH

A-A



ORIGINAL PARTS

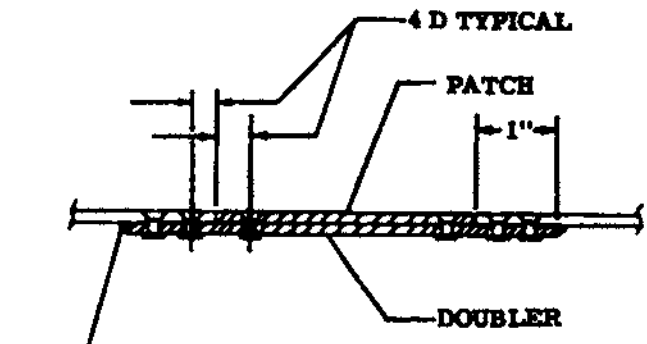
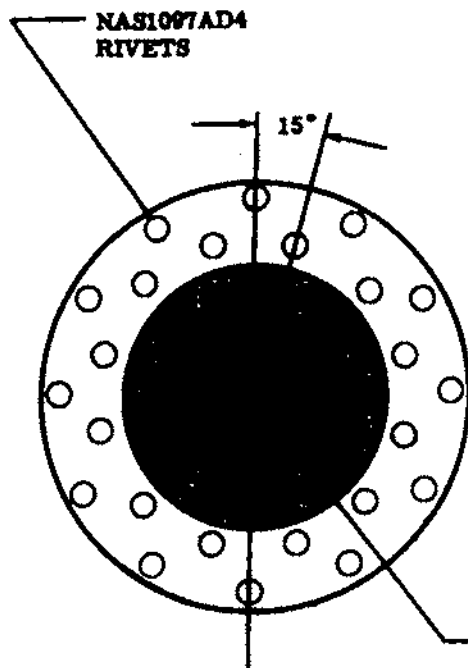
REPAIR PARTS

REPAIR PARTS IN CROSS SECTION

RIVET TABLE	
SKIN GAGE	RIVET DIA.
0.020	3/32
0.025	1/8
0.032	1/8
0.040	1/8
0.051	5/32

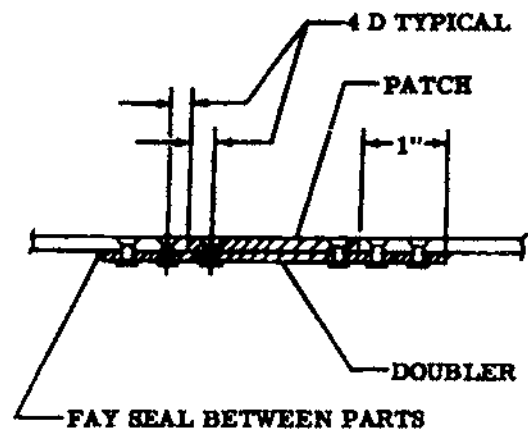
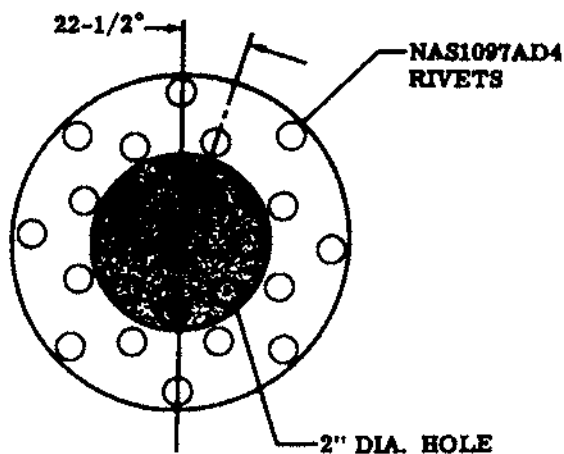
Typical Clear-of-Structure Skin Repair
Figure 9

-  ORIGINAL PARTS
 REPAIR PARTS
 REPAIR PARTS IN CROSS SECTION

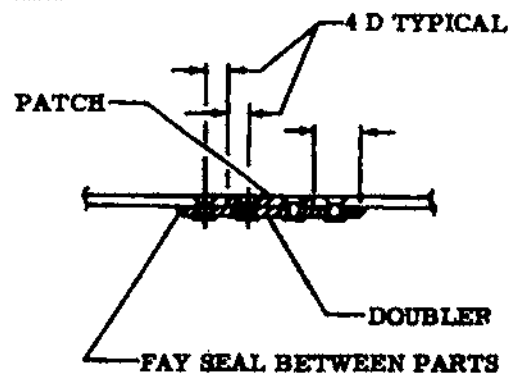
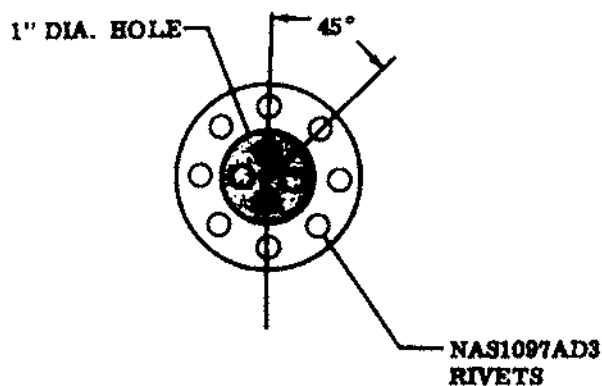


CIRCULAR SKIN PATCHES ARE USED IF
 THE LOCATION OF THE SKIN DAMAGE IS
 GREATER THAN 2.0 INCHES FROM ANY
 STRUCTURE (SKIN DOUBLER, RIB(S),
 SPAR(S), ETC.), AND IF THE CUTOUT DAMAGE
 AREA IS 3.00 INCHES IN DIAMETER OR LESS.

PATCH REPAIR FOR 3 INCH DIAMETER HOLE

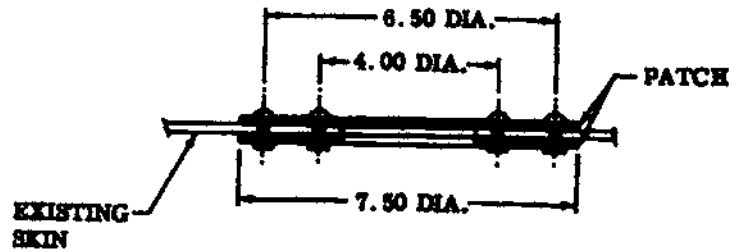
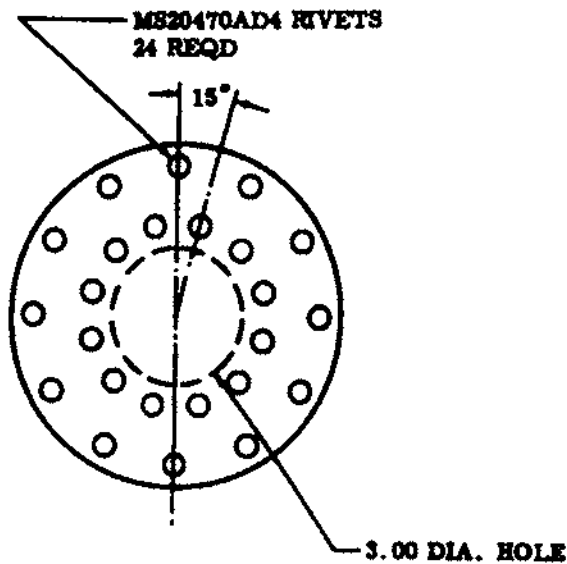


PATCH REPAIR FOR 2 INCH DIAMETER HOLE



PATCH REPAIR FOR 1 INCH DIAMETER HOLE

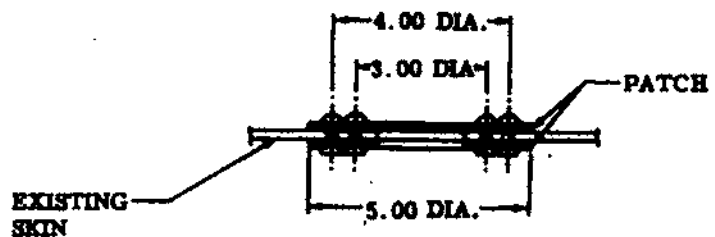
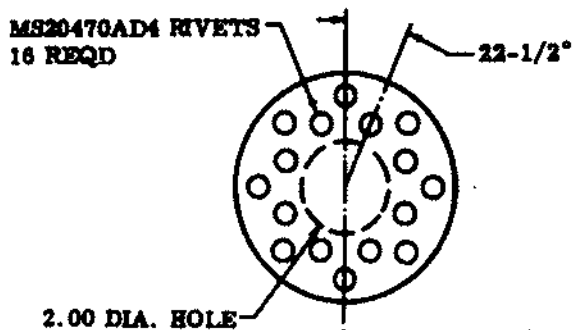
Typical Patch Repair of Circular Holes Pressurized Cabin Section
Figure 10



SECTION THRU PATCH

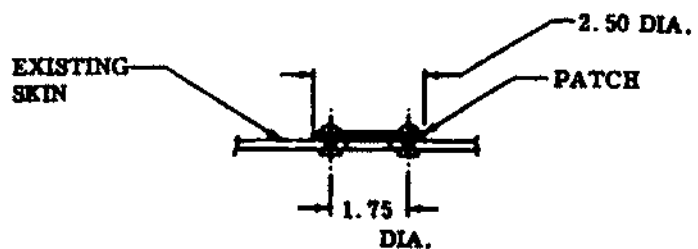
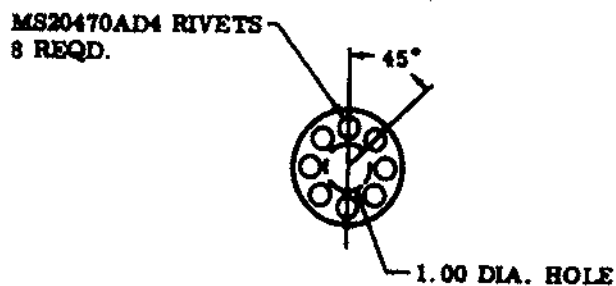
CIRCULAR SKIN PATCHES ARE USED IF THE LOCATION OF THE SKIN DAMAGE IS GREATER THAN 2.0 INCHES FROM ANY STRUCTURE (SKIN DOUBLERS, RIBS) SPARS), ETC.) AND IF THE CUTOUT DAMAGE AREA IS 3.0 INCHES IN DIAMETER OR LESS.

PATCH REPAIR FOR 3 INCH DIAMETER HOLE



SECTION THRU PATCH

PATCH REPAIR FOR 2 INCH DIAMETER HOLE

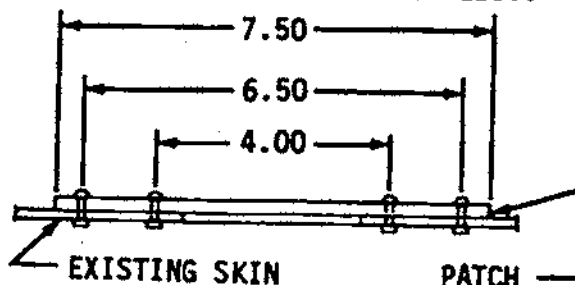
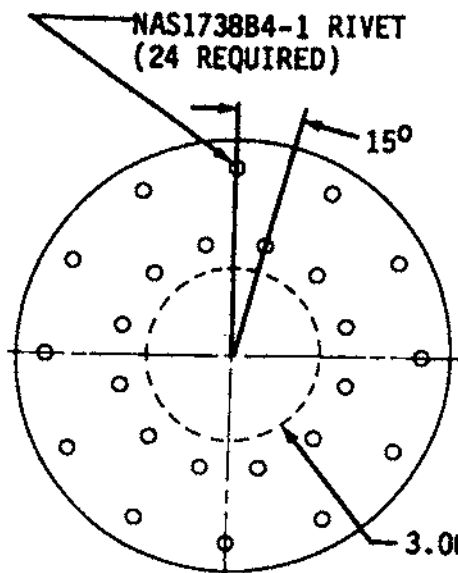


SECTION THRU PATCH

PATCH REPAIR FOR 1 INCH DIAMETER HOLE

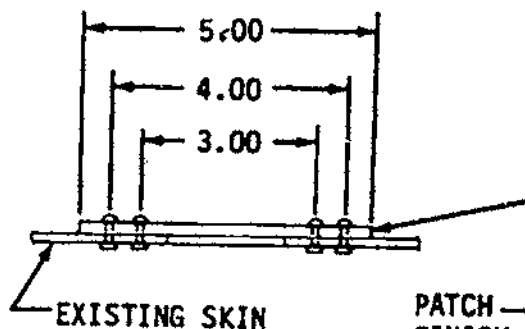
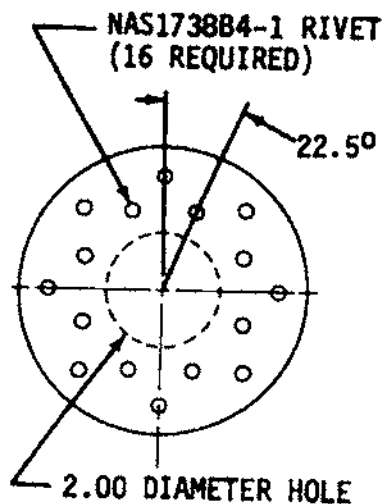
Typical Patch Repair of Circular Holes Unpressurized Section
Figure 11 (Sheet 1 of 2)

CIRCULAR SKIN PATCHES ARE USED IF THE LOCATION OF THE SKIN DAMAGE IS GREATER THAN 2.0 INCHES FROM ANY STRUCTURE (SKIN DOUBLERS, RIB(S), SPAR(S), ETC.) AND IF THE CUTOUT DAMAGE AREA IS 3.0 INCHES IN DIAMETER OR LESS.



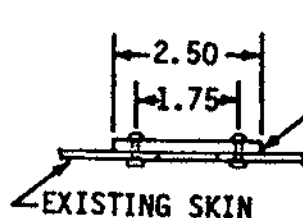
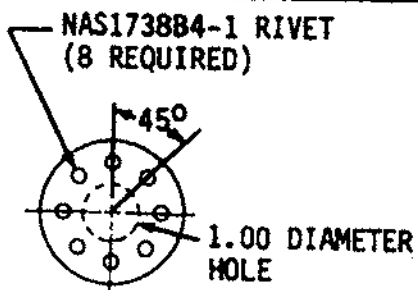
FINISH - EXTERIOR F27-0
- INTERIOR F27-15

CIRCULAR SKIN PATCH FOR 3-INCH DIAMETER HOLE



FINISH - EXTERIOR F27-0
- INTERIOR F27-15

CIRCULAR SKIN PATCH FOR 2-INCH DIAMETER HOLE



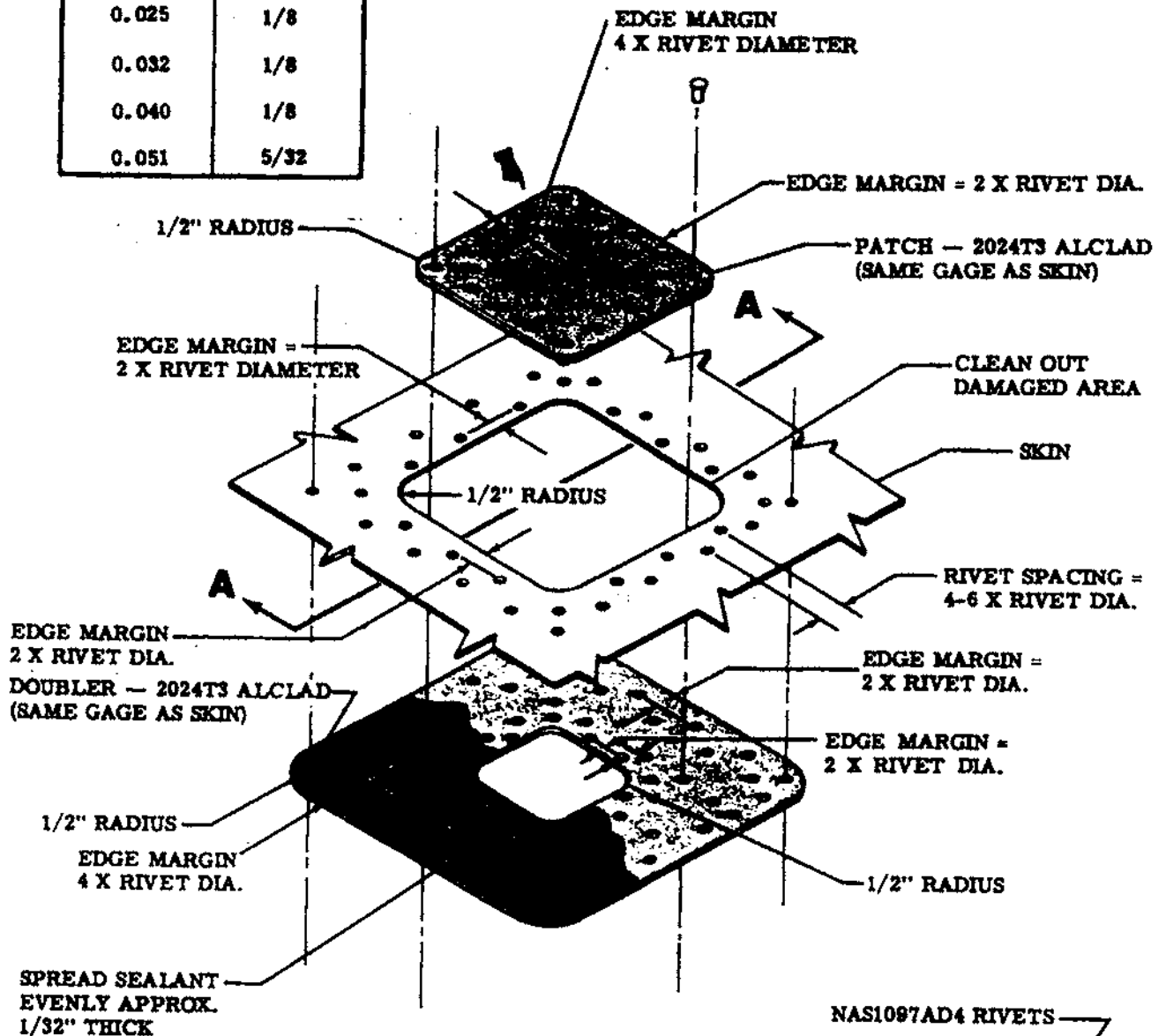
FINISH - EXTERIOR F27-0
- INTERIOR F27-15

CIRCULAR SKIN PATCH FOR 1-INCH DIAMETER HOLE

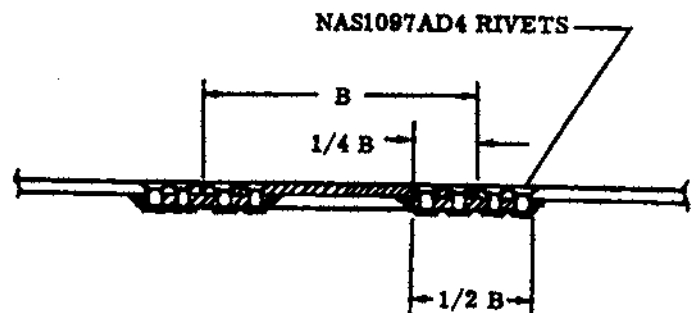
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Typical Patch Repair of Circular Holes Unpressurized Section
Figure 11 (Sheet 2)

RIVET TABLE	
SKIN GAGE	RIVET DIA.
0.020	3/32
0.025	1/8
0.032	1/8
0.040	1/8
0.051	5/32

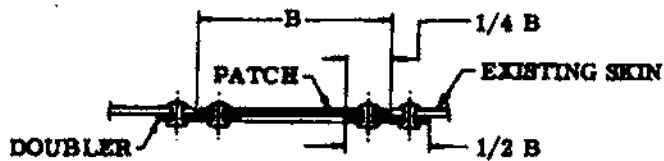


-  ORIGINAL PARTS
-  REPAIR PARTS
-  REPAIR PARTS IN CROSS SECTION



A-A SECTION THRU ASSEMBLED PATCH

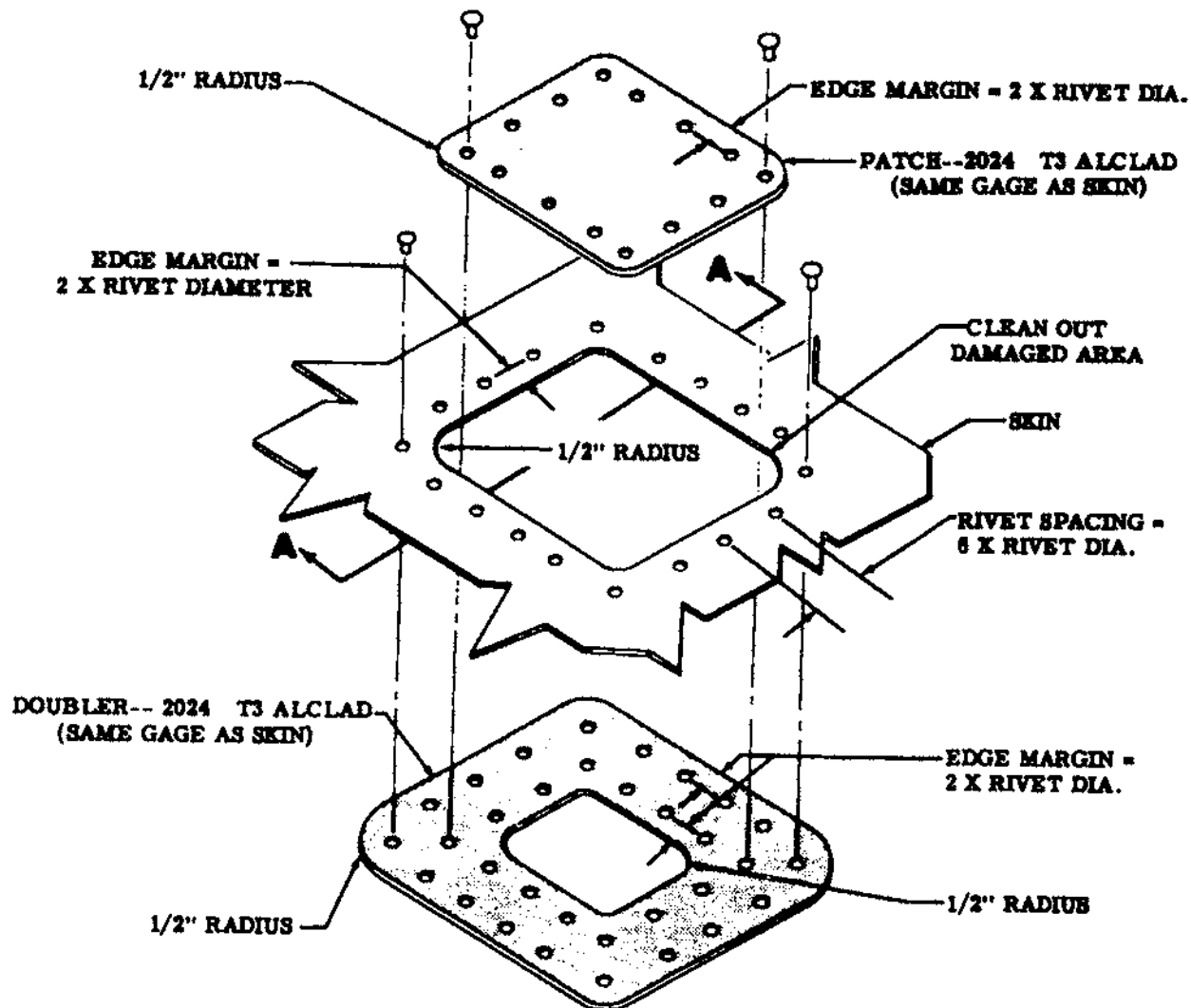
Typical Insert Patch in Pressurized Cabin Section
Figure 12



SECTION THRU ASSEMBLED PATCH

A-A

RIVET TABLE	
SKIN GAGE	RIVET DIA.
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.025	1/8
.032	1/8
.040	1/8
.051	5/32

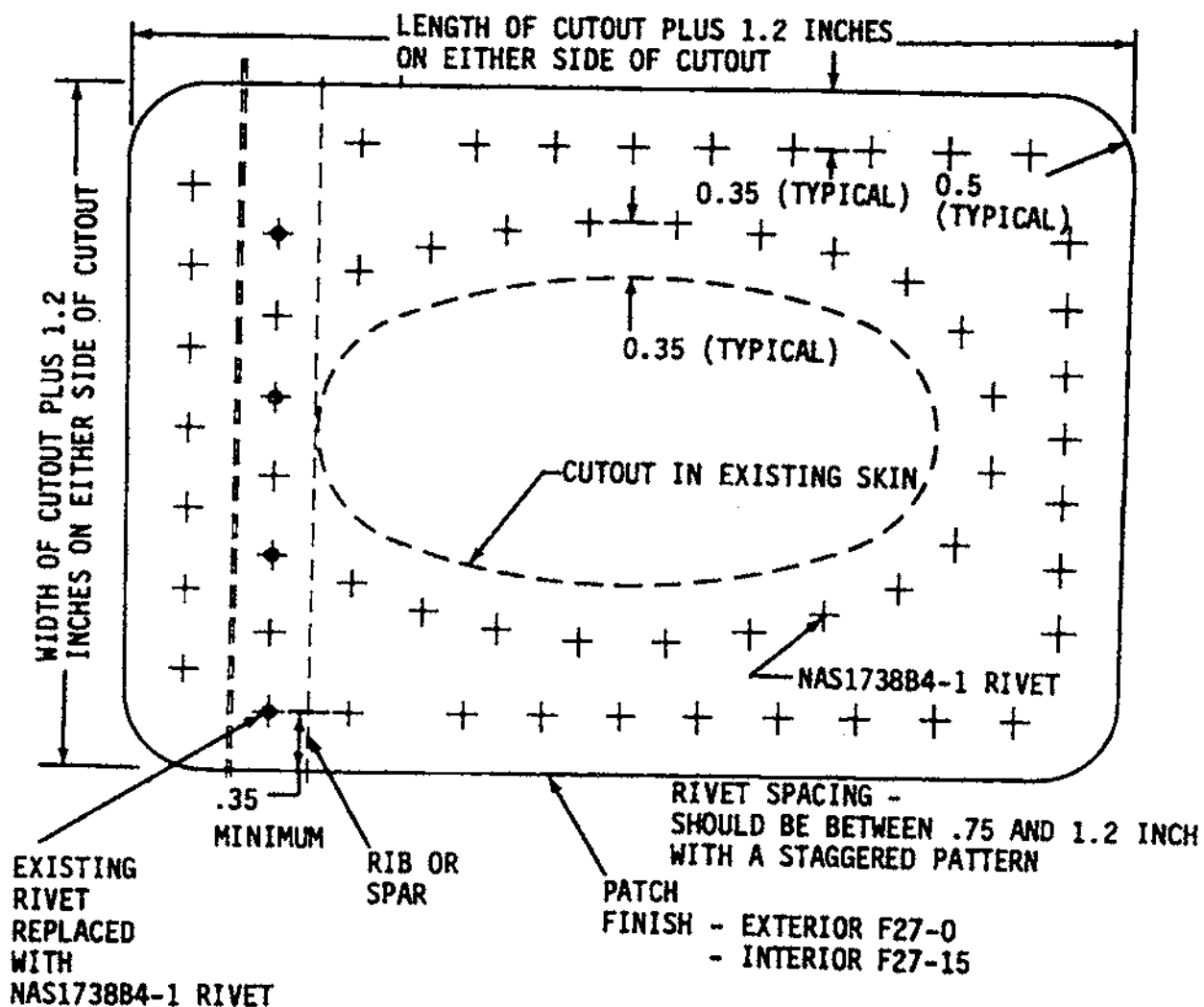


-  ORIGINAL PARTS
-  REPAIR PARTS
-  REPAIR PARTS IN CROSS SECTION

Typical Rectangular Patch in Unpressurized Section
Figure 13 (Sheet 1 of 2)

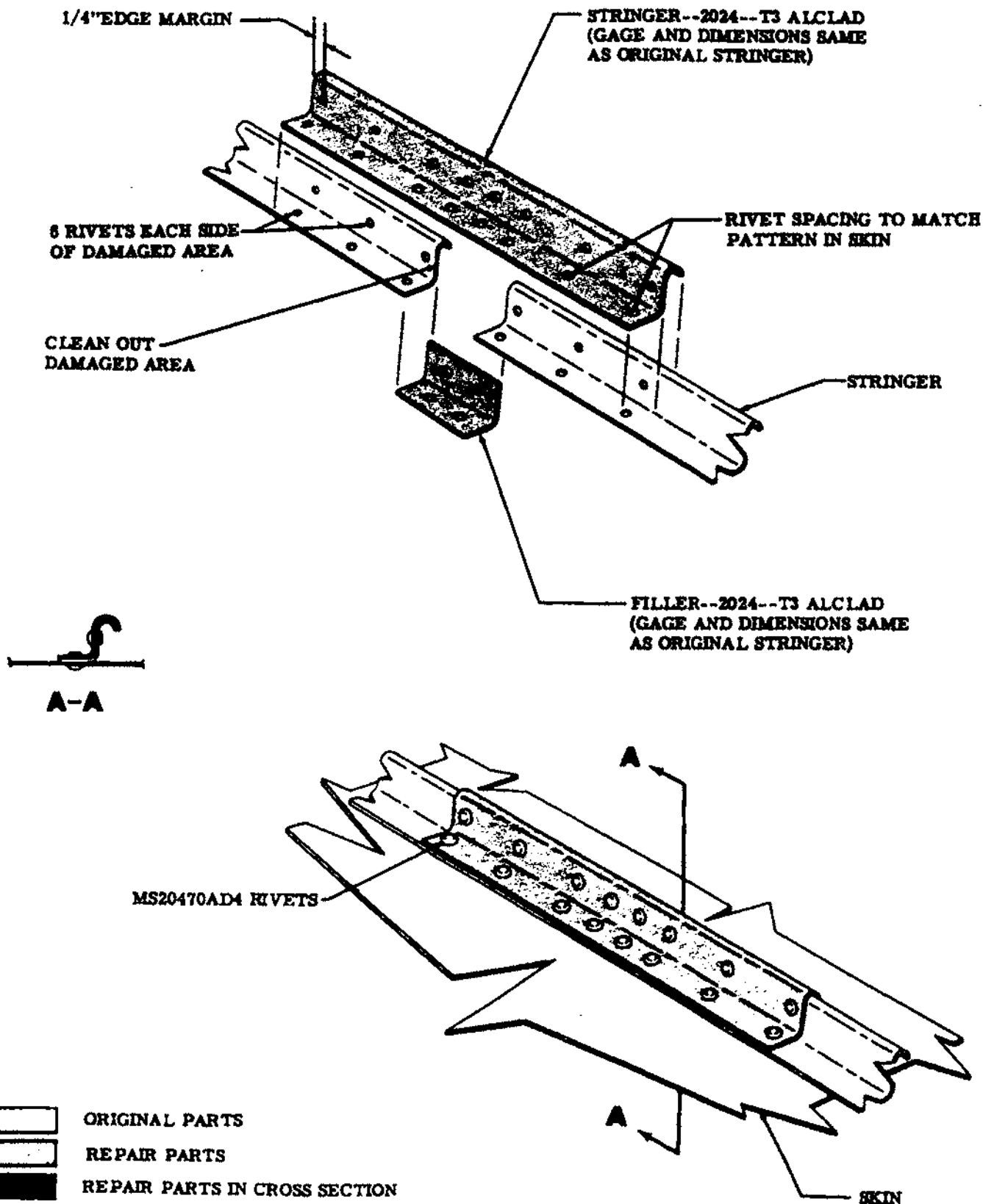
THIS PATCH IS USED WHENEVER THE SKIN DAMAGE EXTENDS WITHIN 2.0 INCHES OF A RIB OR STIFFENER. THE RECTANGULAR SKIN PATCH IS ALSO USED WHENEVER THE CUTOUT DAMAGED AREA IS GREATER THAN 3.0 INCHES IN DIAMETER.

NOTE: WHEN INSTALLING PATCH PICKUP ALL EXISTING RIVET LOCATIONS.



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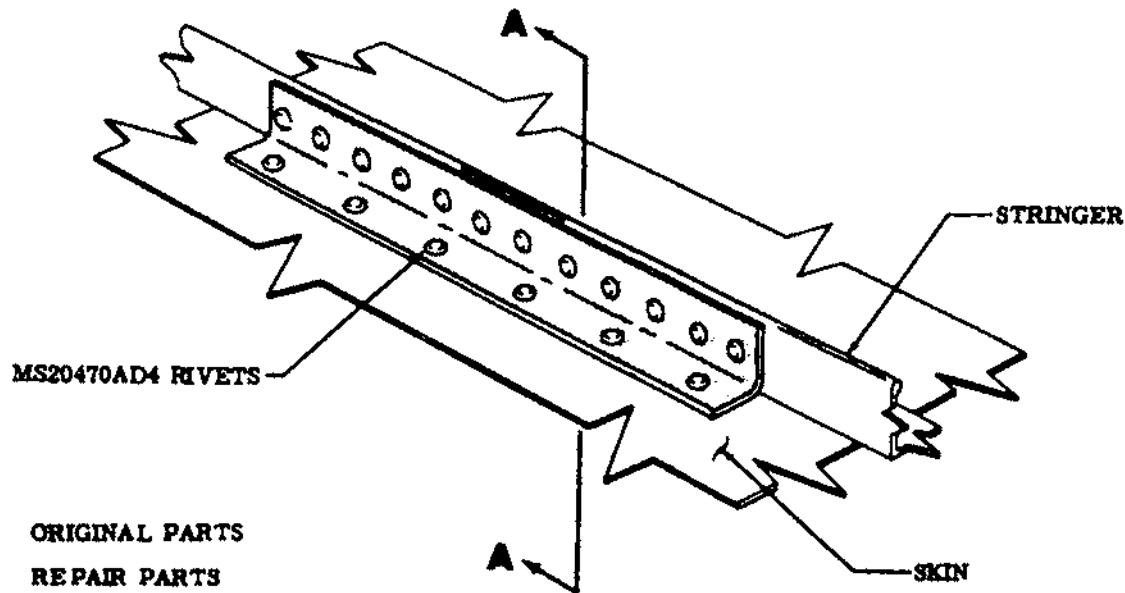
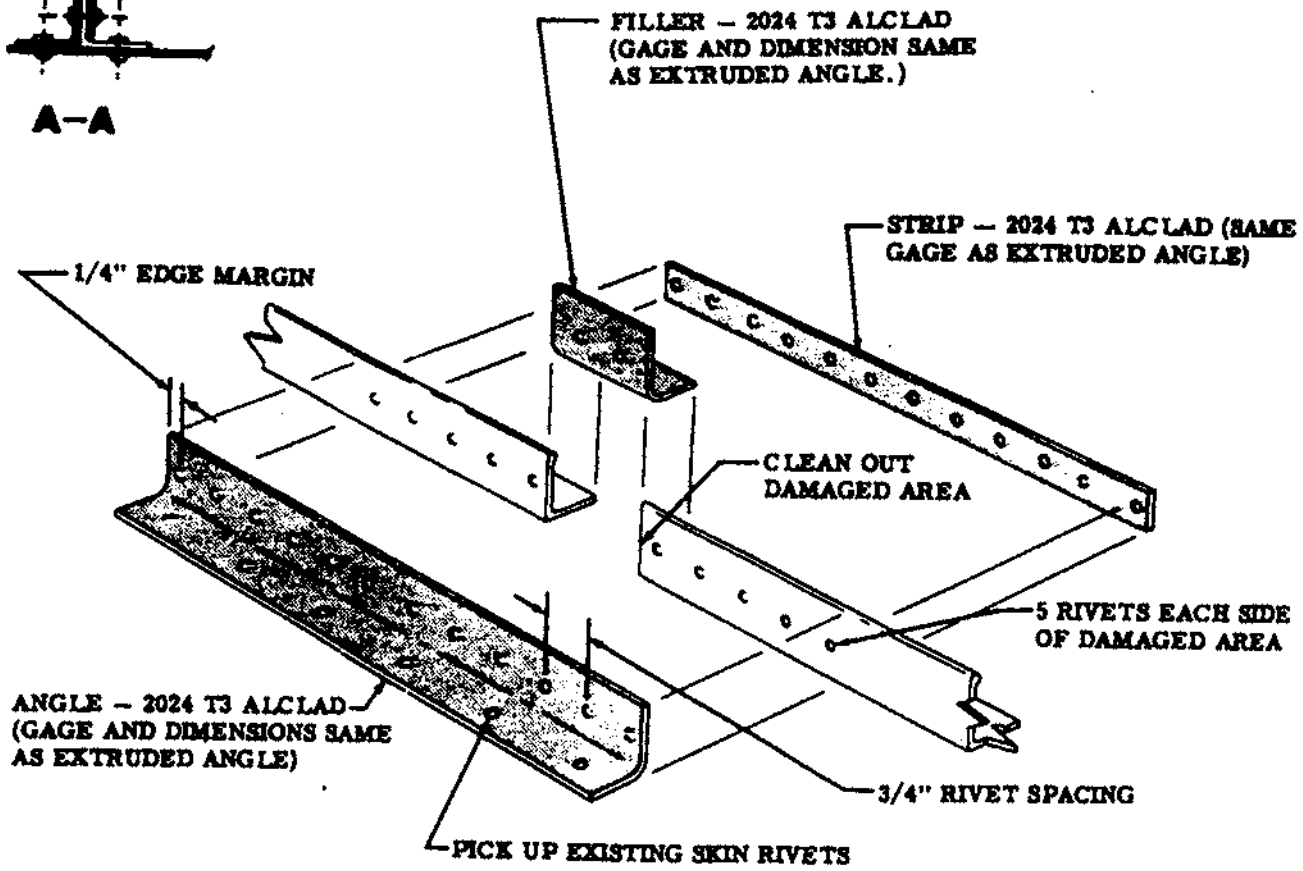
Typical Rectangular Patch in Unpressurized Section
Figure 13 (Sheet 2)



Typical Stub Wing Leading Edge Stringer Repair
Figure 14



A-A

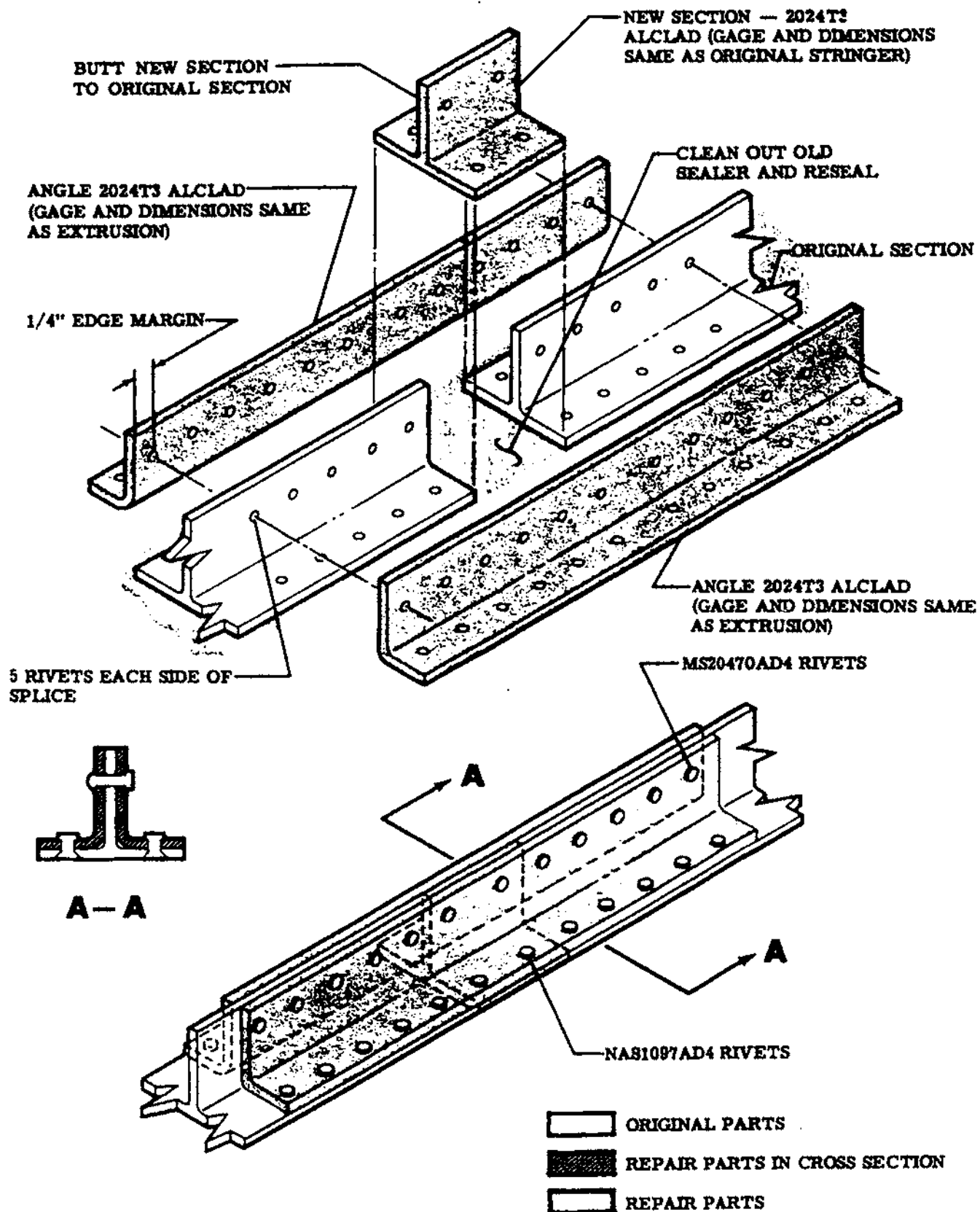


ORIGINAL PARTS

REPAIR PARTS

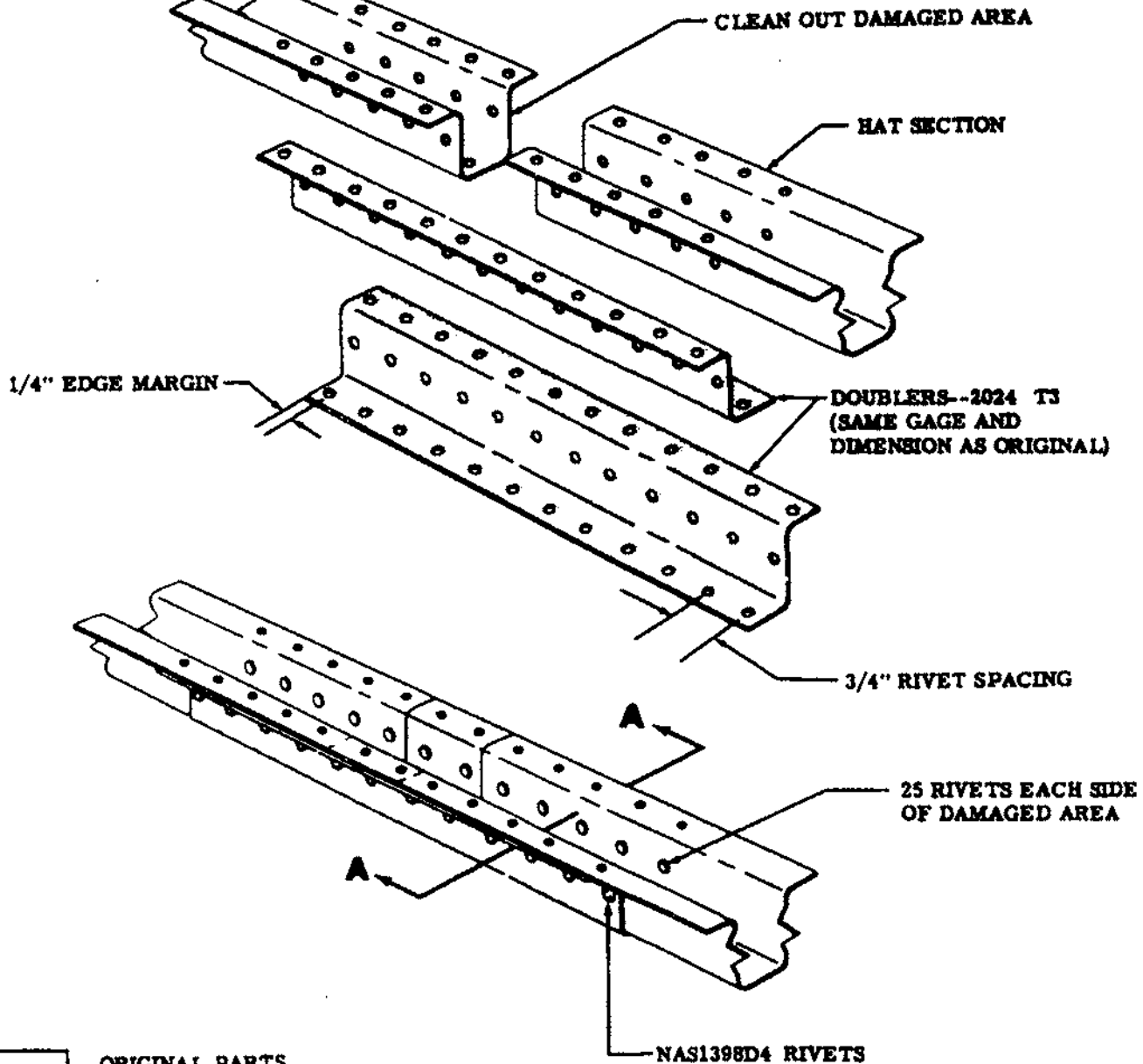
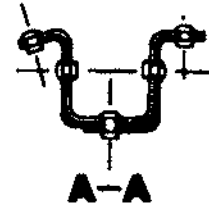
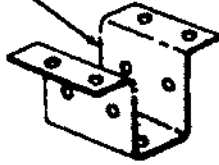
REPAIR PARTS IN CROSS SECTION

Typical Fuselage Stringer Repair Unpressurized Section
Figure 15



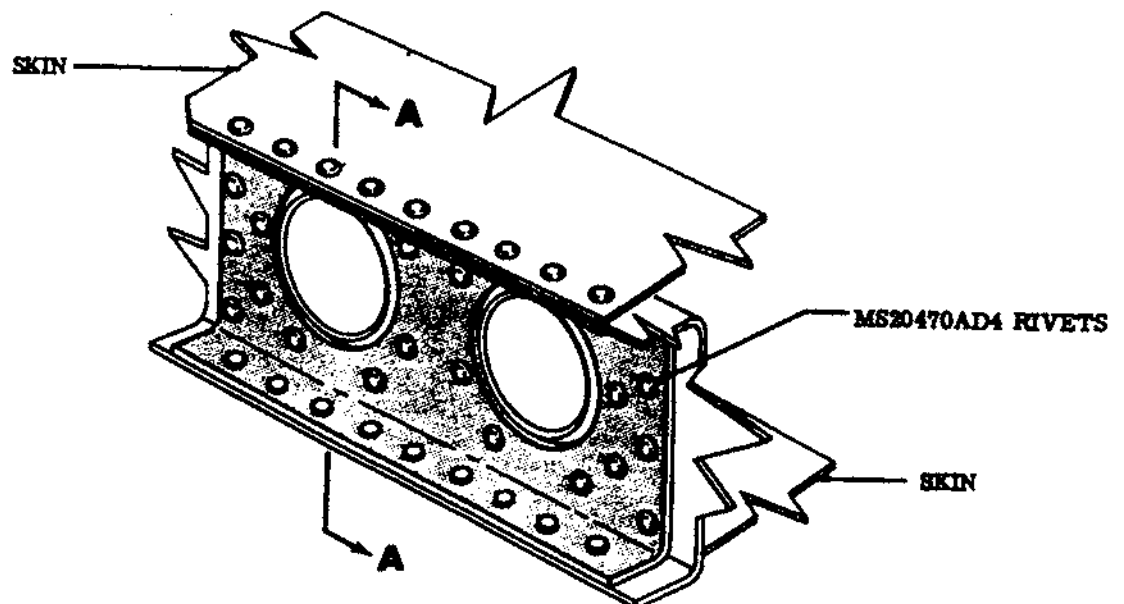
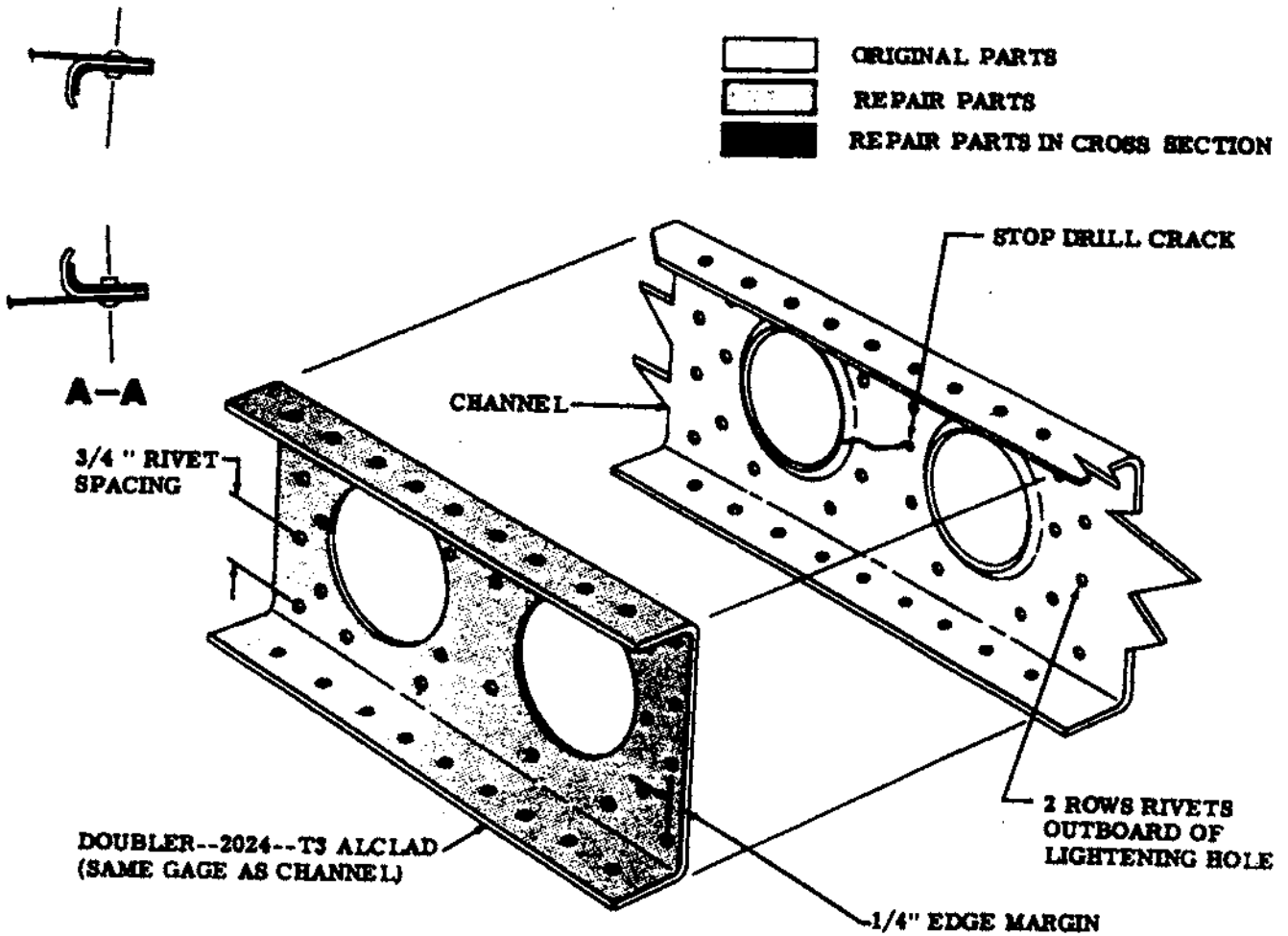
Typical Fuselage Stringer Splice Pressurized Section
Figure 16

FILLER--2024 T3 (SAME GAGE
AND DIMENSIONS AS ORIGINAL)

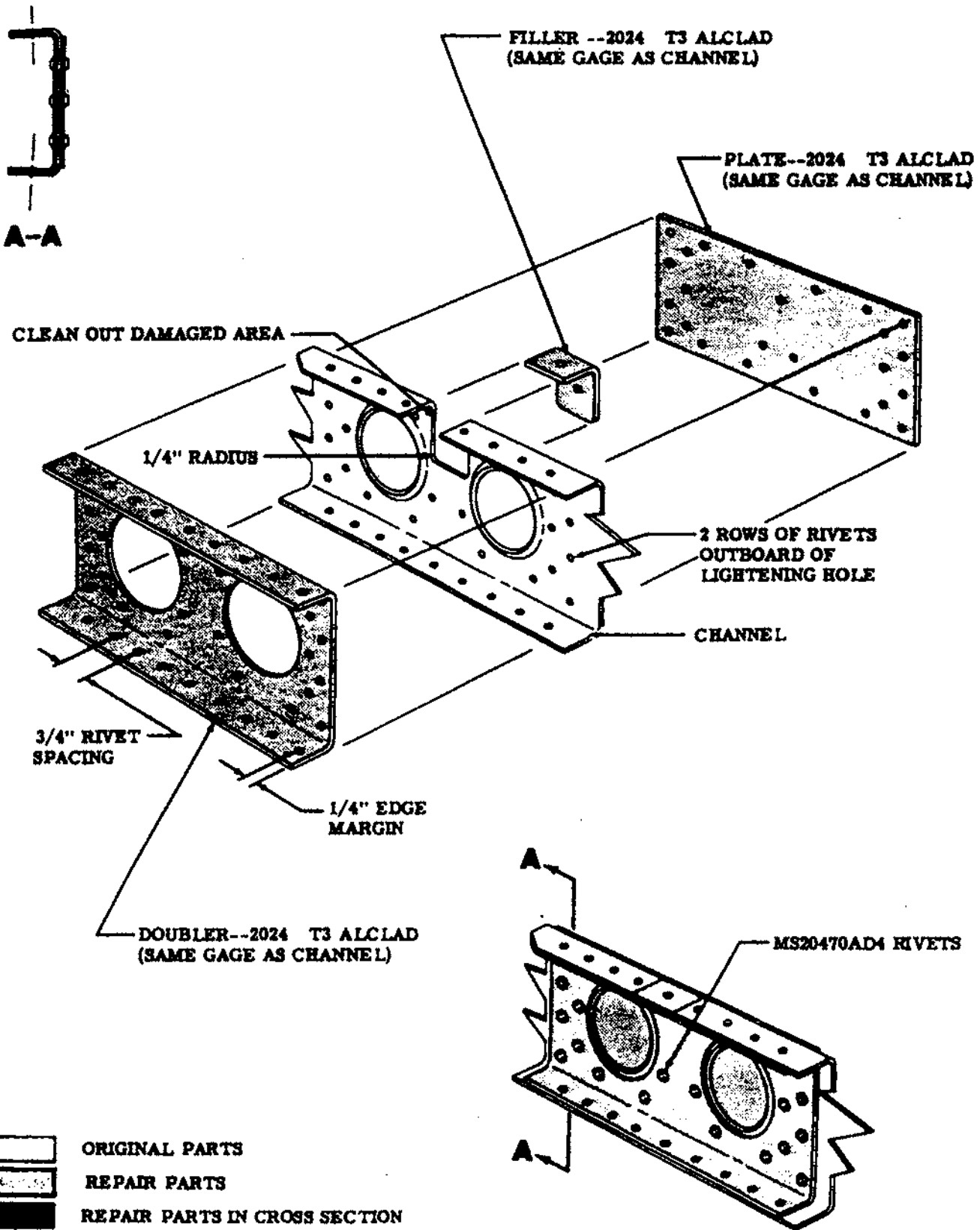


	ORIGINAL PARTS
	REPAIR PARTS
	REPAIR PARTS IN CROSS SECTION

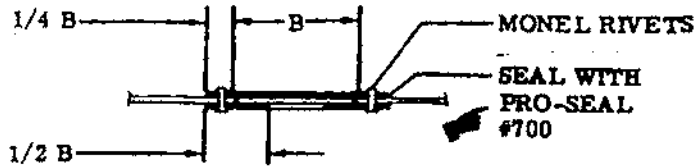
Typical Pressure Bulkhead Hat Section Repair
Figure 17



Typical Channel Repair
Figure 18

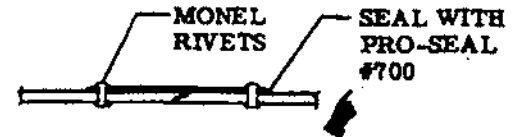


Typical Channel Flange Repair
Figure 19



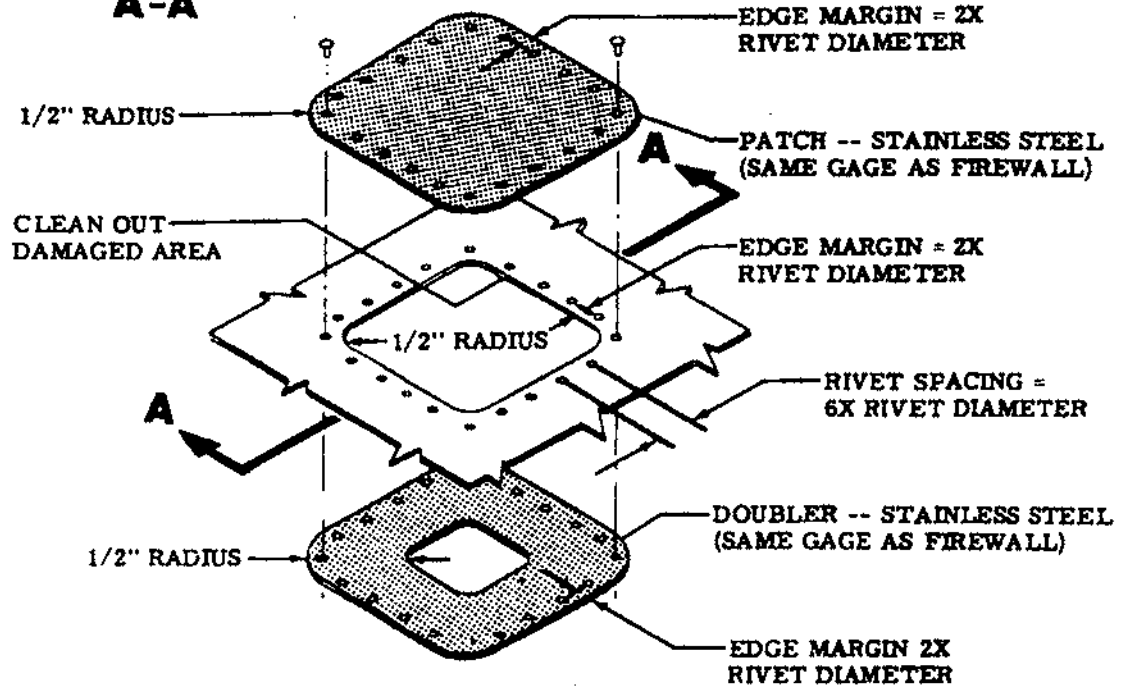
SECTION THRU ASSEMBLED PATCH

A-A

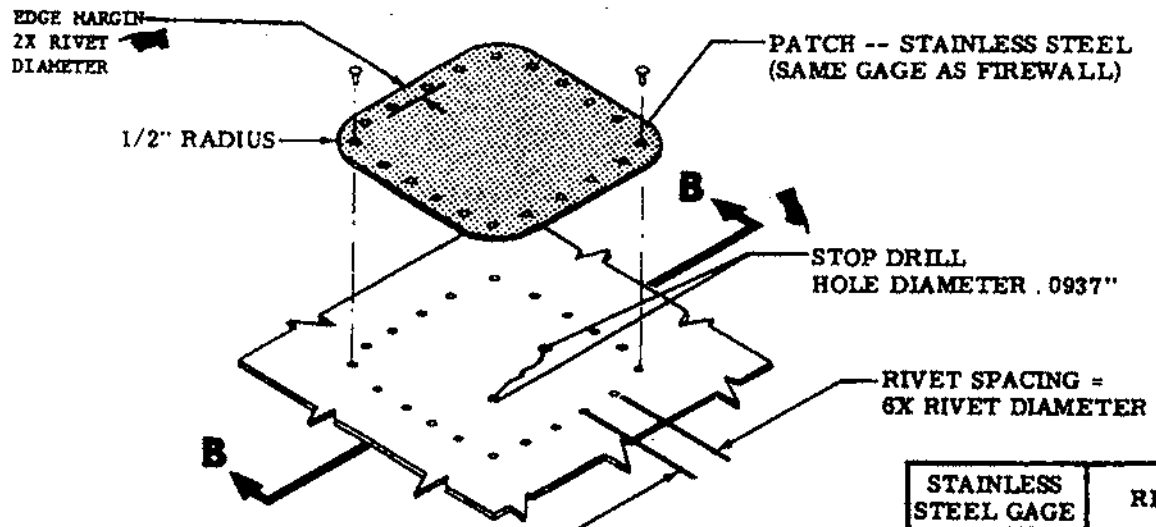


SECTION THRU ASSEMBLED PATCH

B-B



HOLE REPAIR METHOD



CRACK REPAIR METHOD

-  ORIGINAL PARTS
 REPAIR PARTS
 REPAIR PARTS IN CROSS SECTION

STAINLESS STEEL GAGE	RIVET
.016	3/32

Typical Firewall Repair
Figure 20

14981002



APPLY SEALANT IN CONTACT
AREA-SPREAD EVENLY APPROX
.03" THICK

NAS1097AD4 RIVET

CLEAN OUT DAMAGED AREA

JOGGLE
.040" IN .16"

2.50"



APPLY SEALANT IN CONTACT
AREA-SPREAD EVENLY APPROX
.03" THICK

NAS1097AD4 RIVET

.50"

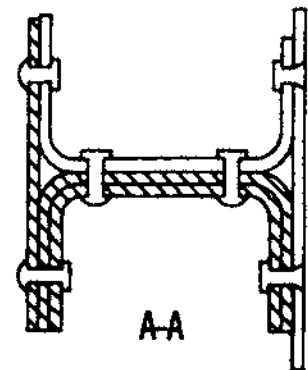
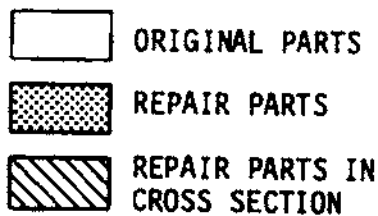
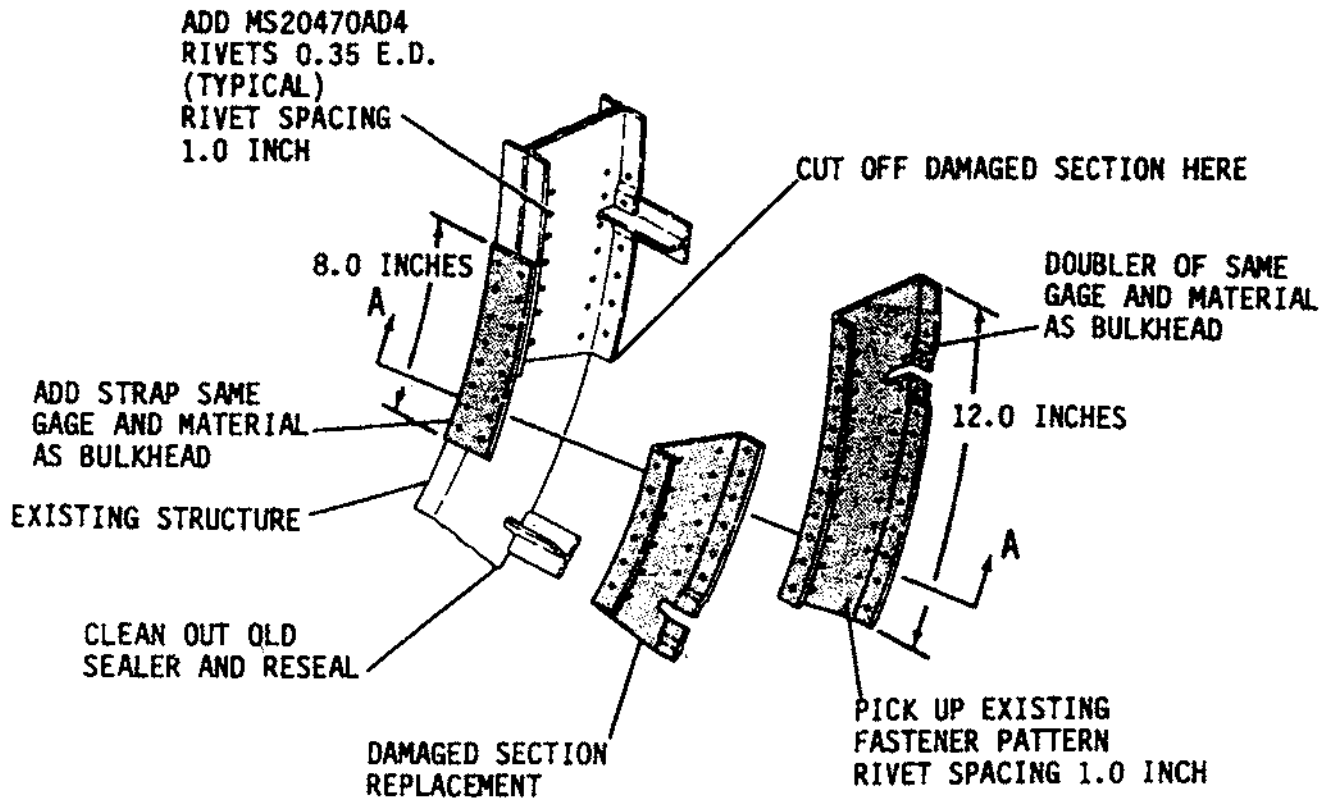
1.25"

.25"

1.00"

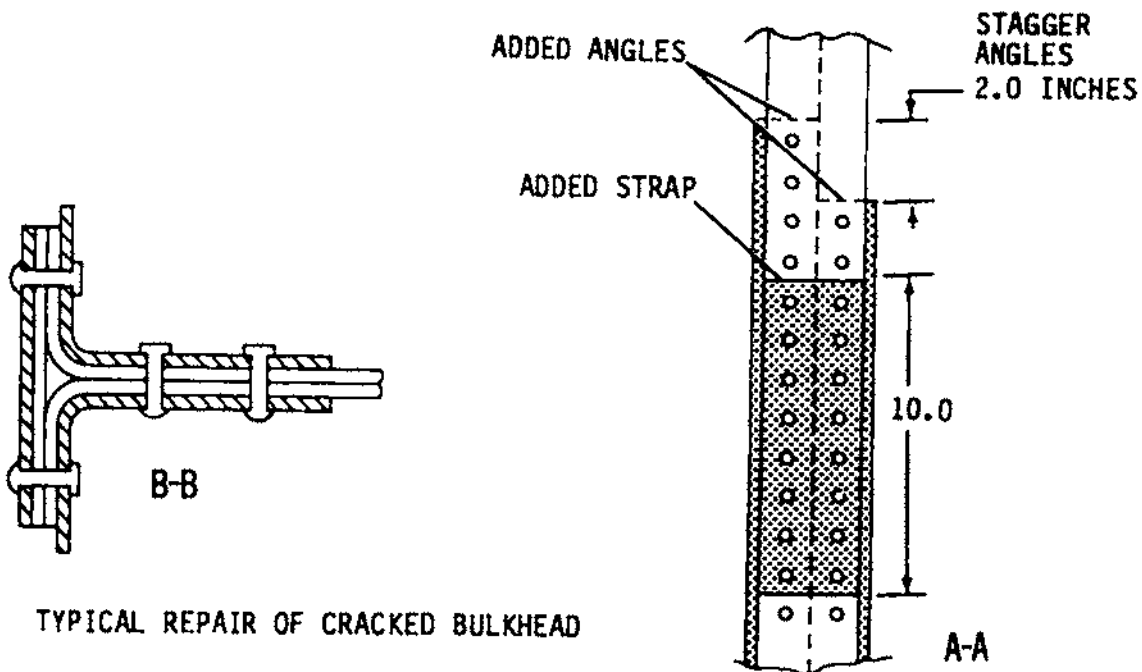
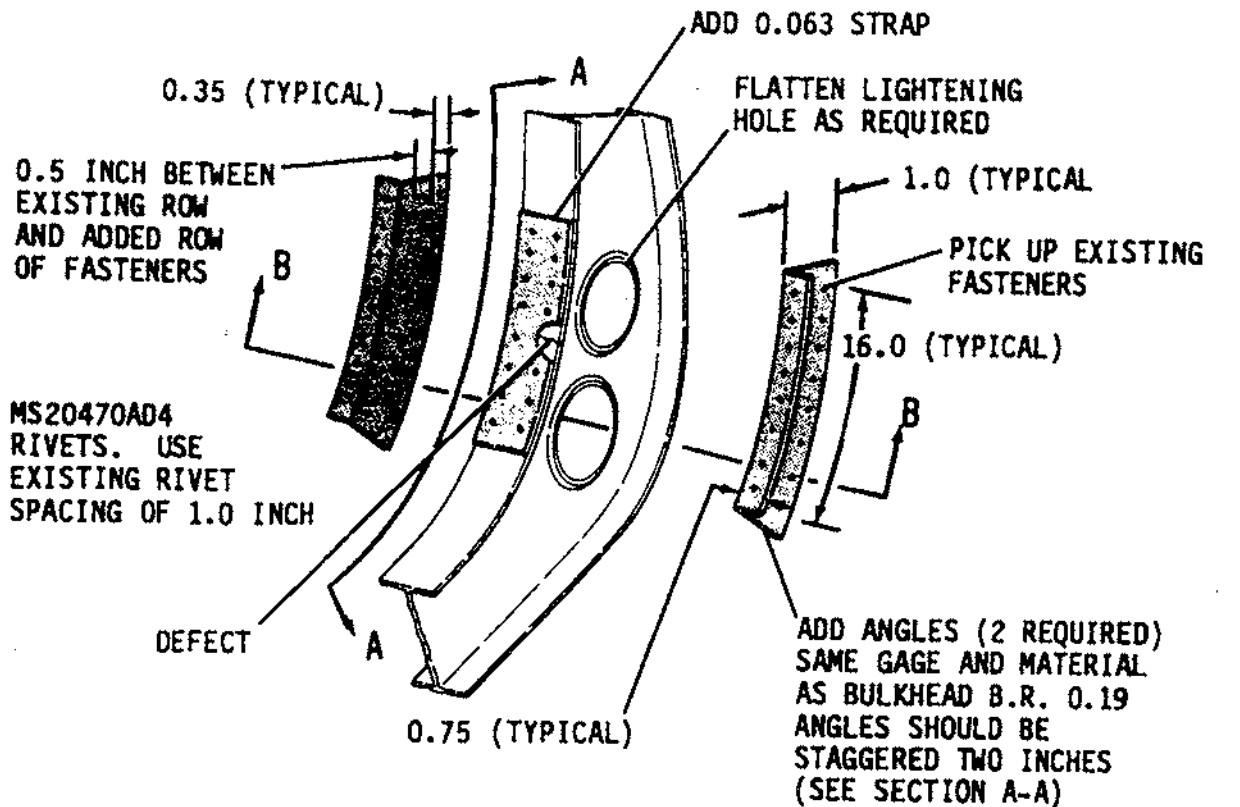
2.50"

Typical Cabin Skin Crack Repair
Figure 21

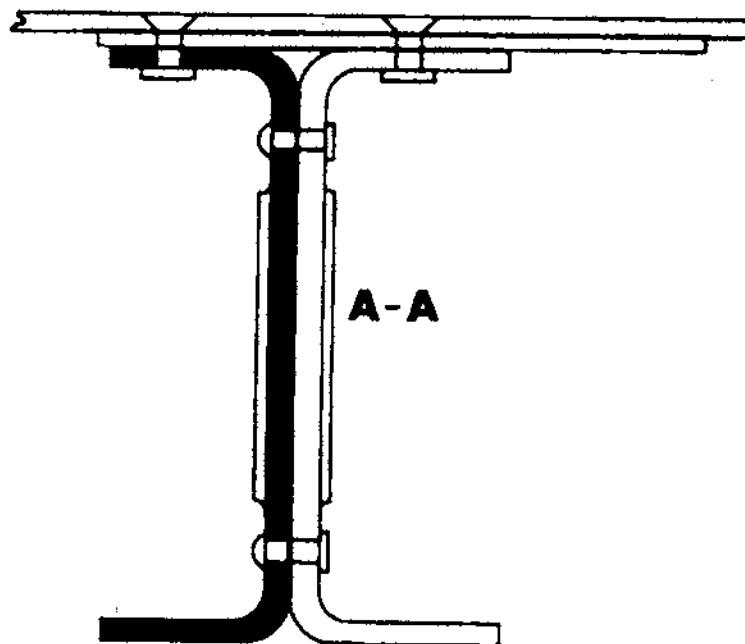
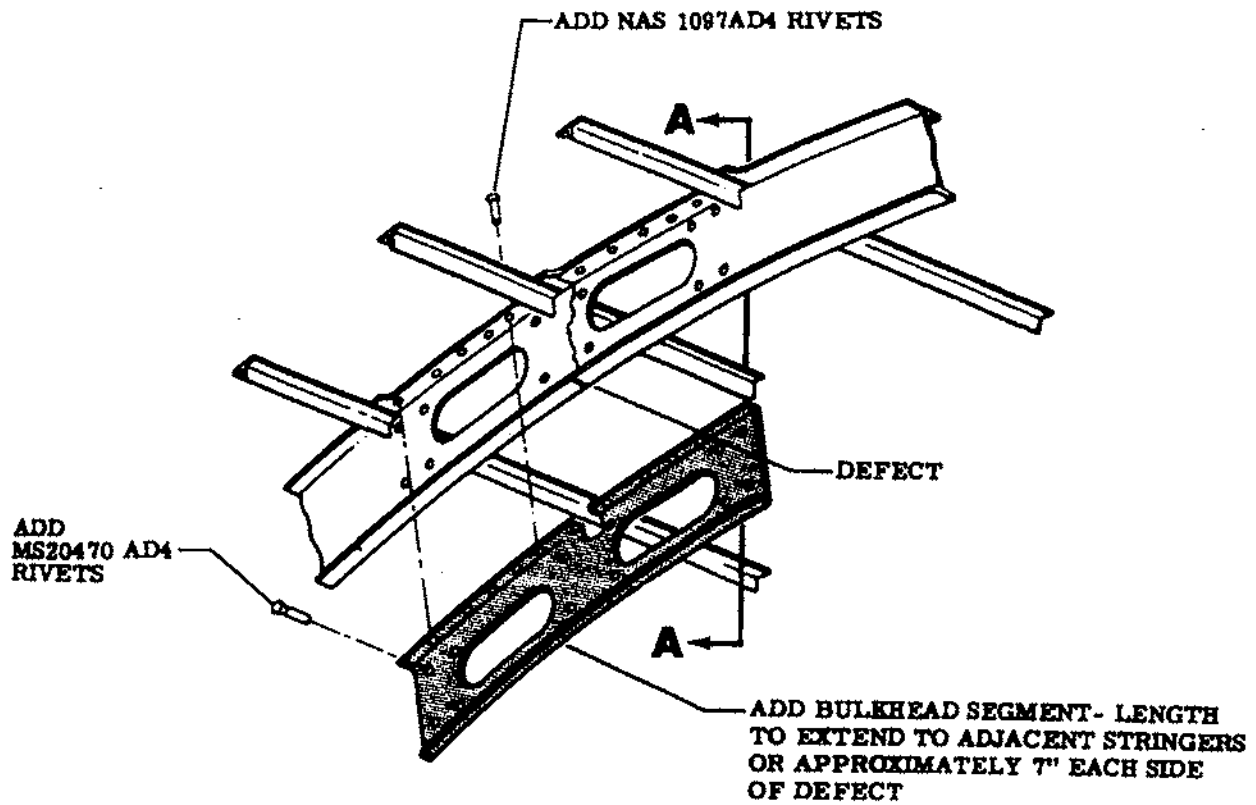


TYPICAL REPLACEMENT OF BULKHEAD SECTION

 Typical Cabin Bulkhead Repair
 Figure 22 (Sheet 1)

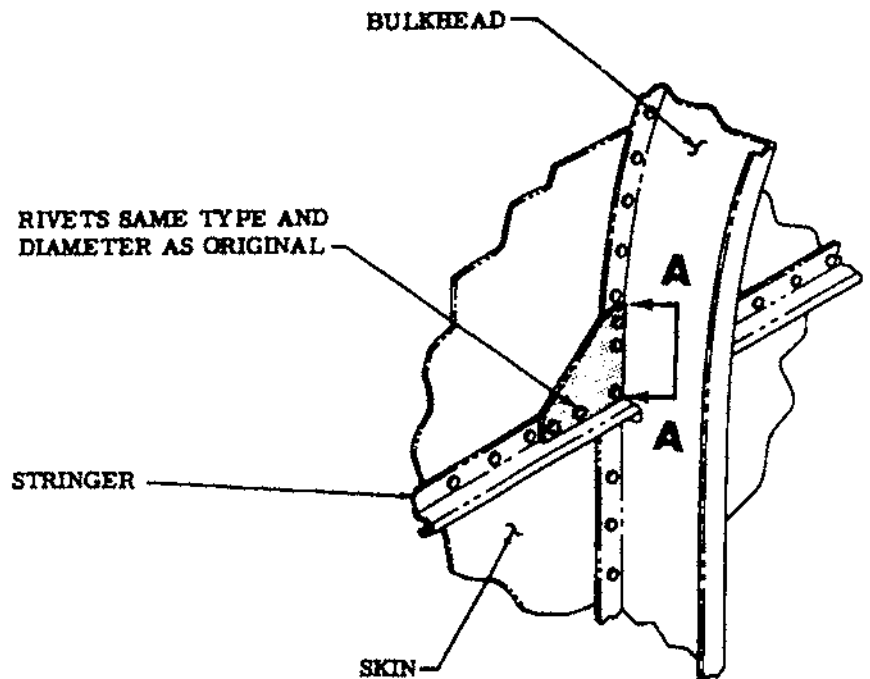
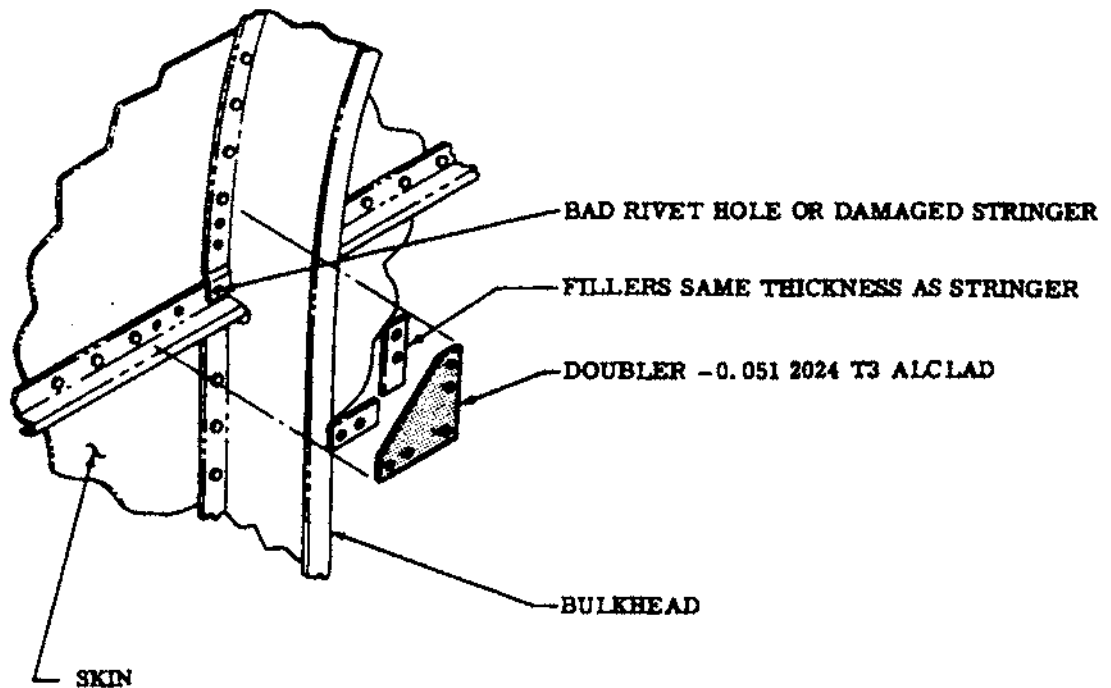


Typical Cabin Bulkhead Repair
Figure 22 (Sheet 2)



TYPICAL CABIN BULKHEAD REPAIR

Typical Cabin Bulkhead Repair
Figure 22 (Sheet 3)



	ORIGINAL PARTS
	REPAIR PARTS
	REPAIR PARTS IN CROSS SECTION

Typical Stringer to Bulkhead Repair
Figure 23

STOP DRILL CRACK IF CRACK DOES
NOT EXTEND TO EDGE OF PART

DOUBLER—0.032 2024 T3 ALCLAD

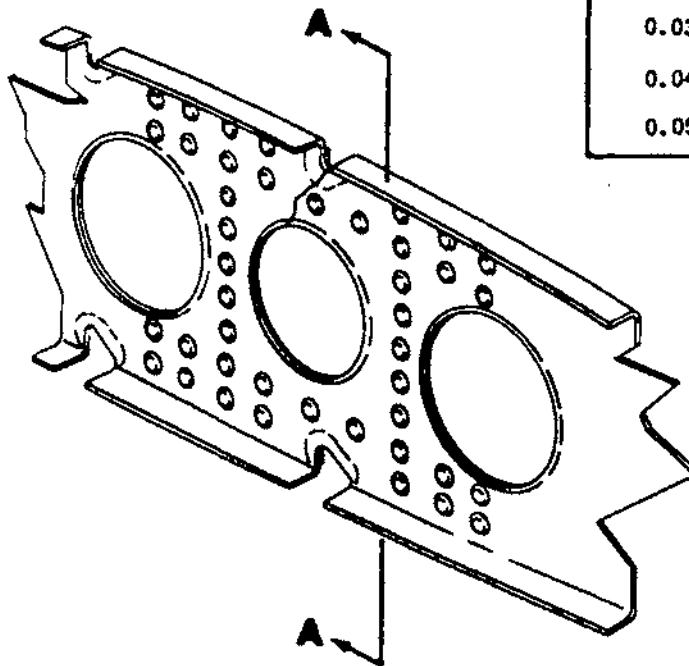
1/4" EDGE
MARGIN

RIB

RIVET TABLE	
SKIN GAGE	RIVET DIA.
0.020	3/32
0.025	1/8
0.032	1/8
0.040	1/8
0.051	5/32



A-A

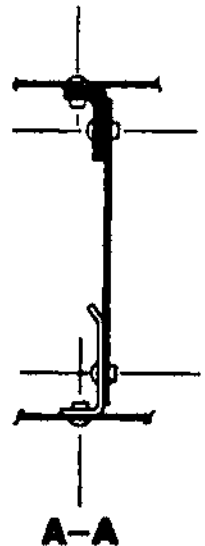
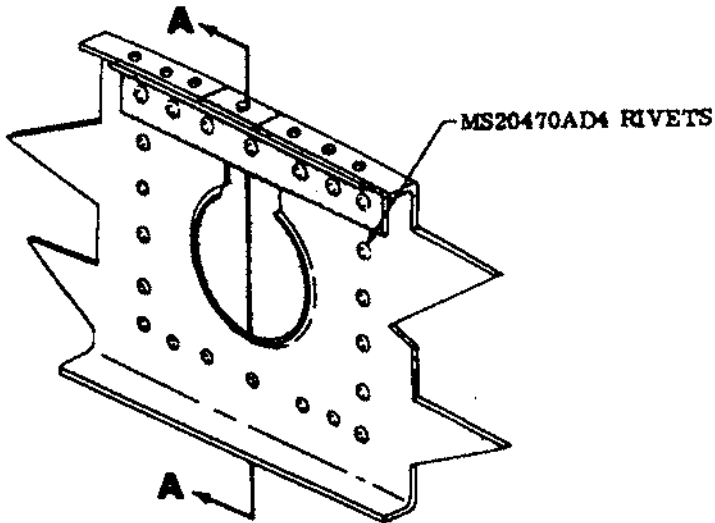
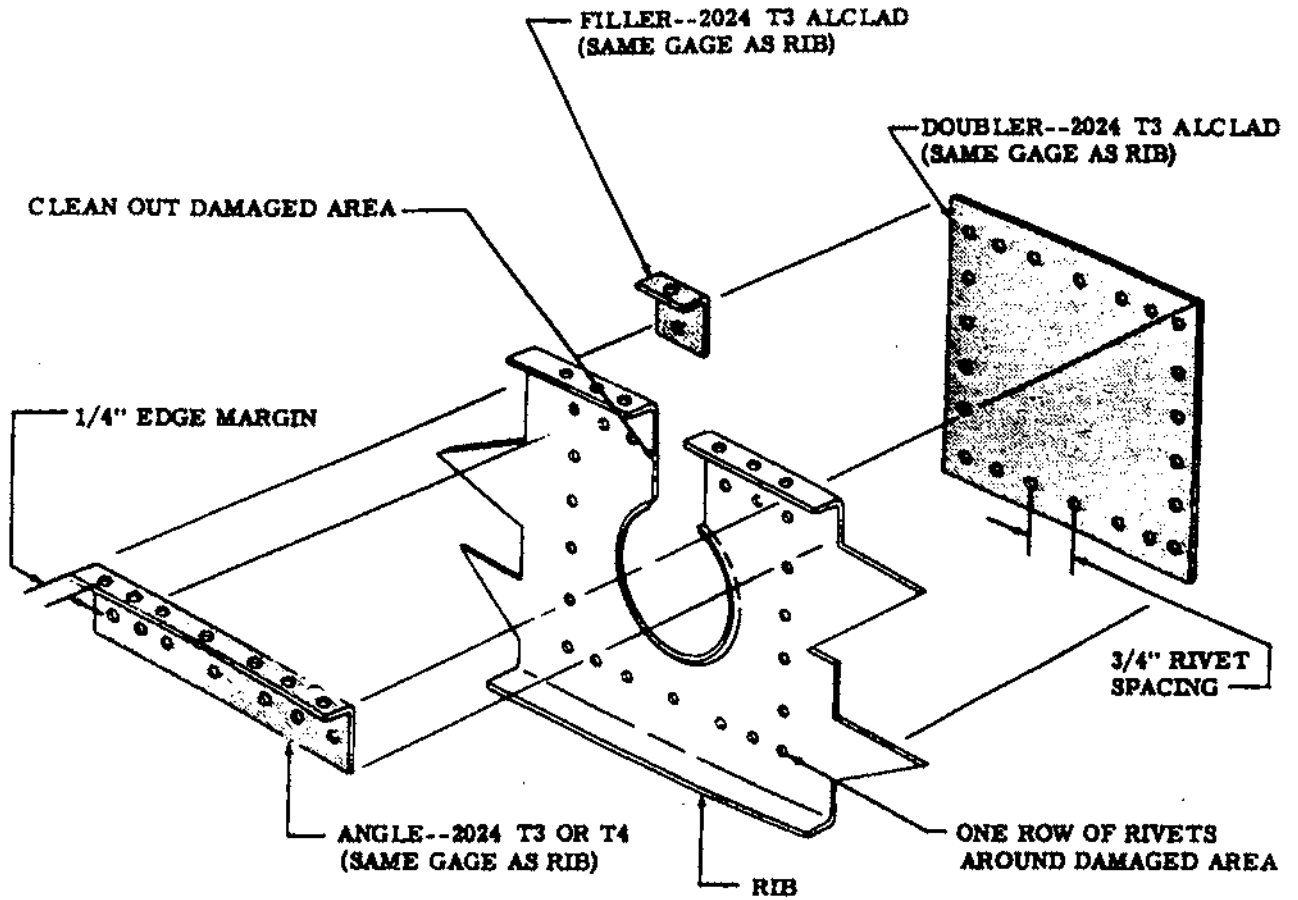


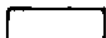
ORIGINAL PARTS

REPAIR PARTS

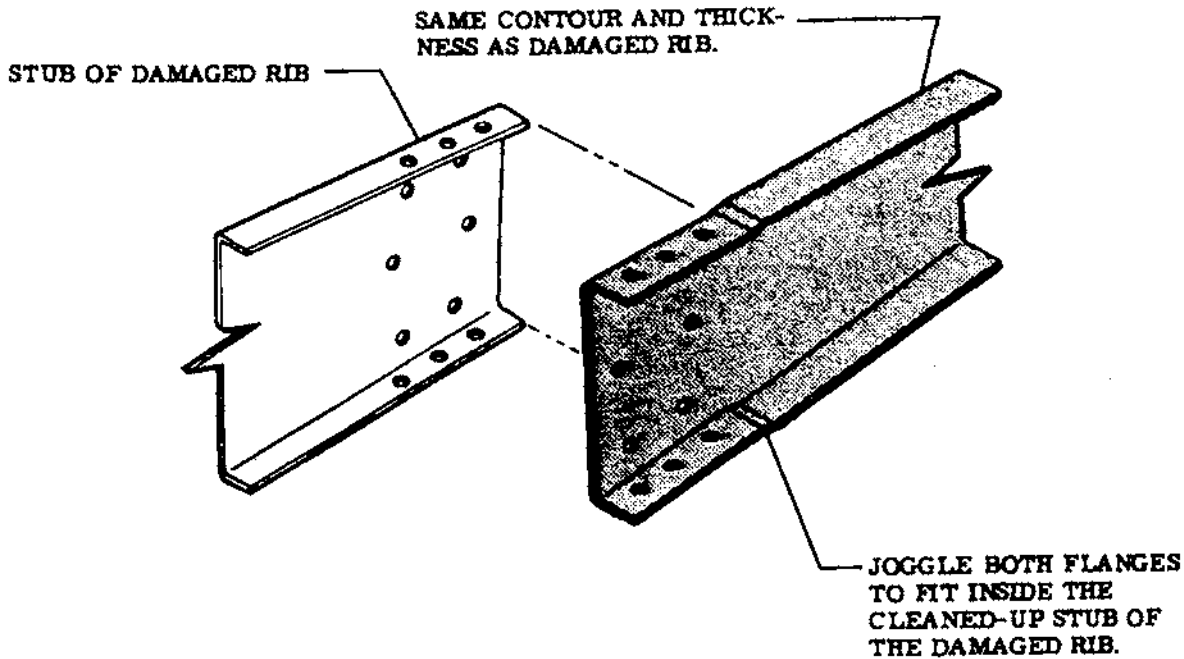
REPAIR PARTS IN CROSS SECTION

Typical Rib Web Repair
Figure 24

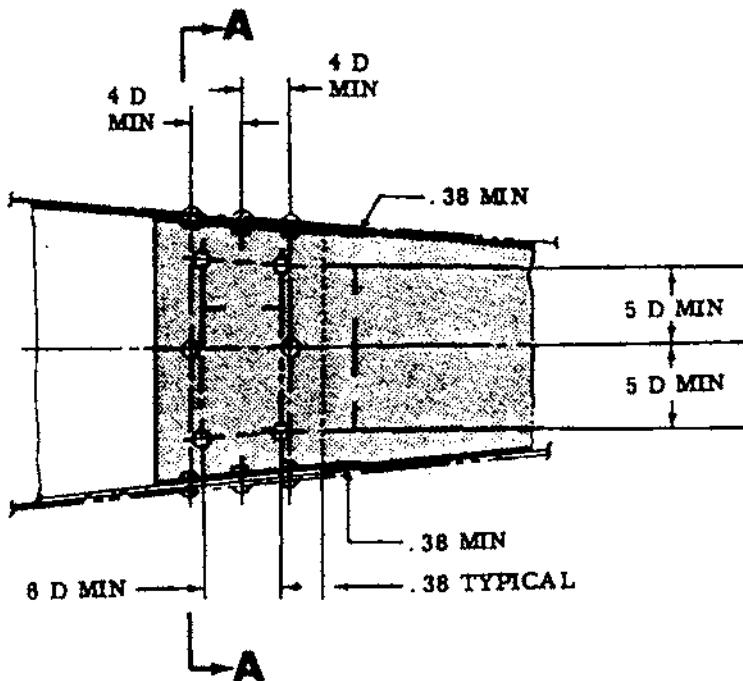


-  ORIGINAL PARTS
-  REPAIR PARTS
-  REPAIR PARTS IN CROSS SECTION

Typical Rib Flange Repair
Figure 25

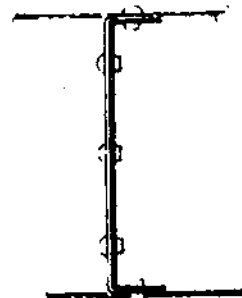


NUMBER OF ROWS OF RIVETS IN WEB DEPENDS ON AREA AVAILABLE. SEE MINIMUM SPACING. MAXIMUM SPACING IS ONE INCH. RIVETS IN FLANGES MUST BE AS SHOWN.

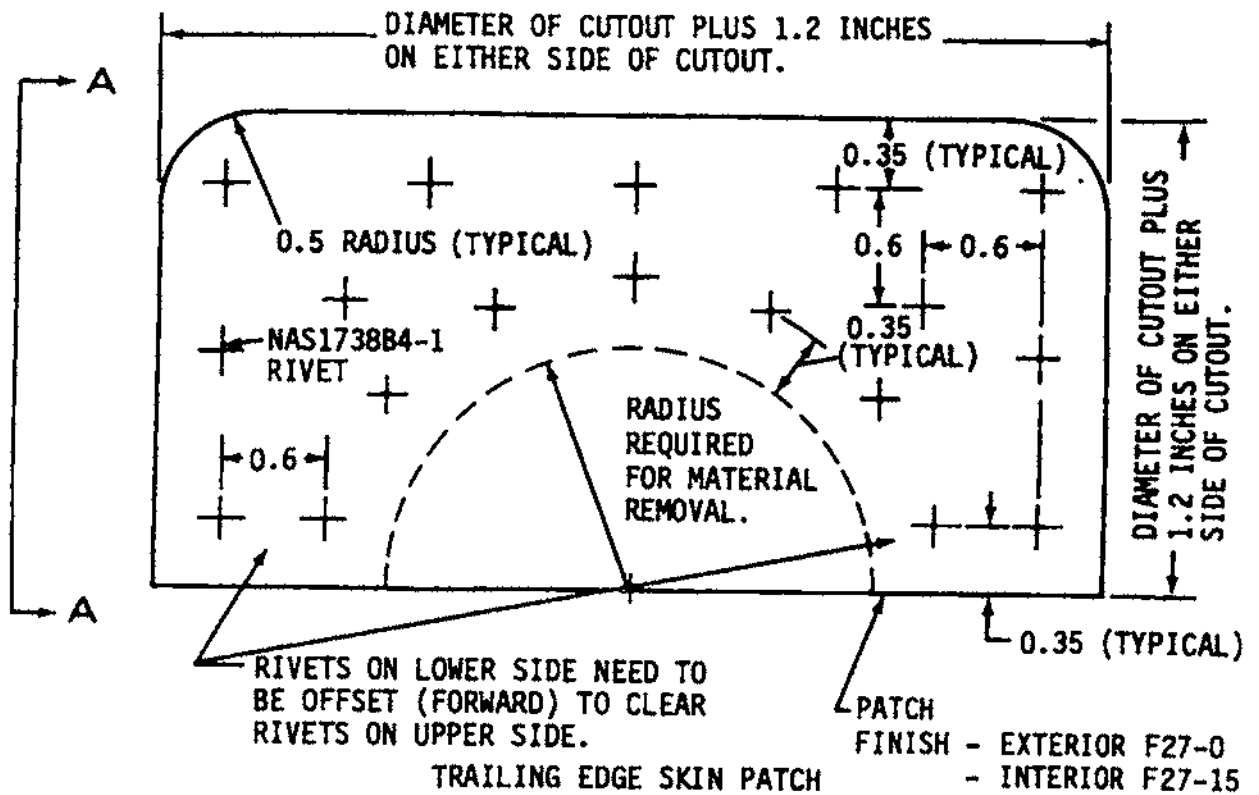


FOR RIB THICKNESS OF .032 OR LESS USE MS20470AD3 RIVETS AND FOR THICKER MATERIAL USE MS20470AD4 RIVETS.

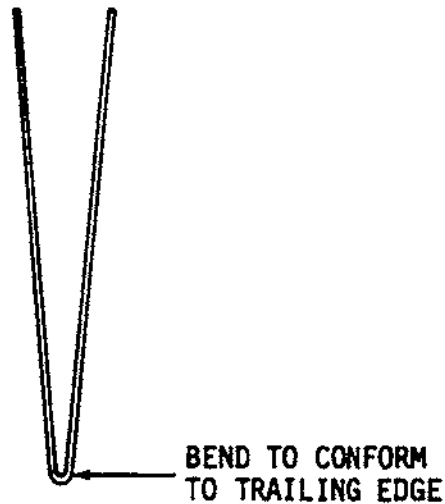
-  ORIGINAL PARTS
-  REPAIR PARTS
-  REPAIR PARTS IN CROSS SECTION



Typical Repair of Control Surface Rib
Figure 26



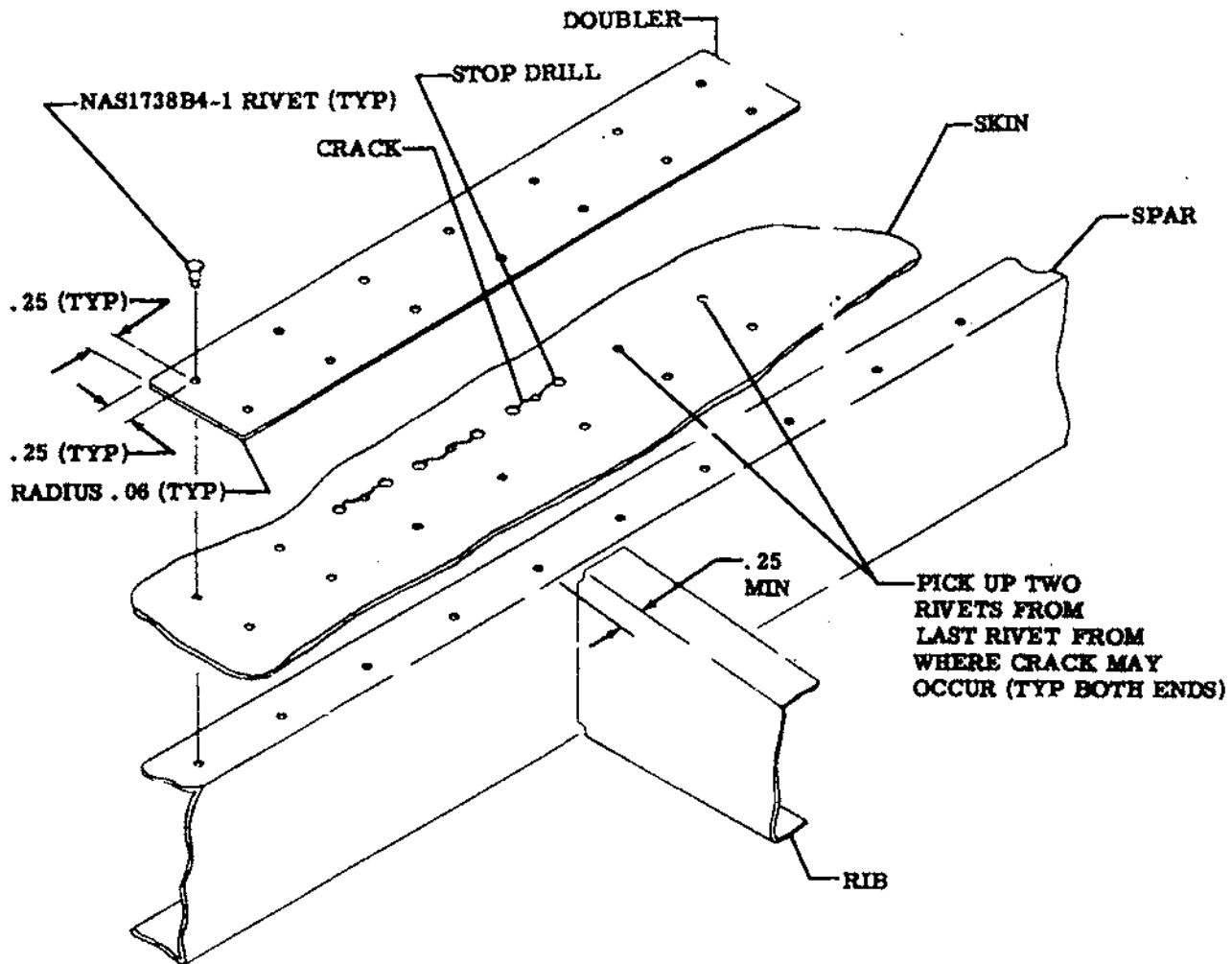
DETAIL B



VIEW A-A

Control Surface Repair
Figure 27

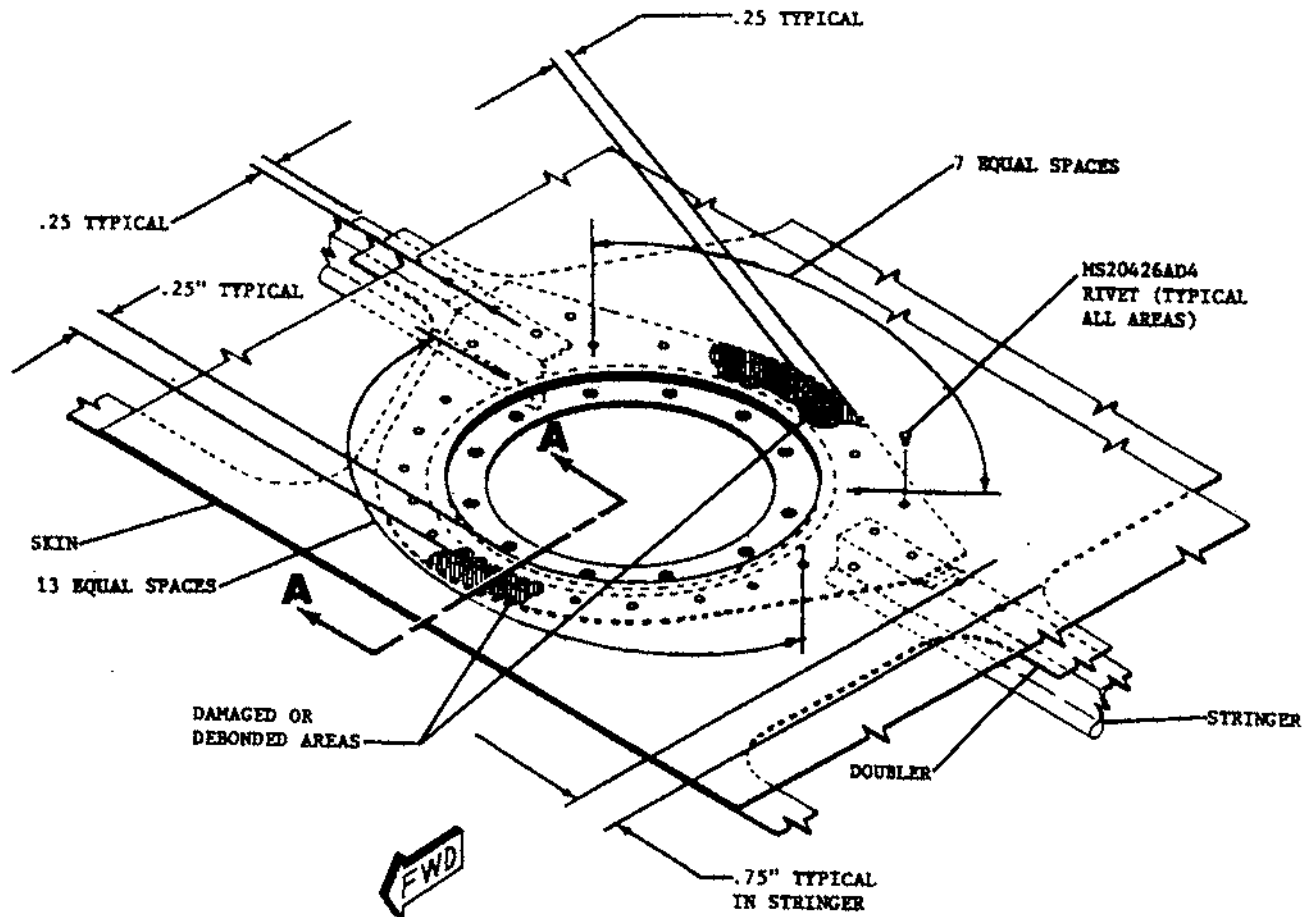
59821003



STOP DRILL BOTH ENDS OF CRACK WITH
.098 DIA. DRILL (THRU SKIN ONLY)

Typical Skin Repair
Figure 28

51342001

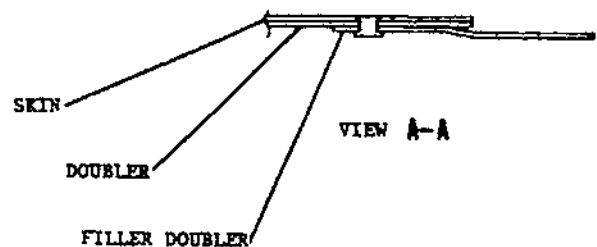


NOTES

INSTALL RIVETS IN WET SEALER
AND FILLET SEAL ALONG STRINGER
AND/OR RIB CAP AT LEAST 2"
BEYOND LAST RIVET.

INSTALL TWO RIVETS BEYOND
DEBONDED AREA.

RIVET	PART NUMBER
1/8	MS20426AD4



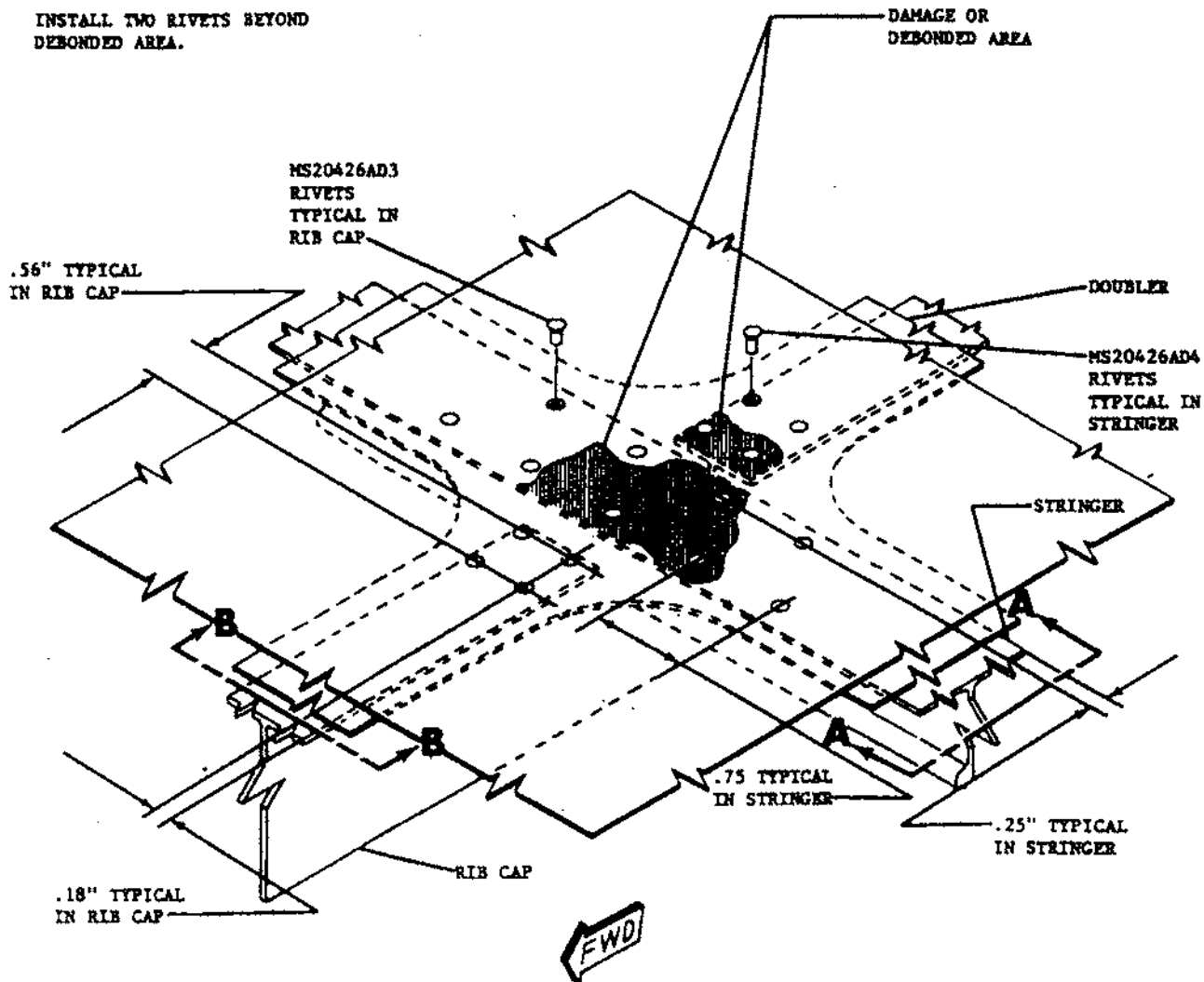
51222004
51221007

Typical Filler Cap Area Repair (Bonded Wing)
Figure 29

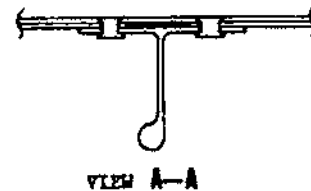
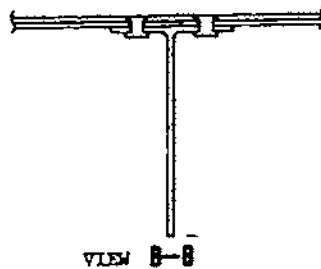
NOTES

INSTALL RIVETS IN WET SEALER
AND FILLET SEAL ALONG STRINGER
AND/OR RIB CAP AT LEAST 2"
BEYOND LAST RIVET.

INSTALL TWO RIVETS BEYOND
DEBONDED AREA.

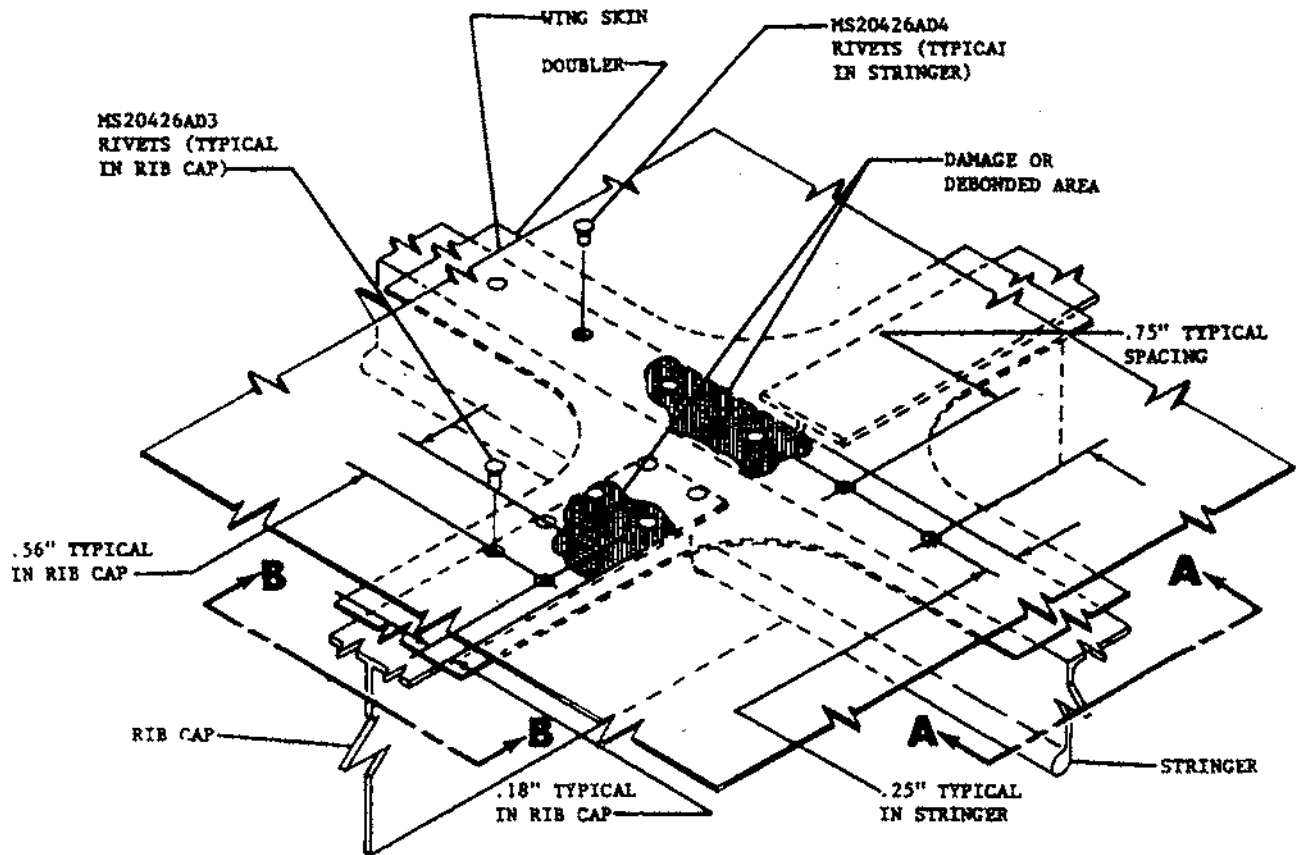


RIVET	PART NUMBER
3/32	MS20426AD3
1/8	MS20426AD4



51222003
51221007
51221007

Typical Outer Wing Panel Repair (Bonded Wing)
(Wing Station 119.29 To 186.47)
Figure 30

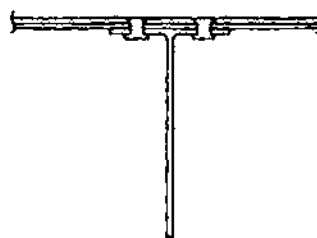


RIVET	PART NUMBER
3/32 1/8	MS20426AD3 MS20426AD4

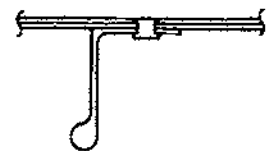
NOTES

INSTALL RIVETS IN WET SEALER AND FILLET SEAL ALONG STRINGER AND/OR RIB CAP AT LEAST 2" BEYOND LAST RIVET.

INSTALL TWO RIVETS BEYOND DEBONDED AREA.



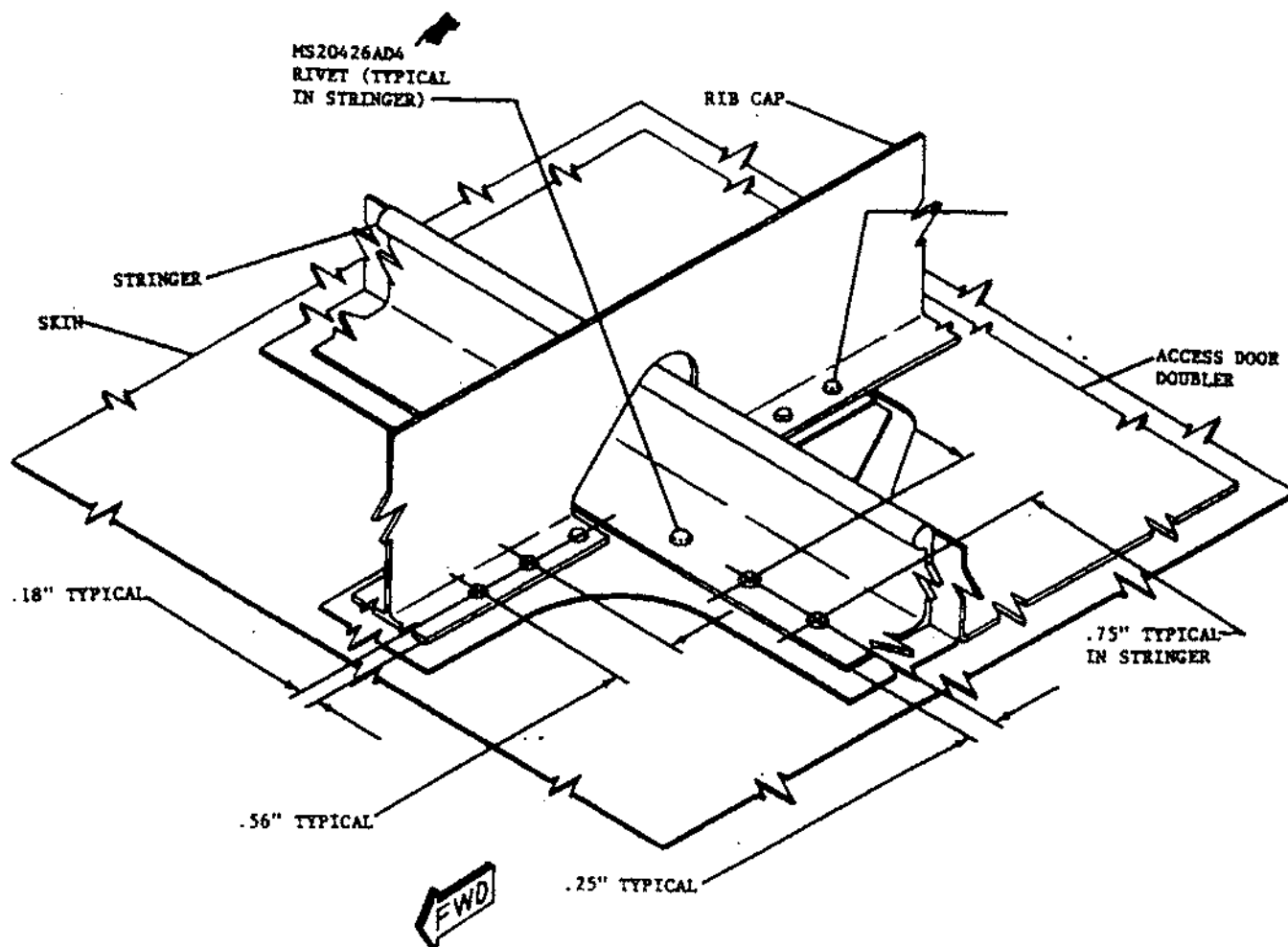
VIEW B-B



VIEW A-A

Typical Outer Wing Panel Repair (Bonded Wing)
(Wing Station 166.47 To 229.71)
Figure 31

51222003
51221007
51221007

NOTES

INSTALL RIVETS IN WET SEALER
AND FILLET SEAL ALONG STRINGER
AND/OR RIB CAP AT LEAST 2"
BEYOND LAST RIVET.

INSTALL TWO RIVETS BEYOND
DEBONDED AREA.

RIVET	PART NUMBER
3/32	MS20426AD3
1/8	MS20426AD4

51222004

Typical Lower Wing Panel Repair (Bonded Wing)
Figure 32

- (7) Install nutplates as shown at four new antenna mounting screw holes.
- (8) Plug obsolete screw holes and nutplate rivet attach holes with rivets at location of removed nutplates.
- (9) Install screws in the two existing forward antenna mounting holes.
- (10) Place the AT460A, part number 121-0007, antenna in location and secure with mounting screws.
- (11) Connect antenna coax cable to antenna connector.
- (12) Conduct operational check of flight phone.
- (13) Install access covers.

8. Skin Repairs.

A. Polishing Repairs.

- (1) These repairs can be accomplished on a surface where:
 - (a) Damage is less than 15 percent of skin in depth.
 - (b) Damage width is not in excess of 0.25 inch.
- (2) To determine the depth of damage for polishing repairs, perform the following test.
 - (a) Clean the damaged area. Use trichlorethylene or other suitable grease removing solution.
 - (b) Place a drop of scratch testing solution on the damaged area. Allow the solution to remain on this area not less than one minute or more than three minutes.

NOTE: Scratch testing solution is made up of 20 gm KNO_3 (potassium nitrate), 10 gm NaOH (sodium hydroxide) and distilled water. Distilled water will be added in quantity to make a 100cc solution.

- (c) Clad areas are not affected by the scratch testing solution; exposed core material will turn dark.
- (d) Immediately after the test, rinse the tested area with clean cold water.

WARNING: USE RUBBER GLOVES WHEN WORKING WITH CHROMIC ACID SOLUTION. WHEN WORKING ON LOWER SKIN SURFACES, WEAR A FACE SHIELD. IF ANY OF THE SOLUTION COMES IN CONTACT WITH YOUR EYES OR SKIN, FLUSH AREA WITH COLD WATER.

- (e) Apply a 5 percent chromic acid solution to the test area; remove excess chromic acid by wiping with a clean cloth.
- (f) Damage that does not penetrate the cladding is not greater in depth than 0.002.

B. Polishing Procedures.

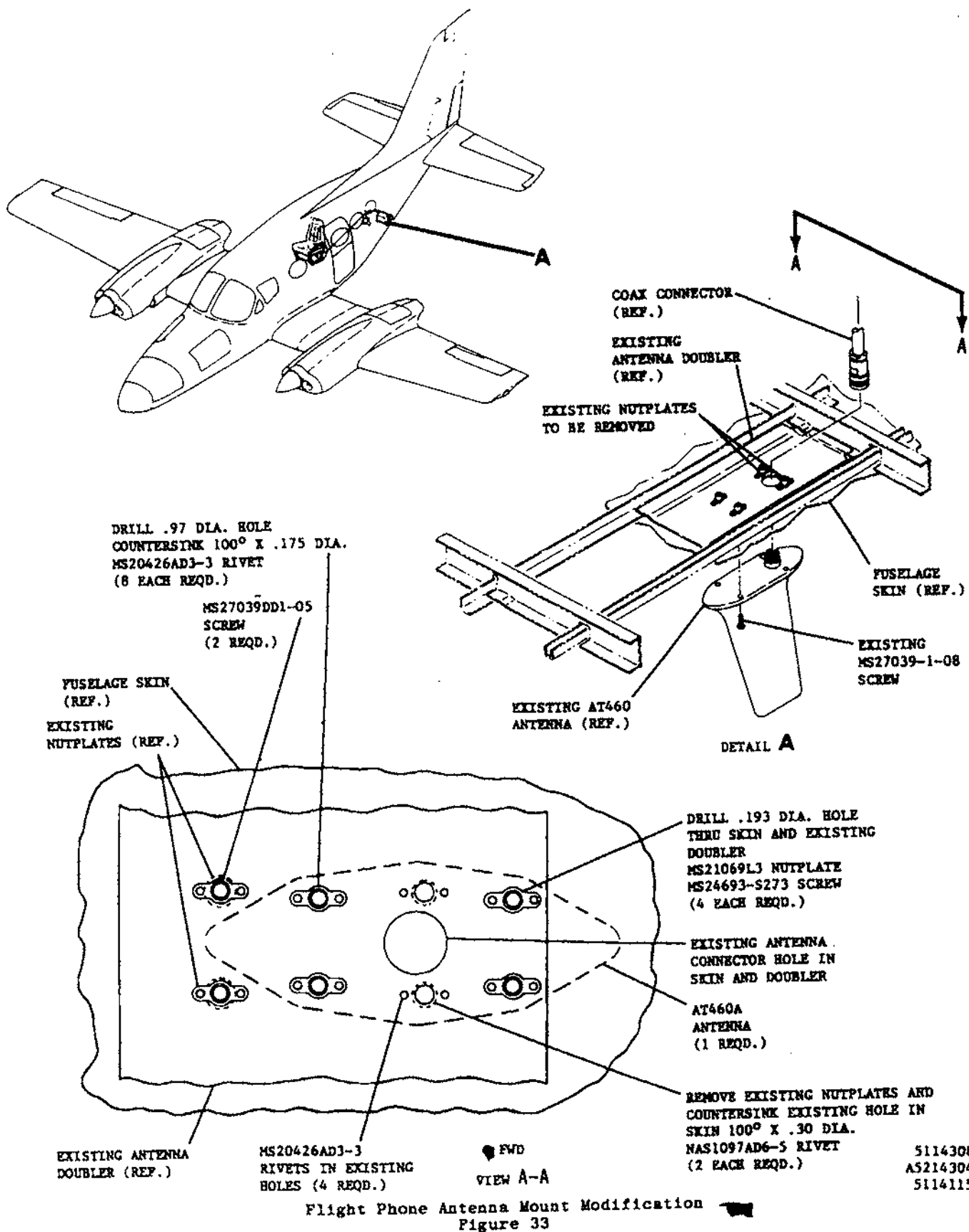
WARNING: USE RUBBER GLOVES WHEN WORKING WITH KELITE L17. WHEN WORKING ON LOWER SURFACES, WEAR A FACE SHIELD. IF ANY OF THE SOLUTION COMES IN CONTACT WITH YOUR EYES OR SKIN, FLUSH AREA WITH COLD WATER.

- (1) Clean the damaged area with Kelite L17. Remove as soon as possible with water.

CAUTION: MAXIMUM WIDTH OF STONED AREA SHOULD NOT EXCEED 0.25 INCH.

- (2) Using a scotchstone and water, work the length of the damaged area until the damage is removed.
- (3) Using 400 grit or finer aluminum oxide, wet or dry sand paper, smooth the stone marks. Work in the direction of the damage.
- (4) Using a brown wrapping paper buff, saturated with light oil and Bon Ami, buff the damaged area. Work in the direction of the damage.

NOTE: Make a paper buff by folding brown wrapping paper in a 6 inch x 6 inch pad.



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- (5) Using jewelers rouge and a soft cotton cloth wrapped around the index finger, polish the surface to remove the abrasion marks. Work in the direction of damage. Do not polish in a circular motion, and limit polishing to damaged area.
- (6) Using the brown wrapping paper buffing pad and oil, blend the reworked area to the surrounding surface. Work with the grain of the metal until a satin finish is obtained.
- (7) Using chemically treated waste (all-in-one polish saturated waste) polish blend the area to the desired finish.

WARNING: USE RUBBER GLOVES WHEN WORKING WITH KELITE L17. WHEN WORKING ON LOWER SURFACES, WEAR A FACE SHIELD. IF ANY OF THE SOLUTION COMES IN CONTACT WITH YOUR EYES OR SKIN, FLUSH AREA WITH COLD WATER.

- (8) Final bland with Kelite L17, then rinse with clean cold water.

C. Modification Repairs.

- (1) The following repairs are for all skins both in and out the cabin. When making the repairs in the cabin area, a staggered double row of rivets is required, if the repair is not supported or made rigid by understructure.
 - (a) Stop drill cracks. Use a number 40 (0.098) drill for metal thickness of 0.032 or less and number 30 (0.128) drill for metal thickness greater than 0.032.
 - (b) Remove damaged area, maintaining a radius of at least 0.25 inch or greater; smooth edges.

NOTE: Repair material and gage must be the same as the original material. Rivet pattern and spacing should be compatible with the original rivet pattern, and spacing should be 6 times the diameter of the rivet.

- (c) Cut repair material as required for the repair area.
- (d) Locate all repair parts and drill holes; then, remove and burr parts.
- (e) Hand sand and solvent wipe so that all faying surfaces will be bare.
- (f) Protective treat metal. Refer to Chapter 1.
- (g) Apply a film of adhesive (EA309) 0.02 to 0.03 inch thick to patch.
- (h) Install patch with appropriate rivets before the adhesive sets up.
- (i) Sand excess adhesive off and refinish as applicable.

9. Repair of Main Spar Web. (Refer to Figure 16-67.) (Airplanes C0001 thru C1412.)

- A. Remove seats, carpet, upholstery and floor panel as required to gain access to main spar feed-thru.
- B. Loosen upper forward fuselage fairing as required to gain access to main spar web.
- C. If not previously removed, remove access panels 512AT, 512BT, 612AT, 612BT, 511AB and 611AB (refer to Figure 1-2A).
- D. Remove 11 existing rivets from skin as shown, refer to rivet removal.
- E. Trim wing skin as follows:
 - (1) Layout a trim line on wing skin as shown.
 - (2) Using a suitable cutting tool, trim wing skin along trim line.

CAUTION: ENSURE THAT CUTTING TOOL DOES NOT DAMAGE RIB FLANGE.

- F. Fill all existing countersunk rivet holes (where existing rivets have been removed) in the airplane skin using Devcon F Aluminum putty. Observe the following to ensure proper application:
 - (1) Read and understand the instruction sheet included in the Devcon F one-pound pack. Ensure strict adherence to mixing and application instructions.
 - (2) Place tape over the back side of holes being filled to minimize protrusion of putty.
 - (3) Press the mixed Devcon F into the holes to be filled. Ensure that countersinks are slightly overfilled to allow for smoothing after putty has cured.
 - (4) In approximately three hours curing time, the (excess waste material) Devcon F can be smoothed to contour of the airplane.

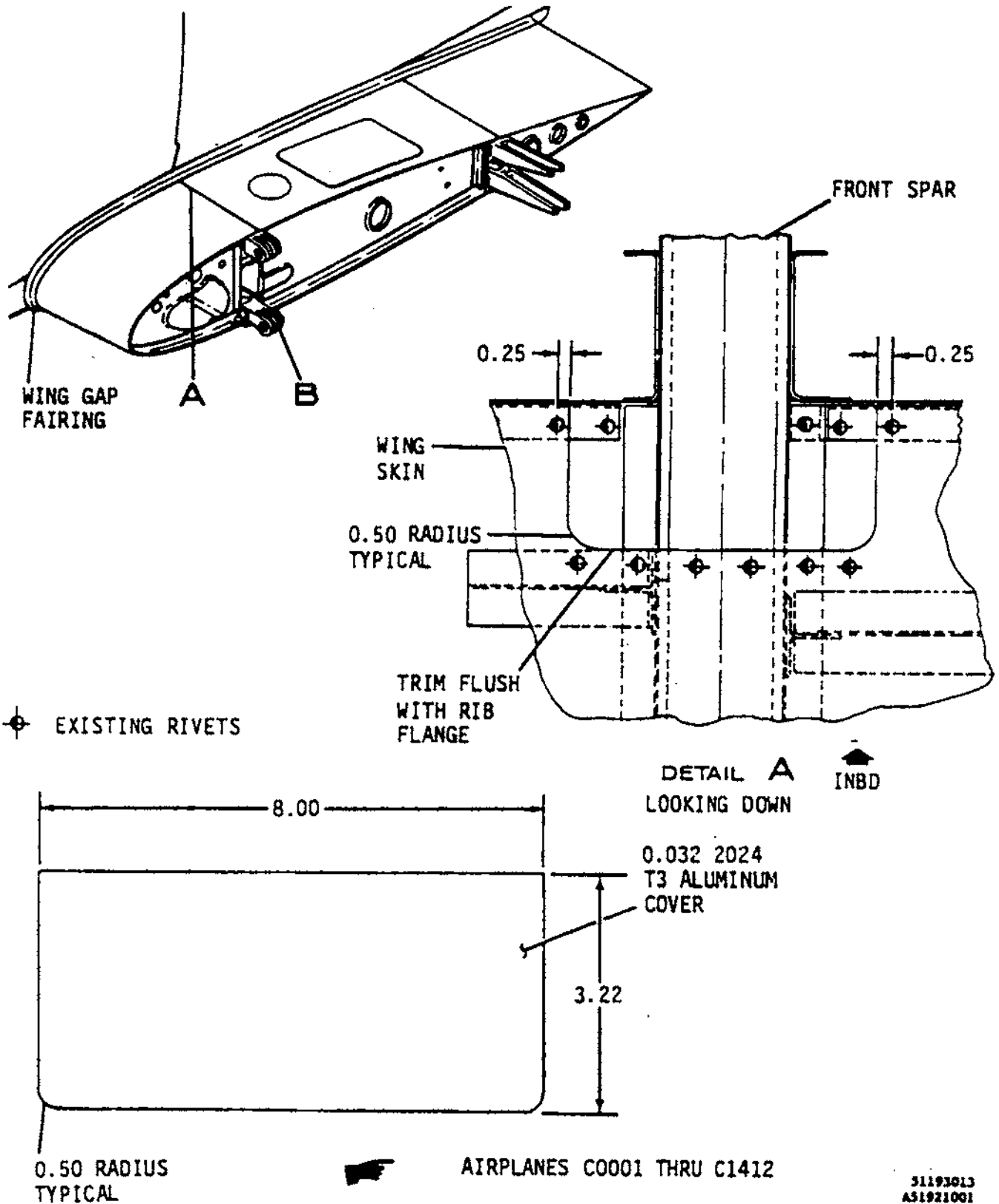
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- G. Trim spar web flush with fuselage skin using a 0.69 and 3.75 radii as shown.
- H. Trim angle on fuselage as shown, remove upper part of angle and discard. Plug holes in fuselage with MS20470AD-4 Rivets. Seal rivets with MIL-S-8802.
- I. Fabricate cover from 0.032 2024T3 aluminum as shown.
- J. Position cover on wing skin as shown, drill four (4) holes through cover to match existing holes.
- K. Layout and drill nine (9) 0.128 holes through cover and skin as shown. Remove cover and deburr holes.
- L. Install cover on skin securing with rivets as shown.
- M. Attach upper forward fuselage fairing with MS20426AD-4 Rivets and seal rivets with MIL-S-8802.
- N. Reinstall seats, carpet, upholstery and floor panels.

10. Replacement of Radome Boot (Refer to Figure 35).

- A. Remove old radome boot from radome.
- B. Install new boot in accordance with Figure 35.

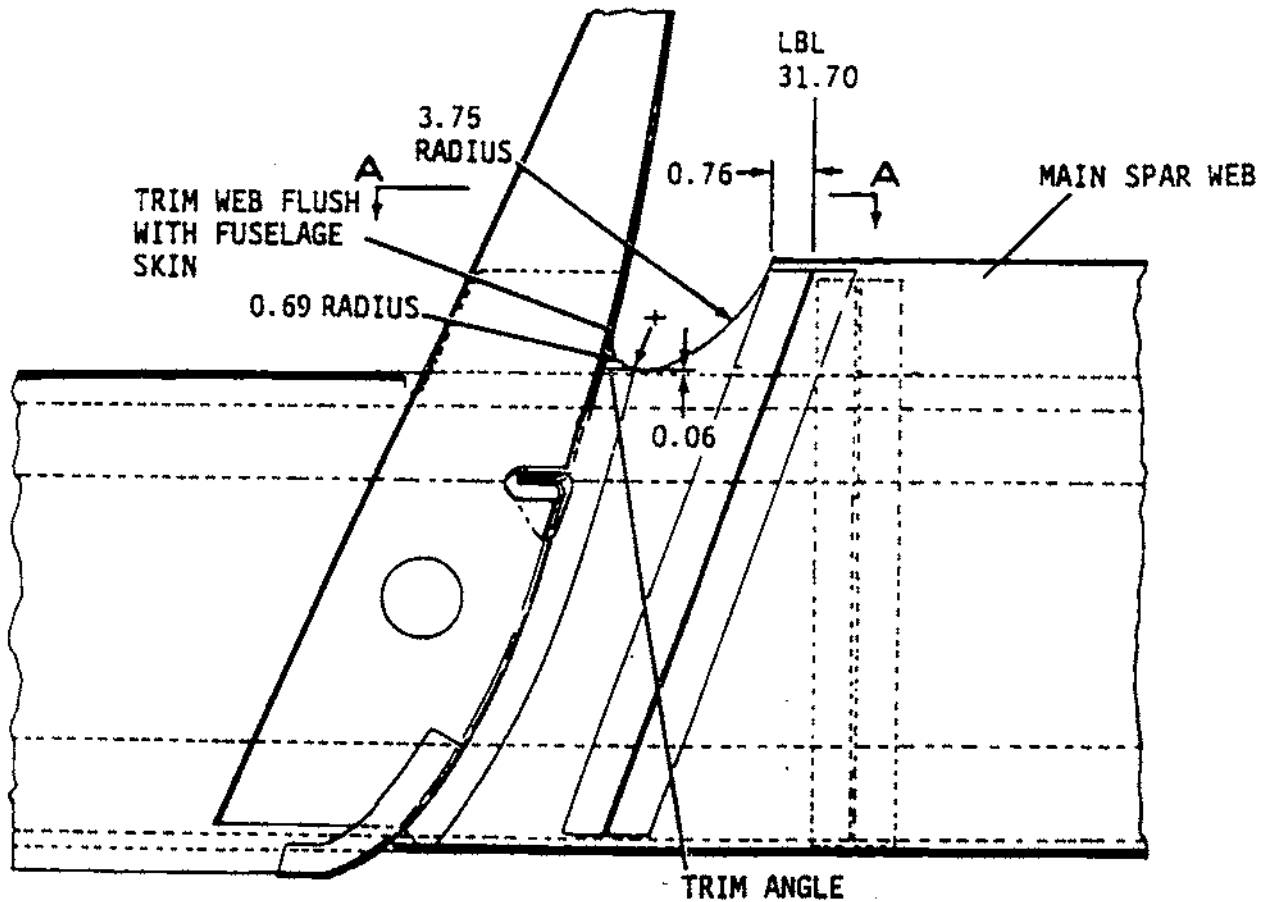
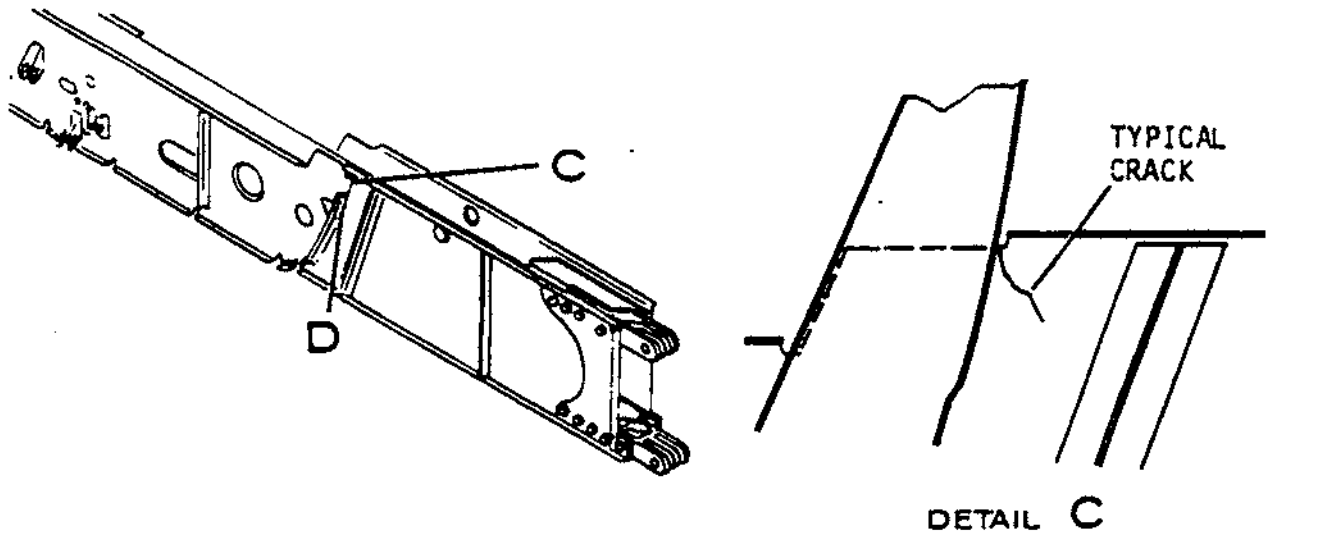
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A31921001
B31921001

Repair of Main Spar Web
Figure 34 (Sheet 1)

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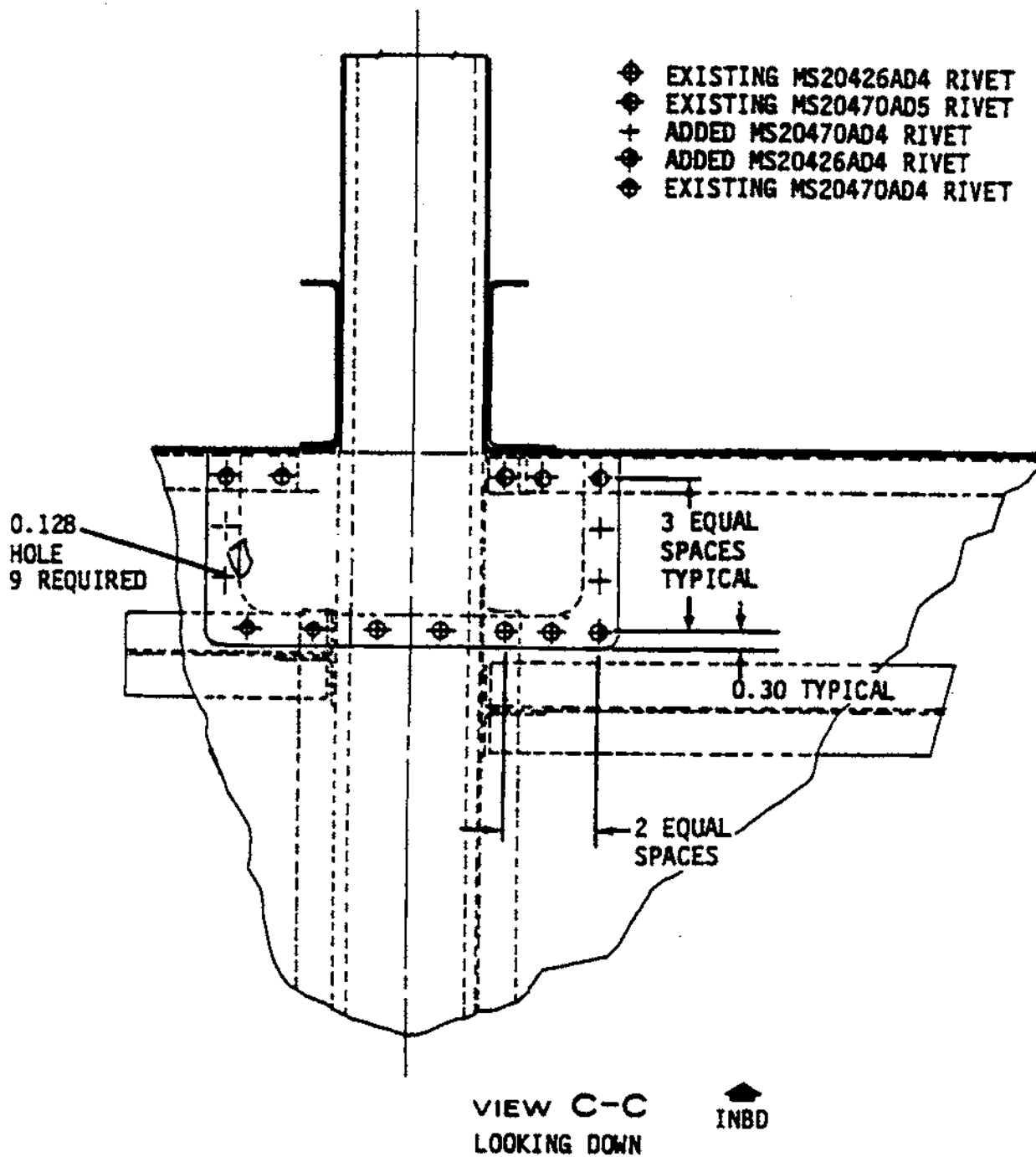
DETAIL D
LOOKING AFT

AIRPLANES C0001 THRU C1412

Repair of Main Spar Web
Figure 34 (Sheet 2)

31921003

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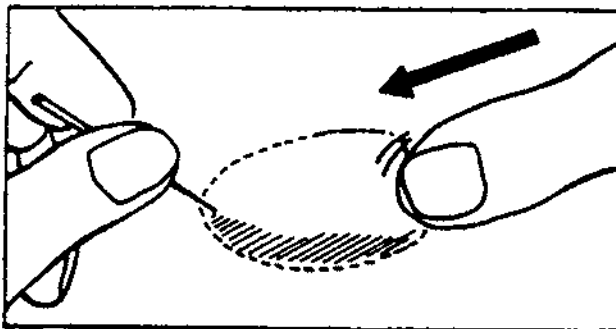
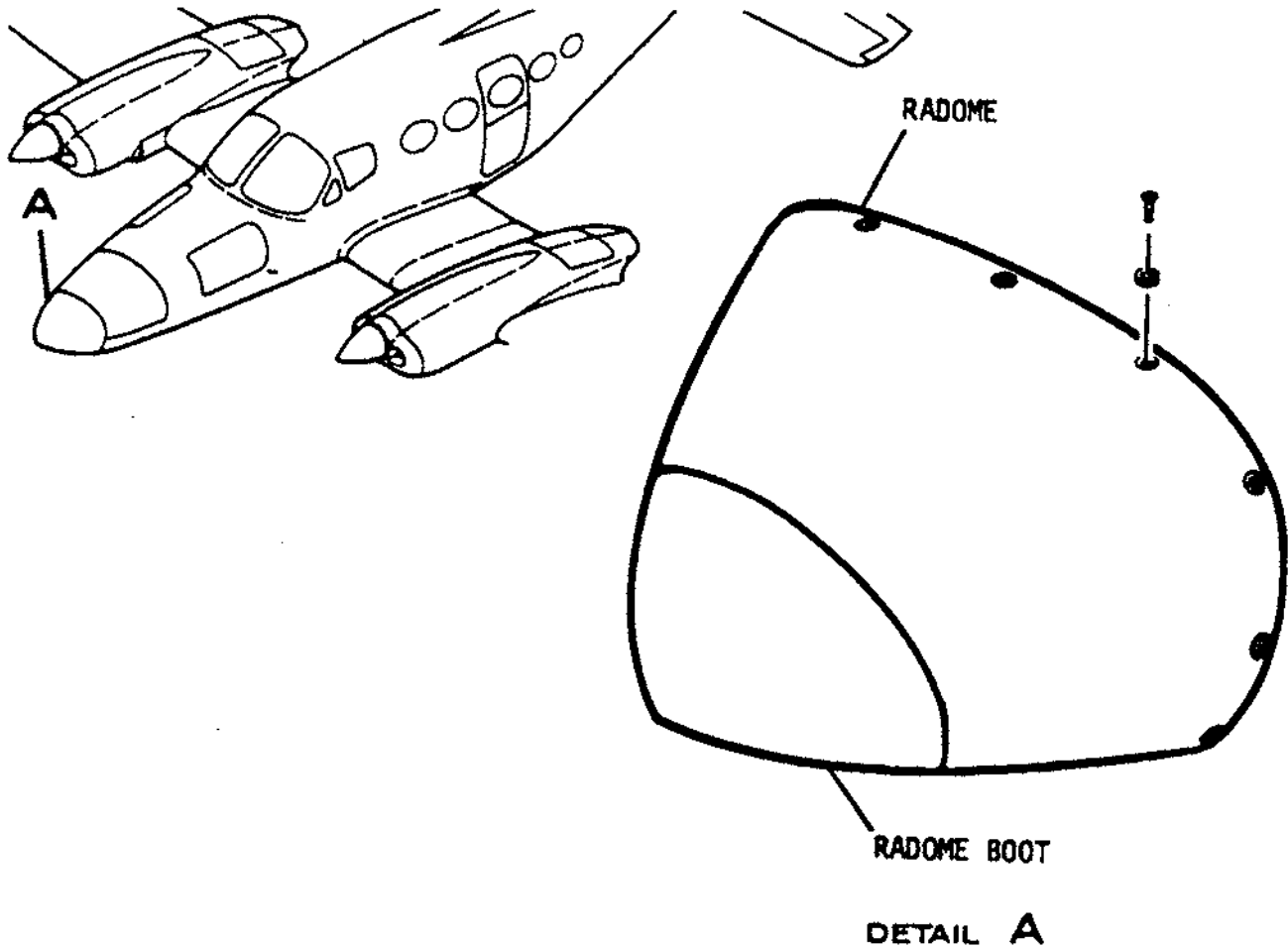


AIRPLANES C0001 THRU C1412

Repair of Main Spar Web
Figure 34 (Sheet 3)

31921003

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REMOVAL OF ENTRAPPED AIR - IF AIR BUBBLES ARE PRESENT AFTER THE APPLICATION, PUNCTURE FILM AT ONE END OF BUBBLE WITH A PIN OR OTHER SHARP, ROUND, POINTED TOOL (DO NOT USE KNIFE OR RAZOR BLADE) AND PRESS OUT ENTRAPPED AIR WITH SQUEEGEE OR FINGER.

Radome Boot Installation
Figure 35

51103008A
A51131007A
51131019

CORROSION - DESCRIPTION AND DETECTIONGeneral

1. This section will describe corrosion so the maintenance personnel can identify the various types of corrosion and apply preventative measures to minimize corrosion activity.
2. Corrosion is the deterioration of a metal by reacting with its environment. Corrosion occurs because most metals have a tendency to return to their natural state.

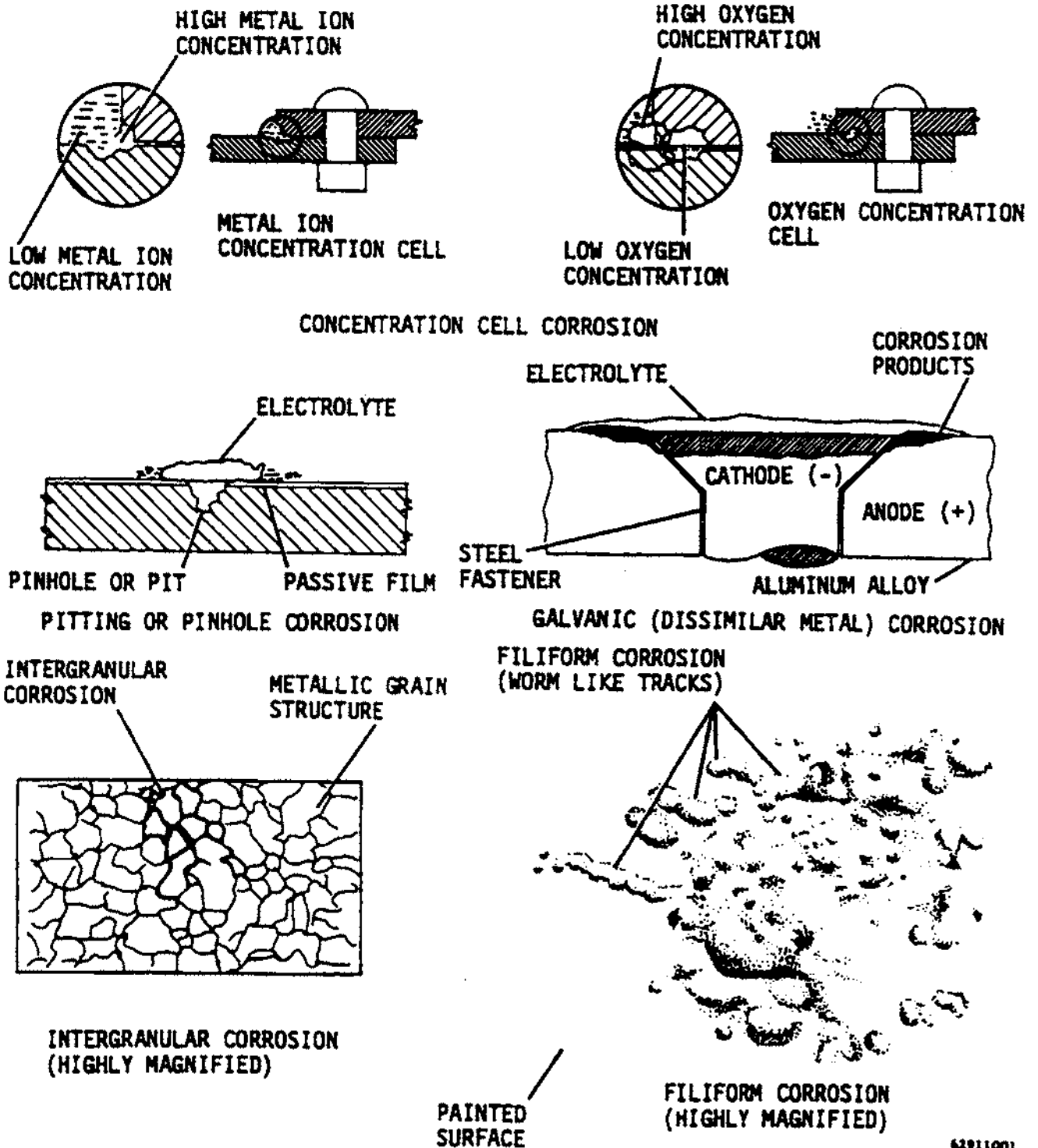
Characteristics of Corrosion

1. Metals corrode by direct chemical or electrochemical reaction with their environment. The following listed steps describe electrochemical reaction.
 - A. Electrochemical type of corrosion can best be compared to a battery cell. Four conditions must exist before electrochemical corrosion can occur.
 - (1) There must be a metal that corrodes and acts as the anode.
 - (2) There must be a less corrodible metal that acts as the cathode.
 - (3) There must be a continuous liquid path between the two metals which acts as the electrolyte, usually condensation and salt or other contaminations.
 - (4) There must be a conductor to carry the flow of electrons from the cathode to the anode. This conductor is usually in the form of a metal-to-metal contact (rivets, bolts, welds, etc.).
 - B. The elimination of any one of the four conditions described above will stop the corrosion reaction process.
 - C. One of the best ways to eliminate one of the four described conditions is to apply an organic film (such as paint, grease, plastic, etc.) to the surface of the metal affected. This will prevent the electrolyte from connecting the cathode to the anode, and current cannot flow, therefore, preventing corrosion reaction.
 - D. At normal atmospheric temperatures, metals do not corrode appreciably without moisture, but the moisture in the air is usually enough to start corrosive action.
 - E. The initial rate of corrosion is usually much greater than the rate after a short period of time. This slowing down occurs because of the oxide film that forms on the metal's surface. This film tends to protect the metal underneath.
 - F. When components and systems constructed of many different types of metals must perform under various climatic conditions, corrosion becomes a complex problem. The presence of salts on metal surfaces (from sea coast operation) greatly increases the electrical conductivity of any moisture present and accelerates corrosion.
 - G. Other environmental conditions which contribute to corrosion are:
 - (1) Moisture collecting on dirt particles.
 - (2) Moisture collecting in crevices between lap joints, around rivets, bolts and screws.

Types of Corrosion

1. The common types of corrosion that are encountered in airplane maintenance is described below. In actual practice, it may be difficult to determine the exact type. The reason for this is, that, more than one type may be occurring in the same area, at the same time. However, even though you may not be able to identify the exact type or types you shall be able to determine that there is some kind of corrosion taking place. If impractical to replace assembly or component, contact authorized repair station.

2. Uniform Etch Corrosion
 - A. The surface effect produced by most direct chemical attacks (as by acid) is uniform etching of the metal. On a polished surface this type of corrosion is first seen as a general dulling of the surface. If such corrosion is allowed to continue unchecked, the surface becomes rough and possibly frosted in appearance.
3. Pitting or Pinhole Corrosion
 - A. The most common effect of corrosion on aluminum and magnesium alloy parts is called pitting. It is first noticeable as a white or gray powdery deposit, similar to dust, which blotches the surface (see Figure 1).
 - B. When the deposit is cleaned away, tiny pits can be seen in the surface. Pitting may also occur in other types of metal alloys.
4. Intergranular Corrosion
 - A. This type of corrosion attacks the grain boundaries of metals. A highly magnified cross-section of any alloy shows the granular structure of the metal.
 - B. This structure consists of quantities of individual grains, and each of these tiny grains has a clearly defined boundary and differs chemically from the metal grain next to it. The adjacent grains of different elements can react with each other as anode and cathode when in contact with an electrolyte. This conductive arrangement causes rapid selective corrosion at the grain boundary, thus destroying the solidity of the metal. See Figure 1.
5. Exfoliation Corrosion
 - A. Exfoliation is a form of intergranular corrosion. It shows itself by "lifting up" the surface grains of a metal by the force of expanding corrosion. This occurs at the grain boundaries just below the surface of the metal.
 - B. Exfoliation gives the appearance of sheets of very thin metal separated by corrosion products. This type of corrosion is most often seen on extruded sections. There the grain thicknesses are usually less than in rolled alloy form. Most exfoliation type corrosion is found on aluminum alloy ducting.
6. Galvanic Corrosion
 - A. Galvanic corrosion occurs when dissimilar metals are in contact. The contacting of these unlike metals provide an internal circuit. An external circuit is provided by the presence of a buildup of an electrolytic substance between these metals. An example is when aluminum components are attached with steel fasteners.
7. Concentration Cell Corrosion
 - A. Concentration cell corrosion occurs when two or more areas of the same metal surface are in contact with different concentrations of the same solution: moist air, water, chemicals, etc.
 - B. The two general types of concentration cell corrosion are identified as: metal ion concentration cell and oxygen concentration cell. See Figure 1.
8. Filiform Corrosion.
 - A. Filiform corrosion is a "concentration cell" corrosion process. When a break in the protective coating over aluminum occurs, the oxygen concentration at the back or bottom of the defect is lower than that at its open surface. The oxygen concentration gradient, thus established, causes an electric current flow, and corrosion results. Filiform corrosion results when this happens along the interface between the metal and the protective coating and appears as small worm like tracks. Filiform corrosion generally starts around fasteners, holes and counter-sinks and at the edge of sheet metal on the outer surface of the airplane. Filiform corrosion is more prevalent in areas with a warm and damp environment.



Corrosion
Figure 1

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62911013
62916004

- B. To help prevent filiform corrosion development, the airplane should be:
- (1) Spray washed at least every two to three weeks (especially in a warm and damp environment).
 - (2) Waxed with a good grade of water repellent wax to help keep water from accumulating in the skin joints and around countersinks.

NOTE: Wax only clean surfaces. Wax applied over salt deposits will almost guarantee a trapped salt deposit which is capable of accumulating moisture and developing into corrosion.

- (3) Keep the airplane hangared to protect it from the atmosphere.
- (4) Fly the airplane to promote aeration of the enclosed parts.
- (5) Ensure all vent/drain holes are open to ventilate the interior of the airplane.

- C. To remove filiform corrosion once it has been discovered, refer to Corrosion Treatment in Chapter 1.

9. Stress Corrosion Cracking

- A. This corrosion is caused by the simultaneous effects of tensile stress and corrosion. The stress may be internal or applied. Internal stresses are produced by nonuniform shaping during cold working of the metal. These stresses are also created by press and shrink fitting general hardware.
- B. Stresses induced when pieces such as rivets and bolts are formed, are internal stress. These components can crack because of the internal stresses, and this characteristic is aggravated by corrosion. That is why such cracking is called stress corrosion cracking.

10. Fatigue Corrosion

- A. Fatigue corrosion is a special case of stress corrosion caused by the combined effects of cyclic stress and corrosion. An example of this kind of corrosion is unprotected engine bleed air ducts that are exposed to moisture. They are often held in such a way that thermal expansion causes repeated twisting of the duct. This causes metal fatigue and cracks in which corrosion can start.

Corrosion Typical Areas

1. Aluminum appears high in the electrochemical series of elements, and its position indicates that it should corrode very easily. However, the formation of a tightly adhering oxide film offers increased resistance under mild corrosive conditions. Most metals in contact with aluminum form couples which can cause galvanic corrosion attack. The alloys of aluminum are subject to pitting, intergranular corrosion, and intergranular stress corrosion cracking.
2. Battery Electrolyte
 - A. The battery, battery cover, battery box and adjacent areas (especially areas below the battery box where battery electrolyte may have seeped) are subject to the corrosive action.
 - B. If spilled battery electrolyte is neutralized and cleaned up at the same time of spillage, corrosion can be held to a minimum by using a weak boric acid solution to neutralize the potassium hydroxide (battery electrolyte); if boric acid is unavailable flood the area with cold water.
 - C. When corrosion appears, refer to Chapter 1 for corrosion removal and treatment.

3. Relief Tube Area and Toilet Area

- A. The accessible areas shall be cleaned and disinfected after each flight (if used). The key to controlling corrosion is cleanliness. The inaccessible areas are protected by sealant. When corrosion appears, refer to Chapter 1 for corrosion removal and treatment.

4. Steel Control Cable

- A. Checking for corrosion on control cables is normally accomplished during the preventative maintenance check. During preventative maintenance, broken wire and wear of the control cable is also checked.
- B. If the surface of the cable is corroded, carefully force the cable open by reverse twisting and visually inspect the interior. Corrosion on the interior strands of the cable constitutes failure and the cable must be replaced. If no internal corrosion is detected, remove loose external rust and corrosion with a clean dry coarse-weave rag or fiber brush.

NOTE: Do not use metallic wools or solvents to clean installed cables. Use of metallic wool will embed dissimilar metal particles in the cables and create further corrosion. Solvents will remove internal cable lubricant allowing cable strands to abrade and further corrode.

- C. After thorough cleaning of the exterior cable surface, apply a light coat of lubricant (5565430-28) to the external cable surface.

5. Piano Type Hinges

- A. The construction of piano type hinges forms moisture traps as well as the dissimilar metal couple between the steel hinge pin and the aluminum hinge. Solid film lubricants are often applied to reduce corrosion problems.
- B. Care and replacement of solid film lubricants require special techniques peculiar to the particular solid film being used. A good solid film lubricant are lubricants conforming to Specification MIL-G-81322. Refer to Chapter 2.
- (1) Solid film lubricants prevent galvanic coupling on close tolerance fittings and reduce fretting corrosion. Surface preparation is extremely important to the service/wear life of solid film lubricants.
- (2) Solid film lubricants are usually applied over surfaces pre-coated with other films such as anodize and phosphate. They have been successfully applied over organic coatings such as epoxy primers.

CAUTION: SOLID FILM LUBRICANTS CONTAINING GRAPHITE, EITHER ALONE OR IN MIXTURE WITH ANY OTHER LUBRICANTS, SHALL NOT BE USED SINCE GRAPHITE IS CATHODIC TO MOST METALS AND WILL CAUSE GALVANIC CORROSION IN THE PRESENCE OF ELECTROLYTES.

6. Integral Fuel Tanks

- A. The presence of soil, contamination, a brown slimy substance, and pitting type corrosion has been observed in the lower areas of the integral fuel tanks of certain airplanes. This condition has caused a general degradation of some topcoating and some depolymerization and loosening of sealant materials in lower areas.
- B. The contaminants resembled normal aluminum corrosion products, including a considerable quantity of iron. The brown, slimy deposits proved to be microbial in nature. Examination of the corrosion pits by metallurgical technician indicated the presence of intergranular attacks.

7. Requirements Peculiar to Faying Surfaces of Airframes, Airframe Parts and Attaching Surfaces of Equipment, Accessories, and Components

- A. When repairs are made on equipment or when accessories and components are installed, the attaching surfaces of these items shall be protected. The following requirements are peculiar to faying surfaces in airframes, airframe parts, and attaching surfaces of equipment, accessories, and components.
- B. Surfaces of Similar or Dissimilar Metals
 - (1) All faying surfaces, seams and lap joints protected by sealant shall have entire faying surface coated with sealant. Excess material squeezed out shall be removed so that a fillet seal remains. Joint areas which could hold water shall be filled or coated with sealant.
 - (2) Faying surfaces that are to be adhesive bonded shall be treated and processed as specified in Chapter 1.

C. Attaching Parts

- (1) Attaching parts such as nuts, bushings, spacers, washers, screws, self-capping screws, self-locking nuts, clamps, etc., do not need to be painted in detail except when dissimilar metals or wood contact are involved in the materials being joined. Such parts shall receive a wet or dry coat of primer.

NOTE: Corrosion inhibiting solid film lubricants, Specification MIL-L-46010 and Specification MIL-L-46147, may be used to protect attaching parts from corrosion.

- (2) All holes drilled or reworked in aluminum alloys to receive bolts, bushings, screws, rivets and studs shall be treated with Specification MIL-C-81706 material before installation of fastener or bushing.
- (3) All holes drilled or reworked in magnesium shall receive a chrome acid pretreatment before installation of bolts, bushings, screws, rivets and studs.
- (4) All rivets used to assemble dissimilar metals shall be installed wet with sealant conforming to Specification MIL-S-81733.
- D. Close Tolerance Bolts - Close tolerance bolts passing through dissimilar metals shall be coated before installation with a corrosion inhibiting solid film lubricant conforming to Specification MIL-L-46010 and/or Specification MIL-L-46147.
- E. Washers - Aluminum alloy washers of suitable design shall be used under machine screws, countersunk fasteners, bolt heads and nuts that would otherwise contact magnesium.
- F. Adjustable Parts - Threads of adjustable parts such as tie rod ends, turnbuckles, etc., shall be protected with solid film lubrication conforming to Specification MIL-L-46010 or Specification MIL-L-46147.
- G. Slip Fits - Slip fits shall be assembled using wet primer conforming to Specification MIL-P-23377, non-drying zinc chromate paste, or solid film lubricant conforming to Specification MIL-L-46010 or Specification MIL-L-46147.
- H. Press Fits - The pressing shall be accomplished with an oil-containing material conforming to Specification MIL-C-11796, Class 3, or Specification MIL-C-16173, Grade 1, or other suitable material that will not induce corrosion.

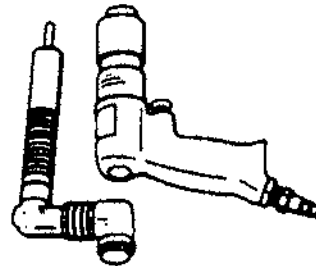
8. Electrical

- A. Bonding and ground connections shall be as described by the installation procedure.
- B. Potting of Electrical Connectors and Electrical Terminals - Corrosion in electrical systems and resultant failure can often be attributed to moisture and climatic condition. Potting compounds are used to safeguard against moisture.

- C. Fungus-Proofing of Electrical and Electronic Equipment - Fungi can create serious problems, as fungi can act as an electrolyte, destroying the resistance of electrical insulating surfaces. Corrosion of metal can be accelerated because of the moisture absorbed by fungi. Moisture and fungus resistant varnish conforms to Specification MIL-V-173.
- 9. Exhaust Gas Corrosion.
 - A. Repair of exhaust gas corrosion, refer to chapter 13-10.



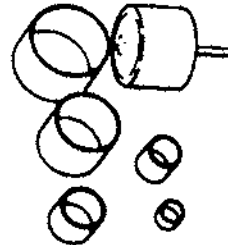
90° AIR VANE GRINDER CAN BE OBTAINED FROM INDUSTRIAL SUPPLIERS



1/4 INCH DRIVE AIR MOTOR 3500 TO 4750 RPM 360° ADAPTER CAN BE OBTAINED FROM INDUSTRIAL SUPPLIERS



ROTARY FILES, BALL AND CONICAL SHAPES MANUFACTURED BY INDUSTRIAL SUPPLIERS



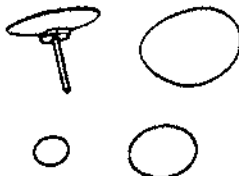
DRUM SANDER, 1/4 INCH DIAMETER DRIVE DRUM, 3/4 INCH AND 1 BY 1 INCH SLEEVE, ALUMINUM OXIDE ABRASIVE, MANUFACTURED BY INDUSTRIAL SUPPLIERS



SPIRAPPOINT CONES WITH 1/2 INCH DIAMETER ADAPTER CONE. SIZES 3/4 BY 1-1/2 INCHES, 1/2 BY 3/4 INCH AND 5/8 BY 1-1/2 INCHES, MANUFACTURED BY INDUSTRIAL SUPPLIERS



FLEXIBLE SANDING WHEEL, "GRIND-O-FLEX," 1/2 BY 2 INCHES AND 1 BY 3 INCHES, 80 GRIT ALUMINUM OXIDE ABRASIVE, MANUFACTURED BY MERIT PRODUCTS INC., 3691 LEANWEE AVE., LOS ANGELES, CALIFORNIA



MUSHROOM SANDING PAD WITH 1, 2 AND 3 INCH DIAMETER ALUMINUM OXIDE ABRASIVE DISCS. 1/4 INCH DIAMETER SHANK FOR AIR MOTOR, 1/4-28 SIZE THREADED SHANK FOR AIR VANE, MANUFACTURED BY BEHR MANNING CO., 6116 HOWE ST., TROY, NEW YORK

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Corrosion Removal Tools
Figure 2