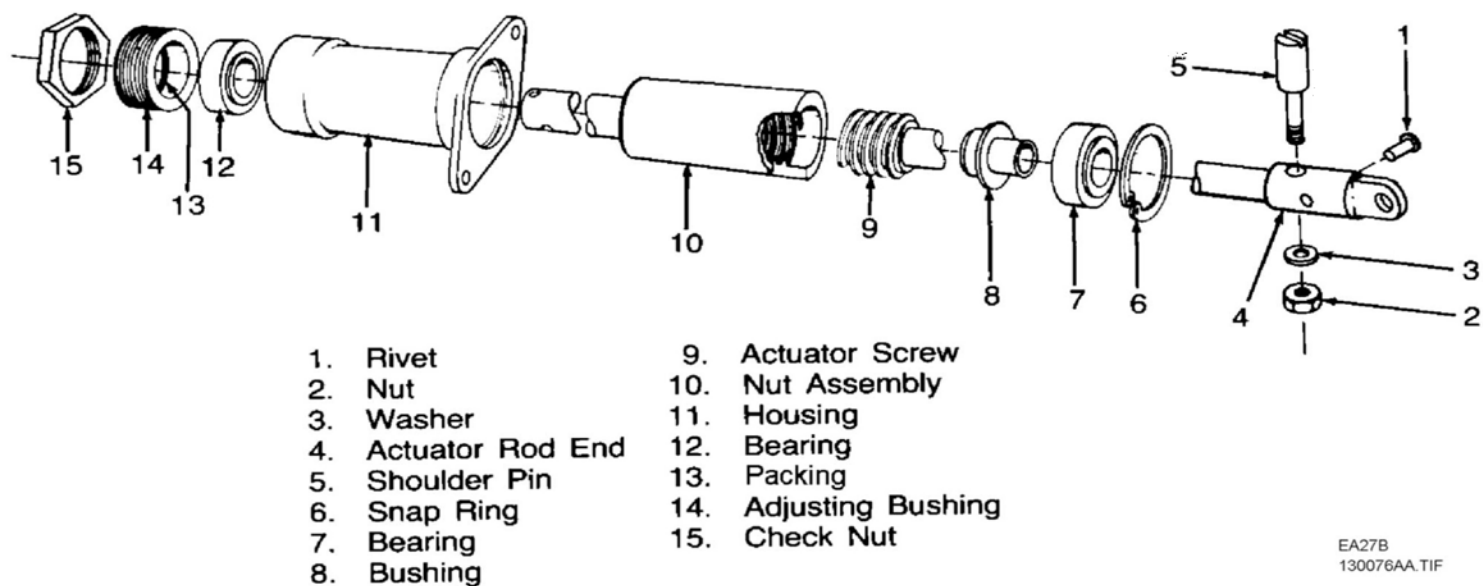


Figure 203 : Sheet 1 : Elevator Tab Actuator

E24134



EA27B
130076AA.TIF

Figure 204 : Sheet 1 : Elevator Tab Actuator (E-1111 Only)

E24105

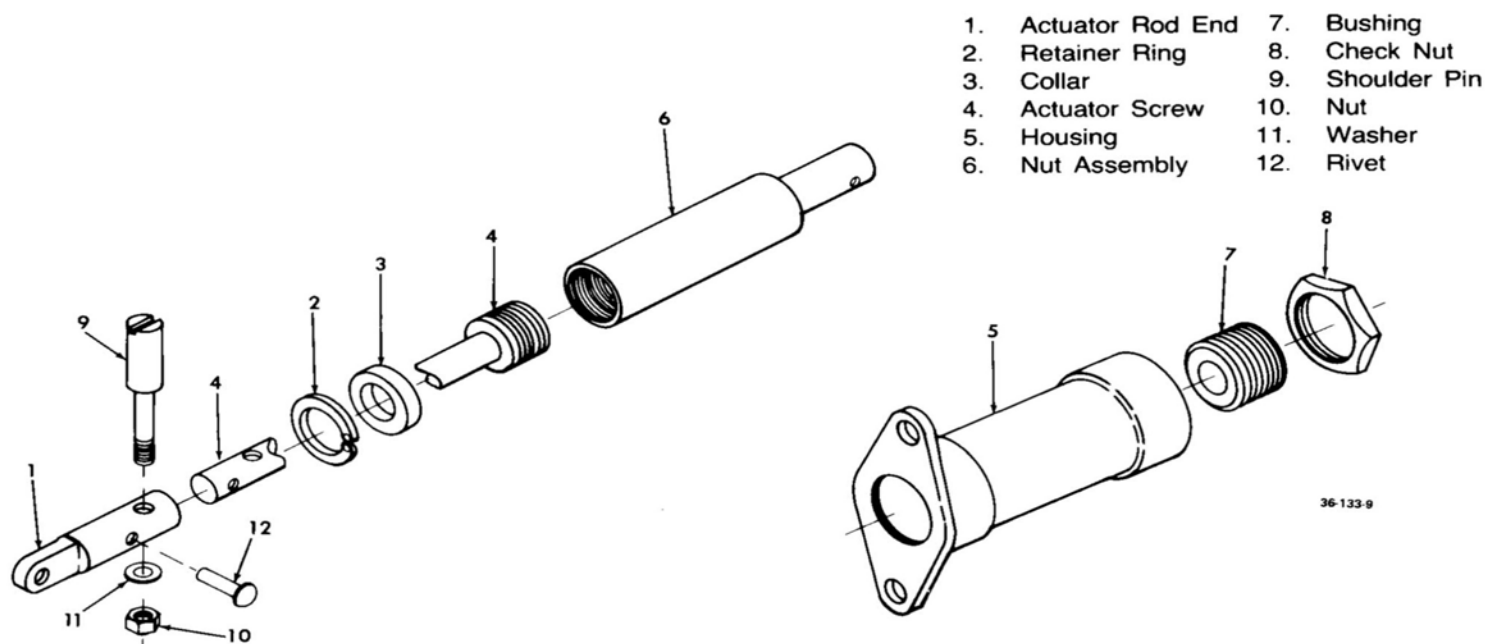
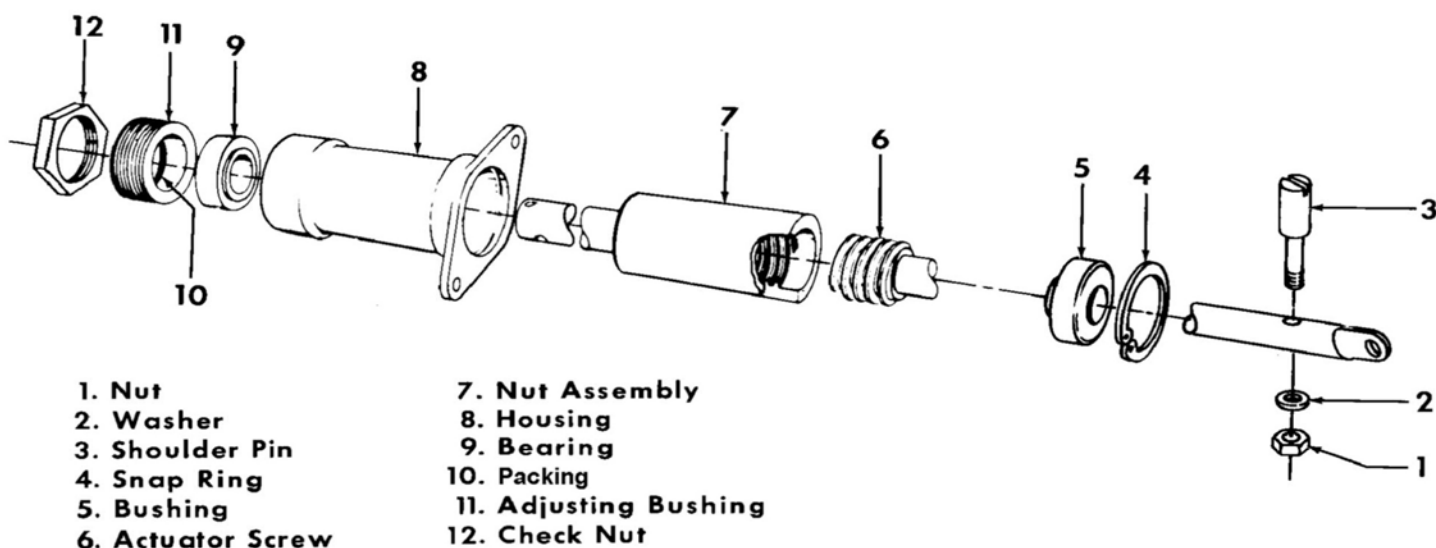


Figure 205 : Sheet 1 : Elevator Tab Actuator

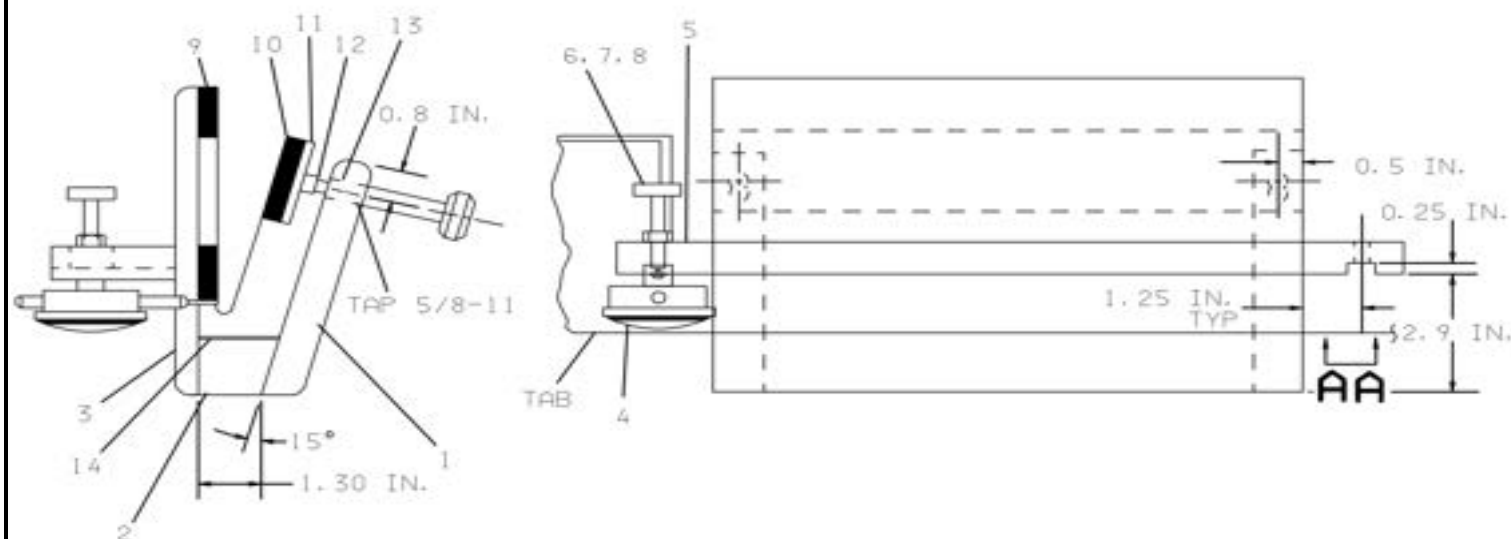
E24100



EA27B
130077AA.TIF

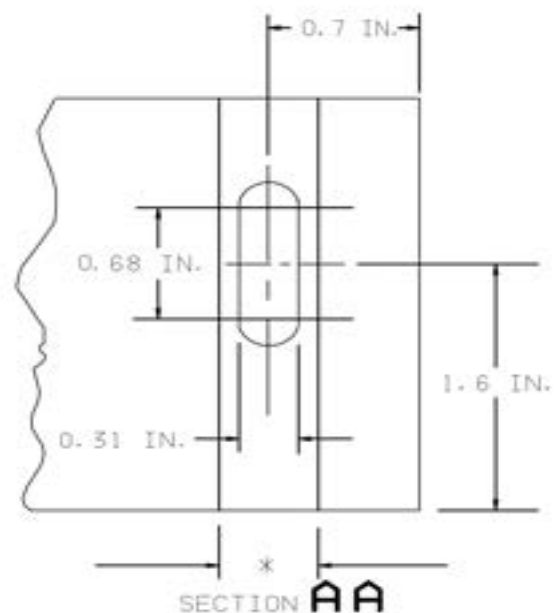
Figure 206 : Sheet 1 : (Revised) - Fabricating Clamp for Tab Deflection

E22949



ITEM NO.	QUANT.	DESCRIPTION
1	2	3/4 X 1 X 6 ALUMINUM OR EQUIV.
2	2	1 X 1 3/8 X 1 3/4 ALUMINUM OR EQUIV.
3	1	1/2 X 7 1/2 X 10 ALUMINUM OR EQUIV.
4	1	C81Q INDICATOR **
5	1	3/4 X 2 1/2 X 14 ALUMINUM EQUIV.
6	1	1/4 DIA. X 2 CORROSION RES. STL.
7	1	1/4 DIA. X 1 CORROSION RES. STL.
8	1	1/4-28 NUT
9	1	3/8 X 5 X 10 RUBBER
10	1	3/8 X 2 X 10 RUBBER
11	1	1/4 X 2 X 10 CORROSION RES. STL.
12	2	1/2 X 13 X 3 VLIER TORQUE SCREW
13	2	KN813 KEENSERT OR TAP 1/2-13
14	2	1/8 X 1 X 3/4 RUBBER

**P/N OF FEDERAL PRODUCTS CORP., PROVIDENCE, R.I.

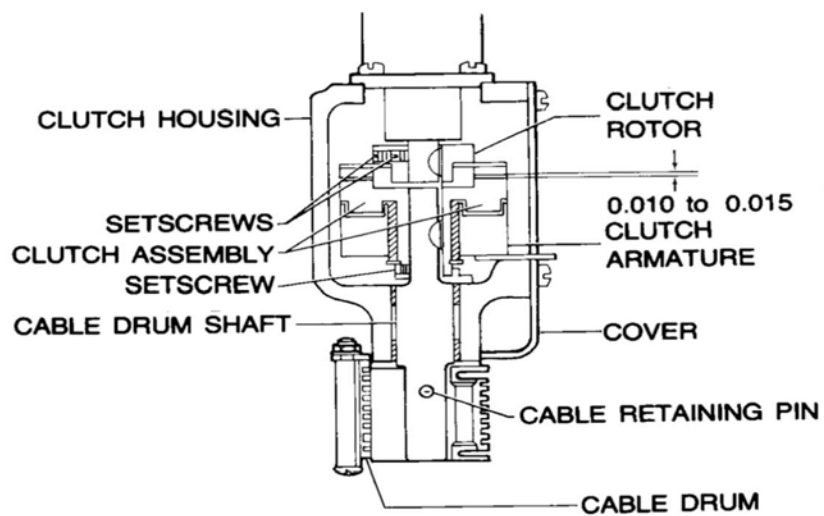


* THIS GROOVE TO BE A SNUG FIT TO THE SCREW BRACKET ON THE DIAL INDICATOR

EAC278:
140090AA.AJ

Figure 207 : Sheet 1 : (Revised) - Electric Trim Tab Actuator - Magnetic Clutch

E24096



EA27B
140089AA.TIF

UNIVERSAL TRAVEL BOARD - ADJUSTMENT/TEST

1. Information

- WARNING:** Before attempting to adjust, rig or remove any major flight control component, set all control surfaces to neutral.
- WARNING:** Do not operate the flight control system while rig pins are installed. Damage and/or personal injury may occur.
- WARNING:** All control rig pins are designed to be inserted and removed without binding. If any pin is forced into position or binds when removed from rig pin hole, that system is not properly rigged.
- WARNING:** Before performing any maintenance on the flight control system, display a caution tag in the cockpit area prohibiting movement of control surfaces.
- WARNING:** Make sure that all personnel and equipment are clear of the control surface area prior to movement or testing.
- WARNING:** Whenever any part of flight control system is dismantled, adjusted, repaired or replaced, a detail investigation must be made upon completion. Make sure that the distortion, tools, rags or any other loose articles or foreign matter that could impede the free movement and safe operation of the system are not present. Check the security of locking devices, movement in proper direction and that the system and installation in the work area are clean prior to returning the airplane to service.
- WARNING:** If any component is removed that could be installed more than one way, mark or identify the component clearly before removal.

Table 501. Equipment/Material

Equipment/Material	Part/Item No.
Digital Protractor	KS6005 or equivalent
Universal Travel Board	TE-100TB

2. Universal Travel Board

A. Setup

The Universal Travel Board is an adjustable tool designed to locate neutral position of various control surfaces. Once neutral has been located, a digital protector (Refer to [Table 501](#)) (P/N KS6005 or equivalent) is used to measure surface deflection (Refer to [Figure 503](#)).

NOTE: The Universal Travel Board must be calibrated prior to each use (Refer to [27-00-00, 501](#)).
The locations given for the Universal Travel Board are selected to avoid measuring the elevator on a fixed or moveable trim tab. For this reason, some of the locations given may not match the location shown in the applicable Maintenance Manual. When the location given differ from the location in the applicable maintenance manual, use the locations listed in [Table 502](#).
When the Universal Travel Board is properly assembled the A3 ruler will not be on the same side as A1 and A2 rulers. Unless instructed, do not disassembled the tool to put the scales on the same side, as this will affect measurement accuracy.
On some models the A1 (9) and A2 (10) can not both be placed on spars. These instances will have "N" in the SPAR column with the location in the corresponding COMMENT column. When A1 (9) and A2 (10) legs land on a Universal head fastener (protruding), move A1 (9) and A2 (10) legs inboard or outboard to clear and are on the airplane skin.

- (1) Adjust A1 (9) , A2 (10) and A3 (16) to the applicable setting listed in [Table 502](#).
- (2) Assemble the Universal Travel Board per [Figure 501](#) and place it on the control surface at the location indicated in [Table 502](#).

NOTE: Do not move the flight controls with the A3 pin (16) in contact with the aileron or elevator.
The stabilizer assembly may be attached at any convenient point and make sure legs, A1 (9) and A2 (10), remain in contact with the surface.

- (1) Slide the vertical assembly forward. The notch in A3 pin (16) will capture the surface in the neutral position (0°) (Refer to [Figure 502](#)).

NOTE: Tip of legs A1 (9) and A2 (10) must be in complete contact with airplane control surface at all times during 0° check. The tip of legs A1 (9) and A2 (10) must be centered over the spars when required by

Table 502.

Make sure A1 (9) and A2 (10) legs are sitting on surface skin and not on rivet head or other surrounding structure, A1 (9) and A2 (10) legs must be on airplane skin to achieve accurate measurement. Always follow rigging procedures in the applicable Maintenance Manual, utilizing the Universal Travel Board to determine the neutral position (0°). Both left and right surfaces must be rigged to neutral position and symmetrical prior to checking and adjusting control surface travel.

B. Check and Rigging of Travel

NOTE: Make sure the digital protractor is used in accordance with the manufacturer's instructions when checking surface travel.

- (1) After the neutral position has been verified, place the digital protractor on the control surface to be checked at a right angle to the hinge line and zero the instrument. Move the vertical beam (11) away from the trailing edge of the surface being measured.
- (2) Move the surface as required by the Maintenance Manual to check the required range of motion of the left hand and right hand control surfaces. If necessary, use the adjustment procedures as outlined in the applicable Maintenance Manual.
- (3) The digital protractor may be used to measure the deflection of other horizontal surfaces as long as neutral can be accurately established in accordance with the applicable Maintenance Manual.
- (4) When finished, remove all tools and equipment. Check the flight control surfaces for freedom of motion and direction of travel as outlined in the applicable Maintenance Manual.

C. Digital Protractor Calibration Refer to [Figure 504](#).

Refer to manufacturer's recommendations for digital protractor calibration (P/N KS6005 or equivalent) .

Table 502. Universal Travel Board Locations

Surface	Location	Spars	Settings (Inches)			Comments
			A1	A2	A3	
Elevator	Seven rivets out from tirm tab cutout, WS 46.00	N	16	10 3/4	4 3/4	A1 is located on the rivet line of the nose rib, forward of the front spar, A2 is located on the aft spar.

Figure 501 : Sheet 1 : (Revised) - Universal Travel Board (Typical Installation)

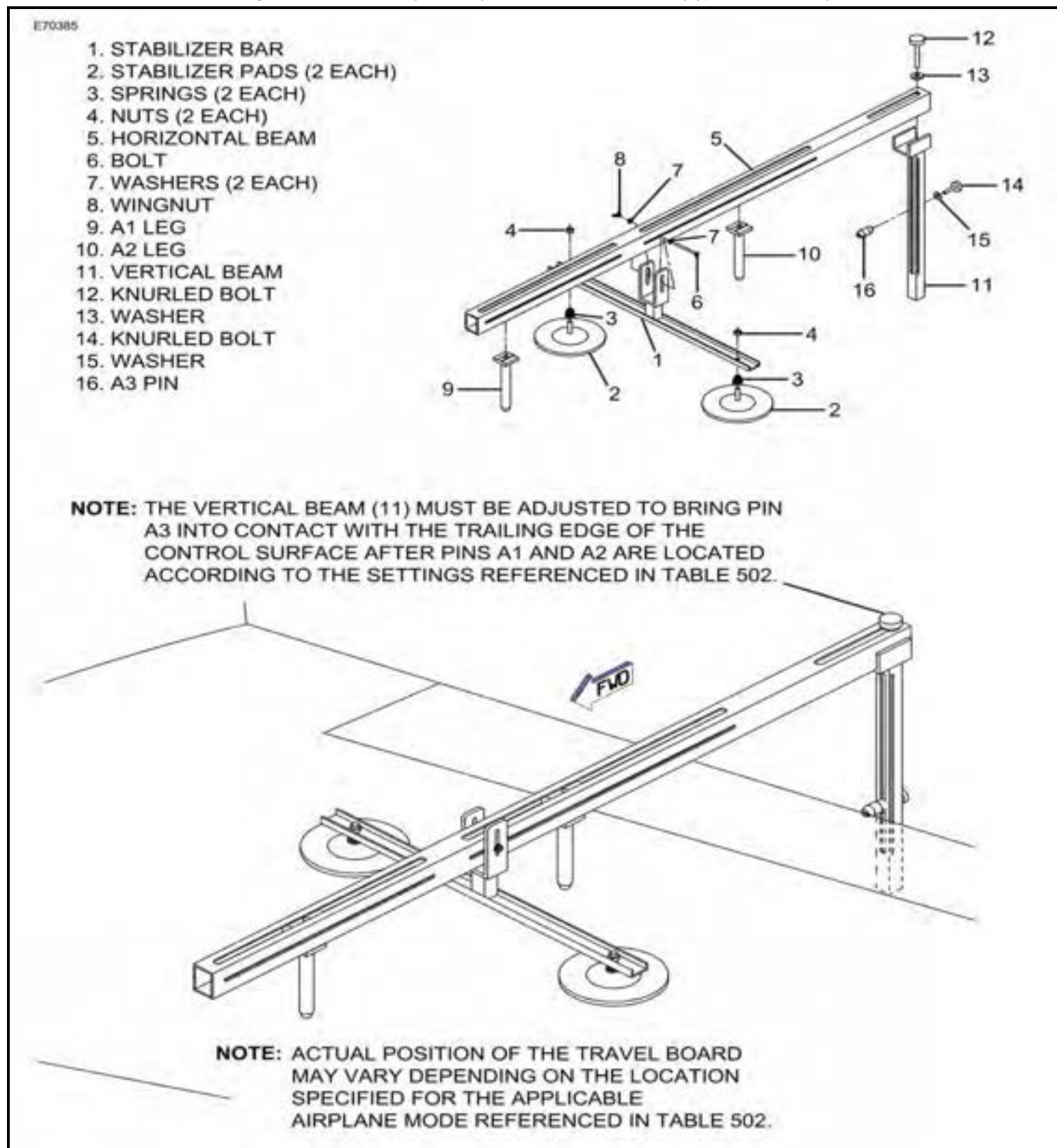


Figure 502 : Sheet 1 : (Revised) - Typical View of A3 at Trailing Edge

E70386

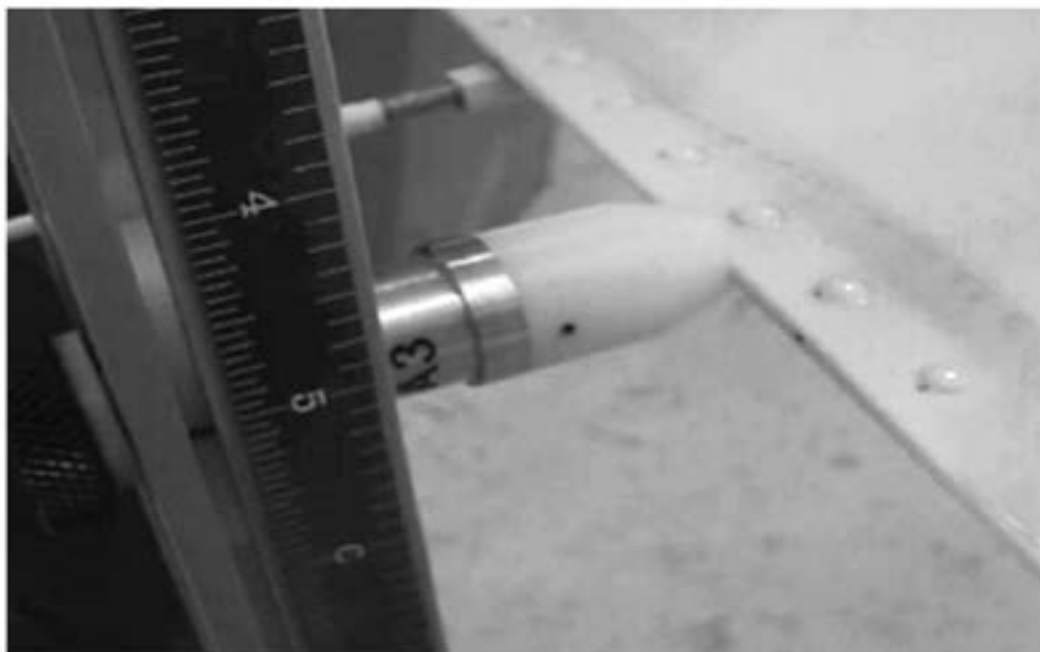


Figure 503 : Sheet 1 : (Revised) - Typical View of Kell-Strom Digital Protractor (Shown with Attitude Adapter Installed)

E70387

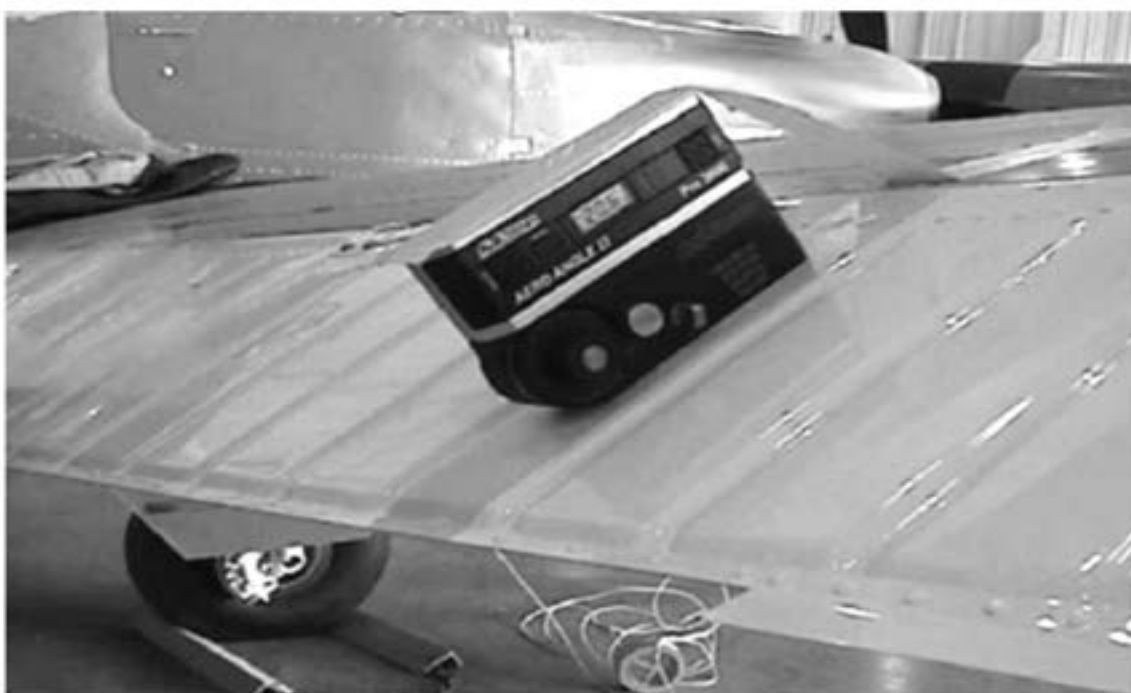


Figure 504 : Sheet 1 : (Revised) - Universal Travel Board A1 and A2 Legs, Measurement

E70388



FLIGHT CONTROLS - STALL WARNING/SAFE FLIGHT SYSTEM - DESCRIPTION AND OPERATION

1. Stall Warning/Safe Flight System - Description and Operation

A. Stall Warning System

The stall warning system is designed to give the pilot advance warning of an impending stall. The stall warning switch is located on the bottom leading edge of the left wing. Air moving over the vane of the switch will cause the switch to open or close depending on the air velocity. The opening or closing of the stall warning switch indicates the lift capabilities of the wing and subsequently indicates to the pilot the approaching of a stall condition.

FLIGHT CONTROLS - STALL WARNING/SAFE FLIGHT SYSTEM - MAINTENANCE PRACTICES

1. Stall Warning - Maintenance Practices

A. Adjustments , Refer to [Figure 201](#).

The stall warning switch is carefully adjusted when the airplane is test flown at the factory. Should it require readjusting, proceed as follows: Locate the switch installation on the under surface of the left wing and loosen the two Phillips Head screws, one on either side of the vane. If the stall warning has been coming on too early, move the vane back and down. If the stall warning has been coming on too late, move the vane up and forward. Moving the vane, with the Phillips head screws loosened, moves the entire unit up or down inside the wing causing the switch to be closed earlier or later. Retighten the screws after making each adjustment. NEVER TRY TO ADJUST THE SWITCH BY BENDING THE VANE.

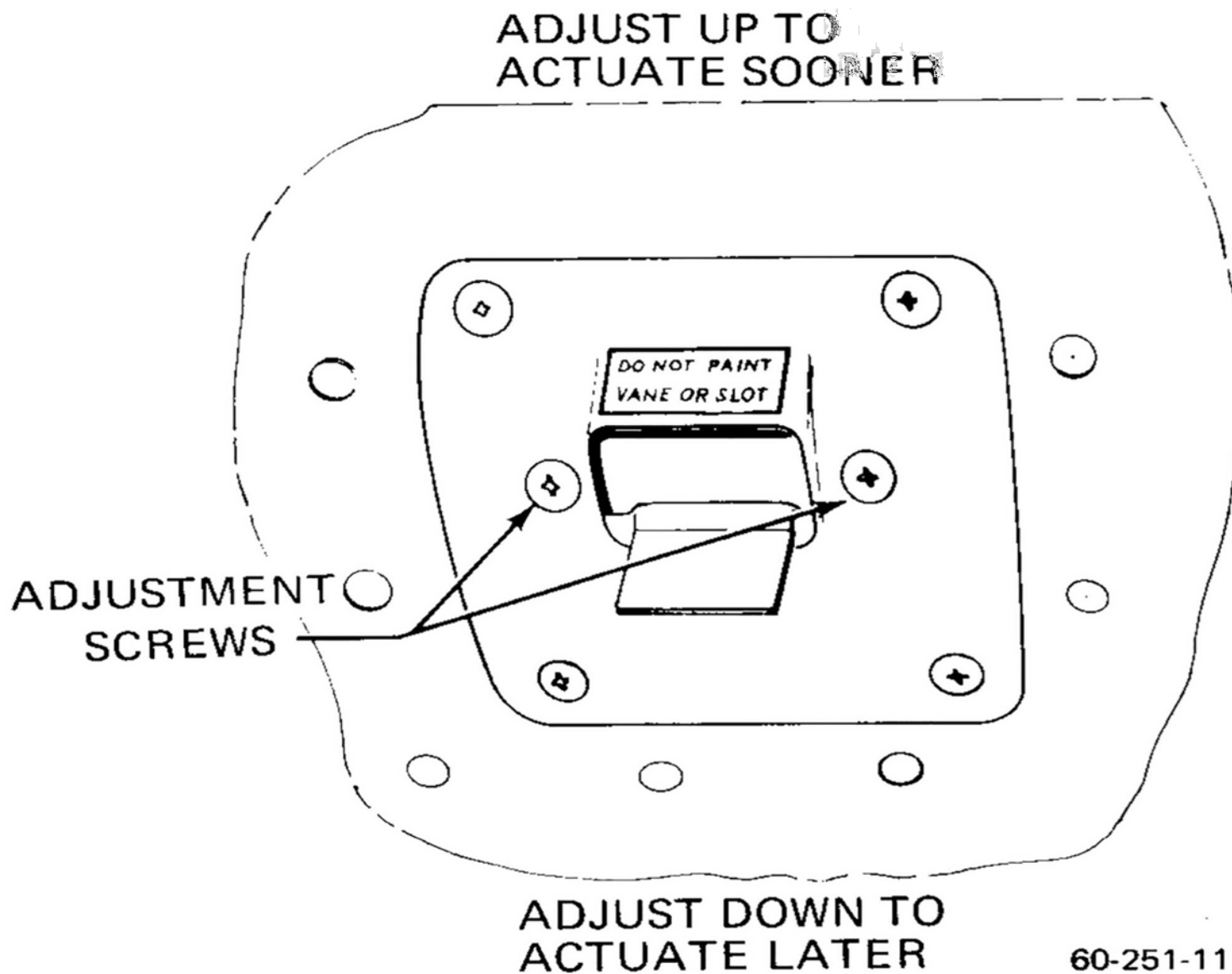
NOTE: If a new switch (lift detector) is being installed it should be positioned (with vane full down) so that the upper surface of the vane is in alignment with the index line on the cover plate. The airplane should then be flown and the switch adjusted as indicated in the following procedure.

As a rule of thumb, moving the vane 1/4 inch will change the time the stall warning actuates by about five mph of indicated airspeed. The only way to test the accuracy of the setting is to fly the airplane into a stall, noting the speed at which the warning horn comes on and the speed at which the full stall occurs.

The stall should be made with the flaps and gear up and power off. Prior to stalling decelerate no faster than one mile per second. It may be necessary to make several alternate adjustments and test flights before the desired setting can be reached. The stall warning should actuate, ideally, at 7-9 mph ahead of the complete stall. The switch setting should be checked and adjusted as necessary whenever a wing or wing leading edge is replaced or extensively repaired, or if a new switch is installed. The switch should require no adjustment in normal service.

Figure 201 : Sheet 1 : Stall Vane Adjustment

E24090



FLAPS - DESCRIPTION AND OPERATION

1. Flaps - Description and Operation

The flaps are hinged in specially designed tracks. When extended, the flap moves rearward as it pivots downward. This gives a large, effective wing area, which produces additional lift and drag.

One flap is installed on each wing. The flaps are operated by an electric-motor-driven gearbox on the aft side of the front spar at the centerline of the airplane. The gearbox drives two flexible drive shafts, each connected to an acme thread-type jackscrew at each flap. The flaps are controlled by a lever in the subpanel, and the flap position is indicated by an instrument to the left of the control column. The lever (switch) must be pulled out of a detent to change positions.

CAUTION: If the flap switch knob is tightened too tight, the safety detent can be defeated.

On airplane serials E-1111, E-1241 thru E-1370; CJ-149; CE-748, CE-772 thru CE-815; D-10097, and D-10120 thru D-10178, the flaps may be stopped at any position by moving the flap switch to OFF when the flaps reach the desired position. The switch is placarded UP, OFF, and DOWN. The markings on the position indicator will be UP, 10°, 20°, and DN. On airplane serials CJ-150 and After; CE-816 and After; D-10179 and After; E-1371 thru E-2110 except E-1946 and E-2104; EA-11 thru EA-388 except EA-320, the indicator is marked UP, 15°, and DN. Serials E-1946, E-2104 and E-2111 and After; EA-320, EA-389 and After have lights to indicate flap position. These lights are marked to indicate the down, in-transit, and approach positions of the flaps. All lights are out when the flaps are up. The flaps can be stopped only on the up, approach, or down position as indicated by the flap switch. The flap position transmitter (if installed) is located near the left flap actuator. Power to operate the indicator lights of later serials is controlled by the flap relay and limit switches.

NOTE: After an emergency extension at speeds above the normal extension speeds, inspect the flaps for damage or distortion before the next flight.

FLAPS - MAINTENANCE PRACTICES

1. Maintenance Practices

A. Flap

(1) Removal

- (a) Remove the bolt from the flap actuating arm.
- (b) Remove the bonding cable from the flap tracks.
- (c) Remove the bolts from the flap track brackets and remove the flaps.

(2) Installation

- (a) Hold the flap in position and install the rollers and the bolts in the flap track bracket.

NOTE: Install the flap track rollers (four rollers per flap and two rollers per track) in the flap track brackets with the flanges of the rollers in one track facing the flanges of the rollers in other track.

- (b) Connect the bonding cable and install the bolt in the flap actuating arm.

B. Flap Track Wear Limits

The allowable track wear on the bearing surface is 0.032 inch resulting in a maximum dimension of 0.785 inch in the track slot. The allowable wear into the track side surface is 0.050 inch. Track wear within the preceding limitations may be dressed smooth with light emery cloth to prevent roller binding. Lubricant mixed with solvent (49 and 26, Table 1, 91-00-00) may be brushed on the flap tracks during servicing of the airplane.

C. Flap Limit Switch Adjustment

NOTE: Battery voltage is not sufficient to properly cycle the flaps during rigging. An auxiliary power supply capable of maintaining 28.25 ± 0.25 volts should be used. If an external power receptacle is not available on the airplane, jumper cables may be used between the battery and the power supply. Be sure of the polarity before making the connection.

CAUTION: Excessive operation of the flap motor without proper cooling may cause damage to the motor. Allow a short cooling time after each extension and retraction cycle.

The flap limit switches are mounted on a bracket and installed on the outboard side of the inboard flap track in the left wing panel. The limit switches control the travel of the flaps by breaking the circuit to the flap motor at the extreme limits of travel. They are accessible by lowering the flaps (Refer to Figure 201).

- (1) Two-Position Flaps(CE-748, CE-772 thru CE-815; CJ-149; D-10097, D-10120 thru D-10178; E-1111, E-1241 thru E-1317)

There are two limit switches for this system, one for the uplimit position, and one for the downlimit position. To adjust the flaps to neutral position, loosen the screws of the switch assembly so that the assembly can pivot on the forward elongated hole. Adjust the switch as necessary to stop the flaps in neutral position. Actuate the flap switch to the down position and measure the degrees of travel (proper degree of travel is $30^\circ +0^\circ/-2^\circ$). Adjustment of the down position of the flaps is made on the downlimit switch.

- (2) Three-Position Flaps(CE-816 and After; CJ-150 and After; D-10179 and After; E-1371 and After; EA-11 and After)

The limit switches, one for up, two for the approach position and one for the down travel, control the travel of the flaps by breaking the circuit to the flap motor at the extreme limits of selected travel. The switches are accessible by lowering the flaps

The flap travel is adjusted by moving the limit switches. The left flap is rigged first, then the right flap is synchronized with it. Rig as follows:

CAUTION: When the flaps are in the 0° position, a clearance of $1/16$ inch $+1/16$ inch or $-1/32$ inch between the flap roller and the forward edge of the flap track slot must exist.

NOTE: Rig the flaps under a simulated flight load to reduce overtravel to a minimum after the limit switches have been actuated.

- (a) Adjust the uplimit switch so the flaps will stop at the 0° position.

NOTE: At serials E-1946, E-2104, E-2111 and After, the flap switch approach position is 12° . Adjust the 11° limit (outboard) switch until the flaps are positioned at 11° to 11.5° after the flaps have been actuated from fully up position to the approach position. Adjust the 13° limit switch (inboard) switch until the flaps are at the 13° to 12.5° position after the flaps have been actuated from

fully down to the approach position.

- (b) Adjust the 14° limit switch (inboard) in its mounting slot until the flap is positioned at 14° to 14.5° after the flap has been actuated from fully up to the takeoff position (15° range). Adjust the 16° limit switch (outboard) in its mounting slot until the flap is positioned at 16° to 15.5° after the flap has been actuated from fully down to the takeoff position (15° range).
- (c) Adjust the downlimit switch in its mounting slot until it actuates at 28° to 30° of flap travel.
- (d) Remove the bolt attaching the right actuator to the right flap.
- (e) Turn the jackscrew on the right actuator in or out to align the right flap with the left flap.
- (f) Install the bolt connecting the actuator to the flap.

CAUTION: If the flaps are removed for any reason the main power switch should be in the OFF position.

NOTE: After the flap is completely rigged, adjust the rubber bumper (flap down) installed on the flap and aileron dividing rib. Turn the adjusting screw in or out, as required, to take out play or stop vibration when the flap is in the up position. A distinct change in the sound of the flap motor near the completion of the flap-up travel may indicate an excessive outward adjustment of the bumper.

- (g) Operate the flaps through full travel to make sure the flaps contact the limit switches before they contact the rubber bumper.

D. Flap Position Indicator and Adjustment

The flap position indicator gage is installed in the instrument panel. An adjustable flap position indicator transmitter is installed on the flap actuator in the left wing just forward of the rear spar to coordinate gage reading with flap travel.

- (1) Adjust the flap travel limit switches to provide the correct up and down travel of the flaps. Refer to [FLAP LIMIT SWITCH ADJUSTMENT](#) procedure.
- (2) Run the flaps down and check the pilot's compartment flap position indicator for 100% flaps. If down flaps are not indicated, loosen the transmitter attachment bolts and adjust transmitter fore and aft or rotate slightly until the reading is correct, then tighten the transmitter attaching bolts.
- (3) Run the flaps up and check the indicator for up flaps reading.

E. Flap Motor

(1) Removal

CAUTION: If the flap motor fails or if major overhaul is required for it to operate properly, the flap motor should be replaced. No attempt should be made to overhaul the motor in the field.

- (a) Remove the front seat assemblies.
- (b) Remove the spar cover.
- (c) Detach the clamp supporting the electrical wiring from the right-hand flap-shaft housing.
- (d) Disconnect the motor electrical wiring at the quick disconnect.
- (e) Loosen the two set screws on each cable retainer (Refer to [Figure 202](#)).
- (f) Rotate the cable retainers 90°.
- (g) Loosen the nuts on the inboard side of the mounting supports.
- (h) Pull the flexible drive shafts from the flap motor shafts and retainers.
- (i) Remove the flap motor attaching bolts and remove the flap motor.

(2) Installation

CAUTION: Should the flap motor fail or should major overhaul be required for the flap motor to operate properly, it should be replaced. No attempt should be made to overhaul the motor in the field.

- (a) Place the flap motor in position and secure with the flap motor attach bolts.
- (b) Connect the flap motor electrical wiring at the quick disconnect.
- (c) Install the flexible flap drive shafts into the flap motor shafts, refer to [CONNECTING FLEXIBLE FLAP DRIVE SHAFT TO FLAP MOTOR SHAFT](#) procedure.
- (d) Attach the clamp that supports the electrical wiring from the right flap shaft housing.

- (e) Run the flaps through full travel, up and down, to check flap rigging.
- (f) Install the spar cover.
- (g) Install the front seat assemblies.

F. Connecting Flexible Flap Drive Shaft to Flap Motor Shaft

Connect the LH and RH flexible flap drive shafts to the flap drive motor shaft as follows, refer to [Figure 202](#) for component locations:

- (1) Install the outboard nut and washer as far as they will go onto the threaded portion of the flap shaft housing.
- (2) Start set screws (2) into retainer. Insert the retainer through the flap shaft mounting support and onto the motor shaft as far as it will go.
- (3) Align retainer keyway with key slot in flap motor drive shaft and tighten one set screw temporarily.
- (4) While inserting the flap shaft through the mounting support, install the inboard washer and nut.
- (5) Install the flap shaft through the retainer and into the motor drive shaft until the keyway is just past the key slot in the retainer.
- (6) Loosen the set screw that was tightened in Step (3).
- (7) Make sure the retainer is still installed on the motor shaft as far as it will go and rotate retainer 90°.
- (8) Keep inboard pressure on the retainer and tighten both retainer set screws.
- (9) Secure the flap drive shaft to the mounting support by tightening the two nuts. Tighten inboard nut to make sure there is sufficient clearance between the outboard edge of the retainer and the cable housing to allow the retainer to rotate without coming into contact with the cable housing. If threaded part of cable housing is not long enough to install the two nuts and washer, use a die to add 5/8-24 UNEF threads until 0.88 inch thread length is attained.
- (10) Tighten outboard nut against the mounting support.

G. Flap Shaft

(1) Removal

- (a) Place the airplane on jacks (Refer to 07-00-00, LIFTING AND SHORING) and use the circuit breaker to retract the landing gear until the inboard doors are open.
- (b) Remove the front seat assemblies (Ref [25-00-00, PILOT AND COPILOT SEAT REMOVAL](#)).
- (c) Remove the spar cover.
- (d) Loosen the two set screws on each cable retainer.
- (e) Rotate the cable retainer 90°.
- (f) Remove the nut on the inboard side of the mounting support.
- (g) Pull the flexible drive shaft from the flap motor shaft and retainer.
- (h) Disconnect all clamps securing the shaft housing to the wing structure.
- (i) Remove the dust cover in the rear section of the wheel well.
- (j) Disconnect the flap actuator from the wing flap and the wing spar section.
- (k) Pull the actuator and flexible shaft housing out of the wing.

(2) Installation

- (a) Pull the flexible shaft and housing through the wing and attach the actuator to the wing flap and wing spar section.
- (b) Set the flaps in the up position.
- (c) Push the flexible shaft into the flap motor shaft and retainer.
- (d) Rotate the retainer 90°.
- (e) While holding the retainer onto the motor shaft as far as possible, tighten the two set screws in each retainer.
- (f) Tighten the nut on the inboard side of the mounting support.
- (g) Install the clamps securing the shaft housing to the wing structure.
- (h) Install the dust cover in the rear section of the wheel well.
- (i) Run the flaps through full travel, up and down, to check flap rigging.
- (j) Lower the landing gear and remove the airplane from the jacks (Refer to 07-00-00, LIFTING AND SHORING).
- (k) Install the spar cover.

- (l) Install the front seat assemblies (Refer to [25-00-00, PILOT AND COPILOT SEAT INSTALLATION](#)).

H. Flap Inner Flex Shaft

(1) Removal

- (a) Place the airplane on jacks (Refer to [07-00-00, LIFTING AND SHORING](#)) and retract the landing gear (using the circuit breaker) until the inboard door is open.
- (b) Remove the front seat assemblies (Refer to [25-00-00, PILOT AND COPILOT SEAT REMOVAL](#)).
- (c) Remove the spar cover.
- (d) Loosen the two set screws on the cable retainer (Refer to [Figure 202](#)).
- (e) Rotate the cable retainer 90°.
- (f) Remove the dust cover in the rear of the wheel well to gain access to the actuator.
- (g) Remove the two bolts holding the forward end of the actuator in place.

NOTE: The first clamp which secures the flex drive to the wing may have to be removed to allow more flexibility to the flex drive.

The position transmitter on the left flap may need to be removed.

- (h) Remove the snap ring holding the flex drive to the actuator

NOTE: Do not lose the spacers located under the flange of the flex drive.

- (i) To facilitate installation, note how far the shaft protrudes past the flange of the housing.
- (j) Pull the flex inner shaft from the housing.

(2) Installation

- (a) Lubricate the inner flex shaft with grease ([11, Table 1, 91-00-00](#)).
- (b) Install the inner flex shaft into its housing (Refer to [Figure 202](#)).
- (c) Rotate the inner flex shaft until the key on the inner end of the shaft slides into place. (When this is accomplished, the measurement noted in [FLAP INNER FLEX SHAFT REMOVAL](#) procedure Step (i) should again be noted at this time.)
- (d) Push the flap shaft into the flap motor shaft and retainer.
- (e) Rotate the retainer 90°.
- (f) While holding the retainer onto the motor shafts as far as possible, tighten the two set screws in the retainer.

NOTE: Make sure the spacers are in place in the actuator.

- (g) Install the flap shaft into the actuator and install the snap ring.

NOTE: A screwdriver may be used to make small adjustments to the screw of the actuator if the slot in the actuator does not align with the key of the flex shaft.

- (h) Secure the actuator in place with the two bolts, washers, and nuts.

NOTE: The position transmitter will have to be installed on the left flap if it was removed. Install the clamp on the shaft if it was removed.

- (i) Install the dust cover.
- (j) Lower the landing gear and remove the airplane from the jacks (Refer to [07-00-00, LIFTING AND SHORING](#)).
- (k) Install the front seat assemblies (Refer to [25-00-00, PILOT AND COPILOT SEAT INSTALLATION](#)).
- (l) Cycle the flaps to determine that they are properly rigged.

NOTE: For correct adjustment and rigging of the flap position transmitter refer to the [FLAP POSITION INDICATOR AND ADJUSTMENT](#) procedure.

I. Flap Actuator

(1) Removal

- (a) Place the airplane on jacks (Refer to [07-00-00, LIFTING AND SHORING](#)) and retract the landing gear until the inboard door is open (use the circuit breaker).
- (b) Remove the dust cover in the rear section of the wheel well to gain access to the actuator.
- (c) Lower the flaps and disconnect the actuator from the flap.

NOTE: To retain the original rigging of the flaps, mark the extension of the flap actuator before it is removed so that it may be installed in the same position.

- (d) Remove the flap position transmitter from the flap actuator.
- (e) Remove the snap ring and disconnect the flexible drive housing.
- (f) Remove the pivot bolts from the flap actuator mounting bracket and remove the flap actuator.

(2) Disassembly

- (a) Remove the snap ring (2) to disconnect the flexible shaft (1) from the actuator (Refer to [Figure 203](#)).
- (b) Tap on the piston plug (11) to drive out the seal (17), spacers (3) and bearings (4).
- (c) Slide the piston (6) out of the housing (8).
- (d) Check that the end play between the piston (6) and the actuator screw (5) does not exceed 0.012 inch under 25 to 50 pounds of force in both compression and tension at any of the following positions:
 - 1 With the actuator screw full in and backed out 1 turn.
 - 2 With the actuator screw 1/2 extended.
 - 3 With the actuator screw fully extended and backed in 1 turn.

- (e) If the 0.012 inch tolerance is exceeded, replace the piston and plug with a new one. If the tolerance is still unacceptable replace the screw. Check the end play of the new piston and screw per the preceding step.

NOTE: Mark the piston and screw so that the same threads will be in contact when the piston and screw are assembled.

- (f) Remove the packing (12) from the housing (8).
- (g) Remove the actuator screw (5) from the piston (6).

NOTE: The following step should be accomplished only if the piston (6) or piston plug (11) is to be replaced due to damage or wear.

- (h) Drill out the pin (14) and take the piston plug (11) out of the piston (6).

(3) Assembly

NOTE: A replacement plug (11) may be supplied without the hole for the pin (14).
A replacement piston (6) may be supplied with an under sized hole for the pin (14), on one side of the piston only.

- (a) If necessary drill a 0.185 to 0.189 inch diameter hole through the piston (6) and piston plug (11) for the pin (14). Countersink the hole on both sides of the piston 100° to 0.250 inch.
- (b) Clean all parts with solvent ([16, Table 1, 91-00-00](#)) and inspect for cracks, corrosion, distortion and excessive wear. Refer to [Table 201](#) for tolerances and wear limits.
- (c) Replace the packing (12) and seal (17).
- (d) Coat the piston plug (11) and pin (14) with adhesive ([68, Table 1, 91-00-00](#)) before assembly
- (e) Peen the pin (14) and file it flush with the piston (6).
- (f) Lubricate the bearings (4) with lubricating oil ([51, Table 1, 91-00-00](#)) before inserting the piston (6) in the housing (8).
- (g) Pour lubricating oil ([51, Table 1, 91-00-00](#)) into the housing (8) until it is about two inches from being full.
- (h) Slide a bearing (4) on the screw (5).

NOTE: When the screw and piston are assembled, be sure the same threads are in contact as when they were disassembled. Check the piston and screw assembly end play per Step (d) of [FLAP ACTUATOR DISASSEMBLY](#) procedure.

- (i) Start the screw (5) in the piston (6) and slide the piston into the housing (8).
- (j) Install the remaining bearing (4) and seal (17). Seat these parts in the housing (8) with approximately 100 lbs. pressure, or use a suitable drift and mallet if a press is not available.
- (k) Install a combination of spacers (3), the flexible shaft (1), and the snap ring (2) in the housing. Apply approximately 100 pounds of reverse force to seat the parts against the snap ring.

NOTE: There are three types of spacers (3) used:

- 0.032 inches thick (ALCLAD) - (1 to 7 maximum required).

- 0.032 inches thick (Brass Laminate) - (0 to 5 required).
- 0.016 inches thick (ALCLAD) - (0 to 1 maximum required).

These spacers are used to obtain the end play (Refer to Step (l)) between the piston (6) and housing (8).

- (l) Check the end play between the piston (6) and housing (8) is between 0.002 inch and 0.010 inch.

NOTE: The total end play between the piston (6) and actuator screw (5) plus the end play between the housing (8) and piston (6) shall not exceed 0.022 inch. Subtract the piston-to-screw end play (determined in Step (d) of **FLAP ACTUATOR DISASSEMBLY** procedure) from the total to get the piston-to-housing end play.

If the piston-to-housing end play is not within tolerance, the spacers (3) may be removed or installed to correct the end play. If spacers (3) are removed or installed, do step (k) and (l) again.

- (m) Run the actuator in and out several times to assure proper operation in its full travel. Excess lubricant will be forced out of the vent hole the first time the actuator is run all the way up.

- (n) Install the actuator with the vent hole up.

(4) Installation

- (a) Place the flap actuator in position and secure it to the flap actuator mounting bracket with the pivot bolts.

- (b) Connect the flexible drive housing and install the snap ring.

- (c) Install the flap position transmitter to the flap actuator.

NOTE: The flap position transmitter is on the left-hand flap actuator only.

- (d) Connect the flap actuator to the flaps in the extended position marked during removal.

- (e) Install the dust cover in the rear section of the wheel well.

- (f) Check the flap rigging.

- (g) Lower the landing gear and remove the airplane from the jacks (Refer to 07-00-00, LIFTING AND SHORING).

Table 201. Flap Actuator Manufacturing Tolerances and Wear Limits

Item (Refer to Figure 203 for Item No.)	Manufactured and/or Acceptable Dimensions	Allowable Wear Limits
Piston (6)		
Pivot Bolt Holes (7)	Inside Diameter 0.3432 to 0.3442	0.3452
Housing (8)		
Inside Barrel Dimension (9)	Inside Diameter 0.875 to 0.878	0.879
Piston Plug Hole (10)	Inside Diameter 0.3120 to 0.3130	0.314
Piston Plug (11)		
Housing End Hole (13)	Inside Diameter 0.688 to 0.690	0.694
Piston Shaft (15)	Outside Diameter 0.685 to 0.687	0.684
Piston Collar (16)	Outside Diameter 0.861 to 0.864	0.859

Figure 201 : Sheet 1 : (Revised) - Flap System

E22961

FLAP SETTING

CE-748, CE-772 THROUGH CE-815; CJ-149,
D-10097, D-10120 THROUGH D-10178;
E-1111, E-1241 THROUGH E-1370

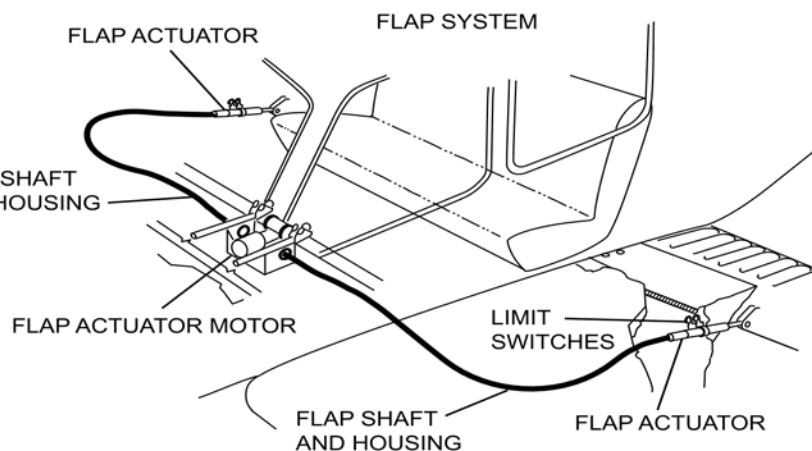
FULL UP = 0°
FULL DOWN = $30^{\circ} +0^{\circ} / -2^{\circ}$

CE-816 AND AFTER, CJ-150 AND AFTER
D-10179 AND AFTER, E-1371 THRU E-2110 EXCEPT
E-1946 AND E-2104, EA-11 AND AFTER

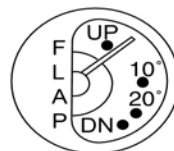
FULL UP = 0°
APPROACH = 15°
FULL DOWN = $30^{\circ} +0^{\circ} / -2^{\circ}$

E-1946, E-2104, E-2111 AND AFTER

FULL UP = 0°
APPROACH = 12°
FULL DOWN = $30^{\circ} +0^{\circ} / -2^{\circ}$

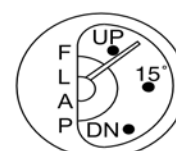


FLAP POSITION INDICATOR



INDICATOR

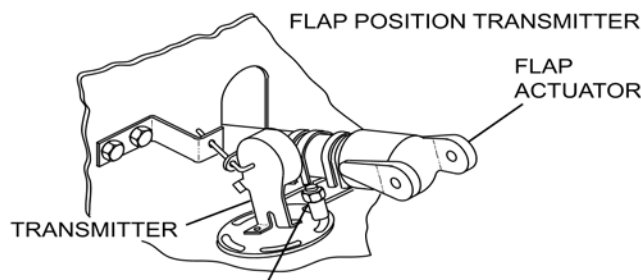
CE-748, CE-772 THROUGH
CE-815; CJ-149, D-10097,
D-10120 THROUGH D-10178
E-1111, E-1241 THROUGH E-1370



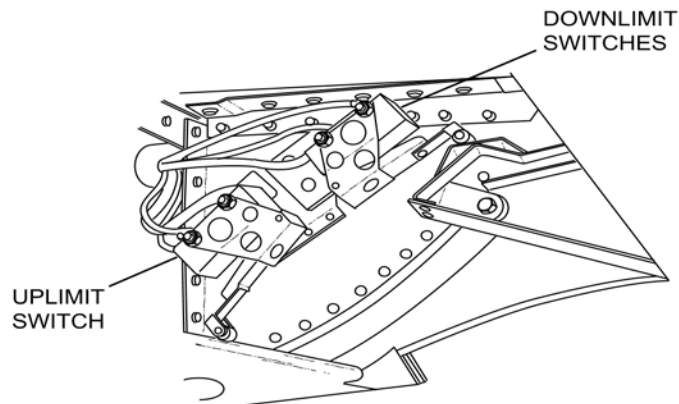
INDICATOR

CE-816 AND AFTER
CJ-150 AND AFTER
D-10179 AND AFTER
E-1371 THRU E-2110 EXCEPT
E-1946 AND E-2104 *
EA-11 THRU EA-388 EXCEPT
EA-320 *

* WHICH HAVE LIGHTS TO
INDICATE POSITION

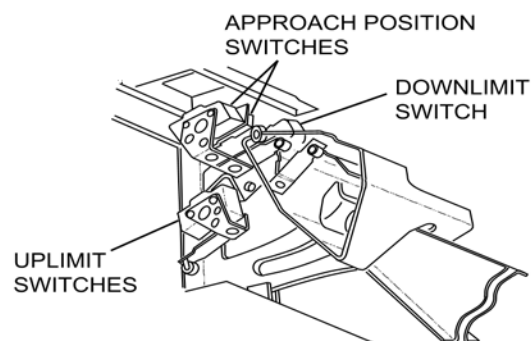


TO ADJUST, LOOSEN MOUNTING
BOLTS AND MOVE FORE AND AFT,
OR ROTATE SLIGHTLY.



CE-748, CE-772 THROUGH CE-815, CJ-149;
D-10097, D-10120 THROUGH D-10178;
E-1111, E-1241 TROUGH E-1370

FLAP LIMIT SWITCHES



CE-816 AND AFTER
CJ-150 AND AFTER
D-10179 AND AFTER
E-1371 AND AFTER
EA-11 AND AFTER

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Figure 202 : Sheet 1 : Flap Cable Retainer

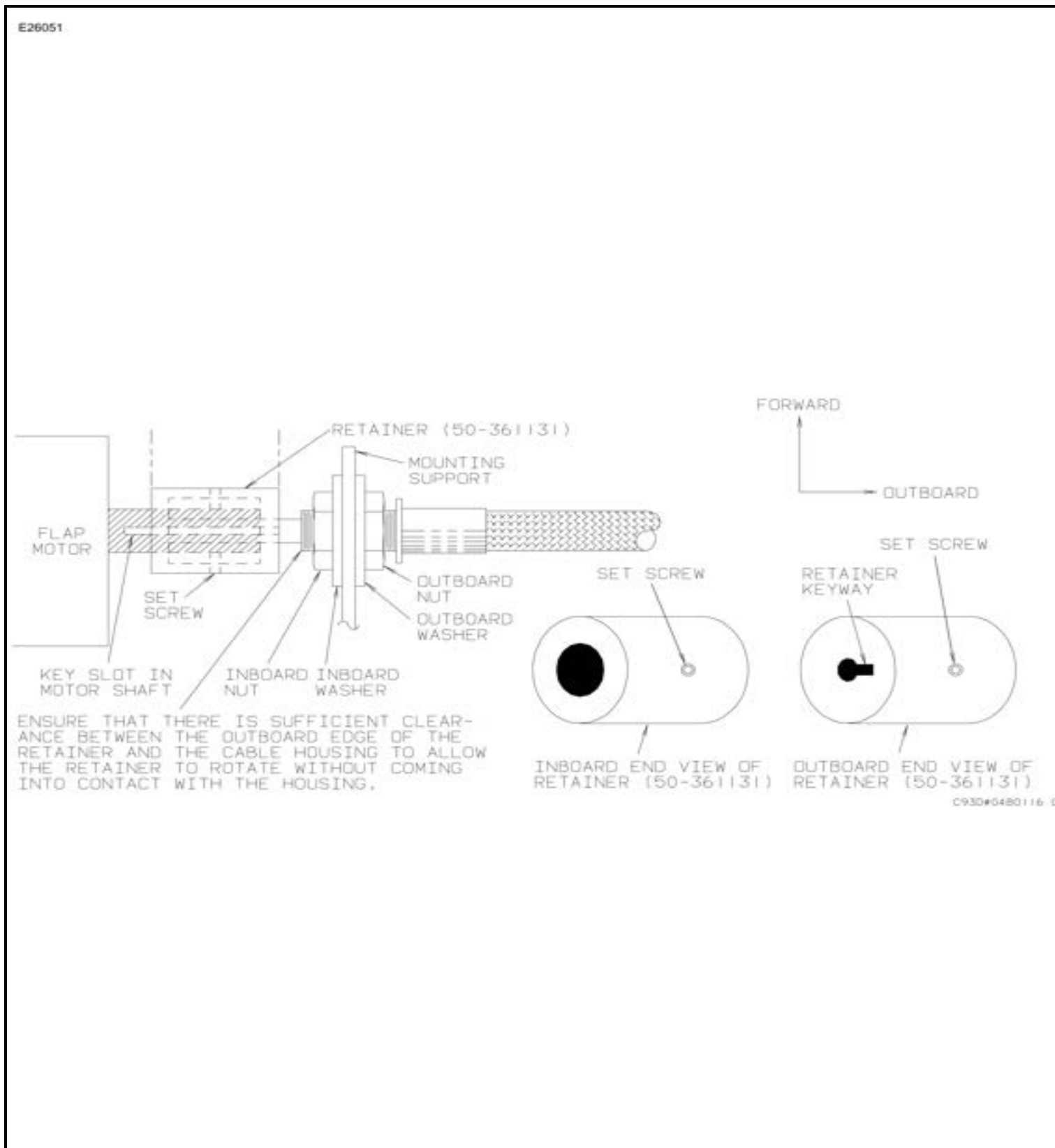
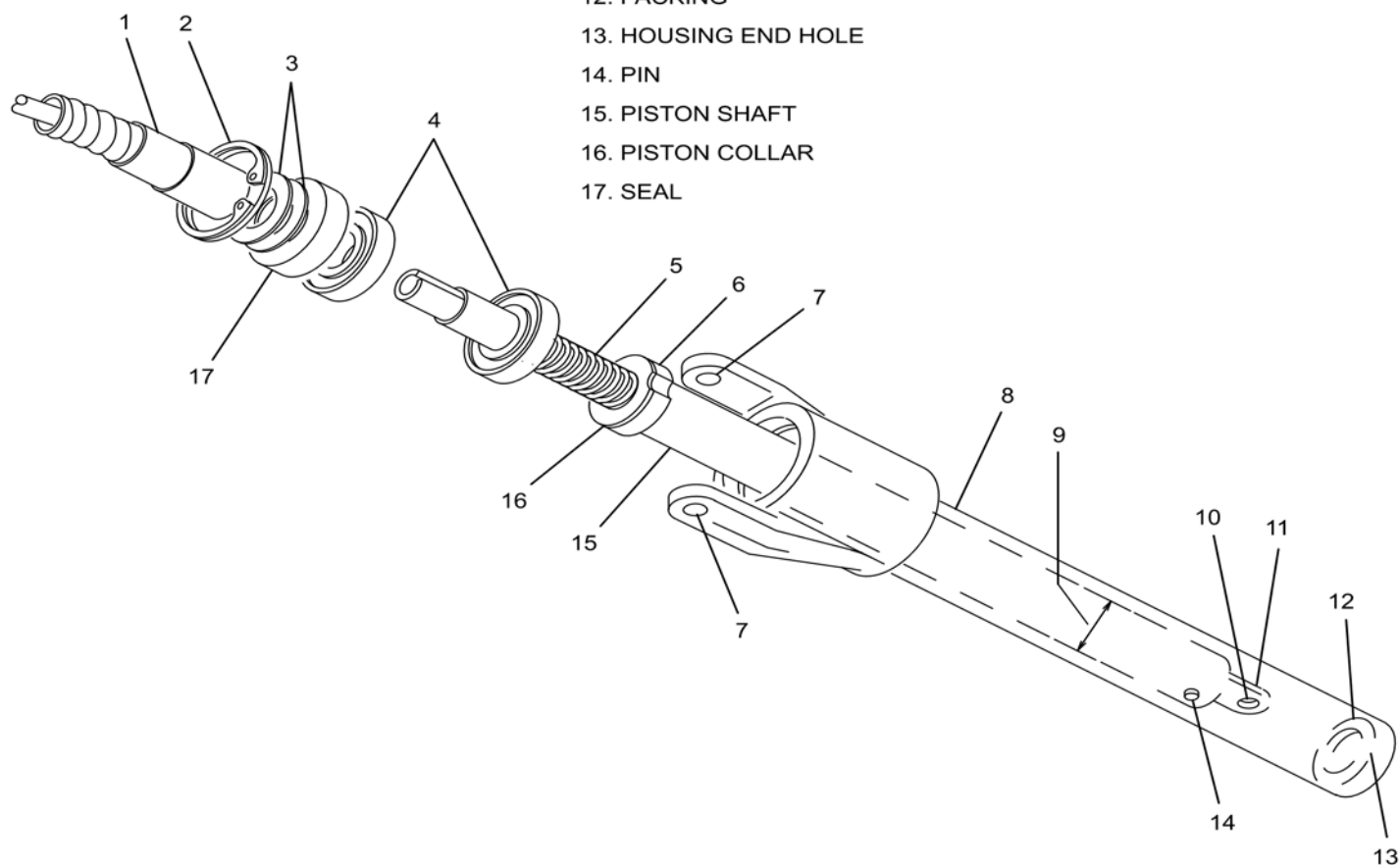


Figure 203 : Sheet 1 : (Revised) - Flap Actuator

E22969

1. FLEXIBLE SHAFT
2. SNAP RING
3. SPACERS
4. BEARINGS
5. ACTUATOR SCREW
6. PISTON
7. HOUSING PIVOT BOLT HOLES
8. HOUSING
9. HOUSING BARREL INSIDE DIMENSION
10. PISTON PLUG HOLE (CONNECTS FLAP TO ACTUATOR)
11. PISTON PLUG
12. PACKING
13. HOUSING END HOLE
14. PIN
15. PISTON SHAFT
16. PISTON COLLAR
17. SEAL



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GUST LOCK AND DAMPENER - DESCRIPTION AND OPERATION

1. Gust Lock and Dampener - Description and Operation

A. Control Lock

A control column lock pin is provided for the control column and the aileron control wheel. The lock pin secures both the aileron control wheel and the elevator control. A cover is provided on the control lock to cover the throttle control, boost pump and the propeller control. Install the control lock assembly in the following sequence:

- (1) Rotate the control wheel to the right and move the column forward so the hole in the bracket and the column align to accept the pin.
- (2) Push the control column lock pin through the hole provided in the control column guide and into the control column.
- (3) Ensure positive retention of the lock pin by placing the cover assembly over the throttle control, boost pump and propeller control.

WARNING: Always completely remove the control lock assembly before engine start, taxiing and flight.

FUEL - GENERAL**1. General - Description and Operation****A. Fuel System**

The standard fuel system on CE-748, CE-772 thru CE-883; CJ-149 thru CJ-155; D-10097, D-10120 thru D-10302; E-1111, E-1241 thru E-1593; and EA-11 thru EA-32 consists of a 25 gallon (22 gallons usable) fuel cell located in each wing leading edge, which provides the airplane with a total fuel capacity of 50 gallons (44 gallons usable) of fuel (Refer to [Figure 1](#)). The standard fuel system on CE-884 and After; CJ-156 and After; D-10303 and After; E-1594 and After, and EA-33 thru EA-272, except EA-242 consists of a 40 gallon (37 gallons usable) fuel cell in each wing leading edge which provides the airplane with an 80 gallon (74 gallons usable) fuel capacity (Refer to [Figure 2](#)). On EA-242 and EA-273 and After, the fuel system consists of a 40 gallon and a 14 gallon cell in each wing. This provides the airplane with 108 gallons (102 gallons usable) of fuel (Refer to [Figure 3](#)). The cells are filled through an independent flush type filler cap located on each wing. On all airplanes except CJ-149 and After, each wing contains a baffled fuel cell to deliver an uninterrupted flow of fuel to the engine. The fuel selector handle, located forward and to the left of the pilot's seat, is placarded OFF-LH TANK-RH TANK for fuel management. Float operated sensors located in each wing tank system measure fuel quantity. A visual measuring tab in each cell is attached to the filler neck of the 80 gallon system. The bottom of the tab indicates 27 gallons of usable fuel in each tank and the detent on the tab indicates 32 gallons of usable fuel in each tank.

At EA-242 and EA-273 and After, a sight gage is installed (inboard of WS 113.172) to aid in taking on a partial load of fuel (Refer to [Figure 3](#)). This gage will indicate a partial load of 25, 30, or 35 gallons in its respective wing. When the gage is indicating in the black zone, do not use the gage.

- (1) Auxiliary or Fuel Boost Pump(CE-748, CE-772 and After; D-10097, D-10120 and After; E-1111, E-1241 thru E-2110 Except E-1946 and E-2104)

The single speed auxiliary fuel pump is mounted in front of the forward spar carry-through on the left side of the airplane. The auxiliary fuel pump provides pressure for starting and emergency operation in case the engine-driven pump fails. Immediately after starting, the auxiliary fuel pump can be used to purge the system of vapor caused by an extremely high ambient temperature or a start with the engine hot. The auxiliary fuel pump is controlled by a switch located on the fuel control panel and placarded AUX FUEL PUMP OPERATION, ON OFF.

- (2) Auxiliary or Fuel Boost Pump(CJ-149 and After)

The fuel boost pump system utilizes two separate boost pumps (a high pressure and a low pressure pump) mounted in front of the forward spar carry-through. The switch which controls these pumps is located on the fuel control panel and is placarded HIGH BOOST, OFF, and ACROBATIC BOOST. The high boost pump may be used if the engine-driven pump fails, if starting the engine during high ambient temperatures or if the engine is hot. The switch must be in acrobatic boost position during acrobatic maneuvers. Both pumps are for intermittent use only. The boost pump pressures should be as indicated in [Table 1](#).

Table 1. Fuel Boost Pump Pressures

High Boost	23.0 psi at No Flow	16.0 psi at 42 gph.
Acrobatic Boost	11.5 psi at No Flow	7.0 psi at 55 gph.

The by-pass cracking pressure of each pump is 3.0 in. of water with a maximum by-pass pressure drop of 0.35 psi at 40 gph.

- (3) Auxiliary or Fuel Boost Pump(EA-11 thru EA-272 Except EA-242)

NOTE: On airplanes equipped with Kit 36-9008-1 the EMERGENCY FUEL PUMP switch is removed and the placard covered with black paint. The high boost fuel boost relay under the pilots floorboard is removed and the manifold pressure switch in the manifold pressure gage line has the electrical connector unplugged and the exposed terminals covered with electrical tape. The vent plumbing outboard of the fuel cell has not been changed but the fuel supply system is essentially that of a B36TC (EA-242, EA-273 and After). The fuel selector valve drain requires the use of the same type tool (see special tools) as the B36TC. Refer to the B36TC (EA-242, EA-273 and After) for the description and operation.

The auxiliary Fuel Pump Switch is placarded OFF-LOW-AUTO on Serials EA-11 thru EA-53. The auxiliary Fuel Pump Switch on Serials EA-54 and After, and airplanes prior to EA-54 complying with Beechcraft Service Instructions No. 1093 is placarded OFF-LOW-HI/LOW.

The two speed auxiliary fuel pump is located in front of the forward spar carry-through on the left side of the airplane. The pump is controlled by three switches located in the cabin. One of the switches is located on the fuel control panel and

placarded AUX FUEL PUMP, OFF, LOW, AUTO or HI/LOW. In the AUTO or HI/LOW position the pump is operating at all times. At low power settings it operates at low boost, and at higher power settings (27 to 30 in. Hg manifold pressure) it operates at high boost. The mode at which the boost pump operates in the AUTO or HI/LOW position is determined by a switch actuated by manifold pressure. Another switch is located in the subpanel just to the left of the fuel control panel and placarded EMERGENCY FUEL PUMP, OFF ON. This switch will override the other switches and actuate the high pressure side of the pump for emergency operation, such as with a failed engine driven fuel pump. The third switch is located forward of the instrument panel and plumbed into the manifold pressure gage line. This switch is actuated by manifold pressure, and closes between 29 to 30 in. Hg on increasing pressure (to actuate the high pressure side of the pump), and opens between 27 to 30 in. Hg on decreasing pressure (to return the pump to low pressure operation). This switch actuates the high pressure side of the pump, but only functions if the switch on the fuel control panel is in the AUTO or HI/LOW position.

(4) Auxiliary or Fuel Boost Pump (E-1946, E-2104, E-2111 and After; EA-242, EA-273 and After)

The two speed auxiliary fuel pump is mounted in front of the forward spar carry-through on the left side of the airplane. The auxiliary fuel pump provides pressure for starting and emergency operation in case the engine-driven pump fails. Immediately after starting, the auxiliary fuel pump can be used to purge the system of vapor caused by an extremely high ambient temperature or a start with the engine hot. The auxiliary fuel pump is controlled by a switch located on the subpanel and placarded AUX FUEL PUMP HI LO OFF.

(5) Fuel System Drains

The fuel system prior to EA-273, except EA-242, is equipped with one snap-type drain in each wing. At serial EA-242 and EA-273 and After, there are two drains in each wing. One drain with its tool is to be used in a preflight check for contaminants in the fuel; the other drain with its Adapter, P/N 107B, is for draining the fuel system. Each fuel cell drain is located on the lower surface of the wing, forward of the main spar, just outboard of the root. The system low spot drain at the bottom of the fuel selector valve is accessible through a door inboard of the left wing root.

Figure 1 : Sheet 1 : (Revised) - Fuel System(CE-748, CE-772 and After; CJ-149 and After; D-10097, D-10120 and After; E-1111, E-1241 and After)

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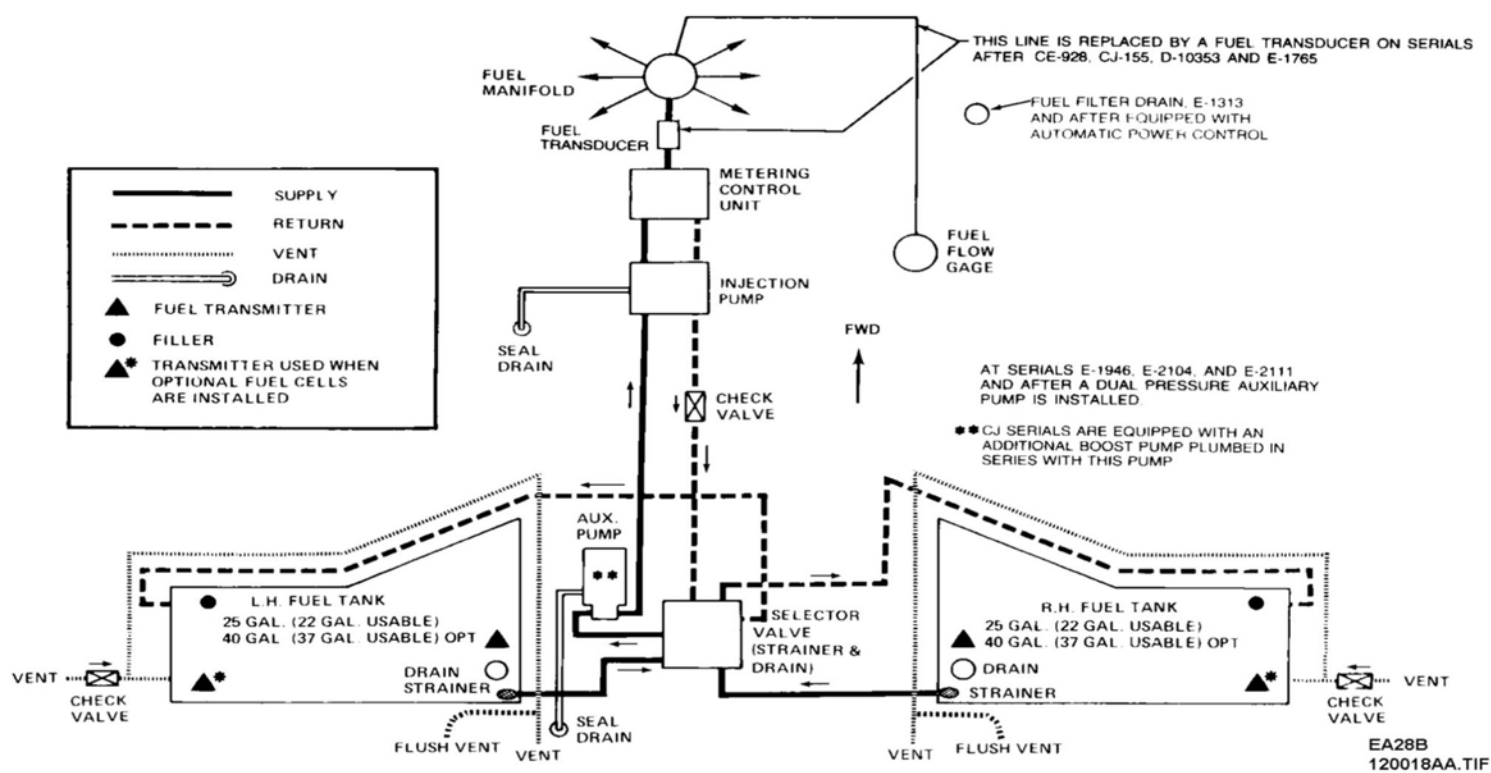
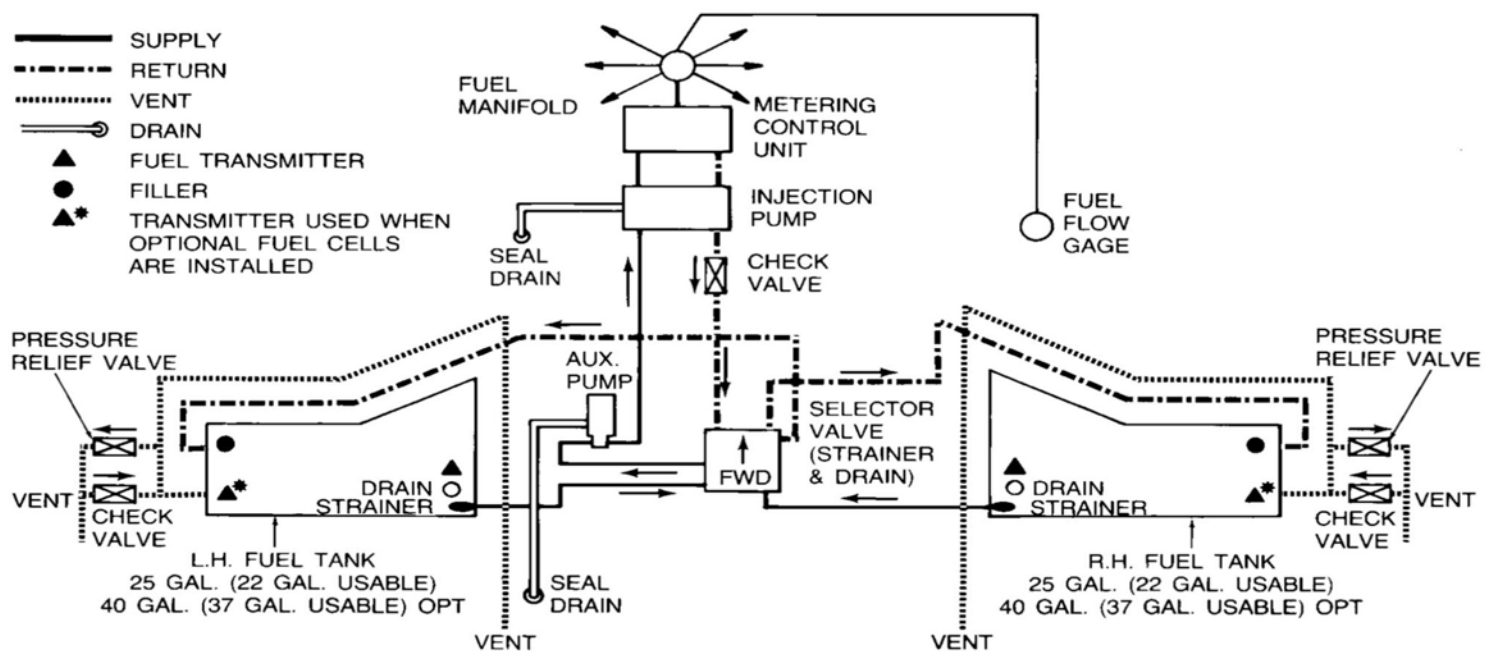


Figure 2 : Sheet 1 : (Revised) - Fuel System(EA-11 thru EA-272 except EA-242)

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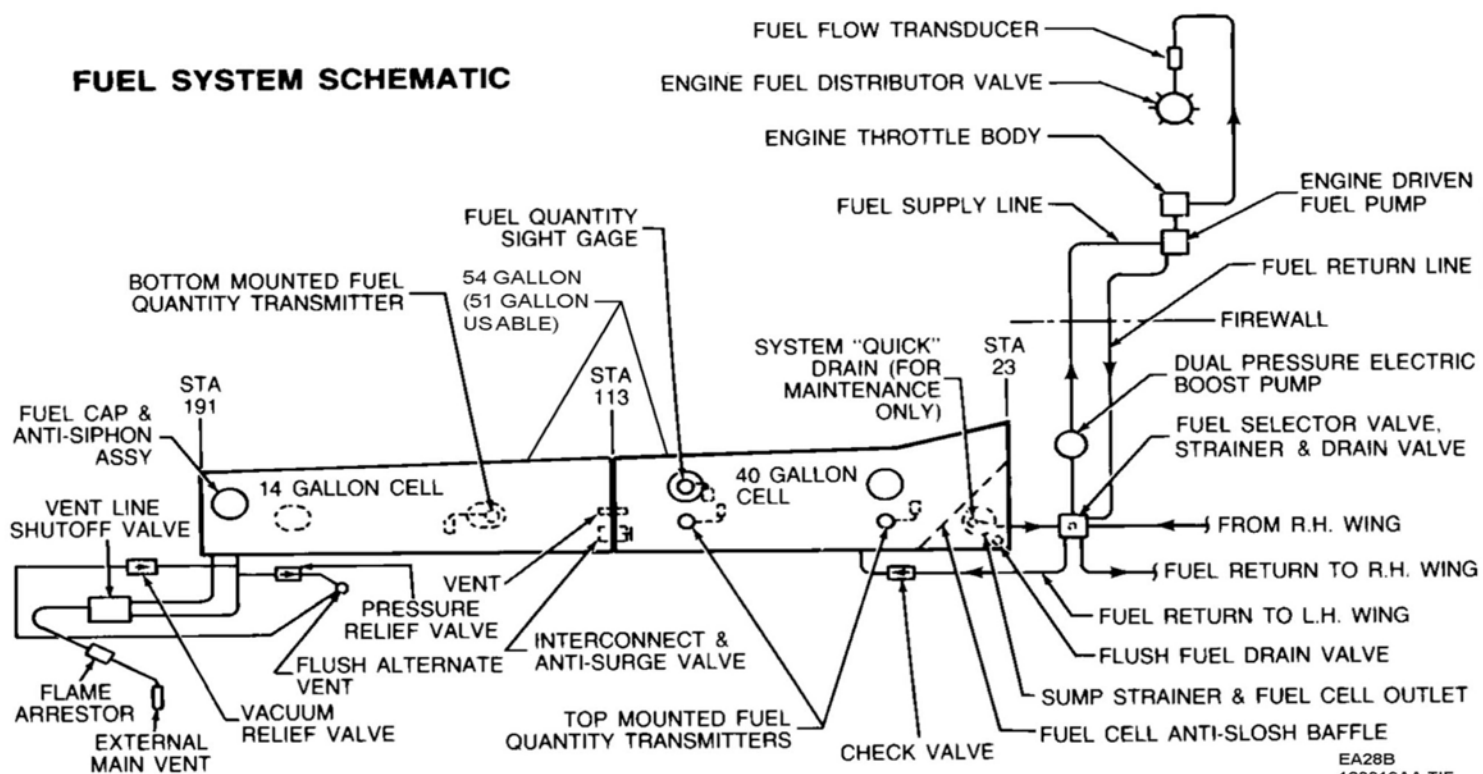


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Figure 3 : Sheet 1 : (Revised) - Fuel System (EA-242, EA-273 and After)

E24070

FUEL SYSTEM SCHEMATIC



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FUEL - MAINTENANCE PRACTICES

1. Fuel Handling Practices

When filling the airplane fuel tanks, always observe the following:

A. Servicing Airplane Fuel

NOTE: Care should be exercised while filling the fuel cell to prevent scratching, denting, or otherwise damaging the surface or leading edge of the wings. Do not allow the fuel nozzle to come in contact with the rubber fuel cell.

- (1) Service the airplane fuel tanks with Grade 100LL (Blue) aviation gasoline, or Grade 100/130 (Green) aviation gasoline. If these fuels are not available, Grade 115/145 (Purple) aviation gasoline may be used. Only for airplane serials E-3630, E-3636 and After, Grade No. 95 (RH-95/130) or grade No. 100 (RH-100/130) aviation gasoline may also be used (1, Table 1, 91-00-00).
- (2) Be certain the airplane is statically grounded to the servicing unit.
- (3) Do not fill fuel cells near open flame or within 100 feet of any open energized electrical equipment capable of producing sparks.

B. Airplane Defueling (EA-11 thru EA-273 except EA-242)

WARNING: Do not defuel near an open flame or within 100 feet of any energized electrical equipment capable of producing sparks.

CAUTION: After defueling or fuel cell replacement, operate the engine on each fuel tank with the airplane on the ground to ensure that all air has been purged from the fuel cells and fuel lines to the engine upon refueling.

To ensure that all fuel is removed from the system and to expedite the defueling operation, the fuel should be drained through the boost pump. The following Steps must be accomplished before energizing the pump:

- (1) Apply external power to the airplane electrical system.
- (2) Place the fuel selector valve in the ON position and the mixture lever in IDLE CUT-OFF.
- (3) Remove the filler caps to vent the system.
- (4) Disconnect the fuel line at the firewall and attach a drain hose. Provide a suitable container for the fuel.
- (5) Energize the boost pump.
- (6) When the fuel is no longer pumped from the airplane, open the sump drains to complete the defueling operation.

C. Airplane Defueling (EA-242, EA-273 and After)

WARNING: Do not defuel near an open flame or within 100 feet of any energized electrical equipment capable of producing sparks.

CAUTION: After defueling or fuel cell replacement, operate the engine on each fuel tank with the airplane on the ground to ensure that all air has been purged from the fuel cells and the fuel lines to the engine upon refueling.

- (1) Provide a suitable container for the fuel.
- (2) Remove the access cover under the drain valve located under the wing near the fuselage.
- (3) Remove the filler caps to vent the system.
- (4) Insert the drain adapter (supplied as loose tool) into the drain valve.
- (5) After draining the fuel, remove the drain adapter and install the access cover.

2. Fuel Strainer

A. Cleaning

CAUTION: The strainer of the non-baffled cell with reservoir and the baffled cell are not interchangeable. Ensure that the correct fuel strainers are reinstalled in the proper cells after cleaning and inspection.

- (1) Most fuel injection system malfunctions can be attributed to contaminated fuel. Inspecting and cleaning the fuel strainers should be considered to be of the utmost importance as a regular part of preventive maintenance.
- (2) Normally the fuel strainers should be inspected and cleaned every 100 hours. However, the strainers should be inspected and cleaned at more frequent intervals depending on service conditions, fuel handling equipment and when operating in localities where there is an excessive amount of sand or dust. It is recommended that the fuel strainer, located in the fuel

selector valve, be inspected and cleaned at intervals of 50 hours of operation and under no condition should the period be extended over 100 hours. The finger strainers in the fuel cell outlets should be removed and cleaned whenever solid materials are found in the cells, or if the airplane has been in storage for an extended period of time.

STORAGE - MAINTENANCE PRACTICES

1. Storage - Maintenance Practices

CAUTION: Any time the fuel system is drained or a fuel cell replaced, air may enter the system. If the possibility that air has entered the system does exist, start and operate the engine on the ground until all air is removed from the system. Operate the engine for several minutes on each tank until proper engine operation is made sure. Refer to the Pilot's Operating Manual before starting and operating the engine.

CAUTION: Do not use magnetic hardware within 18 inches of a flux valve or magnetometer.

A. Fuel Cell (EA-11 thru EA-272 except EA-242)

(1) Removal

- (a) Drain and purge the fuel cells.
- (b) Remove the outboard fuel cell access plate and fuel quantity sensor. (The outboard fuel quantity sensor is installed only in the optional 80 gallon fuel system).
- (c) Remove the inboard access cover and fuel quantity sensor.
- (d) Disconnect all fuel and vent plumbing.

CAUTION: Tape the edge of the access hole to prevent damage to the fuel cell.

- (e) Unsnap the fuel cell and remove it through the outboard fuel cell access hole.

(2) Installation

CAUTION: Care should be taken when replacing fuel cells to make sure the correct type fuel cell is used as a replacement. All Bonanza Series Airplanes except CJ-149 and After use baffled fuel cells. CJ-149 and After incorporate a fuel cell with a collapsible fuel cell reservoir in place of a baffled fuel cell. To avoid damage to the fuel cells, the fuel cell cavities MUST be clean of any debris before installing a replacement cell.

- (a) Return the fuel cell through the outboard fuel cell access hole and snap it into place.

CAUTION: Before closing the zipper, inspect the fuel cell for any foreign material. If the cell is not thoroughly clean, it should be cleaned with a lint-free cloth moistened in water, alcohol or kerosene. No other solvent should be used to clean the fuel cell.

The molded nipple fittings used on the fuel cell are lightweight fittings developed for ease of installation in certain locations in the airplane. To get the best service from this type fitting, it is necessary to do certain procedures at the time of installation. The specific precautions other than the general care in handling are as follows:

- 1 Insert the flow tube into the fitting until 3/8 inch or more of the tube extends through the fitting.
- 2 Locate the hose clamp on the fabric-reinforced area of the nipple; it should clear the end of the fitting by 1/4 inch.
- 3 Torque hose clamps as indicated in Table 201. They should be drawn up in one operation; if retightening is necessary, release the clamp completely and wait at least 15 minutes before retightening.
- 4 Use no sealing paste or gasket compounds.
- 5 Apply a thin film of Simonize wax to metal flow tubes as a lubricant. No other lubricant should be used.

Table 201. Fuel Cell Nipple Clamp Torques

Inside Diameter of Nipple (inches)	Torque for Fuel Nipple Clamps (inch-pounds)
Outside Diameter of Tube (inches)	
0.25 thru 0.62	12 to 16
0.75 and 1.00	15 to 20
1.00	25 to 30
1.50	30 to 35
3.00	35 to 40

CAUTION: If replacement Goodyear fuel cells have clear/yellow nipples, torque the fuel cell nipple clamps to 25 ± 5 inch-pounds.

B. Reservoir (CJ-149 and After)

Install the reservoir after the fuel cell is in the wing and before the access plate is installed. Installation may be done as follows:

(1) Installation

- (a) Tape the reservoir flapper valve shut before installing the reservoir (Refer to [Figure 201](#)).
- (b) Compress the reservoir (squeeze by hand) into a small circumference and pass it through the fuel access ring into the fuel cell.
- (c) Release the reservoir allowing it to assume its original shape.
- (d) Insert the connector assembly into the reservoir while tilting both the reservoir and connector assembly upward.

CAUTION: Care should be exercised to avoid cross threading the connector into the reservoir. Also avoid bending or distorting the fuel strainer which is attached to the end of the connector, for it may become entangled in the foam inside the reservoir.

- (e) Tighten the nipple clamp.
- (f) Connect the fuel line to the connector assembly.
- (g) Remove the tape from the flapper valve and check the valve for free play and good sealing.
- (h) Check to make sure the reservoir is positioned properly on the bottom of the fuel cell.
- (i) Close all access openings used for installing the reservoir.

CAUTION: The parts of the non-baffled fuel cells and the baffled fuel cells are not to be interchanged. When installing a new fuel cell, use only those items pertaining to that particular cell being installed. The strainer for the non-baffled cell with reservoir, for example, is considerably longer than the one for baffled cell and may damage the cell if installed in the baffled cell.

C. Fuel Cell (40 Gallon) (EA-242, EA-273 and After)

(1) Removal

- (a) Drain and purge the fuel cells.
- (b) Remove the outboard fuel cell access cover, fuel quantity sensor, and fuel sight gage and mounting plate.
- (c) Remove the inboard access cover and fuel quantity sensor.
- (d) Remove the access cover under the fuel sump.
- (e) Remove the lockwire and bolts holding the sump in place.
- (f) Lower the sump assembly and disconnect the hose from the fuel outlet. Remove the sump and hose assembly.
- (g) Remove the clamp from the drain valve nipple.
- (h) Remove the drain valve.
- (i) Remove the pilot's and copilot's seats (Refer to Chapter 25-00-00, PILOT AND COPILOT SEAT REMOVAL).
- (j) Remove the royalite cover over the main spar.
- (k) Disconnect the fuel line from the fuel cell fitting.
- (l) Remove the two bolts holding the fuel cell to the wing root rib.
- (m) Remove the cotter pin from the flapper valve and interconnect tube at the outboard end of the fuel cell.
- (n) Loosen the bolt to the flapper valve clamp, and remove the flapper valve.
- (o) Remove the clamps from the two interconnect tubes.

CAUTION: Tape the edge of the access hole to prevent damage to the fuel cell.

- (p) Unsnap the fuel cell and remove it through the outboard fuel cell access hole.

(2) Installation

CAUTION: Care should be taken when replacing fuel cells to make sure the correct type fuel cell is used as a replacement. To avoid damage to the fuel cells, the fuel cell cavities MUST be clean of any debris before installing a replacement cell.

- (a) Install the fuel cell through the outboard fuel cell access hole and snap it into place.

CAUTION: Before closing the zipper inspect the fuel cell for any foreign material. If the cell is not thoroughly clean, it should be cleaned with a lint-free cloth moistened in water, alcohol or kerosene. No other solvent should be used to clean the fuel cell.

- (b) Close zipper in fuel cell dam.

CAUTION: The access cover and fuel quantity sensor may have to be removed from the 14 gallon fuel cell so the small interconnect nipple may be held in place during installation of the 40 gallon cell. A light film of petrolatum (42, Table 1, 91-00-00) may be used as a lubricant on the nipples and under the clamps.

- (c) Install the fuel cell nipples on the interconnect tubes. Torque the nipple clamps per Table 201.

CAUTION: The molded nipple fittings used on the fuel cell are lightweight fittings developed for ease of installation in certain locations in the airplane. To get the best service from this type fitting, it is necessary to do certain procedures at the time of installation. The specific precautions other than the general care in handling are as follows:

CAUTION: 1. Insert the flow tube into the fitting until 3/8 inch or more of the tube extends through the fitting.

CAUTION: 2. Locate the hose clamp on the fabric-reinforced area of the nipple; it should clear the end of the fitting by 1/4 inch.

CAUTION: 3. Torque hose clamps as indicated in Table 201. The hose clamps should be tightened in one operation; if retightening is necessary, release the clamp completely and wait at least 15 minutes before retightening.

CAUTION: 4. Use no sealing paste or gasket compounds.

- (d) Install the flapper valve.

1 Install the cotter pin through the interconnect tube and flapper valve clamp.

2 Tighten the flapper valve clamp.

CAUTION: Use new gaskets.

NOTE: On Uniroyal cells remove two screws to allow installation of the bolts which secure the fuel cell to the wing root rib.

- (e) Install the two bolts which secure the fuel cell to the wing root rib. Torque between 20 to 30 inch-pounds and lockwire.

- (f) Install the drain valve in the fuel cell nipple (make sure the hat section support is in place).

- (g) Install the nipple clamp. Torque per Table 201.

- (h) Connect the sump assembly hose to the fuel outlet. Torque per Chapter 20-06-00.

- (i) Install the sump. Torque the bolts between 45 to 55 inch-pounds and secure the bolts and drain valve assembly with lockwire.

- (j) Install the fuel quantity transmitters (2 in the 40 gallon fuel cell and 1 in the 14 gallon cell if removed). Torque the transmitters between 20 to 30 inch-pounds and the transmitter mounting plate between 45 to 55 inch-pounds.

- (k) Connect the electrical wire to the transmitter.

- (l) Install the fuel cell cover plates and fuel sight gage mounting plate. Torque between 45 to 55 inch-pounds.

- (m) Install the access covers.

- (n) Connect the fuel line to the fuel outlet. Torque per Chapter 20-06-00.

- (o) Install the royalite cover over the main spar.

- (p) Install the pilot's and copilot's seats (Refer to Chapter 25-00-00, PILOT AND COPILOT SEAT INSTALLATION).

D. Fuel Cell (14 Gallon)

(1) Removal

- (a) Drain and purge the fuel cells.

- (b) Remove the access cover under the wing tip.

- (c) Disconnect the vent plumbing from the fuel cell.

- (d) Remove the filler cap, adapter assembly, and anti-siphon assembly.

- (e) Remove the two access covers under the 14 gallon fuel cell.

- (f) Remove the two cover assemblies from the fuel cell.

- (g) Remove the nipple clamps from the interconnect tubes, and remove the nipples from the tubes.

CAUTION: Tape the edge of the access hole to prevent damage to the fuel cell.

- (h) Unsnap the fuel cell and remove it through the outboard fuel cell access hole.

(2) Installation

CAUTION: Care should be taken to avoid damage to the fuel cells, the fuel cell cavities **MUST** be clean of any debris before installing a replacement cell.

- (a) Return the fuel cell through the outboard fuel cell access hole and snap it into place.

CAUTION: If the cell is not thoroughly clean, it should be cleaned with a lint-free cloth moistened in water, alcohol or kerosene. No other solvent should be used to clean the fuel cell.

- (b) Install the cell nipples on the interconnect tubes, and tighten the nipple clamps per [Table 201](#).

CAUTION: The molded nipple fittings used on the fuel cell are lightweight fittings developed for ease of installation in certain locations in the airplane. To get the best service from this type fitting, it is necessary to do certain procedures at the time of installation. The specific precautions other than the general care in handling are as follows:

CAUTION: 1. Insert the interconnect tube into the fitting until 3/8 inch or more of the tube extends through the fitting.

CAUTION: 2. Locate the hose clamp on the fabric reinforced area of the nipple; it should clear the end of the fitting by 1/4 inch.

CAUTION: 3. Torque hose clamps as indicated in [Table 201](#). This should be drawn up in one operation; if retightening is necessary, release the clamp completely and wait at least 15 minutes before retightening.

CAUTION: 4. Use no sealing paste or gasket compounds.

CAUTION: 5. A light film of petrolatum ([42, Table 1, 91-00-00](#)) may be used as a lubricant under the clamps and nipples.

- (c) Connect the vent plumbing in the wing tip. Torque the clamps per [Table 201](#).

NOTE: Use all new gaskets.

- (d) Install the anti-siphon assembly. Torque the bolts between 45 to 55 inch-pounds and lockwire.

- (e) Install the adapter assembly. Use jointing compound ([81, Table 1, 91-00-00](#)) between the skin and adapter.

- (f) Install the fuel cap.

- (g) Install the two cover assemblies, the one with the fuel quantity transmitter is the inboard one. Torque between 45 to 55 inch-pounds and lockwire.

- (h) Connect the electrical wire to the transmitter.

- (i) Install the three access covers.

E. Fuel Cell (CE-748, CE-772 and After; CJ-149 and After; D-10097, D-10120 and After; E-1111, E-1241 and After)

(1) Removal

- (a) Drain and purge the fuel cells.

- (b) Remove the inboard, outboard top access covers, outboard bottom access cover and forward wing bolt cover.

- (c) Disconnect the electrical wire to the fuel quantity transmitters.

- (d) Remove the cover assemblies and fuel quantity transmitters.

- (e) Remove the fuel cap and adapter assembly.

- (f) Disconnect the vent plumbing and fuel line from the fuel cell.

CAUTION: Tape the edge of the access hole to prevent damage to the fuel cell.

- (g) Unsnap the fuel cell and remove it through the outboard fuel cell access hole.

(2) Installation

CAUTION: Care should be taken to avoid damage to the fuel cells, the fuel cell cavities must be clean of any debris before installing a replacement cell.

- (a) Return the fuel cell through the outboard fuel cell access hole and snap it into place.

CAUTION: If the cell is not thoroughly clean, it should be cleaned with a lint-free cloth moistened in water, alcohol or kerosene. No other solvent should be used to clean the fuel cell.

- (b) Connect the vent plumbing and fuel line to the fuel cell.
- (c) Install the adapter assembly. Use sealer compound (81, Table 1, 91-00-00) between the skin and adapter.
- (d) Install the fuel cap.
- (e) Install the cover assemblies and fuel quantity transmitters.
- (f) Connect the electrical wire to the fuel quantity transmitters.
- (g) Install the inboard, outboard top access covers, outboard bottom access cover and forward wing bolt cover.

F. Fuel Cell

(1) Inspection

- (a) Inspect the lower wing surface around the vent and drain nipple areas for fuel stains and evidence of fuel seepage.
- (b) If evidence of fuel seepage is found, remove the fuel access plates on the lower wing.
- (c) Inspect the areas between the fuel cell liners and the wing skins for fuel seepage.
- (d) Inspect the fuel cells for deterioration, cracks and seepage, particularly around the vent, drain outlet and interconnect nipples.
- (e) Interconnect nipples that are not hard or cracked must be inspected by scraping with a finger nail. If materials can be scraped off, the cells must be replaced.

CAUTION: Bladder type fuel cells on airplanes which have been in service for extended periods may have become hard and brittle. These fuel cells must be inspected very carefully. The inspection at this time may cause cracks in the material which in turn may cause fuel seepage.

- (f) If seepage from the cell is confirmed, the cell must either be repaired or replaced. Fuel cells that have become hardened and are not pliable should be replaced. Fuel cells that are pliable and not hardened may be repaired. Refer to FUEL CELL REPAIR procedures.

NOTE: Goodyear BTC-39 construction type fuel cells removed from the airplane for any reason **MUST BE REPLACED and MUST NOT BE REPAIRED or REINSTALLED** in the airplane. Specific inspection instructions for BTC-39 construction fuel cells are contained in Service Instructions No. 0895, or subsequent revision.

- (g) Fuel cells that have been repaired must be inspected for the condition of the repair by draining and purging, removing the access plates and inspect it with a mirror and non-explosive flashlight. The cell must be replaced if blistering is evident or any edge is loose.

G. Fuel Cell Flapper Valve

On airplanes that are equipped with baffled fuel cells, the flapper valves (metal or phenolic) should be inspected periodically (Textron Aviation Inc. recommends that the inspection be done every three years) for freedom of operation and proper seating (Refer to 05-20-00, WINGS AND CARRY-THROUGH STRUCTURE, D18).

(1) Inspection

- (a) Drain all fuel from the airplane.
- (b) Remove the rectangular access plate located just outboard of the fuselage on the upper skin of each wing leading edge.
- (c) Cut the lockwire and remove the attaching bolts from the fuel cell access plate.

NOTE: Clean the area around the access plate before removing the plate.

- (d) Remove the fuel cell access plate and open the zipper in the baffle.
- (e) Locate the flapper valve in the lower outboard section of the baffle and determine if the flapper valve is metal or phenolic.
- (f) If the flapper valve is metal, it should be inspected and repaired, if necessary, as follows:
 - 1 Move the flapper element of the valve through its full travel. There should be no binding and the element should seat securely against the valve plate.
 - 2 If the flapper element binds and/or does not seat properly, the flapper element arm could be bent. The arm can be straightened by placing a screwdriver between the arm and the element and pressing the element toward the closed position.
 - 3 If after straightening the arm, the flapper element still binds and/or does not seat properly, the flapper element

should be removed and replaced with a new flapper element assembly. The flapper element assembly may be replaced by removing the two attaching bolts from the upper part of the flapper valve. The same attaching parts should be used to install the new flapper element assembly. The new flapper element assembly should be inspected after installation to determine that the assembly did not receive damage during installation that could cause it to bind and/or seat properly.

- (g) If the flapper valve is phenolic, it should be inspected and reworked, if necessary, as follows:
- 1 Move the flapper valve element through its full travel. There should be no binding and the element should seat securely against the valve plate.
 - 2 If the flapper element binds and/or does not seat properly, the upper rear side of the flapper element may be binding against the valve plate.
 - 3 The flapper valve element may be relieved from binding by filing a small radius on the upper rear side of the element.

NOTE: A shop towel saturated with light oil may be placed directly below the flapper valve to absorb the phenolic dust during rework.

- 4 After determining that the flapper valve is functioning properly, thoroughly wipe the area in the vicinity of the flapper valve with an oil saturated shop towel.
- (h) Clean the gasket contact area on the fuel cell and fuel cell access plate.
- (i) Close the zipper in the baffle.
- (j) Install a new gasket and secure the fuel cell access plate in place.
- (k) Tighten the fuel cell access plate attaching bolts to a torque of 45 to 50 inch-pounds and secure with lockwire.
- (l) Reinstall the rectangular access plate on the wing leading edge skin.

H. Fuel Cell

(1) Leakage Test

Rubber bladder type fuel cells may be bench tested for leakage by sealing off all openings and inflating the empty cell to 1/4 psi with a mixture of shop air and ammonia gas, then checking for visible indications of leakage on a cloth saturated with phenolphthalein solution (Refer to [Figure 202](#)). To set up and conduct the leakage test, proceed as follows:

- (a) The following equipment is required and should be hooked up as indicated in the schematic in [Figure 202](#).
- 1 Closure plates for the fuel cell openings. Such plates may be fabricated of aluminum sheet cut to a size sufficient to cover the cell openings. Drill holes in the closure plate to match the hole pattern around the opening in the fuel cell.
 - 2 Rubber stoppers to plug the fitting openings in the fuel cell. One of the stoppers should have a hole for insertion of the plastic tubing used to connect the fuel cell into the test setup.
 - 3 A manometer for measuring 6 inches of water differential. The manometer can be fabricated from glass or clear plastic tubing; frame and scale similar to the illustration shown.
 - 4 A regulator that can be set to provide 1/4 psi (6 inches of water) from a supply of shop air.
 - 5 Two flasks (or bottles) approximately one liter (or quart) in capacity. A third container may be hooked into the test setup to provide an optional overflow collector if desired. The two containers should be provided with rubber stoppers that have holes for the insertion of 1/4 inch tubes (glass or metal).
 - 6 Plastic tubing of a size to provide a leak-free fit over the tubes and of a length sufficient to interconnect the test components.
 - 7 Make up a solution of phenolphthalein as follows: Add 1/3 ounce phenolphthalein crystals to 1/2 gallon ethyl alcohol, mix, then add 1/2 gallon water.
 - 8 Make up an ammonia solution by adding 100 cc (3 fluid ounces) of concentrated ammonium hydroxide (NH₄OH) per gallon of water.
 - 9 The Pressure Test Baffle Restrainer (Refer to [Figure 203](#)) is made of 3/4 inch thick plywood. Sand all edges to remove sharp corners and/or splinters that may damage the fuel cell.
- (b) Place the fuel cell and test equipment on a clean work bench.

CAUTION: Make sure the work area is clean of metal shavings or other debris that could damage the fuel cell.

- (c) Install the closure plates over the fuel cell openings and torque the retaining screws as specified in this chapter of this manual for the openings, then insert the rubber stoppers into the open fittings (Refer to [Figure 202](#)).
- (d) The flask (or bottle) containing the ammonium hydroxide solution should be 1/3 to 1/2 full as shown in the illustration.
- (e) Connect a shop air supply to the regulator and interconnect the regulator, beakers, fuel cell, and the manometer.
- (f) Place the baffle restrainer over the velcro tape area prior to inflation (Refer to [Figure 203](#)).

WARNING: Inflation of the fuel cell without the baffle restrainer can result in irreparable damage to the baffle.

- (g) Inflate the fuel cell to 1/4 psi with a mixture of shop air and ammonium gas (Refer to [Figure 202](#)). A 6-inch difference in the two water levels of the manometer will indicate that the fuel cell is inflated to 1/4 psi. It is not necessary to restrain the cell other than to keep it from rolling off the bench. The filling of the cell will be rather slow at the 1/4 psi, but should not be rushed as overpressure of the cell could result.

CAUTION: Wear rubber gloves to protect against skin irritation when handling the cloth. As a further protection against possible penetration of the phenolphthalein solution through the gloves, wash your hands thoroughly after finishing the test.

- (h) Saturate a large, clean cloth with phenolphthalein (Immerse it in a container and squeeze out excess liquid).
- (i) Lay the cloth over the various portions of the fuel cell until the entire exterior of the cell has been covered. With each application of the cloth, watch for the formation of a reddish pink stain on the cloth to indicate the presence of a leak. Encircle the area on the fuel cell beneath such stains with a chalk mark to pinpoint the locations of leaks.

NOTE: Continued use of the testing cloth will require repeated saturations with phenolphthalein since rapid evaporation of the alcohol from the cloth progressively reduces the sensitivity of the test unless the solution in the cloth is frequently renewed.

Refer to Service Instruction No. 0632-280, Rev. I or subsequent and Goodyear Aerospace Corporation Fuel Tank Repair Manual AP368 for further information on inspection of fuel cells for leakage.

I. Fuel Cell Preservation

(1) Goodyear

Goodyear fuel cells (Construction No. BTC-39, BTC-54A and BTC-67) installed in the airplane do not require preservation when the cell is to be empty for an indefinite period of time. The fuel cell should not be open to the atmosphere except for the normal vent lines in the airplane. The cell is assumed wet from a previous filling.

(2) Uniroyal

Uniroyal fuel cells must be filled every 10 days or the walls coated with a thin coat of light engine oil if they are to be preserved for periods of up to one year. Uniroyal fuel cells that are to be stored for periods of one year or longer should be coated with a thin coat of light engine oil and then removed from the airplane as outlined under FUEL CELL REMOVAL. After the fuel cell is removed from the airplane, it should be wrapped in plastic, placed in a box, and stored in a cool dry area.

NOTE: The fuel cell should not be removed or handled until 24 hours after the oil has been applied.

J. Fuel Cell Repair

(1) Goodyear Fuel Cells

For repairs of Goodyear fuel cells, refer to Goodyear Fuel Cell Repair Manual AP368, Vithane Fuel Cells.

(2) Uniroyal Fuel Cells

For repairs of Uniroyal fuel cells, refer to Uniroyal Handbook Recommended Handling and Storage Procedures for Bladder Type and Oil Cells P/N FC 1473-73.

K. Fuel Filler Cap and Fuel Filler Cap Adapter Inspection (EA-11 thru EA-439 and E-1111 and After)

The fuel filler caps and fuel filler cap adapters are located on the wing leading edges.

(1) Fuel Filler Cap

NOTE: Inspect the outer packing for flexibility, splits, cracks or distortion. If the packing is damaged in any way, replace or overhaul the fuel cap.

Visually inspect the fuel filler cap to make sure that all visible packings are in good condition and the hook, bead chain coupling and bead chain are secure. With the fuel filler cap installed on the fuel filler cap adapter, check the force required to lift the handle assembly. The force required to lift the handle shall be 15 ± 3 pounds applied perpendicular to the handle

and applied 0.20 ± 0.03 inches from the edge of the handle at its center (Refer to [Figure 204](#)).

(2) Fuel Filler Cap Adapter

Make sure the two rivets (Refer to [Figure 204](#)) attaching the FULL plate assembly to the fuel filler cap adapter are secure. Loose rivets should be tightened or replaced. Rivet heads should be sealed with sealer/accelerater CS-3204 Class A/B ([74, Table 1, 91-00-00](#)).

Figure 201 : Sheet 1 : Non-Collapsible Fuel Cell Reservoir (CJ-149 and After)

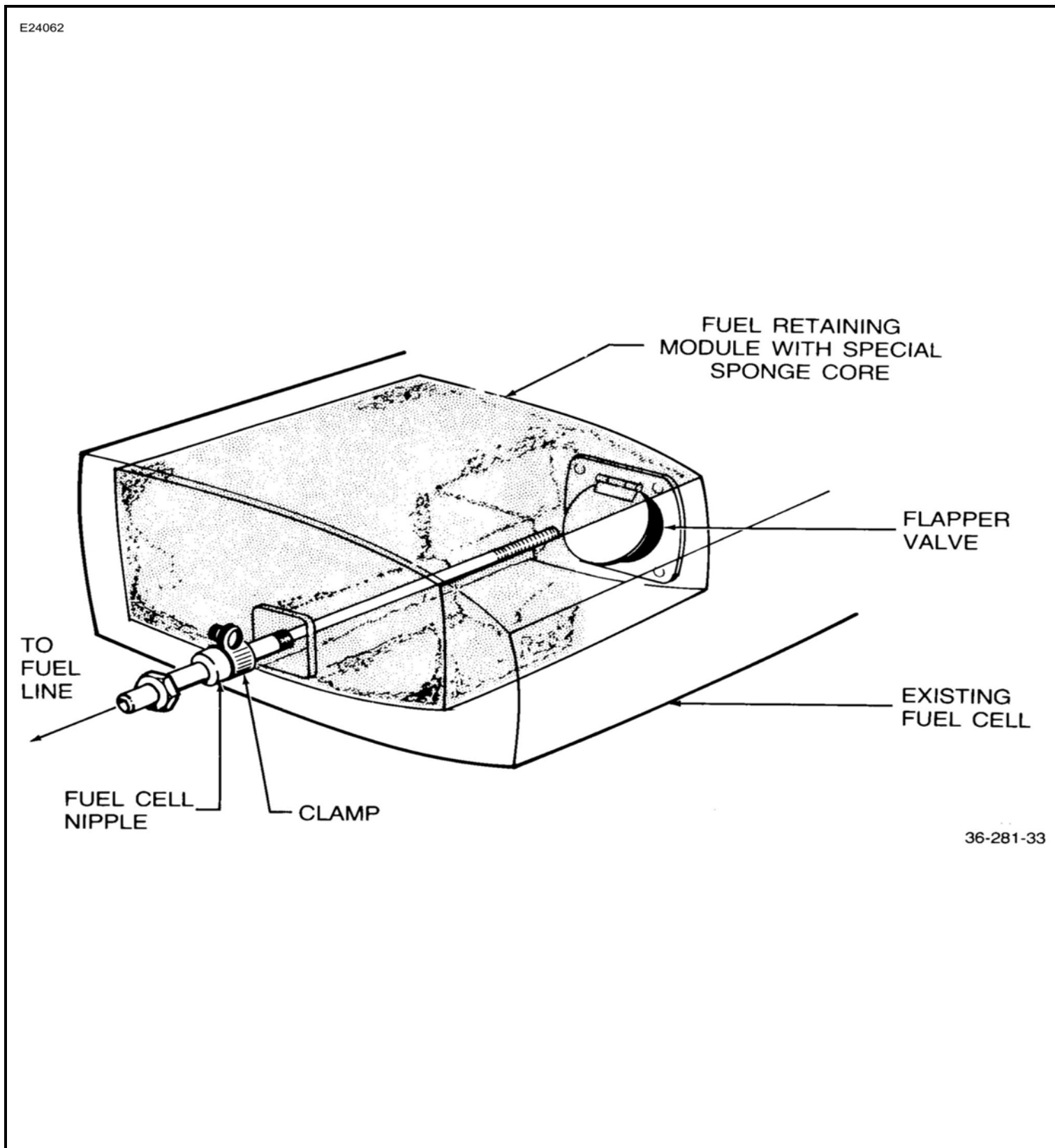


Figure 202 : Sheet 1 : Setup for Leakage Test

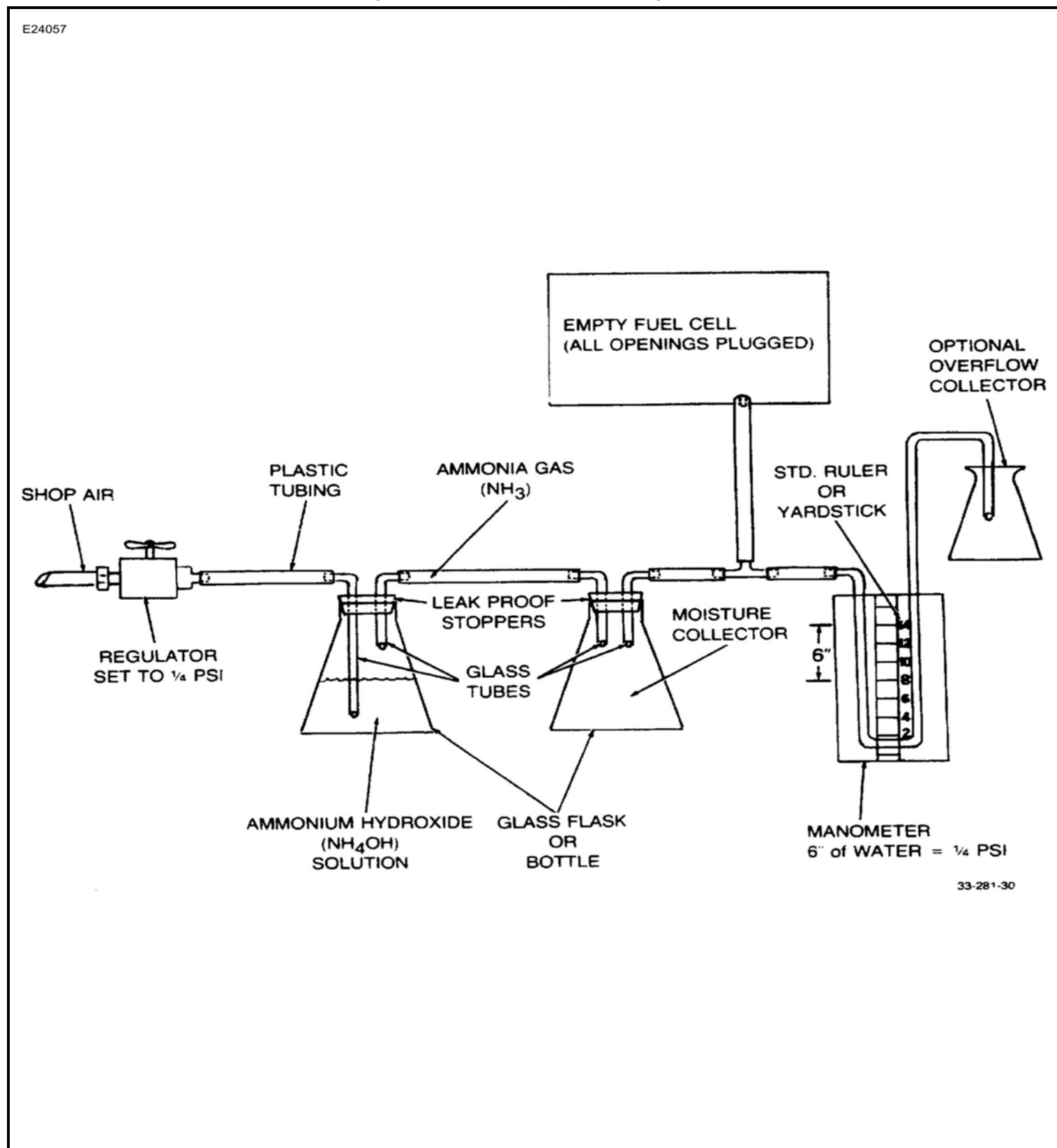


Figure 203 : Sheet 1 : Pressure Test Baffle Restrainer

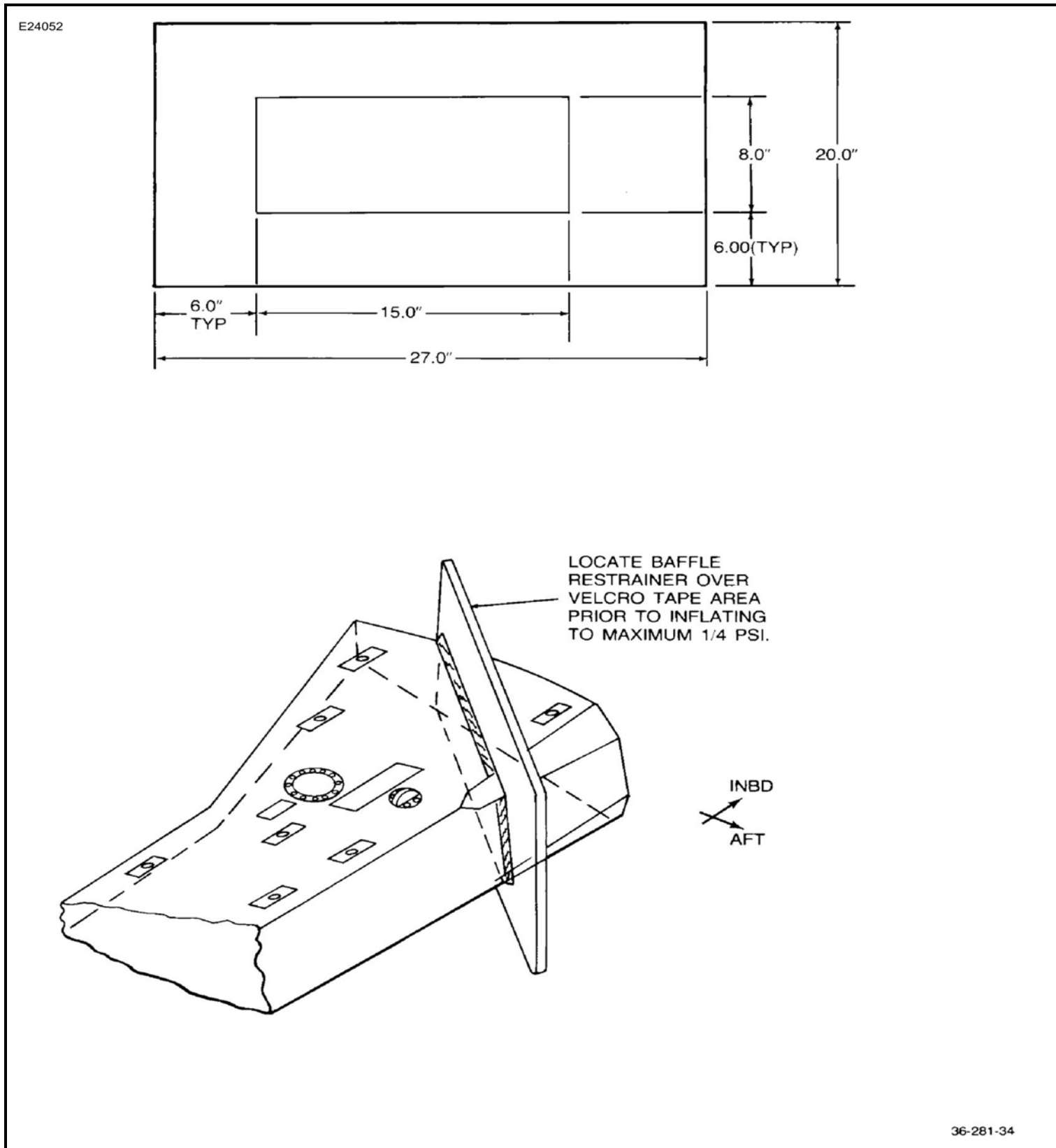
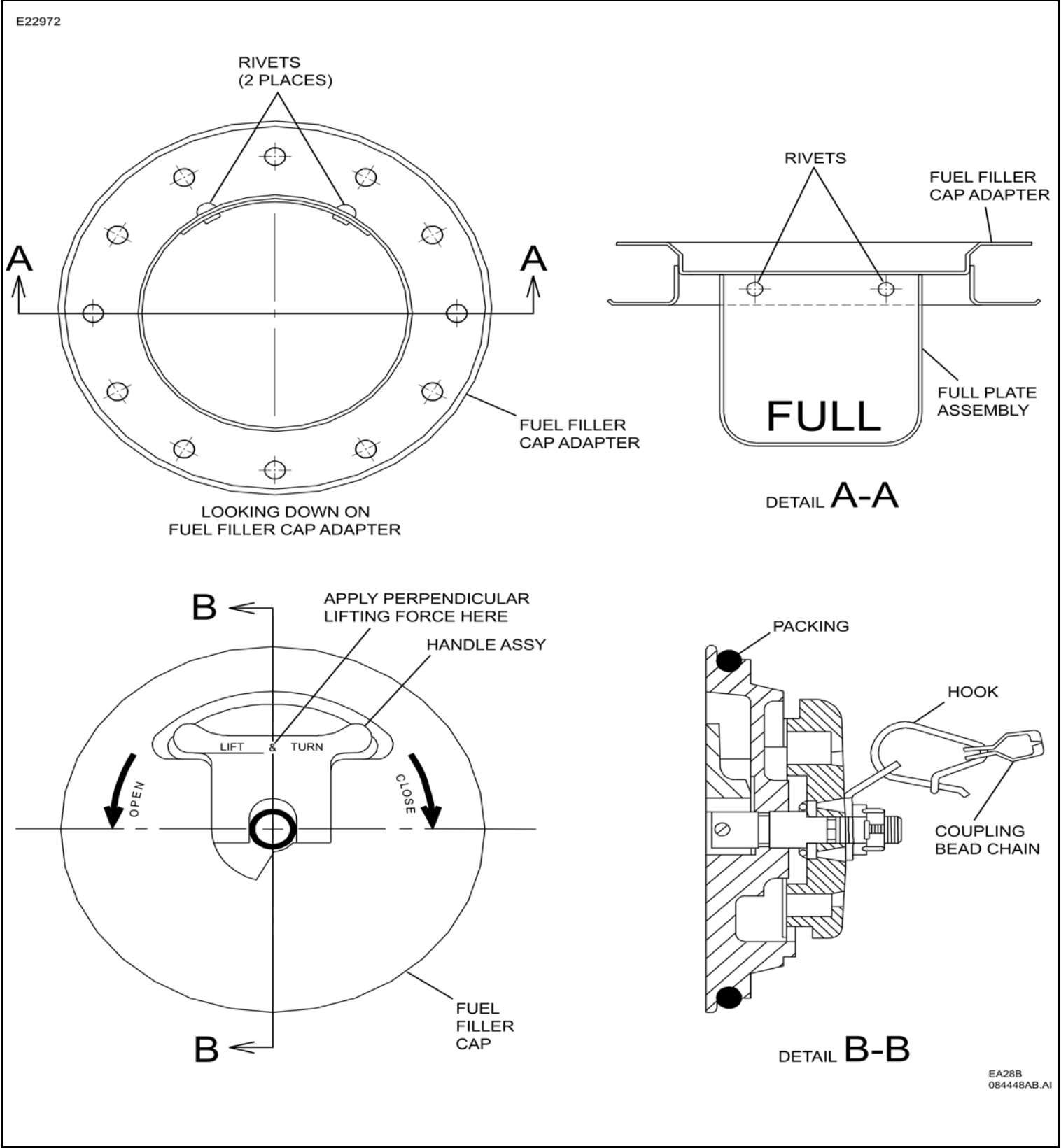


Figure 204 : Sheet 1 : (Revised) - Fuel Filler Cap and Fuel Filler Cap Adapter - Inspection



DISTRIBUTION - MAINTENANCE PRACTICES

1. Distribution - Maintenance Practices

CAUTION: Any time the fuel system plumbing is opened, air may enter the system. This condition may cause rough engine operation or loss of power. If the possibility that air has entered the system does exist, start and operate the engine for several minutes on each tank until proper engine operation is assured. Refer to the Pilot's Operating Handbook and Airplane Flight Manual before starting and operating the engine.

- A. Auxiliary Fuel Pump Removal(CE-748, CE-772 and After; CJ-149 and After; D-10097, D-10120 and After)
 - (1) Drain and purge the fuel system.
 - (2) Remove the pilot and copilot seats (Refer to Chapter 25-00-00, PILOT AND COPILOT SEAT REMOVAL).
 - (3) Remove the royalite cover over the main spar.
 - (4) Remove the fuel selector handle and unscrew the postlight covers from the royalite truss cover, then remove the truss cover.
 - (5) Disconnect the fuel plumbing from the fuel selector valve.
 - (6) Remove the bolts securing the fuel selector valve to the mounting bracket and remove the fuel selector valve.
 - (7) Disconnect the fuel plumbing from the auxiliary fuel pump.
 - (8) Remove the four bolts securing the auxiliary fuel pump to the mounting bracket and remove the auxiliary fuel pump.
- B. Auxiliary Fuel Pump Installation(CE-748, CE-772 and After; CJ-149 and After; D-10097, D-10120 and After)
 - (1) Secure the auxiliary fuel pump and mounting bracket to the airplane with the attach bolts.
 - (2) Connect the fuel plumbing to the auxiliary fuel pump.
 - (3) Secure the fuel selector valve to the mounting bracket with the four attach bolts.
 - (4) Connect the fuel plumbing to the fuel selector valve.
 - (5) Replace the royalite truss cover.
 - (6) Replace the fuel selector handle and the post light covers.
 - (7) Replace the royalite cover over the main spar.
 - (8) Install the pilot and copilot seats (Refer to Chapter 25-00-00, PILOT AND COPILOT SEAT INSTALLATION).
- C. Auxiliary Fuel Pump Removal(E-1111, E-1241 and After; EA-11 and After)
 - (1) Drain and purge the fuel system.
 - (2) Remove the pilot and copilot seats (Refer to Chapter 25-00-00, PILOT AND COPILOT SEAT REMOVAL).
 - (3) Remove the royalite cover over the main spar.
 - (4) Disconnect the fuel plumbing from the auxiliary fuel pump.
 - (5) Remove the four bolts securing the auxiliary fuel pump to the mounting bracket and remove the auxiliary fuel pump. The pump is located in front of the spar carry-through on the pilot's side.
- D. Auxiliary Fuel Pump Installation(E-1111, E-1241 and After; EA-11 and After)
 - (1) Secure the auxiliary fuel pump and bracket to the airplane with the four attach bolts.
 - (2) Reconnect the fuel plumbing to the auxiliary fuel pump.
 - (3) Replace the royalite cover over the main spar.
 - (4) Install the pilot and copilot seats (Refer to Chapter 25-00-00, PILOT AND COPILOT SEAT INSTALLATION).
- E. Fuel Selector Valve Removal
 - (1) Drain and purge the fuel system.
 - (2) Remove the pilot and copilot seats (Refer to Chapter 25-00-00, PILOT AND COPILOT SEAT REMOVAL).
 - (3) Remove the royalite cover over the main spar.
 - (4) Remove the fuel selector handle and unscrew the post light covers from the royalite truss cover, then remove the truss cover.
 - (5) Disconnect the fuel plumbing from the selector valve.
 - (6) Remove the bolts securing the selector valve to the mounting bracket and remove the selector valve.

F. Fuel Selector Valve Installation

- (1) Lubricate the fuel line threads with petrolatum (42, Table 1, 91-00-00) before installation.
- (2) Secure the selector valve to the mounting bracket with the attach bolts.
- (3) Connect the fuel plumbing to the fuel selector valve.
- (4) Replace the royalite truss cover around the fuel selector valve.
- (5) Replace the handle on the fuel selector valve and screw the post light covers back on the royalite truss cover.
- (6) Replace the royalite cover over the main spar.
- (7) Install the pilot and copilot seats (Refer to Chapter 25-00-00, PILOT AND COPILOT SEAT INSTALLATION).
- (8) Test the fuel selector valve to make sure it functions correctly in all positions and the detents correspond to the placard markings.

G. Fuel Strainer Removal (Selector Valve)

Access to the fuel selector valve fuel strainer may be made by opening the access door located under the airplane below the front edge of the pilot's side window (Refer to Figure 202).

- (1) Remove the safety wire around the two screws mounted at the bottom of the fuel selector valve, then remove the screws.
- (2) Remove the bottom of the selector valve and pull the fuel strainer screen from the fuel selector valve.

H. Fuel Strainer Installation (Selector Valve)

- (1) Install the screen at the bottom of the selector valve with the flange up (Refer to Figure 202).
- (2) Replace the bottom of the fuel selector valve and secure with the two attach screws.
- (3) Safety wire the screws.

I. Fuel Strainer Removal (Wing Fuel Cells)

- (1) Drain and purge the fuel system.
- (2) Remove the finger strainer access cover located between the lower portion of the wing and fuselage.
- (3) Disconnect the fuel line from the connector assembly.
- (4) Loosen the fuel cell nipple clamp; disconnect the finger strainer and slide the fuel finger strainer from the fuel cell.

J. Fuel Strainer Installation (Wing Fuel Cells)

- (1) Install the connector assembly in the fuel cell and tighten the nipple clamp.
- (2) Connect the fuel line to the connector assembly.
- (3) Install the access cover on the airplane.

K. Inspection of Fuel Cell Vent Lines and Fuel Filler Caps

The following procedure is recommended for inspection of fuel tank vent lines and filler caps:

- (1) Remove the access plate for each wing fuel cell from the lower wing surface.
- (2) Disconnect the fuel cell vent line from the fuel cell.
- (3) Apply air pressure to the fuel cell end of the vent line.
- (4) Alternately plug each vent opening to assure that air is passing through all branches of the vent system for the cell. Continue to blow air through each branch until any obstructions have been removed.
- (5) Remove the siphon break check valve and blow air through the siphon break line from the check valve end, then install the valve.
- (6) Connect the fuel cell vent line to the fuel cell.
- (7) Install the access plate below each fuel cell.
- (8) Visually check each fuel cell filler cap for looseness or deterioration of the seal which could cause leakage. If seals are deteriorated or damaged, they should be replaced.

CAUTION: Any configuration of the vent other than that described in Step (9). may create a negative vent pressure. A negative vent pressure will pull the air, or air and fuel from the fuel tank.

- (9) Check the extended vent to make sure the vent extends a minimum of 1.75 inches below the lower wing skin surface. The vent tube should be scarfed at a 45° angle on the forward side and should be canted forward 10° from perpendicular to the skin (Refer to Figure 201).

L. Flared Fittings

When installing flared fittings and hoses, make sure the threads are lubricated properly (Refer to [Figure 203](#)) with petrolatum ([42, Table 1, 91-00-00](#)). When previously installed fittings are removed, they should be wiped clean and relubricated before they are reinstalled. Torque all fittings in accordance with the FLARE FITTING TORQUE TABLE (Refer to [Chapter 20-06-00, Table 1](#)).

Figure 201 : Sheet 1 : Fuel Vent

E24039

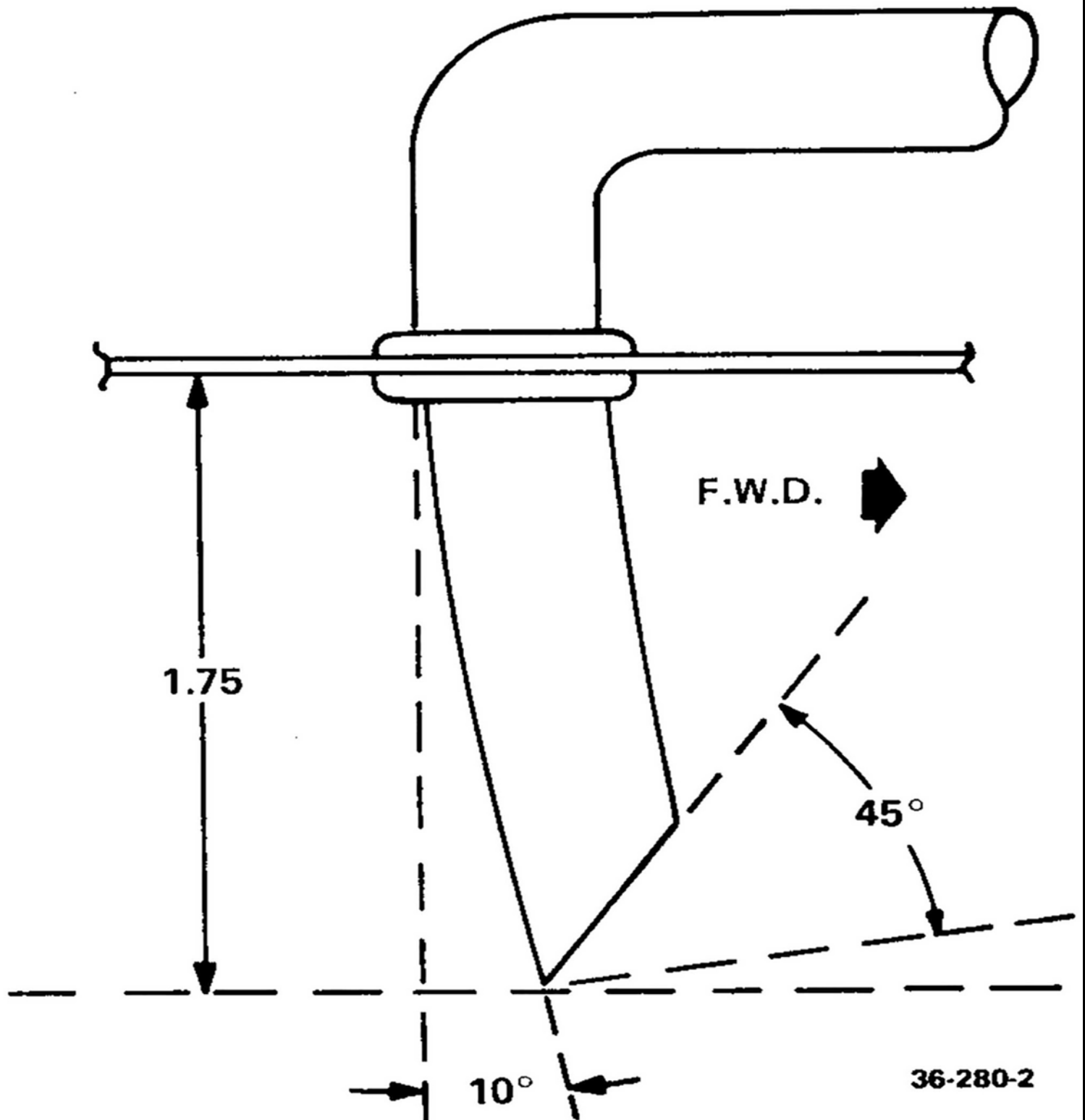


Figure 202 : Sheet 1 : Fuel Strainer

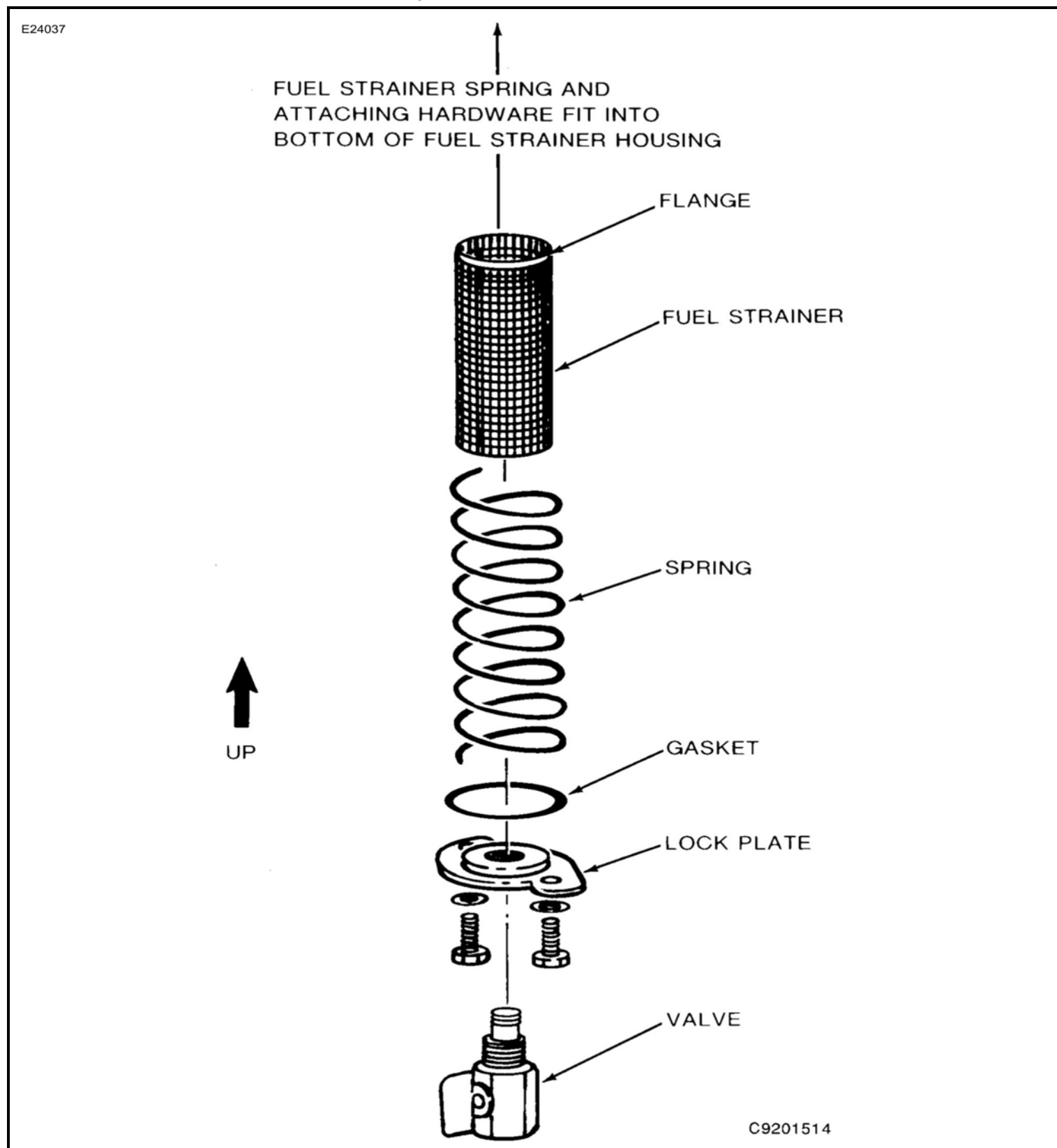
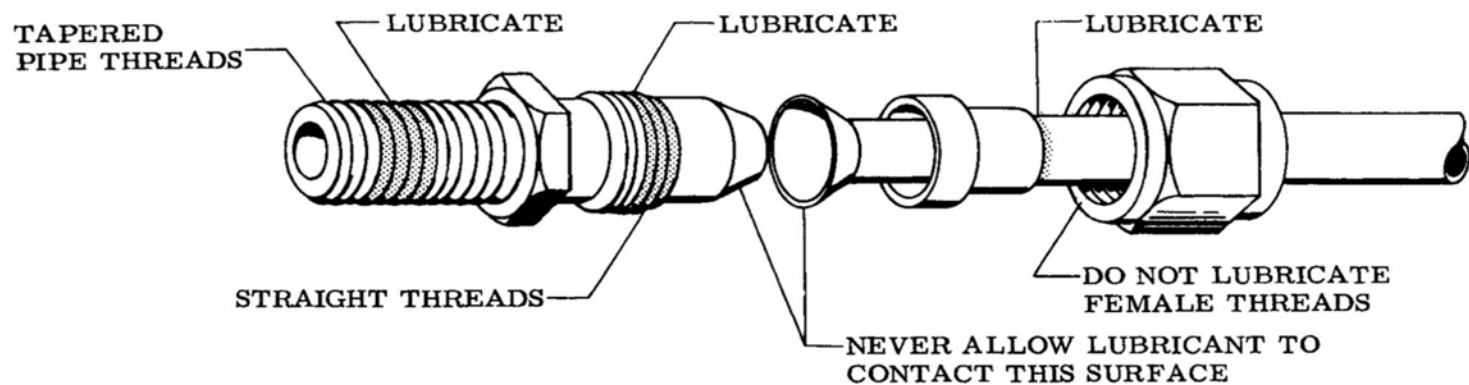


Figure 203 : Sheet 1 : Lubrication of Flared Fittings

E24035



60-604-5

INDICATING - MAINTENANCE PRACTICES

1. Indicating - Maintenance Practices

CAUTION: Any time the fuel system is drained, air may enter the system. If the possibility that air has entered the system does exist, start and operate the engine on the ground until all air is removed from the system. Operate the engine for several minutes on each tank until proper engine operation is assured. Refer to the Pilot's Operating Handbook and Airplane Flight Manual before starting and operating the engine.

A. Fuel Quantity Sensors (80 Gallon System)

Fuel quantity is measured by float type sensor units located in each wing tank system. Electrical signals are transmitted from the sensors to the individual indicators, which indicate fuel remaining in the tank. Resistance between the stud and case of each fuel sensor must be 0 to 0.5 ohms in the empty position and 43 ± 2 ohms in the full position for the outboard fuel sensor and 0 to 0.5 ohms in the empty position and 76 ± 2 ohms in the full position for the inboard fuel sensor.

B. Fuel Quantity Sensors (108 Gallon System)

Fuel quantity is measured by float type sensor units located in each wing tank system. Electrical signals are transmitted from the sensors to the individual indicators, which indicate fuel remaining in the tank. Resistance between the stud and case of each fuel sensor must be 0 to 0.5 ohms in the empty position and 43 ± 2 ohms in the full position for the outboard fuel sensor and 0 to 0.5 ohms in the empty position and 76 ± 2 ohms in the full position for the inboard fuel sensor of the 40 gallon fuel cell. The resistance between the stud and case of the fuel sensor in the 14 gallon fuel cell is 0 to 5 ohms in the empty position and 19 ± 2 ohms in the full position. The total resistance will be 3 ± 3 ohms empty and 140 ± 6 ohms full.

C. Fuel Quantity Indicators

Position the airplane in a level flight attitude with the tanks filled as indicated in Table 201 (80 gallon system) or Table 202 (108 gallon system). Measure the input voltage at the indicator terminals. Each reading should be within ± 2 millivolts of the values shown in Table 201 or Table 202, except the empty reading should be within ± 1 millivolt of the table value.

Table 201. Fuel Quantity Indicators Input Voltage (80 Gallon System)

Fuel Quantity	E	1/4	1/2	3/4	F
Millivolts	3	35	55	85	103

Table 202. Fuel Quantity Indicators Input Voltage (108 Gallon System)

Fuel Quantity	E	1/4	1/2	3/4	F
Millivolts	6	36	60	86	103

(1) Fuel Quantity Sensor Removal

- Turn off the electrical power.
- Drain and purge the fuel system.
- Remove the access panel at the sensor which is to be removed.
- Disconnect the sensor wiring.
- Cut the safety wire and remove the transmitter support screws.

NOTE: Clean the area around the sensor before removing the sensor.

- Remove the sensor and gasket from the fuel cell.

(2) Fuel Quantity Sensor Installation

- Inspect the fuel cell for wrinkles or other obstructions that might impede sensor float travel.
- Set the new gasket and sensor in position and make sure the float is unrestricted through its full travel from stop to stop. The float arm may be bent, if necessary, to provide clearance.
- Install the sensor support screws, torque to 25 in.lbs, and safety.
- Connect the sensor wiring. Turn the power on and check the fuel gage for empty reading.

NOTE: If the gage does not read empty, reinspect the sensors to make sure the float arm is on the down stop and the float clears the bottom of the fuel cell. Check all the wiring for faulty connections.

- Fill the tanks and check the fuel gages for full readings.

NOTE: See Service Instructions No. 0925, Rev. I or subsequent for more information on the

replacement of the fuel quantity sensors.

- (3) Fuel Quantity Indicator Calibration
 - (a) Position the airplane in a level flight attitude.
 - (b) Remove the glareshield over the instrument panel.
 - (c) Locate the two printed circuit boards positioned on the back of the instrument panel just to the left of center.
 - (d) Locate the calibration screw in the back of each printed circuit board.
 - (e) Calibrate the fuel quantity indicator as follows:
 - 1 Make sure the fuel tank that corresponds to the fuel quantity being calibrated is full.
 - 2 Turn the calibration screw in the back of the corresponding printed circuit board until the needle on the fuel quantity indicator points to the F (full) mark.
 - (f) Reinstall the glareshield.

ICE AND RAIN PROTECTION - GENERAL

1. General

The airplane is equipped with a variety of ice and rain protection systems that can be utilized during operation under inclement weather conditions. Air from the cabin heating system prevents the windshield from fogging. The propellers are protected against icing by optional electrothermal boots on each blade that, when activated, automatically cycle to aid in dispersing the formation of ice. The pitot mast contains a heating element connected to the airplane electrical system for protecting the pitot opening from becoming clogged with ice.

An optional weather radar system is available for the Bonanza series airplanes starting at serials CD-878 and after, D-10264 and after, E-1534, E-1537 and after and EA-11 and after. The indicator is located in the radio section of the instrument panel and the antenna is located in the outboard leading edge of the right wing (see [34-40-00](#)).

PROPELLERS - DESCRIPTION AND OPERATION

1. Propellers - Description and Operation

A. Electric Propeller Deicing

The electric propeller deicer system includes an on-off switch (on the LH instrument subpanel), an ammeter, a timer, a brush assembly, slip rings and an electrically heated boot for each propeller blade. When the on-off switch is turned ON, the ammeter (near the centre of the instrument panel) registers the amount of current (2 bladed, 8 - 12 amps; 3 blade, 14 - 18 amps) passing through the system. If the current rises beyond the switch limit, an integral circuit breaker will cut off the power to the timer. The current flows from the timer (forward of instrument panel) to the brush assembly (mounted in front of the engine case) and is conducted by the brush assembly to the slip rings installed on the spinner backing plate. At serials D-10404 and after, CE-1024 and after, E-2069 and after, and EA-378 and after, the slip rings became part of an assembly attached between the engine hub and the propeller. The slip rings distribute current to the deicer boots on the propeller blades. Heat from the boots reduces the grip of the ice, which is then removed by the centrifugal effect of propeller rotation and by the blast of the airstream. The timer cycles power to the heating element on each blade. It takes three minutes for the timer to complete a cycle of 90 seconds on, 90 seconds off. Whenever the system is turned on, the ammeter in the instrument panel or subpanel registers the proper amperage, or zero amperage, depending on the phase the timer is in.

PROPELLERS - TROUBLESHOOTING

1. Propellers - Troubleshooting

A. Propeller - Troubleshooting Deicer System

The ammeter of the deicing system can be used to indicate the general nature of most electrical problems. Consequently, it is recommended that, to determine which circuits are involved, troubleshooting be preceded by the ammeter test outlined in step (1) of the 50 HOUR INSPECTION (5-20-00), and the HEAT TEST (30-60-00, 201). A reading of two thirds the normal amount of current (or one half on two bladed props) is an indication that one of the circuits is open between the slip ring assembly and deicer heater. If the ammeter registers excess current, the power lead is shorted to ground. It is possible that the excess current has welded the timer contacts in one phase. Under these circumstances, the timer will either feed current to the welded contacts continuously, or not cycle. If the former is true, the heat test will show heating throughout the two phases. Unless the grounded power lead is located and corrected, any new timer that is installed may suffer the same internal damage during the first use of the system. In general, for most effective use of the troubleshooting table (Refer to [Table 101](#)) all of the "indication" entries should be read to locate that which matches conditions of the particular system being checked. The numbered "probable cause" and "remarks" then indicate the proper sequence of checks. It should be noted, however, that such numbers are assigned with respect to the approximate usefulness of the check rather than to the most likely sequence of occurrence.

Table 101. Troubleshooting Propeller Deicer System

Indication	Probable Cause	Remarks
1. Ammeter shows zero current (both phases of the 3 minute cycle).	a. Switch circuit breaker tripped.	a. Locate and correct short before resetting circuit breaker by turning switch OFF then ON.
	b. Switch faulty.	b. If no voltage at switch output with voltage at switch input, replace the switch. If voltage is OK at switch output, go to step "d".
	c. No power from airplane.	c. If no voltage into switch, locate and correct open circuit.
	d. Ammeter faulty. (If some or all deicers heat with ammeter at zero, replace ammeter.	d. Test for voltage up to and out of ammeter. If low or zero output but proper input, replace the ammeter. If no voltage to ammeter, locate and fix open circuit between switch and ammeter.
	e. Open circuit between ammeter and timer.	e. Disconnect harness at timer and check voltage pin B (of harness) to ground. If none, locate and correct open circuit.
	f. Open circuit in wiring between timer and firewall connector.	f. Refer to the paragraph on HEAT TEST (30-60-00, 201) to find deicers not heating and test for voltage on that pin of firewall connector. If zero over three minutes, locate and fix open circuit in wiring from timer to firewall.
	g. Open between firewall and deicer lead straps.	g. If voltage OK to firewall plug, try voltage at junction of deicer lead and slip ring lead. If no voltage, find and correct open circuit in wiring to brush block, open circuit within brush block, or no contact brush to slip ring.
	h. No ground circuit.	h. If voltage at deicer leads, locate and fix open circuit from deicer to ground.

2. Ammeter shows normal current part of cycle, low current rest of cycle.	a. Open circuit in deicer or slip ring assembly.	a. Disconnect deicer straps to check heater resistance. If resistance is within specified limits, locate and fix open circuit in slip ring leads. If not, replace deicer with open circuit.
	b. High resistance in circuit with low current.	b. If not in contact of brush to slip ring (including ground brush), trace wiring to deicer and to timer to fix partially broken wire, loose or corroded connection.
3. Ammeter shows low current.	a. Airplane voltage low.	a. Check bus voltage.
	b. Ammeter faulty.	b. Refer to step "1.d".
	c. High resistance up to timer.	c. Check for partially broken wire, loose or corroded connection in wiring from airplane supply to timer input.
4. Ammeter shows excess current.	a. Ammeter faulty.	a. Refer to step "1.d".
	b. Ground between ammeter and timer.	b. Disconnect harness at timer and with ohmmeter, check from pin B (of harness) to ground. If ground is indicated, locate and correct.
	c. Ground between brush block and timer.	c. Disconnect leads at brush block and check from power leads to ground with ohmmeter. If ground is indicated, locate and correct.
	d. Ground between brush block and deicers (excluding ground brush circuit).	d. If no short exists at brush slip ring contact, check for ground from slip ring lead to prop while flexing slip ring and deicer leads. If a ground is indicated, locate and correct.
	e. Timer faulty.	e. Test timer as indicated paragraph on TIMER CHECK (30-60-00, 201)
5. Ammeter does not "flick" each 90 seconds.	a. Timer ground open.	a. Disconnect harness at timer and check with ohmmeter from pin G (of harness) to ground. If no circuit, refer to the Bonanza Wiring Diagram Manual P/N 35-590012-9.
	b. Timer contacts are welded (caused by short circuit in system).	b. Test timer as in paragraph on TIMER CHECK (30-60-00, 201) . If timer does not cycle with voltage at pin B, replace timer but be sure short causing original failure has been located and corrected.
6. Ammeter flicks between 90 second phase periods.	a. Loose connection between airplane power supply and timer input.	a. If trouble occurs over entire cycle, trace wiring from power source to timer input to locate and tighten loose connections.
	b. Loose or poor connection, timer to deicers.	b. Check for rough or dirty slip rings causing brush to "skip". If not this, trace circuits to locate and fix loose or poor connection.
	c. Timer cycles erratically.	c. Test timer as indicated in TIMER CHECK (30-60-00, 201) .

	d. Electrical wiring breakdown.	Replace the faulty deicer boot.
7. Radio noise or interference with deicers on.	a. Brushes arcing.	a. Check brush alignment as in step (8) of 100 HOUR INSPECTION (5-20-00). Look for rough or dirty slip rings. If this is the cause, clean, machine or replace slip ring assembly. Check for slip ring alignment.
	b. Loose connection.	b. Refer to step (7) of 100 HOUR INSPECTION (5-20-00).
	c. Switch faulty.	c. Try jumper wire across switch. If radio noise disappears, replace the switch.
	d. Wiring located within less than 8 inches of radio equipment wiring.	d. Replace at least 8 inches from input wiring to radio equipment.
8. Rapid brush wear or frequent breakage.	a. Brush block out of alignment.	a. Check brush alignment as in step (8) of 100 HOUR INSPECTION (5-20-00).
	b. Slip ring wobbles.	b. Check slip ring alignment with dial indicator.
	c. Rough slip ring.	c. Replace or machine.
	d. Dirty slip rings.	d. Clean the slip rings.
	e. Brushes arcing.	e. See step "8.a".

PROPELLERS - MAINTENANCE PRACTICES

1. Propellers - Maintenance Practices

A. Propeller Deicer Boot Removal

- (1) Remove the propeller spinner.
- (2) Disconnect the deicer boot leads from the spinner bulkhead and slip ring.
- (3) Remove the clip securing the lead strap to the spinner bulkhead and the clamp securing it to the propeller hub.

CAUTION: Place the blade so the solvent will run away from the hub. The solvent may damage the propeller seals.

NOTE: If the lead strap is retained by a strap rather than a clamp, remove the boot lead strap retaining strap as follows:

- (a) Using solvent (31 or 19, Table 1, 91-00-00) to soften the adhesive of the strap, loosen one corner of the strap sufficiently to grasp it with pliers or similar tool.
- (b) Apply a slow steady pull to the strap while using the solvent to soften the adhesive.
- (4) If applicable, remove the boot lead strap retaining strap, using methyl ethyl ketone or toluol (31 or 19, Table 1, 91-00-00) to soften the adhesive of the strap, loosen one corner of the strap sufficiently to grasp it with pliers or similar tool.

CAUTION: Unless the boot being removed is to be scrapped, cushion the jaws of any pulling tool to prevent damaging the boot surface.

- (5) Apply a slow, steady pull to the strap while using the solvent to soften the adhesive.
- (6) Using solvent (31 or 19, Table 1, 91-00-00) to soften the adhesion line between the boot and the blade, loosen one corner of the boot sufficiently to grasp it with vise grip pliers or a similar tool.
- (7) Apply a slow, steady pull on the boot to pull it off the propeller surface while continuing to use the solvent to soften the adhesive.
- (8) Remove the remaining adhesive from the boot and propeller blade with solvent (19 or 31, Table 1, 91-00-00).

B. Propeller Deicer Boot Installation

NOTE: If a new propeller is installed, the drying time of the adhesive (52, Table 1, 91-00-00) must be extended per B.F. Goodrich Service Bulletin No. E-75-51.

- (1) On B.F. Goodrich installations position the deicer boot on the propeller blade so that its center line at the inboard end is adjacent to the split in the propeller blade clamp and 1 inch outboard of the clamp, and the center line at the outboard end falls on the blade leading edge. Be sure the lead strap is in the proper position to be clamped to the blade retaining clamp.

NOTE: On McCauley installations, place the center line of the deicer boot on the leading edge of the propeller. For other McCauley installation dimensions refer to Figure 201, Sheet 1.

- (2) Mask off an area approximately 1/2 inch from the outer end and each side of the boot (Refer to Figure 201, Sheet 2).

NOTE: On installations using rubber lead straps mask off an area approximately 1/2 inch from the area which will be occupied by the lead strap retainer strap (around the blade shank).

- (3) Remove the deicer boot and clean the blade in the masked area from the retaining clamp outboard. Clean the area thoroughly with solvent (31 or 19, Table 1, 91-00-00). For final cleaning, wipe the solvent off quickly with a clean, dry, lint free cloth to avoid leaving a film.

CAUTION: If the blade is painted with lacquer remove all paint within the masked off area. If the blade is painted with polyurethane, slightly sand within the masked off area, using 400 grit sandpaper.

CAUTION: The metal and rubber parts must be thoroughly clean to assure maximum adhesion.

- (4) Moisten a clean cloth with solvent (31 or 19, Table 1, 91-00-00) and clean the unglazed surface of the deicer boot and both sides of the rubber retainer strap if applicable, changing the cloth frequently to avoid contamination of the clean area.
- (5) Thoroughly mix the adhesive (52, Table 1, 91-00-00) and apply one even brush coat to the propeller blade and to the unglazed back side of the boot. Allow the cement to dry for at least one hour at 40° F or above when the relative humidity is less than 75%, or two hours if the humidity is between 75% and 90%. Do not apply the cement if the relative humidity is higher than 90% or the temperature is below 50° F.
- (6) After allowing sufficient drying time, apply a second brush coat of cement to the propeller and to the unglazed surface of the deicer boot. Apply cement to the lead strap as necessary to cement the strap to the propeller, up to the hub. Allow the

cement to dry.

NOTE: When solvent (31, Table 1, 91-00-00) is used to soften the cement it provides approximately 10 seconds time for deicer application, while solvent (19, Table 1, 91-00-00) will provide approximately 40 seconds working time.

- (7) Position the deicer boot on the propeller, starting one inch from the blade retaining clamp, making sure the lead strap is in position to clamp to the blade retaining clamp. Moisten the cement lightly with solvent (31 or 19, Table 1, 91-00-00) and tack the boot center line to the blade leading edge. If the center line of the boot deviates from the blade leading edge, pull up with a quick motion and replace properly. Roll firmly along the center line with a rubber roller (Refer to Figure 202).

CAUTION: Never use a metal or wooden roller for this purpose, for they would damage the heating elements in the deicer boot.

- (8) Gradually tilting the roller, work the boot carefully over each side of the blade contour. Avoid trapping air pockets under the boot (Refer to Figure 203).
- (9) Roll outwardly from the center line to the edges of the boot (Refer to Figure 204). If excess material at the edges tends to form puckers, work them out smoothly and carefully with the fingers.
- (10) Roll the tapered edges of the boot with a narrow steel stitch roller.
- (11) Clean the blade with a clean cloth moistened with solvent (19 or 31, Table 1, 91-00-00). Be careful not to let the solvent run into the edge of the boot.
- (12) Apply one even brush coat of sealer around the edges of the boot, allowing 1/16 to 1/8 inch overlap on the boot but extending to the masking tape. Use BFG 82-076-1 and -2 on B.F. Goodrich installations and Sunbrite 78-U-1003 enamel and U-1001-C catalyst on McCauley installations. Remove the masking tape after applying the cement to obtain a neat border.
- (13) Install the clamp securing the lead strap to the propeller blade retaining clamps.

NOTE: The rubber retainer strap should wrap around the blade shank over the inboard 1/4 inch of the deice boot on B.F. Goodrich or 1/2 inch on McCauley installations.

- (14) Connect the lead terminals and install the clip on the spinner bulkhead. There must be no slack between the terminal and the clip to assure enough slack between the clip and the clamp on the blade to allow full proper travel.

CAUTION: After deicer boot installation allow at least 12 hours for the adhesive (52, Table 1, 91-00-00) to dry before starting the engine, and 12 hours more before energizing the deicers.

C. Brush Module Replacement (B. F. Goodrich)

The modular brush assembly is made up of two modules, each consisting of a plastic housing with an integral brush and spring. These modular units are stacked with a spacer held together by screws to produce the modular brush assembly. When a brush wears to where only 3/8 inch of brush material remains, the module containing the brush should be replaced. 1/4 inch of brush remains, the brush module MUST be replaced.

NOTE: During measurement only 1/16 inch of brush should protrude from the brush module, this being the normal protrusion when the brush is installed on the airplane.

Brush wear is determined by inserting a pin into a hole in the back of the brush module. On all modules having brushes with rods, the brush module should be replaced when the pin can be inserted 15/64 inch and MUST be replaced when the pin can be inserted 19/64 inch. On the rodless brushes, the module should be replaced when the pin can be inserted 1-5/64 inches and MUST be replaced when the pin can be inserted 1-9/64 inches. To replace the brushes, proceed as follows:

- (1) Disconnect the wire harness terminals at the terminal of the modular units that make up the brush block assembly.
- (2) Remove the screws, nuts and washers securing the modular brush assembly to its mounting bracket.
- (3) Remove the assembly retaining screws and separate the modules and spacer.
- (4) Replace each module with another of the same part number. The part number is etched into the surface of the plastic housing.
- (5) Restack the modules and spacers as necessary. If there is interference between adjacent ring terminals, reposition one module with the terminal on the opposite side of the brush module assembly.
- (6) Install the assembly screws so that the screwhead fits in the recess in the spacer, place the flat washer between the star washer and modular housing and install the retaining nut. Make sure the assembly is square before tightening the assembly screws in place.
- (7) Place the modular brush assembly on the mounting bracket and insert the mounting screws through both the block and

bracket. One washer fits under the head of the screw and one under the retaining nut.

- (8) Before installing the retainer nuts, make sure that the brushes are aligned with the slip rings such that the entire brush face contacts the copper ring. If the brushes do not align with the slip rings throughout the entire 360 degrees of slip ring rotation, install shims (P/N 1E1157) between the brush module spacer and the mounting bracket until the brushes are properly aligned with the approximate center of the slip ring.
- (9) Install the retaining washers and nuts, making certain that $1/16 \pm 1/32$ inch is maintained between the brush modules and the slip ring surface. To prevent damage to the brushes, the modular brush assembly should be angled so that the brushes contact the slip rings at an angle of approximately two degrees from the perpendicular, as measured toward the direction of slip ring rotation (Refer to [Figure 205](#)).
- (10) Reconnect the "B" and "C" terminals of the airplane system wire harness to the same designated terminals of the modular brush assembly. Ensure that the adjacent ring terminals are not touching.

D. Deicer Timer Check

Experience in the field has indicated that often the timer is considered defective when the source of the trouble lies elsewhere. For this reason, the following test should be performed before the timer is removed as defective:

- (1) With the wiring harness disconnected at the timer and the deicer switch to the ON position, check the voltage from pin B of the harness plug to ground. If no voltage is present, the timer is NOT at fault; however, if system voltage is present at pin B, check the circuit from harness plug pin G to ground with an ohmmeter. If no circuit is indicated, the fault is in the ground lead rather than in the timer. If ground connection is open, the timer step switch will not change position.
- (2) After the ground and power circuits have been checked, 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. With the deicing switch ON, check the voltage to ground from pin B of the timer. The voltmeter should indicate bus voltage. Next check the DC voltage to ground from pin C or pin D on serials D-10404 and after, CE-1024 and after, E-2069 and after, and EA-378 and after; it should indicate bus voltage for 90 seconds, zero volts for 90 seconds, bus voltage for 90 seconds, etc.

E. Heat Test

Before this test can be performed, the jumper wire installed for the timer test must be removed so that the connector plug can be replaced in the timer receptacle. Two men are required to perform this test: one in the cockpit to monitor the ammeter; the other outside by the prop to check the deicer boots. The man in the cockpit turns the deicer system ON while the man outside feels the deicer boots to see if they are heating properly. The man in the cabin observes the ammeter for the proper readings (2 bladed: 8 - 12 amps, 3 bladed: 14 - 80 amps) throughout the timing sequence. The ammeter needle should deflect every 90 seconds in response to the switching action of the timer. Each time this occurs, the man in the cockpit must notify the man inspecting the propeller deicer boots so that the latter can check the proper heating sequence of the propeller deicer boots (the entire boot will either heat or cool, depending on the timer sequence). If any irregularities are detected, a continuity check should be performed on the wiring from the timer to the brush module holder and the propeller deicer terminal connections.

CAUTION: While following the instructions of the HEAT TEST, move the propeller back and forth to prevent arcing between the brushes and slip ring.

WARNING: Before moving the propeller, make certain that the ignition switch is off and that the engine has cooled completely. There is always some danger of a cylinder firing when the propeller is moved.

F. Brush Module Resistance Check (B. F. Goodrich)

To check for a short circuit, or high resistance in the brush module, measure the resistance from the face of the brush to its terminal studs or receptacle pin with a low range ohmmeter. If this resistance measures over 0.013 ohm, locate and repair the cause of excessive resistance. If the resistance measures zero, locate and correct the open circuit or replace the module. Check the resistance between the terminal studs or receptacle pins. This resistance should not be less than 0.5 meg-ohm.

G. Slip Ring Alignment (B. F. Goodrich)

The slip rings are properly aligned when they run in a true plane relative to the brush module. This condition may be checked by attaching a dial indicator gage to the front of the engine crankshaft housing in such a manner that a reading of the slip ring wobble may be obtained. To avoid error in readings, rotate the slip rings slowly while pushing in on the propeller to take the play out of the thrust bearings. If the total run out over 360 degrees of rotation exceeds 0.005 inch, or 0.002 inch for any 4 inch arc, the slip rings should be aligned as follows:

- (1) Approximately a 0.012 inch adjustment may be made to correct the slip ring wobble by varying the torque on the attachment bolts. Using the dial indicator to follow the points of maximum deviation, adjust the slip ring assembly to the prescribed run out limits by varying the torque of the mounting bolts as required within a range of 40 to 100 inch-pounds.
- (2) If more than 0.012 inch of adjustment is required for alignment, the slip ring assembly may be shimmed to within the

prescribed limits for true running by the addition of AN960C416L washers on the mounting bolts between the slip ring assembly and the spinner bulkhead. If necessary, fabricate thinner shims to the AN960 size. Again the torque may be varied as in step (1).

NOTE: The above adjustments may affect the clearance between the brush module and slip rings; consequently, after slip ring alignment, a check should be made to ascertain that a distance of from 1/32 to 3/32 inch is maintained between the brush module and slip ring surface (Refer to Figure 205).

H. Slip Ring Machining (B. F. Goodrich)

Slip rings which have roughened or damaged surfaces, but which are structurally sound, can be machined and restored to serviceability. Remove the slip ring assembly from the airplane and mount it in a lathe. Position it concentrically in the lathe, with not over 0.002 inch wobble or run out over 360 degrees rotation. Take light cuts for a smooth finish and cut no deeper than required to remove surface damage. The contact surfaces of the slip rings must be parallel within 0.005 inch and flat within 0.005 inch overall. Deviation from flat is not to exceed 0.002 inch over a 4 inch arc. If necessary, undercut the insulation between the slip rings to a depth of 0.020 to 0.030 inch below the contact surface of the slip rings. In this operation, width of the slip ring MUST NOT be reduced more than 0.005 inch. Contact surfaces of the slip rings must have a finish of 29 - 35 microinches. Deburr the slip ring edges and reinstall in the airplane and align.

NOTE: If in machining, the solder or braze connection on the underside of the slip ring is exposed, replacement of the slip ring assembly will be necessary.

I. Brush Wear Limits (McCauley)

The brushes may be checked for wear by one of the following methods.

(1) On the Airplane

- (a) Insert a thin stiff feeler gage into the slot on the side of the brush block (Refer to Figure 206).
- (b) If it goes past the back of the brushes, the brushes need replacing.

(2) Removed from the Airplane

- (a) Insert a thin stiff feeler gage into the slot on the side of the brush block past the back of the brushes (Refer to Figure 206).
- (b) Gently push the brushes into the brush block.
- (c) If any brush has 0.094 inch brush or less remaining outside the brush block, that brush assembly needs replacing.

J. Brush Replacement (McCauley)

- (1) Remove the brush block from the engine as indicated in BRUSH BLOCK REMOVAL.
- (2) Remove the two screws in the back of the brush block (Refer to Figure 206).
- (3) Pull the brush holder and brushes from the brush block. Discard the brush holder and brushes.
- (4) Replace the brushes and brush holder by first sliding the brushes into the slots of the brush block, then sliding the brush holder into place.
- (5) Install the two screws which hold the holders in place. Torque the screws to 20 to 24 inch-pounds.
- (6) Push the brushes back into the brush block to ensure that they spring back freely.
- (7) If the brushes bind, loosen the screws and reposition the brush holders so the brushes ride freely in the slots. Torque the screws to 20 to 24 inch-pounds.
- (8) Install the brush block as indicated in BRUSH BLOCK INSTALLATION.

K. Brush Block Removal (McCauley)

- (1) Disconnect the lead wires from the terminal strip.
- (2) Disconnect the brush block mounting screws and remove the brush block from the engine.

L. Brush Block Installation (McCauley)

- (1) Install the brush block on the engine with the two screws, but do not tighten the screws.
- (2) Add or remove shims (Refer to Figure 207) to the brush block mounting screws until each entire brush is in contact with its slip ring through 360° of rotation.
- (3) Position the brush block on the mounting bracket so that the distance between the brush block and the face of the slip rings is 0.064 ±0.015 inch.

- (4) Tighten the screws.

M. Slip Ring (McCauley)

On these slip rings the mounting bolts cannot be retorqued or shims added to correct wobble or non concentric rotation. Wear or slight wobble may be removed by machining.

NOTE: Friction from the brushes will cause a concave wear pattern on the slip rings. This does not necessitate replacement or machining unless rapid brush wear is encountered. When a new brush assembly is installed on slip rings with normal wear, the brushes will rapidly seat without degradation of operation or service life.

(1) Slip Ring Alignment (McCauley)

If a chattering or screeching noise is heard coming from the brush block/slip ring area, the probable cause is improper brush block-to-slip ring alignment. A chattering or screeching detected while turning the propeller (in the normal direction of rotation) by hand should be corrected immediately. If the chattering or screeching is heard above idling engine noise; the problem is severe. Repositioning the brush block (Refer to [Figure 206](#)) should correct the problem.

(2) Slip Ring or Brush Block Cleaning (McCauley)

The slip rings and brush block may be cleaned with a clean cloth dampened with methyl ethyl ketone.

(3) Slip Ring Machining (McCauley)

Structurally sound slip rings with damaged surfaces may be machined to restore serviceability.

- (a) Clean the slip ring assembly with methyl ethyl ketone before machining.

- (b) Check the assembly mounting surface flatness. It must be flat within 0.005 inch overall.

- (c) Locate the assembly concentrically in a lathe so that there is no more than 0.002 inch wobble or run out over 360° of rotation. The assembly should be fixed in the lathe in the same manner as it was attached to the propeller assembly. This will ensure that run out held while machining the assembly will be transferred when it is mounted on the propeller.

- (d) Take a light cut for a smooth finish (25 to 20 microinches).

NOTE: The spindle speed should be 500 rpm or greater. If machine vibration is noticed, it must be corrected. Machine vibration which is not corrected will result in a chattered finish. Feed rate is to be 0.002 inch or less with a final pass of 0.005 inch to 0.010 inch.

- (e) Ensure that the face surface of the slip rings are parallel and flat within 0.008 inch overall.

- (f) The slip ring holder face and insulation around and between the slip rings must be undercut to 0.050 inch to 0.060 inch (Refer to [Figure 208](#)).

CAUTION: When undercutting the insulation between the slip rings, do not cut the inside diameters or the outside diameters of the slip rings more than 0.003 inch past the original diameters.

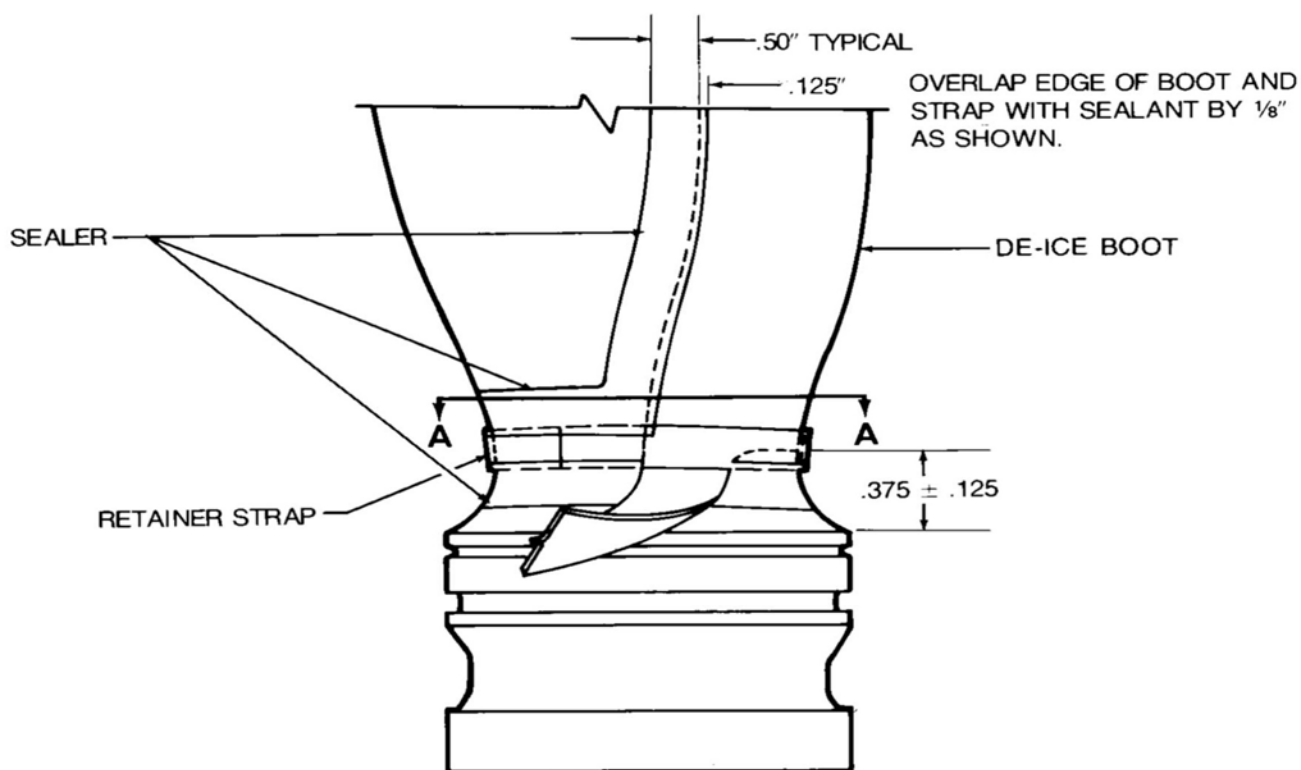
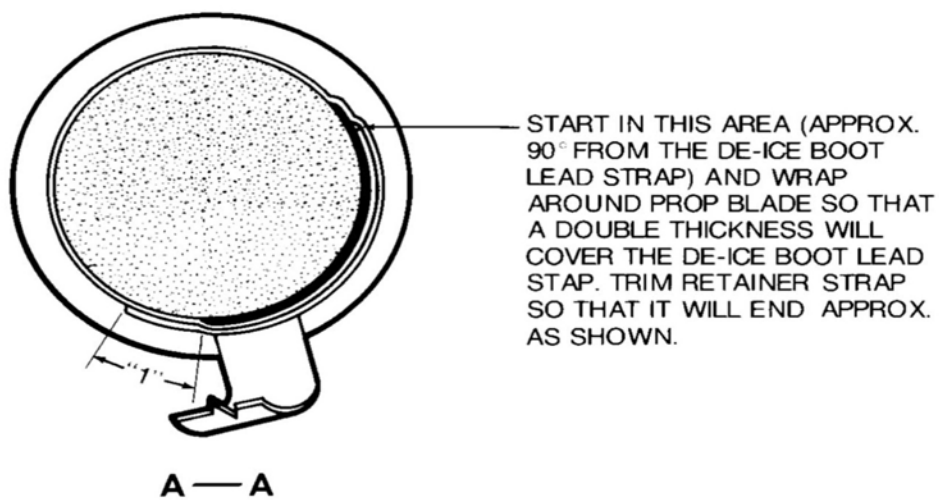
- (g) Deburr the slip ring edges.

- (h) Polish the ring faces with crocus cloth to obtain a finish of 16 to 22 microinches.

- (i) Check the electrical resistance between each ring and the holder and between each ring. The resistance should be a minimum of 50K ohms.

Figure 201 : Sheet 1 : Boot Deicer Installation (McCauley)

E24031



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Figure 201 : Sheet 2 : Boot Deicer Installation (McCauley)

E24027

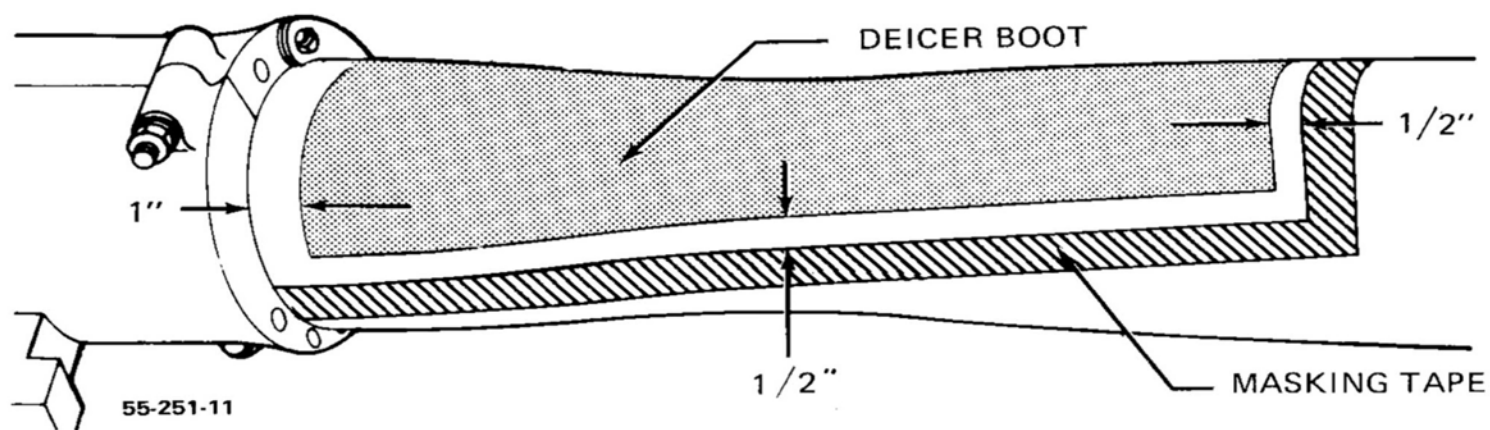


Figure 202 : Sheet 1 : Center Rolling

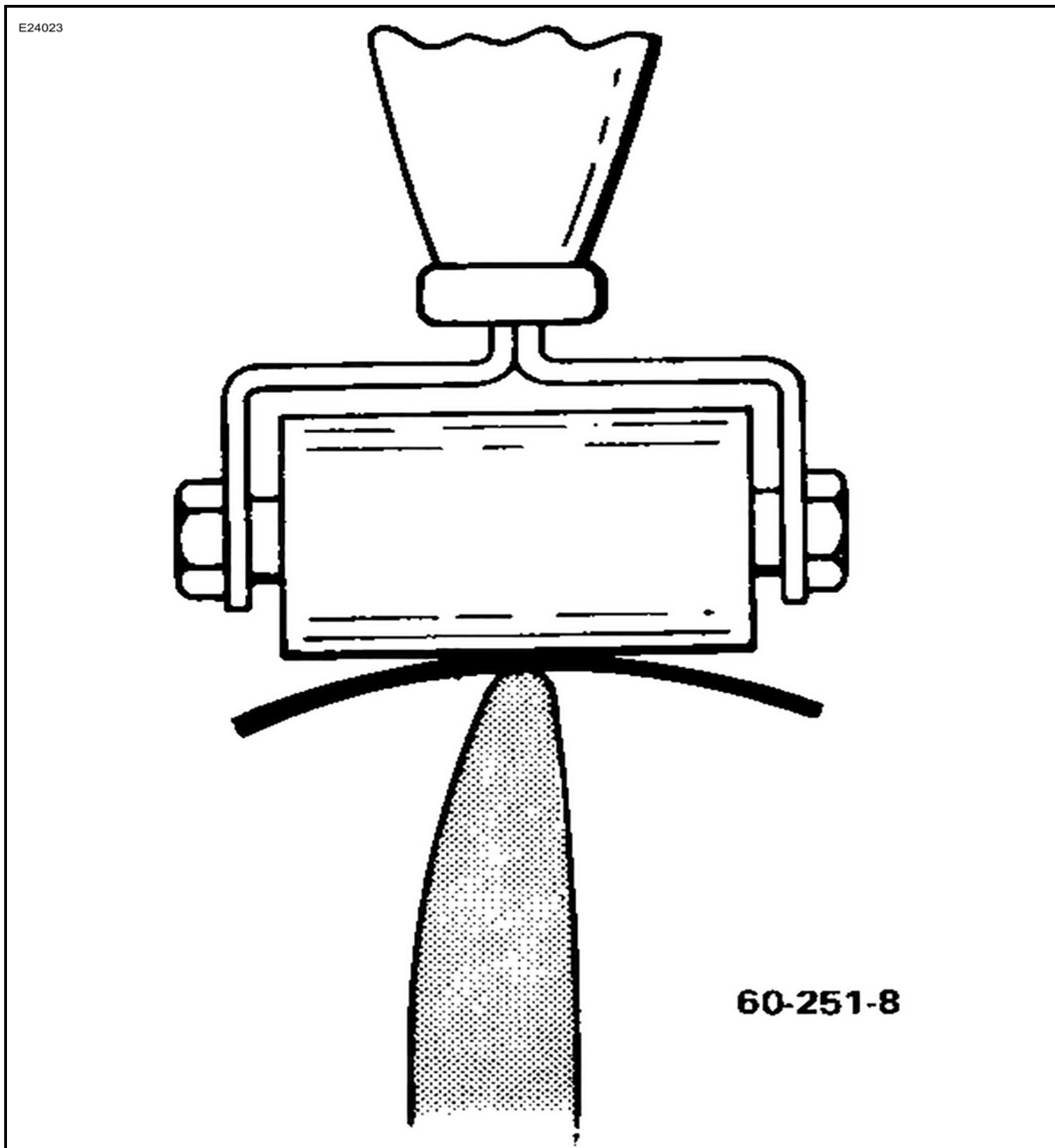
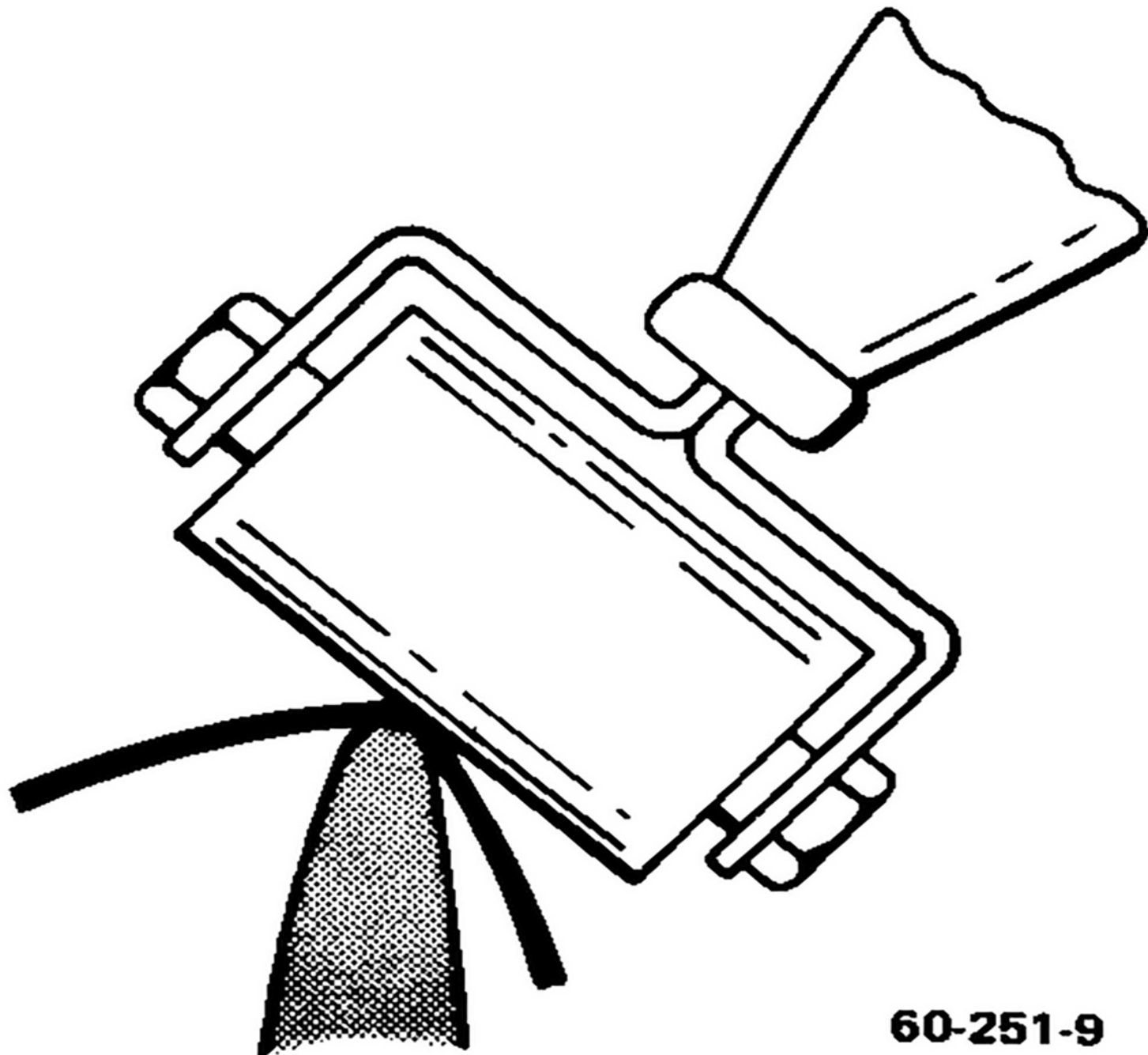


Figure 203 : Sheet 1 : Side Rolling

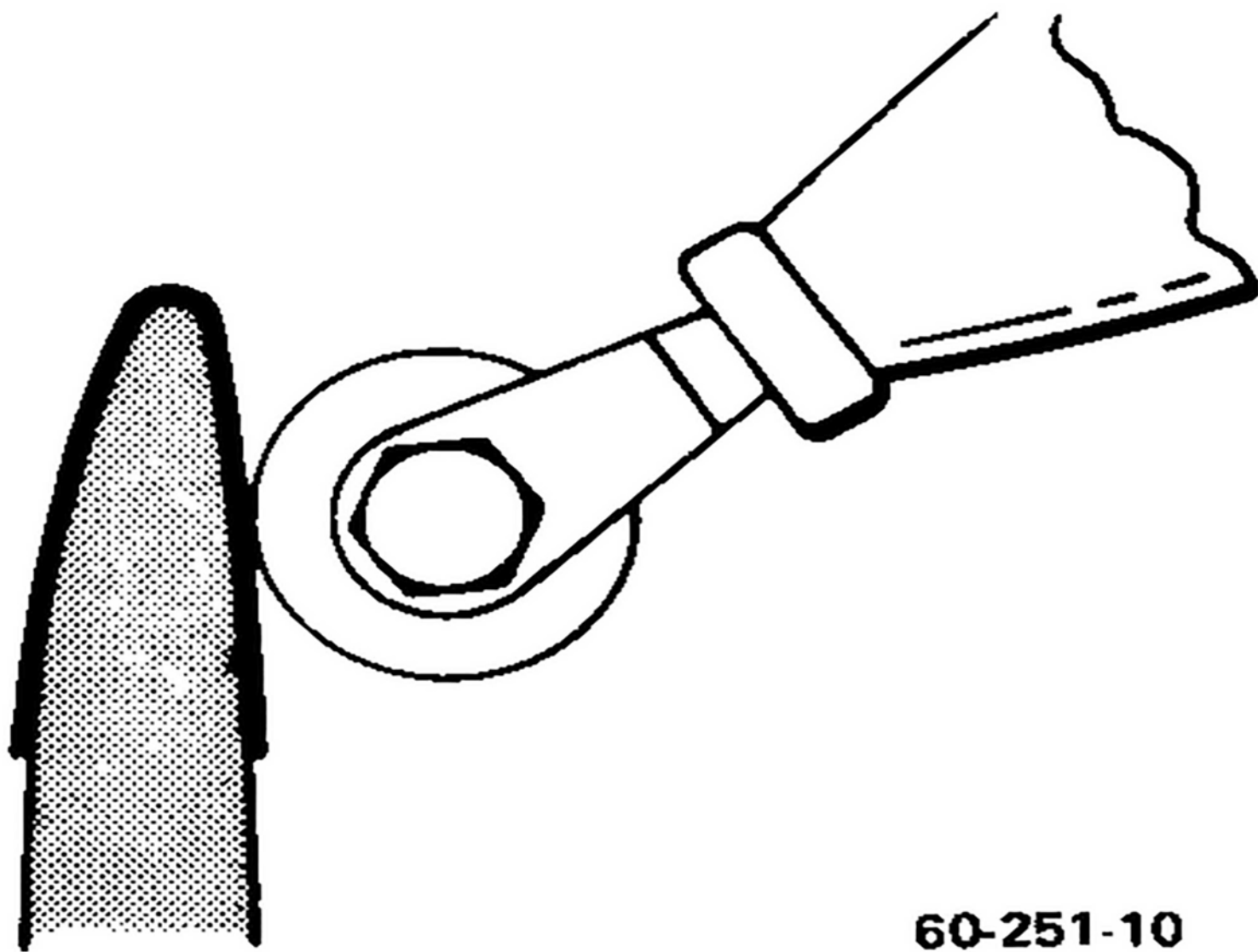
E24019



60-251-9

Figure 204 : Sheet 1 : Edge Rolling

E24011



60-251-10

Figure 205 : Sheet 1 : Propeller Deicer Brush Module (B.F. Goodrich)

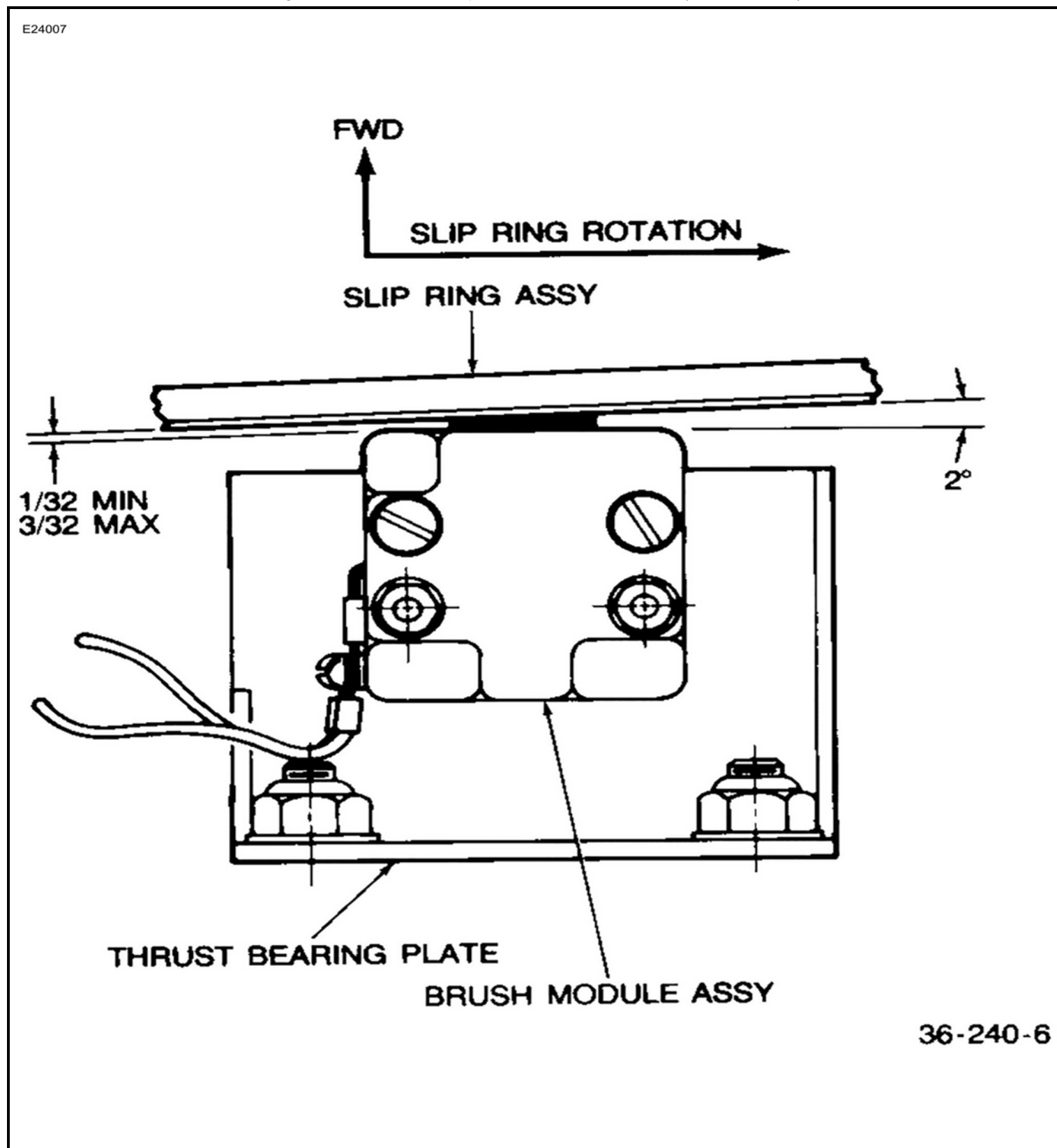


Figure 206 : Sheet 1 : Brush Block Assembly (McCauley)

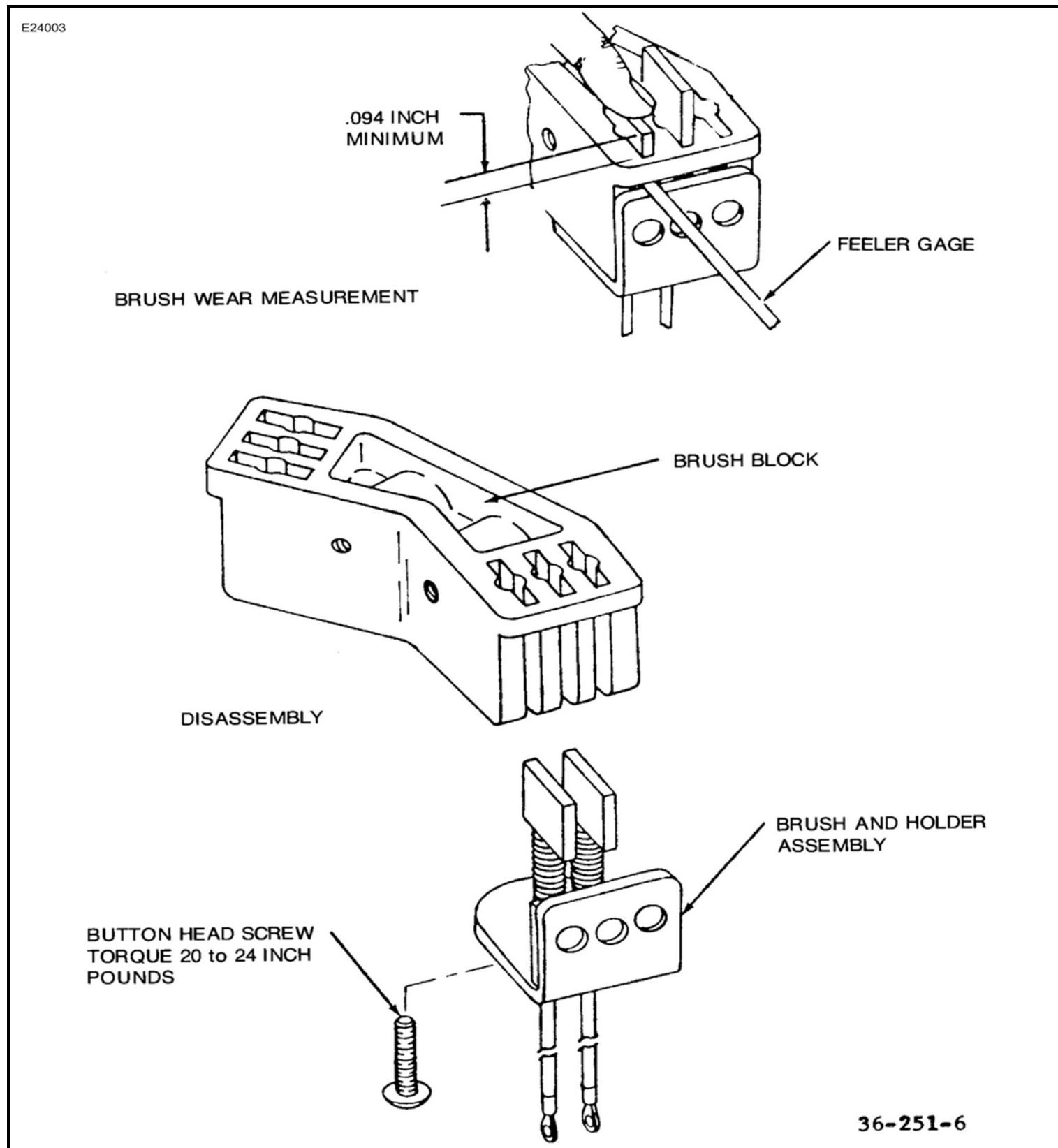
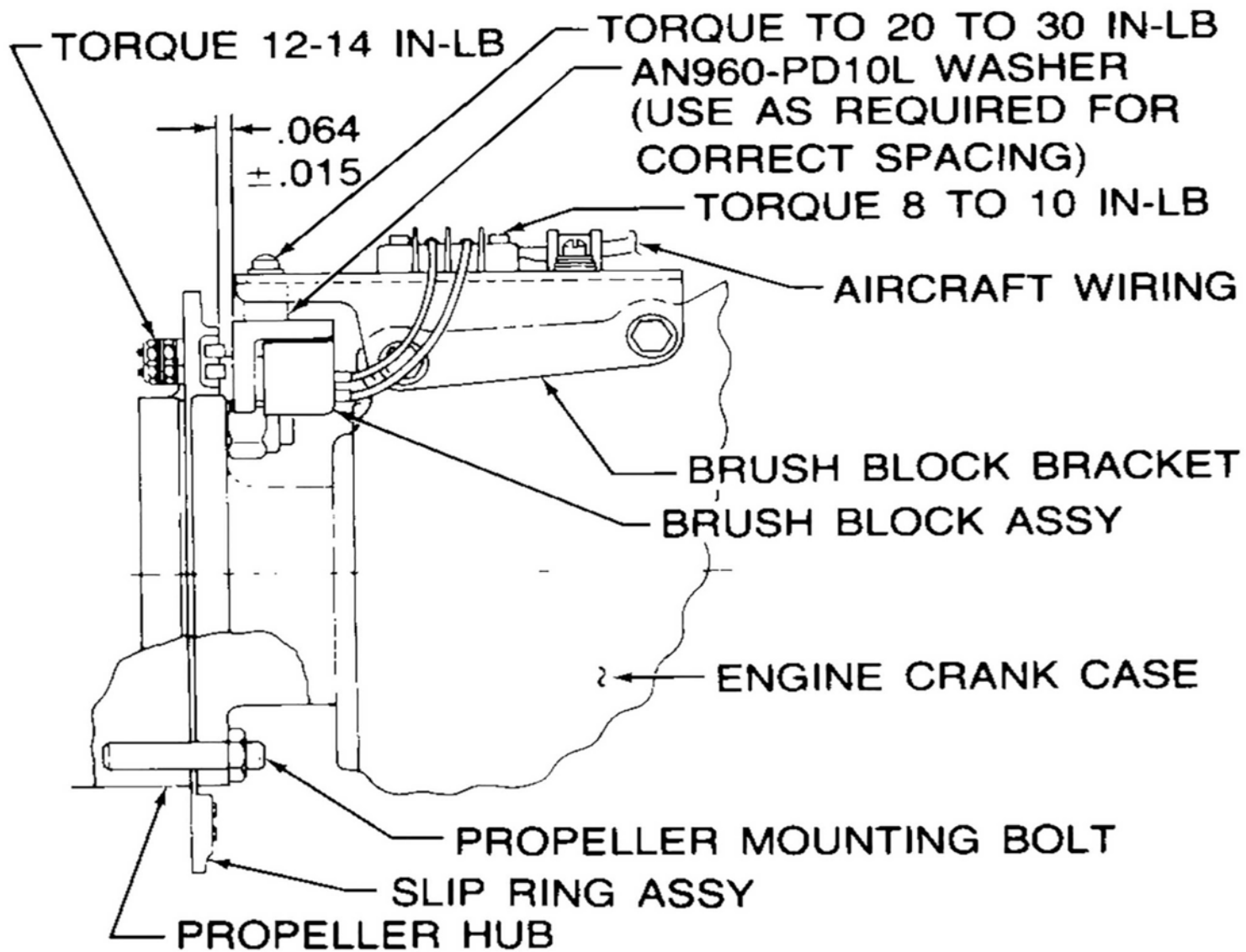


Figure 207 : Sheet 1 : Propeller Deicer Brush Module (McCauley)

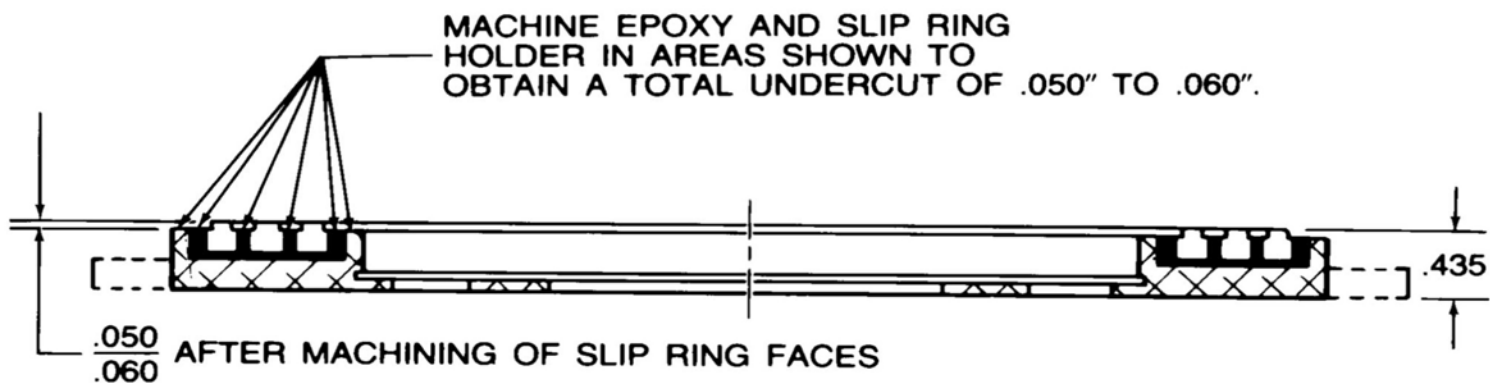
E23996



36-251-5

Figure 208 : Sheet 1 : Slip Ring Machining (McCauley)

E23993



CAUTION

WHEN UNDERCUTTING INSULATION BETWEEN RINGS,
DO NOT CUT INSIDE AND OUTSIDE DIAMETERS OF
SLIP RINGS MORE THAN .003" PAST THE ORIGINAL
UNDERCUT DIAMETERS.

36-251-7

PASSENGER COMPARTMENT - REMOVAL/INSTALLATION**1. Passenger Compartment - Removal/Installation****A. Instrument Post Light Bulb Removal**

Individual post lights, located adjacent to the instruments on the instrument panel may have bulbs removed as follows:

- (1) Pull the light shield from the post light assembly.
- (2) Remove the bulb from the post light assembly.

B. Instrument Post Light Bulb Installation

- (1) Install the bulb in the post light assembly.
- (2) Insert the shield to the instrument post light assembly.

C. Instrument Wedge Light Tray Removal

Internal lighting of the instruments provides additional illumination across each instrument. A light tray mounted on the top side of the bezel of each instrument holds two bulbs wired in parallel. If the bulbs are damaged or burn out the light tray with bulbs must be replaced.

- (1) Remove the screws that secure the instrument panel in place and tilt the instrument panel aft to gain access to the instruments.

NOTE: Instruments located at the lower edge of the panel may be removed if necessary to gain access to the light tray at the top of the instruments.

- (2) Remove the screws that attach the light tray to the instrument bezel.

D. Instrument Wedge Light Tray Installation.

- (1) Install the new light tray and secure in place with the attaching screws.

E. Electroluminescent Panel Removal

Electroluminescent panels provide lighting for the instrument subpanel. The electroluminescent lamp is an integral part of the finished panel and cannot be replaced separately. If the acrylic face panel or the printed circuit board becomes damaged, the whole unit must be replaced.

- (1) Remove the attaching screws located on each side of the face panel.
- (2) Disconnect the wiring running from the printed circuit board at the splice.
- (3) Pull the assembly from the subpanel.

F. Electroluminescent Panel Installation

- (1) Reconnect the wiring at the splice.
- (2) Place the panel assembly in place in the subpanel and secure it with the attaching screws.

G. Warning and Position Light Bulb Removal (Landing Gear, Alternator, Baggage Door)

- (1) Remove the light shield.
- (2) Remove the bulb.

H. Warning and Position Light Bulb Installation (Landing Gear, Alternator, Baggage Door)

- (1) Replace the bulb in the light assembly.
- (2) Install the light shield on the light assembly.

I. Glareshield Floodlight Bulb Removal

- (1) Locate the defective bulb.
- (2) Remove the glareshield attach screws and push up on the glareshield to gain access to the bulb.
- (3) Remove the bulb.

J. Glareshield Floodlight Bulb Installation

- (1) Replace the bulb in the light assembly.
- (2) Install the glareshield and secure with the attach screws.

K. Passenger Reading Light Bulb Removal

- (1) Remove the aluminium light cover.
- (2) Remove the bulb.

- L. Passenger Reading Light Bulb Installation
 - (1) Replace the bulb in the light assembly.
 - (2) Install the aluminium light cover on the light assembly.
- M. Compass Light Bulb Removal
 - (1) Flip the bulb shield over to one side.
 - (2) Bulb will pop out.
- N. Compass Light Bulb Installation
 - (1) Replace the bulb in the light assembly.
 - (2) Flip the bulb shield back over the bulb.
- O. Trim Tab Light Bulb Removal
 - (1) Pull the light assembly away from the back of the instrument panel.
 - (2) Remove the bulb.
- P. Trim Tab Light Bulb Installation
 - (1) Replace the bulb in the light assembly.
 - (2) Install the light assembly into the instrument panel.
- Q. Courtesy Light Bulb Removal
 - (1) Remove the screws attaching the upper door moulding to the door.
 - (2) Bend door moulding over to gain access to the bulb.
 - (3) Remove the bulb from the light assembly.
- R. Courtesy Light Bulb Installation
 - (1) Replace the bulb in the light assembly.
 - (2) Secure the moulding to the door with the attach screws.
- S. Map Light Bulb Removal
 - (1) Remove the screws securing the center plate to the control wheel.
 - (2) Pull out center plate and remove the bulb from the light assembly.
- T. Map Light Bulb Installation
 - (1) Replace the bulb in the light assembly.
 - (2) Reinstall the center plate in the control wheel and secure with the attaching screws.
- U. Cabin Overhead Light Bulb Removal(Prior to CE-933, CJ-156, D-10357, E-1783, EA-171)
 - (1) Remove the overhead panel assembly to gain access to the bulb. (Fresh air vents and vent knob must be removed also.)
 - (2) Remove the bulb from the light assembly.
- V. Cabin Overhead Light Bulb Installation(Prior to CE-933, CJ-156, D-10357, E-1783, EA-171)
 - (1) Replace the bulb in the light assembly.
 - (2) Reinstall the overhead panel assembly.
 - (3) Reinstall the fresh air vents and vent knob.
- W. Cabin Overhead Light Bulb RemovalCE-933 and after, CJ-156 and after, D-10357 and after, E-1783 and after, EA-171 and after)
 - (1) Squeeze the lens sufficiently to release the catches and pull the lens away from the light assembly.
 - (2) Remove the inoperative light bulb.
- X. Cabin Overhead Light Bulb InstallationCE-933 and after, CJ-156 and after, D-10357 and after, E-1783 and after, EA-171 and after)
 - (1) Install a new light bulb
 - (2) Install the lens into the light assembly.

EXTERIOR - DESCRIPTION AND OPERATION

1. Exterior - Description and Operation

A. Strobe Lights

Flashing strobe lights are mounted on each wing tip and are available on the tail cone. The system is activated by a circuit breaker switch mounted on the instrument subpanel. The strobe lights are powered by a power supply unit located in the baggage compartment. A transistorized circuit in the power supply unit steps up the voltage of the airplane electrical system to the level (approximately 400 volts) required to operate the strobe lights. The stepped-up-voltage is stored in a capacitor until released to the strobe lights. The current from the power supply unit is conducted to the flashtube of the strobe light by a specially shielded power cable. A charge of high voltage electricity is momentarily released to a coil in the flashtube assembly. The coil further steps up the charge to a point where it ionizes the xenon gas in the flashtube. The high voltage stored in the capacitor then surges through the gas to produce a brilliant burst of light energy that characterizes the strobe light. When the capacitor voltage drops sufficiently the lamp will go out while the capacitor begins recharging for the next cycle.

B. Anti-Collision Beacons

Lower and upper anti-collision beacons are installed, one to the underside of the airplane (left of the airplane center line between the wings) and one on the top of the vertical stabilizer (leading edge).

The beacon is either round or streamlined in construction and has various lamp/lens configurations, these being:

- Single lamp with a rotating lens inside a large round cover.
- Single flashing lamp inside a large round cover.
- Two lamps (reflector type) on a rotating platform, inside a large round cover.
- Two lamps (reflector type) mounted in tandem, on a oscillating platform, inside a streamlined cover.

C. Step Light - Optional

On series E-2104, E-2111 and after; and EA-320, EA-389 and after, a step light may be mounted in the fuselage just forward of the step and aft of the right wing trailing edge. The switch is mounted in the top of the forward door frame. In some installations, the aft door ajar switch will activate the step light as well as perform its annunciator function. The timer is located on the forward side of the forward spar carry through, and the five amp fuse is located on the right side forward of the firewall.

This system is wired directly to the battery through a five amp fuse and will operate any time the doors are opened. The courtesy lights are a part of the same system and operate simultaneously with the step light. Once the step light has been activated the timer will turn the light off in approximately 15 minutes.

EXTERIOR - TROUBLESHOOTING

1. Exterior - Troubleshooting

A. Exterior Lights - Troubleshooting

Table 101. Troubleshooting Exterior Lights

Trouble	Probable Cause	Remarks
Strobe Lights		
1. Lights inoperative.	Circuit breaker tripped.	Check for short circuit. Reset circuit breaker.
	Loose connection.	Check and tighten electrical connections.
	Battery defective.	Replace battery or use external power.
	Power supply inoperative.	Replace.
2. One bulb does not light.	Bulb burnt out.	Replace bulb.
	Fixture not grounded.	Check for good bonding between fixture and structure. Tighten mounting screws.
	Loose connection.	Check all connections in circuit.
	Defective fixture or switch.	Replace fixture or switch.
Tail Light, Tail Nav/Strobe Light, Landing Light And Taxi Light		
3. Lamp fails to light	Circuit breaker switch tripped.	Check for short circuit. Reset circuit breaker.
	Circuit breaker switch defective	Check continuity through switch. Replace if necessary
	Lamp burned out	Replace lamp
	Loose connection or defective wiring	Tighten connections and check wire circuit continuity. Replace or repair wire if necessary.

EXTERIOR - REMOVAL/INSTALLATION

1. Exterior - Removal/Installation

A. Lights

(1) Power Supply Unit Removal

(a) CE-748, CE-772 and after; CJ-149 and after; D-10097, D-10120 and after; E-1111, E-1241 thru E-1370

WARNING: High voltage is involved in the circuit between the power supply and strobe light assemblies. Although a bleed-off resistor is incorporated in the power supply circuit, turn the control switch for the strobe lights OFF and allow at least 10 minutes to elapse prior to disconnecting the cables at the power supply or strobe light assemblies and before handling either of these units in any way. Failure to observe these precautions may result in physical injury from electrical shock.

- 1 Remove the floorboard on the RH side of the baggage compartment.
- 2 Disconnect the electrical wiring to the power supply.
- 3 Remove the screws, washers and nuts anchoring the module to the support structure.
- 4 Remove the power supply from the airplane.

(b) E-1371 and After; EA-11 and After

WARNING: Observe the warning precautions given earlier in the removal instructions for the earlier serializations.

- 1 Locate the access cover in the floorboard, aft of fuselage station 170, on the right side of the airplane, in the baggage compartment
- 2 Remove the 4 screws and washers from the cover and remove the cover.
- 3 Disconnect the electrical wiring from the power supply
- 4 Remove the screws which hold the power supply in place and remove the power supply.

(2) Power Supply Unit Installation

(a) CE-748, CE-772 and After; CJ-149 and After; d-10097, D-10120 and After; E-1111, E-1241 thru E-1370

CAUTION: An incorrect hook-up of the wires in either the power input or between the strobe light assemblies and the power supply will cause a reversal of polarity that results in serious component damage and failure. Care must be taken to ensure that the red wire is connected to positive (+) power and the black wire is connected to ground. Make sure that the connectors are properly assembled and that white/red, white/black and white/yellow wires are connected properly. The shields for the wing and tail light cables should be grounded to the airplane structure at the power supply. Refer to the WIRING DIAGRAM MANUAL P/N 35-590102-9 to ensure a correct hook-up of the components in the strobe light system.

- 1 Position the power supply unit in the airplane and secure with the screws, washers and nuts.
- 2 Connect the electrical wiring to the power supply.
- 3 Install the floorboard on the RH side of the baggage compartment.

(b) E-1371 and After; EA-11 and After

- 1 Place the power supply in its proper location and install the screws which hold it in place.
- 2 Connect the electrical wiring to the power supply adhering to the caution indicated for the above earlier serializations.
- 3 Place the access cover in place and install the screws and washers.
- 4 Reinstall the carpet.

(3) Wing Strobe Light Removal

WARNING: High voltage is involved in the circuit between the power supply and strobe light assemblies. Although a bleed-off resistor is incorporated in the power supply circuit, turn the control switch for the strobe lights OFF and allow at least 10 minutes to elapse prior to disconnecting the cables at the power supply or strobe light assemblies and before handling either of these units in any way. Failure to observe these precautions may result in physical injury from electrical shock.

- (a) Remove the transparent shield covering the wing tip lights.
 - (b) Detach the strobe light assembly from the wing by removing the allen head screws. Remove the nuts securing the mounting bracket to the strobe light assembly.
 - (c) Disconnect the electrical wiring.
 - (d) Remove the screws securing the end plate assemblies to the light assembly. Remove the end plate assemblies.
 - (e) Remove the clear filter cover from the strobe light housing assembly.
NOTE: Place a clean cloth around the flashtube to keep fingers from coming in contact with the glass.
 - (f) Carefully remove the flashtube from the contact assemblies.
- (4) Wing Strobe Light Installation
- CAUTION:** Observe the caution procedure stated in POWER SUPPLY UNIT INSTALLATION.
- (a) Replace the flashtube.
NOTE: Place a clean cloth around the flashtube to keep fingers from coming in contact with the glass.
 - (b) Reinstall the clear filter cover in the strobe light housing.
 - (c) Install the end plate assemblies and mounting bracket on the strobe light housing and secure with the screws and nuts.
 - (d) Reconnect the wiring and secure the strobe light assembly to the airplane with the allen head screws.
 - (e) Reattach the transparent shield to the wing tip.
- (5) Wing Navigation Light Removal
- (a) Remove the attaching screws from the transparent shield and remove from the wing tip.
 - (b) Remove the screw from the navigation light bulb retainer and remove the retainer.
 - (c) Rotate the bulb counterclockwise to remove.
- (6) Wing Navigation Light Installation
- (a) Replace the bulb.
 - (b) Install the retainer on the navigation light bulb and secure with the screw.
 - (c) Install the transparent shield and secure with screws.
NOTE: Before installing the transparent shield on the wing, apply Presstite 176 sealer around the shield to ensure moisture cannot enter the light compartment.
- (7) Tail Strobe Light Removal
- WARNING:** High voltage is involved in the circuit between the power supply and strobe light assemblies. Although a bleed-off resistor is incorporated in the power supply circuit, turn the control switch for the strobe lights OFF and allow at least 10 minutes to elapse prior to disconnecting the cables at the power supply or strobe light assemblies and before handling either of these units in any way. Failure to observe these precautions may result in physical injury from electrical shock.
- (a) Remove the tail cone and light shield to gain access to the strobe light assembly.
 - (b) Disconnect the strobe/nav light assembly from the airplane electrical system.
 - (c) Rotate the nav bulb counterclockwise and remove the bulb if it needs to be replaced.
 - (d) If the flashtube assembly needs replacement, remove the screws on the backside of the light assembly and remove the light assembly from the tail cone.
- (8) Tail Strobe/nav Light Installation
- (a) Replace the flashtube assembly and secure to the tail cone with the screws in the backside of the light assembly.
 - (b) Replace the bulb if necessary.
 - (c) Reconnect the strobe/nav light assembly to the airplane electrical system.
 - (d) Reinstall the light shield over the strobe/nav light assembly.
 - (e) Reinstall the tail cone on the airplane.
- (9) Tail Navigation Light Removal
- (a) Remove the outer light shield to gain access to the bulb

- (b) Remove the inner bulb shield from the bulb.
 - (c) Rotate the bulb counterclockwise to remove.
- (10) Tail Navigation Light Installation
- (a) Replace bulb in the holder
 - (b) Place the inner bulb shield over the bulb.
 - (c) Reinstall the outer light shield on the tail cone.
- (11) Taxi Light Removal
- (a) Remove the screws from the light retaining ring.
 - (b) Remove the screws on the back of the light to disconnect the wiring.
- (12) Taxi Light Installation
- (a) Replace the light and place the retaining ring around the light. Secure the retaining ring with screws. Properly index the light bulb.
 - (b) Reconnect the wiring to light and secure with screws.
- (13) Landing Light Removal
- (a) Remove the outer retaining screws to detach the light from the lower portion of the nose bug.
 - (b) Remove the screws from the back of the light assembly and pull off the retaining ring.
 - (c) Disconnect the wiring from the light assembly by removing the screws
 - (d) Remove the seal from between the light and the retaining ring.
- NOTE:** The beam adjustment screws should not be moved in either direction during removal or installation of the landing light. This will ensure that no further adjustment of the light will be needed.
- (14) Landing Light Installation
- (a) Replace the light and install the seal back around the light.
 - (b) Install the retaining ring around the light and secure with screws.
 - (c) Reconnect the wiring to the back of the light and secure with screws.
 - (d) Install the light assembly on the lower portion of the nose bug and secure with screws.
- (15) Upper Rotating Beacon Removal
- (a) Remove the screw from the lens retaining clamp. Remove the lens.
 - (b) Remove the bulb by rotating counterclockwise.
- (16) Upper Rotating Beacon Installation
- (a) Replace the bulb in the holder.
 - (b) Install the lens on the plane making sure that the black "mask" is facing forward.
 - (c) Secure the lens clamp with the screw.
- (17) Lower Rotating Beacon Removal(Prior to E-2050, CE-1014, D-10404 and EA-324 Except EA-320)
- (a) Remove the screw from the lens retaining clamp. Remove the lens.
 - (b) Remove the bulb by rotating counterclockwise.
- (18) Lower Rotating Beacon Installation(Prior to E-2050, CE-1014, D-10404 and EA-324 Except EA-320)
- (a) Replace the bulb in the holder.
 - (b) Install the lens on the plane
 - (c) Secure the lens clamp with the screw.
- (19) Lower Rotating Beacon Removal(E-2050 and After, EA-320, EA-324 and After; CE-1014 and After; D-10404 and After)
- (a) Remove the screw from the lens.
 - (b) Remove the lens.
 - (c) Remove the bulb.
- (20) Lower Rotating Beacon Installation(E-2050 and After, EA-320, EA-324 and After; CE-1014 and After; D-10404 and After)

- (a) Install the bulb.
- (b) Install the lens and secure with the screw.
- (21) Step Light Bulb Removal
 - (a) Locate the small upholstery side panel over the step light.
 - (b) Remove the screws which hold the upholstery panel in place and remove the panel.
 - (c) Pull the light assembly from its mounting bracket.
 - (d) Remove the light bulb.
- (22) Step Light Bulb Installation
 - (a) Install a new bulb (1495 G E) in the light socket.
 - (b) Install the light assembly in its mounting bracket.
 - (c) Place the upholstery panel in place and install the screws.

Table 401. Light Bulb Replacement

(D-10097, D-10120 and After; CE-748, CE-772 and After; CJ-149 and After; E-1111, E-1241 thru E-2110 except E-1946 and E-2104; EA-11 thru EA-388 except EA-320)	
Location	Bulb Replacement
Alternator Out Light	327
Cabin Overhead Light	1864
Clock Light	267
Compass Light	327
Condenser Door Open Light	327
Courtesy Light	1864
Door Ajar Light	327
Elevator Trim Tab Light	1819
Flight Compartment Floodlights	313
Fuel Select Light	327
Instrument Post Lights	327
Instrument Wedge Lights	267
Landing Gear Intransit Lights	327
Landing Gear Uplock Lights	327
Landing Light	4596
Light Tray Assembly	267
Map Light	1495
Navigation Light (Tail)	A7512-24
OAT Light	327
Reading Light	303
Rotating Beacon (Lower) (Prior to E-2050, CE-1014, D-1404 and EA-324 except EA-320)	D7080A5-24
Rotating Beacon (Lower) (E-2050 thru E-210 except E-1946 and E-2104; EA-324 thru EA-388; CE-1014 and after)	WRM1939
Rotating Beacon (Upper)	D7080A1-24
Subpanel Post Lights	327
Strobe Light (Tail)	30-0815-1

Strobe Light (Wing)	30-1467-1
Tail Light	1683

(E-1946, E-2104, E-2111 and After; EA-320, EA-389 and After	
Location	Bulb Replacement
Alternator Out Light	327
Cabin Overhead Light	303
Cabin Reading	303
Clock Light	327
Compass Light	327
Condenser Door Open Light	327
Courtesy Light	1864
Door Ajar Light	1864
Elevator Trim Tab Light	1819
Flap Indicator	327
Flight Compartment Floodlights	313
Fuel Select Light	327
Glareshield	313AM
Instrument Post Lights	327
Instrument Wedge Lights	58-380022-13 Light Tray
Landing Gear Transit Light	327
Landing Gear Downlock Lights	327
Landing Light	4596
Map Light	1495
Navigation Light (Tail)	A508
Navigation (Wing)	A7512-24
OAT Light	327
Oxygen Post Light	334
Pedestal Post Lights	334
Reading Light	303
Rotating Beacon (Lower)	A707-9B-24
Rotating Beacon (Upper)	WRM1939
Rotating Beacon (Tail)	WRM1939
Step Light	1495
Strobe Light (Tail)	A506
Strobe Light (Wing)	30-1467-1
Tail Light	1683
Taxi Light	4313

Table 402. Table 402Whelen Beacons - Light Bulb Replacement

(D-10391; CE-748, CE-974, thru CE-1349 and CE-1351; CJ-156 thru CJ-179; E-1942 thru E-2476; EA-288 thru EA-490)
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Location	Bulb Replacement
Rotating Beacon	WRM1939
(CE-1350, CE-1352 and After; CJ-180 and After; E-2477 and After; EA-491and After)	
Location	Bulb Replacement
Flashing Beacon	34-0226010-91

FLIGHT ENVIRONMENT DATA - DESCRIPTION AND OPERATION

1. Flight Environment Data - Description and Operation

A. Pitot System

The pitot system provides a source of impact air for operation of the airspeed indicator. The pitot mast is located under the leading edge of the left wing outboard of WS 122.75 on serials D-10097, D-10120 and After; CE-748, CE-772 and After; CJ-1149 and After; E-1111, E-1241 thru E-1370. At serials E-1371 and After; EA-11 and After the pitot mast is located outboard of WS 191.0. The pitot head is provided with an electric heating element which is turned on and off with a switch on the instrument panel. The switch should be on when flying in visible moisture. It is not advisable to operate the pitot heating element on the ground except for testing or for short intervals of time to remove ice and snow (Refer to [Figure 1](#) and [Figure 2](#)).

B. Normal Static Air System

The normal static system provides a source of static air to the flight instruments through a flush static fitting on each side of the airplane aft fuselage. On airplanes D-10097, D-10120 and After; CE-748, CE-772 and After; CJ-1149 and After; E-1111, E-1241 thru E-1370, aft of the rear closure bulkhead (rear seat panel) is a drain line, located at the low point of the static system. On E-1371 and After; EA-11 and After the drain is located under the airplane below the front edge of the pilot's side window (aft of FS 58). The drain may be accessed through the fuel strainer access door. They are provided to drain moisture accumulations from the system. The drain plug should be removed and the moisture drained from the plastic line every 100 hours and/or after exposure to visible moisture or sand and dust, either in the air or on the ground.

C. Emergency Static Air System

An optional emergency static source may be installed to provide air for instrument operation, should the static ports become clogged. The emergency static control valve is located on the left side panel below the instrument subpanel at approximately FS 65. The static air control valve is a two-position valve with both OFF NORMAL and an ON EMERGENCY position. The valve handle is red in color and operation instructions are on a placard near the valve. For further information regarding the emergency static air source system, refer to the respective pilots operating handbook.

2. Flight Environmental Data/Pitot Static - Troubleshooting

A. Pitot and Static Pressure System

Table 1. Troubleshooting Pitot and Static Pressure System

Indication	Probable Cause	Remarks
1. Heating element inoperative.	a. Defective switch.	a. Replace switch.
	b. Grounded or open circuit.	b. Check continuity. Repair and replace as necessary.
	c. Defective heating element in pitot head.	c. Replace heating element.
2. Circuit breaker keeps tripping.	a. Grounded wire.	a. Remove ground from positive lead.
3. Instruments inoperative or erratic in operation.	a. Lines clogged.	a. Open drain valve, allow lines to drain. Disconnect the lines at the instrument panel and blow out lines with low air pressure.
	b. Lines leak.	b. Check lines for loose connection points and tighten.
	c. Leak in instruments.	c. Check instrument case.

3. Flight Environmental Data/Pitot Static - Maintenance Practices

CAUTION: Do not use magnetic hardware within 18 inches of a flux valve or magnetometer.

A. Pitot System Pressure Test

A functional test of the pitot system can be made by using an observer in the cabin to watch the airspeed indicator while air pressure is built up artificially by using a section of soft rubber tubing as follows:

- (1) Clamp the rubber tubing over the pitot head inlet, making certain that the connection is airtight.

CAUTION: To avoid rupturing the diaphragm of the airspeed indicator, roll up the rubber tubing slowly.

- (2) Crimp the end of the tubing and slowly roll it up until the airspeed indicator registers approximately 100 knots.

- (3) Secure the rolled up tubing so that it will hold the airspeed reading.
- (4) If there is no decline in the reading after several minutes, there is no leak in the pitot system.
- (5) If a decline in the reading of the airspeed indicator is observed, check the pitot system plumbing for leaky hoses and loose connections.

CAUTION: Release the air pressure slowly by unrolling the rubber tubing; a sudden release of the air pressure may damage the airspeed indicator.

B. Inspecting Pitot System Hoses

Before the pitot system is checked for leaks, the hose sections should be visually inspected for signs of deterioration. There are two sections of hose in the pitot system: one hose at the pitot mast, accessible by removing the inspection door adjacent to the mast, and the other hose behind the floating instrument panel which connects the pitot line to the airspeed indicator, accessible through the access door in the left side of the firewall. Hoses that are cracked or hardened should be replaced with rubber hose (14, Table 1, 91-00-00). Anytime a hose is replaced, repeat the PITOT SYSTEM PRESSURE CHECK.

C. Static System Checks

Proper functioning of the static air system is vital to safety of flight, particularly on instrument flight. Correct maintenance of the system should be performed as required.

The amount of attention required by the static system will depend largely on operating conditions. Extremes of humidity or precipitation, or of dry, dusty conditions, should be signals for increased emphasis on static systems check, since both are favorable to accumulations of foreign matter in the ports and lines.

D. Cleaning Static Air System

CAUTION: Never blow air through the line toward the instrument panel; to do so will seriously damage the instruments. When blowing back through the line from the instrument panel, make sure that no air is blown into the instruments.

NOTE: Wax or polish applied to the air buttons can cause wrong instrument readings. The static air buttons should be cleaned periodically with a cleaning solvent to insure that no film exists on the static air buttons.

Blow LOW pressure air through the lines from the disconnected lines at the airspeed indicator, altimeter and vertical speed indicator to the static ports. Cover each static port separately when blowing to ensure that each line is clear. Instrument error or possible damage could result if even one port is clogged with dirt or foreign matter.

E. Testing the Static System for Leaks

The static system, altimeter instrument, and all ATC transponders must be tested and inspected at twenty four month intervals in compliance with the requirements specified in FAR Parts 91.411 and 91.413 under Title 14 of the Code of Federal Regulations.

CAUTION: To avoid damaging the airspeed indicator, the indicator should be removed from the system and the lines capped or an equal pressure should be applied to the pitot side of the indicator while leak testing the system.

Check the hoses connecting the static air line to the instrument plumbing and the tygon tubing which forms the static air line drain. Hoses which are cracked, particularly at the bends or connection points, or which have become hard, should be replaced with rubber hose (14, Table 1, 91-00-00).

F. Outside Air Temperature Gage

The outside air temperature gage is mounted in the left side panel beneath the storm window. The pointer registers on a dial calibrated in degrees over a range of -70 to +150 °F (-50 to +60 °C).

(1) Removal of the Outside Air Temperature Gage

CAUTION: Tape the gage to the molding or have an assistant hold the gage to prevent it from falling.

- (a) Remove the sun shield, boss, and washers from the stem.
- (b) When removing the gage, use care to avoid damaging the stem.

(2) Inspection of the Outside Air Temperature Gage

Inspect the sun shield for dents, plugged openings and any misalignment that would allow contact with the stem. Inspect the nut and stem base for stripped or damaged threads. Inspect rubber washers for peeling, cracking and resiliency. Inspect the index markings on the gage for legibility. Inspect the pointer for chipped or peeling paint. Replace defective parts.

(3) Installation of the Outside Air Temperature Gage

- (a) Install the mounting washer, boss and gage into the left side panel molding.

CAUTION: Tape the gage to the molding or have an assistant hold the gage to prevent it from falling.

- (b) Install the outer washers and boss.
- (c) Install the sun shield.

Figure 1 : Sheet 1 : Pitot and Static System(D-10097, D-10120 and After; CE-748, CE-772 and After; CJ-1149 and After; E-1111, E-1241 thru E-1370)

E26128

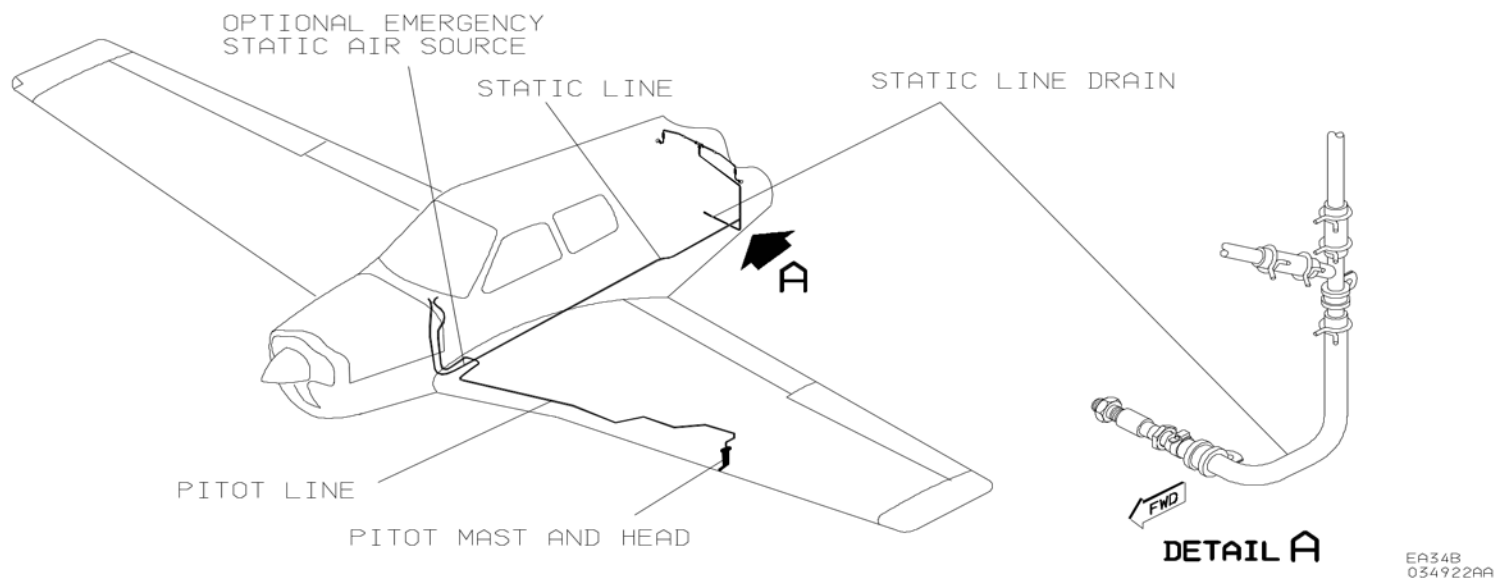
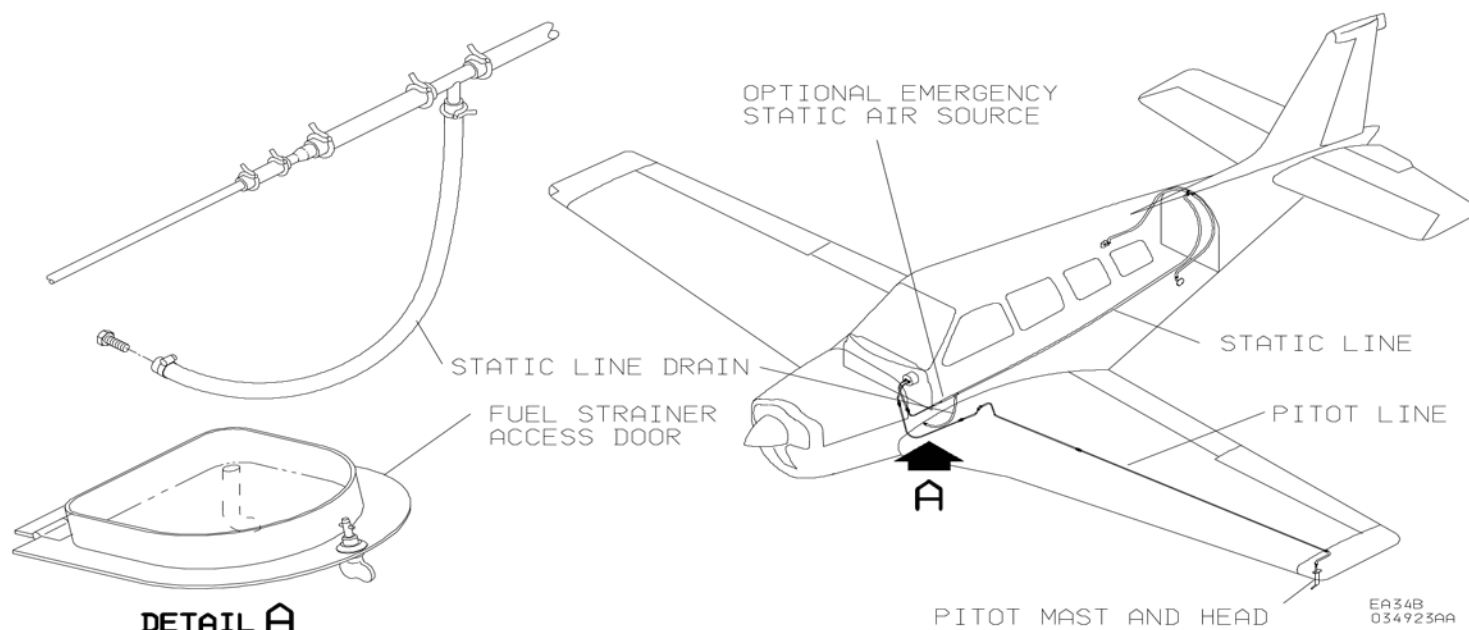


Figure 2 : Sheet 1 : Pitot and Static System(E-1371 and After; EA-11 and After)

E26138



INDEPENDENT POSITION DETERMINING - DESCRIPTION AND OPERATION**1. Independent Position Determining - Description and Operation****A. Weather Radar**

The weather scout 1 consists primarily of two items: the indicator in the radio section of the instrument panel, and the antenna in the outboard section of the right wing. There is also supporting equipment, such as a large capacity engine driven air pump, electrical wiring, plumbing etc. When the radar is turned on, there is a 30 to 40 second warm up period with the word WAIT displayed on the screen. After WAIT disappears from the screen there is a delay of approximately four minutes before the radar will function, (it is required that ventilation air be pumped through the antenna bay for approximately 4.5 minutes before the antenna will energize).

WARNING: When the radar is on, personnel should not be within three feet of the radar antenna. This includes the complete 180° arc in front of the antenna. The eyes, reproductive and other vital organs of the body are particularly vulnerable to radiation damage.

The time delay of 4.5 minutes starts upon completion of two actions: (1) the radar is turned on, (2) there is air pressure equal to approximately two inches of water in the air supply line to the antenna, (the sense switch is located in the air line near the antenna.) This air flow purges the antenna bay of all fuel fumes before the antenna comes on. The special fiberglass covering of the radar antenna is manufactured of three layers of 181 Volan, Epon 828 resin, Furane 951 hardener, Flex-T flexolizer. Any area of the fiberglass through which the radar will either transmit or receive should not be repaired.

INDEPENDENT POSITION DETERMINING - REMOVAL/INSTALLATION

1. Independent Position Determining - Removal/Installation

A. Weather Radar

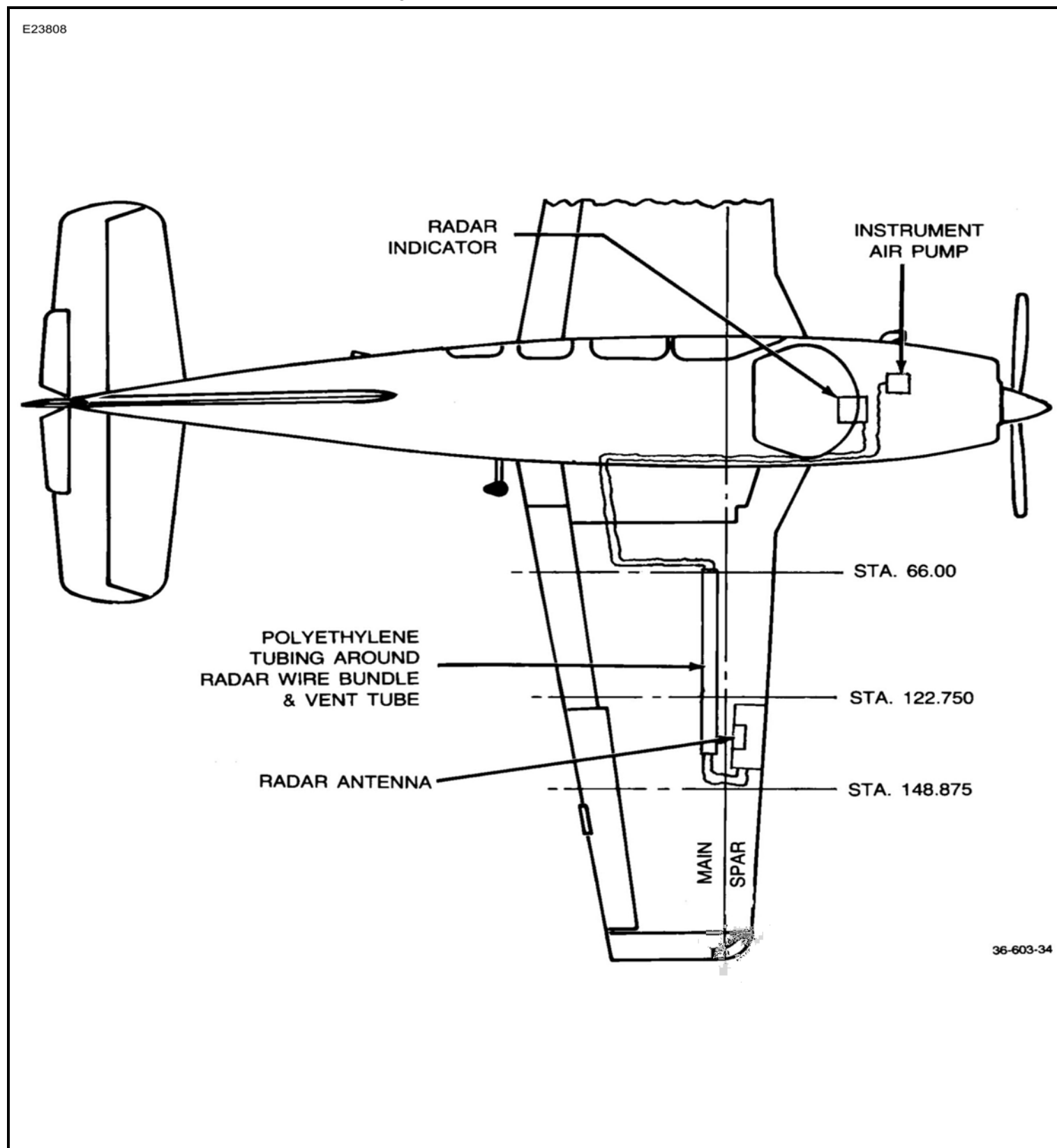
(1) Radar Antenna Removal

- (a) Locate the antenna in the outboard leading edge of the right wing (Refer to [Figure 401](#)).
- (b) Remove the fiberglass antenna cover from the wing leading edge.
- (c) Remove the four bolts (2 on each end) from the antenna.
- (d) Pull the inboard end of the antenna forward until the connectors on the outboard end are accessible.
- (e) Disconnect the electrical connector, then disconnect the air line connector.
- (f) Remove the antenna.

(2) Radar Antenna Installation

- (a) Place the antenna in the wing (Refer to [Figure 401](#)).
- (b) Connect the air line connector, then connect the electrical connector.
- (c) Place the antenna in its mounting location and install the four bolts which secure it in place.
- (d) Install the fiberglass cover on the wing.

Figure 401 : Sheet 1 : Radar Schematic



OXYGEN - GENERAL

1. General - Description and Operation

The oxygen system for Bonanza series airplanes is optional.

The oxygen system on all Bonanza series airplanes prior to airplane serials EA-440 (except EA-320) has one 49 cu-ft oxygen cylinder. On airplane serials E-1241 and After; and EA-11 through EA-388, an optional 76.5 cu-ft oxygen cylinder was offered. The oxygen cylinder is located inside the fuselage and attached to the floor in front of the spar carry through. The filler valve is attached to the spar cover below the copilot's seat. The oxygen console is located to the left of the pilot and contains the pilot's outlet and cylinder pressure gage (Refer to [Figures 1 and 2](#)). On airplanes prior to airplane serials E-2111 (except E-1946 and E-2104); and prior to airplane serials EA-389 (except EA-320) the oxygen console also contains a shutoff valve with the pressure regulator mounted on the back of the console. These airplanes also have a shutoff valve mounted on the oxygen cylinder. On airplane serials E-1946, E-2104, E-2111 and After and EA-320, EA-389 and After, there is a cable operated shutoff valve mounted on the oxygen cylinder. The push-pull control knob for this shutoff valve is located in the subpanel below the pilot's control column.

The oxygen system for airplane serials EA-320, EA-440 and After, has wing mounted oxygen cylinders (Refer to [Figure 3](#)). The 49 cu-ft system has one 49 cu-ft cylinder mounted in the left wing only. The 98 cu-ft system has two 49 cu-ft cylinders, one mounted in each wing. Mounted on the end of each cylinder is the altitude compensating regulator, overboard dump, and the shutoff valve. The cylinder(s) are mounted in the applicable wing aft of the main spar and outboard of Wing Station (WS) 66. The filler valve and a pressure gage are mounted in the top of the wing outboard of WS 66 and aft of the main spar. Access to the filler valve and pressure gage is gained by removing the access panel located on top of the left wing, aft of the main spar and outboard of WS 66. The access panel is held in place by six Dzus fasteners. There is an overboard dump system on each cylinder which will automatically dump the oxygen any time the cylinder pressure reaches between 2,500 and 2,775 psi. There is an indicator (placarded OXY, H.P. Relief) under each wing which will rupture any time in the dump system is activated. The shutoff valve for each oxygen cylinder is controlled by a single push-pull control knob located in the pilot's subpanel. There is only one control knob for either the one cylinder or two cylinder systems (Refer to [Figure 4](#)). An additional oxygen pressure gage for each oxygen cylinder and the pilot's outlet are located in the pilot's left side panel. The copilot's outlet is located in the right side panel.

The oxygen system may be equipped with oxygen outlets for the pilot and copilot, and for the 3rd, 4th, 5th, or 6th cabin seats. On airplane serials prior to CE-929 (except CE-919, CE-923, CE-925, CE-927); prior to CJ-156; prior to D-10353 (except D-10348); prior to E-1594 (except E-1422, E-1551, E-1569, and E-1581); and prior to EA-33 (except EA-21 and EA-28), the oxygen outlets are all in the sidewalls of the airplane (Refer to [Figure 1](#)). On airplane serials CE-919, CE-923, CE-925, CE-927, CE-929 and After; CJ-156 and After; D-10348, D-10353 and After; E-1422, E-1551, E-1569, E-1581, E-1594 and After; and EA-21, EA-28, EA-33 and After, the oxygen outlets for the pilot and copilot are in the sidewall, while a five-outlet passenger manifold is located in the headliner near the center of the airplane (Refer to [Figure 2](#)). The oxygen masks for the pilot (except on airplane serials E-1946, E-2104, E-2111 and After) and the copilot are stowed in a box under their seats. On airplane serials E-1946, E-2104, E-2111 and After, the mask for the pilot may be stowed in a place the pilot considers convenient. On airplane serials EA-320, EA-440 and After, the pilot's and copilot's outlets are in the applicable side panels and the passenger outlets are located in the headliner near the center of the airplane (Refer to [Figure 3](#)). The mask for the pilot and copilot may be stowed in a box under their seats. On airplane serials EA-320, EA-389 and After, the mask for the pilot may be stowed in a place the pilot considers convenient. The third and fourth seat oxygen masks are stowed in a box attached either to the front or rear of the rear spar, depending upon the seating arrangement. The oxygen masks for the fifth and sixth seats are stowed in a box attached to the bottom of their seats.

Each oxygen cylinder should be filled to a pressure $1,850 \pm 50$ psi at a temperature of 70°F. This pressure may be increased 3.5 psi for each degree of temperature increase, or lowered 3.5 psi each degree of temperature decrease. A pressure gage is connected directly to each oxygen cylinder and indicates the oxygen supply (psi) available. The altitude compensating pressure regulator, airplane serials EA-320, EA-440 and After, limits system operation to above 8,000 ft, where its sensing element meets increases in altitude with increased oxygen flow. When the oxygen system is not in use, the push-pull control knob should be placed in the off position so that the shutoff valve on each oxygen cylinder is shut off to prevent oxygen loss. For oxygen system servicing, Refer to Chapter 12.

Figure 1 : Sheet 1 : Oxygen System(Prior to CE-929 except CE-919, CE-923, CE-925, CE-927;prior to CJ-156; prior to D-10353 except D-10348; prior to E-1594 except E-1422,E-1551, E-1569 and E-1581; prior to EA-33 except EA-21 and EA-28)

E23802

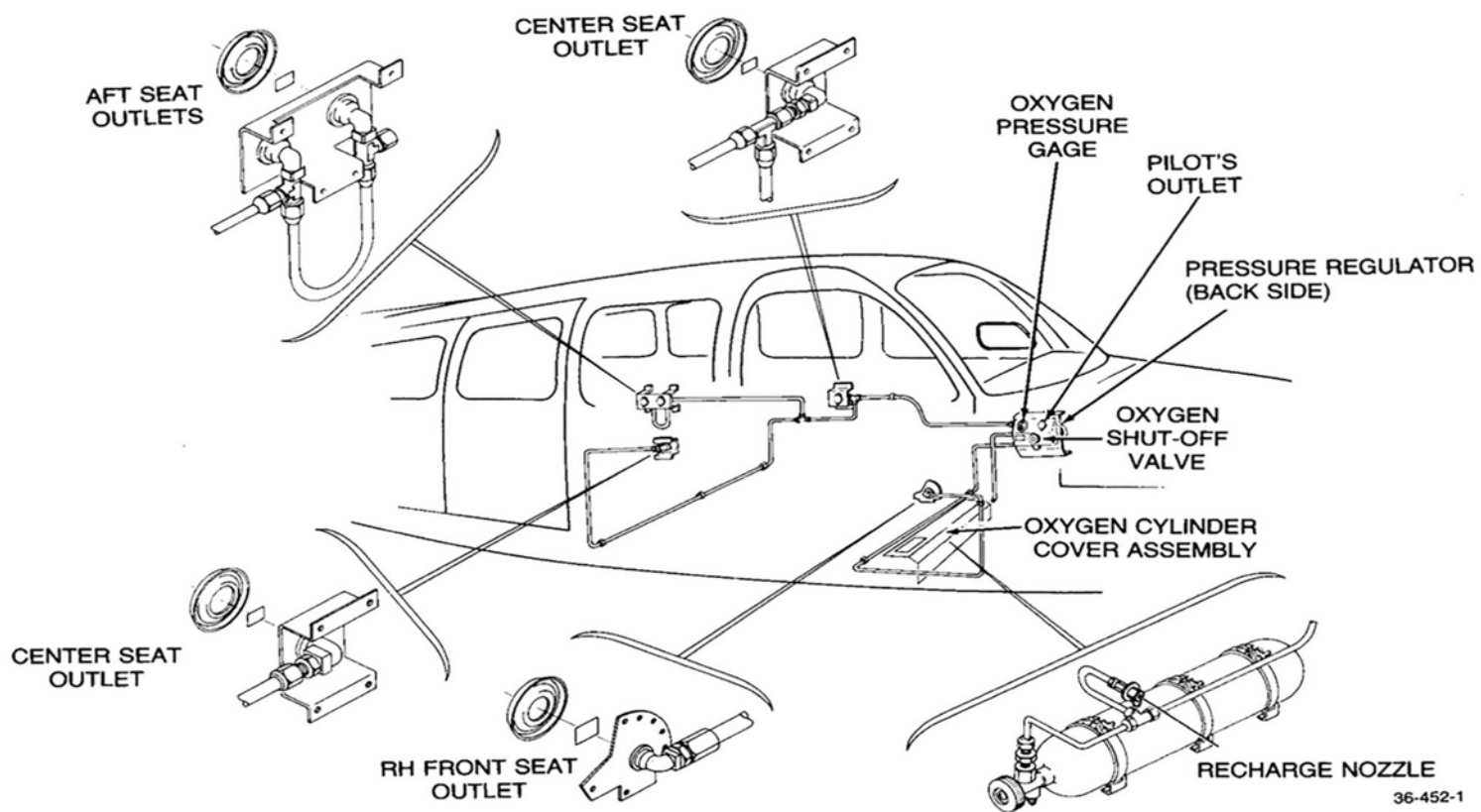
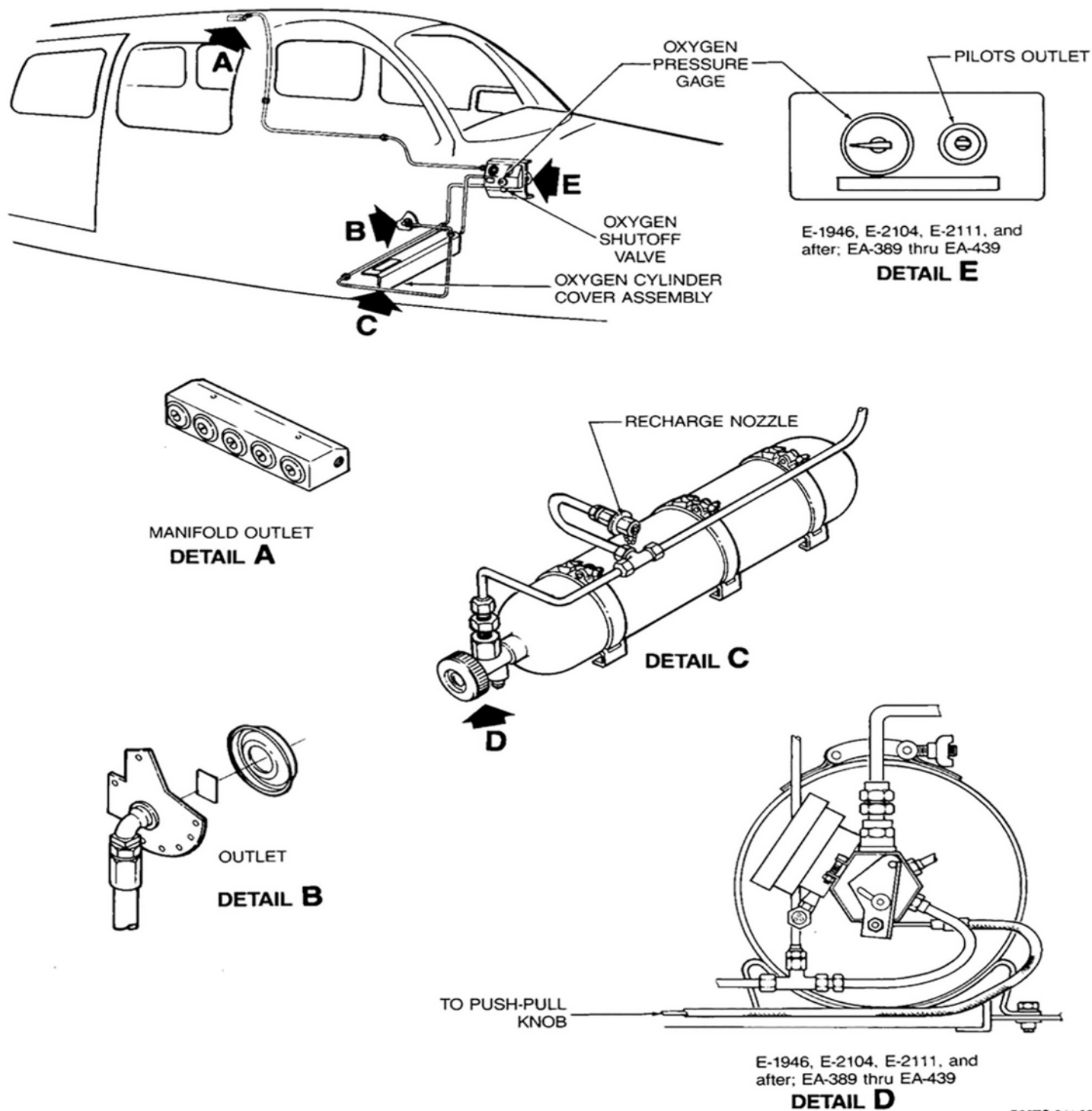


Figure 2 : Sheet 1 : Oxygen System(CE-919, CE-923, CE-925, CE-927, CE-929 and After; CJ-156 and After; D-10348, D-10353 and After; E-1422, E-1551, E-1569, E-1581,E-1594 and After; EA-21, EA-28, EA-33 thru EA-439 except EA-320)

E23795



B36TC-341-35

Figure 3 : Sheet 1 : Oxygen System(EA-320, EA-440 and After)

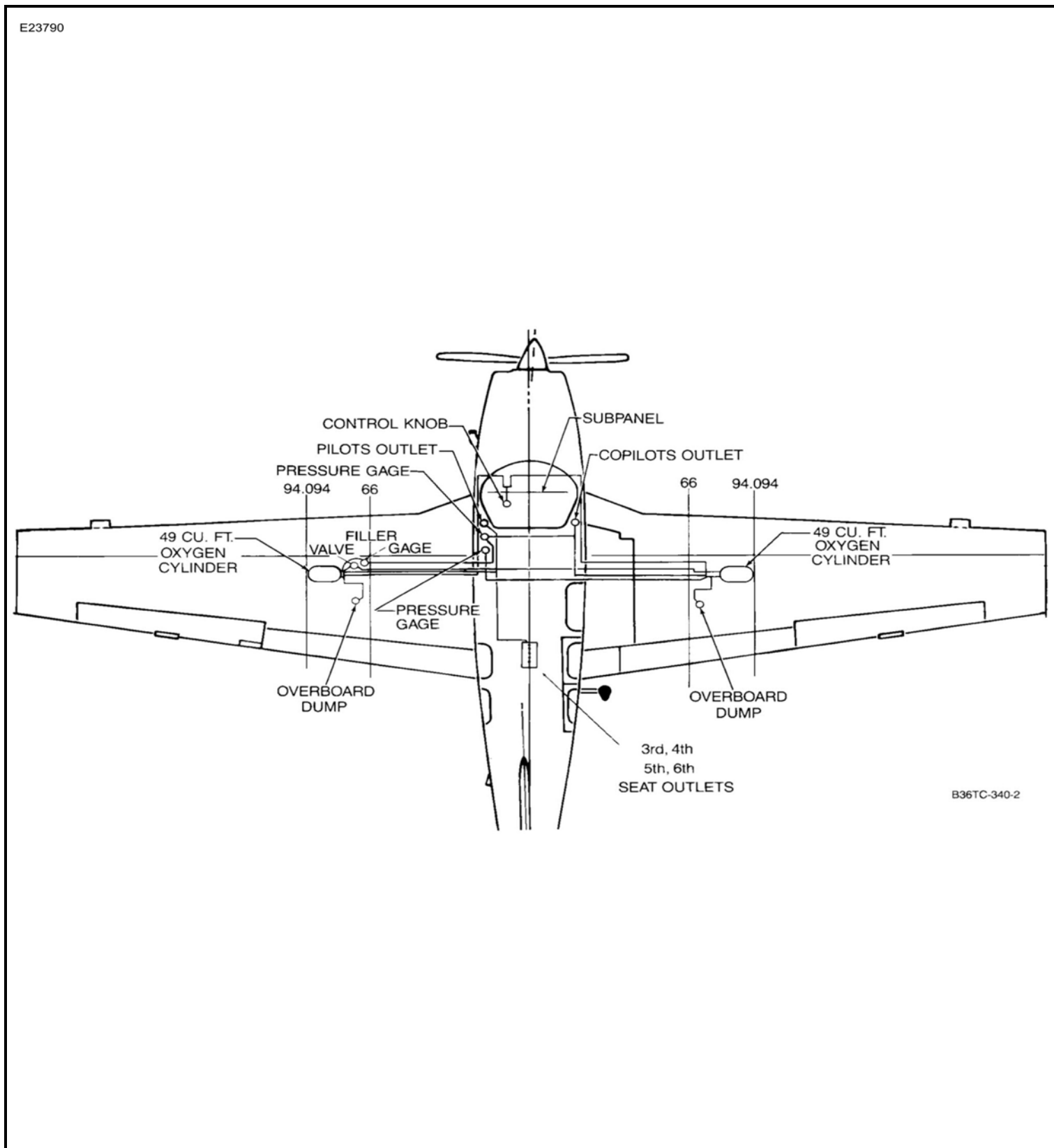
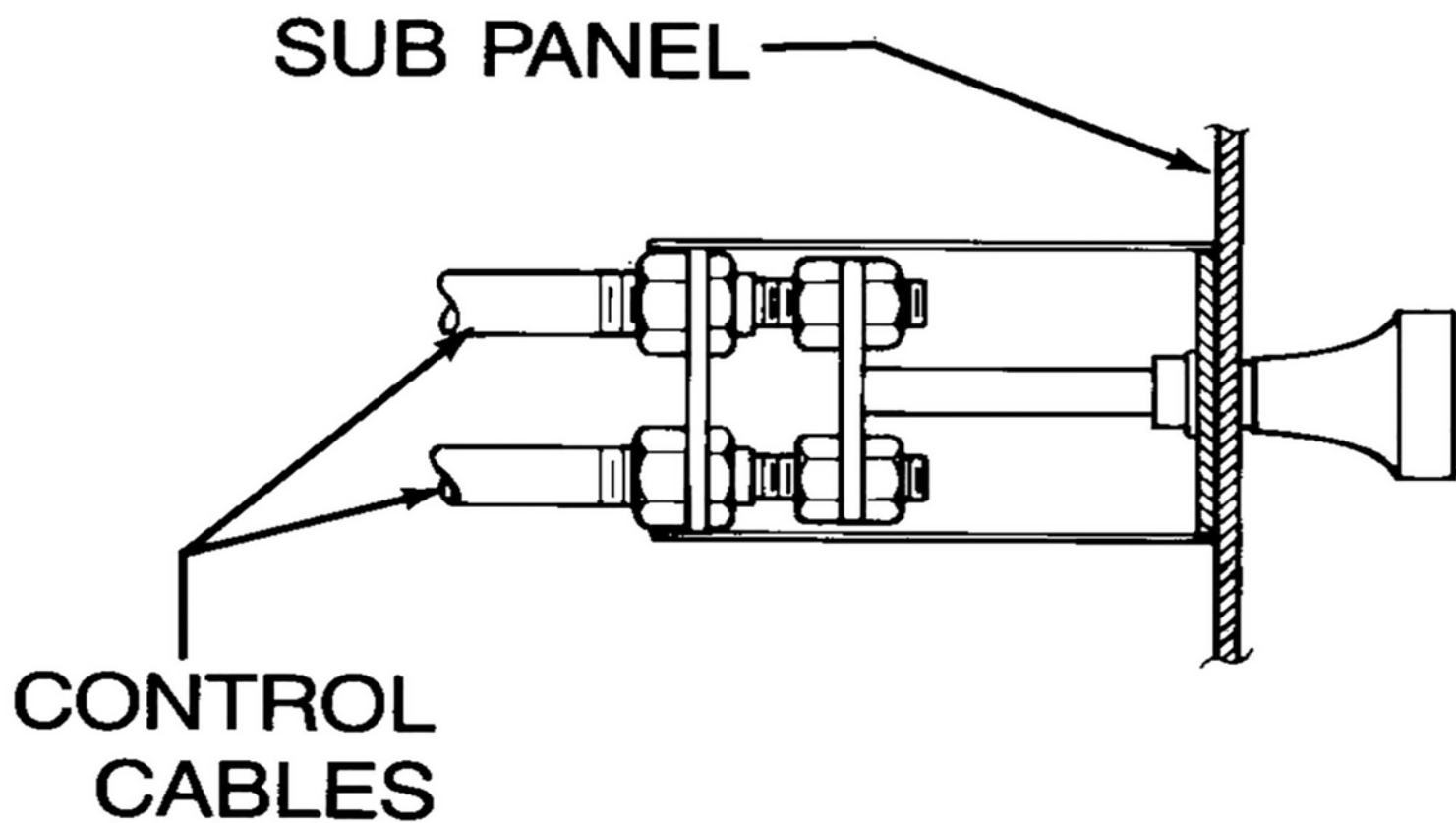


Figure 4 : Sheet 1 : Oxygen Shut-Off Control

E23783



B36TC-340-3

OXYGEN - MAINTENANCE PRACTICES

1. Oxygen

WARNING: Keep fires, cigarettes and sparks away when outlets are in use. Open and close all oxygen valves slowly. Make sure the oxygen shut-off valve is in the closed position. Inspect the filler connection for cleanliness before attaching it to the filler valve. Keep tools, hands and components clean, as fire or explosion may occur when pure oxygen comes in contact with organic material such as grease or oil.

CAUTION: All persons handling and servicing oxygen systems should review proper precautions to be observed during servicing. FAA Advisory Circular 43.13-1A contains the necessary information.

- A. Oxygen Low Pressure Test Procedure (D-10097, D-10120 and After; CE-748, CE-772 and After; E-1111, E-1241 thru E-2110 except E-1946 and E-2104; EA-11 thru EA-388 except EA-320)

WARNING: Keep fire, cigarettes and sparks away from the vicinity of the oxygen cylinder. Oil and grease will ignite upon contact with oxygen under pressure.

- (1) Turn the valve on the oxygen cylinder to the full off position.
- (2) Disconnect the oxygen cylinder from the regulator at the regulator and cap the open lines.
- (3) Plug a 0 to 100 psi pressure gage into any outlet except the pilot's outlet.
- (4) Pressurize the system 50 to 55 psi and allow the system to stabilize for 2 minutes.
- (5) During the following 15 minutes the pressure drop should not exceed 5.0 psi.
- (6) If the pressure test is satisfactory, reconnect the high pressure lines disconnected in Step (2).
- (7) Pressure test the connections made in Step (6) using cylinder pressure (1,500 psi or higher), and leak test compound (91-00-00, Table 1, 13).
- (8) After the test, wipe the area clean and dry.

- B. Oxygen High Pressure Test Procedure (D-10097, D-10120 and After; CE-748, CE-772 and After; E-1111, E-1241 thru E-2110 except E-1946 and E-2104; EA-11 thru EA-388 except EA-320)

- (1) Check to make certain the system is charged to 1,500 psi or higher.
- (2) Make sure the shut-off valve on the oxygen console is turned off.
- (3) Turn off the oxygen supply at the oxygen cylinder.
- (4) Observe the pressure gage on the oxygen console; there should be a pressure drop of no more than 400 psi in 5 minutes.
- (5) If the test was satisfactory, turn on the oxygen supply at the oxygen cylinder. If a leak was detected, check the suspected areas with leak test compound (91-00-00, Table 1, 13) and repeat Steps (3). thru (5).
- (6) After the test, wipe the area clean and dry.

- C. Oxygen Low Pressure Test Procedure (E-1946, E-2104, E-2111 and After; EA-320, EA-389 and After)

WARNING: Keep fire, cigarettes and sparks away from the vicinity of the oxygen cylinder. Hands, clothing and tools should be clean. Oil and grease will ignite upon contact with pure oxygen under pressure.

- (1) Turn the oxygen to the full off position (use the push-pull knob).
- (2) Disconnect the oxygen low pressure lines from the regulator(s) and cap the open lines.
- (3) Plug a 0 to 100 psi pressure gage into any outlet.
- (4) Pressurize the system to 50 to 55 psi and allow the system to stabilize for 2 minutes.
- (5) During the next 15 minutes the pressure drop should not exceed 5.0 psi.
- (6) If the pressure test is satisfactory, reconnect the lines disconnected in Step (2).
- (7) Pressure test the connections made in Step (6) using cylinder pressure (1,500 psi or higher in the cylinder), and leak test compound (91-00-00, Table 1, 13).
- (8) After the test, wipe the area clean and dry.

- D. Oxygen High Pressure Test Procedure (E-1946, E-2104, E-2111 and After; EA-320, EA-389 and After)

WARNING: Keep fire, cigarettes and sparks away from the vicinity of the oxygen cylinder. Hands, clothing and tools should be clean. Oil and grease will ignite upon contact with pure oxygen under pressure.

- (1) Check to make certain the system is charged to 1,500 psi or higher.
- (2) Make sure the shut-off valve(s) are off. Check the push-pull knob.

- (3) Observe one of the pressure gages, there should be no pressure drop in 30 minutes.
- (4) If the leak test is not satisfactory, use leak test compound (91-00-00, Table 1, 13) on the system connections until the leak is located.
- (5) Make the necessary repairs and repeat Step (3).
- (6) Wipe the tested areas clean and dry.

E. Oxygen System Purging

WARNING: Do not use oxygen intended for medical purposes, or such industrial uses as welding. Such oxygen may contain excessive moisture that could freeze up the valves and lines of the oxygen system. When filling the oxygen system, use only MIL-O-27210 Aviator's Breathing Oxygen (91-00-00, Table 1, 10).

Offensive odors may be removed from the oxygen system by purging. The system should also be purged any time the lines are left open and subject to contamination. Purging is accomplished by connecting a recharging cart into the system and permitting oxygen to flow through the lines and outlets until any offensive odors have been carried away. The following steps outline the procedures recommended for purging the oxygen system.

WARNING: Avoid making sparks and keep all burning cigarettes or fire away from the vicinity of the airplane when the outlets are in use. Inspect the filler connection for cleanliness before attaching it to the filler valve. Make sure that your hands, tools, and clothing are clean, particularly from grease and oil stains, for these contaminants will ignite upon contact with oxygen.

- (1) Connect a line from a recharging cart to the oxygen filler valve.
- (2) Slowly open the oxygen supply.
- (3) Slowly open the valve which allows oxygen to flow through the mask outlets.
- (4) Plug in an oxygen mask at each outlet in the cabin and cockpit.
- (5) Open all doors and windows.
- (6) Set the cart pressure regulator to deliver 50 psi to the system.
- (7) Allow system to purge for one hour and check for the presence of odor. If the odor is still present, continue purging for one additional hour. If the odor is still present after the second hour of purging, replace the supply cylinder.

F. Oxygen Cylinder Removal (D-10097, D-10120 and After; CE-748, CE-772 and After; E-1111, E-1241 thru E-2110 except E-1946 and E-2104; EA-11 thru EA-388 except EA-320)

WARNING: Keep fire, cigarettes and sparks away from the vicinity of the oxygen cylinder. Hands, clothing and tools should be clean. Oil and grease will ignite upon contact with pure oxygen under pressure.

- (1) Slowly close the oxygen supply cylinder valve.
- (2) Remove the pilot's and copilot's seat. Refer to 25-00-00, PILOT AND COPILOT SEAT REMOVAL procedures.
- (3) Remove the spar cover.
- (4) Disconnect the line from the supply cylinder.
- (5) Cap the open line immediately with a clean metal fitting.
- (6) Loosen the bracket clamp wing nuts.
- (7) Unhook the cylinder clamps and remove the cylinder from the brackets.

G. Oxygen Cylinder Installation (D-10097, D-10120 and After; CE-748, CE-772 and After; E-1111, E-1241 thru E-2110 except E-1946 and E-2104; EA-11 thru EA-388 except EA-320)

WARNING: Keep fire, cigarettes and sparks away from the vicinity of the oxygen cylinder. Hands, clothing and tools should be clean. Oil and grease will ignite upon contact with pure oxygen under pressure.

- (1) Place the new cylinder in the brackets and close the cylinder clamps.
- (2) Tighten the bracket clamp wing nuts.
- (3) Carefully inspect the fittings on both the cylinder and the line for cleanliness and the presence of foreign matter, which may contaminate the oxygen until it is unfit for breathing.
- (4) Connect the line fitting to the cylinder fitting.
- (5) Slowly open the supply cylinder valve.
- (6) Test the connections for leaks with Oxygen System Leak Test Compound (13, Table 1, 91-00-00).

- (7) Install the spar cover.
 - (8) Install the seats. Refer to 25-00-00, PILOT AND COPILOT SEAT INSTALLATION procedures.
- H. Oxygen Cylinder Removal (E-1946, E-2104, E-2111 and After; EA-389 thru EA-439)
- (1) Make certain the system is turned off.
 - (2) Remove the pilot's and copilot's seat. Refer to 25-00-00, PILOT AND COPILOT SEAT REMOVAL procedures.
 - (3) Remove the spar cover.
WARNING: Keep fire, cigarettes and sparks away from the vicinity of the oxygen cylinder. Hands, clothing and tools should be clean. Oil and grease will ignite upon contact with pure oxygen under pressure.
CAUTION: Care must be exercised to prevent accidentally turning the oxygen on. Some oxygen will be lost when the lines are disconnected, especially the high pressure line.
 - (4) Disconnect the control cable from the oxygen valve.
 - (5) Disconnect the lines from the oxygen cylinder and cap or plug the openings.
 - (6) Loosen the wing nuts on the cylinder clamps and disconnect the clamps.
 - (7) Remove the oxygen cylinder.
- I. Oxygen Cylinder Installation (E-1946, E-2104, E-2111 and After; EA-389 thru EA-439)
- (1) Place the cylinder in the proper position in the airplane.
 - (2) Connect the cylinder clamps and tighten the wing nuts.
WARNING: Keep fire, cigarettes and sparks away from the vicinity of the oxygen cylinder. Hands, clothing and tools should be clean. Oil and grease will ignite upon contact with pure oxygen under pressure.
CAUTION: Care must be exercised to prevent accidentally turning the oxygen on. Some oxygen will be lost when the lines are connected, especially the high pressure line.
 - (3) Remove the plugs or caps and install the oxygen lines.
 - (4) Connect the control cable to the oxygen valve.
 - (5) Check for leaks as indicated in OXYGEN LOW PRESSURE TEST PROCEDURE (E-1946, E-2104, E-2111 and After; EA-320, EA-389 and After) and in OXYGEN HIGH PRESSURE TEST PROCEDURE (E-1946, E-2104, E-2111 and After; EA-320, EA-389 and After).
 - (6) Install the spar cover.
 - (7) Install the pilot's and copilot's seats. Refer to 25-00-00, PILOT AND COPILOT SEAT INSTALLATION procedures.
- J. Oxygen Cylinder Removal (EA-320, EA-440 and After)
- (1) Turn the oxygen off.
 - (2) Locate the oxygen cylinder access panel located under the wing aft of the main spar and outboard of WS 66.
 - (3) Remove the screws from the access panel and remove the panel.
WARNING: Keep fire, cigarettes and sparks away from the vicinity of the oxygen cylinder. Hands, clothing and tools should be clean. Oil and grease will ignite upon contact with pure oxygen under pressure.
CAUTION: Care must be exercised to prevent accidentally turning the oxygen on. Some oxygen will be lost when the lines are disconnected, especially the high pressure line.
 - (4) Disconnect the control cable from the oxygen cylinder valve.
 - (5) Disconnect the lines from the oxygen regulator and cap or plug the openings.
 - (6) Loosen the wing nuts on the cylinder clamps.
 - (7) Position a suitable cradle under the oxygen cylinder and disconnect the clamps.
- K. Oxygen Cylinder Installation (EA-320, EA-440 and After)
- (1) Position the oxygen cylinder in position in the wing and connect the clamps.
 - (2) Check to be certain the cylinder is in the proper position and tighten the clamp wing nuts. Safety wire the nuts.
WARNING: Keep fire, cigarettes and sparks away from the vicinity of the oxygen cylinder. Hands, clothing and tools should be clean. Oil and grease will ignite upon contact with pure oxygen under pressure.
CAUTION: If there is oxygen in the cylinder, there will be some oxygen lost when the high pressure lines are

connected, particularly the pressure gage line.

- (3) Remove the caps or plugs from the connection points and install the oxygen lines.
 - (4) Connect the control cable to the oxygen cylinder valve.
 - (5) Check for leaks as indicated in OXYGEN LOW PRESSURE TEST PROCEDURE (EA-320, EA-440 and After) and OXYGEN HIGH PRESSURE TEST PROCEDURE (EA-320, EA-440 and After).
 - (6) If the pressure tests are satisfactory, install the access cover under the wing.
- L. Oxygen Control Cable Adjustment (E-1946, E-2104, E-2111 and After; EA-389 thru EA-439)
- (1) Remove the pilot's and copilot's seats. Refer to 25-00-00, PILOT AND COPILOT SEAT REMOVAL procedures.
 - (2) Remove the spar carry through cover.
 - (3) Adjust the control cable by repositioning the cable, cable housing or both.
 - (4) Install the spar carry through cover.
 - (5) Install the pilot's and copilot's seats. Refer to 25-00-00, PILOT AND COPILOT SEAT INSTALLATION procedures.
- M. Oxygen Control Cable Adjustment (EA-320, EA-440 and After)
- The control cable(s) may be adjusted either in the wing(s) at the valve(s) or at the push-pull control knob just forward of the instrument subpanel (Refer to 35-00-00, [DESCRIPTION AND OPERATION, Figure 4](#)). Coarse adjustments may be made at the valve(s) by repositioning the cable, cable housing, or both. The valve(s) are located on the cylinder above an access panel outboard of WS 66 and aft of the main spar. Finer adjustment of the system cables may be made at the push-pull control knob just forward of the instrument subpanel. On the two cylinder system both valves shall simultaneously turn off or on by the operation of the push-pull control knob.
- N. Oxygen Cylinder Retesting
- Oxygen cylinders used in the airplanes are the light weight type, stamped 3 HT on a plate on the side of each cylinder. Each oxygen cylinder must be hydrostatically tested every three years and the test date stamped on the cylinder. The cylinders have a service life of 24 years and/or 4,380 pressurizations, whichever occurs first. When the service life of the cylinder is complete, the cylinder must be discarded.
- O. Constant Flow Oxygen Mask Cleaning
- The following instructions are for cleaning constant flow mask assemblies that have not been disassembled for overhauling:
- CAUTION: Protective gloves shall be worn throughout this procedure.**
- (1) Prepare a cleaning and disinfectant solution by mixing one ounce of cleaner/disinfectant (91-00-00, [Table 1, 71](#)) with two gallons of distilled water (91-00-00, [Table 1, 72](#)). The solution shall not be hotter than 140°F.
CAUTION: Do not allow any liquid inside the reservoir bag or the flow indicator. If the inside of the reservoir bag gets wet it could be difficult to dry properly. Any liquid reaching the inside of the flow indicator would impair the operation.
 - (2) Carefully wipe the exterior of the mask face-piece assembly, the reservoir bag, the flow indicator, and the oxygen tubing with a soft cotton cloth or gauze pad dipped into the prepared cleaner/disinfectant solution.
CAUTION: When wiping/cleaning the interior of the face cushion, be careful not to damage the dilution valve diaphragm.
 - (3) Wipe the interior of the mask face cushion with a soft cotton cloth or gauze pad dipped into the prepared cleaner/disinfectant solution.
 - (4) Using a soft cotton cloth or gauze pad dipped in distilled water maintained at room temperature, wipe the all areas that were cleaned to remove any trace of the cleaner/disinfectant solution. Allow the unit to dry at room temperature.
 - (5) Allow the mask assembly to dry at room temperature.
 - (6) After the mask assembly is completely dry, seal it in a clean plastic bag.

PNEUMATIC - GENERAL

1. General - Description and Operation

A. Instrument Air System

The instrument air pressure system provides air for operation of the directional gyro and horizon gyro. Air is drawn through an inlet air filter mounted on the rear engine baffle by the dry air pump. The air is then routed through the air pressure regulator and inline filter to the gyros. The regulator, which is located near the inline filter on the rear engine baffle, should be adjusted to a pressure of 5.0 inches of Hg as indicated on the cockpit gage (Refer to [Figure 1](#)).

Instrument air pressure is monitored by the instrument air gage located in the upper right side of the instrument panel. (At serials E-1946, E-2104, E-2111 and After; EA-320, EA-389 and After, the pressure gage is in the left side of the instrument panel.)

B. Standby Instrument Air System (CE-1056 and After; CJ-156 and After; E-2180 thru E-2216 if Installed, E-2217 and After; EA-422 thru EA-442 if Installed, EA-443 and After; and Airplanes with Kit No. 36-5009 or 36-5011 Installed)

CAUTION: Never use an air pump which has been dropped or mishandled.

A standby instrument air pressure system is provided to supply instrument air in the event the primary instrument air pressure system fails. The system incorporates a pressure pump which is driven by an electric motor, a pump intake filter which is mounted on the underside of the engine, an inline filter and a pressure regulator. The standby system is controlled by an ON/OFF toggle switch, placarded STANDBY GYRO P, located on the left subpanel. When the system is activated, a solenoid valve, mounted in the pressure supply line just aft of the firewall fitting, automatically isolates all air driven instruments except the directional gyro and the horizon gyro. The standby air pressure system is plumbed into the primary system ducting by use of a manifold with check valves to prevent backflow. Refer to [Figure 2 Sheet 1](#) and [Figure 2 Sheet 2](#)

Figure 1 : Sheet 1 : Pressure System Schematic

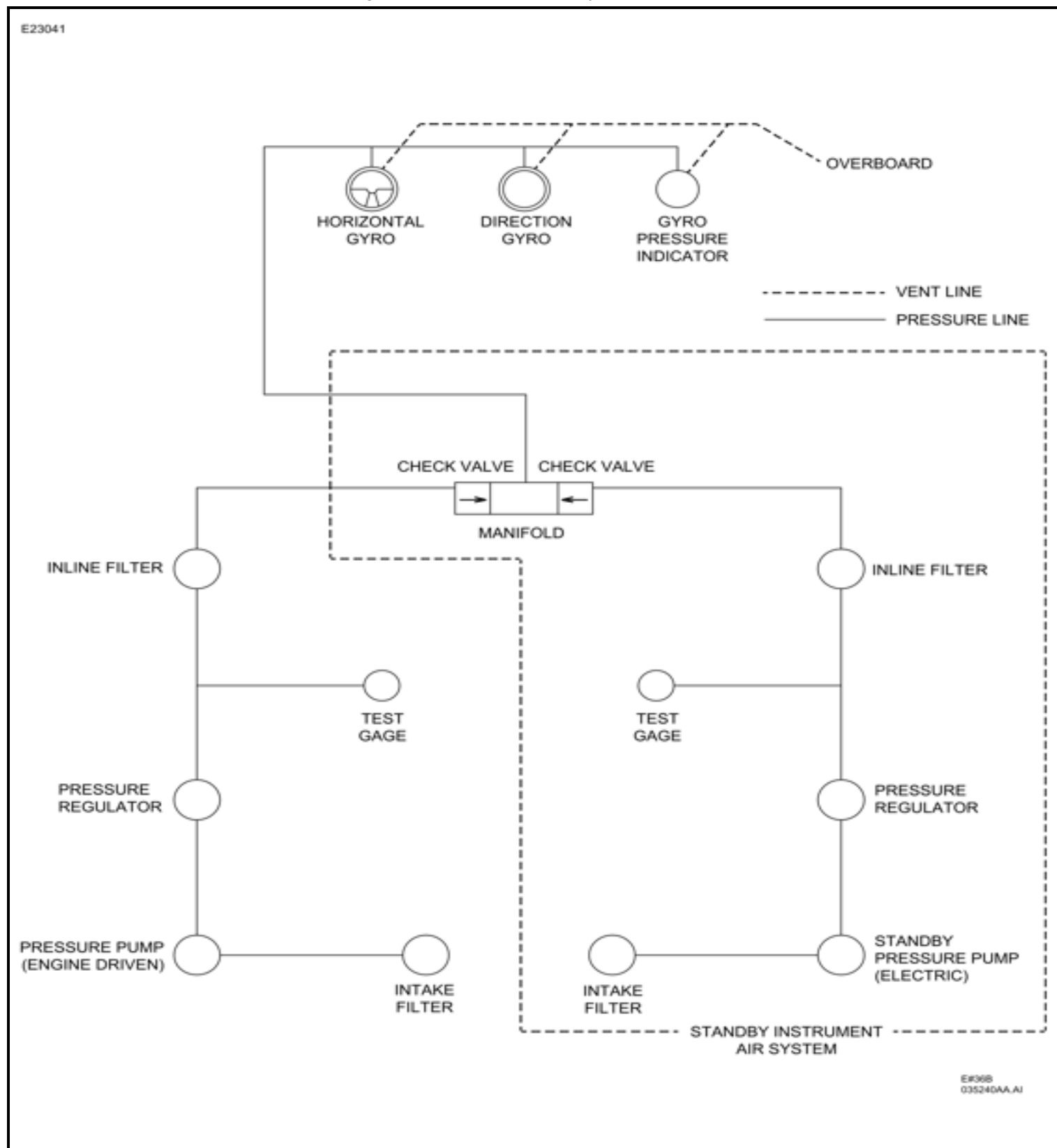


Figure 2 : Sheet 1 : Standby Instrument Air System CE-1056 and After; CJ-156 and After; E-2180 thru E-2216 If Installed, E-2217 and After, and Airplanes With Kit No. 36-5009 Installed

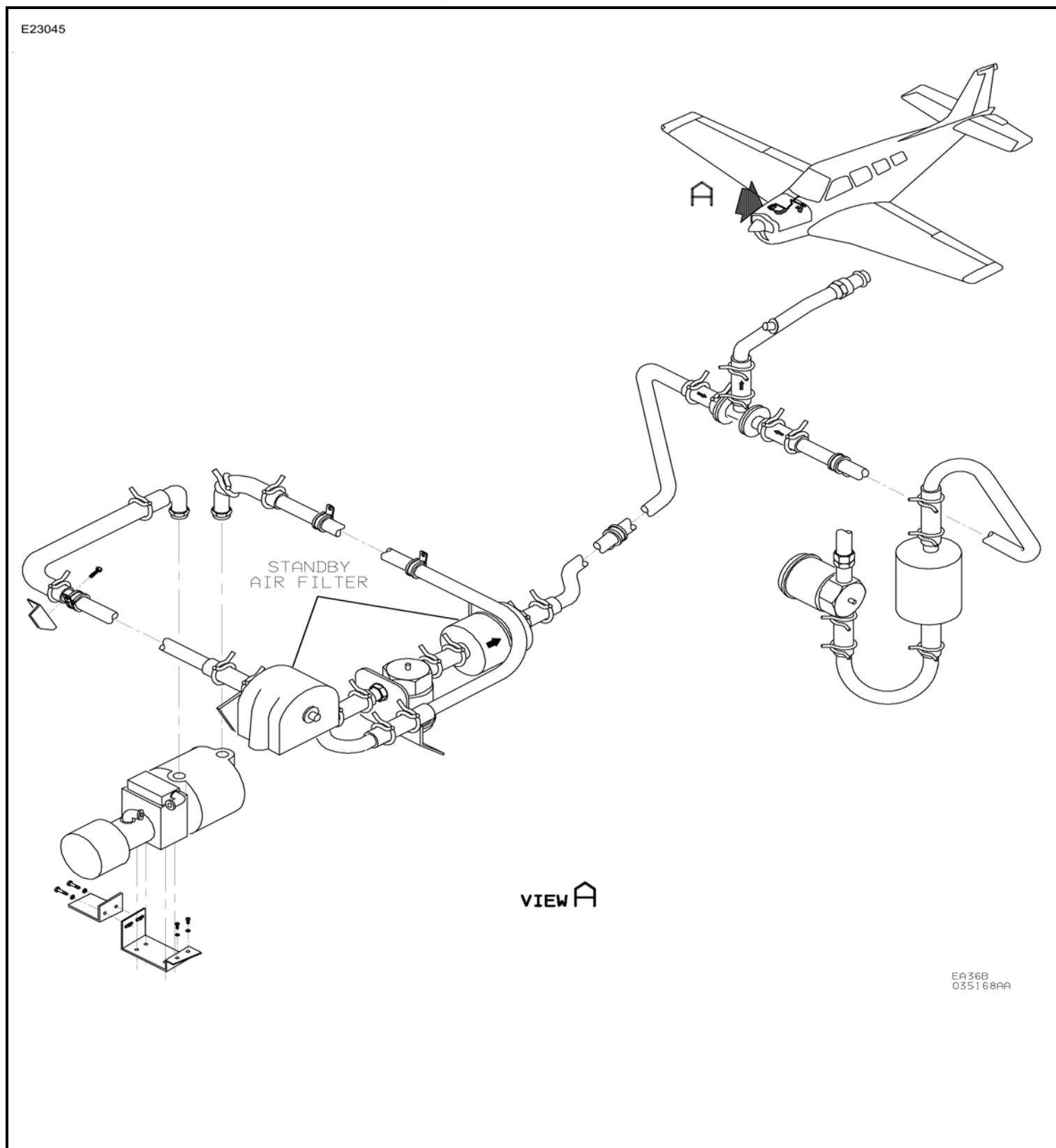
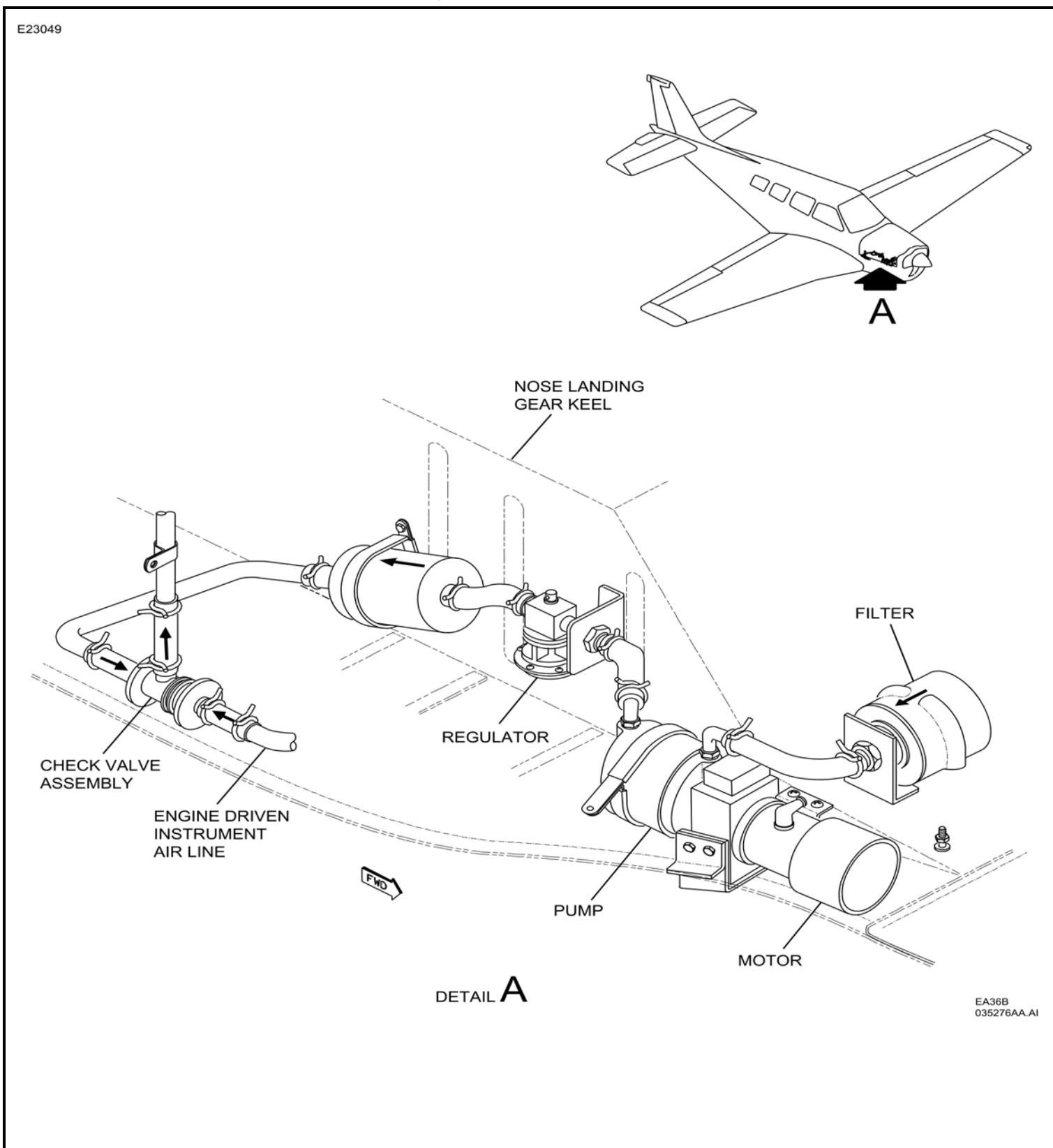


Figure 2 : Sheet 2 : Standby Instrument Air System CE-1056 and After; CJ-156 and After; E-2180 thru E-2216 If Installed, E-2217 and After, and Airplanes With Kit No. 36-5009 Installed



PNEUMATIC - TROUBLESHOOTING

1. General - Troubleshooting

A. Troubleshooting Instrument Air System

Table 101. Troubleshooting Instrument Air System

Indication	Probable Cause	Remarks
1. Zero indication on instrument gage.	a. Hole in gyro plumbing, line plugged, filter plugged or plumbing disconnected.	a. Inspect plumbing, replace or connect lines or replace filter as necessary.
	b. Defective instrument pressure gage.	b. Replace gage.
	c. Defective gyro horizon or direction gyro.	c. Inspect instrument and replace as necessary.
	d. Defective pump.	d. Replace pump.
	e. Defective regulator.	e. Replace regulator.

NOTE: Troubleshooting procedures for the primary and standby air pressure systems are the same.

PNEUMATIC - MAINTENANCE PRACTICES

1. General - Maintenance Practices

A. Servicing

Impurities and foreign matter are removed from the air by two pressure system filters. The intake filter is located on the top of the engine, ahead of the pressure pump. This filter should be replaced in accordance with the OVERHAUL AND REPLACEMENT SCHEDULE in [Chapter 05-10-00](#). The filter element must not be subjected to solvents and must be replaced if this occurs. Always reinstall the filter cover with the opening facing down. The inline filter is located between the pressure regulator and the instruments. The frequency of replacing this air filter will depend upon service conditions; however, they should be replaced in accordance with the OVERHAUL AND REPLACEMENT SCHEDULE in [Chapter 05-10-00](#).

The intake filter for the standby instrument air system is located on the underside of the engine attached to the keel structure. The inline filter is mounted in the right engine compartment between the pressure regulator and the instruments, at FS 28.25 to 30.75. The intake filter and inline filter should be replaced in accordance with the OVERHAUL AND REPLACEMENT SCHEDULE in [Chapter 05-10-00](#).

When operating in localities where there is a great amount of dust or sand in the air, the filters should be replaced at more frequent intervals. Under extremely dusty conditions, it may be necessary to inspect the filters daily. A clogged filter reduces air flow and slows up the rotor, causing improper gyro indication due to a loss of gyroscopic inertia.

B. Low Instrument Air Pressure

- (1) If the pressure pump has failed or operation of the instruments indicates a fluctuation of the system pressure or a decrease in system pressure, check for excessive pressure, a partial restriction in the lines, a filter partially obstructed, or pressure loss resulting from loose connections. These conditions may be checked by:

NOTE: Use a dry, low pressure air source (10 psi maximum) for this test. If air flow resistance in the filter removed from the airplane exceeds that of the new filter by more than 1.0 psi, replace the filter.

- (a) Removing the inline filter from the system and checking it for obstructions by comparing the resistance to flow with a new filter.
 - (b) Check all connections for tightness.
 - (c) Check the lines for bends, kinks and excessive carbon.
- (2) With the discrepancy repaired, or whenever any components are replaced in the pressure system, adjust the pressure, refer to PRESSURE REGULATOR ADJUSTMENT procedure.

C. Air Filter Removal (Intake)

- (1) Gain access to the filter by opening the left engine cowl (Refer to [Figure 201](#)).
- (2) Remove the nut, washers, and cover from the filter.
- (3) Remove the spacer and nut which secures the filter.
- (4) Remove the filter.

D. Air Filter Installation (Intake)

- (1) Install the filter and secure with the nut (Refer to [Figure 201](#)).
- (2) Install the spacer and cover. The cover should be installed with the cover opening facing down.
- (3) Secure the cover with the washers and nut.
- (4) Close the engine cowl.

E. Standby Air Filter Removal (Intake)

- (1) Gain access to the filter by opening the right engine cowl (Refer to [Figure 201](#)).

NOTE: The standby system intake filter is mounted on the underside of the engine attached to the keel structure.

- (2) Remove the nut, washers, and cover from the filter.
 - (3) Remove the spacer and nut which secures the filter.
 - (4) Remove the filter.

F. Standby Air Filter Installation (Intake)

- (1) Install the filter and secure with the nut (Refer to [Figure 201](#)).
- (2) Install the spacer and cover. The cover should be installed with the cover opening facing down.

- (3) Secure the cover with the washers and nut.
- (4) Close the engine cowling.
- G. Air Filter Removal (Inline)
 - (1) Open the engine cowling and locate the filter attached to the bracket below the engine baffle.
 - (2) Remove the inlet and outlet hoses from the filter.
 - (3) Remove the nut and washer which hold the filter in place.
 - (4) Remove the filter.
- H. Air Filter Installation (Inline)
 - (1) Place the filter in position and secure with washer and nut.
 - (2) Install the inlet and outlet hoses.
 - (3) Close the engine cowling.
- I. Standby Air Filter Removal (Inline)
 - (1) Open the left engine cowling and locate the filter attached to the bracket below the engine baffle.
 - (2) Remove the inlet and outlet hoses from the filter.
 - (3) Remove the nut and washer which hold the filter in place.
 - (4) Remove the filter.
- J. Standby Air Filter Installation (Inline)
 - (1) Place the filter in position and secure with washer and nut.
 - (2) Install the inlet and outlet hoses.
 - (3) Close the engine cowling.
- K. Pressure Regulator Removal
 - (1) Open the engine cowling and locate the pressure regulator.
 - (2) Remove the inlet and outlet hoses.
 - (3) Remove the nut and washer which secure the regulator in position.
 - (4) Remove the regulator.
- L. Pressure Regulator Installation
 - (1) Place the regulator in position.
 - (2) Install the nut and washer.
 - (3) Install the inlet and outlet hoses.
 - (4) Close the engine cowling.
- M. Standby Pressure Regulator Removal
 - (1) Open the left engine cowling and locate the pressure regulator.
 - (2) Remove the inlet and outlet hoses.
 - (3) Remove the nut and washer which secure the regulator in position.
 - (4) Remove the regulator.
- N. Standby Pressure Regulator Installation
 - (1) Place the regulator in position.
 - (2) Install the nut and washer.
 - (3) Install the inlet and outlet hoses.
 - (4) Close the engine cowling.
- O. Standby Pressure Regulator Adjustment (CE-1056 and After; CJ-156 and After; E-2180 and After; EA-422 and After; and Airplanes With Kit 36-5009 or 36-5011 Installed)

NOTE: This procedure is performed with the engine NOT running and the primary instrument air system turned off.

 - (1) Gain access to the regulator by opening the engine cowling.

- (2) Install a test gage (0 to 10 psi) in the outlet side of the pressure regulator.

NOTE: During this procedure, battery voltage must be maintained at 28.5 ± 0.3 volts. It is recommended that an auxiliary power supply, regulated to 28.5 ± 0.25 vdc, be used.

- (3) With the engine NOT running, and the primary instrument air system OFF, turn ON the standby air pump circuit breaker switch in the left subpanel.

- (4) Adjust the pressure regulator to provide 5.0 +0.1/ -0.2 inches of Hg as indicated on the instrument air pressure gage mounted in the instrument panel.

NOTE: Rotate the adjusting screw clockwise to increase the pressure and counterclockwise to decrease the pressure.

CAUTION: At no time should the gage installed in the outlet side of the pressure regulator indicate more than 5.0 psi. If this is not enough air pressure for satisfactory instrument operation, the system has a leak, blockage or restriction which must be repaired immediately.

- (5) Turn the standby air pump circuit breaker switch on the left subpanel to OFF.

- (6) Remove the test gage from the airplane.

- (7) Close the engine cowl.

NOTE: When this procedure is completed, adjust the primary instrument air system, refer to **PRESSURE REGULATOR ADJUSTMENT** procedure.

P. Pressure Regulator Adjustment

NOTE: When performing this procedure on airplanes with the standby air pressure system installed, make sure that the standby air pressure system is turned OFF.

- (1) Gain access to the pressure regulator by opening the engine cowl.

- (2) Install a test gage (0 to 10 psi) at the outlet side of the pressure regulator.

- (3) Adjust the pressure regulator to 5.0 +0.1/ -0.2 inches of Hg as indicated on the instrument air pressure gage mounted in the instrument panel with the engine operating at 2,300 rpm. Rotate the adjusting screw on the pressure regulator clockwise to increase the pressure and counterclockwise to decrease the pressure.

CAUTION: At no time should the gage installed in the outlet side of the pressure regulator indicate more than 5.0 psi. If this is not enough air pressure for satisfactory instrument operation, the system has a leak, blockage or restriction which must be repaired immediately.

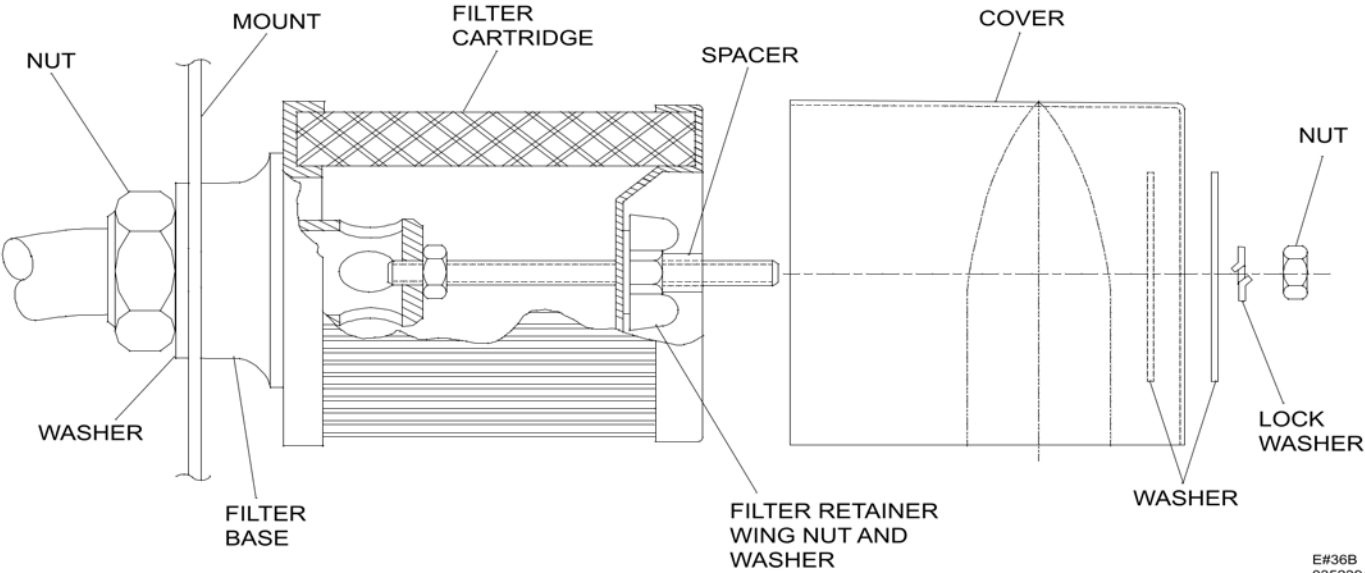
- (4) Check the instrument air pressure gage in the instrument panel. With the engine operating at 800 rpm, the pressure should remain in the green arc.

- (5) Remove the test gage from the airplane.

- (6) Close the engine cowl.

Figure 201 : Sheet 1 : Intake Air Filter

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ELECTRIC PANELS - GENERAL

1. General - Description And Operation

The instrument panel on the airplane is divided into seven general groupings: (1) A floating panel, located on the upper left corner of the instrument panel, which contains those instruments necessary to sustain flight. (2) The center stationary panel which contains instruments that indicate the various monitoring systems of the engine. (3) The avionics and radio rack, located to the right of the engine instrument panel, which contains various optional avionics and radio receiving equipment. (4) The stationary right panel which contains indicators, switching and the glove box. (5) The upper left subpanel, located below the left floating panel and above the left subpanel autopilot control switching, OMNI indicators and the flap position indicator. (6) The lower left subpanel contains the heater and air controls for cabin temperature, ignition switch, circuit breaker switches, light controls, flap control and fuel pump controls. (7) The lower right subpanel contains the landing gear control and indicating lights and the standard and optional; circuit breakers. Refer to [Figure 1](#), [Figure 2](#) and [Figure 3](#).

Figure 1 : Sheet 1 : Instrument and Control Panel(Except serials E-1946, E-2104, E-2111 and After and EA-320, EA-389 and After)

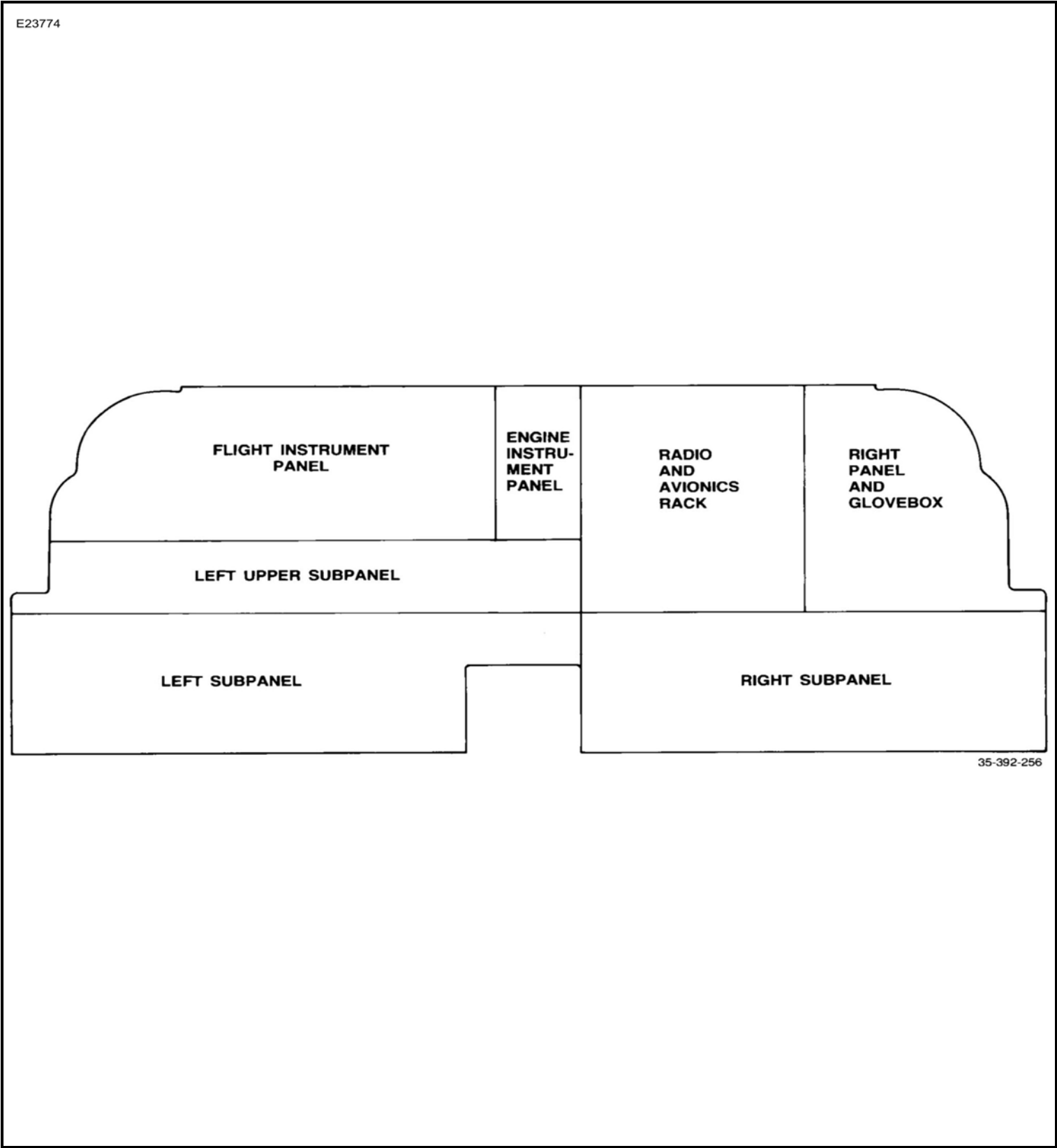


Figure 2 : Sheet 1 : Instrument and Control Panel(Serials E-1946, E-2104, E-2111 thru EA-4101, EA-320, EA-389 and After)

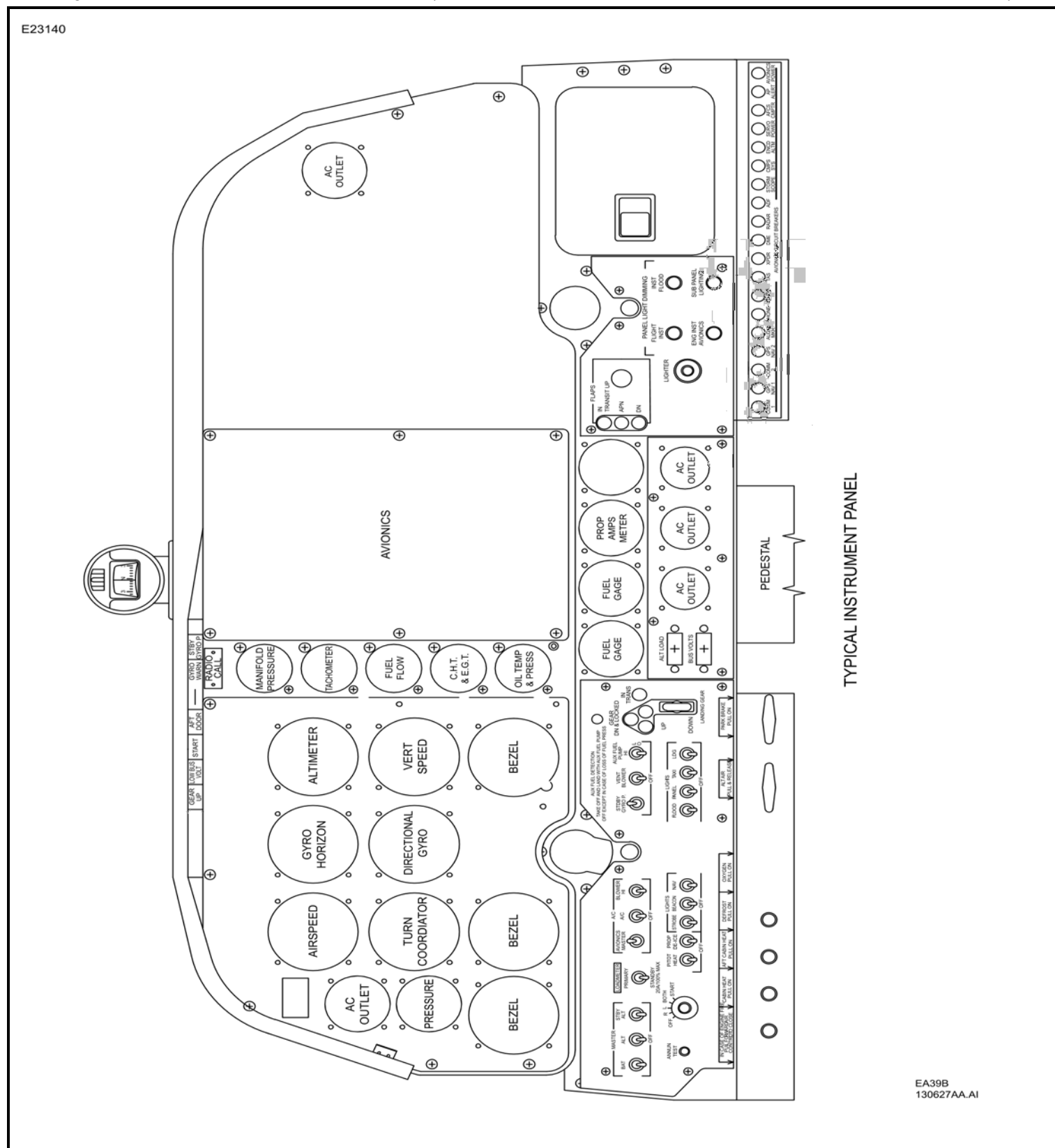
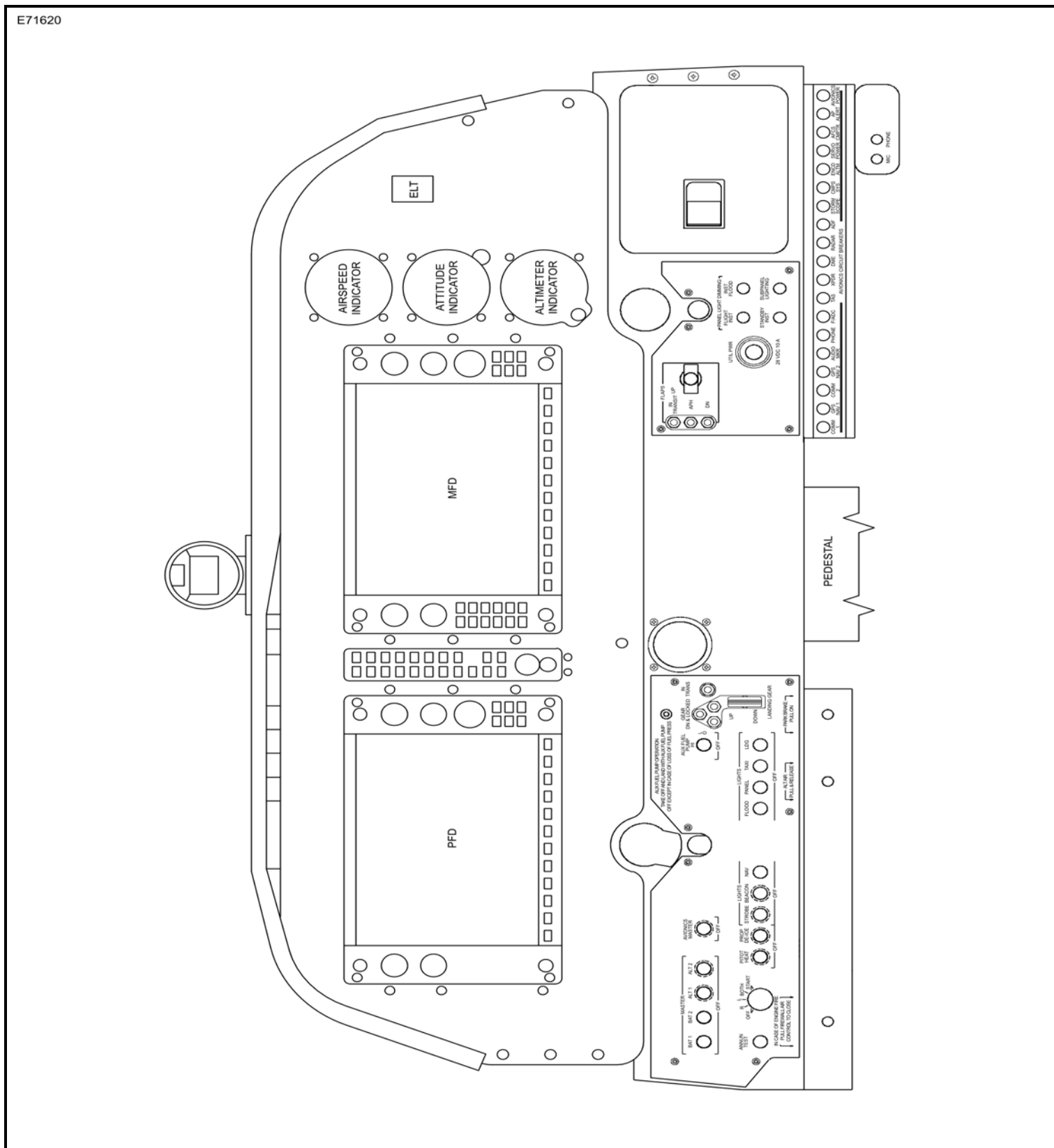


Figure 3 : Sheet 1 : (Revised) - Instrument and Control Panel(Serials E - 4102 and After)



INSTRUMENT AND CONTROL PANELS - MAINTENANCE PRACTICES**1. Instrument and Control Panels - Maintenance Practices**

WARNING: To avoid personal injury, shut off all electrical power, both battery and external, before removing or installing any electrical components.

A. Glareshield Removal

- (1) Remove the attach screws at each end of the glareshield.
- (2) Lift the glareshield gently to detach it from the velcro hook and pile which secures it at its top side.
- (3) Disconnect the electrical quick disconnects for both the compass and the glareshield lights.
- (4) Disconnect the defroster heat duct.
- (5) Remove the glareshield.

B. Glareshield Installation

- (1) Place the glareshield in position and connect the defroster heat duct.
- (2) Connect the electrical quick disconnects for both the compass and the glareshield lights.
- (3) Install the attach screws at each end of the glareshield.
- (4) Press downward on the top side of the glareshield to secure the velcro hook and pile.

C. Removal of Engine and Flight Instruments

- (1) Remove the glareshield.
- (2) Disconnect the plumbing and/or electrical connections from the flight instruments.
- (3) Disconnect and remove any post lights.
- (4) Remove the mounting screws securing the instrument to the panel section.
- (5) Remove the instrument.

D. Installation of Engine and Flight Instruments

- (1) Place the instrument in the proper position in the panel.
- (2) Secure the instrument to the panel with the attaching screws.

CAUTION: If any screws are replaced upon reinstallation of any instrument, be sure they are the same length as the original screws.

- (3) Connect the post lights as necessary.
- (4) Connect the plumbing and/or electrical connections to the flight instruments.
- (5) Install the glareshield.

E. Removal of the Engine Instrument Cluster

- (1) Remove the glareshield.
- (2) Disconnect the harness connector on the back of the engine instrument cluster.
- (3) Remove the screws securing the instrument cluster to the instrument panel. Support the cluster assembly while removing the screws to prevent dropping it.
- (4) Remove the cluster from the panel.

F. Installation of the Engine Instrument Cluster Panel

- (1) Place the engine instrument cluster panel in the proper position in the instrument panel.
- (2) Secure the instrument cluster to the instrument panel with the screws.

CAUTION: If replacement of the screws is required, use screws of the same length as the original screws to avoid internal damage to the instrument cluster.

- (3) Connect the engine harness connector to the back of the instrument cluster.
- (4) Install the glareshield.

G. Removal of Radio/Avionic Equipment

- (1) Locate the component you wish to remove from the radio/avionic rack.
- (2) Loosen the allen screw which secures the piece of gear in the rack.

- (3) Slide the required piece of gear from the shelf on the radio/avionic rack.

H. Installation of Radio/Avionic Equipment

- (1) Slide the radio/avionic component you wish to install on its proper shelf.
- (2) Make sure the component is seated all the way back in the shelf to make its electrical connection.
- (3) Tighten the allen screw which retains the component in the shelf.

I. Right and Left Subpanel

Access to the individually mounted circuit breakers is obtained from the underside of the instrument panel. Before starting any removal or installation procedures, ensure that the battery switch is in the OFF position, the battery is disconnected and that the external ground power unit is disconnected. When removing any of the components for maintenance purposes, tag and identify any wires removed to facilitate reinstallation of the components.

ELECTRICAL AND ELECTRONIC EQUIPMENT RACKS - MAINTENANCE PRACTICES**1. Electrical and Electronic Equipment Racks - Maintenance Practices**

The circuit diagrams and the accompanying equipment lists in the Wiring Diagram Manual identify each electrical component with a reference designator. Further, the equipment list identifies the area in which the component is installed by a zone number. The airplane zoning diagram shows the various zones of the airplane (Refer to [Table 201](#) and [Figure 201](#)). The lists of components, and the illustrations showing their installation on the following pages, identify these components by the reference designator, shown in parenthesis (), assigned each component in the applicable Wiring Diagram Manual.

Table 201. Component Location Zones

		() Indicates Right Side					
100	BELOW FLOOR			300	AFT FUSELAGE AND EMPENNAGE (Cont'd)		
	140		Firewall to Main Spar		361	(362)	Elevator
	150		Main Spar to Rear Spar		370		Tail Cone
	160		Aft of Main Spar	410	ENGINE COMPARTMENT		
200	FORWARD FUSELAGE			500		(600)	WING AND CONTROL SURFACES
	221	(222)	Firewall (Attached to or Accessible from Forward Side)		531	(631)	Wing, Inboard Leading Edge
	231	(232)	Firewall to Instrument Panel		532	(632)	Wing, Inboard-Aft of Main Spar
	240		Instrument Panel and Subpanel		533	(633)	Flap
	251	(252)	Cabin (Floor Line to Headliner)		541	(641)	Wing, Outboard-Leading Edge
	253		Cabin Headliner Area		542	(642)	Wing, Outboard-Aft of Main Spar
	270		Main Spar Carry-Through Structure		543	(643)	Aileron
	280		Rear Spar Carry-Through Structure		550	(650)	Wing Tip
300	AFT FUSELAGE AND EMPENNAGE			700	GEAR DOORS AND WHEEL WELLS		
	310		Aft Fuselage		710		Nose Landing Gear
	320		Dorsal Fin (Aircraft with Conventional Tail)		730	(740)	Main Landing Gear

	330		Vertical Stabilizer (Aircraft with Conventional Tail)		800	DOORS		
	340		Rudder (Aircraft with Conventional Tail)			820		Cabin Entry Door
	351	(352)	Horizontal Stabilizer			830		Baggage or Cargo Door

- A. Area Between the Firewall and Instrument Panel - Airplane Zones 231 and 232
The electrical components located between the firewall and instrument panel (zones 231 and 232) are individually mounted with screws or bolts. Before performing any maintenance on these components, make sure the battery switch is OFF, the battery is disconnected, and the external power source (if installed) is disconnected. When removing these components for maintenance, tag and identify any wires removed to aid the reinstallation of the components
For maintenance coverage of the voltage regulator, refer to [Chapter 24-30-00, 201](#) of the Maintenance Manual. The electrical equipment junction box contains the flap position PC board, the annunciator dimming PC board, relays, diodes, and an externally mounted flasher (Refer to [Figure 202](#)). The following components are located in airplane zones 231 and 232: Electrical Equipment Junction Box (231) (A19)Landing Gear Warning Horn (231) (LS11)Stall Warning Horn (231) (LS12)Voltage Regulator (232) (VR11) Manifold Pressure Switch (231) (S54)LH Fuel Quantity PCB (231) (A13)RH Fuel Quantity PCB (231) (A14)
- B. Area Which Includes the Forward, Right Side of the Firewall, the Engine Compartment, and the Nose Landing Gear Well - Airplane Zones 222/410/710
The electrical components located in the above areas and zones are mounted with nuts, bolts, screws, or clamps. Before doing any maintenance on these components, make sure the battery switch is OFF, the battery is disconnected, and the external power source (if installed) is disconnected. When removing these components for maintenance, tag and identify any wires removed to aid the reinstallation of the components.
The nose landing gear uplock and downlock switches are located in the nose wheel well, and are mounted on the right, outboard side of the wheel well keel (Refer to [Figure 203](#)). These switches work in conjunction with the indicator lights on the right subpanel to indicate nose landing gear position.
For maintenance coverage of the battery, refer to Chapter 12 of the Maintenance Manual. The throttle warning horn switch (S41) and the optional landing gear safety switch (S34) are located on the throttle control shaft and are located in zone 410. Adjustment and pictorial coverage of these switches is found in Chapter 32 of the Maintenance Manual. All major engine electrical components i.e., alternator, starter, etc., will be shown in the IO-520 or TSIO-520 Series Aircraft Engines Overhaul Manual, FORM X-30039A or X-30042 or for the IO-550 use FORM X-30568.
Refer to the relevant [Figure 203](#) sheet for electrical components located on the firewall electrical equipment plate of a particular airplane.
- C. Area Beneath the Floor from the Firewall to the Main Spar and from the Main Spar to the Rear Spar - Airplane Zones 140 and 150
The electrical components located from the firewall to the main spar, and from the main spar to the rear spar are mounted with nuts, bolts, screws and clamps. Before performing any maintenance on these components, make sure the battery switch is OFF, the battery is disconnected, and the external power source (if installed) is disconnected. When removing these components for maintenance purposes, tag and identify any wires removed to aid the reinstallation of the components.
CAUTION: Make sure the grommets are installed in the area of the main spar through which the wire harness passes, so chafing of the harness will not occur.
The auxiliary fuel pumps are located forward of the main spar; all other components in this figure are located aft of the main spar (Refer to [Figure 204](#)). There are three different auxiliary fuel pumps used in the Bonanza Series airplanes: On serials CE-748, CE-772 and After; D-10097, D-10120 and After; E-1111, E-1241 and After, a reference designator (B11) is used for high boost pump. On serials CJ-149 and After, two auxiliary boost pumps are used: Reference designator (B11) for high boost and reference designator (B12) for low boost. On serials EA-11 and After, a single pump with both high and low speeds is used. The pump used on EA-11 and After is reference designator (B13).
The flight dimming transistor bracket assembly contains four dimming transistors and is located in zone 150 (left side). For

adjustment of the landing gear uplimit and downlimit switches, refer to Chapter 32 of the Maintenance Manual. The following components are located in airplane zones 140 and 150:

Auxiliary Fuel Boost Pump (140) (B11, B12, or B13) See above. Light Dimming Transistor Bracket Assembly (150) (A21) Glareshield Light Dimming Transistor (150) (Q1) Subpanel Light Dimming Transistor (150) (Q2) Eng Inst and Avionics Console Light Dimming Transistor (150) (Q3) Flight Instrument Light Dimming Transistor (150) (Q4) Inverter (150) (MG1) Flap Motor (150) (B22) Landing Gear Motor (150) (B21) Dynamic Brake Landing Gear Relay (150) (K17) Landing Gear Uplimit Switch (150) (S39) Landing Gear Downlimit Switch (150) (S40)

D. Area Which Includes the Wings and Main Landing Gears - Airplane Zones 531 thru 650, and Zones 730 and 740

The electrical components located within the wings and main landing gear wheel wells are mounted with nuts, bolts, screws, clamps, and rivets. Before performing any maintenance on the components, make sure the battery switch is OFF, the battery is disconnected, and the external power source (if installed) is disconnected. When removing the components for maintenance purposes, tag and identify any wires removed to aid the reinstallation of the components.

Each wing contains two fuel level transmitters which provide fuel quantity information to their respective fuel quantity indicator on the engine instrument panel (Refer to [Figure 205](#)). The inboard fuel quantity transmitter for each wing is located at approximately WS 43.00, and the outboard transmitter is located at approximately WS 97.00.

The heated pitot tube is mounted on the left outboard wing rib at approximately WS 125.00. The pitot tube heat element wires are routed with the tube air line. When the pitot tube is removed for maintenance purposes, cap the end of the air line to prevent entry of foreign material. Remove the cap upon reinstallation of the tube.

The stall warning switch is located on the left outboard wing leading edge at approximately WS 140.00. Adjustment coverage of the stall warning system is located in Chapter 27 of the Maintenance Manual. The stall warning switch is removable by screws located around the perimeter of the mounting bracket.

The landing gear uplock and downlock switches, a pair for each main landing gear, are located in the wheel well on the aft side of the front wing spar at WS 45.00 for the gear up switch, and at WS 52.00 for the gear down switch. These switches work in conjunction with the indicator lights on the right subpanel to indicate landing gear position.

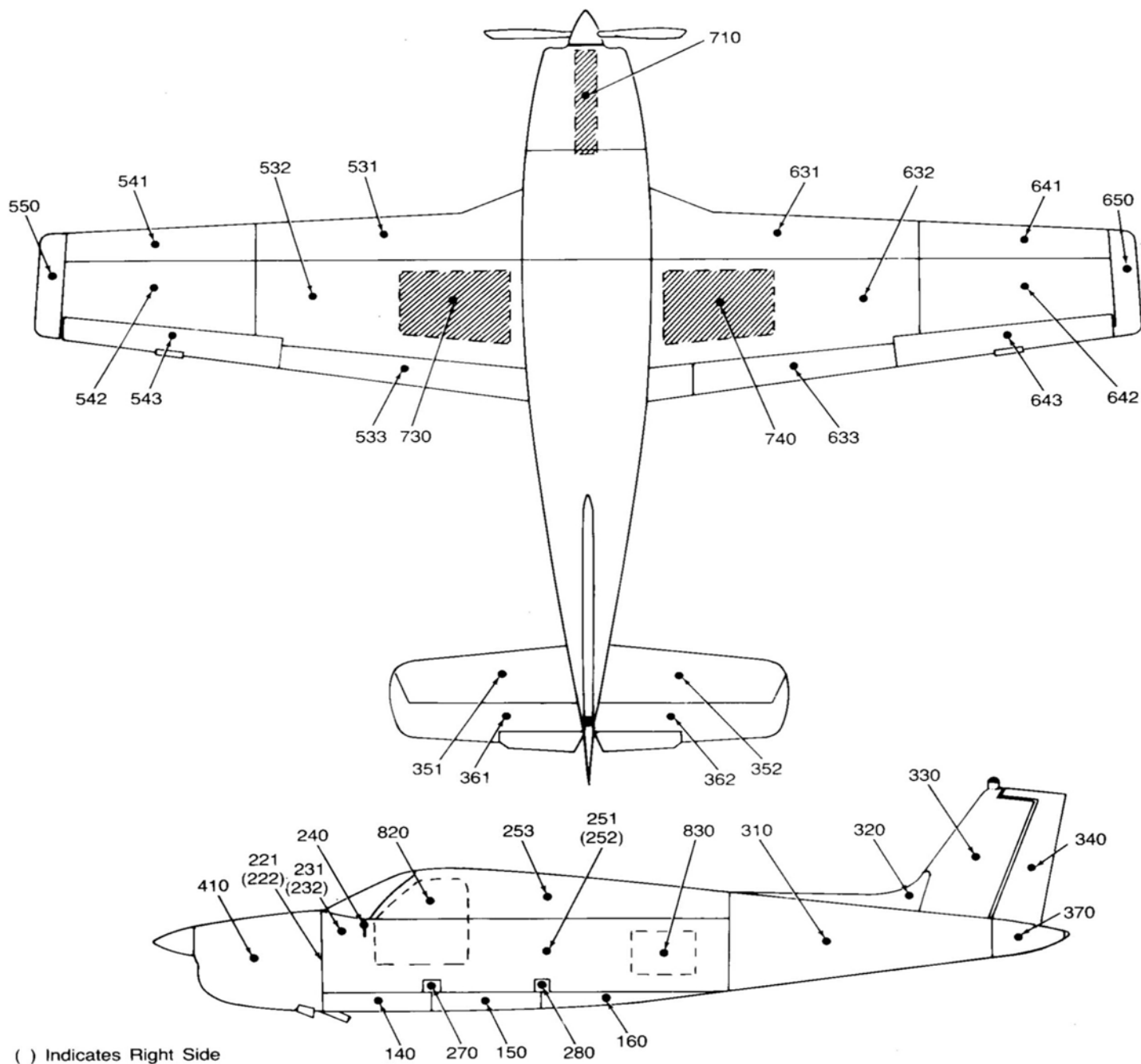
The electrical flap position transmitter and the flap limit switches are located within the left wing. The flap position indicator is mounted at the left flap actuator at approximately WS 40.00. It is accessible through the landing gear wheel well forward of the wing rear spar. The flap limit switches are accessible forward of the left flap and may be serviced with the flaps lowered. The flap switches are located at approximately WS 33.00. For flap limit switch adjustment refer to [27-50-00](#). At airplane serials D-10179 and After; CJ-150 and After; CE-816 and After; E-1371 and After; and EA-11 and After the airplanes are equipped with 14 degree and 16 degree approach flap limit switches in addition to the uplimit and downlimit flap switches of prior airplane serials.

A landing gear safety switch (squat switch) is located on the strut of each main landing gear. The safety switches are provided to prevent inadvertent retraction of the landing gear on the ground. The switches open the control circuit when the struts are compressed. The landing gear safety switches also serve to control the position of the retractable air conditioner condenser. When the airplane is on the ground and the air conditioner is turned on, the condenser extends to the ground extension position. The following electrical components are located in the area which includes the wings and main landing gear. This area includes airplane zones 531 thru 650, and zones 730 and 740:

Stall Warning Switch (531) (S43)	Switch, RH Landing Gear Downlock (740) (S65)
Heated Pitot Tube (531) (HR23)	Flap Position Transmitter (730) (MT2)
Transmitter, LH Inboard Fuel (531) (R20)	Switch, Flap Uplimit (533) (S50)
Transmitter, LH Outboard Fuel (531) (R21)	Switch, Flap Downlimit (533) (S51)
Transmitter, RH Inboard Fuel (631) (R22)	Switch, 14 Degree Flap Limit (533) (S76)
Transmitter, RH Outboard Fuel (631) (R23)	Switch, 16 Degree Flap Limit (533) (S47)
Switch, LH Landing Gear Uplock (730) (S60)	Switch, RH Landing Gear Safety (740) (S36)
Switch, LH Landing Gear Downlock (730) (S61)	Switch, LH Landing Gear Safety (730) (S37)
Switch, RH Landing Gear Uplock (740) (S64)	

Figure 201 : Sheet 1 : Airplane Zoning Diagram

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Figure 202 : Sheet 1 : Right Area Between Firewall and Instrument Panel - Zone 232

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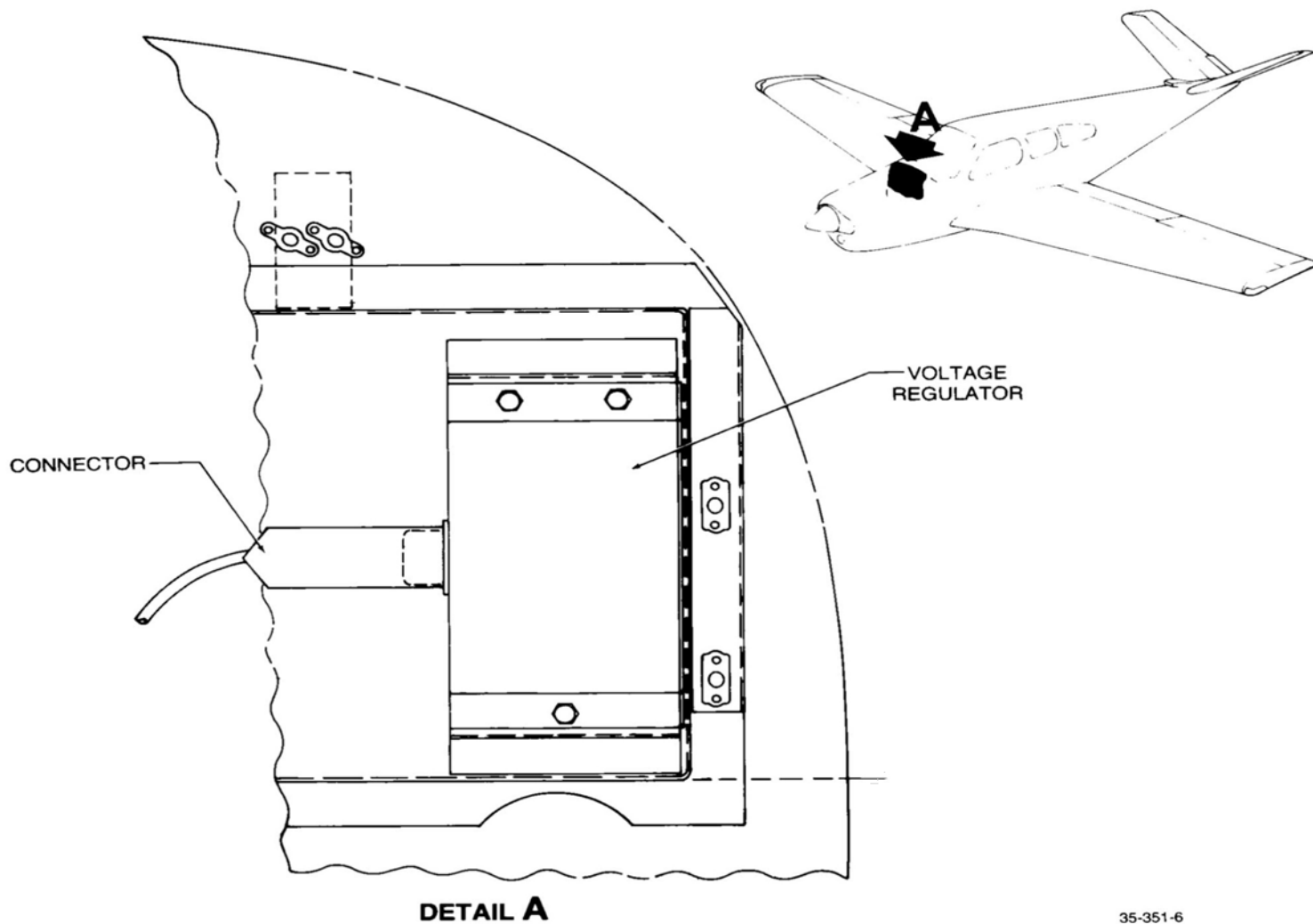


Figure 202 : Sheet 2 : Right Area Between Firewall and Instrument Panel - Zone 232

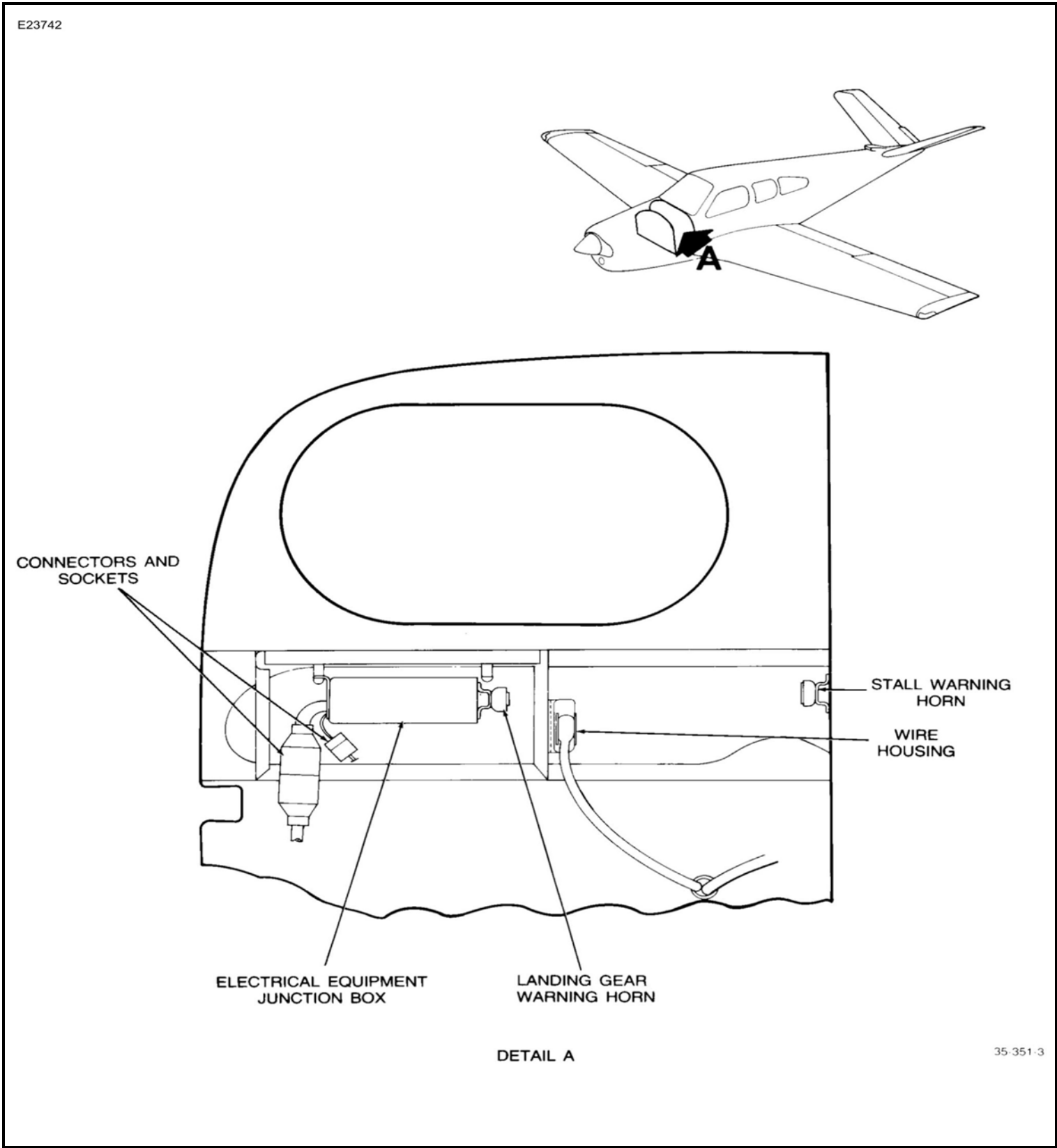


Figure 202 : Sheet 3 : Right Area Between Firewall and Instrument Panel - Zone 232

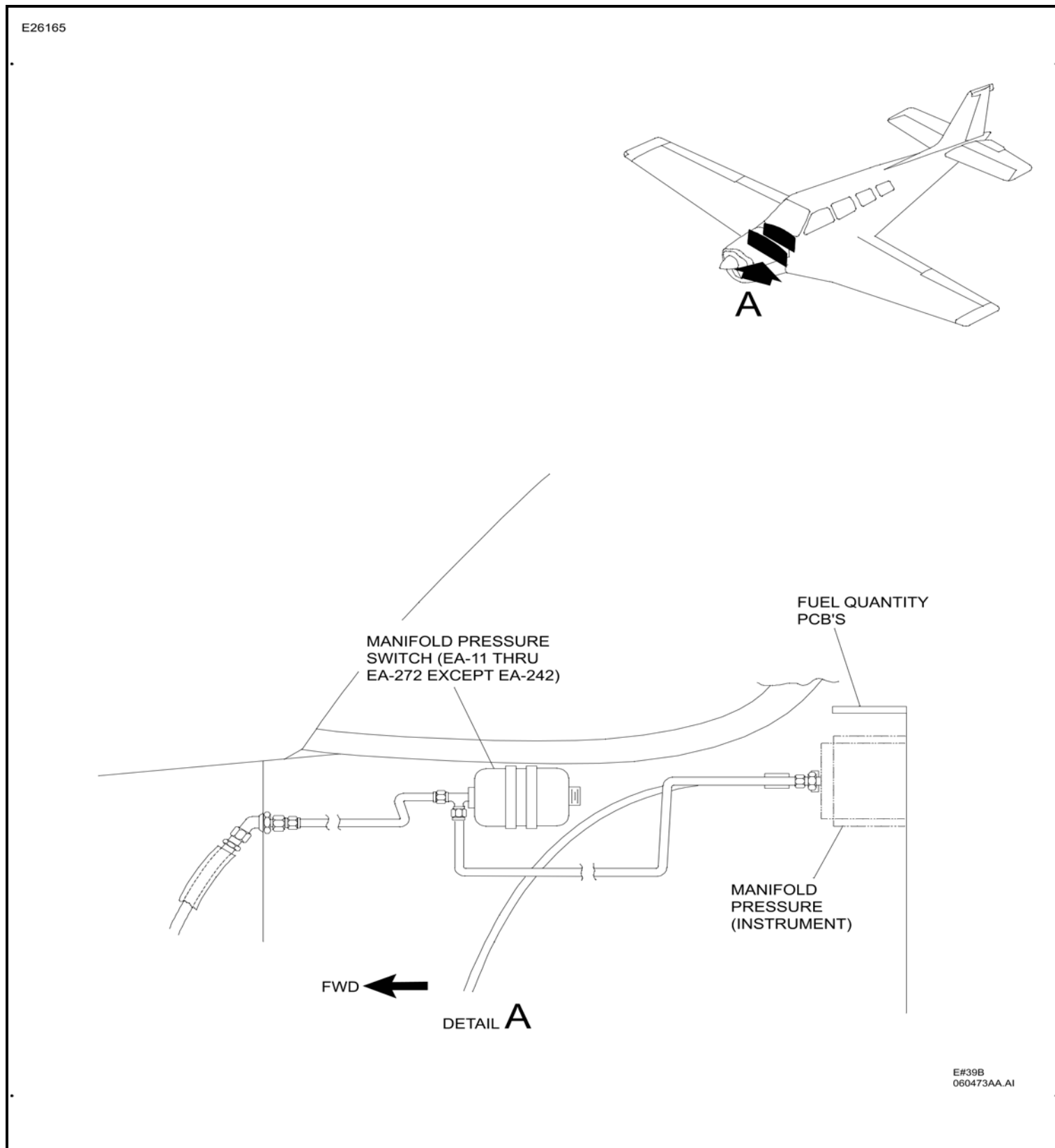


Figure 203 : Sheet 1 : Forward, Right Side of Firewall and Engine Compartment - Zones 222/410

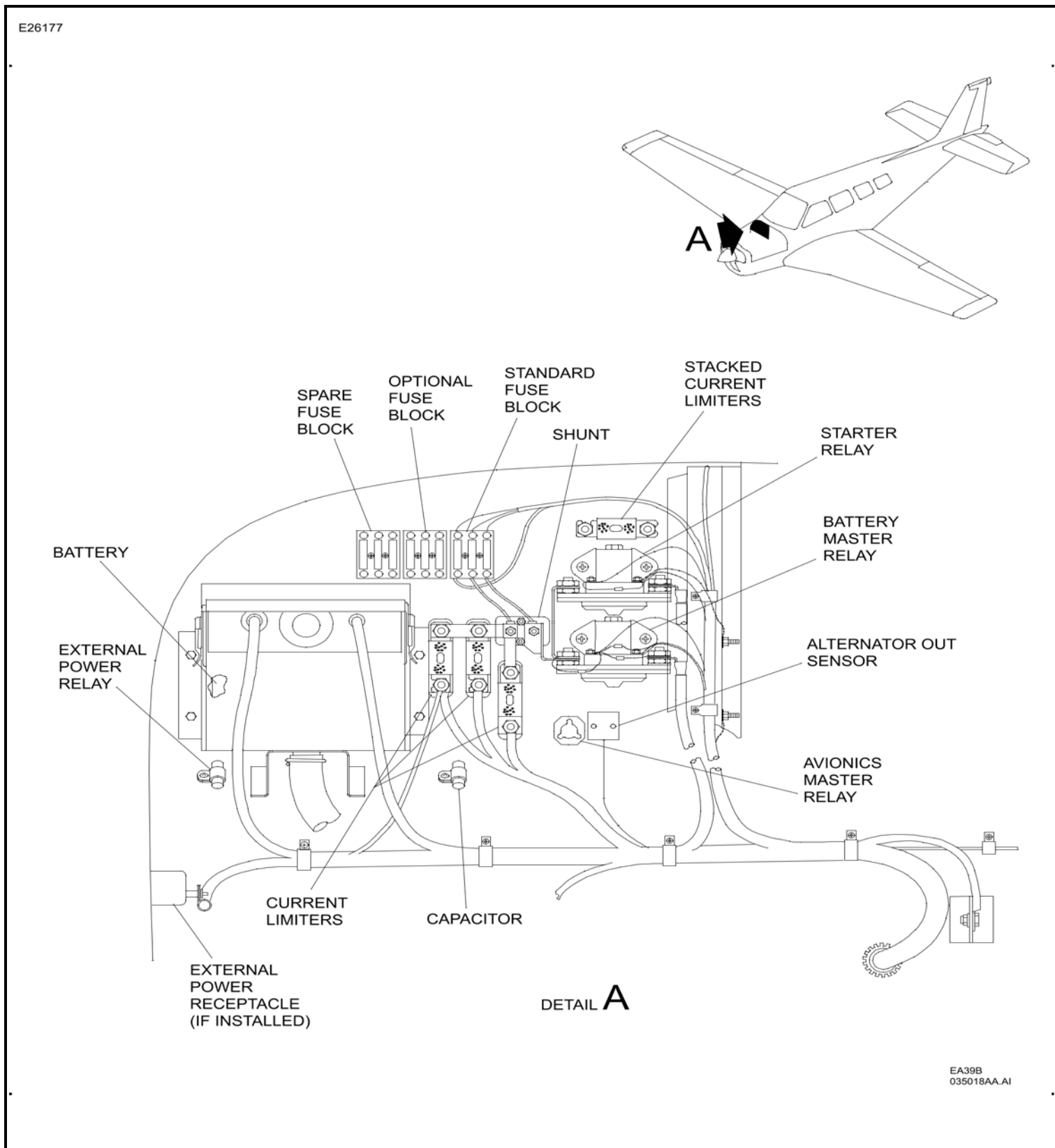


Figure 203 : Sheet 2 : Forward, Right Side of Firewall and Engine Compartment - Zones 222/410

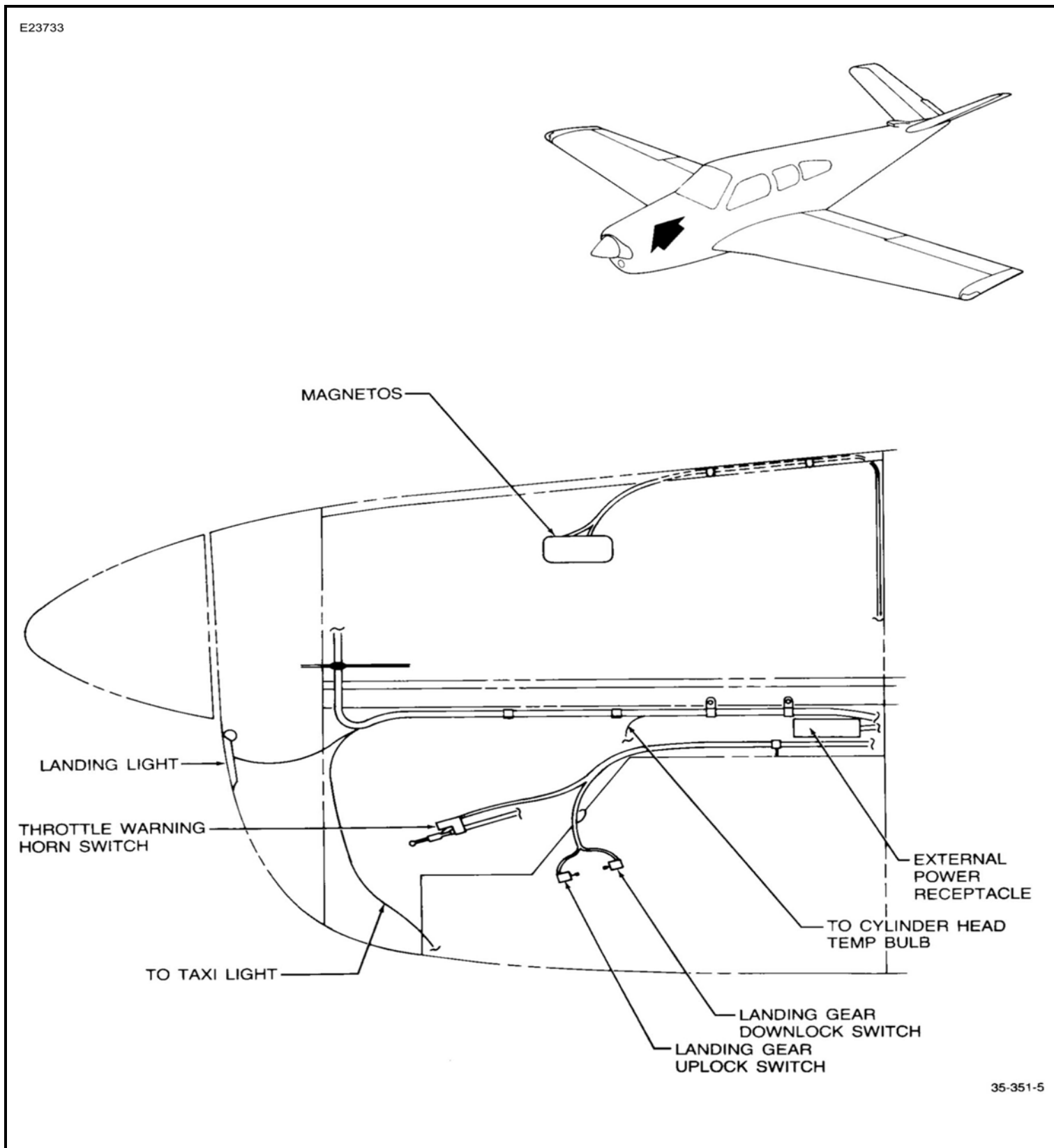


Figure 203 : Sheet 3 : Forward, Right Side of Firewall and Engine Compartment - Zones 222/410

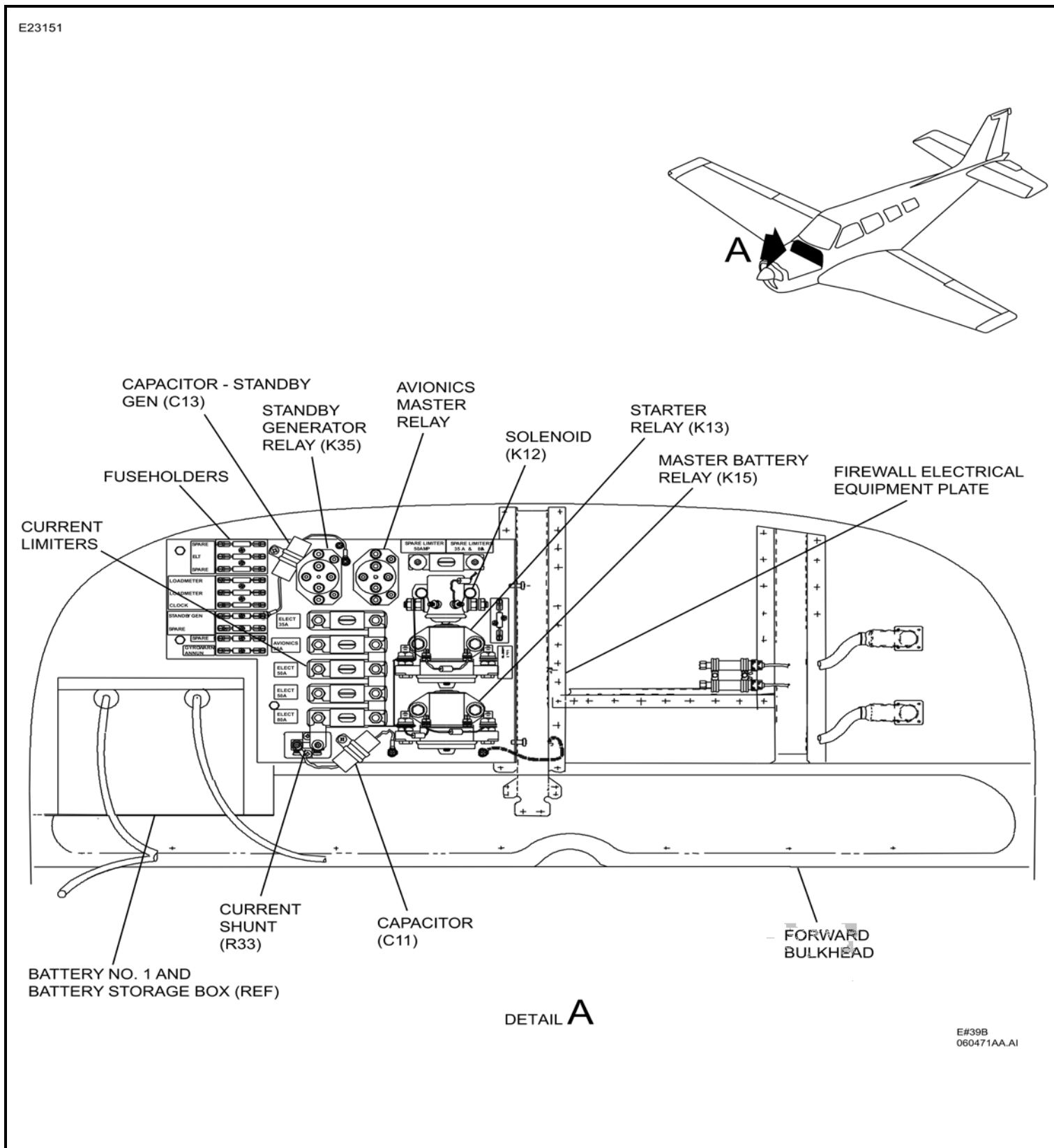


Figure 203 : Sheet 4 : Forward, Right Side of Firewall and Engine Compartment - Zones 222/410

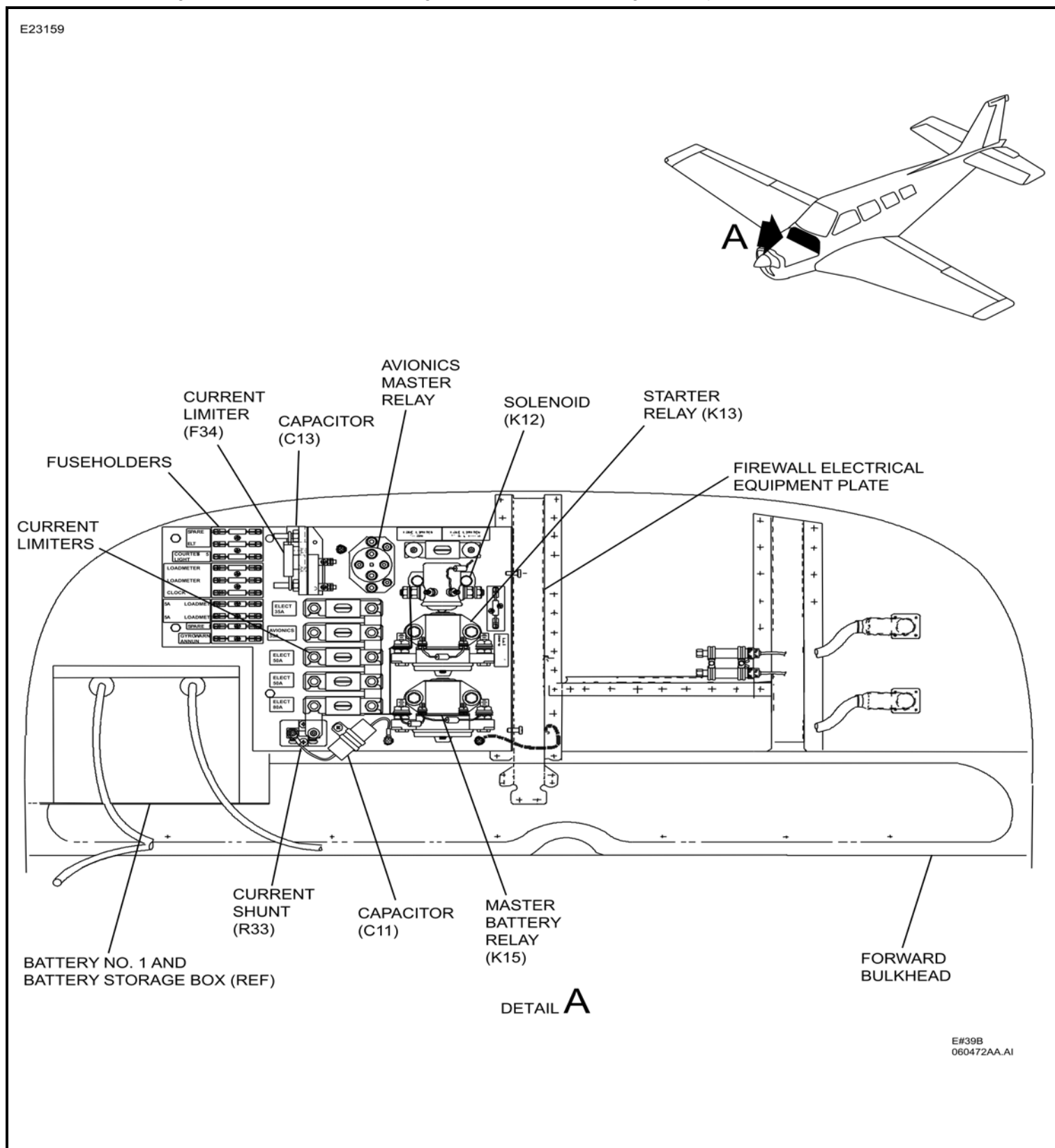


Figure 204 : Sheet 1 : (Revised) - Area Beneath the Floor From the Firewall to the Rear Spar - Zones 140/150

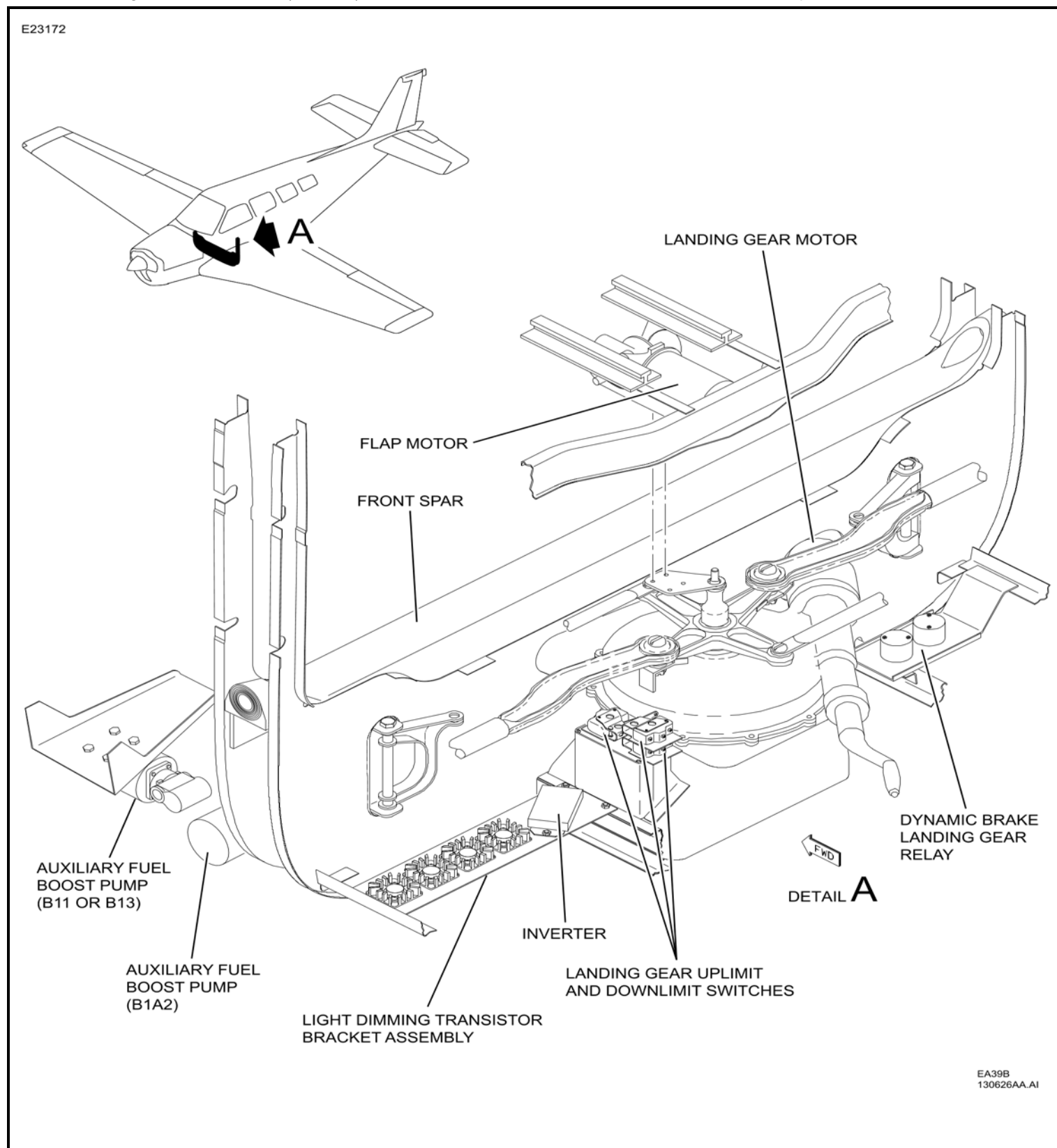
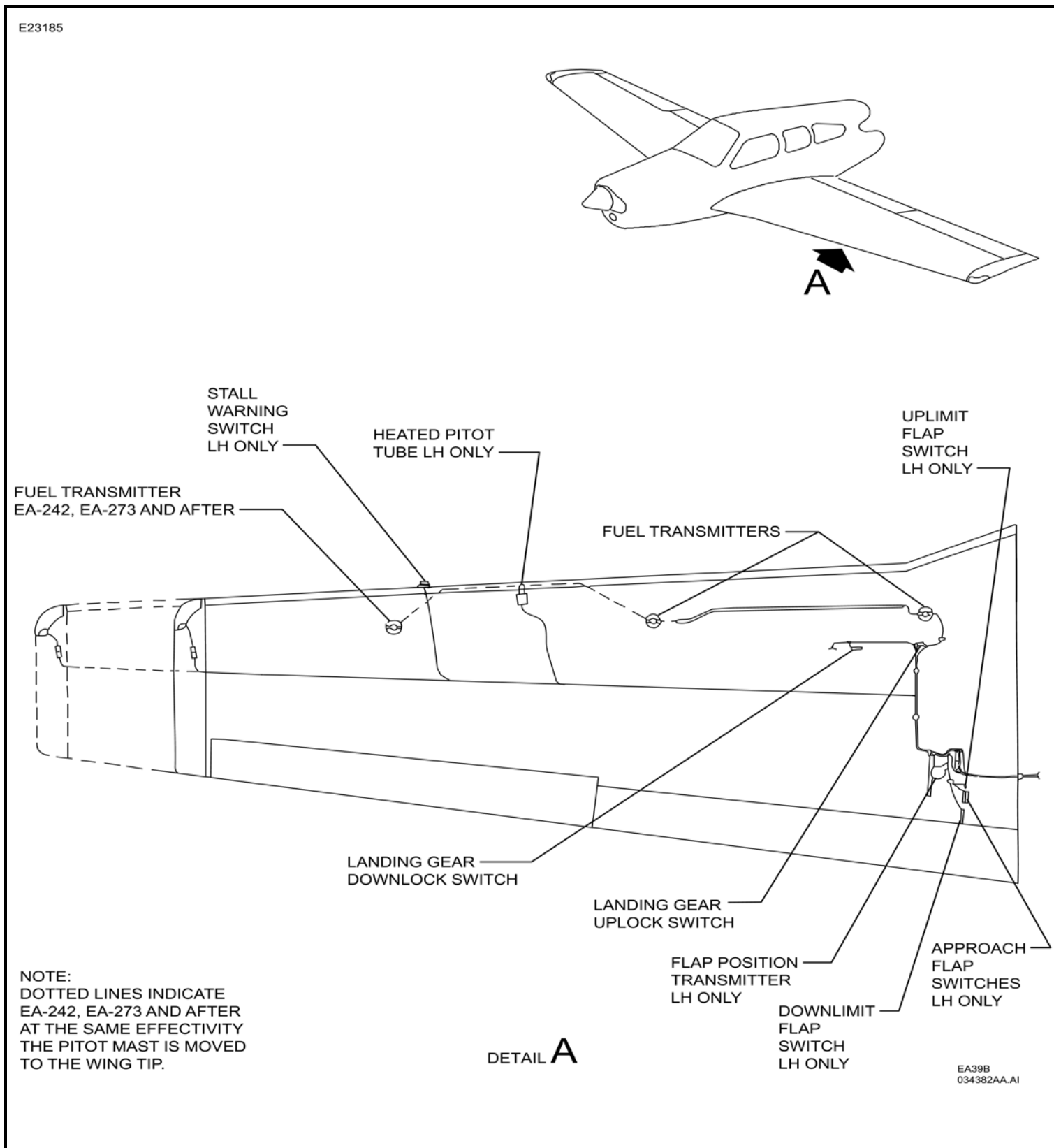


Figure 205 : Sheet 1 : Area Which Includes the Wings and Main Landing Gear (Left Wing Shown) Zones 531 thru 650 and Zones 730 and 740



STRUCTURES - GENERAL

1. General - Description And Operation

The airplane is all metal with a semimonocoque type construction. Stresses are carried by both the skin and stiffener members of the fuselage, wings and empennage. The airplane has primarily a riveted structure. Field repairs to skins and stiffener members may be accomplished with standard materials and hand tools. The basic structure of the airplane is the fuselage, which is constructed of bulkheads strengthened with longerons, stringers and skin panels.

The wing sections are attached to the fuselage carry through structure by front main and rear spars. The leading edge and rear panel (box section) of each wing are attached to the main spar by continuous piano type hinges. The wing tip is attached to the last outboard wing rib. The horizontal and vertical stabilizers are each constructed around two channel-section spars and are covered with a skin stiffened by internal beads. Each is attached to the fuselage at the front and rear spars. The elevators and rudder both have a main spar and ribs.

A. Primary Structural Components

The following primary structural components are essential to the proper function of the airplane. Damage occurring to any of the components would seriously endanger the safety of the airplane and/or the passengers.

- (1) Control systems.
- (2) Engine mounts.
- (3) Fittings.
- (4) Skins of the fuselage, wings, tail surfaces and control surfaces.
- (5) Wing, tail surface, and control surface spars.
- (6) Landing gears and support structures.
- (7) Auxiliary members used to strengthen or support other members carrying direct loads.
- (8) Seats and seat structure.

B. Structural integrity of V35B and V35B-TC airplanes is improved by installation of Kit No. 35-4016-7 S. The kit will provide additional support to the leading edge of the stabilizers and can be installed without removal of the stabilizer.

C. Secondary Structural Components

In the event of damage, the following secondary structural components would require immediate attention, but would not necessarily endanger the safety of the airplane and/or the passengers.

- (1) Wing tips.
- (2) Fairings.
- (3) Nonstructural doors and covers.
- (4) Furnishings and upholstery (excluding seating).

STRUCTURES - MAINTENANCE PRACTICES

1. General - Maintenance Practices

A. Structural Repair

In general, structural repair methods used on the airplane may be in accordance with AC 43.13-1A AIRCRAFT INSPECTION AND REPAIR MANUAL and AC 43.13-2 AIRCRAFT ALTERATIONS MANUAL. Never make a skin replacement or patch from a material thinner than the original skin. Patches should be of the next thicker material. The following considerations are recommended in addition to AC 43.43-1 and AC 43.13-2 for repair of the airplane.

- (1) All lap joints, including patches must have at least two staggered rows of rivets.
- (2) All repair material must be free of any defects such as nicks, scratches etc. which can cause stress to rise.
- (3) Never dimple a structural member by driving the rivet head into the part.
- (4) Do not countersink deeper than 75% of the material thickness.

B. Repair Of Fiberglass Components

- (1) Large holes and cracks require that the damaged area be cut out and trimmed just beyond the area of damage. If the parts are painted, remove the paint and sand that portion of the part extending at least two inches beyond the cutout.
- (2) Prepare three patches of laminated glass cloth such as Trevano, Uniglas or their equivalent. Cut the first patch to the dimensions of the sanded area, the second patch a half inch smaller than the first and the third patch a half inch smaller than the second.
- (3) Prepare the MIL-R-7575 resin (24, [Table 1](#), 91-00-00) for the patch in accordance with the manufacturers instructions. Make sure that your hands are free of oil, grease and dirt when handling the resin.
- (4) Apply an even coat of resin to the sanded area. Impregnate all three laminated glass cloth patches by laying the patches on clean waxed paper and working the resin through the fabric with a two inch brush.
- (5) Place the large patch over the cutout area, working out all bubbles and wrinkles. If the patch starts to sag, place a support behind the repair area. Coat the support with automobile wax to prevent the resin from adhering to the support. Work out all air bubbles and wrinkles while installing the second patch over the first. Install the third patch over the second in the same manner.
- (6) Brush the repaired area with an even coat of resin. After the patches have cured for 24 hours at temperatures between 23° C (75° F) and 68° C (150° F), blend the patch into the contour of the part with fine sandpaper. Paint the repair to match the rest of the part.

DOORS - GENERAL

1. General - Description And Operation

A. Cabin Door

The airplane is provided with a cabin door which furnishes access to the flight compartment. The door is located on right side of the fuselage between FS 58.00 and FS 100.00 on the Model A36 series airplanes and between FS 68.00 and FS 104.9 on the Model 33 and 35 series airplanes. Each door is hinged on the forward side of the door at two points, and a door stop is located on the bottom edge of each door.

The cabin door is provided with an aft outside and forward inside door handle. The outside handle contains the cabin door lock and tumbler assembly. The door contains three latches: a hook latch on the upper edge of the door, a sliding bolt latch on the aft side of the door and a pin type latch on the lower edge of the door. A cable assembly connects the movement of the upper latch and a bell crank assembly controls the movement of both the aft and lower pin latches. An optional courtesy light is installed in the door above the window. The wiring for the courtesy light exits the door above the upper door hinge.

B. Cabin Door Quick Release Mechanism (CJ-149 and After Only)

The cabin door can be instantaneously jettisoned by a quick release mechanism in the event of an emergency. The quick release mechanism actuates the door latches through a lever and cam arrangement. To prevent accidental activation of the mechanism the red handle that actuates the release is secured to the escutcheon on the door by an aluminum catch and a single strand of safety wire. The wire breaks and the aluminum catch straightens out to release the handle when the latter is pulled. The cam on the lever to which the handle is attached then rotates to actuate the link that unlatches the upper and lower door latches. Simultaneously, an actuator on each end of the quick release lever rotates and, through inter connecting links, withdraws the retainers that lock the upper and lower hinges in place around the hinge pins. This completely releases the door from the fuselage.

C. Utility Doors (E-1111, E-1241 and After; EA-11 and After)

The A36 series airplanes are provided with two utility doors which furnish access to the cabin area. The doors are located on the right side of the fuselage between FS 124.55 and FS 170.00. Each utility door contains a window, with the forward door being hinged on the forward side and the aft door being hinged on the aft side. Each utility door has a folding door stop located at the bottom edge of each door.

The forward utility door contains an outside D-ring latch handle with a lock and tumbler assembly and an inside latch handle. The forward door contains three latches: two pin type latches one on top and one on the bottom edges of the door and a bayonet latch which makes contact with the striker plate on the aft door. The movement of the three latches is controlled by a bell crank assembly. The aft utility door contains a lever type handle on the front edge, inside of the door. The door contains two hook type latches which each engage a striker plate lip at the top and bottom of the door sill. The movement of the two latches is controlled by a bell crank assembly.

D. Baggage Doors (CE-748, CE-772 and After; CJ-149 and After; D-10097, D-10120 and After)

Bonanza airplanes other than the A36 series are provided with an optional (small or large) baggage door for cargo storage. The doors are located on the right side of the fuselage. The small door is located between FS 131.00 and FS 151.00 and the large door is located between FS 131.00 and FS 170.00. Either door is hinged on the forward side. The small baggage door has a stop rod on the forward inboard side of the door near the door hinge and the large door has a scissors type door stop connecting the top of the door sill to the top of the baggage door.

The small baggage door contains a combination latch and lock mechanism located on the aft side of the door. The latch makes contact with a striker plate on the door sill. This is the only latching device on the small baggage door. The large baggage door contains an outside and inside D-ring latch handle. A lock assembly is provided and is located beside the handle. The large baggage door contains three pin type latches located on the aft edge and the top and bottom edges of the door. The movement of the three latches is controlled by a bell crank assembly.

CABIN PASSENGER/CREW DOOR - MAINTENANCE PRACTICES**1. Cabin Passenger/Crew Door - Maintenance Practices**

- A. Cabin Door Removal (E-1111, E-1241 and After; EA-11 and After; CE-748, CE-772 and After; D-10097, D-10120 and After)
Refer to [Figure 201](#).

- (1) Remove the inboard door handle.
- (2) Remove the window upper molding trim.
- (3) Remove the armrest, upholstery panel and the ash tray.
- (4) If the optional courtesy light is installed, disconnect the wire splice which is located behind the right side of the instrument panel.
- (5) With the door open, insert a screwdriver between the door stop and the bottom of the door. Slowly close the door while applying a downward pressure on the door stop until the stop is released from the door.
- (6) Remove the two phillips screws from each hinge cover.
- (7) Remove the remaining screws which secure the door frame to the hinges.

NOTE: At the upper hinge, four screws are located aft of the hinge cover; on the lower hinge, three screws are aft of the hinge cover.

- (8) Carefully remove the door by pulling the door directly away from the hinges.

NOTE: Shims have been installed between the hinges and the door to obtain a proper fit. The shims should be retained and the same number of shims installed, where removed, under each hinge when the door is reinstalled.
Door assembly may be adjusted up or down and forward or aft by sliding door on hinges. Adjust inboard or outboard by changing shims to inboard or outboard side of hinges. Do not omit hinges.

- B. Cabin Door Installation (E-1111, E-1241 and After; EA-11 and After; CE-748, CE-772 and After; D-10097, D-10120 and After)

- (1) If the door is new, place the door in position and mark the door hinge tab and perimeter of the door frame where any excess material needs to be removed. Remove the excess material to obtain the best fit prior to installing the seal.
- (2) On a new door, install new door seals around the inside edge of the door frame. Check the old door for reference to a new door seal location.
- (3) Place the door in position, making sure the upper and lower door hinge shims are in place. The same number of shims should be used on installation of the door as when the door was removed. The shims serve to keep the door flush to the fuselage.
- (4) Attach the four phillips screws aft of the upper door hinge which secure the door frame to the hinge. Attach the three phillips screws aft of the lower door hinge.
- (5) Attach the upper and lower hinge cover plates; each is attached with two phillips screws.
- (6) Install the door stop in the channel located on the bottom edge of the door.

NOTE: The upper door hook latch bracket, located in the door sill above the door, should be preset flush with the door sill.

- (7) If the door contains the optional courtesy light installation, feed the wire from the courtesy light to the location behind the right side of the instrument panel by routing the wire above the door hinge to behind the panel. Splice the courtesy light wire to its connecting wire.
- (8) Install the upholstery panel, ashtray and armrest.
- (9) Install the window upper molding trim.
- (10) Install the inboard door handle.
- (11) If adjustments to the installed door are required, refer to [CABIN DOOR ADJUSTMENT](#).

- C. Cabin Door Removal (CJ-149 and After Only)

To remove the door, cut safety wire securing the quick release handle (red) in place and straighten out the aluminum catch. Pull the handle that disengages the hinge pin retainers and remove the door.

CAUTION: Support the door carefully to avoid damaging the wing when the quick release frees the door.

- D. Cabin Door Installation (CJ-149 and After Only)

To install the door, position the door so that the hinge pins slide into the hinge slots, then push in the quick release handle (red)

until the retainers engage the holes in the hinge to lock the hinges in place around the hinge pins. Bend the aluminum catch back in place over the handle and secure the handle to the catch with one wrap of 0.020 in. (0.051 cm) diameter copper wire per QQ-W-343 Type S.

E. Cabin Door Adjustment

If any of the following conditions exist, check and adjust the cabin door latching mechanism:

- The door is difficult to close.
- There is excessive wind noise around the door.
- The door is not airtight or watertight.
- The door is opening in flight.
- The door has recently been removed or repaired.

(1) Ensure that the door's internal latch mechanism is not binding and/or preventing proper door closing as follows:

- (a) With the door in the open position, operate the latching mechanism several times to ensure that the internal mechanism is operating smoothly and properly.
- (b) With the door still in the open position, rotate the inside door handle counterclockwise as far as possible. Mark the inside handle escutcheon plate at the edge of the blade protruding from the inner forward end of the handle.
- (c) Place the latch in the open position and then close and latch the door. Check to see that the handle rotates to the position that was marked in the previous step. If the handle does not line up with the mark, open the door and remove the door upholstery. Inspect the latching mechanism to determine the reason for the interference and make the necessary adjustments.

NOTE: The areas of possible interference are where the lower pin, the upper latch hook, and the aft latch bolt engage in the door frame.

(2) The latches may require adjustment to ensure positive door locking as follows:

- (a) Upper Latch - There are three points that should be inspected and/or adjusted on the upper latch.
 - 1 Check to ensure that the upper latch mechanism is over center when the door is latched. This can be accomplished by using a small inspection mirror to see that the upper operating link is against the adjustment screw and the forward edge of the upper operating link is forward of the forward edge of the lower operating link. If the latch mechanism is not over center when the door is latched, adjust the over center stop screw (Refer to [Figure 202, Sheet 1](#)).
 - 2 Check to ensure that the upper latch hook pin is positioned so that it is almost touching the aft portion of the hook without riding on the hook. If the upper hook does not properly engage the pin, move the pin forward or aft (it has four positions) to obtain proper adjustment.
 - 3 Check for proper adjustment of the door upper latch bracket in the door sill above the door. If the door does not fit properly in the frame (inboard/outboard) when closed and latched, leaving a noticeable gap between the door and the frame, the upper latch bracket needs to be adjusted in to create more tension on the door. This can be accomplished by adjusting the forward tension screw.
- (b) Lower Latch - The lower aft latch pin should be adjusted in the latched (closed) position so that the shoulder (straight sided) portion of the pin has extended through both the striker plate and the door opening frame to a minimum of 0.05 in. (0.13 cm) above the tapered area of the pin. The latch pin must engage a minimum of 0.33 in. (0.84 cm) below the lower surface of the door opening frame (Refer to [Figure 202, Sheet 2](#)). Adjust the latching pin as follows, so that it just clears the striker plate when the latch is in the unlatched (open) position, and does not interfere with door opening.

NOTE: The amount of the latching pin protruding from the door with the latch mechanism open will depend on the gap between the bottom of the door and the door frame in the fuselage.

- 1 Remove the safety wire in the turnbuckle.
- 2 Turn the barrel to extend or retract the pin as necessary.

NOTE: It may be necessary to shorten the pin guide by grinding a maximum of 0.2 in. (0.51 cm) off the top of the pin guide in order to obtain enough travel to make this adjustment.

- 3 For E-2711, E-2728 and After, EA-537 and After and prior airplanes with Kit 36-4007-1 installed, perform the following steps, otherwise proceed to Step 5.
 - a Adjust turnbuckle so the latching pin will extend a minimum of 0.85 in. (2.16 cm) through door pan when the latching mechanism is in the over center (latched) position. The latching pin may extend up to 0.18 in. (0.46 cm) out of the door pan when the latch mechanism is in the unlatched position (Refer to [Figure 203](#)).

- (3) Install any upholstery and/or equipment that was removed.

When a lock on the baggage compartment door, cabin door or ignition is broken or worn, it is not necessary to install a full set of replacement locks with a new key. A new tumbler can be readily converted (one time), for use with an old key. To fit a new tumbler to a key proceed as follows:

- (1) Insert the key to be used into the new lock.
- (2) With key in the unlocked position, examine the top of the lock barrel where the slots for the tumbler are located.
- (3) Note that one or more tumblers are protruding through the slot.
- (4) With a fine file, remove the raised portion of each of these tumblers. The key will now operate the new lock.
To install a new lock in the cabin door, proceed as follows:
- (5) Loosen the upholstery panel on the cabin door to gain access to the handle mechanism through the cutout in the channel under the latch assembly.
- (6) Remove the lower aft screw from the external door handle fairing directly under the lock mechanism and remove the pin from the handle through the cutout in the door channel.

NOTE: Both the extreme aft screw and the lower aft screw of the outside latch housing serve as retainers. The extreme aft screw secures the door handle spring in position, and the lower aft screw retains the sliding bolt latch pin in position.

- (7) Remove the aft screw from the external door handle fairing. This will free the handle spring and allow the handle to be disengaged from the actuating assembly.
- (8) After fitting the new lock to the key, install the lock barrel in the unlocked position into the handle.
- (9) Bevel the edges of the square hole in the locking cam (beveled edge must face out) and place the cam on the end of the lock barrel. The locking lug on the cam must be in line with the handle.
- (10) Cover a steel plate with cloth to prevent marring the latch handle and peen the end of the lock barrel until the locking cam is firmly riveted in place.
- (11) Install the handle in the door.

G. Removing and Installing the Cabin Door Teleflex Cable

- (1) Remove the inside door handle and the machine screws on the upper door facing.
- (2) Remove the door upholstery panels.
- (3) Remove the bolt securing the teleflex cable to the upper door latch.
- (4) Remove the bolt securing the lower end of the cable to the lower actuating arm.

NOTE: Attach a length of safety wire to the lower end of the cable before removing it from the door and leave the wire in the cable track as a means of positioning the new cable.

- (5) Grasp the upper end of the cable with vise grip pliers and pull it out through the upper latch opening. Remove the safety wire from the cable.

NOTE: Braze or silver solder two AN340-832 nuts to two new AN742-4 clamps.

- (6) Prior to installing the upper clevis, place one of the newly prepared clamps between the shoulders on the lower end of the cable housing and attach the safety wire remaining in the door to the upper end of the cable housing.
- (7) Pull the housing into position by gripping it with vise grip pliers below the shoulder at the lower end. Pull on the safety wire attached to the upper end while tapping on the vise grip pliers to drive the housing through the door channel.
- (8) Align the lower clamp with the hole in the door facing and secure it with a machine screw, then install the upper clamp in place on the housing and secure it in the same manner.
- (9) Install the upper clevis and attach the cables to the upper and lower latch connections.
- (10) Adjust cable tension by varying the cable length at either latch connection.

H. Interior Cabin Door Handle

- (1) Interior Cabin Door Handle Removal And Installation

NOTE: It may be necessary to place the interior cabin door handle in the unlatched position to access both screws that secure the door handle.

- (a) Remove the two screws that secure the interior door handle base plate.
- (b) Slide the interior door handle from the shaft, maintaining the same orientation of the door handle with respect to the shaft (Refer to [Figure 204](#)).
- (c) Rotate the door handle 90° clockwise, maintaining the base plate in the same position.

NOTE: Interior door handle configuration of some airplanes may differ from that shown in [Figure 204](#). Initial setup is important to confirm proper movement and operation of the latching points.

- (d) Remove the necessary hardware and adjust clevis as required to position the inside door shaft assembly to approximately 30° below horizontal when in locked position.
- (e) Attach clevis to inside door shaft assembly with removed hardware.
- (f) Slide the interior door handle over the shaft and secure using the screws removed in Step (a).
- (g) Latch the door by rotating the interior door handle counterclockwise.

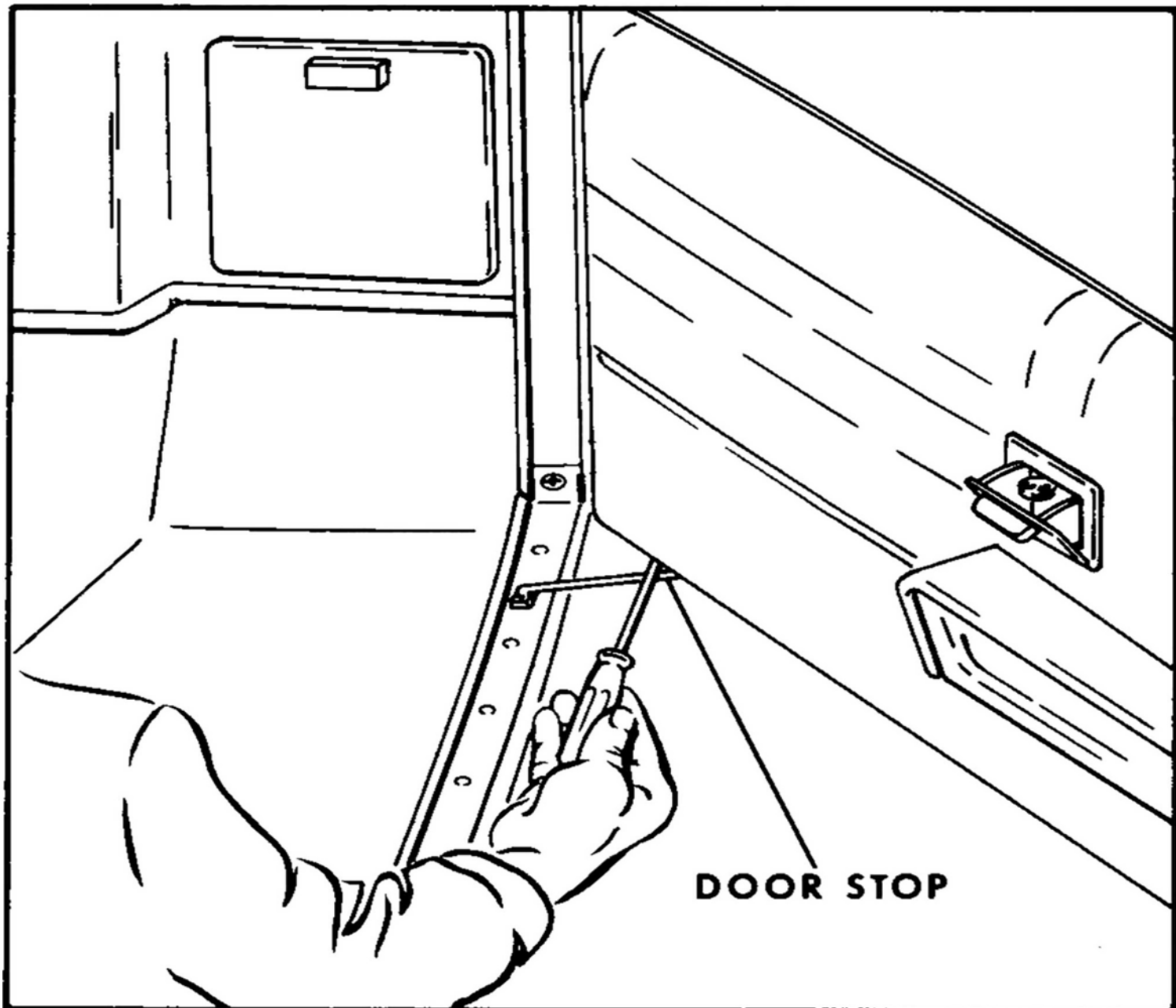
CAUTION: Rotation of the interior door handle without depressing the handle lock release button should not result in unlatching of the door.

- (h) Rotate the interior door handle clockwise without depressing the handle lock release button. If the door remains

- latched, proceed to Step (i). If the door becomes unlatched, repeat Steps (a) thru (e).
- (i) With the door latched, depress the handle lock release button while rotating the door handle clockwise. The door should unlatch.

Figure 201 : Sheet 1 : Cabin Door Stop

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Figure 202 : Sheet 1 : Cabin Door Latch Points

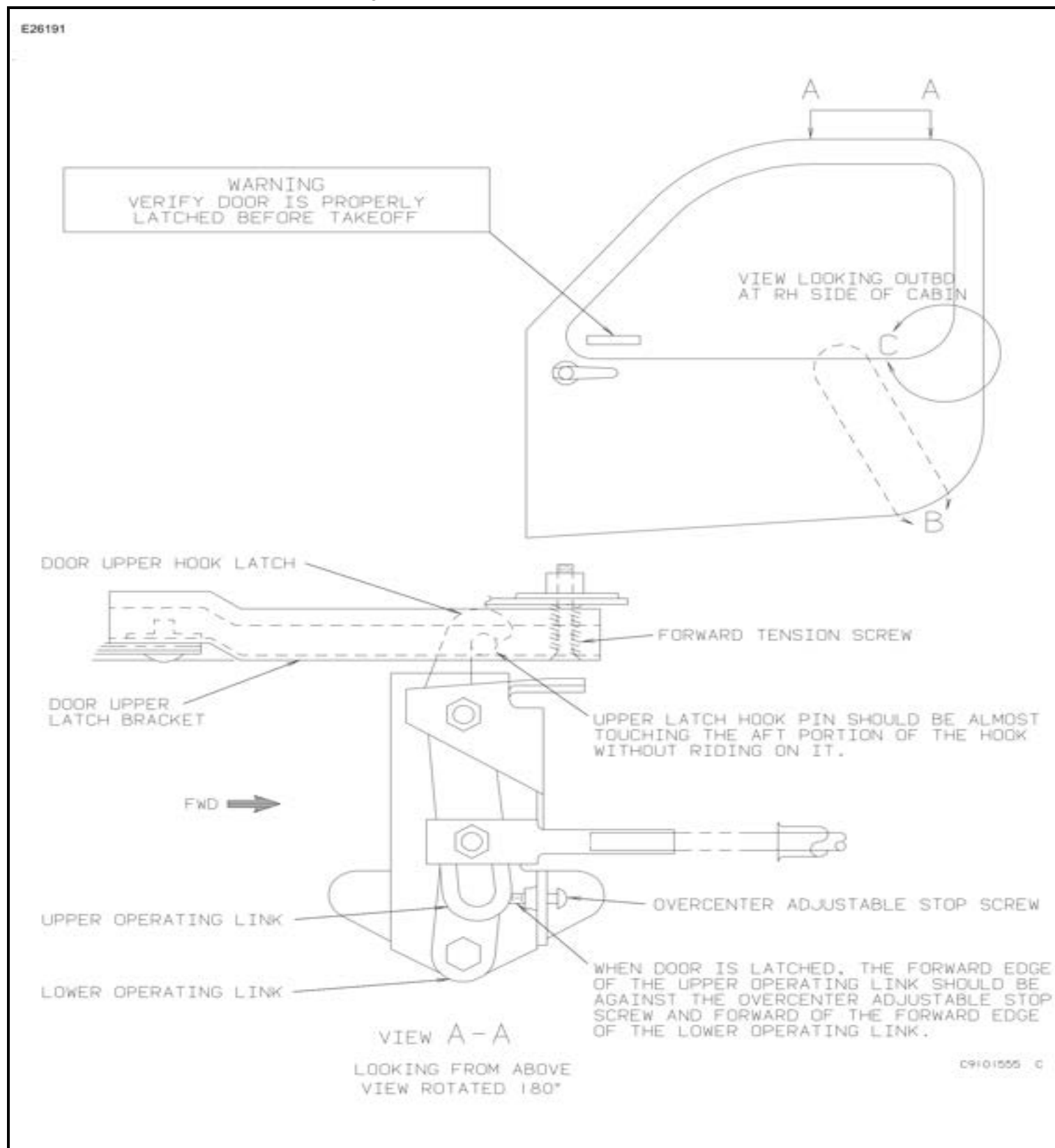


Figure 202 : Sheet 2 : Cabin Door Latch Points

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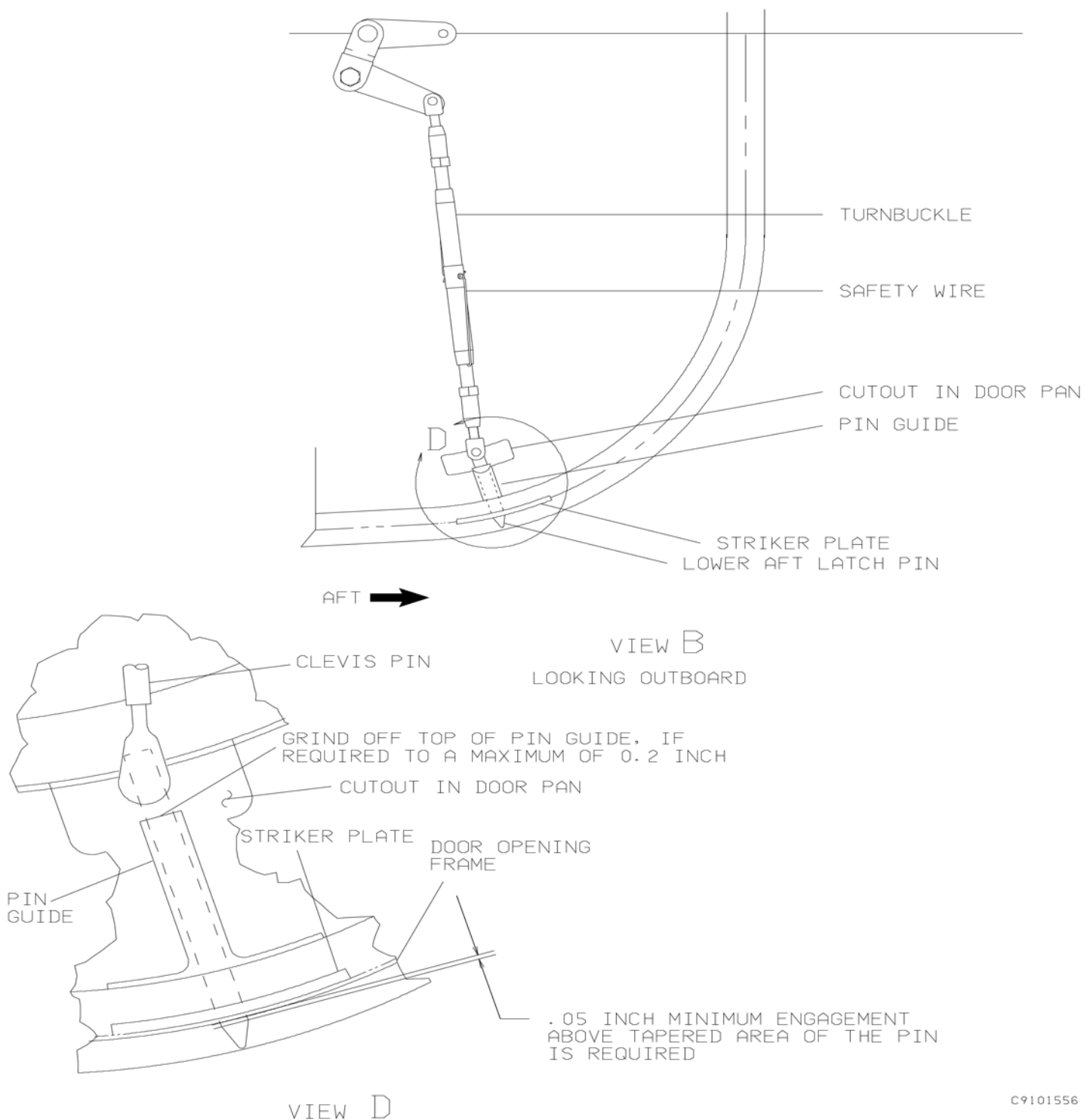


Figure 202 : Sheet 3 : Cabin Door Latch Points

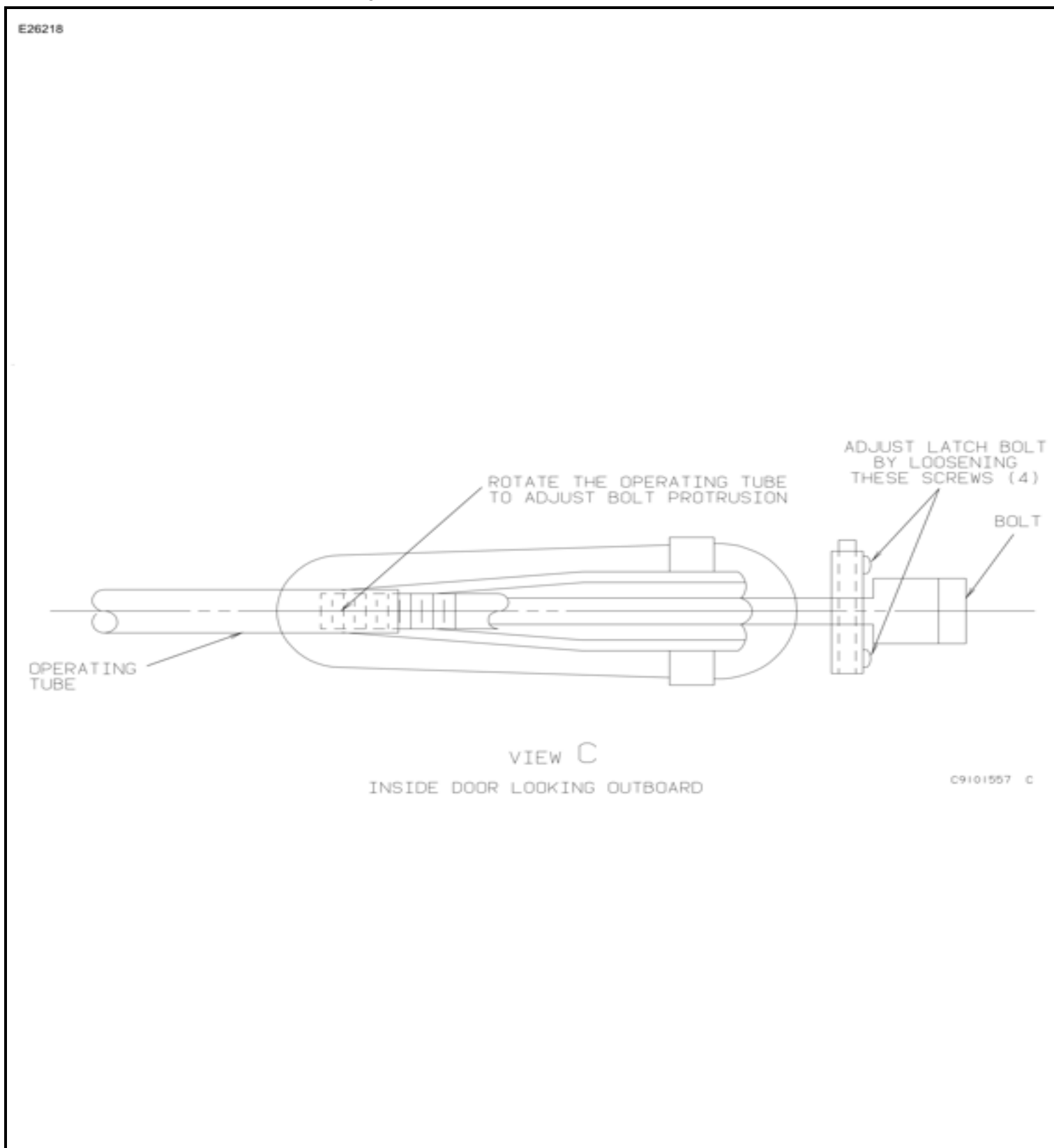


Figure 203 : Sheet 1 : Cabin Door Lower Linkage Adjustment(E-2711, E-2728 and After; EA-537 and After, Prior Airplanes with Kit 36-4007-1 Installed and Airplanes compliant with MSB 2457 by installing Kit P/N 36-4007-1P or Kit P/N 36-4008-1P)

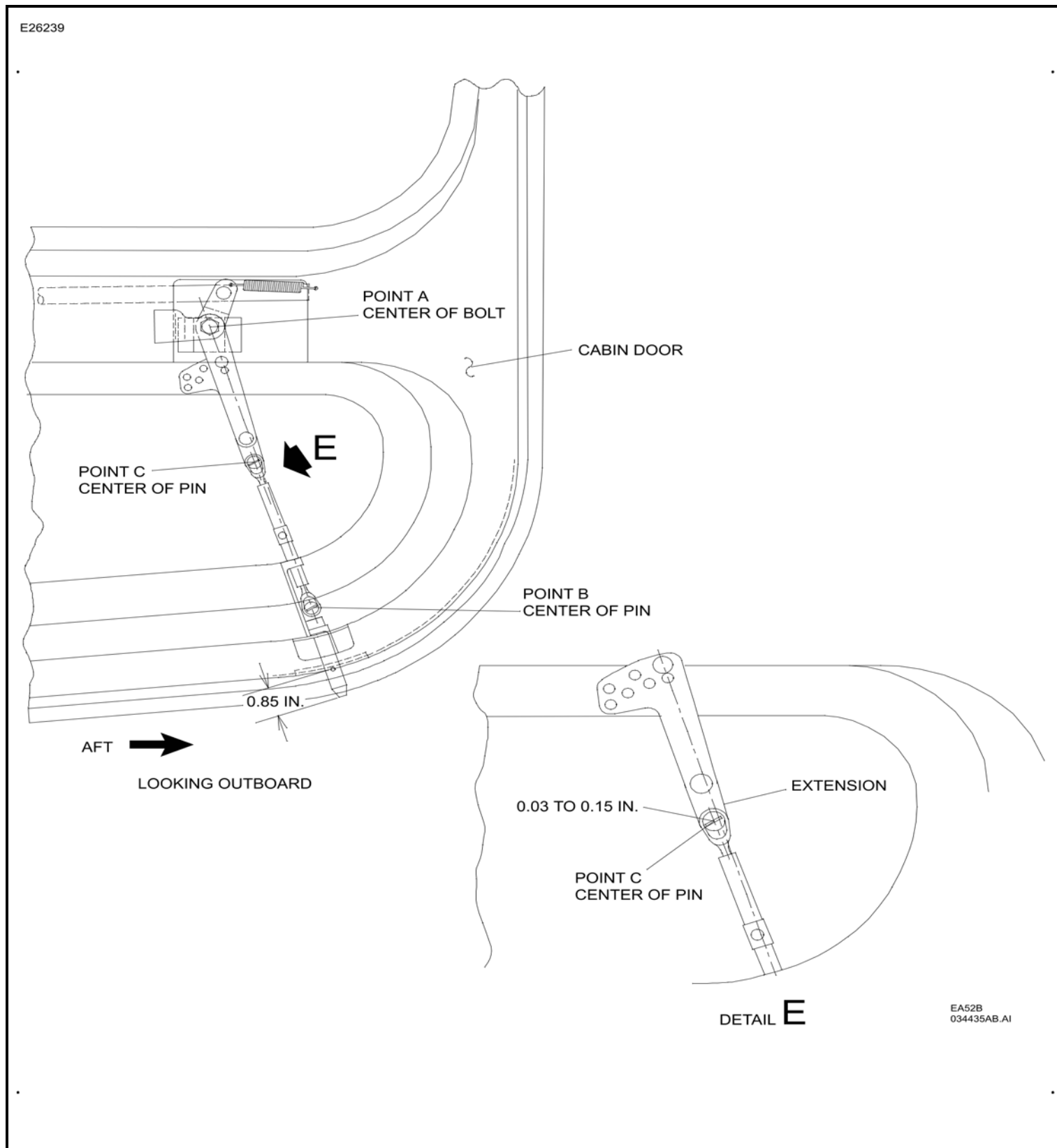
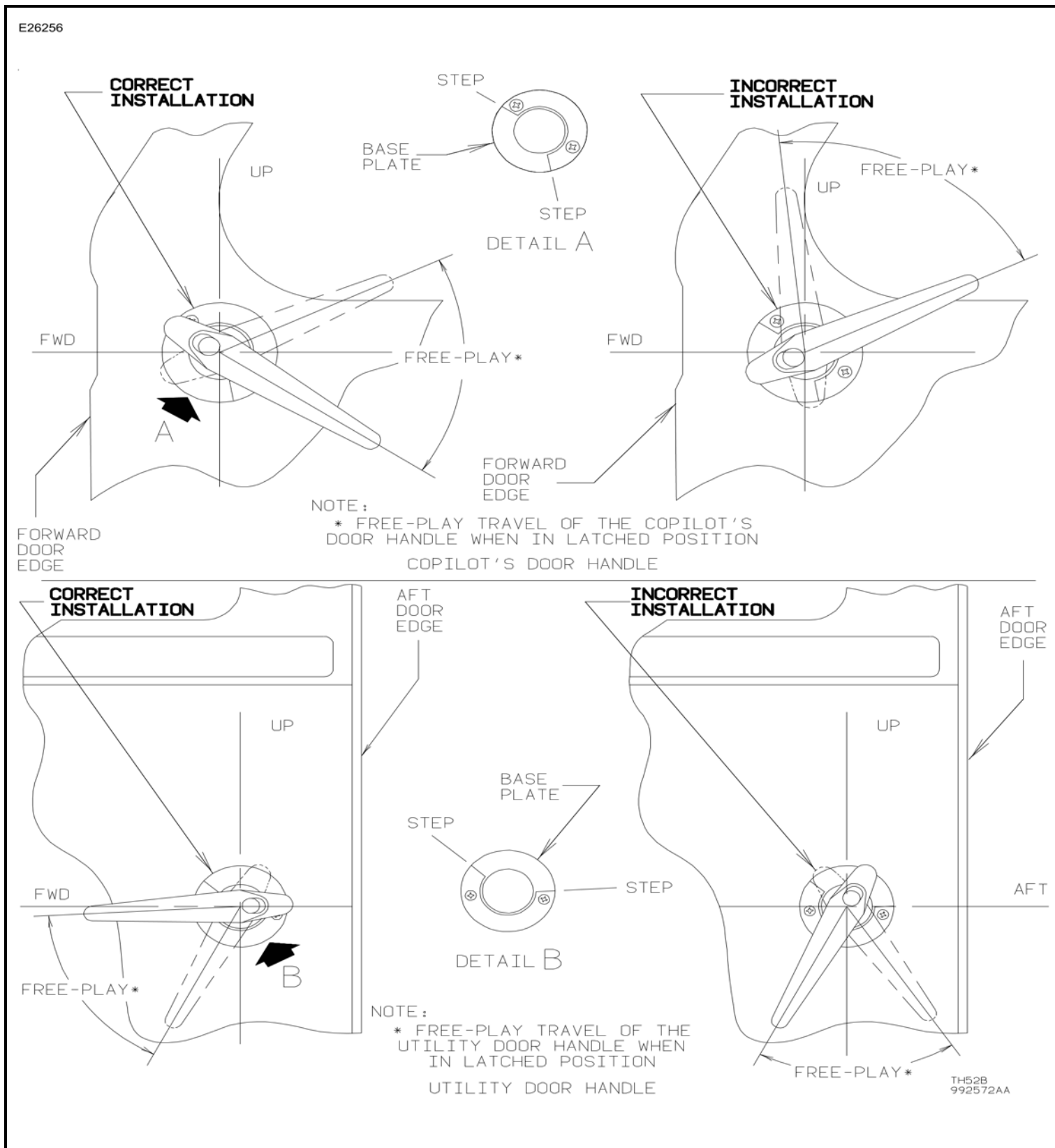


Figure 204 : Sheet 1 : Interior Crew Door Handle and Interior Utility Door Handle Installation and Orientation



CARGO - MAINTENANCE PRACTICES**1. Cargo - Maintenance Practices****A. Utility Door Removal (E-1111, E-1241 and After; EA-11 and After)**

- (1) With the doors open, remove the screws that attach the scissors door stop to the door sill.
- (2) Support the doors and remove the hinge pins by pulling straight up.

B. Utility Door Installation (E-1111, E-1241 and After; EA-11 and After)

- (1) Support the doors and install the hinge pins.
- (2) Install the screws that attach the scissors door stop to the door sill.

C. Utility Door Adjustment (E-1111, E-1241 and After; EA-11 and After)

If the utility door does not close properly or permits air leaks while completely closed, several adjustments may be made to assure proper sealing of the door. After determining the origin of the air leakage as to whether it is from around the forward half of the utility door or the aft half of the door, make the following adjustments as necessary:

(1) Adjustment Of The Aft Half Of The Utility Door

- (a) Adjustments of the aft door may be performed by removing the upholstery paneling and shortening or lengthening the door latch connecting tube assembly.

NOTE: By shortening the connecting tube assemblies, the door will be pulled tighter against the door seal.

- (b) To adjust the length of the connecting tube assembly, remove the cotter key, washers and pin. Turn the pin eye "in" to shorten the tube assembly and turn the pin eye "out" to lengthen the tube assembly.
- (c) After the desired length has been set, install the pin, washers and cotter key.
- (d) Replace the upholstery paneling.

(2) Adjustment Of The Forward Half Of The Utility Door

- (a) If air leakage is found around the forward half of the door, the necessary adjustments may be made at the aft door latch striker plates, located slightly above and below the upper and lower door sill of the aft door.
- (b) For a tighter fit, loosen the screws on the upper and lower striker plates on the aft door and move them inboard. By moving the plates inboard, the aft door will adjust inboard thus pulling inward the forward door when it is latched.

D. Utility Door Latch Pin Adjustment (E-1111, E-1241 and After; EA-11 and After)

If the forward door does not open freely, the door latch pins may not be retracting enough. This may be corrected by the following adjustments:

- (1) Remove the upholstery paneling.
- (2) Remove the cotter keys, pins and washers.
- (3) Loosen the pin eye jam nut and turn the pin eye "in" to shorten the tube assemblies; turn the pin eye "out" to lengthen the tube assemblies.
- (4) After the desired length has been set, tighten the pin eye jam nut. Install the pins, washers and cotter keys.
- (5) Replace the upholstery paneling.

E. Interior Utility Door Handle Removal and Installation

Refer to [52-10-00, 201](#), INTERIOR CABIN DOOR HANDLE for the removal, installation and checkout instructions for the interior utility door handle.

F. Large Baggage Door Removal (CE-748, CE-772 and After; CJ-149 and After; D-10097, D-10120 and After)

- (1) On the large type door, unlatch the door and remove the scissors type door stop at the top of the door.
- (2) Remove the door hinge pin.

G. Large Baggage Door Installation (CE-748, CE-772 and After; CJ-149 and After; D-10097, D-10120 and After)

- (1) Install the door hinge pin.
- (2) Install the scissors type door stop at the top of the door.

H. Small Baggage Door Removal (CE-748, CE-772 and After; CJ-149 and After; D-10097, D-10120 and After)

- (1) On the small door, unlatch the door and remove the door hinge pin while carefully holding the door in position.
- (2) Disconnect the door stop rod from the door at the door.

- I. Small Baggage Door Installation (CE-748, CE-772 and After; CJ-149 and After; D-10097, D-10120 and After)
 - (1) Connect the stop rod to the door.
 - (2) While carefully holding the door in position, install the hinge pin.
- J. Baggage Door Adjustment (CE-748, CE-772 and After; CJ-149 and After; D-10097, D-10120 and After)
 - (1) If the large baggage door does not open freely, the door latch pins may not be retracting enough. This may be corrected by the following adjustments:
 - (a) Remove the upholstery paneling.
 - (b) Remove the cotter keys, pins, and washers.
 - (c) Loosen the pin eye jam nut and turn the pin eye "in" to shorten the tube assemblies; turn the pin eye "out" to lengthen the tube assemblies.
 - (d) After the desired length has been set, tighten the pin eye jam nut. Install the pins, washers and cotter keys.
 - (e) Replace the upholstery paneling.
 - (2) If additional inward tension for a tighter fit of the door is required, adjust inward the three striker plates on the door sill (large door), or inward on the single latch mechanism contact plate on the door sill (small door).

FUSELAGE - MAINTENANCE PRACTICES

1. Fuselage - Maintenance Practices

A. Wing Forward Spar Carry-Through Structure Inspection Without Repair Kit

This procedure provides inspection and repair information relating to the forward wing spar structure at the forward and aft frames.

NOTE: The areas identified in Figure 201 should be inspected for cracking at the intervals specified for non repaired structures by Table 201 using the following inspection procedure:

- (1) Remove the carry-through cover to obtain access to the forward spar carry-through structure. Refer to the FORWARD CARRY-THROUGH SPAR COVER REMOVAL procedure in Chapter 25-00-00.
- (2) Thoroughly clean the forward and aft frames (webs) of the forward spar carry-through structure in the areas shown in Figure 201 with solvent (26, Table 1, 91-00-00).
- (3) Perform a visual inspection of the cleaned areas for evidence of cracks.
- (4) Perform a fluorescent or dye penetrant inspection of the cleaned area per MIL-STD-6866 and inspect for evidence of cracks.
- (5) If cracks are discovered, determine the crack size and method of repair as outlined in the WING FORWARD SPAR CARRY-THROUGH STRUCTURE REPAIR/INSPECTION procedure.
- (6) If no cracks are noted, install the carry-through cover. Refer to the FORWARD CARRY-THROUGH SPAR COVER INSTALLATION procedure in 25-00-00.

B. Wing Forward Spar Carry-Through Structure Inspection With Repair Kit

NOTE: The areas identified in Figure 201 should be inspected for cracking at the intervals specified for repaired structures by Table 202 using the following inspection procedure:

- (1) Remove the carry-through cover to obtain access to the forward spar carry-through structure. Refer to the FORWARD CARRY-THROUGH SPAR COVER REMOVAL procedure in 25-00-00.
- (2) Thoroughly clean the forward and aft frames (webs and reinforcing doubler) of the forward spar carry-through structure in the areas shown in Figure 201 with solvent (26, Table 1, 91-00-00).
- (3) Perform a visual inspection of the cleaned areas for evidence of cracks.
- (4) Perform a fluorescent or dye penetrant inspection of the cleaned area per MIL-STD-6866 and inspect for evidence of cracks.
- (5) If cracks are discovered in the doubler or the existing web face, the crack has progressed beyond the doubler profile; contact the Technical Support Department at Textron Aviation Corporation for further instructions.
- (6) If no cracks are noted, install the carry-through cover. Refer to the FORWARD CARRY-THROUGH SPAR COVER INSTALLATION procedure in 25-00-00.

C. Wing Forward Spar Carry-Through Structure Repair/Inspection

NOTE: The extent of repair/inspection is limited to cracking in the radius of the web flange and cracks in the web face around the fasteners in the lower forward spar cap.

(1) Bend Radius Crack

The following procedure should be performed to repair/inspect cracks in the bend radius (Refer to Figure 201):

CAUTION: Caution must be used during the stop drilling operation. Do not drill into the spar cap, skin or any other structure. A thin stainless steel sheet may be used to prevent damaging adjacent structure.

- (a) A crack exceeding 4.0 inches in length must be repaired PRIOR TO FURTHER FLIGHT per the applicable kit listed in Table 203.
- (b) A crack up to 4.0 inches in length must be stop drilled with a #30 drill bit at the crack ends. The area must be repaired per the applicable kit listed in Table 203 within the next 100 flight hours, 12 months or the next scheduled inspection, whichever occurs first.

(2) Web Face Crack

The following procedure should be performed to repair/inspect cracks in the web face around the huckbolt fasteners (Refer to Figure 201):

CAUTION: Do not stop drill, due to the possibility of damaging structure behind web face.

- (a) A crack passing through two fasteners and extending beyond for more than 0.5 inch on either end shall be repaired

PRIOR TO FURTHER FLIGHT per the applicable kit listed in [Table 203](#).

- (b) Any other crack shall be repaired per the applicable kit listed in [Table 203](#) within the next 25 flight hours, 12 months or the next scheduled inspection, whichever occurs first.
- (3) Combination Bend Radius and Web Face Cracks
 - (a) If cracks are found in both the forward and aft frames on the same side of the airplane, in either the web face and/or the bend radius, and any of the cracks are more than 1.0 inch long, a repair shall be made PRIOR TO FURTHER FLIGHT.
 - (b) If cracks are found in both the forward and aft frames on the same side of the airplane, in either the web face and/or the bend radius, and all of the cracks are less than 1.0 inch long, a repair shall be made per the applicable kit listed in [Table 203](#) within the next 25 flight hours, 12 months or the next scheduled inspection, whichever occurs first.
 - (c) If a fuselage skin crack is discovered around the opening for the lower forward carry-through fitting, an external skin doubler may be required. Contact the Technical Support Department at Textron Aviation Corporation for further instructions.
 - (d) Install the carry-through cover. Refer to the FORWARD CARRY-THROUGH SPAR COVER INSTALLATION procedure in Chapter 25-00-00.

Table 201. Inspection Program for Non Repaired Structures

Aircraft Serial No.	Initial Inspection	Frequency of Inspection
Model F33A (CE-748, CE-772 thru CE-1192)	1,500 HOURS	500 HOURS
Model F33C (CJ-149 thru CJ-179)	1,500 HOURS	500 HOURS
Model V35B (D-10097, D-10120 thru D-10403)	1,500 HOURS	500 HOURS
Model A36 (E-1111, E-1241 thru E-2397)	1,500 HOURS	500 HOURS
Model A36TC (EA-11 thru EA-272, except EA-242) Model B36TC (EA-242, EA-273 thru EA-471)	1,500 HOURS	500 HOURS
Model F33A (CE-1193 and After)	3,000 HOURS	1,000 HOURS
Model A36 (E-2398 and After)	3,000 HOURS	1,000 HOURS
Model B36TC (EA-472 and After)	3,000 HOURS	1,000 HOURS

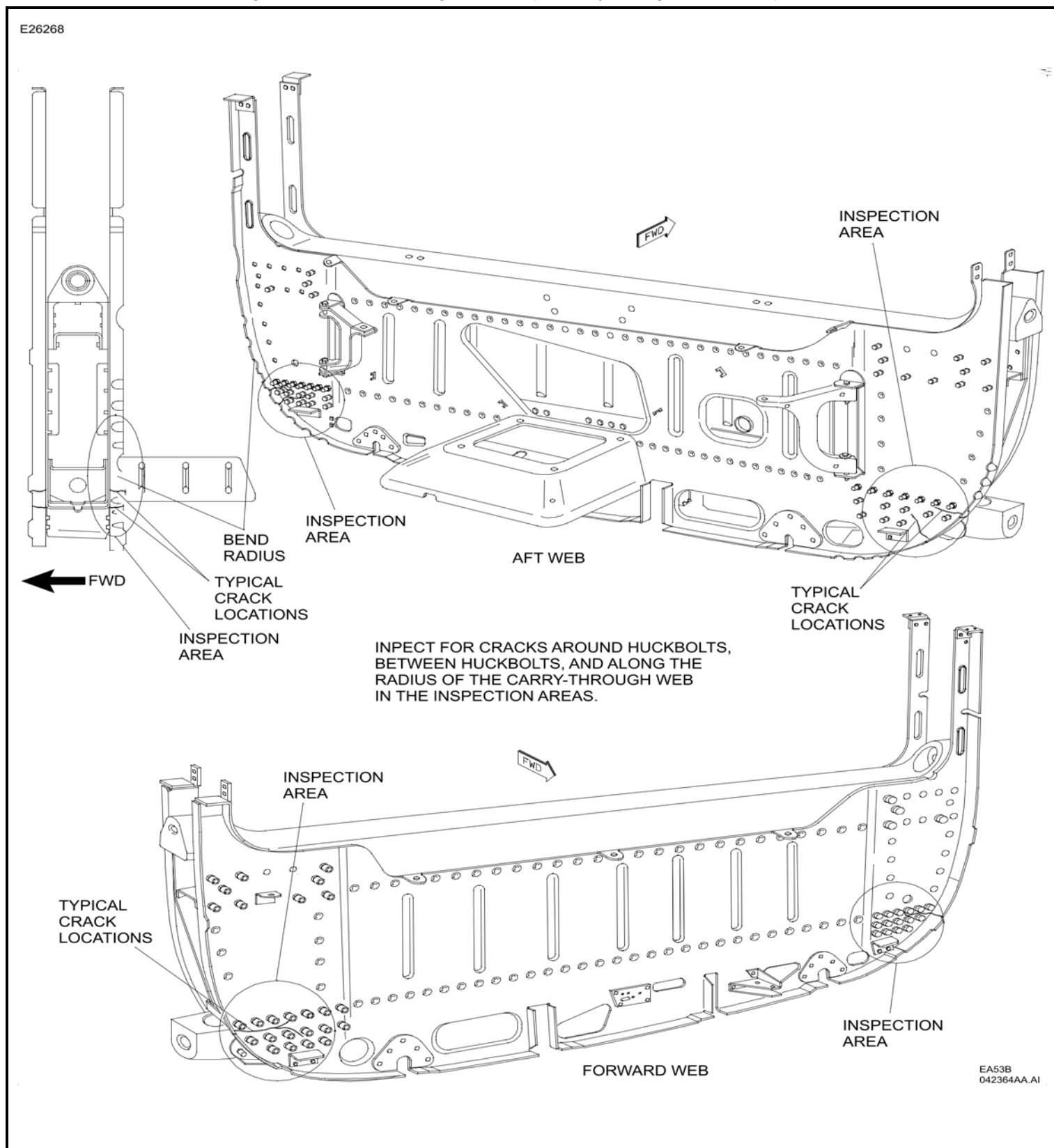
Table 202. Inspection Program for Repaired Structure

Aircraft Serial No.	Initial Inspection	Frequency of Inspection
Model F33A (CE-748, CE-772 thru CE-1192)	1,500 HOURS	500 HOURS
Model F33C (CJ-149 thru CJ-179)	1,500 HOURS	500 HOURS
Model V35B (D-10097, D-10120 thru D-10403)	1,500 HOURS	500 HOURS
Model A36 (E-1111, E-1241 thru E-2397)	1,500 HOURS	500 HOURS
Model A36TC (EA-11 thru EA-272, except EA-242) Model B36TC (EA-242, EA-273 thru EA-471)	1,500 HOURS	500 HOURS
Model F33A (CE-1193 and After)	3,000 HOURS	1,500 HOURS
Model A36 (E-2398 and After)	3,000 HOURS	1,500 HOURS
Model B36TC (EA-472 and After)	3,000 HOURS	1,500 HOURS

Table 203. Forward Spar Carry-Through Structure Repair Kits

Aircraft Serial No.	Part Number	Kit Description	Quantity Per Aircraft
Model F33A (CE-748, CE-772 and After) Model F33C (CJ-149 thru CJ-179) Model V35B (D-10097, D-10120 thru D-10403) Model A36 (E-1111, E-1241 and After) Model A36TC (EA-11 thru EA-241, EA-243 thru EA-272)	36-4004-5	Forward Sparcarry- Through Structure Reinforcement (Forward Frame)	1 Required
Model F33A (CE-748, CE-772 and After) Model F33C (CJ-149 thru CJ-179) Model V35B (D-10097, D-10120 thru D-10403) Model A36 (E-1111, E-1241 and After) Model A36TC (EA-11 thru EA-241, EA-243 thru EA-272)	36-4004-7	Forward Sparcarry- Through Structure Reinforcement (Aft Frame)	1 Required
Model B36TC (EA-242, EA-273 and After)	36-4004-9	Forward Sparcarry- Through Structure Reinforcement (Forward Frame)	1 Required
Model B36TC (EA-242, EA-273 and After)	36-4004-11	Forward Sparcarry- Through Structure Reinforcement (Aft Frame)	1 Required

Figure 201 : Sheet 1 : Wing Forward Spar Carry-Through Structure Inspection



PLATES/SKIN - MAINTENANCE PRACTICES

1. Plates/Skins - Maintenance Practices

- A. Fuselage Access Openings Refer to [Figure 201](#), [Figure 202](#) and [Figure 203](#)
- B. Fuselage Skin Thickness

Table 201. Fuselage Skin Thickness(CE-748, CE-772 and After; CJ-149 and After)

Number (Refer to Figure 204)	Material	Thickness In Inches
1.	2024-T3	0.020
2.	2024-T3	0.025
3.	2024-T3	0.032
4.	2024-T42	0.020
5.	2024-T42	0.032
6.	6061-T6	0.020
7.	6061-T6	0.025
8.	6061-T6	0.040
9.	COMP 301 CRES	0.016

Table 202. Fuselage Skin Thickness(D-10097, D-10120 and After)

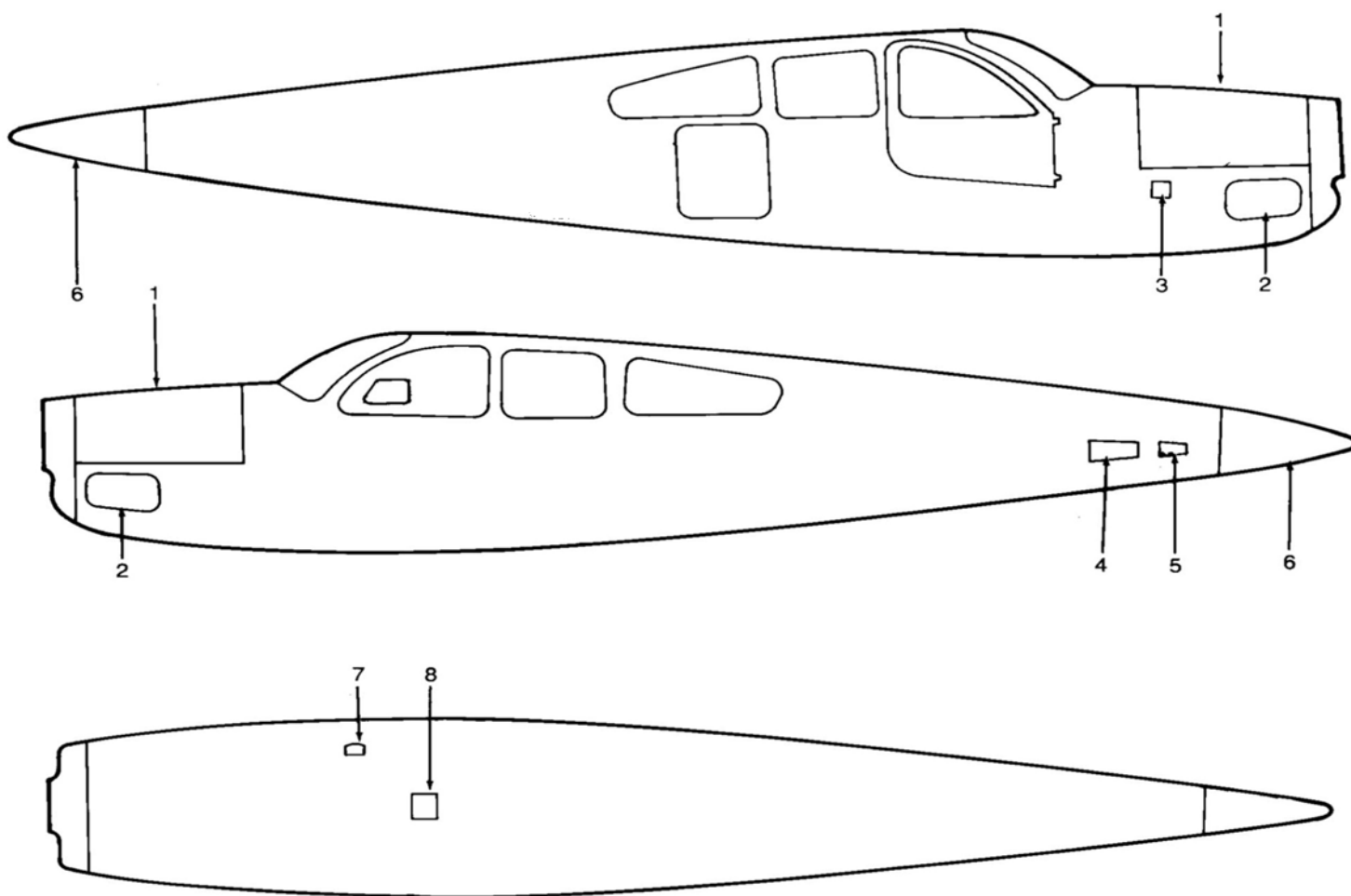
Number (Refer to Figure 205)	Material	Thickness In Inches
1.	2024-T3	0.020
2.	2024-T3	0.025
3.	2024-T3	0.032
4.	2024-T42	0.020
5.	6061-T6	0.020
6.	6061-T6	0.025
7.	6061-T6	0.040
8.	COMP 301 CRES	0.016

Table 203. Fuselage Skin Thickness(E-1111, E-1241 and After; EA-11 and After)

Number (Refer to Figure 206)	Material	Thickness In Inches
1.	2024-T3	0.020
2.	2024-T3	0.025
3.	2024-T3	0.032
4.	2024-T3	0.040
5.	2024-T3	0.063
6.	2024-T4	0.032
7.	2024-T42	0.020
8.	2024-T42	0.032
9.	6061-T4	0.025
10.	6061-T4	0.040
11.	6061-T6	0.020
12.	6061-T6	0.025
13.	COMP 301 CRES	0.016

Figure 201 : Sheet 1 : Fuselage Access Openings(CE-748, CE-772 and after; CJ-149 and after)

E23717



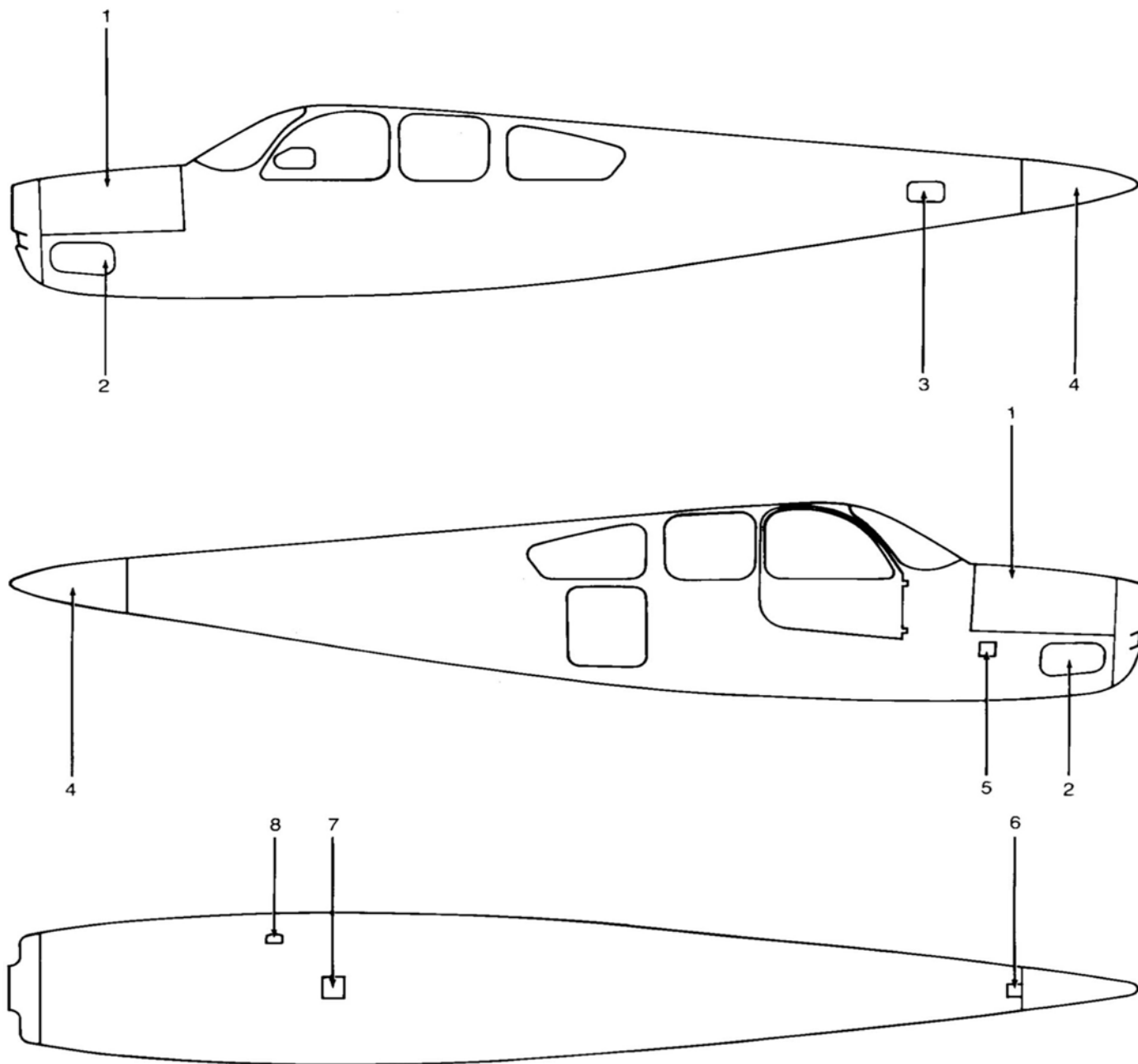
1. Engine Cowl
2. Access Plates for Engine
3. External Power Receptacle
4. Empennage Utility Access

5. Empennage Utility Access
6. Empennage Control Linkage
7. Fuel Strainer
8. Landing Gear Actuator

33-13-15

Figure 202 : Sheet 1 : Fuselage Access Openings(D-10097, D-10120 and After)

E23709



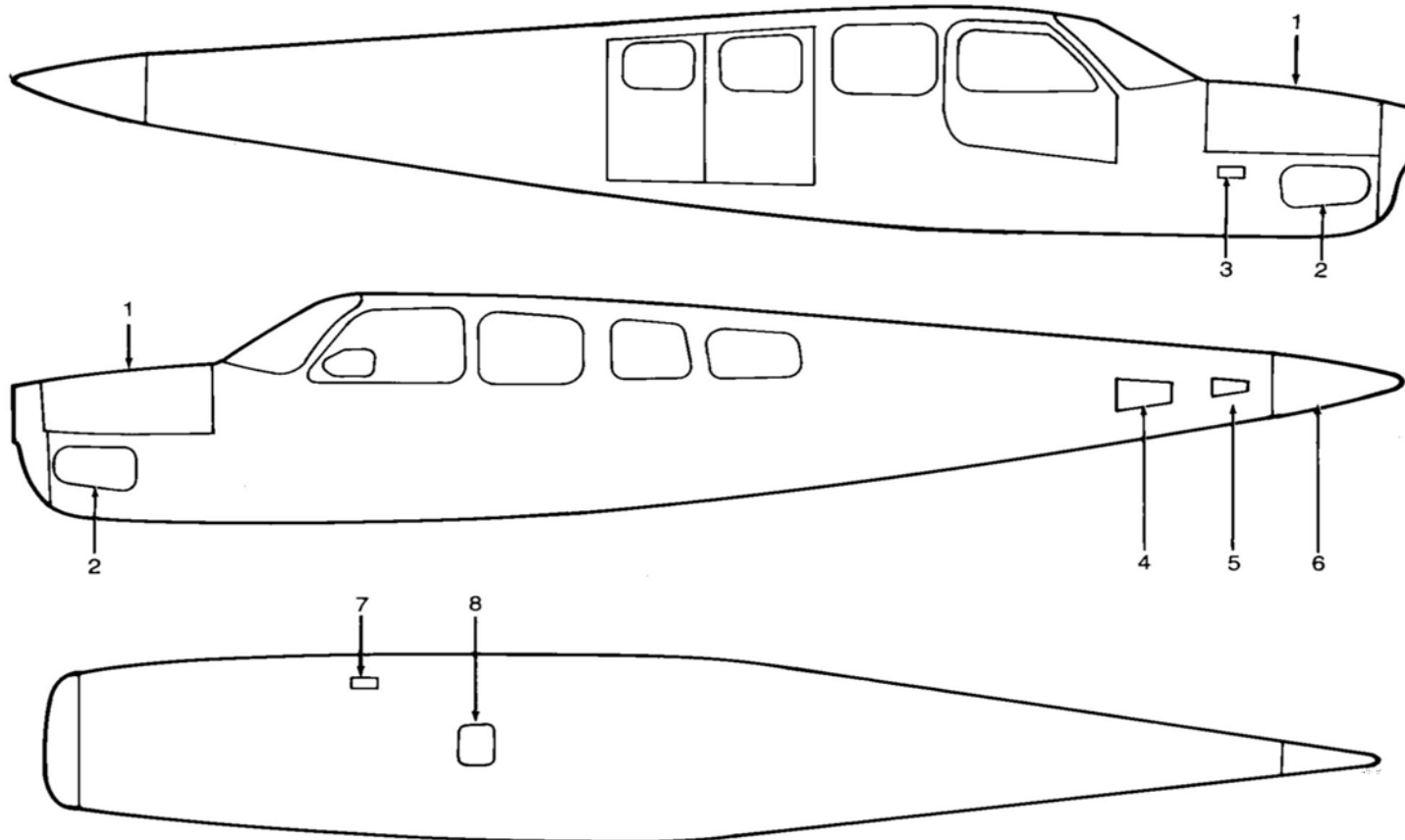
1. Engine Cowl
2. Access Plates for Engine
3. Differential Mechanism (LH)
4. Empennage Control Linkage

5. External Power Receptacle
6. Differential Mechanism (Lower)
7. Landing Gear Actuator
8. Fuel Strainer

36-13-16

Figure 203 : Sheet 1 : Fuselage Access Openings(E-1111, E-1241 and After; EA-11 and After)

E23705



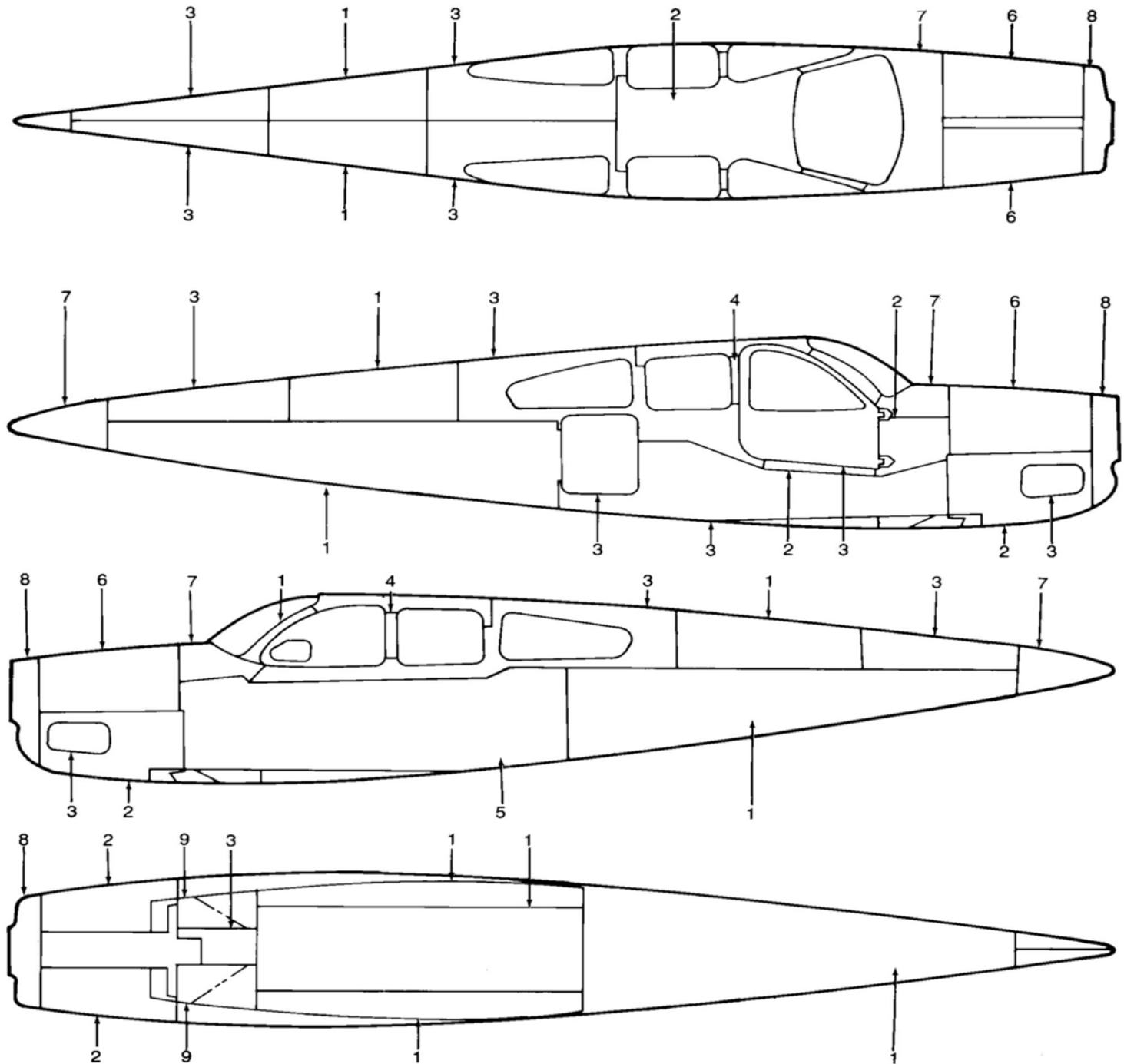
1. Engine Cowl
2. Access Plates for Engine
3. External Power Receptacle
4. Empennage Utility Access

5. Empennage Utility Access
6. Empennage Control Linkage
7. Fuel Strainer
8. Landing Gear Actuator

36-13-17

Figure 204 : Sheet 1 : Fuselage Skin Thickness(CE-748, CE-772 and After; CJ-149 and After)

E23700



33-13-18

Figure 205 : Sheet 1 : Fuselage Skin Thickness(D-10097, D-10120 and after)

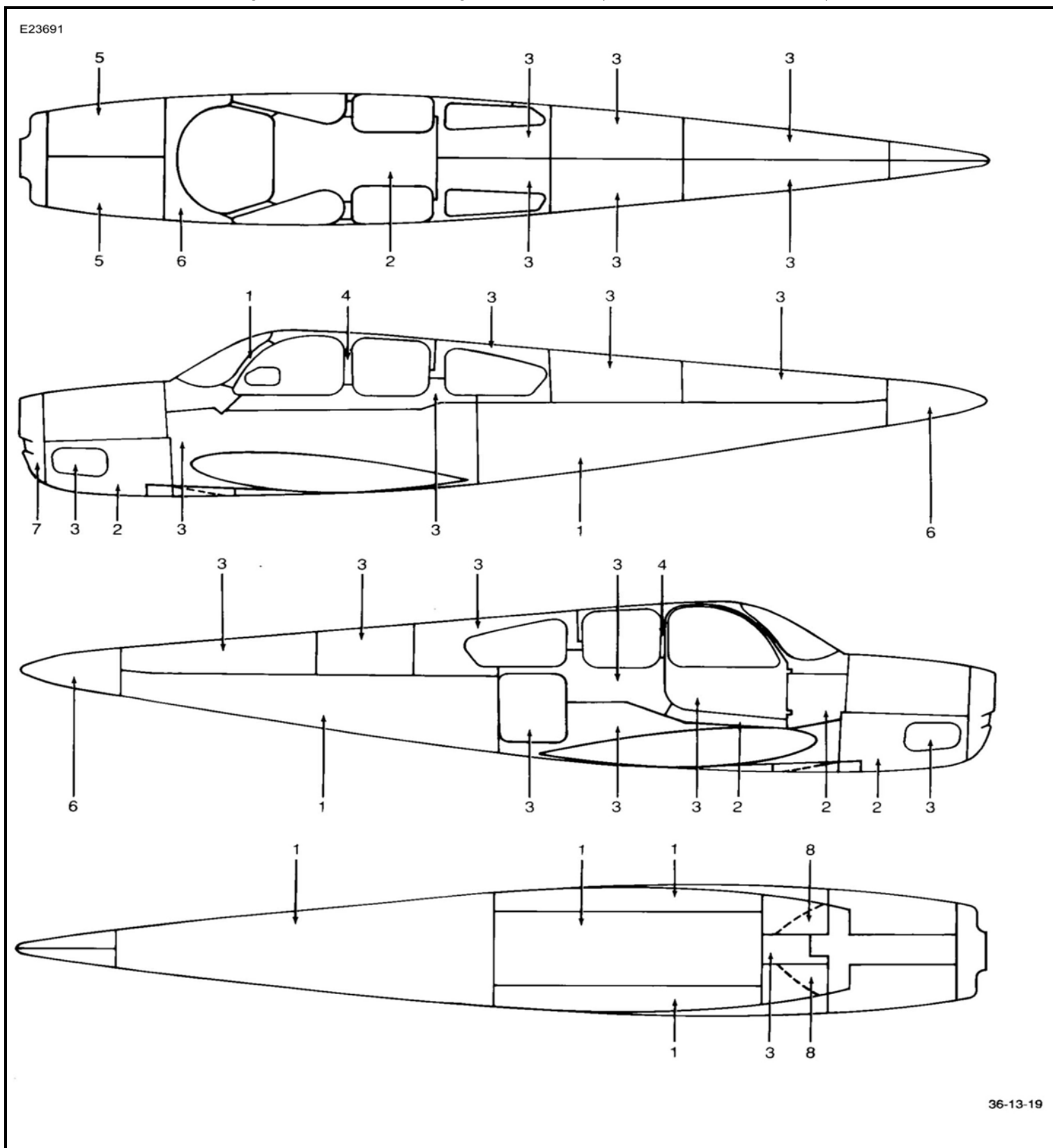
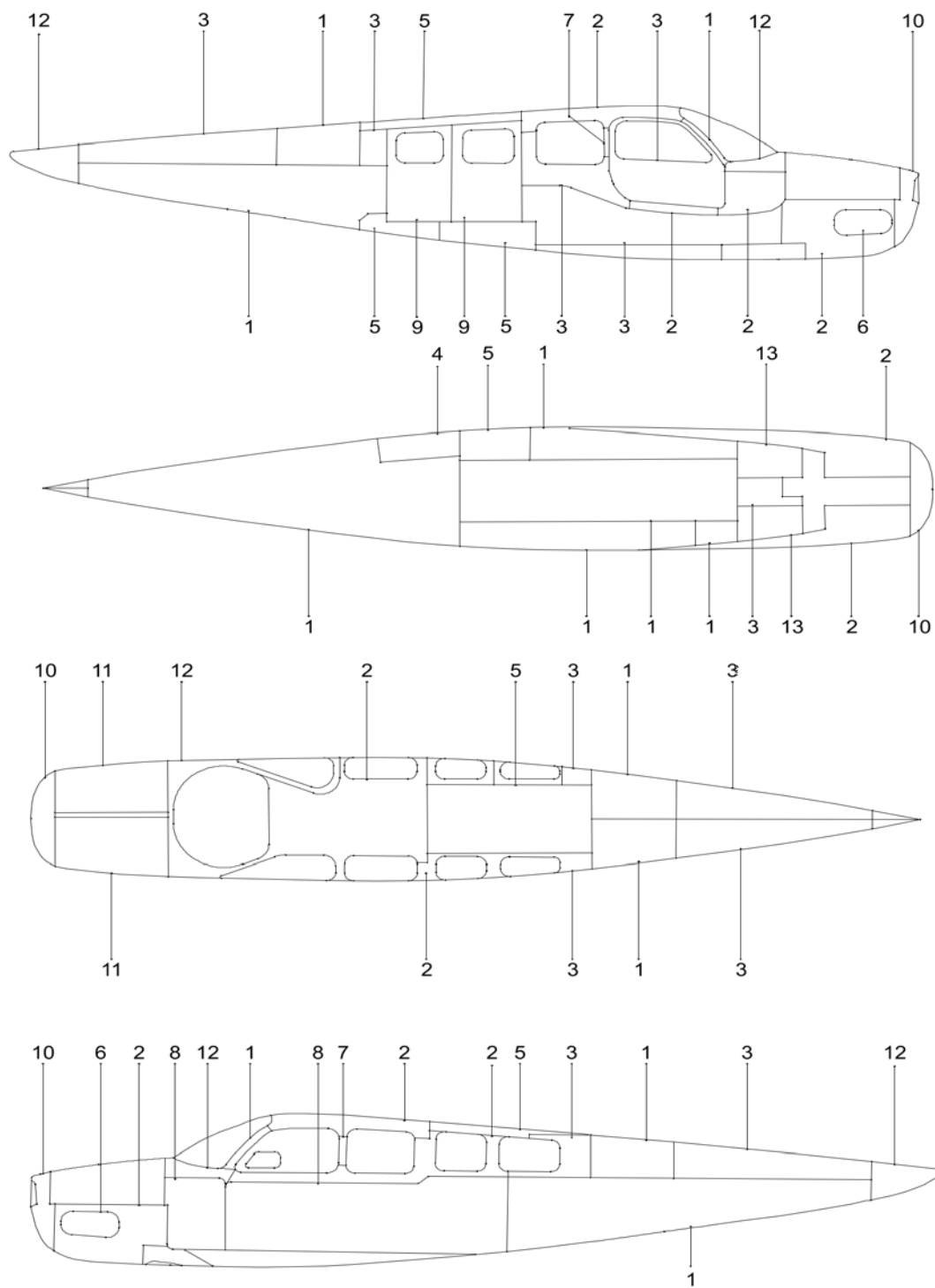


Figure 206 : Sheet 1 : Fuselage Skin Thickness(E-1111, E-1241 and After; EA-11 and After)

E26279



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STABILIZERS - MAINTENANCE PRACTICES

1. General - Maintenance Practices

A. Empennage Skin Thickness

- (1) For the empennage skin thickness for Airplanes CE-748, CE-772 and After; CJ-149 and After; E-1111, E-1241 and After; EA-11 and After, refer to [Figure 201](#), [Figure 202](#) and Table 201.

Table 201. Empennage Skin Thickness (Airplanes CE-748, CE-772 and After; CJ-149 and After; E-1111, E-1241 and After; EA-11 and After)

Number	Material	Thickness In Inches
1.	Royalite	3/32
2.	181 Glass Cloth and Polyester Resin	
3.	Acrylic PVC Alloy Sheet	0.090
4.	Magnesium Alloy - Condition H	0.020
5.	2024-T	0.020
6.	2024-T3	0.020
7.	6061-T4	0.020
8.	2024-T	0.032
9.	2024-T3	0.032
10.	2024-T	0.040
11.	6061-T6	0.040
12.	6061-T6	0.050
NOTE: Skin thickness for the left side of the empennage is the same as the right side.		
* This skin used only on CJ-149 and after.** This skin used only on CE-748, CE-772 and after; E-1111, E-1241 and after; EA-11 and after.		

- (2) For the empennage skin thickness for Airplanes D-10097, D-10120 and After, refer to [Figure 203](#), [Figure 204](#) and Table 202.

Table 202. Empennage Skin Thickness (Airplanes D-10097, D-10120 and After)

Number	Material	Thickness In Inches
1.	Magnesium Alloy - Condition H	0.020
2.	2024-T3	0.020
3.	2024-T4	0.020
4.	2024-T3	0.025
5.	2024-T3	0.040
6.	6061-T6	0.040
7.	6061-T6	0.050

Figure 201 : Sheet 1 : Empennage(CE-748, CE-772 and After; CJ-149 and After; E-1111, E-1241 and After; EA-11 and After)

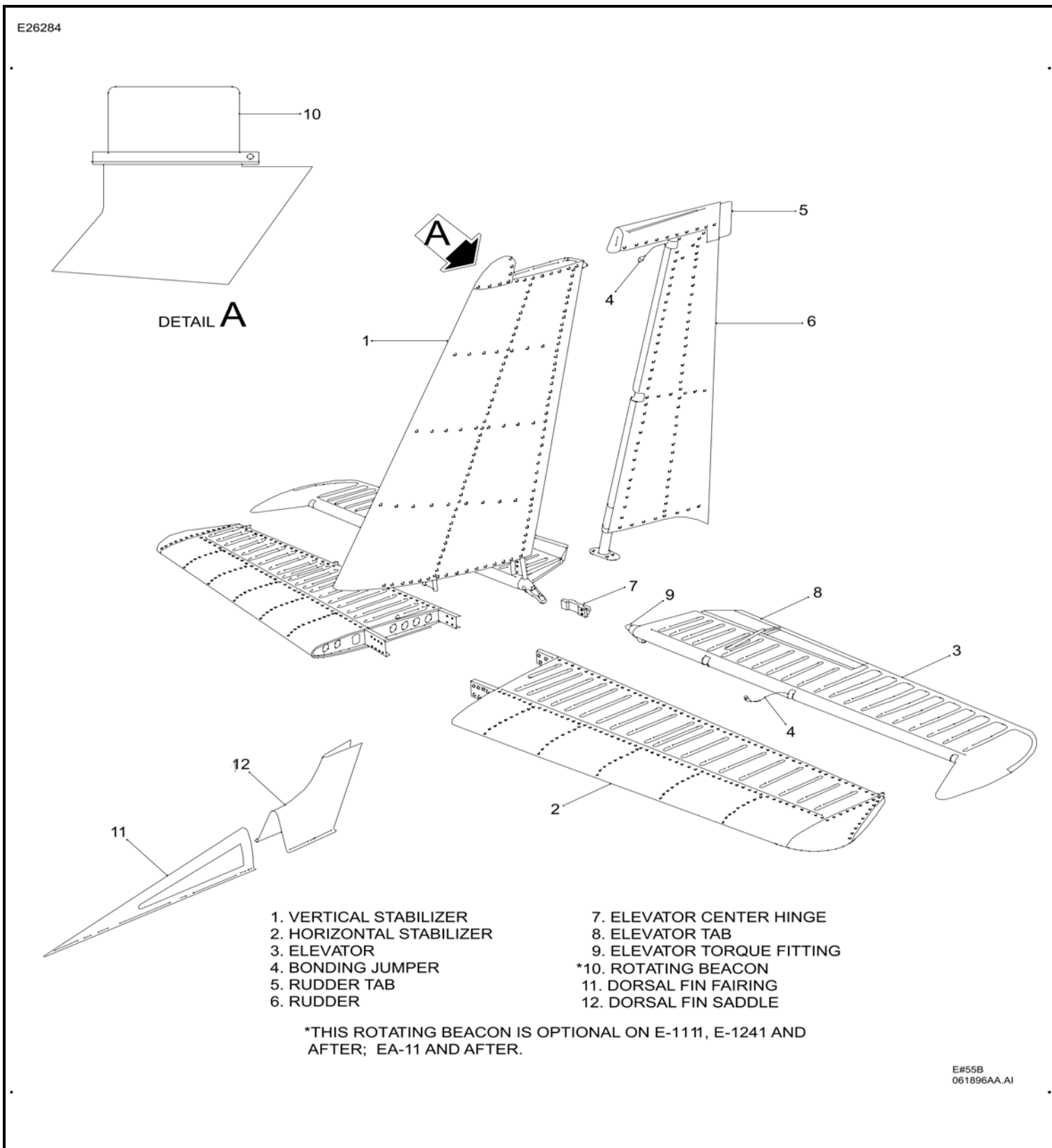


Figure 202 : Sheet 1 : Empennage Skin Thickness(CE-748, CE-772 and After; CJ-149 and After; E-1111, E-1241 and After; EA-11 and After)

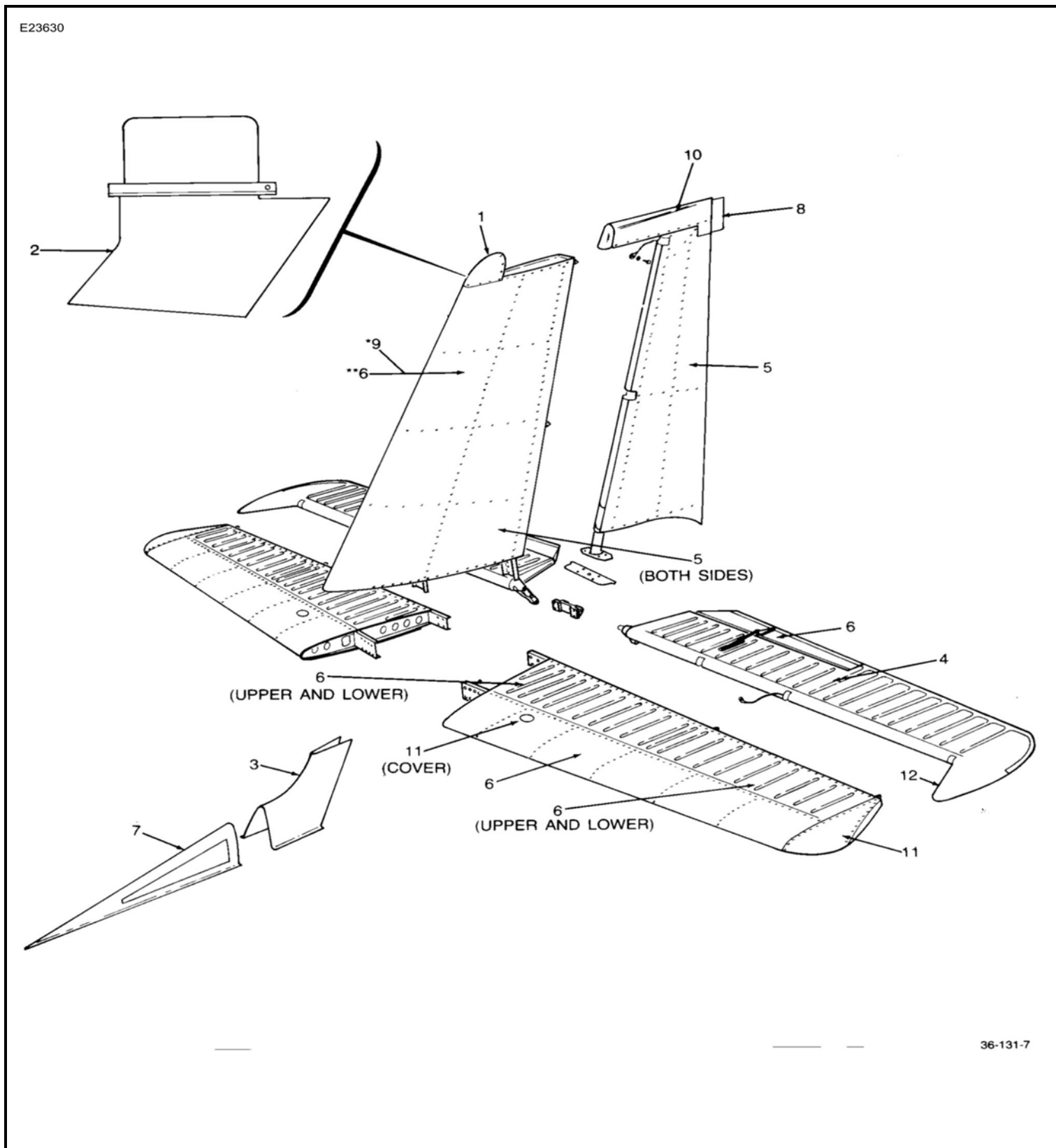
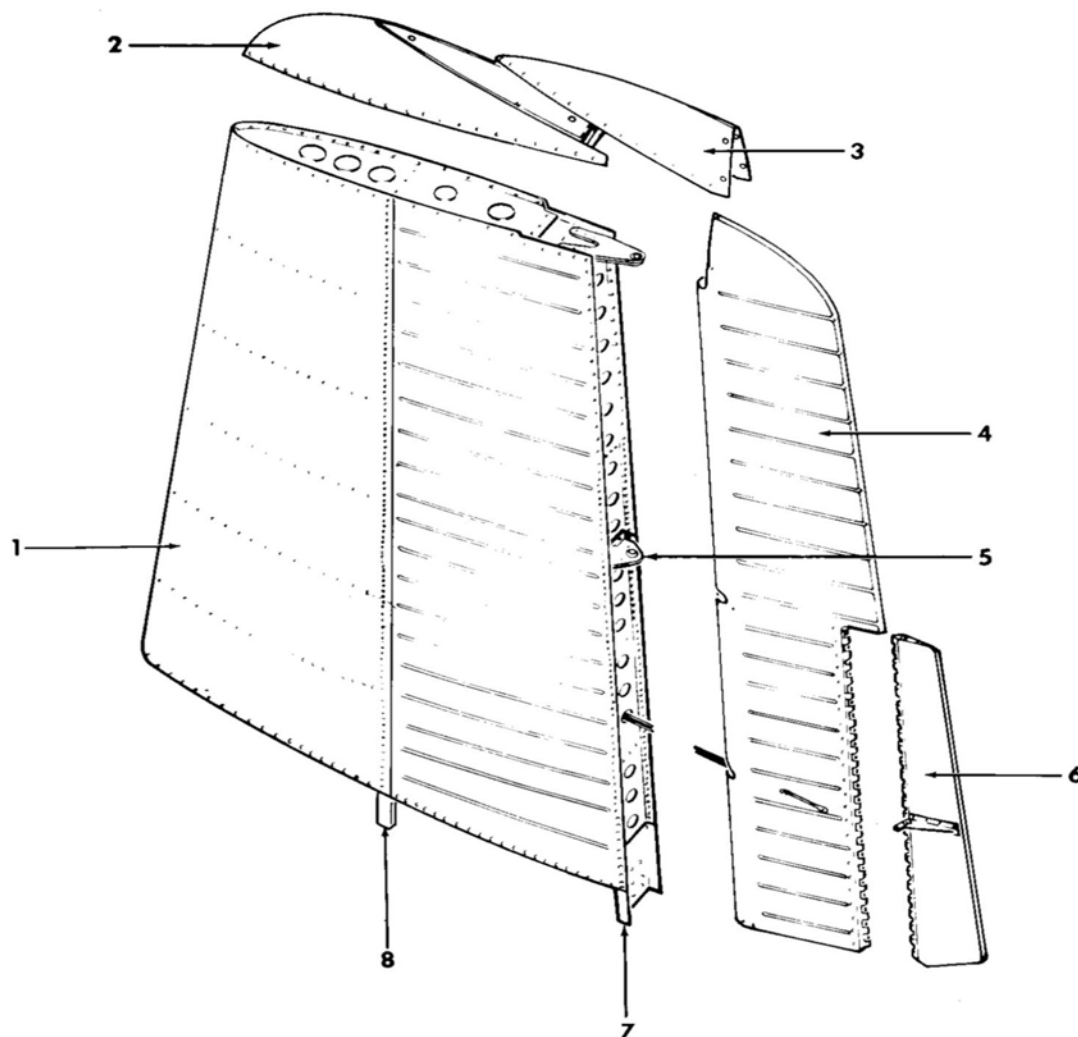


Figure 203 : Sheet 1 : Empennage(D-10097, D-10120 and after)

E23601

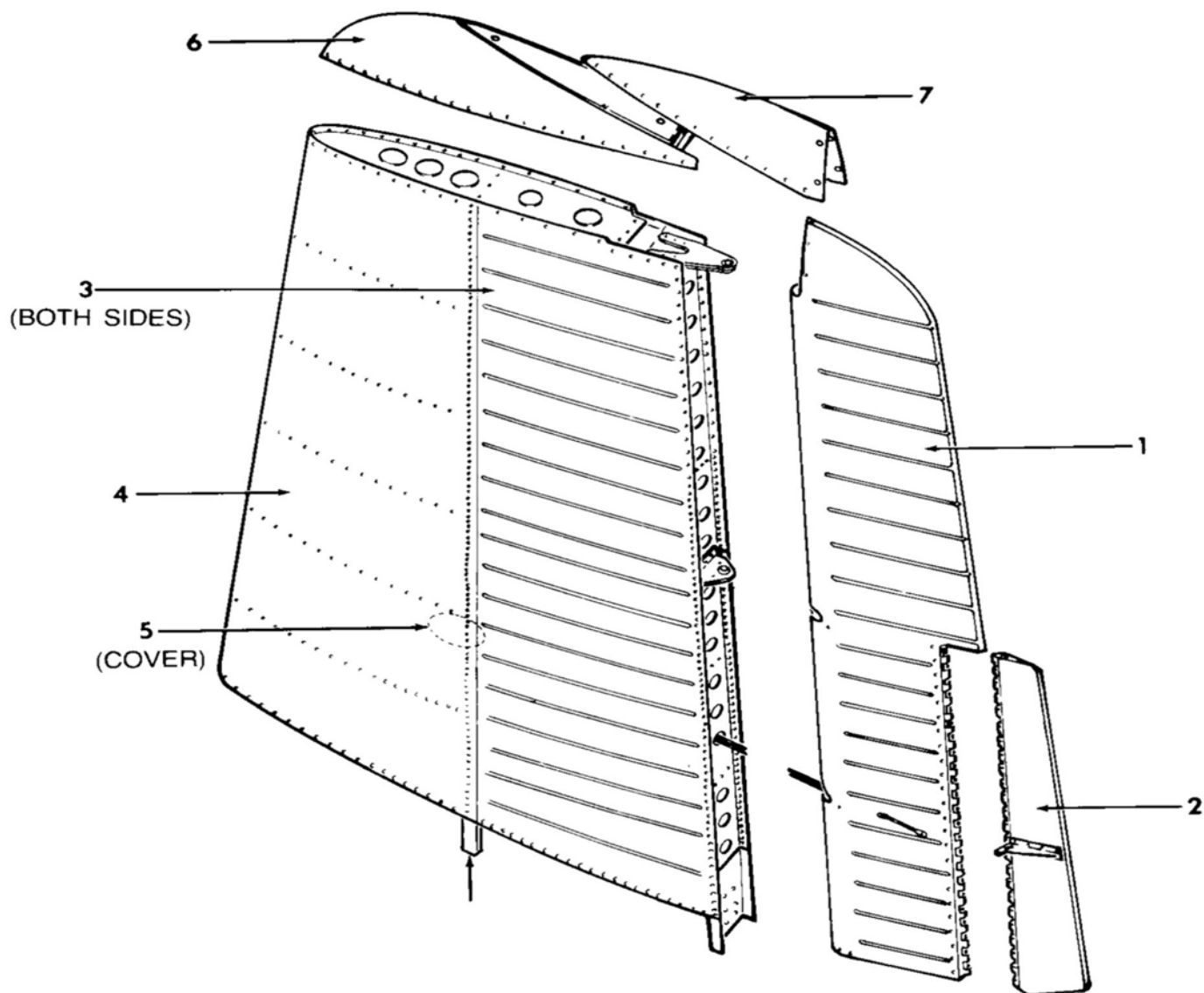


1. Stabilizer
2. Stabilizer Tip
3. Ruddervator Horn
4. Ruddervator
5. Stabilizer Hinge
6. Ruddervator Tab
7. Stabilizer Rear Spar
8. Stabilizer Front Spar

36-131-6

Figure 204 : Sheet 1 : Empennage Skin Thickness(D-10097, D-10120 and after)

E23588



36-131-5

HORIZONTAL STABILIZERS - MAINTENANCE PRACTICES

1. Horizontal Stabilizers - Removal/Installation

A. Horizontal Stabilizer Removal (CE-748, CE-772 and After; CJ-149 and After; E-1111, E-1241 and After; EA-11 and After)

- (1) Remove the applicable elevator. Refer to ELEVATOR REMOVAL in Chapter [27-30-00, 201](#).
- (2) Remove the access panels located on the left side at the rear of the fuselage.
- (3) Disconnect the elevator tab cables, accessible through the left side fuselage access openings.
- (4) Remove the elevator rear spar attaching bolts and the elevator center hinge bracket on the rear spar.
- (5) Disconnect the trim tab pushrods.
- (6) While supporting the stabilizer, remove the attach bolts at the front spar.
- (7) Remove the stabilizer.

B. Horizontal Stabilizer Installation (CE-748, CE-772 and After; CJ-149 and After; E-1111, E-1241 and After; EA-11 and After)

- (1) Place the stabilizer in position and install the rear spar attaching bolts.
NOTE: When installing the horizontal stabilizer, the nuts for the rear spar attaching bolts must be placed on the forward side of the spar to avoid contact with the elevator center hinge assembly.
- (2) Install the forward stabilizer spar attaching bolts. Place one MS 20002C4 washer under the head of each bolt and two AN960-416 washers under each nut. Torque the nuts on the bolts to 85-100 inch-pounds.
- (3) Install four aft stabilizer spar attaching bolts through the inboard holes in each spar with the bolt heads on the aft side of the spar. Place one MS20002C4 washer under the head of each bolt and one AN960-416 washer under each nut. Torque the nuts to 85-100 inch-pounds.
- (4) Install the inboard elevator hinge bracket on the aft side of the aft spar with four bolts with heads on the aft side of the hinge bracket. Place one MS20002C4 washer under the head of each bolt and two AN960-416 washers under each nut. Torque the nuts to 85-100 inch-pounds.
- (5) Connect the trim tab pushrods to the stabilizer.
- (6) Connect the elevator tab cables, accessible through the left side fuselage access openings.
- (7) Install the access panels.
- (8) Install the applicable elevator. Refer to INSTALLATION OF ELEVATOR in Chapter [27-30-00, 201](#).

C. Stabilizer Removal (D-10097, D-10120 and After)

NOTE: If not already installed, kits are available to provide additional support to the stabilizer leading edge on V-tail Bonanzas. Refer to Chapter [51-00-00](#).

- (1) Remove the applicable elevator. Refer to ELEVATOR REMOVAL in Chapter [27-21-00, 201](#).
- (2) Remove the access panels located on the left side, at the rear of the fuselage.
- (3) Disconnect the elevator tab cables, accessible through the left side fuselage access openings.
- (4) Remove the attach bolts at the front spar.
- (5) While supporting the stabilizer, remove the stabilizer attach bolts at the rear spar.
- (6) Remove the stabilizer.

D. Stabilizer Installation (D-10097, D-10120 and After)

- (1) Place the stabilizer in position and install the rear stabilizer attaching bolts.
- (2) Install the forward stabilizer spar attaching bolts.
- (3) Torque the front spar attaching nuts to 200-225 inch-pounds and the rear spar attaching bolts to 85-100 inch-pounds.
- (4) Connect the elevator tab cables, accessible through the left side fuselage access openings.
- (5) Install the access panels.
- (6) Install the applicable elevator. Refer to ELEVATOR INSTALLATION in Chapter [27-21-00, 201](#).

ELEVATOR AND RUDDERVATOR - MAINTENANCE PRACTICES

1. Elevator and Ruddervator

A. Balancing The Elevator (CE-748, CE-772 and After; CJ-149 and After; E-1111, E-1241 and After; EA-11 and After)

When the elevator control surface is being repainted, suspend it by the trailing edge so that excess paint will drain toward the leading edge. AFTER ANY REPAINTING OR REPAIR, THE FINISHED SURFACE SHOULD BE CHECK BALANCED TO ENSURE THAT ITS STATIC MOMENT ABOUT THE HINGE LINE IS WITHIN THE MANUFACTURERS PRESCRIBED LIMITS. The complete painted elevator assembly, including the control arm and the tab control rod should not be tail heavy over a maximum moment of 7.8 inch-pounds. The static moment is the total unbalanced weight of the elevator control surface multiplied by the perpendicular distance from its hinge centerline to the center of gravity, when the chord line is horizontally level. The weight is measured in pounds and the distance in inches. The static moment of a 100 percent balanced elevator control surface is 0.0 lb. A tail heavy surface exhibits static underbalance. A nose heavy surface exhibits static overbalance.

(1) Checking Balance

The elevator balance must be checked in a draft free area with the elevator completely assembled in flying condition. ALL PAINTING, INCLUDING STRIPES AND TOUCH UP MUST BE COMPLETED. The tab, tab pushrod, static wicks and hinge bolts must be attached. The chord line must be horizontally level and the hinge line must be properly supported when the static moment is measured. Although many different methods of check balancing exist, they can be categorized under the following two headings:

- (a) Actual Force Measurement - measurement of the force applied by the elevator surface on a single support at a known distance from the centerline of the hinge.
- (b) Counterbalancing - the application of a known force or weight at a measured distance from the hinge line to counter the unbalance moment of the elevator assembly.

(2) Check Balance By Force Measurement

The equipment required to perform the check balance by force measurement is as follows:

- (a) A stand with a knife edge supports as illustrated in [Figure 201](#). The knife edges should be in the same horizontal plane.
- (b) A certified beam balance calibrated in units of 0.01lb. or less. The balance should have a flat weighing platform and its capacity should equal tare plus 2 lbs. minimum.
- (c) A support spindle similar to the illustration and levelling blocks as required (blocks + spindle = tare).
- (d) A straightedge, ruler and spirit level.

(3) Balancing Procedure Force Measurement Method

Locate the chord line by placing a straightedge at the inboard end of the elevator so that one end is aligned with the center of the torque tube and the other end is centered on the trailing edge. Mark the chord line by grease pencil or other means on the rib. Remove the straightedge. Fit correct size bolts in the outboard and center hinge brackets and mount the elevator on the knife edges. Ensure that it is free to rotate about the hinge line. Support the trailing edge behind the center hinge point with a spindle resting on a leveled beam balance platform as illustrated. The spindle must be vertical throughout the balancing procedure. Hold a spirit level against the marked chord line and level it by extending or contracting the spindle. Measure the perpendicular distance from the hinge centerline to the point supported by the spindle. Ensure that the spirit level and rule are removed from the surface and read the reaction on the beam balance. Calculate the static underbalance moment "M" from the formula:

- (a) $M = D(R-T)$ inch-pounds where, D = Perpendicular distance from the hinge centerline to the spindle point (inches). R = Reaction (pounds) read from the beam balance. T = Tare, i.e. spindle plus levelling blocks or shims on the scale platform (pounds).
- (b) The following is an example: D is 13.5 inches, R is 1.49 lb. and T = 1.00 lb. $M = 13.5 (1.49 - 1.00)$; $M = 6.6$ inch-pounds. M is within the range which is satisfactory. If M is not within the prescribed range, refer to step "i" under [BALANCING PROCEDURE COUNTERBALANCING METHOD](#).

(4) Check Balance By Counterbalancing

The equipment required to perform check balancing by counterbalancing is as follows:

- (a) A stand with knife edge supports as illustrated in [Figure 201](#). The knife edges must be in the same horizontal plane.
- (b) A paper cup or similar lightweight container.
- (c) Approximately 2 pounds of lead shot.
- (d) A certified beam balance weighing device calibrated in units of 0.01 pound or less.

- (e) A straightedge, ruler and a spirit level.

(5) Balancing Procedure Counterbalancing Method

- (a) Locate the chord line by placing a straightedge at the inboard end of the elevator assembly so one that one end is on the hinge centerline and the other end is centered on the trailing edge. Mark the chord line with a suitable marker, such as a grease pencil, then remove the straightedge.
- (b) Secure the trim tab in its neutral position with a small piece of masking tape.
- (c) Fit the correct size bolts in the hinge clevises and mount the elevator on the knife edge supports. Ascertain that the elevator is free to rotate about the hinge line.
- (d) To determine if weight should be added or removed, use a short length of small diameter string secured to the surface with a small piece of masking tape and a paper cup hanging vertically as illustrated in [Figure 201](#). Slightly loosen the forward top screw on the elevator leading edge tip. Suspend the paper cup on the inboard side of the tip and wrap the string around the screw. Secure the string to the surface with a small piece of masking tape aft of the top forward screw and near the hinge centerline as shown in [Figure 201](#). The cup must be free to hang vertically.

CAUTION: Be certain the forward top screw on the elevator leading edge tip is secured after the elevator has been balanced.

- (e) Add small quantities of lead shot to the cup until the elevator balances with the chord level. Check this by holding the spirit level aligned with the marked chord line.
- (f) The distance "D" must be perpendicular to the hinge line. Measure "D" from the hinge line to the suspension point of the cup.
- (g) Remove the cup, contents and string, then weigh them.

NOTE: Since any weighing error is magnified by distance "D", weighing is most important and must be done carefully on scales that are certified for accuracy.

- (h) Calculate the static balance as follows:

1 The weight of the cup and contents is designated by "W".

2 The over or underbalance moment is designated by "M".

3 $M = W \times D$.

4 The following is a typical example of a balancing calculation:

Assume the elevator is underbalanced (tail heavy) and the paper cup was suspended from the horn. If the elevator balances with the chord line level at 'W = 0.60 pound' and 'D = 12.6 inches', then: $M = 0.60 \times 12.6 M = 7.6$ inch-pounds. In this instance "M" is within the required static balance range and is therefore acceptable.

- (i) The complete painted elevator assembly, including the control arm and the tab control rod must not be tail heavy over a maximum moment of 7.8 inch-pounds. If the static balance does not comply, remove the elevator horn cover and add or remove solder to bring the elevator balance within the required limits.

NOTE: Coat the weight with a corrosion preventive material such as zinc chromate primer (20, Table 1, 91-00-00) to insulate the dissimilar metals. Replace the elevator horn cover and recheck the balance.

B. Balancing The Ruddervator (D-10097, D-10120 and After)

When the ruddervator control surface is being repainted, suspend it by the trailing edge so that excess paint will drain toward the leading edge. AFTER ANY REPAINTING OR REPAIR, THE FINISHED SURFACE SHOULD BE CHECK BALANCED TO ENSURE THAT ITS STATIC MOMENT ABOUT THE HINGE LINE IS WITHIN THE MANUFACTURERS PRESCRIBED LIMITS. The complete painted ruddervator assembly, including the control arm and the tab control cable attach bolt, nut and washer for both sides of the tab should not be tail heavy over a maximum moment of 14.4 to 17.4 inch-pounds. The static moment is the total unbalanced weight of the ruddervator control surface multiplied by the perpendicular distance from its hinge centerline to the center of gravity, when the chord line is horizontally level. The weight is measured in pounds and the distance in inches. The static moment of a 100 percent balanced elevator control surface is 0.0 lb. A tail heavy surface exhibits static underbalance. A nose heavy surface exhibits static overbalance.

(1) Checking Balance

The balance must be checked in a draft free area with the ruddervator completely assembled in flying condition. ALL PAINTING, INCLUDING STRIPES AND TOUCH UP MUST BE COMPLETED. The tab, tab control cable attach bolt, nut and washer for both sides of the tab, static wicks and hinge bolts must be attached. The chord line must be horizontally

level and the hinge line must be properly supported when the static moment is measured. Although many different methods of check balancing exist, they can be categorized under the following two headings:

- (a) Actual Force Measurement - measurement of the force applied by the ruddervator surface on a single support at a known distance from the centerline of the hinge.
 - (b) Counterbalancing - the application of a known force or weight at a measured distance from the hinge line to counter the unbalance moment of the ruddervator assembly.
- (2) Checking Balance By Force Measurement
- The equipment required to perform the check balance by force measurement is as follows:
- (a) A stand with a knife edge supports as illustrated in [Figure 201](#). The knife edges should be in the same horizontal plane.
 - (b) A certified beam balance calibrated in units of 0.01lb. or less. The balance should have a flat weighing platform and its capacity should equal tare plus 2 lbs. minimum.
 - (c) A support spindle similar to the illustration and levelling blocks as required (blocks + spindle = tare).
 - (d) A straightedge, ruler and spirit level.
- (3) Balancing Procedure Force Measurement Method
- Locate the chord line by placing a straightedge at the inboard end of the ruddervator so that one end is aligned with the center of the torque tube and the other end is centered on the trailing edge. Mark the chord line by grease pencil or other means on the rib. Remove the straightedge. Fit correct size bolts in the outboard and center hinge brackets and mount the ruddervator on the knife edges. Ensure that it is free to rotate about the hinge line. Support the trailing edge behind the center hinge point with a spindle resting on a leveled beam balance platform as illustrated. The spindle must be vertical throughout the balancing procedure. Hold a spirit level against the marked chord line and level it by extending or contracting the spindle. Measure the perpendicular distance from the hinge centerline to the point supported by the spindle. Ensure that the spirit level and rule are removed from the surface and read the reaction on the beam balance. Calculate the static underbalance moment "M" from the formula:
- (a) $M = D(R-T)$ inch-pounds where, D = Perpendicular distance from the hinge centerline to the spindle point (inches). R = Reaction (pounds) read from the beam balance. T = Tare, i.e. spindle plus levelling blocks or shims on the scale platform (pounds).
 - (b) The following is an example: D is 13.5 inches, R is 2.26 lb. and T = 1.00 lb. $M = 13.5 (2.26 - 1.00)$; M = 17 inch-pounds. M is within the range which is satisfactory. If M is not within the prescribed range, refer to step (i) under [BALANCING PROCEDURE COUNTERBALANCING METHOD](#).
- (4) Check Balance By Counterbalancing
- The equipment required to perform check balancing by counterbalancing is as follows:
- (a) A stand with knife edge as illustrated in [Figure 201](#). The knife edges must be in the same horizontal plane.
 - (b) A paper cup or similar lightweight container.
 - (c) Approximately 3.5 pounds of lead shot.
 - (d) A certified beam balance weighing device calibrated in units of 0.01 pound or less.
 - (e) A straightedge, ruler and a spirit level.
- (5) Balancing Procedure Counterbalancing Method
- (a) Locate the chord line by placing a straightedge at the lower closure rib of the ruddervator so one that one end is aligned with the centerline of the torque tube and the other end is centered on the trailing edge. Mark the chord line with a suitable marker, such as a grease pencil, then remove the straightedge.
 - (b) Secure the trim tab in its neutral position with a small piece of masking tape.
 - (c) Fit the correct size bolts in the hinge clevises and mount the ruddervator on the knife edge supports. Ascertain that the ruddervator is free to rotate about the hinge line.
 - (d) To determine if weight should be added or removed, if the balance is tail down: On the ruddervator leading edge tip, slightly loosen the forward top screw. Suspend a paper cup on the inboard side of the tip and wrap the string around the screw. Secure the string to the surface with a small piece of masking tape aft of the top forward screw and near the hinge centerline as shown in [Figure 201](#). The cup must be free to hang vertically.

CAUTION: Be certain the forward top screw on the ruddervator leading edge tip is secured after the ruddervator has been balanced.

- (e) Add small quantities of lead shot to the cup until the ruddervator balances with the chord line level. Check this by holding the spirit level aligned with the marked chord line.
- (f) The distance "D" must be perpendicular to the hinge line. Measure "D" from the hinge line to the suspension point of the cup.
- (g) Remove the cup, contents and string, then weigh them.

NOTE: Since any weighing error is magnified by distance "D", weighing is most important and must be done carefully on scales that are certified for accuracy.

- (h) Calculate the static balance as follows:

1 The weight of the cup and contents is designated by "W".

2 The over or underbalance moment is designated by "M".

3 $M = W \times D$.

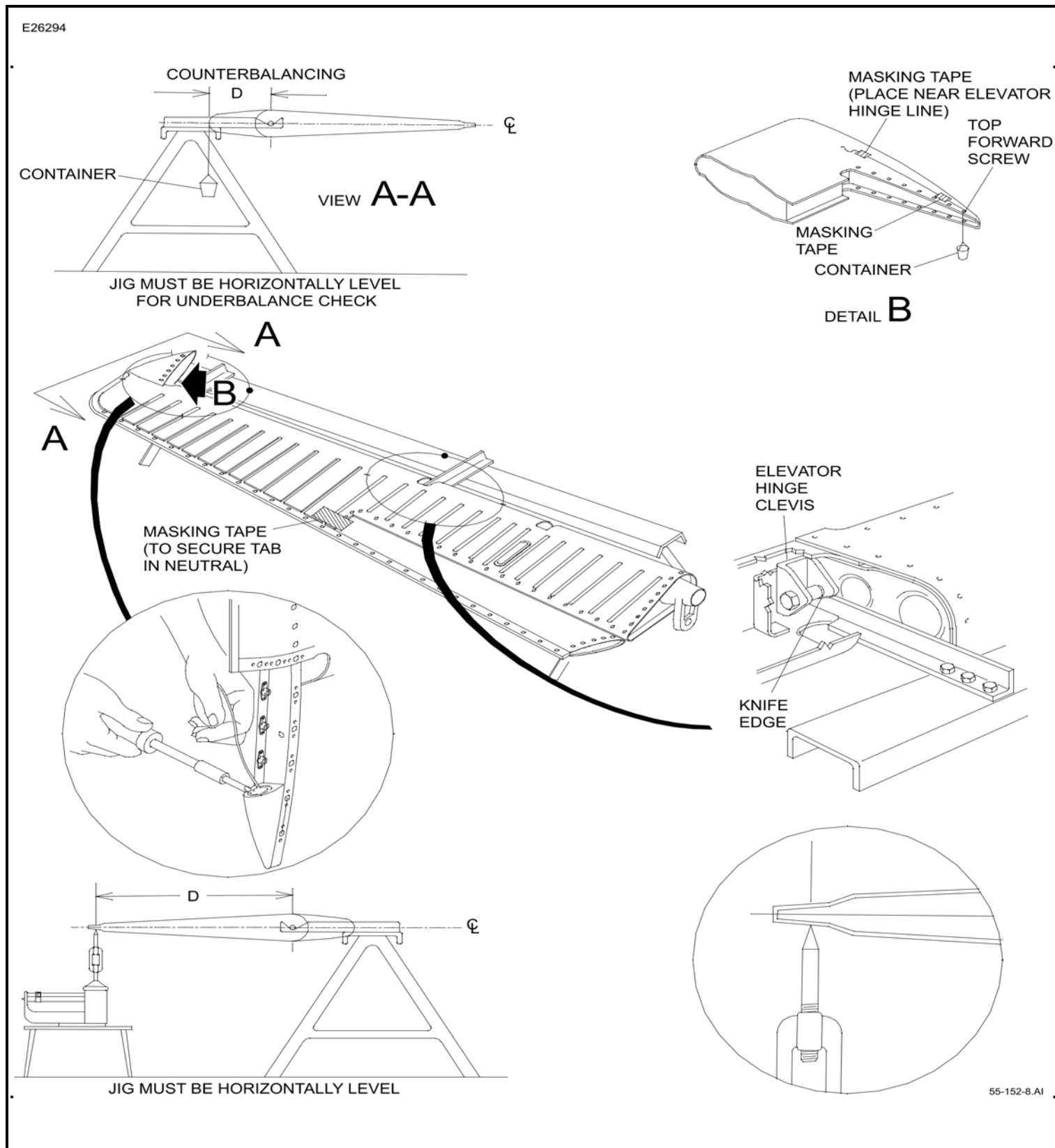
4 The following is a typical example of a balancing calculation:

Assume the ruddervator was underbalance (tail heavy) and the paper cup was suspended from the leading edge. If the ruddervator balances with the chord line level at 'W = 2.83 pound' and 'D = 6 inches', then: $M = 2.83 \times 6$
 $M = 17$ inch-pounds. The product of W x D. In this instance "M" is within the required static balance range and is therefore acceptable.

- (i) The complete painted ruddervator assembly, including the control arm and the tab control cable attach bolt, nut and washer for both sides of the tab, should not be tail heavy over a maximum moment of 14.4 to 17.4 inch-pounds. If the static balance does not comply, remove the ruddervator horn cover and add or remove solder to bring the elevator balance within the required limits.

NOTE: Coat the weight with a corrosion preventive material such as zinc chromate primer (20, Table 1, 91-00-00) to insulate the dissimilar metals. Replace the elevator horn cover and recheck the balance.

Figure 201 : Sheet 1 : Balancing the Elevator, Ruddervator



VERTICAL STABILIZER - MAINTENANCE PRACTICES

1. Vertical Stabilizer - Maintenance Practices

- A. Vertical Stabilizer Removal (CE-748, CE-772 and After; CJ-149 and After; E-1111, E-1241 and After; EA-11 and After)
 - (1) Remove the elevators, horizontal stabilizers and the rudder. Refer to the applicable chapters for removal instructions.
 - (2) Remove the stabilizer saddle and fairings.
 - (3) Disconnect the rotating beacon wires (if applicable).
 - (4) Support the stabilizer and remove the bolts at the front and rear spars.
 - (5) Pull the stabilizer straight up to remove it from the fuselage.
- B. Vertical Stabilizer Installation (CE-748, CE-772 and After; CJ-149 and After; E-1111, E-1241 and After; EA-11 and After)
 - (1) Carefully place the vertical stabilizer in position and install the bolts in the front and rear spars.
 - (2) Torque all AN4 vertical stabilizer attaching bolts to 50-70 inch-pounds.
 - (3) Connect the rotating beacon wires (if applicable).
 - (4) Install the stabilizer saddle and fairings.
 - (5) Install the elevators, horizontal stabilizers and rudder. Refer to the applicable chapters for installation procedures.

RUDDER - MAINTENANCE PRACTICES

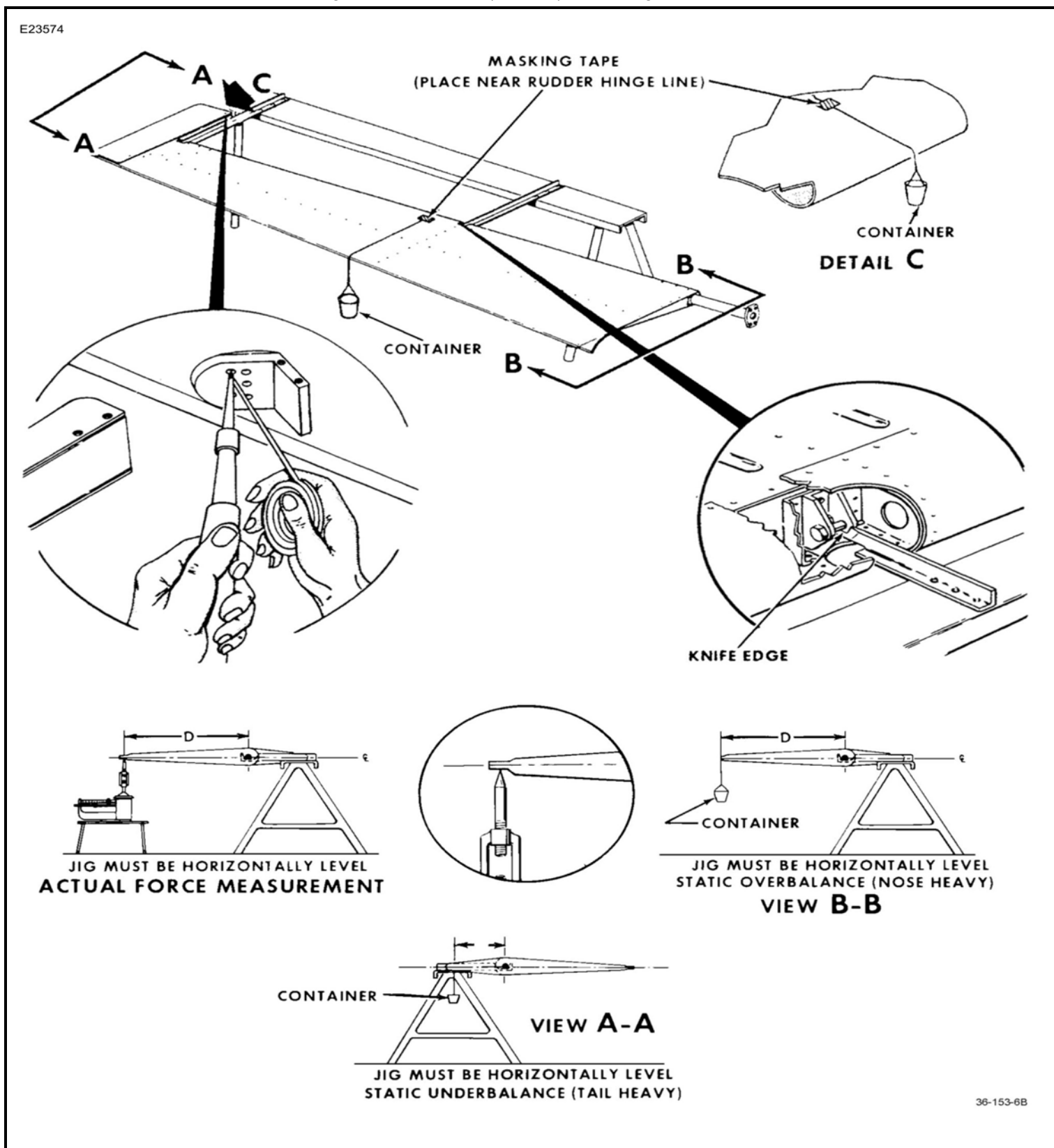
1. Rudder

- A. Balancing The Rudder CE-748, CE-772 and After; CJ-149 and After; E-1111, E-1241 and After; EA-11 and After)
When the rudder surface is being repainted, suspend it by the trailing edge so that excess paint will drain toward the leading edge. AFTER ANY REPAINTING OR REPAIR, THE FINISHED SURFACE SHOULD BE CHECK BALANCED TO ENSURE THAT ITS STATIC MOMENT ABOUT THE HINGE LINE IS WITHIN THE MANUFACTURERS PRESCRIBED LIMITS. The complete painted rudder assembly, including the control arm should not be tail heavy over a maximum moment of 8.4 inch-pounds. The static moment is determined by multiplying the unbalanced weight of the rudder assembly times the perpendicular distance from its hinge centerline to the center of gravity when the chord line is horizontally level. The weight is measured in pounds and the distance in inches. The static moment of a 100 percent balanced rudder assembly is 0.0 inch-pounds. Tail heaviness indicates static underbalance while a nose heaviness indicates static overbalance.
- (1) Checking Balance
The rudder balance must be checked in a draft free area with the rudder completely assembled in flying condition. ALL PAINTING, INCLUDING STRIPES AND TOUCH UP MUST BE COMPLETED. The tab, static wicks and hinge bolts must be attached. The chord line must be horizontally level and the hinge line must be properly supported when the static moment is measured. Although many different methods of check balancing exist, they can be categorized under the following two headings:
- (a) ACTUAL FORCE MEASUREMENT - measurement of the force applied by the rudder surface on a single support at a known distance from the centerline of the hinge.
 - (b) COUNTERBALANCING - the application of a known force or weight at a measured distance from the hinge line to counter the unbalance moment of the rudder assembly.
- (2) Check Balance By Force Measurement
The equipment required to perform the check balance by force measurement is as follows:
- (a) A stand with a knife edge supports as illustrated in [Figure 201](#). The knife edges should be in the same horizontal plane.
 - (b) A certified beam balance calibrated in units of 0.01 lb. or less. The balance should have a flat weighing platform and its capacity should equal tare plus 2 lbs. minimum.
 - (c) A support spindle similar to the illustration and levelling blocks as required (blocks + spindle = tare).
 - (d) A straight edge, ruler and spirit level.
- (3) Balancing Procedure Force Measurement Method
Locate the chord line by placing a straight edge at the inboard end of the rudder so that one end is aligned with the center of the torque tube and the other end is centered on the trailing edge. Mark the chord line by grease pencil or other means on the rib. Remove the straight edge. Fit correct size bolts in the outboard and center hinge brackets and mount the rudder on the knife edges. Ensure that it is free to rotate about the hinge line. Support the trailing edge behind the center hinge point with a spindle resting on a leveled beam balance platform as illustrated. The spindle must be vertical throughout the balancing procedure. Hold a spirit level against the marked chord line and level it by extending or contracting the spindle or by using blocks and shims under the spindle. Measure the perpendicular distance from the hinge centerline to the point supported by the spindle. Ensure that the spirit level and rule are removed from the surface and read the reaction on the beam balance.
Calculate the static underbalance moment "M" from the formula:
- (a) $M = D(R-T)$ inch-pounds where, D = Perpendicular distance from the hinge centerline to the spindle point (inches). R = Reaction (pounds) read from the beam balance. T = Tare, i.e. spindle plus levelling blocks or shims on the scale platform (pounds).
 - (b) The following is an example: D is 13.8 inches, R is 1.49 lb. and T = 1.00 lb. $M = 13.8 (1.49 - 1.00)$; $M = 6.8$ inch-pounds. M is within the range which is satisfactory. If M is not within the prescribed range, refer to step (h) under [BALANCING PROCEDURE COUNTERBALANCING METHOD](#).
- (4) Check Balance By Counterbalancing
The equipment required to perform check balancing by counterbalancing is as follows:
- (a) A stand with knife edge as illustrated in [Figure 201](#). The knife edges must be in the same horizontal plane.
 - (b) A paper cup or similar lightweight container.
 - (c) Approximately 2 pounds of lead shot.

- (d) A certified beam balance weighing device calibrated in units of 0.01 pound or less.
- (e) A straightedge, ruler and a spirit level.
- (5) Balancing Procedure Counterbalancing Method
 - (a) Locate the chord line by placing a straightedge at the lower closure rib of the rudder so that one end is aligned with the centre of the torque tube while the other end is centered on the trailing edge. Mark the chord line with a suitable marker, such as a grease pencil, then remove the straightedge.
 - (b) Fit the correct size bolts in the hinge brackets and mount the rudder on the knife edge supports. Ascertain that the rudder is free to rotate about the hinge line.
 - (c) To determine if weight should be added or removed, suspend a paper cup from a point near the center of the rudder trailing edge if the balance is nose down or near the centre of the horn leading edge if the balance is tail down. Use a short length of small diameter string secured to the surface with a small piece of masking tape as illustrated in [Figure 201](#). The cup must be free to hang vertically.
 - (d) Add small quantities of lead shot to the cup until the rudder balances with the chord line level. Check this by holding the spirit level aligned with the marked chord line.
 - (e) The distance "D" must be perpendicular to the hinge line. Measure "D" from the hinge line to the suspension point of the cup.
 - (f) Remove the cup, contents and string, then weigh them.
- (g) Calculate the static balance as follows:
 - 1 The weight of the cup and contents is designated by "W".
 - 2 The over or underbalance moment is designated by "M".
 - 3 $M = W \times D$.
 - 4 The following is a typical example of a balancing calculation:
Assume the rudder is underbalanced (tail heavy) and the paper cup was suspended from the horn leading edge. If the rudder balances with the chord line level at 'W = 0.65 pound' and 'D = 12.5 inches', then: $M = 0.65 \times 12.5M = 8.1\text{inch-pounds}$. In this instance "M" is within the required static balance range and is therefore acceptable.
- (h) The complete painted rudder assembly, including the control arm must not be tail heavy over a maximum moment of 8.4 inch-pounds. If the static balance does not comply, remove the weight in the rudder horn and add or remove solder to bring the rudder balance within required limits.

NOTE: Coat the weight with a corrosion preventive material such as zinc chromate primer to insulate the dissimilar metals. Replace weight in the rudder horn cover and recheck the balance.

Figure 201 : Sheet 1 : (Revised) - Balancing The Rudder



WINDOWS - GENERAL

1. General - Description and Operation

The windshield and windows for the Bonanza Series airplanes are made of cast acrylic plexiglass.

The flight compartment of each airplane is equipped with a windshield, cabin door window and a left cabin window with an enclosed storm window. The cabin area of the airplane contains an openable window on each side, just aft of the flight compartment. The cabin of the Model A36 airplanes contains two windows on each side, behind the openable windows; a window in each of the two utility doors and matching windows on the left side. The cabin area of the Model 33 and 35 Series airplanes contains an aft window on each side of the airplane, just behind the openable windows.

WINDOWS - MAINTENANCE PRACTICES

1. General

A. Cleaning Plastic Windows

CAUTION: Do not use an ice scraper to remove ice from windows because this practice may cause scratches to the window surface. To avoid scratches, any cleaning of the windows should be done with care.

Plastic windows should be kept clean and waxed at all times. To prevent scratches and crazing, wash the windows carefully with plenty of soap and running water.

CAUTION: When washing the windows, do not use water from a bucket or pail. Sand, dirt particles or other debris may collect in the standing water and cause scratches in the plastic.

Use the palm of the hand to feel and dislodge dirt and mud. A soft cloth, chamois or sponge may be used only for the purpose of carrying water to the surface of the window. After washing, rinse the window thoroughly with running water and dry it with a clean, moist chamois. Do not rub the plastic window with a dry cloth because this will cause an electrostatic charge which attracts dust. Remove oil and grease with a cloth moistened with solvent (26, Table 1, 91-00-00, 58, Table 1, 91-00-00, or 59, Table 1, 91-00-00), then rinse the window with clear water.

CAUTION: Never use gasoline, benzine, alcohol, carbon tetrachloride, fire extinguisher, antiice fluid, lacquer thinner or a glass cleaner with a base of these materials, for such materials will soften the plastic and may cause crazing. Aliphatic naptha and similar solvents are highly flammable and extreme care must be exercised when using these chemicals.

If it is desirable to use a commercial cleaner to clean the plastic windows, use only cleaners that are approved by Textron Aviation Corporation. There are several cleaners available commercially that state they are approved for use on acrylic surfaces. However, it has been discovered that some of these cleaners cause acrylic plastic to craze. Therefore, only the following products are approved as cleaners for acrylic plastic windows:

- Federal Specification PP-560, Part No. 403D.
- Parko Anti-static Plastic Polish.
- McGuiars MGH-10 (60, Table 1, 91-00-00)

Follow the directions on the container.

After washing plastic windows with soap and water, apply a good grade of commercial wax (61, Table 1, 91-00-00). The wax will fill in minor scratches and help prevent further scratches. Apply a thin even coat of wax and bring it to a high polish by rubbing lightly with a clean, dry, soft flannel cloth. Never use a power buffer as the heat generated by the buffing pad may soften the plastic.

If the windows were cleaned with one of the three commercial cleaners mentioned previously, it will not be necessary to apply wax. Each of these cleaners contains wax, as well as cleaning agent.

FLIGHT COMPARTMENT - REMOVAL/INSTALLATION

1. Flight Compartment - Removal/Installation

A. Windshield Removal

- (1) Remove the glareshield. Refer to GLARESHIELD REMOVAL, Chapter [39-10-00, 201](#).
- (2) Remove the attaching screws from the defroster duct and move the duct to clear the lower row of rivets on the windshield (Ref. [Figure 401](#)).
- (3) Mark the position of the three glareshield supports attached to the inside of the windshield frame.
- (4) Mark the location and remove the headliner trim strips and lower the headliner to permit the windshield to be removed.
- (5) Remove any necessary molding that covers the window frame to facilitate windshield removal.
- (6) Remove the rivets from around the windshield.
- (7) Remove the windshield.

NOTE: Due to the windshield being sealed, considerable effort may be required to release the windshield from the canopy section.

B. Windshield Installation

- (1) Remove any sealer around the canopy with toluol. Touch up any scratches or bare metal with zinc chromate primer.
- (2) Place the windshield in position and mark the area where material must be removed from the windshield to obtain a proper fit. The windshield frame edge should not bind in the radius of the fuselage framework.
- (3) Remove the windshield and trim off excess material as determined in step (2).
- (4) Place the windshield in position and cleco in place using the pilot holes provided.
- (5) Back drill the windshield frame using the existing holes in the canopy section as a guide.
- (6) Remove the windshield, deburr all holes and apply sealer ([17, Table 1, 91-00-00](#) or [75, Table 1, 91-00-00](#)) to the windshield frame where it makes contact with the canopy section.
- (7) Place the windshield in position and cleco in place.
- (8) Using rivets, secure the windshield to the canopy section making sure the glareshield supports are installed in the same position as they were removed.
- (9) Clean off the excess sealer from the outside of the windshield frame.
- (10) Mask off an area of the windshield 1/4 inch from the windshield frame using masking tape.
- (11) Clean the surface of the windshield with Isopropyl Alcohol.
- (12) Weather/fillet seal between the windshield and frame with sealant ([17, Table 1, 91-00-00](#) or [75, Table 1, 91-00-00](#)). Smooth the sealant with an appropriate sealant tool to make sure of a smooth transition between the windshield and frame.
- (13) Install the headliner trim strips and secure the headliner in position.
- (14) Install any windshield molding removed for windshield removal.
- (15) Install the glareshield. Refer to GLARESHIELD INSTALLATION, [39-10-00, 201](#).

C. Forward Left Window Removal

- (1) Remove the upholstery panels as required to gain access to the window frame.
- (2) Remove the trim strip from around the inside of the window.
- (3) Remove the rivets from around the window.
- (4) Remove the window.

D. Forward Left Window Installation

- (1) Clean the sealer from the canopy section where the old window was removed using solvent ([19, Table 1, 91-00-00](#)). Touch up any scratches or bare metal with primer ([20, Table 1, 91-00-00](#)).
- (2) Place the window in position and mark the area where material must be removed from the window frame to obtain a proper fit.
- (3) Remove the window and trim off the excess material as determined in step (2).
- (4) Place the window in position and cleco in place using the pilot holes provided.

- (5) Back drill the window frame using the existing holes in the canopy section as a guide.
- (6) Remove the window, deburr all holes and apply sealer (17, Table 1, 91-00-00 or 75, Table 1, 91-00-00) to an area approximately 1/2 inch wide on the canopy section where the old sealer was removed.
- (7) Place the window in position and cleco in place.
- (8) Using rivets, secure the window to the canopy section making sure the trim strip clips are reinstalled in the same position as removed.
- (9) Install the upholstery panels.
- (10) Install the trim strip.
- (11) Clean off the excess sealer from the outside of the window frame.
- (12) Mask off an area of the window 1/4 inch from the window frame using masking tape.
- (13) Clean the surface of the window with Isopropyl Alcohol.
- (14) Weather/fillet seal between the window and frame with sealant (17, Table 1, 91-00-00 or 75, Table 1, 91-00-00). Smooth the sealant with an appropriate sealant tool to make sure of a smooth transition between the window and frame.

E. Storm Window Removal

- (1) Open the latch mechanism at the top of the storm window.
- (2) Remove the two internally threaded hinge pins at the bottom of the storm window.

F. Storm Window Installation

- (1) Install the two internally threaded hinge pins at the bottom of the storm window.
- (2) Close the latch mechanism at the top of the storm window.

G. Cabin Door Window Removal

- (1) Remove the inboard door handle, ash tray and arm rest.
- (2) Remove the center upholstery panel.
- (3) Remove the trim strip around the inside of the window.
- (4) To facilitate reinstallation, mark the location of the trim strip clips.
- (5) Remove the rivets around the window retainer.
- (6) Remove the window.

H. Cabin Door Window Installation

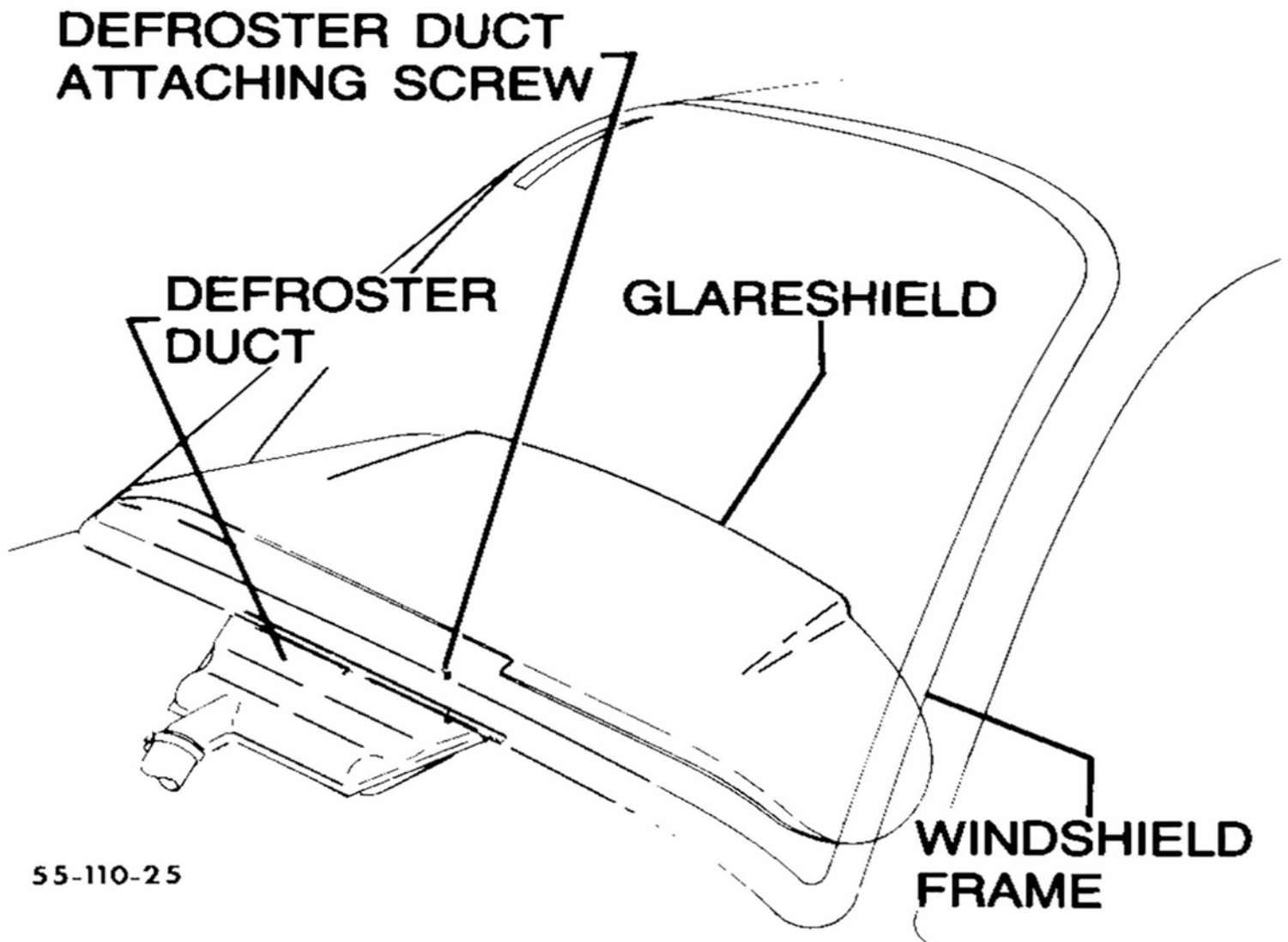
- (1) Clean the sealer from the door where the old window was removed, using solvent (19, Table 1, 91-00-00). Touch up any scratches or bare metal with primer (20, Table 1, 91-00-00).
- (2) Apply sealer (17, Table 1, 91-00-00 or 75, Table 1, 91-00-00) to an area approximately 1/2 inch wide on the door where the old sealer was removed.
- (3) Place the new window in position.
- (4) Place the retainer in position, over the window and cleco the retainer to the cabin door.
- (5) Secure the window retainer to the door skin with rivets.

NOTE: When riveting the window in place, install the trim strip clips in the same locations as marked in step (4) of the window removal procedure.

- (6) Install the trim strip.
- (7) Mask off an area of the window 1/4 inch from the window frame using masking tape.
- (8) Clean the surface of the window with Isopropyl Alcohol.
- (9) Weather/fillet seal between the window and frame with sealant (17, Table 1, 91-00-00 or 75, Table 1, 91-00-00). Smooth the sealant with an appropriate sealant tool to make sure of a smooth transition between the window and frame.
- (10) Clean and paint as necessary.
- (11) Reinstall the center upholstery panel.
- (12) Reinstall the inboard door handle, ash tray and arm rest.

Figure 401 : Sheet 1 : Windshield

E23558



CABIN - REMOVAL/INSTALLATION

1. Cabin - Removal/Installation

A. Openable Window Removal

- (1) Remove the emergency release pin.
- (2) Remove the hinge pin.

B. Openable Window Installation

- (1) Install the hinge pin.
- (2) Install the emergency release pin.

C. Utility Doors Window Removal (E-1111, E-1241 and After; EA-11 and After)

- (1) Remove the window molding trim.
- (2) Remove the rivets from the window retaining strips.

NOTE: When removing the rivets from the retainers on the forward window, remove the latch link rod so that all the rivets are accessible.

- (3) Remove the window.

D. Utility Doors Window Installation (E-1111, E-1241 and After; EA-11 and After)

- (1) Clean the old sealer from the door where the window was removed, using solvent (19, Table 1, 91-00-00). Touch up any scratches or bare metal with primer (20, Table 1, 91-00-00).
 - (2) If new retaining strips are required, dimple the rivet holes in the retaining strips with a 5/16 inch dimpler.
 - (3) Place the window in position and cleco the retaining strips in place.
 - (4) Tape the entire outside surface of the window, then trim the excess tape away from the area that overlaps the door frame. This procedure locates the area that the new sealer is to be applied.
 - (5) Remove the retaining strips and window. Apply sealer (22, Table 1, 91-00-00) to the area of the window located in step (4).
 - (6) Place the window in position and rivet the retaining strips in place.
- NOTE:** Connect the latch link rod if the forward is being replaced.
- (7) Clean excess sealer from the outside of the window edge and install the interior window molding.

E. Windows Aft of Openable Windows Removal

- (1) Remove the upholstery panels as required to gain access to the window frame.
- (2) Remove the trim strip from around the inside of the window.
- (3) Remove the rivets (Model A36 series airplanes) or screws from the window retaining strips.
- (4) Remove the window.

F. Windows Aft of Openable Windows Installation

- (1) Clean the sealer from the cabin section where the old window was removed using solvent (19, Table 1, 91-00-00). Touch up any scratches or bare metal with primer (20, Table 1, 91-00-00).
- (2) Apply sealer (17, Table 1, 91-00-00) to an area approximately 1/2 inch wide on the cabin section where the old sealer was removed.
- (3) Place the window in position and install the window retaining strips to the cabin section with screws. On the Model A36 series airplanes only, the retaining strips are secured with screws on the top retainer and rivets on the side and bottom retainers.
- (4) Clean excess sealer from the outside of the window edge and install the trim strips to the inside of the window.
- (5) Install the upholstery panels.

WINGS - GENERAL

1. General - Description and Operation

The all metal wing group consists of the front and rear spars, leading edge, wing tips, flaps, ailerons, and fuel tanks. The wing tips, flaps, and ailerons are readily removable. The forward wing attaching point is located at FS 83.00 while the rear wing attaching point is located at FS 118.00 on all Model 33, 35 and 36 series airplanes. An optional remote compass is located in the left wing tip on all serials except CJ-149 and After.

WINGS - MAINTENANCE PRACTICES

1. General

A. Wing Tip Removal

- (1) Remove the screws attaching the wing tip to the wing.
- (2) Disconnect the electrical leads to the navigation light.
- (3) Disconnect the remote compass at the left wing tip (if installed).

B. Wing Tip Installation

- (1) Connect the remote compass at the left wing tip (if installed).
- (2) Connect the electrical leads to the navigation light.
- (3) Place the wing tip in position and secure it to the wing with screws.

C. Wing Removal

- (1) Drain and purge the fuel cells.
- (2) Remove the front seats.
- (3) Remove the rear seat panel.
- (4) Remove the wing mounting bolt access plates from the top and bottom of the wing.
- (5) Place the airplane on jacks and raise the airplane until the wheels are clear of the ground. Refer to Chapter 07-00-00 for jacking instructions. A three point jack should be used because of the unbalanced condition of the airplane after the wing is removed.
- (6) Disconnect and cap hydraulic lines at the wing root.
- (7) Operate the landing gear switch until the inboard landing gear doors are fully open
- (8) Disconnect the inboard door actuator rod from the control horn.
- (9) Disconnect the landing gear uplock cable at the inboard connection in the wheel well.
- (10) Disconnect the landing gear actuator rod from the V-brace in the wheel well.
- (11) Disconnect and cap the fuel lines between the wing root rib and the fuselage.
- (12) Disconnect and cap the pitot line at the left wing root in the wheel well.
- (13) Disconnect and label electrical wiring in the wheel well.
- (14) Disconnect and identify the aileron cables at the turnbuckles located inside the cabin, forward of the rear spar below the floorboards.
- (15) Disconnect the flap drive shaft from the motor.
- (16) Cradle the wing.
- (17) Place a wing stand under the wing not being removed and place a stand under the tail.
- (18) Outline the position of the wing on the fuselage as a guide for reinstallation - (recommend grease pencil).
CAUTION: There should be no bolt binding during removal. Should binding occur, adjust the wing position until the bolt disengages freely. Do not screw or drive a bolt in or out of the fittings.
- (19) Remove the mounting nuts, bolts and washers from the wing.
WARNING: A bushing is installed in the lower front spar attach fitting. This bushing should not be removed when the wing is removed, and must be in place when the wing is reinstalled.
NOTE: Discard the mounting nuts. Install new mounting nuts when installing the wing. Discard the special soft aluminum washer used on the wing upper mounting bolts. Install new aluminum washers when installing the wing.
- (20) Disconnect the cold air flex duct at the wing leading edge.
- (21) Remove the wing by pulling it straight away from the fuselage.

D. Removal of Leading Edge and Main Spar

NOTE: Support the landing gear to avoid damaging the aft spar gear connection or remove the gear at both connections.

The wing must be removed from the airplane before the leading edge or main spar can be removed. Remove the attaching

screws at the wing tip and wing butts. Access to the screws at the main spar root is through the wheel well. Pull the hinge pins which attach the leading edge, disconnect the landing gear and remove the main spar.

E. Installation of Leading Edge and Main Spar

CAUTION: Do not attempt to spin the hinge pin in with a drill motor. Heat and expansion may cause the wire to seize or break.

The hinge pins are to be driven with a rivet gun by supporting the hinge pin in telescoping tube, repair Kit 35-0588-1. Make sure the hinge halves are free of metal burrs and mated before attempting to drive the hinge pin. Grind the end of the pin to a point before starting it in the hinge. A second rivet gun or mallet may be used to tap along the upper or lower edge of the main spar to help the pin through the hinge. Use a wooden block as a pad to prevent damage to the spar.

F. Wing Installation

WARNING: Do not install wing bolts that have reached their life limit (10 years after the initial inspection) (Refer to Table 201).

At each inspection interval (Refer to Table 201) and when attachment nuts are removed, install new wing attach nuts.

NOTE: When replacing wing bolts make sure that the replacement bolts have been properly inspected using the magnetic particle process. Bolts must be magnetically inspected before installation as wing bolts. Bolts may be acquired through Textron Aviation Parts & Distribution. THE INDIVIDUAL PLACING THE ORDER MUST STIPULATE THE NEED TO HAVE THE BOLTS INSPECTED BEFORE SHIPMENT.

- (1) Using a nonmetallic brush and solvent (26, Table 1, 91-00-00 or 31, Table 1, 91-00-00), clean all wing attach fittings and hardware. Inspect the wing attach fittings and hardware as instructed under WING BOLT AND FITTING INSPECTION.
- (2) Coat the fitting bolt bores and bearing faces, bolts, washers and nuts with corrosion preventive compound (5, Table 1, 91-00-00).

WARNING: The bushing installed in the lower forward spar attach fitting must be in place before installation of the wing attach bolts.

- (3) Move the wing into position, align the wing fittings with the carry-through fittings, and insert the bolts.

CAUTION: Each bolt must be inserted by hand without binding. If a bolt cannot be easily inserted, reposition the wing until the bolt moves freely through fittings. Do not drive or screw bolt into the fittings. Bolts and nuts must be oriented as shown in applicable illustration for each location (Figure 201, Figure 202, Figure 203, and Figure 204).

- (4) Start the nuts on the upper forward and aft bolts. Rotate the wing trailing edge until the wing is aligned with the outline on the fuselage. After alignment is established, make sure that the lower forward bolt is not binding in the bolt bore. If bolt binding is encountered, adjust the wing position until the bolt moves freely.
- (5) Tighten the upper forward and aft nuts.

CAUTION: When torquing wing nuts, make sure the wrenches do not bottom out on wing attach fittings. Such an occurrence could cause false torque readings and damage to fittings. After torquing the upper forward wing attach nut, remove the holding force from the wing cradle and torque the remaining three nuts.

Before the lower aft nut is torqued, a slight gap may be evident between the fittings. This gap should not exceed 0.060 in width. No gap should remain after the nut is torqued. Torque the wing attach bolts at the nut end, do not rotate the bolt in the bolt bore.

- (6) Torque the nuts in the following order: upper forward, upper aft, lower forward, and lower aft. When a torque wrench adapter is used, the length of the adapter must be added to the length of the torque wrench and the proper torque value computed as detailed in Chapter 20-01-00.
- (7) Coat the bolt threads that protrude through the nut with corrosion preventive compound (5, Table 1, 91-00-00).
- (8) Connect the cold air duct at the wing leading edge.
- (9) Connect the flap drive shaft to the flap motor.
- (10) Connect the aileron cables at the turnbuckles.
- (11) Connect the electrical wiring in the wheel well.
- (12) Connect the pitot line in the wheel well (left only).
- (13) Connect the fuel lines.

- (14) Connect the landing gear actuator rod.
- (15) Connect the landing gear uplock cable.
- (16) Connect the inboard door actuator rod.
- (17) Connect the hydraulic brake lines and bleed the brakes.
- (18) At the first scheduled inspection after the wing has been installed, check the attaching bolts for proper torque. Check the drain ports to make sure they are not obstructed.

G. Adjusting the Wings

After the wing has been installed or repaired, flight tests may show the wing to be chronically heavy or light. This condition may be corrected by rotating the wing to lower the trailing edge of a heavy wing or raise the trailing edge of a light wing or by a combination of adjusting both wings. The aluminum washers between the upper wing fittings must be replaced each time the position of the wing is changed. If both wings have been removed, install the right wing with the trailing edge at the highest point of the adjustment travel and the left wing 1/16 inch down from the highest point of travel. The total adjustment on each wing is approximately 1/8 inch. The following steps should be implemented when adjusting the wings:

- (1) Using a grease pencil, outline the position of the wing on the fuselage.
- (2) Place the airplane on a three point jack and raise until the wheels are clear. Refer to Chapter 07-00-00 for jacking instructions. Place a suitable cradle under the wing being adjusted and a wing stand under the opposite wing. A tail stand will also be required to provide stability.
- (3) Loosen the nuts on the lower wing attach bolts and remove the bolts and nuts from the upper wing attach fittings. Coat the bearing faces and bolt bores of the fittings, the complete bolt, washers, and nut with corrosion preventive compound (5, Table 1, 91-00-00). Install new soft aluminum washers between the upper wing attach fittings. Install the bolts, washers, and nuts into the fittings. Raise or lower the trailing edge as required and torque the wing attach nuts in the following order: upper forward, upper aft, lower forward, and lower aft. There should be no gap between the fittings after the last nut is torqued. Torque each nut to the wet torque value shown in the appropriate illustration (Figures 201, Figures 202, Figures 203, and Figures 204). Coat the exposed threads that protrude through the nuts with corrosion preventive compound (5, Table 1, 91-00-00).

NOTE: After torquing the upper forward wing attach nut, remove the holding force from the wing cradle before torquing the remaining three nuts.

- (4) Remove the wing and tail stands, remove the airplane from the jack, and test fly the airplane.
- (5) At the first scheduled inspection (not to exceed 100 hrs) after the wing has been adjusted, check for correct wing bolt torque. Check the drain ports in the upper wing attach fittings to make sure they are not obstructed.

H. Wing Bolt and Fitting Inspection

WARNING: The wing bolts installed in the Bonanza series airplanes five years old or older must be removed and inspected. If the bolts prove to be free of all damage, they may be reinstalled for an additional five year period. At the end of this period the bolts must again be removed and inspected. Ten years after the initial inspection, all wing bolts must be replaced with new hardware. When wing attach nuts are removed, always replace them with new nuts. Render unserviceable all components removed in compliance with this warning. See Table 201 for the inspection and replacement cycle of the wing bolts.

NOTE: Read the entire section before removing any wing bolts.

- (1) Before removing any wing bolt, draw an outline of the wing position on the fuselage with a grease pencil. If wing bolt binding is encountered and the wing must be shifted, the outline will be helpful in returning the wing to its original position.

WARNING: Use only the components specified in the applicable illustrations. DO NOT INSTALL THE BLACK P/N H-20 NUTS, these nuts have been dry film lubricated with molybdenum disulfide. When MIL-C-16173, Grade II corrosion preventive compound is added to these nuts, the additional lubrication may cause improper preload in the bolt when it is torqued.

CAUTION: There should be no wing bolt binding during removal or installation of bolts. Do not screw or drive a bolt in or out of the fittings. If wing bolt binding is encountered, place the airplane on a three point jack and raise until the wheels are clear (see Chapter 07-00-00 for jacking instructions). Place a wing stand under each wing and a tail stand under the aft fuselage. Defuel the wing, loosen the remaining three bolts and rotate the wing until the binding bolt moves freely through the fittings. Replace the soft aluminum washers between the upper wing attach fittings and torque the bolts as instructed under WING INSTALLATION. If bolt binding is not encountered and the wing has not

shifted, replacement of soft aluminum washers between the upper wing attach fittings is not required.

After removing wing attach nuts for any reason, always install new wing attach nuts. Do not reuse existing nuts.

NOTE: Textron Aviation Corporation supplies wing attach hardware that has been given an additional magnetic particle inspection since manufacture. These components may be identified by the green dye on the head of the bolt and on some portion of the nut.

- (2) Starting at the lower wing attach point on each side, remove, inspect and torque one bolt at a time until the complete set of eight bolts and nuts have been inspected.
- (3) Using a nonmetallic brush, thoroughly clean the bolts and washers with solvent (26 or 31, Table 1, 91-00-00).

CAUTION: Make sure the 95-110025-1 (Refer to Figure 201), the 50-105011 (Refer to Figure 203), and the 95-110025-7 (Refer to Figure 202 and Figure 204) washers have a complete radius with no sharp edges that could damage the wing fittings. Replace any washers that have an incomplete radius or sharp edges.

- (4) If the bolts do not exceed the life limit shown in Table 201, visually inspect each bolt with a 10-power or stronger magnifying glass; inspect for corrosion, cracks, and mechanical damage. The cadmium plating may display areas that appear rubbed, discolored, or polished. These areas are usually the result of prevailing installation procedures and are of no significance. A bolt should not be rejected because of cadmium plating deterioration; however, any component that is cracked, corroded or has mechanical damage must be replaced.
- (5) Using the magnetic particle inspection process described in this chapter (Refer to MAGNETIC PARTICLE INSPECTION), check each bolt for circumferential crack indications. If the bolts prove to be free of all damage (corrosion, cracks, and mechanical damage), they may be reused after demagnetization and cleaning.
- (6) Clean the spar fitting bolt bores with naphtha or methyl propyl ketone (26, Table 1, 91-00-00 or 31, Table 1, 91-00-00). Do not strip the epoxy paint from this area. Inspect the surface condition of each fitting; focus special attention on the washer seat and bolt bore area. If scoring, corrosion pitting or washer impressions are discovered in this area, contact Textron Aviation Corporation Technical Support. If the fitting is satisfactory, coat the bolt bore and bearing faces of the fitting with Alodine 1200, 1200S, or 1201 (53, Table 1, 91-00-00). Allow the coating to remain on the surface for approximately five minutes. When the five minutes have elapsed, wash the coated areas with water and blow dry (do not wipe dry). Paint the treated areas with zinc chromate primer (20, Table 1, 91-00-00) and allow to dry.
- (7) Coat the bearing faces and bolt bores of the fittings, the complete bolt, washers, and nut with corrosion preventive compound (5, Table 1, 91-00-00).
- (8) Install the bolt, washers, and nut into the fitting.

CAUTION: Make sure the wing bolt wrenches do not bottom out on the fittings when torquing the nut. This could result in damage to the wing fittings and erroneous torque readings.

- (9) Torque the nut to the wet torque value shown in the appropriate illustration (Figures 201, Figures 202, Figures 203, and Figures 204). When a torque wrench adapter is used, the length of the adapter must be added to the length of the torque wrench and the proper torque value computed as detailed in Chapter 20-01-00.
- (10) Coat the exposed threads that protrude through the nut with corrosion preventive compound (5, Table 1, 91-00-00).
- (11) Check that the decal shown in Figure 205 is affixed to the appropriate locations on the airplane. When the corrosion preventive compound has been applied to the wing bolts, affix the decal to the following locations:
 - (a) On the side of the fuselage immediately above the right forward and aft wing bolt covers.
 - (b) On the wing immediately forward of the left forward and aft wing bolt covers.
 - (c) On the wing immediately forward of the lower forward wing bolt covers on both sides.
 - (d) On the wing immediately aft of the lower aft wing bolt covers on both sides.
- (12) Check the drain ports in the upper wing attach fittings to make sure they are not obstructed and are free to drain.
- (13) At the first scheduled inspection after the wing bolts have been loosened and torqued or after initial installation, check each bolt for correct torque.

Table 201. Wing Bolt and Nut Inspection and Replacement Cycle

New Airplane	5 years Initial inspection	5 years Second inspection	5 years First replacement interval	5 years Repeat inspection and replacement cycle
	First inspection must be done at the first scheduled inspection (airplanes 5 years old and older)	5 years Second inspection	5 years First replacement interval	5 years Repeat inspection and replacement cycle
NOTE: At each inspection, and when attachment nuts are removed, the nuts must be replaced. At each replacement interval, all wing attach hardware (bolts, washers, and nuts) must be replaced.				

Table 202. Wing Bolt Wrenches and Torque Adapters

Position	Bolt Part Number	Wrench Part Number	Nut Part Number	Nut Torque Adapter
Upper Forward	131790-1	TS1222-3, TS1222-5, 50-590012, TS1222-4, TS1222-8	12NB-126 (Prior to CE-928; CJ-156; D-10353; E-1758 and EA-150) EB-126 (CE-928 and After; CJ-156 and After; D-10353 and After; E-1758 and After; EA-150 and After)	TS1171-2, TS1176-2 TS1176-10, TS1171-10
Lower Forward	131790-2 (CE-748; CE-722 and After; CJ-149 and After; E-1111, E-1241 and After; D-10097, D-10120 and After; EA-11 thru EA-272, except EA-242) 131790-3 (EA-242, EA-273 and After)	TS1222-5, 50-590012, TS1222-4, TS1222-8 TS1222-3	12NB-126 (Prior to CE-928; CJ-156; D-10353; E-1758 and EA-150) EB-126 (CE-928 and After; CJ-156 and After; D-10353 and After; E-1758 and After; EA-150 thru EA-272, except EA-242) EB-144 or ZEB1845-144(EA-242, EA-273 and After)	TS1171-2, TS1176-2 TS1176-10, TS1171-10 50-590014
Upper Aft	130909B103	50-590012, TS1222-5, TS1222-4, TS1222-8	12NB-108	50-590013, TS1171-1, TS1176-1
Lower Aft	130909B274	50-590012, TS1222-5, TS1222-4, TS1222-8	12NB-108	50-590013, TS1171-1, TS1176-1

I. Magnetic-Particle Inspection

Magnetic-Particle Inspection is a method for locating surface and subsurface discontinuities in ferromagnetic materials (i.e. materials capable of being magnetized); consequently, nonferrous materials (such as aluminum alloys, magnesium alloys, copper alloys, lead, titanium alloys, pickle base alloys and many stainless steel alloys) cannot be inspected by this method. Magnetic-Particle Inspection is based upon the principle that any discontinuities lying in a direction generally transverse to the direction of the magnetic field of the part magnetized for the test will cause a leakage field to be formed at and above the surface of the part. The presence of the leakage field denoting the discontinuity is detected by the use of finely divided ferromagnetic particles over the surface of the part. Some of the particles are magnetically gathered and held by the leakage field to form an outline indicating the location, size, shape and extent of the discontinuity. In general, magnetic particle inspection utilizes a variety of types of equipment for magnetization as well as several methods for application of ferromagnetic particles to the test part. Additionally, the ferromagnetic particles are available in a selection of colors (including fluorescent) and particle shapes. Magnetic particle inspections required by this manual can best be accomplished utilizing the wet continuous method on the standard wet horizontal type equipment with either visible or fluorescent magnetic particles suspended in a petroleum base vehicle (normally kerosene). Since magnetic particle indications are best obtained when the discontinuity lies in a direction

transverse to the magnetic field, the following procedures are recommended for optimum detection of discontinuities in bolts.

WARNING: Improper operation of the particle inspection, because of faulty equipment or untrained operators, can jeopardize the airworthiness of parts being tested. Minute electrical arc burns caused during inspection by improper operation of the test equipment can result in eventual failure of the part.

Bolts: Inspection of a bolt is accomplished by longitudinal magnetization in a multi turn, low-fill factor coil (i.e. the inner diameter of the coil greatly exceeds the bolt diameter). For proper magnetization the bolt is positioned close to the coil inside wall with the bolt length perpendicular to the winding direction. The magnetic particle suspension is flowed on the bolt and the appropriate current is applied to achieve adequate field strength. Using the described procedure, laboratory testing has indicated that the ampere turn values listed in Table 203 provide for optimum detection of discontinuities perpendicular to the bolt axis.

After magnetic particle inspection, the parts must be carefully demagnetized and cleaned of the ferromagnetic particles. Examine parts for any possible evidence of electric arc burn that may have occurred during the inspection.

Table 203. Magnetic-Particle Inspection(Steel Bolts)

Bolt Diameter	Total Bolt Length Including Head to Nearest 1/4 Inch	Ampere Turns *
5/8 inch	2 1/2 inch	7,900
5/8 inch	2 3/4 inch	7,100
5/8 inch	3 inch	6,600
3/4 inch	3 inch	7,900
3/4 inch	3 1/4 inch	7,400
3/4 inch	3 1/2 inch	6,700
3/4 inch	3 3/4 inch	6,300
7/8 inch	3 1/2 inch	7,900
7/8 inch	3 3/4 inch	7,400
7/8 inch	4 inch	6,900
7/8 inch	5 inch	5,500
1 inch	5 inch	6,300

* Amperage requirement is the ampere turns value divided by the number of turns on the coil. For example: A 1-inch diameter x 5-inch long bolt tested on a 5-turn coil would require 6,300/5, or 1,260 amps.

Table 204. Magnetic-Particle Inspection(Steel Nuts)

Nut Size	Central Conductor Size	Amperage
5/8 inch	1/2 inch	500 Amps
3/4 inch	5/8 inch	600 Amps
7/8 inch	3/4 inch	700 Amps
1 inch	7/8 inch	800 Amps

J. Outboard Wing Main Spar Cap Inspection

The outboard wing main spar cap must be inspected annually for corrosion.

WARNING: All areas of the spar cap from the wing attach fitting to the outboard end of the spar cap must be inspected.

NOTE: Special emphasis should be placed on airplanes that have been operated or stored for extended periods (5 years or longer) where geographical locations or atmospheric conditions are highly conducive to corrosion.

Inspection of the upper and lower spar cap should be accomplished in the following manner:

- (1) Examine the forward and aft sides of the spar cap where it meets the skin. If a whitish, salt-like, nonmetallic substance is noted in these areas, a thorough inspection should be performed to determine if corrosion has occurred. Wax or paint trapped between the edge of the skin and the exposed section of the spar cap should not be misinterpreted as corrosion.

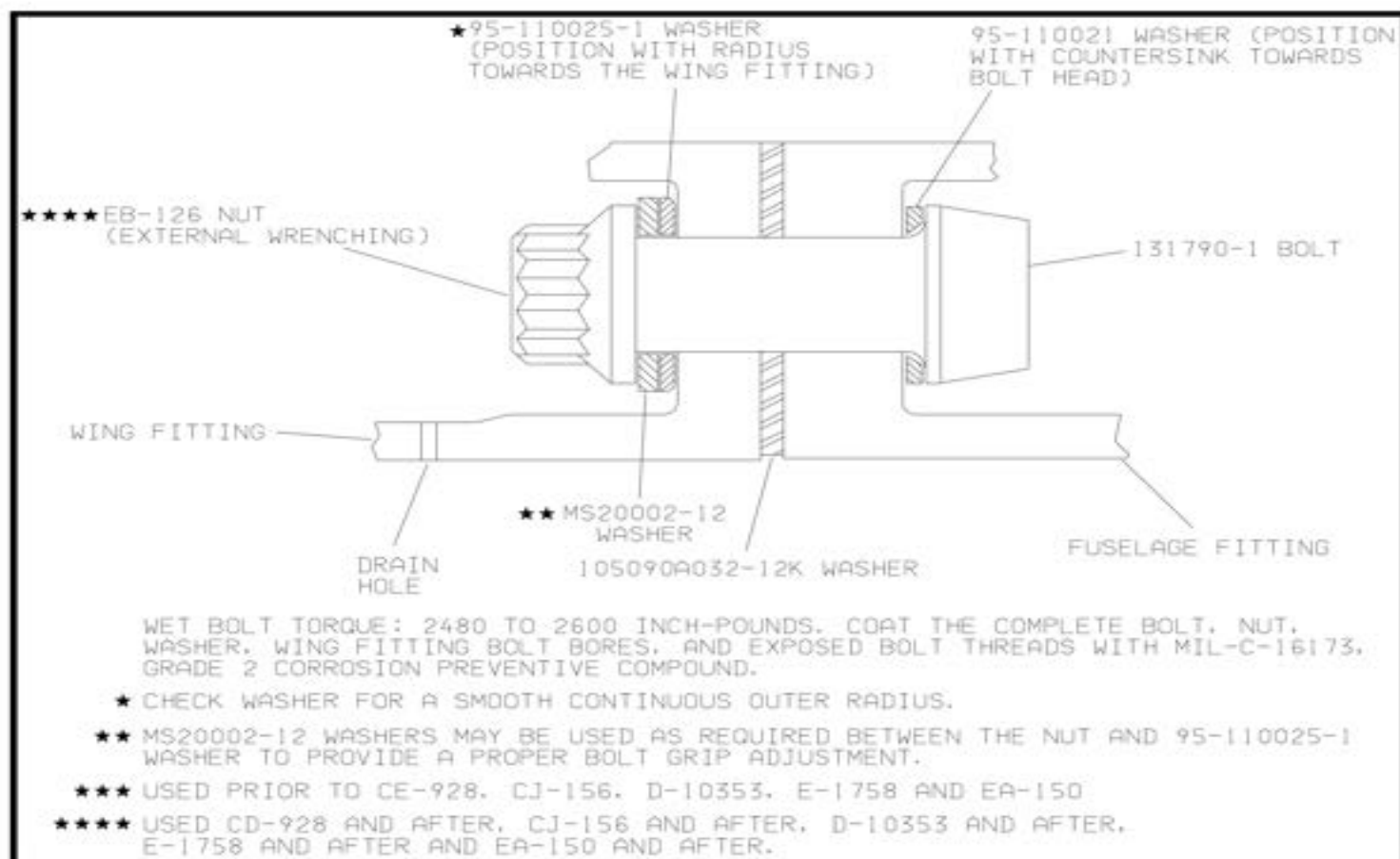
- (2) Wash all exposed areas of the upper and lower spar cap.
- (3) Visually inspect all exposed areas of the upper and lower spar caps for irregularities, such as paint blisters, raised or uneven areas, and cracks. The exposed areas of the spar cap are extruded flat and irregularities could be an indication of corrosion. Investigate all irregularities to determine if any damage has occurred (Refer to [Figure 206](#)).

NOTE: **Uneven or raised areas on the spar caps may be detected by sliding the fingers over the surface, by moving a straight edge over the surface or by sighting down the length of the par cap surface.**

If unusual conditions are encountered that cannot be resolved locally, contact Textron Aviation Corporation Technical Support for evaluation and determination of corrective action that may be required.

Figure 201 : Sheet 1 : Upper Forward Wing Bolt Installation

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NOTE
SEE TABLE 202 FOR
WING BOLT TOOLS



NOTE

CONCURRENT WITH THE SCHEDULED TORQUE CHECK, INSPECT THE UPPER WING ATTACH FITTINGS TO ASSURE THAT THE DRAIN HOLES ARE CLEAR.

★★★★ 12NB126 NUT
(INTERNAL WRENCHING)

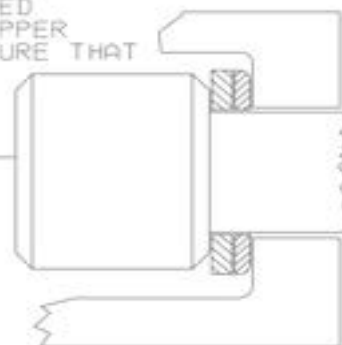
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Figure 202 : Sheet 1 : Upper Aft Wing Bolt Installation

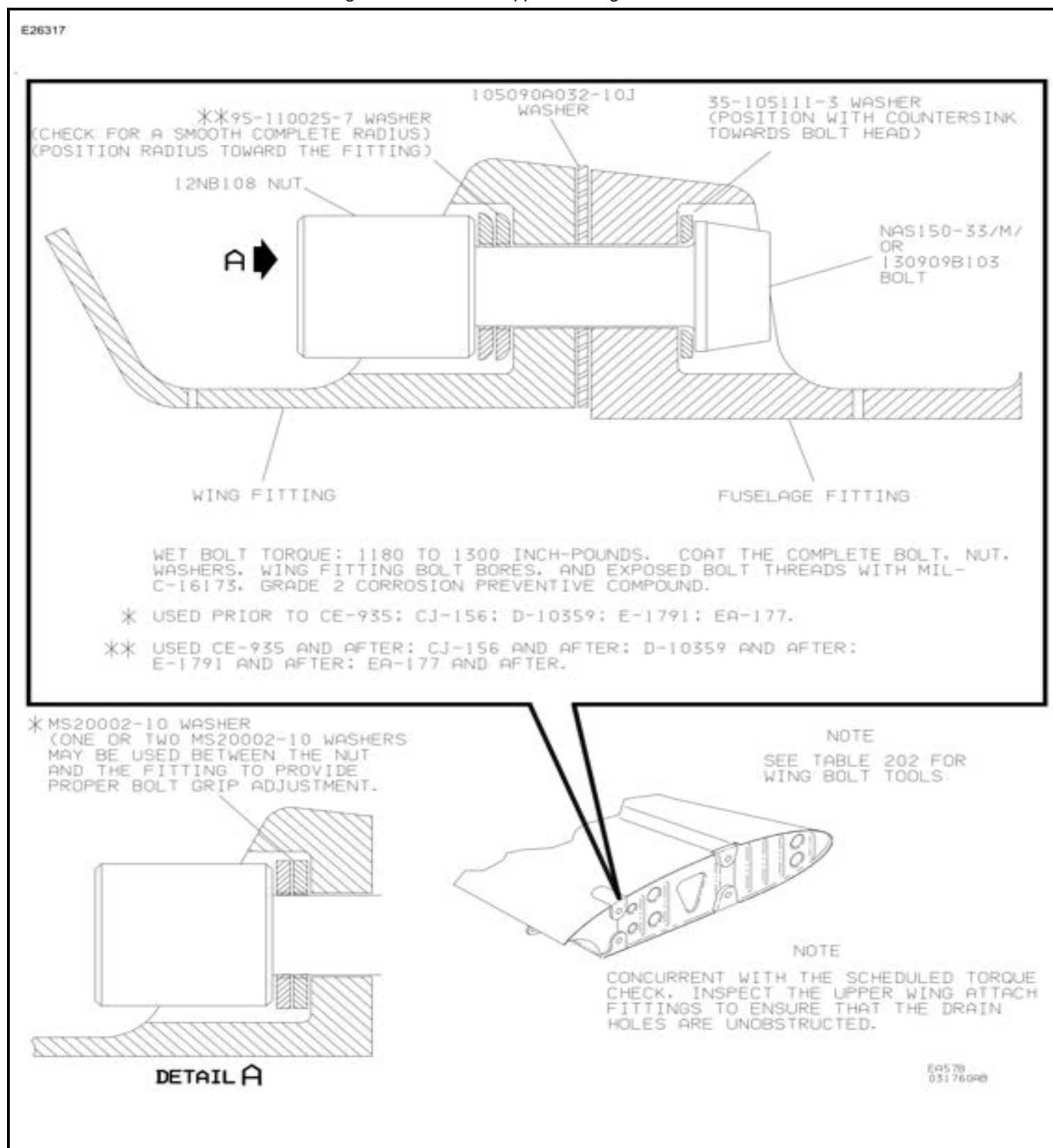


Figure 203 : Sheet 1 : (Revised) - Lower Forward Wing Bolt Installation

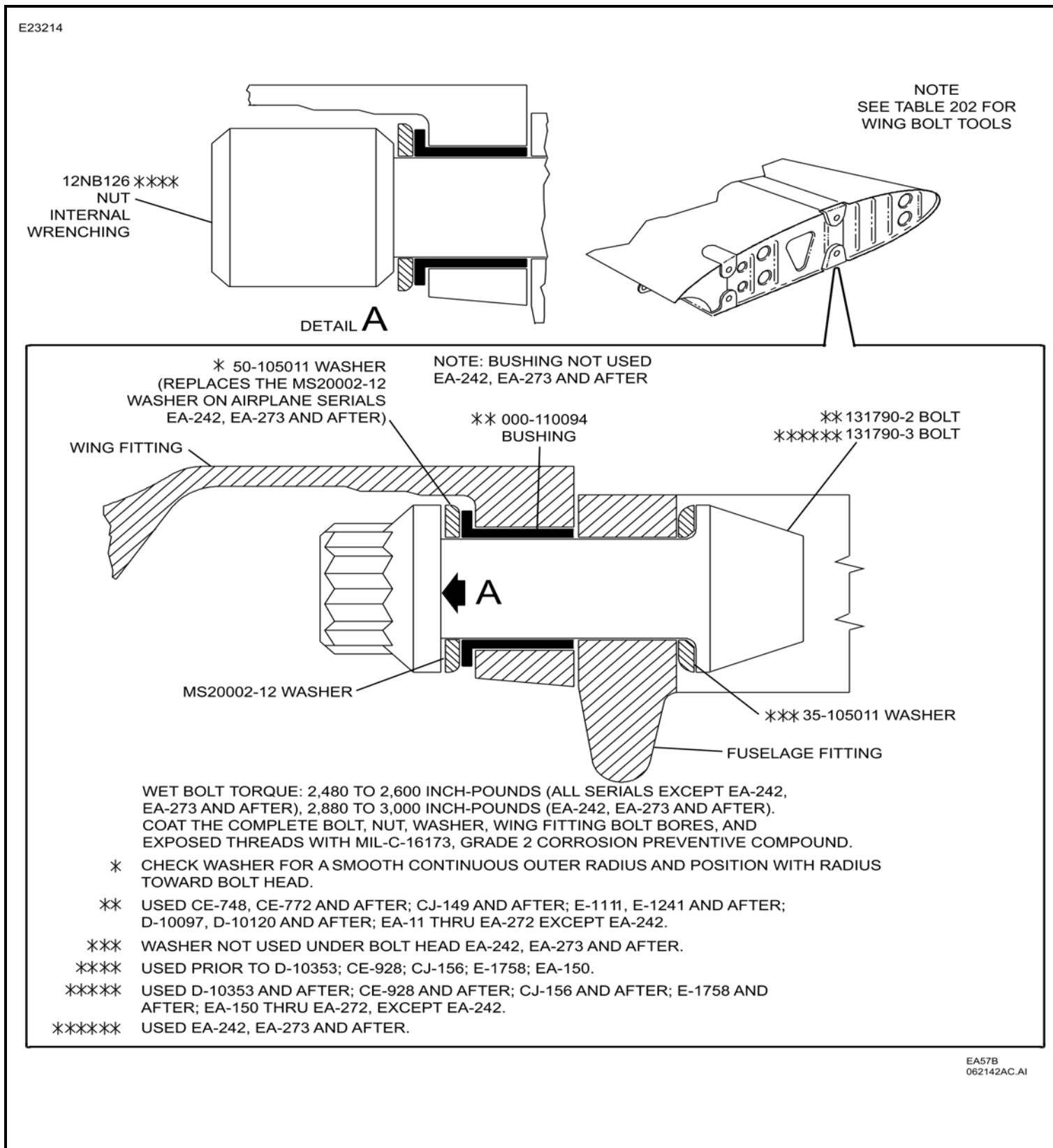


Figure 204 : Sheet 1 : Lower Aft Wing Bolt Installation

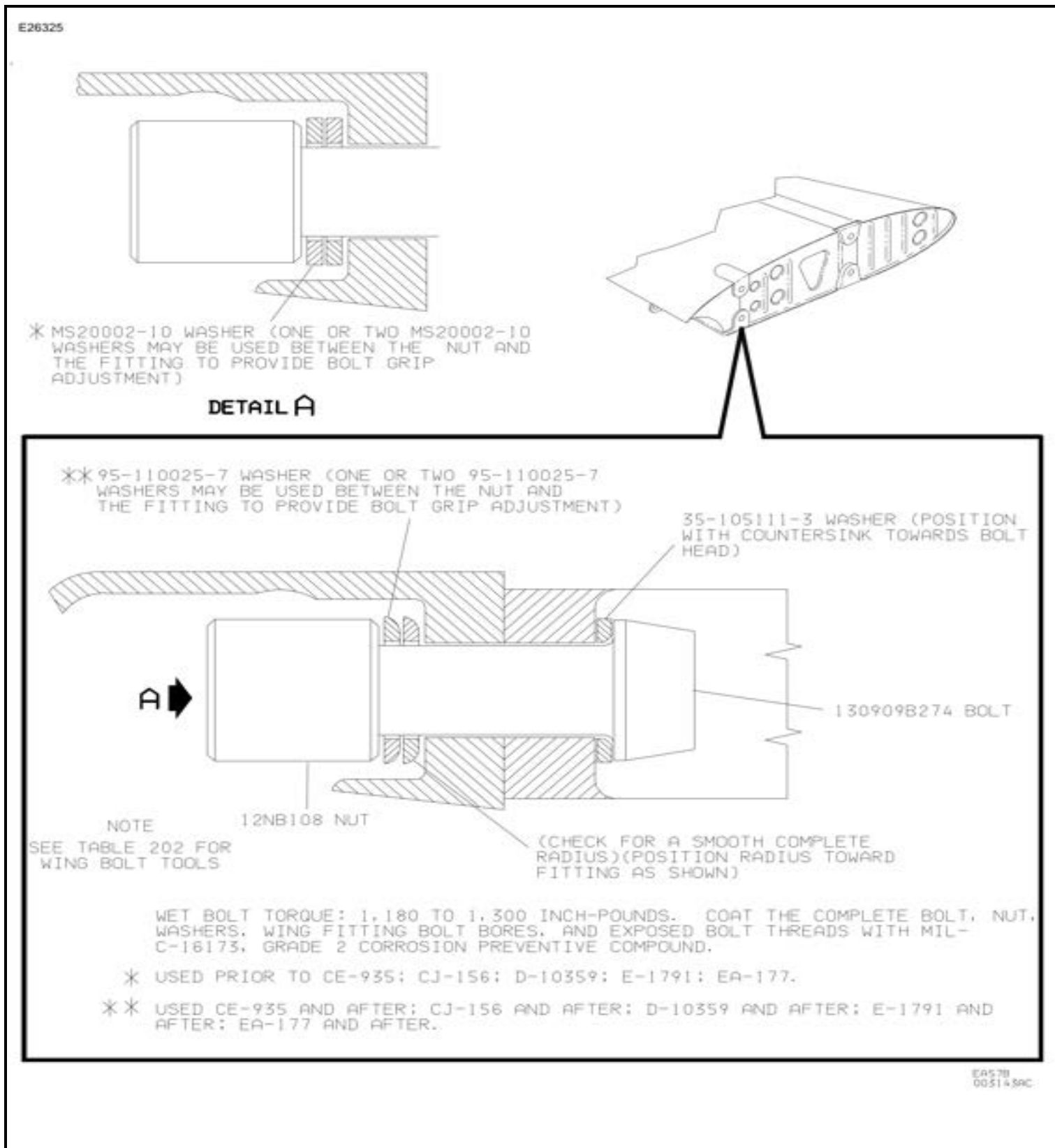


Figure 205 : Sheet 1 : Lubrication Bolt Identification Placard P/N 36-920046-5 (White) or P/N 36-920046-7 (Black)

E26336

NOTICE

WING BOLTS ARE LUBRICATED
SEE MAINTENANCE MANUAL
FOR CORRECT TORQUE VALUES

WHEN THE CORROSION PREVENTIVE COMPOUND HAS BEEN APPLIED TO THE WING BOLTS,
AFFIX THE ABOVE DECAL TO THE FOLLOWING LOCATIONS:

1. ON THE SIDE OF THE FUSELAGE IMMEDIATELY ABOVE THE RH FORWARD AND AFT WING BOLT COVERS.
2. ON THE WING IMMEDIATELY FORWARD OF THE LH FORWARD AND AFT WING BOLT COVERS.
3. ON THE WING IMMEDIATELY FORWARD OF THE LOWER FORWARD WING BOLT COVERS ON BOTH SIDES.
4. ON THE WING IMMEDIATELY AFT OF THE LOWER AFT WING BOLT COVERS ON BOTH SIDES.

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Figure 206 : Sheet 1 : Visual Spar Cap Inspection

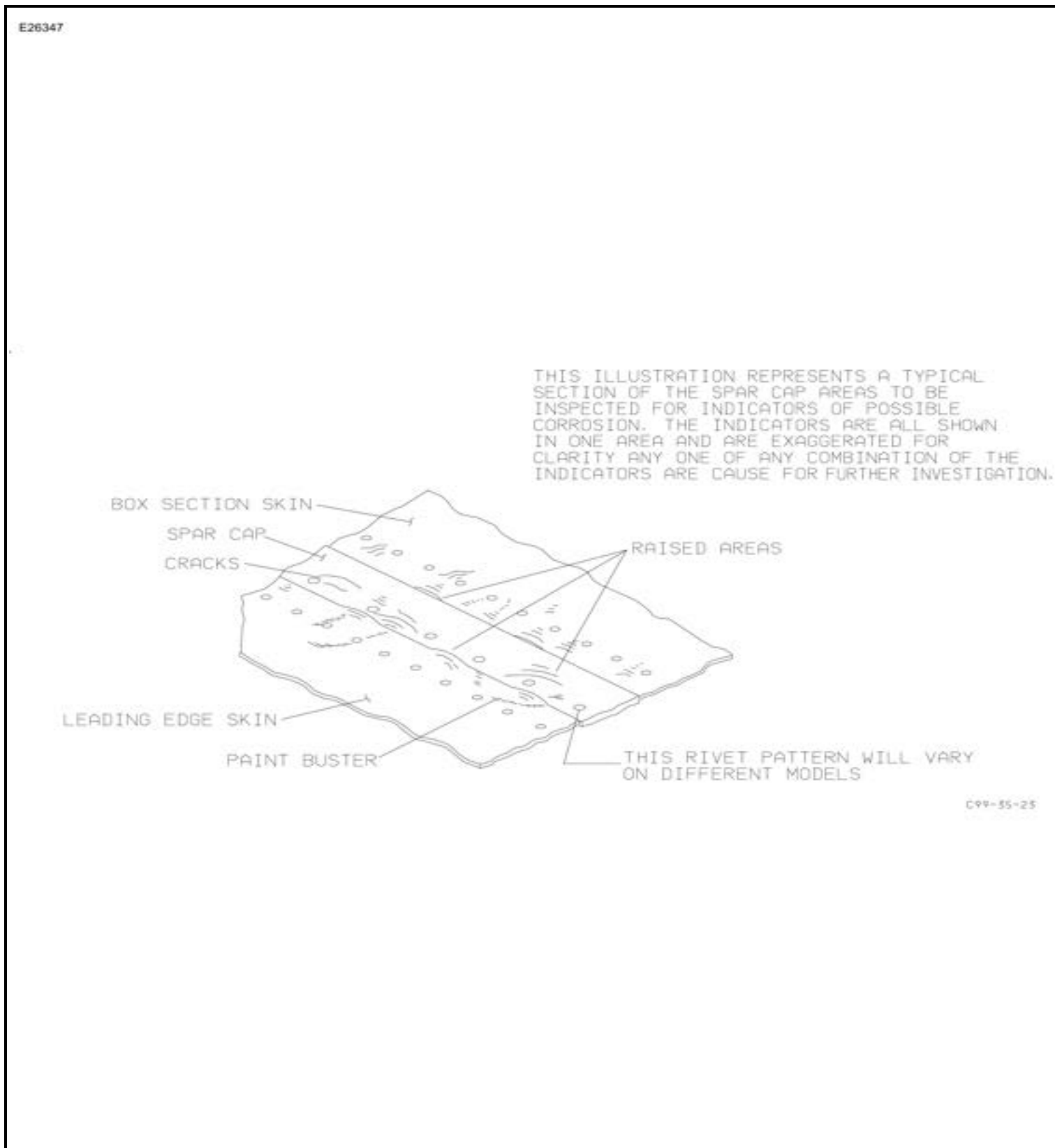


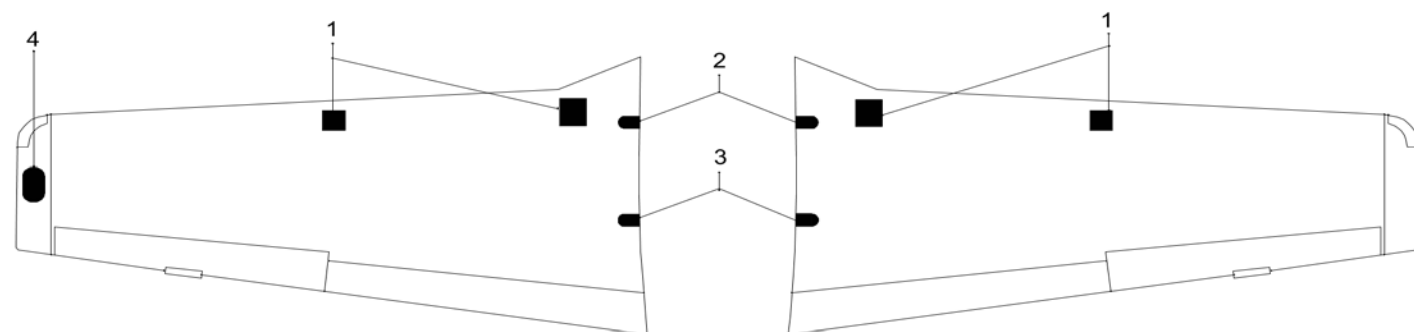
PLATE SKIN - MAINTENANCE PRACTICES

1. Plate Skin - Maintenance Practices

- A. Refer to [Figure 201](#) and [Figure 202](#).

Figure 201 : Sheet 1 : Wing Access Openings

E26357

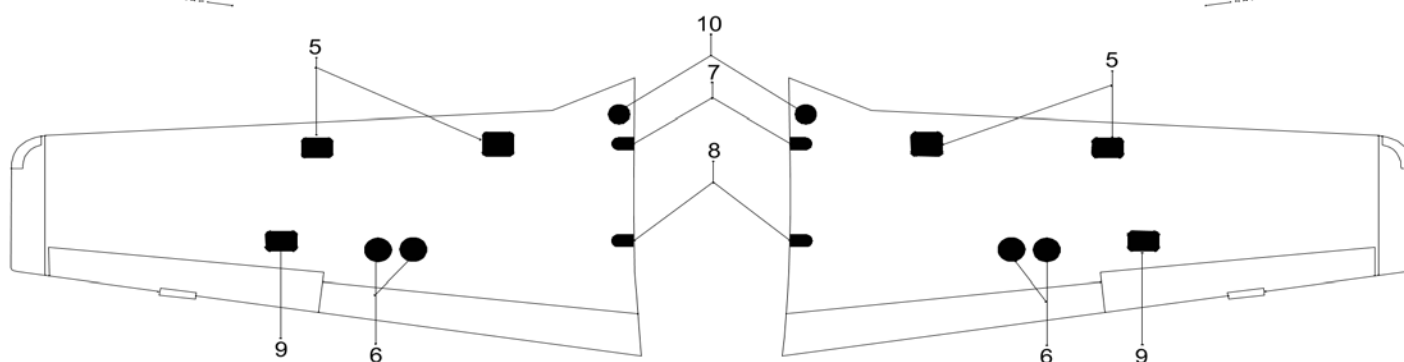


LEFT WING

WINGS - TOP VIEW

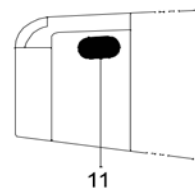
RIGHT WING

WING TIP (EA-242, EA-273 AND AFTER.)

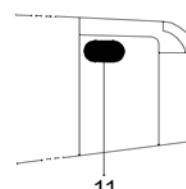


WINGS - BOTTOM VIEW

WING TIP (EA-242, EA-273 AND AFTER.)



RIGHT WING



LEFT WING

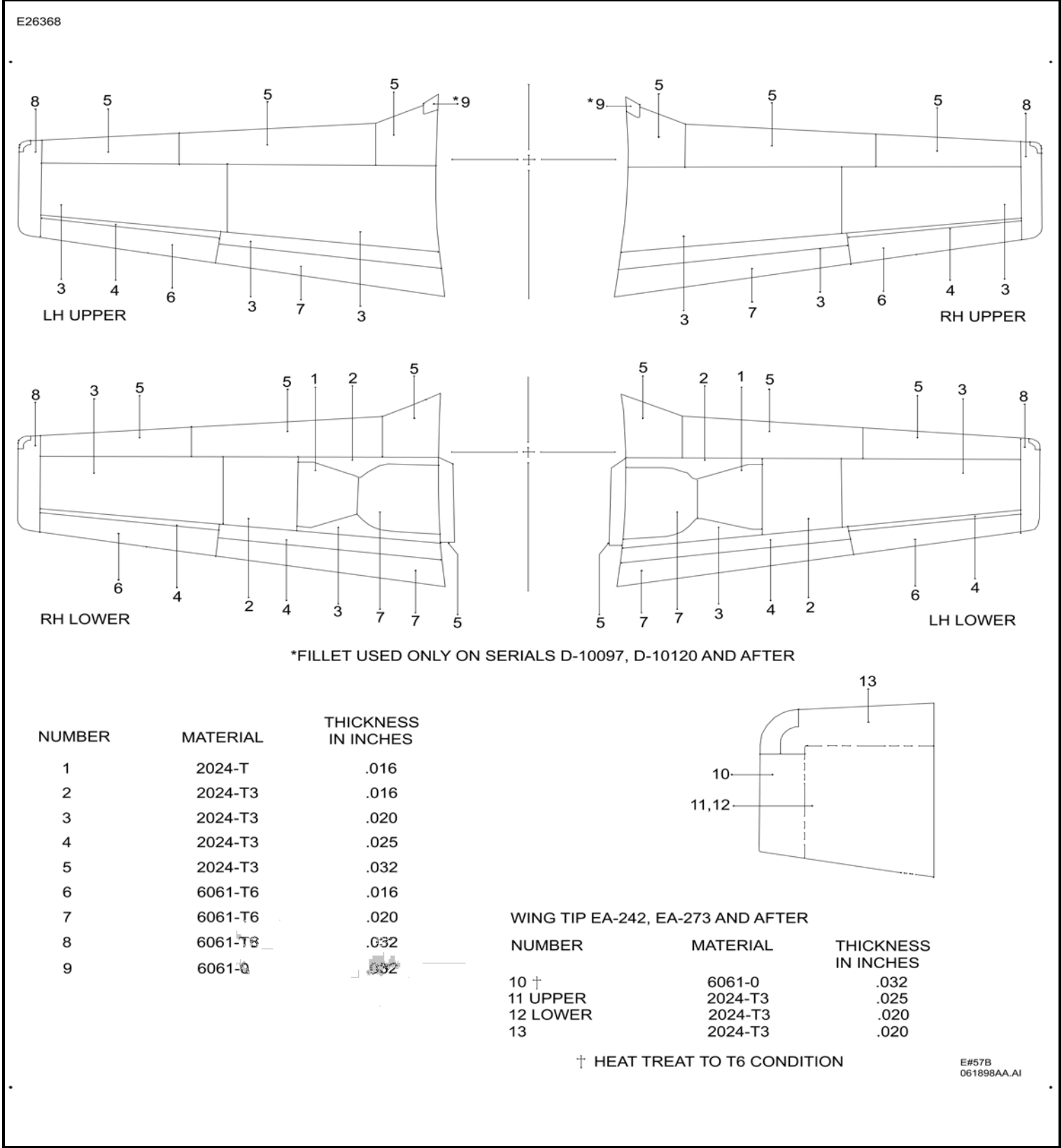
PLATE SKIN - MAINTENANCE PRACTICES

WING ACCESS OPENINGS

1. UPPER FUEL CELL AND TRANSMITTER ACCESS
2. UPPER FORWARD WING ATTACH BOLT
3. UPPER AFT WING ATTACH BOLT
4. OPTIONAL REMOTE COMPASS (EXCEPT CJ-149 AND AFTER)
5. LOWER FUEL CELL ACCESS
6. FLAP ACTUATOR ACCESS
7. LOWER FORWARD WING ATTACH BOLT
8. LOWER AFT WING ATTACH BOLT
9. AILERON BELLCRANK ACCESS
10. FUEL DRAIN (EA-242, EA-273 AND AFTER)
11. FUEL VENT FLOAT VALVE, FLAME ARRESTOR, VENT AND VACUUM REFILL VALVE (EA-242, EA-273 AND AFTER)

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Figure 202 : Sheet 1 : Wing Skin Thickness(*Fillets used only on serials D-10097, D-10120 and after)



ATTACH FITTINGS - MAINTENANCE PRACTICES

1. Attach Fittings - Maintenance Practices

The major fittings in each wing are the supporting structures adjacent to the attachment points for the flap actuator, flap tracks and flap, aileron hinge brackets and hinges, main landing gear support brace and landing gear doors. Minor fittings include brackets to support cable pulleys, bell cranks and similar components. If the landing gear hinge bolt fittings are cracked or if the spar is warped or buckled, replacement is necessary.

BALANCING CONTROL SURFACES - DESCRIPTION AND OPERATION

1. Balancing Control Surfaces - Maintenance Practices

A. Balancing the Aileron

When the aileron control surface is being repainted, suspend it by the trailing edge so that excess paint will drain toward the leading edge.

NOTE: After any repainting or repair, the finished surface must be check balanced to ensure that its static moment about the hinge line is within the prescribed limits.

The painted aileron assembly must be nose-heavy by 0.2 to 1.5 in.-lbs. The static moment of the aileron is determined by multiplying the unbalanced weight of the aileron assembly times the perpendicular distance from the hinge center line to the center of gravity when the chord line is horizontally level. The weight is measured in pounds and the distance in inches. The static moment of a 100 percent balanced control surface is 0.0 in.-lbs. A tail-heavy surface exhibits static under balance. A nose-heavy surface exhibits static overbalance.

B. Checking Balance

The aileron balance must be checked in a draft-free area with the aileron completely assembled in flying condition.

NOTE: All painting, including stripes and touch-up, must be completed.

The tab, static wicks, and hinge bolts must be attached. The chord line must be horizontally level and the hinge line must be properly supported when the static moment is measured. Although many different methods of check balancing exist, they can be categorized under the following two headings:

- (1) Counterbalancing - The application of a known force or weight at a measured distance from the hinge line to counter the unbalance moment of the aileron assembly.
- (2) Actual Force Measurement - Measurement of the force applied by the aileron surface on a single support at a known distance from the center line of the hinge.

C. Equipment Required to Perform Check Balancing

- (1) A stand with knife edge supports as illustrated in [Figure 1](#). The knife edges must be in the same horizontal plane.
- (2) A paper cup or similar light weight container.
- (3) Approximately 1 lb of lead shot.
- (4) A certified beam balance weighing device calibrated in units of 0.01 lb or less.
- (5) A straight edge, ruler, and spirit level.

D. Balancing Procedure

(1) Counterbalancing Method

- (a) Locate the chord line by placing a straight edge at the inboard end of the aileron assembly so that one end is on the trailing edge and the other end is centered on the leading edge. Mark the chord line with a suitable marker, such as a grease pencil, then remove the straight edge.
- (b) Fit the correct size bolts in the hinge brackets and mount the aileron on the knife edge supports. Ascertain that the aileron is free to rotate about the hinge line.
- (c) To determine if weight should be added or removed, suspend a paper cup from a point near the center of the aileron trailing edge. Use a short length of small diameter string secured to the surface with a small piece of masking tape as illustrated in [Figure 1](#). The cup must be free to hang vertically.
- (d) Add small quantities of lead shot to the cup until the aileron balances with the chord line level. Check this by holding the spirit level aligned with the marked chord line.
- (e) The distance D must be perpendicular to the hinge line. Measure D from the hinge line to the suspension point of the cup.

NOTE: Since any weighing error is magnified by the distance D, weighing is most important and must be done carefully on scales that are certified for accuracy.

- (f) Remove the cup, contents, and string, then weigh them.
- (g) Calculate the static balance as follows:
 - 1 The weight of the cup and contents is designated by W.
 - 2 The over or under balance moment is designated by M.
 - 3 $M = W \times D$

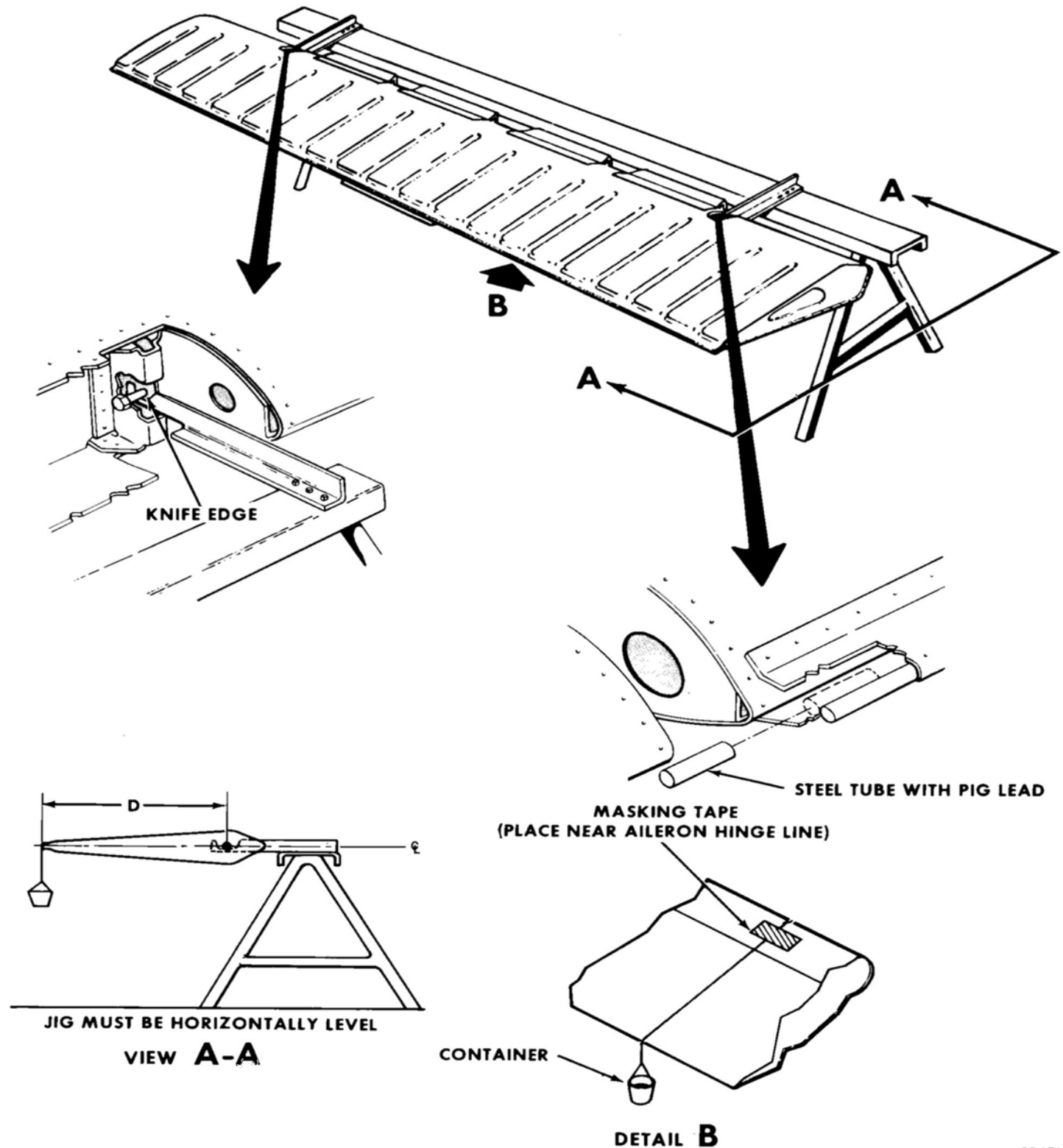
- 4 The following is a typical example of a balancing calculation: Assume the aileron is overbalance (nose-heavy) and the paper cup was suspended from the trailing edge. Assume that the aileron balances with the chord line level at $W = 0.150$ lb and $D = 10.0$ in., then... $M = 0.150 \times 10.0M = 1.50$ in.-lbs. The product of $W \times D$. In this instance, M is within the required static balance range and is therefore acceptable.

CAUTION: When a lead rod is added to obtain correct balance, it must be installed securely with rivets. A loosely installed rod will vibrate and may cause an undesirable vibration of the surface.

- (h) The center of gravity of the aileron is forward of the hinge center line causing the surface to be nose-heavy. Proper aileron balance is obtained by adding or removing lead rod at the leading edge of the aileron. The rod is 15/32 in. diameter and is installed in brackets attached to the leading edge of the aileron. When adding additional lead rod the maximum total of the length of the rod to be added is not to exceed 5 in. over the entire length of the aileron and would be installed at the center brackets.

Figure 1 : Sheet 1 : Balancing the Aileron

E23537



36-151-1A

PROPELLER ASSEMBLY - DESCRIPTION AND OPERATION

1. Propeller Assembly - Description and Operation

A. Propellers

The Bonanza airplanes are equipped with a two-blade or three-blade McCauley propeller or a three-blade Hartzell propeller as indicated in Table 1.

Table 1. Propellers

McCauley	Hartzell
CE-748, CE-772 thru CE-912, CE-917, CE-919, CE-978 and After.	CE-913 thru CE-916, CE-918, CE-920 thru CE-977.
D-10097, D-10120 thru D-10349, D-10383 and After.	D-10350 thru D-10382.
E-111, E-1241 thru E-1715, E-1932 thru E-3220.	E-1716 thru E-1931, E-3221 and After.
EA-11 thru EA-105, EA-107, EA-108, EA-110, EA-118, EA-242, EA-273 thru EA-631.	EA-106, EA-109, EA-111 thru EA-117, EA-119 thru EA-241, EA-243 thru EA-272, EA-632 and After.

These units are single-acting propellers in which the centrifugal twisting moment of the rotating blades is opposed by hydraulic pressure in the cylinder (and spring force in the McCauley propellers) to obtain the correct pitch for the engine load. Governor (engine driven) controls the amount and pressure of oil passing through the propeller shaft to the power piston in the propeller hub. An increase in engine power output causes oil to enter the piston, thus increasing propeller pitch. A decrease in engine power output results in oil leaving the piston, thus decreasing pitch.

PROPELLER ASSEMBLY - MAINTENANCE PRACTICES

1. Propeller Assembly- Maintenance Practices

A. Propeller Removal

WARNING: To avoid possible injury, ensure that the ignition switch is in the OFF position before working on the propeller.

- (1) Remove the six propeller attach nuts from the studs attaching the propeller to the engine crankshaft flange.
NOTE: When propeller deice is installed, it is necessary to tape the brushes in place before the propeller is removed.
- (2) Place a drain trough under the attaching point of the propeller to the crankshaft, to prevent oil draining into the engine cowl.
WARNING: Make sure the sling is correctly rated to support the weight of the propeller assembly during removal.
- (3) Support the propeller assembly with a sling.
- (4) Remove the propeller from the engine crankshaft flange.
- (5) Use clean shop rags to plug the center of the engine crankshaft and the propeller hub.

B. Propeller Installation

- (1) Lubricate the O-ring that is installed in the circular groove of the propeller hub and hub bore surfaces with engine oil (2, Table 1, 91-00-00) before installing the propeller.

WARNING: Make sure the sling is correctly rated to support the weight of the propeller assembly during installation.

- (2) With a suitable crane hoist and sling, carefully move the propeller assembly to the aircraft engine mounting flange in preparation for installation.
- (3) Wipe clean the propeller face and both engine flange surfaces and install the propeller as directed, below.
 - (a) **Two blade propeller:** Place the No. 1 propeller blade directly over the T/C mark on the crankshaft flange
 - (b) **Three blade propeller:** (F33A, A36 and Optional for B36TC). Install propeller on engine flange. Refer to Figure 201 for indexing of propeller to engine crankshaft flange.
 - (c) **Three bladed Hartzell propeller:** (E-1946, E-2104, E-2111 and after). PHC propellers are installed with one blade aligned with the engine TC mark on the propeller mounting flange. The engine TC mark is aligned with one dowel-pin hole and will be pointing up and aligned with the engine case split line when cylinder #6 is at TDC. Refer to Step (7). for installation procedure.

NOTE: Due to the close tolerance fit of the prop hub bore to the pilot on the crankshaft, the hub must be placed square on the engine shaft and seated evenly to the crankshaft flange.

- (4) **McCauley propellers:** Liberally apply grease, A-1637-16 (P/N of McCauley - furnished with propeller), or grease (70, Table 1, 91-00-00) to threads of studs and nuts and also to faces of nuts.
- (5) **McCauley propellers:** Snug the six propeller attach nuts down evenly in a diagonal pattern. Torque the attach nuts in a diagonal pattern to 45-50 foot-pounds for McCauley propellers.
- (6) **McCauley propellers:** Wipe off excessive grease after torquing.
- (7) **Hartzell Propellers:** When installing an Hartzell three blade propeller on an F flange, do the following:

CAUTION: Alignment of the dowel pins must be straight to avoid damage to the propeller hub, o-ring, or o-ring groove.

CAUTION: Do not use the propeller mounting hardware to draw the dowel pins into position as this can result in damage to the propeller hub, o-ring, or o-ring groove.

 - (a) Install the propeller on the engine flange. Make certain to align the dowel pins in the propeller flange with the corresponding holes in the engine mounting flange.
 - (b) Install the propeller mounting hardware and torque as detailed in step 1 and 2 below:

CAUTION: The mounting hardware must be clean and dry to prevent excessive preload of the mounting flange.
Tighten mounting hardware evenly to avoid hub damage.
All torques listed are dry torque.

The propeller must be flush with the engine prop flange before tightening or torquing the mounting hardware.
Always refer to the Hartzell propellers owner's manual (115N), or subsequent, for current final torque values.

- 1 Using Sequence A (Refer to [Figure 202](#)), torque all bolts to an initial 40 foot-pounds.
 - 2 Using Sequence B (Refer to [Figure 202](#)), torque all mounting hardware to a final torque as detailed in the Hartzell Manual (115N) or subsequent.
- (8) Remove the crane hoist from the airplane area.
- (9) It may be necessary to check the alignment of the deicer brushes to the slip ring as noted in [Chapter 30-60-00](#).
- (10) Check the prop blade track after installation.

C. Propeller Adjustment

For adjustments, service, overhaul and maintenance procedures, refer to the applicable FAA Approved Propeller Manual and or Approved Propeller Overhaul Shop Manual. All pitch measurements are made at the 30 inch station. For McCauley propeller adjustments refer to [Table 201](#). For Hartzell propeller adjustments refer to [Table 202](#).

Table 201. McCauley Propeller Adjustment

Hub/Blade Part Number	Low Pitch	High Pitch
Two-Blade Propellers		
Hub: 2A36C23	13.3° ± 0.2°	29.7° ± 0.5°
Blade: 84B-0		
Three-Blade Propellers		
Hub: 3A32C406 X	13.3° ± 0.3°	29.0° ± 0.5°
Blade: X 82NDB-2		
Hub: 3A32C76	13.3° ± 0.2°	29.0° ± 0.5°
Blade: 82NB-2		
Hub: 3A32C76-U	15.0° ± 0.2°	34.5° ± 0.1°
Blade: 82NB-2		
Hub: 3A32C406 X	15.8° ± 0.3°	34.9° ± 0.5°
Blade: X 82NDB-4		
Hub: 3A32C409-X	13.7° ± 0.3°	28.8° ± 0.5°
Blade: 82NDB-2		

Table 202. Hartzell Propeller Adjustment

Hub/Blade Part Number	Low Pitch	High Pitch
THREE-BLADE PROPELLERS		
Hub: PHC-C3YF-1RF (Used on IO-520-BB)	12.0° ± 0.2°	33.0° ± 1.0°
Blade: F8468A-6R		
Hub: PHC-C3YF-1RF (Used on TSIO-520-UB & IO-550-B)	13.0° ± 0.2°	36.0° ± 1.0°
Blade: F8468A-6R		
Hub: PHC-C3YF-1RF	13.0° ± 0.2°	36.0° ± 1.0°
Blade: F8468A-8R		

D. Minor Propeller Repair

Minor nicks, dents, and gouges may be dressed out by qualified personnel only. Blend any nicks or gouges into the leading edge with smooth curves and generous radii (Refer to [Figure 203](#)). Re-anodize reworked area by the chromic acid process

only.

If shortening of the propeller is necessary for repair, care should be taken that the blades are not shortened to a length less than the minimum amount specified. When shortening a propeller to repair the tip(s) all of the blades must be shortened an equal amount and the tips have identical shapes.

The specified diameters for McCauley two-blade and three-blade propellers are provided in [Table 203](#). The specified diameters for Hartzell three-blade propellers are provided in [Table 204](#).

Table 203. McCauley Propellers Diameter Specifications

Hub/Blade Part Number	MaximumInches	MinimumInches
TWO-BLADE PROPELLERS		
Hub: 2A36C23	84	82
Blade: 84B-0		
THREE-BLADE PROPELLERS		
Hub: 3A32C406 X	80	78 1/2
Blade: 82NDB-2		
Hub: 3A32C76	80	78 1/2
Blade: 82NB-2		
Hub: 3A32C76U	80	78 1/2
Blade: 82NB-2		
Hub: 3A32C406 X	78	77
Blade: 82NDB-4		
Hub: D3A32C409 X	80	79
Blade: 82NDB-2		

Table 204. Hartzell Propellers Diameter Specifications

Hub/Blade Part Number	MaximumInches	MinimumInches
THREE-BLADE PROPELLERS		
Hub: PHC-C3YF-1RF	80	78
Blade: F8468A-6R		
Hub: PHC-C3YF-1RF	78	77
Blade: F8468A-8R		

Figure 201 : Sheet 1 : McCauley Propeller Indexing

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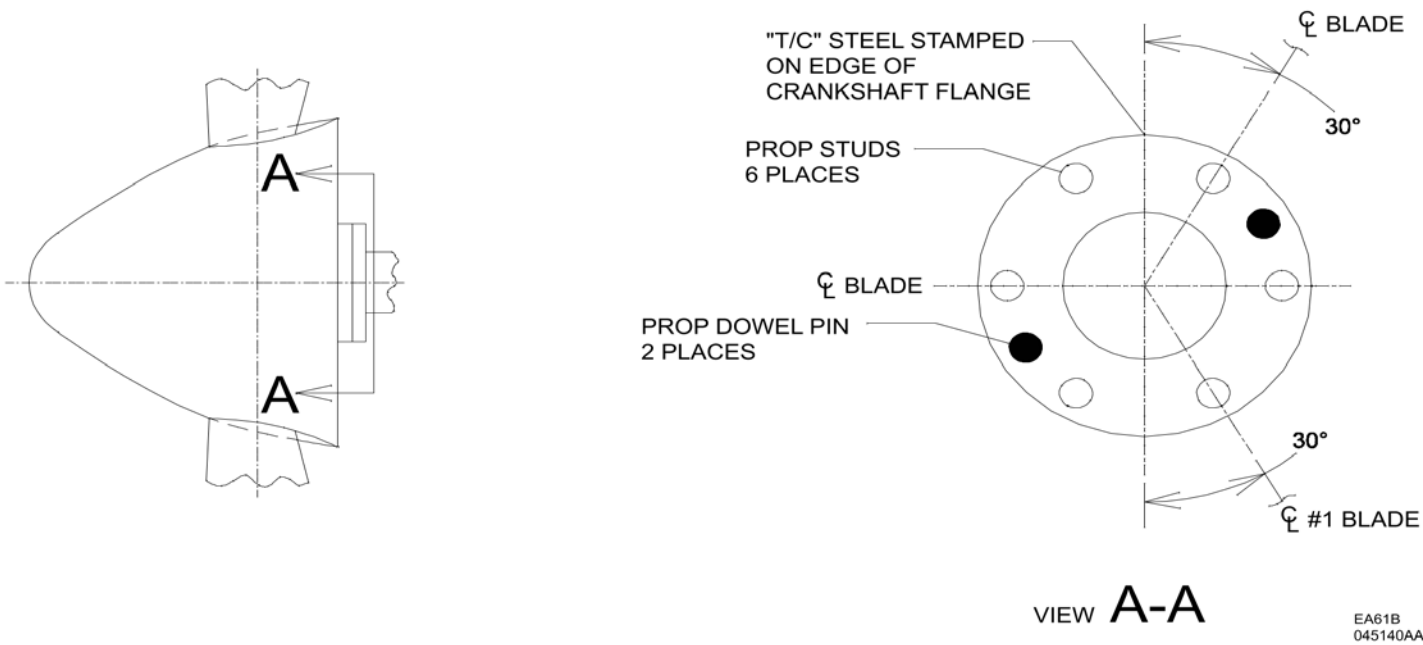
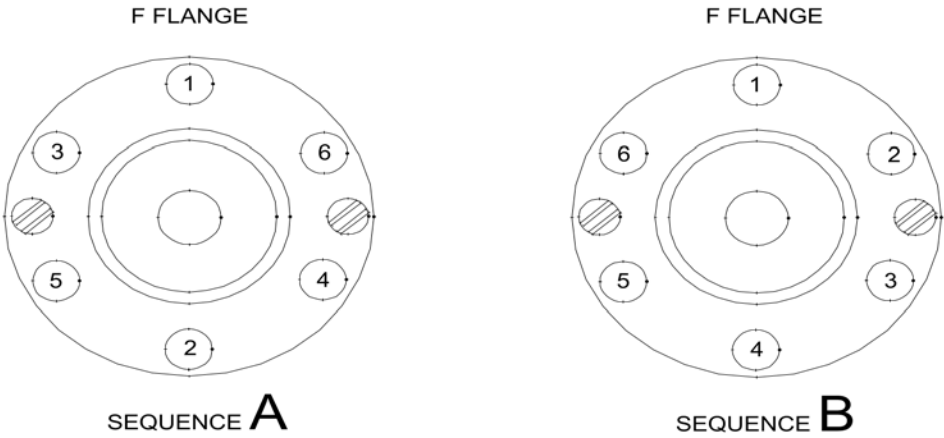


Figure 202 : Sheet 1 : Hartzell Propeller Mounting Hardware - Torque Sequence

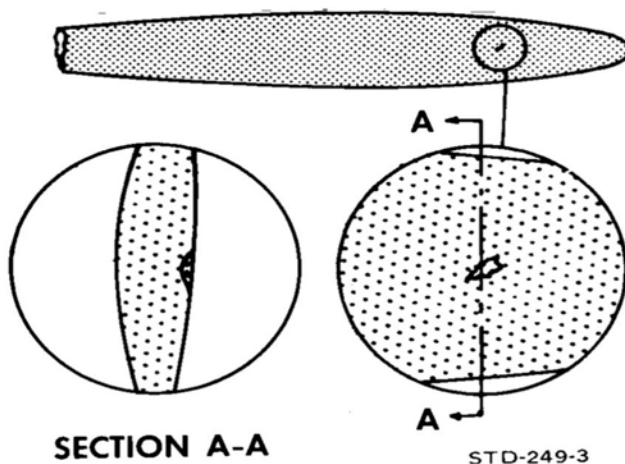
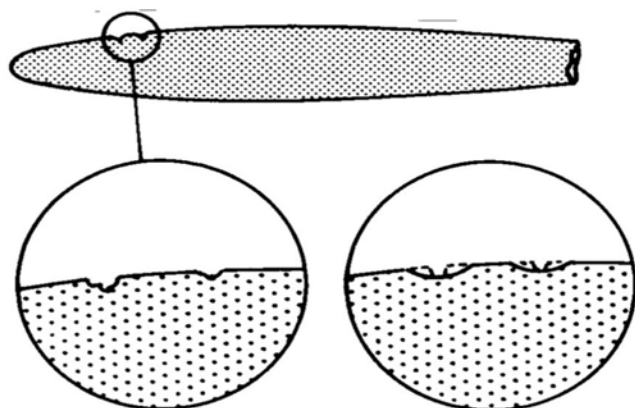
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Figure 203 : Sheet 1 : Minor Propeller Blade Repair

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CONTROLLING - MAINTENANCE PRACTICES

1. Controlling - Maintenance Practices

A. Propeller Governor Removal

- (1) Open the engine cowl.
- (2) Disconnect the control rod end at the governor control lever.

NOTE: Care should be taken not to loosen the jam nut on the control rod end which could alter the setting of the control rod.

- (3) Remove the four mounting nuts and pull the governor from the engine.
- (4) Cover the governor base and engine pad to protect them.

B. Propeller Governor Installation

- (1) Remove the cover from the governor base and wipe the base clean.
- (2) Install a new governor mounting gasket on the governor, ensuring that the protruding gasket screen is facing into the body of the governor.
- (3) Remove the cover from the engine pad and wipe the pad clean.
- (4) Reinstall the governor on the engine pad and secure with the four mounting nuts. Torque the nuts to 180 to 220 inch-pounds.
- (5) Reconnect the control rod to the governor lever.
- (6) Close the engine cowl.

C. Propeller Governor Adjustment

The propeller governor can be adjusted for a high RPM setting. The high RPM adjustment must be checked while the airplane is in flight. For instructions on adjustment of the low RPM setting refer to IDLE SPEED AND MIXTURE ADJUSTMENT, Chapter 71-00-00.

(1) High RPM Adjustment

The high RPM adjustment must be checked while the airplane is in flight. Observe the take off RPM to see if it exceeds the red line figure. If excessive RPM is observed adjust the high RPM screw inward to reduce the RPM. The propeller governor adjustment screw is located on the governor, facing outward from the engine. One complete revolution of the screw reduces the propeller RPM by approximately 25-30 revolutions.

ENGINE - GENERAL

1. General - Description

For specific information and instructions on the care of the airplane's engine, such as inspection, disassembly, assembly, cleaning, repair, replacement, and the special tools and equipment required for these tasks, refer to the applicable Continental Aircraft Engine Overhaul Manual. The manuals are as follows:

- For IO-520 series engines (aircraft serials: CE-748, CE-772 and After; CJ-149 and After; D-10097, D-10120 and After; E-1111, and E-1241 through E-2110 except E-1946 and E-2104), refer to Continental Aircraft Engines Overhaul Manual, FORM X-30039A.
- For IO-550-B series engines (aircraft serials: E-1946, E-2104 and After), refer to Continental Aircraft Engines Overhaul Manual, FORM X-30568.
- For TSIO-520 series engines (aircraft serials: EA-11 and After), refer to Continental Aircraft Engines Overhaul Manual, FORM X-30042.

CAUTION: It is important that when replacing the engine, it's components, and/or it's accessories, all part numbers be verified to ensure that the proper part has been obtained for replacement. An incorrect part replacement may result in extensive damage to the airplanes engine.

INDICATING - DESCRIPTION AND OPERATION

1. Indicating - Description and Operation

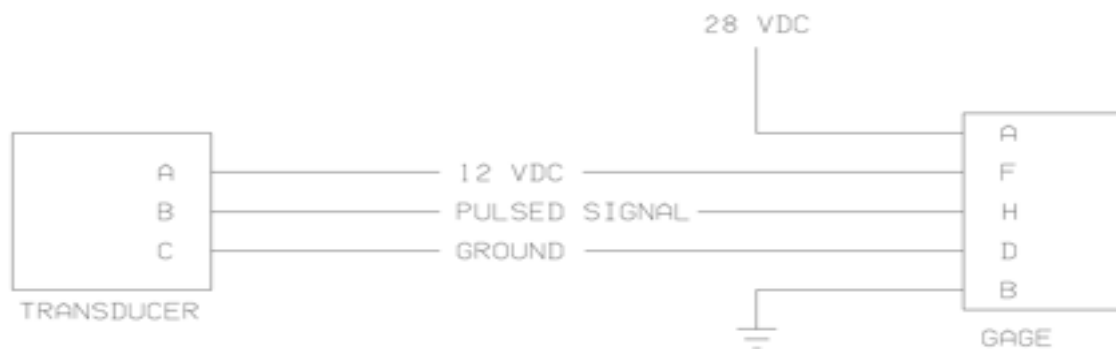
A. Fuel Flow Indicator

On the fuel flow systems prior to CE-929; CJ-156; D-10354; E-1766, and EA-159, the indicator in the instrument panel is teed into the fuel supply line down stream from the throttle servo. In this system the indicator converts fuel pressure to readout in fuel flow of gallons per hour.

On serials CE-929 and After; CJ-156 and After; D-10354 and After; E-1766 and After; EA-159 and After, the fuel flow system does not rely on fuel pressure to indicate fuel flow (Refer to [Figure 1](#)). In this system fuel flowing through a transducer modulates an electric signal which is directed to the fuel flow indicator in the instrument panel. The fuel flow indicator gives a readout in gallons per hour. The major components of the system are the transducer and the indicator. Engine fuel flows through the transducer then to the engine fuel distributor valve. The transducer is attached to the top of the engine crankcase, near the forward end on the center line of the engine. The indicator has dual pointers, one for fuel flow and one for manifold pressure. The circuit breaker for the fuel flow system is located in the subpanel in front of the copilot.

Figure 1 : Sheet 1 : Fuel Flow Indicator System

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PIN - A ON THE GAGE RECEIVES 28 VOLTS D.C. AIRCRAFT VOLTAGE.
PIN - A ON THE TRANSDUCER RECEIVES 12 VOLTS D.C. FROM THE GAGE.
PIN - B ON THE TRANSDUCER SENDS A PULSED SIGNAL BACK TO THE GAGE
DEPENDING UPON THE FUEL FLOW SENSED BY THE TRANSDUCER.
PIN - C ON THE TRANSDUCER IS THE GROUND CONNECTION TO THE GAGE PIN D.

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INDICATING - REMOVAL/INSTALLATION

1. Indicating - Removal/Installation (CE-929 and After; CJ-156 and After; D-10354 and After; E-1766 and After; EA-159 and After)

A. Transducer Removal

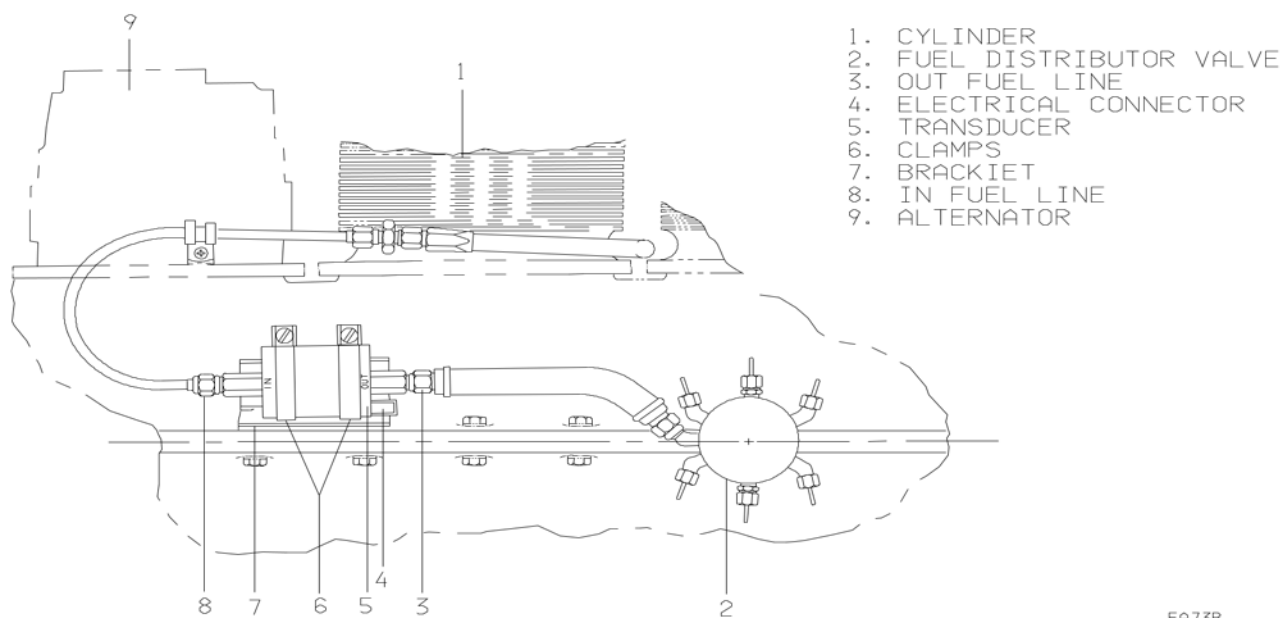
- (1) Remove electrical power.
- (2) Open the engine cowl.
- (3) Disconnect the electrical connector (4) (Refer to [Figure 201](#)).
- (4) Disconnect and cap the two fuel lines (8, 3) and cap the openings on the transducer to prevent contamination.
- (5) Loosen clamps (6) and slide out transducer (5).

B. Transducer Installation

- (1) Slide the transducer in place and tighten the clamps (6) (Refer to [Figure 201](#)).
- (2) Uncap and connect the two fuel lines (8, 3) to transducer (5).
- (3) Connect the electrical connector (4).
- (4) Close the engine cowl.
- (5) Restore electrical power.

Figure 401 : Sheet 1 : Transducer Removal/Installation

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IGNITION - GENERAL

1. General - Description and Operation

- A. CE-748, CE-772 and After; CJ-149 and After; D-10097, D-10120 and After; E-1111, E-1241 and After
The engine is equipped with two Bendix S6RN-1225 magnetos. Each magneto incorporates an impulse coupler. At starter cranking speeds the impulse coupler automatically retards the spark for starting purposes. Centrifugal force disengages the impulse coupling prior to reaching engine idle speed. The impulse coupler then acts as a straight drive and the magnetos fire at the normal firing position of the engine.
- B. EA-11 through EA-439
The engine is equipped with a Bendix S6RN-1201 magneto (left side) and a Bendix S6RN-1205 magneto on the right side. This system incorporates a starter vibrator. The left magneto has two sets of points: the retarded set of points is used for engine starting and the main set of points is used when the engine is running.
When the starter is engaged the right magneto is grounded and the left magneto (using the retarded set of points) is supplied with pulsating current from the starter vibrator, which received its current from the starter solenoid. The starter vibrator is located on the left aft side of the firewall.
- C. EA-440 and After
The engine is equipped with two slick 6220, impulse coupled, pressurized magnetos. Pressurizing the magnetos will prevent internal arcing which may occur in unpressurized magnetos while flying at high altitudes. The air to pressurize the magnetos is taken from the throttle body and should be at or near sea level pressure at all times. After the pressurizing air leaves the throttle body it passes through a filter on the way to the magnetos. This filter should be checked every 50 hours and replaced as required. If the filter is white it may be continued in service, but if it is red or contaminated the filter should be replaced.
- D. Ignition and Starter Switch
The combination ignition and starter switch has five positions:
- OFF - The magnetos are inoperative.
 - R - The right magneto is firing its plugs; the left magneto is not firing its plugs.
 - L - The left magneto is firing its plugs; the right magneto is not firing its plugs.
 - BOTH - Both magnetos are firing their plugs.
 - START - On S6RN-1225 and Slick magnetos, the starter circuit is completed and the starter is operating. The impulse coupling is engaged to retard the spark for starting. On S6RN-1201 and S6RN-1205 magnetos, the starter solenoid is operating and the vibrator is energized causing current to flow through the retard breaker on the left magneto while the right magneto is grounded.

IGNITION - TROUBLESHOOTING

1. General

A. Ignition System Troubleshooting

Table 101. Troubleshooting Ignition Systems

Indication	Probable Cause	Remarks
1. Engine fails to start.	a. Spark plugs loose, wet, fouled or defective.	a. Clean or replace defective spark plugs.
	b. Magneto primary ground wire short circuited.	b. Check primary ground wire between magneto and switch.
	c. Dirty, burned or pitted magneto breaker points.	c. Clean points or replace if badly burned or pitted.
	d. Moisture or oil in magneto distributor.	d. Clean magneto distributor.
	e. Internal trouble with magnetos.	e. Turn engine over and check spark jump. Replace magneto if there is no spark or if spark is weak.
2. Hard starting.	a. Magneto improperly timed to engine.	a. Time magneto to engine.
	b. Magneto breaker points are not set properly.	b. Set points.
	c. Impulse coupling inoperative or late.	c. Remove access cover and check impulse coupling action.
3. Rough running engine.	a. Spark plugs loose or fouled.	a. Clean and regap spark plugs.
	b. Spark plugs, leads or connectors oily, dirty or cracked.	b. Clean leads and connectors and replace damaged connectors.
	c. Defective ignition harness.	c. Make continuity and high voltage tests on harness. Replace harness or leads if necessary.
	d. Magnetos incorrectly timed.	d. Time magnetos to engine.
	e. Dirty or burned breaker points.	e. Clean or replace if badly burned.
4. Low power.	a. Burned or defective ignition harness.	a. Check continuity of harness and replace if necessary.
	b. Magnetos incorrectly timed	b. Time magnetos to engine.
	c. Internal trouble with magnetos.	c. Turn engine over and check spark. Replace magneto if there is weak or no spark.

IGNITION - MAINTENANCE PRACTICES

1. General - Maintenance Practices

A. Magneto Drop Off Check

The drop off check is accomplished by switching the magneto switch from BOTH to either the RIGHT or LEFT position and noting any loss or variance in RPM.

- (1) Thoroughly warm up the engine and set the propeller control in low pitch. Place the mixture control in FULL RICH.
- (2) Set the throttle to produce 1700 RPM.
- (3) Note the amount of RPM differential between the LEFT and RIGHT magnetos as the magneto switch is turned from BOTH to LEFT, back to BOTH and then turned to the RIGHT position. The difference between the two magnetos operated individually should not exceed 50 RPM. Normal magneto drop off on either magneto should be within 50 RPM of each other. If the magneto drop off is excessive on either magneto (150 RPM), an inspection to determine the cause should be accomplished. Common causes are incorrectly timed magnetos or incorrect fuel/air ratio.

NOTE: Due to the design changes in today's higher performance engines, the comparison of single magneto operation versus both magnetos is no longer a sound criteria for evaluation of magneto performance. Therefore, all magneto checks should be performed on a comparative basis between right and left magneto performance. In addition, absence of magneto drop off should be cause for suspicion that the timing has been bumped up in advance of the specified setting.

CAUTION: To avoid fouling the spark plugs, operation on one magneto should not exceed 5 seconds.

B. Magneto Point Gap And Timing

It is assumed that the magnetos have been properly internally timed and points adjusted per the applicable Bendix or Slick vendor publications. To adjust the magneto points other than that specified in the applicable vendor publication will alter the magneto 'E gap' and cause a weak spark. This internal timing and point adjustment should not be made on the airplane. For inspection purposes the point gap may be checked when the cam follower is resting on the high point of the cam lobe. The magneto point gap should be as follows:

Magneto	Point Gap In Inches
Bendix S6RN-1201 and S6RN-1205 - Main breaker	0.016 ± 0.003
Bendix S6RN-1201 - Retard breaker	0.016 ± 0.006
Bendix S6RN-1225	0.016 ± 0.003
Slick 6220	0.009 ± 0.001

On the magnetos the internal timing and point adjustment should be made at the time of assembly or overhaul (Bendix timing Kit No. 11-8150-1 is available for internal timing of the magneto. Slick T100 Assembly and Timing Kit is available for Slick magnetos).

NOTE: For adjustment of contact opening and internal timing of Bendix magnetos, refer to Bendix, for applicable manuals. Magneto contact assemblies should be checked after the first 25 and 50 hours operation and each 50 hours thereafter.

C. Preparing The Magneto For Installation On The Engine

On Bendix magnetos turn the magneto drive in the direction opposite to normal rotation (this keeps the impulse couplers from engaging) (non impulse coupled magnetos may also be rotated opposite to normal rotation) until the respective timing mark (viewed through the inspection hole) on the distributor gear is aligned with the divided casting line of the magneto housing. Now the magneto is ready to install on the engine and to fire No. 1 cylinder.

Slick magnetos may be prepared for installation on the engine as follows:

- (1) Insert the T-118 timing pin (or a 6 penny nail) in the R hole in the distributor block.
- (2) Turn the magneto drive in the direction opposite to normal rotation until the pin inserts through the hole in the gear (approximately 1/4 inch).

NOTE: If the pin is binding, but will not insert into the hole in the gear, it has hit the pointer on the gear. Pull the pin out until the pointer has passed, reinstall the pin and continue rotation until the pin inserts in the hole in the gear.

- (3) The magneto is now ready to install on the engine and supply ignition spark to number one cylinder.
- (4) As soon as the magneto is installed on the engine the timing pin must be removed.

NOTE: If the magneto drive is rotated with the timing pin installed the magneto will be damaged.

D. Magneto Pressurization Air Filter

The magneto pressurization air filter is located on top of the engine between the magnetos. This filter may be continued in service as long as it appears white and is not contaminated. The filter should be checked every 50 hours and replaced as necessary.

E. Removal Of The Magnetos

- (1) Remove the four screws retaining the high tension outlet and remove the outlet from the magneto.

CAUTION: Current production magnetos do not have the automatic grounding devices featured on earlier Scintilla magnetos. To be safe treat all magnetos as hot whenever the ground lead (switch terminal) is disconnected. To ground the magneto, connect a wire to the switch lead of the magneto and ground the wire to the case.

- (2) Remove the grounding wire from the magneto.
- (3) Remove the two magneto retaining nuts and washers and pull the magneto away from the accessory case.

F. Installation And Timing Of Magnetos

- (1) Remove the lower spark plug from each cylinder.
- (2) Cover the lower spark plug hole of No. 1 cylinder with the thumb and turn the crankshaft until pressure is felt on the thumb.
- (3) Remove the plug in front of No. 6 cylinder and observe the timing marks on the alternator drive gear as the crankshaft is rotated. There are two marks; one at the 20° BTC position and one at the 24° BTC position. When a position halfway between these marks is centered in the viewing hole, No. 1 cylinder is at the 22° BTC position of the compression stroke.

NOTE: Prepare the magneto for installation on the engine as described in PREPARING THE MAGNETO FOR INSTALLATION ON THE ENGINE.

- (4) Hold the magneto in the position it will occupy when installed and check alignment of the gear coupling slot and impulse coupling lugs. If not aligned, pull the gear out of mesh, but not out of the oil seal and turn to correct alignment. Push the gear back into mesh.
- (5) Place a new gasket on the magneto flange and install the magneto carefully so drive coupling lugs mate with the slots of the drive coupling. Install holding washers, lockwashers and nuts but tighten only enough to permit turning the magneto for final timing, without looseness.
- (6) Connect the timing light lead to the switch terminal (ground terminal) of each magneto. Both timing lights should be on. Tap the right magneto down until the light goes out. Secure the magnetos.
- (7) Turn the crankshaft a few degrees counterclockwise and bring it back again until the timing marks are aligned. At this point, both timing lights should go out at the same instant that the position half way between the timing marks on the alternator drive gear appears in the centre of the of the crank case inspection hole.
- (8) If the timing lights do not go out at the same time, loosen the magneto that is late or early and repeat the process outlined in steps (5) and (6) above.

G. Timing The Magnetos To The Engine

- (1) Remove the top spark plug from each cylinder.
- (2) Remove the plug in front of No. 6 cylinder and observe the timing marks on the alternator drive gear as the crankshaft is rotated. There are two marks; one at the 20° BTC position and one at the 24° BTC position. When a position halfway between these marks is centered in the viewing hole, No. 1 cylinder is at the 22° BTC position of the compression stroke.
- (3) Rotate the crankshaft in the direction of normal rotation to bring No. 1 cylinder up on its compression stroke. If the engine is equipped with impulse coupled magnetos, continue slowly rotating the engine until the impulse couplings snap.
- (4) Connect a timing light to the switch terminal (ground terminal) of the right magneto and rotate the crankshaft in the direction opposite to normal rotation to a position past the timing marks on the alternator drive gear (approximately 26°).
- (5) Turn the crankshaft in the normal direction of rotation until the light goes out. If 22° BTC is indicated by the timing marks on the alternator drive gear, the magneto is correctly timed.
- (6) Repeat steps (4) and (5) for the left magneto.
- (7) If the magnetos are not correctly timed, proceed as follows:
 - (a) Install the timing light on the magneto which is not properly timed.
 - (b) Set No.1 cylinder at 22° BTC as indicated in steps (3) through (5).

- (c) Loosen the magneto mounting nuts.
- (d) Rotate the magneto until the light just goes out.
- (e) Tighten the magneto mounting nuts.

H. Installation And Timing Of Magnetos (With A Timing Disc And Pointer)

Even though the Continental engines have factory installed timing marks, a positive top dead center (TDC) locator and timing disc similar to that provided with the "Universal Engine Timing Indicator" may be used to time the magneto to the engine or to check the accuracy of the engine timing marks. The engine should be timed to fire at $22^{\circ} +0^{\circ} -2^{\circ}$ before top center (BTC).

WARNING: The magneto is grounded through the ignition switch, therefore, any time the switch (primary) wire is disconnected from the magneto, the magneto is in a switch ON or HOT condition. Before turning the propeller by hand, disconnect all spark plug leads to prevent accidental firing of the engine.

CAUTION: Current production magnetos do not have the automatic grounding devices. To be safe treat all magnetos as hot whenever the ground lead is disconnected. To ground the magneto, connect a wire to the switch lead at the filter capacitor and ground the wire to the engine case.

- (1) To locate the compression stroke of number one cylinder, remove the lower spark plugs from each cylinder except No. 1 cylinder. Remove the top plug from number one cylinder;
- (2) Place thumb of one hand over the No. 1 cylinder spark plug hole and rotate the crankshaft in the direction of normal rotation until the compression stroke is indicated by positive pressure inside the cylinder lifting the thumb off the spark plug hole.
- (3) After locating the compression stroke of No. 1 cylinder, locate the advanced firing position of No. 1 cylinder by the use of a timing disc and pointer or the factory installed timing marks on the engine.

NOTE: On IO-520, TSIO-520 and IO-550 series engines the timing marks are located on the alternator drive gear. Remove the plug in front of No. 6 cylinder to observe the TDC and advance timing marks. In all cases, it must be definitely determined that the No. 1 cylinder is at the correct firing position on the compression stroke, after the crankshaft is turned in its normal direction of rotation.

- (4) If a universal timing disc and pointer is to be used, install the TDC locator in the top spark plug hole of No. 1 cylinder.
- (5) Slowly rotate the engine in the normal direction of rotation until the piston lightly touches the locator.
- (6) Install the timing disc on the propeller spinner and rotate the timing disc until 0° (TC) is located under the pointer.
- (7) Rotate the engine in the opposite direction to normal rotation until No.1 piston lightly touches the locator.
- (8) Note the reading on the timing disc. Now rotate the disc toward 0° (TC) until 1/2 the reading noted is shown.
- (9) Remove the TDC locator from the spark plug hole.
- (10) Rotate the engine in the normal direction of rotation to the compression stroke of No. 1 cylinder and until the pointer arrives at the number of degrees noted last in step (8) (1/2 the first noted reading in step (8)).
- (11) Rotate the timing disc until the pointer is positioned at 0° (TC).
- (12) Rotate the engine opposite to the normal direction of rotation to approximately 5° beyond the specified timing for the engine being timed.
- (13) Rotate the engine in the normal direction to the specified before top center (BTC) firing position (this is to remove gear backlash). Further movement of the engine should not be necessary until the magnetos are installed.

NOTE: Without turning the magneto coupling, hold the magneto in the position it will occupy when installed on the engine and check alignment of engine drive coupling slot and magneto impulse coupling lugs. If not aligned, pull the engine gear out of mesh (but not out of the oil seal) and turn to alignment. Push gear back into mesh.
The magnetos were prepared for installation to fire No. 1 cylinder in PREPARING THE MAGNETO FOR INSTALLATION ON THE ENGINE.

- (14) Place new gaskets on magneto flanges and install the magnetos carefully so drive coupling lugs mate with slots on engine drive coupling. Install holding washers, lockwashers and nuts but tighten only enough to permit turning the magnetos for final timing, without looseness.
- (15) Install timing lights on the magnetos.
- (16) With the engine still positioned to fire No. 1 cylinder at the specified BTC rotate the right magneto in the direction necessary to cause the points to just break open as indicated by the timing light.
- (17) Secure the right magneto.

- (18) Repeat steps (16) and (17) on the left magneto.
- (19) Recheck the magneto settings to confirm the $+0^{\circ}$ -2° has not been exceeded.
- (20) Turn the engine crankshaft a few degrees in the opposite direction to normal rotation and bring it back again until the advance timing mark is under the pointer on the timing disc. At this point both timing lights should indicate, at the same time, that the magneto points opened.
- (21) If the timing lights do not respond at the same time, loosen the magneto that is either early or late and repeat the process outlined in step (16).
- (22) Remove the timing lights and reinstall the electrical leads to the magnetos.

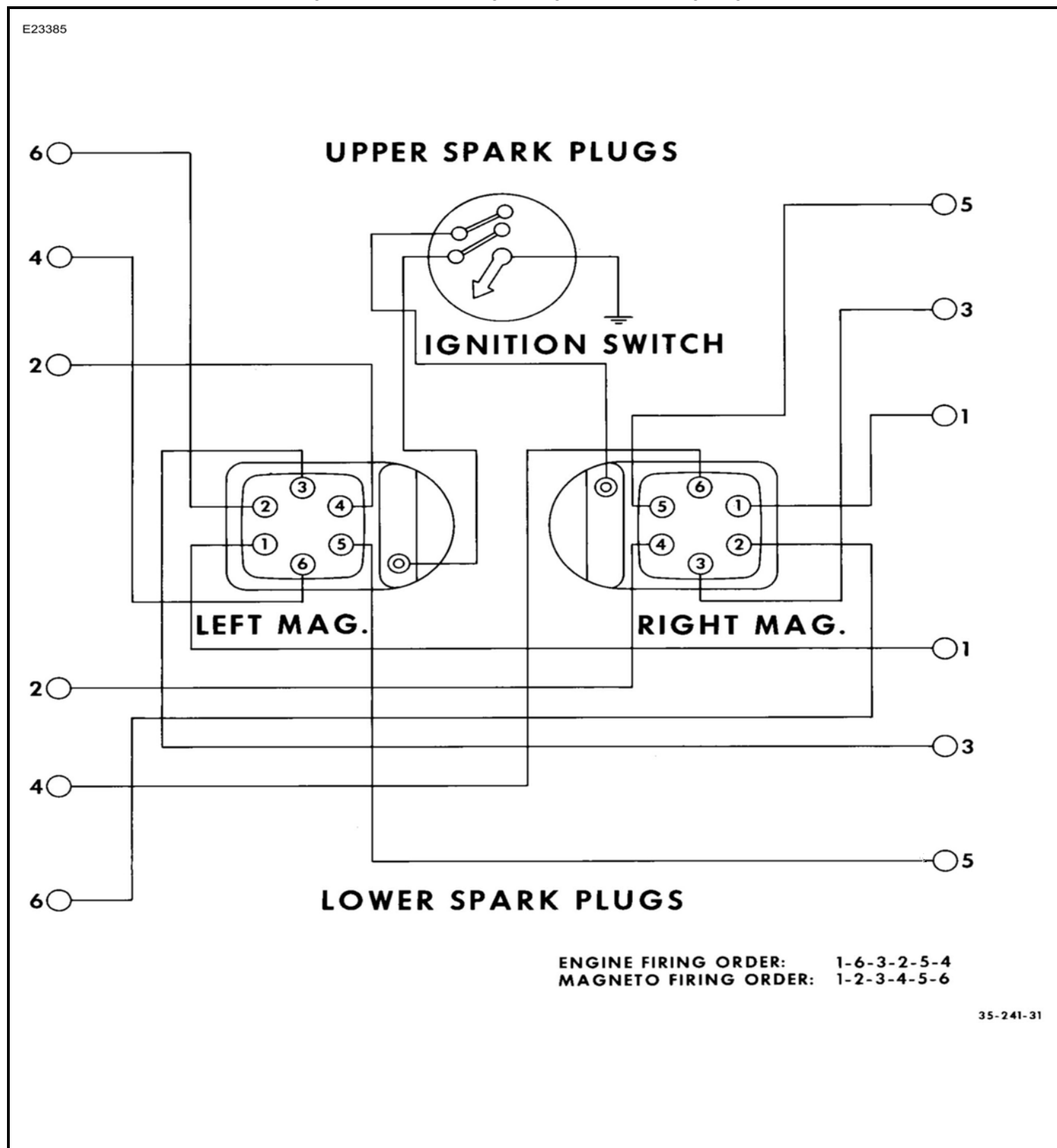
DISTRIBUTION - MAINTENANCE PRACTICES

1. Distribution - Maintenance Practices

Conventional dual ignition is provided by two magnetos (Refer to [Figure 201](#)). In this ignition system the left magneto fires the 1-3-5 lower and 2-4-6 top spark plugs, while the right magneto fires the 1-3-5 top and 2-4-6 lower spark plugs.

In the event that an ignition harness or an individual lead is to be replaced, consult the Magneto Wire Routing Diagram (Refer to [Figure 201](#)) to be sure that the harness is correctly installed. Mark the locations of clamps and clips to be certain that replacement is accomplished properly. For the engine firing order and magneto firing order refer to [Figure 201](#).

Figure 201 : Sheet 1 : Engine Magneto Wire Routing Diagram



ENGINE INDICATING (EA-11 AND AFTER) - MAINTENANCE PRACTICES

1. General - Maintenance Practices (EA-11 and After)

A. Turbine Inlet Temperature Indicator Calibration

TIT calibration is mandatory because the engine or turbocharger may be damaged by operating at excessive temperatures (operation at above a TIT of 1,650 °F (900 °C) is limited to 60 seconds).

CAUTION: Damage to the turbocharger turbine blades, excessive turbine coking and excessive oil consumption may be caused by turbine inlet temperatures above 1,650 °F (900 °C).

To prevent a turbine inlet over-temperature condition due to an inaccurate TIT indicator reading, the indicator should be checked every 100 hours and calibrated if required.

The following procedure may be used to check and calibrate the TIT indicator:

- (1) Remove the TIT probe from the turbocharger intake manifold. (Do not disconnect the wires from the probe.)
 - (a) On airplanes EA-320, EA-389 and After, install a ground jumper between the probe body and the engine or airframe.
- (2) Using the AICal test equipment, heat the probe to 1,650 °F (900 °C).
- (3) If the TIT indicator reads 1,650 °F (900 °C) the indicator is properly calibrated. If the TIT indicator reading is not 1,650 °F (900 °C) the calibration screw must be adjusted (Refer to [Figure 201](#) and [Figure 202](#)).
 - (a) On airplanes EA-11 thru EA-388, except EA-320, the calibration screw is located on the face of the TIT instrument.
 - (b) On airplanes EA-320, EA-389 and After, the calibration screw is located on the back of the CHT/TIT instrument.
- (4) If the seal was broken on the calibration screw (front mounted), reseal by applying a small amount of torque seal to the calibration screw.
- (5) Remove ground jumper installed in Step (1)(a).
- (6) Reinstall the probe in the turbocharger intake manifold.

Figure 201 : Sheet 1 : TIT Indicator(EA-11 thru EA-388, Except EA-320)

E25393

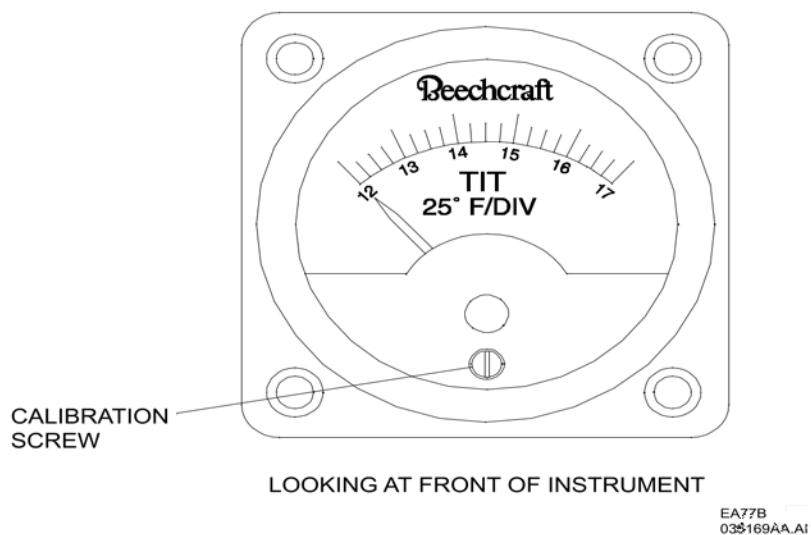
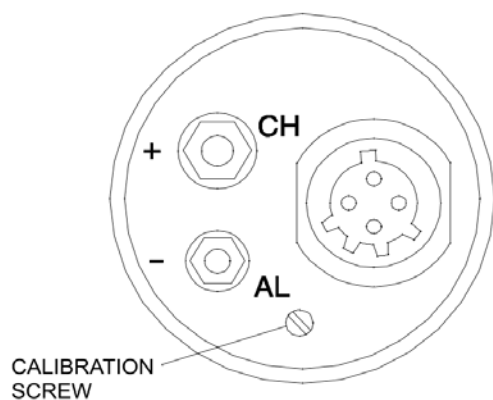


Figure 202 : Sheet 1 : TIT Indicator(EA-320, EA-389 and After)

E25388



LOOKING AT REAR OF INSTRUMENT

EA77B
040561AA, AI

OIL - GENERAL

1. General - Description And Operation

The engine oil system is a full pressure, wet sump type and has a 12 quart capacity. The oil system consists of an oil radiator and automatic thermostat bypass control, oil temperature indicator, oil pressure indicator, oil pressure relief valve, oil drain in the engine sump and an oil pump which is an integral part of the engine. The oil system operating temperatures are controlled by the automatic thermostat bypass control. The bypass control will limit oil flow through the cooler when operating temperatures are below normal and will permit the oil to bypass the cooler, should it become clogged.

OIL - MAINTENANCE PRACTICES

1. General

A. Oil System

Servicing the engine oil system primarily involves maintaining the oil at the proper level and changing the oil and filter at the recommended intervals. Under normal operating conditions, the recommended number of operating hours between oil changes is 100 hours. When operating under adverse weather conditions the oil should be changed more frequently. The engines should be warmed up to operating temperature to assure complete draining of the oil. The engine oil drain plug is secured with lock wire. To remove and install the engine oil filter, refer to OIL FILTER REMOVAL and OIL FILTER INSTALLATION (Refer to [Chapter 12-10-00](#)). When changing the oil and filter, always check for metal contamination in the used oil.

CAUTION: If metal contamination of the oil system is detected and the cause corrected, the oil cooler should be replaced. In addition, flush out the system through the interconnected oil system plumbing and replace or clean any other accessories that will remain with the engine.

NOTE: Metal contamination that warrants oil cooler replacement would also warrant engine investigation.

B. High Oil Temperature

Oil temperature is controlled by a spring loaded Vernatherm oil cooler control valve. Refer to the Engine Overhaul Manual for Vernatherm oil cooler control valve specifications. This valve will operate properly if the oil has not become contaminated with dirt or other foreign particles. If indications are that the valve is not operating properly, remove the valve and clean it in solvent ([16, Table 1, 91-00-00](#)). Also, inspect the valve seat for damage. No repairs can be made to this valve and readjustments are not recommended since special testing equipment is required. The travel of the valve can be checked by immersing the valve assembly in heated water. The minimum amount of travel should be 0.090 inch as the temperature is raised from 120° F to 170° F. Replace defective valves.

C. Oil Cooler Removal

- (1) Access to the oil cooler may be gained through the left cowl door.
- (2) Disconnect the oil temperature wire and the oil pressure line.
- (3) Remove the nine bolts and washers securing the baffling to the oil cooler.
- (4) Remove the five attaching nuts and washers, (two at the top of the oil cooler and three at the oil cooler inlet). Remove the oil cooler.

D. Oil Cooler Installation

- (1) Install a new gasket at the oil cooler inlet.
- (2) Install the attaching nuts and washers.
- (3) Install the oil temperature wire and the oil pressure line.
- (4) Start the engine and check for leakage and proper operation and temperatures.

E. Break-In Engine Oil

The new airplane is delivered with Rustband oil (MIL-C-6529, Type 2) in the engine. This is a corrosion preventive oil and should be removed at 20 hours of operation, but no later than 25 hours of operation. If the Rustband oil is not removed at the proper time, varnish may form in the engine. Oil conforming to MIL-L-6082 may be added to the Rustband oil as necessary. After removing the Rustband oil, refill with MIL-L-6082 mineral oil which should be used until oil consumption has stabilized, an ashless dispersant oil, complying with Continental Motors Specification MHS-24B and MIL-L-22851, must be used. For several suitable engine oils, both break in and after break in, see the Consumable Materials Table ([2, Table 1, 91-00-00](#)).

NOTE: It is recommended to use a 75% power setting during the break in period. Avoid over cooling caused by long power off and/or rapid descents.

F. Recommended Oil Grades For Engines

Ambient Air Temperature	Recommended Viscosity
Above 40° F	SAE-50
Below 40° F	SAE-30 or 10W30
All Temperatures	15W50 or 20W50

CRANKING - DESCRIPTION AND OPERATION

1. Cranking - Description and Operation

The Bonanza Series airplanes are each equipped with a 24-volt starter which engages with the engine accessory drive gear. The starter is located on the right aft side of the engine.

The Bonanza Series airplanes are each equipped with a 24-volt starter which engages with the engine accessory drive gear. The starter is located on the right aft side of the engine.

A. Troubleshooting

Table 1. Troubleshooting Starter System

Trouble	Probable Cause	Remarks
1. Starter inoperative.	Circuit breaker tripped.	Reset circuit breaker.
	Starter switch inoperative.	Check cockpit lights; if not operative, check switches and battery solenoid.
	Defective starter relay.	Check continuity of starter system.
	Low battery.	Test battery, if low, replace or start with external power.
	Open circuit.	Check continuity of circuit.
	Defective starting motor.	Check brushes, springs, condition and commutator. Replace if necessary.

B. Maintenance Practices

(1) Starter Removal

- Access to the starter may be gained through the right hand cowl door.
- Disconnect the electrical wiring from the starter.
- Remove the two nuts and washers from the mounting studs and remove the starter retaining the nuts and washers for starter installation.

(2) Starter Installation

- Install a new O-ring on the flange of the starter.
- Position the starter on the mounting pad.
- Install the previously retained attaching nuts and washers and torque the nuts to 200-220 inch-pounds.
- Connect the electrical wiring to the starter.

NOTE: Prior to attaching the starter to the engine, clean any rust, corrosion or dirt from the mounting surfaces of the starting motor and the engine. Also check all ground strap connections to make sure they are clean and tight.

- Start the engine to check for oil seepage at the mounting flange and check for proper operation.

(3) Starter Overhaul

Refer to applicable Supplier Publications for complete tests and maintenance procedures.

(4) Starter Lubrication

No lubrication is required on the starting motor except at the time of overhaul. Soak new bearings in oil (80, Table 1, 91-00-00) before installation. Saturate the felt oiling pad in the commutator end head with oil (80, Table 1, 91-00-00). Allow excess oil to drain out before installing end head on motor. Put a light film of grease (15, Table 1, 91-00-00) on the armature shaft before assembling the motor.

CAUTION: Do not clean the starter in any degreasing tank or grease dissolving solvents. Avoid excessive lubrication.

(5) Starter Brushes

The starter brushes should slide freely in the holder and make full contact on the commutator. The brushes should be replaced when they have worn to 1/4 inch. or less. Proper brush spring tension with new brushes installed is 32-40 ounces. This tension is measured with a scale hooked under the brush spring near the brush and the reading taken just as the spring leaves the brush.

CHARTS - GENERAL**1. Charts****A. Consumable Materials**

The recommended materials listed in Table 1 as meeting federal, military or supplier specifications are provided for reference only and are not specifically prescribed by Textron Aviation Inc. The products included in these tables have been tested and approved for aviation usage by Textron Aviation Inc., by the supplier, or by compliance with the applicable specifications. Generic or locally manufactured products which conform to the requirements of the specification listed may be used even though not included in the tables. Only the basic number of each specification is listed. No attempt has been made to update the listing to the latest revision. It is the responsibility of the technician or mechanic to determine the current revision of the applicable specification prior to usage of the product listed. This can be done by contacting the supplier of the product to be used.

Table 1. Consumable Materials

Material	Specification	Product	Supplier
1. Fuel, Engine	ASTM D 910	100LL (Blue), 100/130 (Green), 115/145 (Purple)	
	GB 1787	*No.95 (RH-95/130)(Orange) * No.100 (RH-100/130) (Orange)	
CAUTION: Do not mix oils of different brands or oils of different types produced by the same manufacturer.			
2. Engine Oils (BREAK-IN) (First 20 to 30 hours of a new or remanufactured engine)	SAE J 1966, Any approved aircraft engine oil graded at 1100 (SAE 50) or 1065. (SAE 30) Multiviscosity oil not recommended.	Exxon Aviation Oil 100	Exxon Mobil L and S, 3225 Gallows Rd. Fairfax, VA 22037
		Castrolaero 113 (Grade 1065)	Castrol Oil Canada Ltd. P.O. Box 3, New Toronto Postal Station, Toronto, Ontario
		Castrol Aviator S	Air BP Lubricants Div. of BP Prod. N.A. Parsippany, NJ 07054
		Aeroshell Oil 100, Aeroshell Oil 65	Shell Oil Company 50 West 50th St. New York, NY 10020
2. Engine Oils (continued) (AFTER BREAK-IN)	TCM MHS-24B SAE J 1899 Any approved aircraft engine oil graded at SAE 30, SAE 50, or Multiviscosity	Phillips 66 Aviation Oil, Type A; X/C Aviation Multiviscosity Oil SAE 20W50: X/C Aviation Multiviscosity Oil SAE 25W60	Phillips Petroleum Co. Bartlesville, OK 74003
		Aeroshell Oil W Aeroshell Oil W SAE 15W50	Shell Oil Company 50 West 50th St. New York, NY 10020
		Conoco Aero S	Continental Oil Company Ponca City, OK
		Texaco Aircraft Engine Oil-Premium AD	Texaco, Inc. 135 E. 42nd Street New York, NY 10017
		Castrolaero, AD Oil	Castro Oil Canada Ltd. P.O. Box 3 New Toronto Postal Station Toronto, Ontario
		Pennzoil Aircraft Engine Oil	Pennzoil Company Drake Building Oil City, PA 16301
		Sinclair Avoil	Sinclair Refining Co. 500 Fifth Ave. New York, NY 10020

		Exxon Aviation Oil EE Exxon Elite	Exxon Mobil L and S 3225 Gallows Rd. Fairfax, VA 22037
		BP Aero Oil	BP Oil Corporation BP (North American) Ltd. 620 Fifth Avenue New York, NY 10020
		Quaker State AD Aviation Oil	Quaker State Oil & Refining Corporation Oil City, PA 16301
2. Engine Oils (Continued) (AFTER BREAK-IN)		Delta-Avoil Oil	Delta Petroleum Co., Inc. P.O. Box 10397 Jefferson, LA 70181
		Union Aircraft Engine Oil HD	Union Oil Company of California
		Gulfpride Aviation AD	Gulf Oil Corp. 439 7th Ave. P.O. Box 1166 Pittsburg, PA 15230
3. Corrosion Preventive Compound (Engine Oil)	MIL-C-6529 Type II	Anti-Corrode No. 205	Cities Service Oil Co. 60 Wall Tower New York, NY
		Rust Foil No. 652-2	Franklin Oil Corp. Bedford, OH 44146
		Kendex No. 7038	Kendall Refining Co. 1177 Kendall Ave. Bradford, PA 16701
	MIL-L-87177	Super-Corr B	Lektro-Tech, Inc. 4556 South Manhattan Ave, Suite L Tampa, FL 33611
4. Preservative Oil	MIL-P-46002, Grade I	Nucle Oil 105	Daubert Chemical Co. 4700 S. Central Ave. Chicago, IL 60638
		Protect VA	Penreco, 106 S. Main St. Butler, PA 16001
		Ferro-Gard 1009-G	Ranco Laboratories Inc. 3617 Brownsville Road Pittsburgh, PA
5. Corrosion Preventive Compound, Solvent Cutback, Cold-Application	MIL-C-16173, Grade II	Braycote 137	Bray Oil Co. 1925 Marianna St. Los Angeles, CA 90032
		Petrotech 1-4	Penreco, P.O. Box 671 Butler, PA 16001
		Valvoline TECTYL 890	Ashland Oil Co. 1409 Winchester Ave. Ashland, KY 41101
		Turco 5351	Turco Products, Inc. Division of Purex Corp. 26400 South Main Wilmington, CA 90746
6. Grease, Automotive	MIL-G-10924	Shell A and A Grease	Shell Oil Co. One Shell Plaza, P.O. Box 2463 Houston, TX 77001

		Cato Code 5210	Cato Oil & Grease Co. Inc. P.O. Box 26868, Oklahoma City, OK 73126
		SA8263242	Southwest Petro Chem Inc. 1400 S. Harrison Olathe, KS 66061
		Sunoco C-352-EP	Sun Oil Company P.O. Box 426 Marcus Hook, PA 19061
7. Refrigerant, Air Conditioner (Charging)	R-12	Racon 12	Racon Inc. 6040 S. Ridge Road Wichita, KS 67215
		Genetron 12	Allied Chemicals Corp. P.O. Box 4000R Morristown, NJ 07960
		Freon 12	DuPont E I De Nemours and Company, Inc. Organic Chemicals Dept. 1007 Market Street Wilmington, DE 19898
8. 500 Viscosity Oil, (R-12 Air Conditioner Compressor)		Suniso 5GS	Virginia Chemicals Inc. 3340 W. Norfolk Road Portsmouth, VA 27303
		Texaco WF100	Texaco, Inc. 135 E. 42nd Street New York, NY 10017
9. Hydraulic Fluid	MIL-H-5606	Brayco 756D	Bray Oil Co. 1925 Marianna St. Los Angeles, CA 90032
		PED 3565	Standard Oil of California 225 Bush Street San Francisco, CA 94104
10. Aviator's Breathing Oxygen	MIL-O-27210		Obtain Locally.
11. Lubricating Grease (Aircraft and Instruments, Low & High Temperature)	MIL-PRF-23827 Type I (Do not use MIL-PRF-23827 Type II grease)	Mobilgrease 27	Exxon Mobil Corp. 3225 Gallows Rd. Fairfax, VA 22037-0001
		Royco 27	Anderol, Inc. 215 Merry Lane East Hanover, NJ 07936
		AeroShell 33	Shell Oil Co. One Shell Plaza P.O. Box 2463 Houston, TX 77001
12. Refer to Item No. 11.			
13. Oxygen System Leak Testing Compound	MIL-L-25567		Obtain Locally.
14. Rubber Hose	MIL-H-5593		Obtain Locally.
15. Grease		Lubriplate 777	Fiske Brothers Refining Co. 129 Lockwood Newark, NJ 07105
16. Solvent or White Spirits	PD680 Type III or British Stoddard Solvents	Stoddard Solvents (Mineral Spirits)	Obtain Locally.

17. Sealer		Presstite 576	Presstite-Keystone Engineering Co. 3900 Choteau Ave. St. Louis, MO 63110
18. Sealer		EC 1814	Minnesota Mining & Manufacturing Co. 3M Center St. Paul, MN. 55101
19. Toluol (Toluene)	TT-T-548		Obtain Locally.
20. Zinc Chromate Primer	MIL-P-8585		Obtain Locally.
21. Sealer		PR-1440	Courtaulds Aerospace Inc. 5454 San Fernando Rd. Glendale, CA 91209
22. Sealer		PRI221B1/2	PRC Products Research & Chemical Corp. Burbank, CA
23. Solvent		CRC-2-26	Corrosion Reaction Consultants Inc. Philadelphia, PA
24. Resin	MIL-R-7575	Laminac 4116	American Cyanamid Co. S. Cherry St. Wallingford, CT 06492
25. Wash Primer		EX2016G	Ameron Industrial Coatings Division P.O. Box 2153 Wichita, KS 67201
26. Naphtha	TT-N-95		Obtain Locally.
27. Paint Stripper		Turco 4260	Turco Products Inc. 26400 S. Main Los Angeles, CA 90646
28. Deleted			
29. Tape		No. 27 Tape	Minnesota Mining & Manufacturing Co. 3M Center St. Paul, MN. 55101
30. Tape, Anti-Seize, Tetrafluoroethylene with dispenser (1-inch)	MIL-T-27730		Johnson & Johnson Inc. Permacel Division U.S. Highway 1 New Brunswick, NJ 08901
31. Methyl Propyl Ketone			Obtain Locally.
32. Black Rubber Cement		EC678	Minnesota Mining & Manufacturing Co. 3M Center St. Paul, MN. 55101
33. Acid etching primer	MIL-C-8514		Obtain Locally.
34. Refer to Item No. 25.			
35. Thinning Catalyst		T6070 Catalyst	Ameron Industrial Coatings Division P.O. Box 2153 Wichita, KS 67201
36. Primer Base		6165 Base	U.S. Paint Lacquer & Chemical Co. 1501 N. Belmont Wichita, KS 67208

37. Catalyst		AA-92-C-4A Catalyst	U.S. Paint Lacquer & Chemical Co. 1501 N. Belmont Wichita, KS 67208
38. Urethane Primer			U.S. Paint Lacquer & Chemical Co. 1501 N. Belmont Wichita, KS 67208
39. Sealer		Presstite 176	Presstite-Keystone Engineering Co. 3900 Choteau Ave. St. Louis, MO 63110
40. Penetrating Oil		Mouse Milk	Worldwide Aircraft Filters Corp. 1685 Abram Ct. San Leandro, CA 94577
41. Anti-seize Compound	MIL-A-907D	Anti-seize Compound C5A	Fel-Pro Inc. 7450 McCormick Skokie, IL 60076
42. Anti-seize Compound, Graphite Petrolatum	VV-P-236		Armite Laboratories 1845-49 Randolph St. Los Angeles, CA 90001
43. Thread Lubricant		Threadlube	Parker Appliance Co. Cleveland, OH
44. Sealer		Silastic 140	Dow Corning S. Saginaw Road Midland, MI 48641
45. Sealing Compound		R-134-B Perfect Seal	Ford Motor Co. Dearborn, MI
46. Grease, Aircraft General Purpose Wide Temperature Range	MIL-G-81322	Mobilgrease 28	Exxon Mobil L and S 3225 Gallows Rd. Fairfax, VA 22037
47. Refer to Item No. 73.			
48. Lubricating grease (Wheel Bearing)		Aeroshell 5	Shell Oil Co. One Shell Plaza P.O. Box 2463 Houston, TX 77001
49. Lubricant Molybdenum Disulfide Powder	MIL-M-7866	Molykote Z	Wilco Co. 4425 Bandini Blvd. Los Angeles, CA 90023
			Moly-Paul Products Ltd. Noble Road London, England
50. Silicone Compound	MIL-S-8660	DC-4	Dow Corning Corp. S. Saginaw Road Midland, MI 48640
		Y-2136	Union Carbide 333 Woodward Ave. P.O. Box 44 Tonawanda, NY 14150
		XS 4005	General Electric Silicon Products Dept. Mechanicville Rd. Waterford, NY 12188
51. Lubricating Oil (Gear)	MIL-PRF-2105 Grade 75W	101-380016-1	Hawker Beechcraft Authorizes Service Centers
		Mobil Lube SHC 75W-90	Exxon Mobil Corp. 3225 Gallows Rd. Fairfax, VA 22037-0001

		Mobile Delvac Synthetic Gear Oil 75W-90	Mobil Oil Corp. Fairfax, Virginia
		TRAXON Synthetic SAE 75W-90 Gear Oil	Petro-Canada Lubricants Centre 385 Southdown Road Mississauga, Ontario L5J 2Y3
		Oriofiat W75/M	Fiat Lubricant S.P.A. Via Santena, 1 10029 Villastellone (Tornio) Italy
		Shell SPIRAX EW SAE 75W-90	Shell Oil Products US Houston, TX 77210-4453
52. Adhesive		1300L or EC1403 (Normal Commercial Designation)	Minnesota Mining & Manufacturing Co. 3M Center St. Paul, MN 55101
53. Coating		Alodine 1200, 1200S, or 1201	Amchem Products, Inc. Spring Garden St. Ambler, PA 19002
54. Translucent Adhesive		RTV-108	General Electric Co. Silicone Products Dept. Waterford, NY 12188
55. Tape		No. 474	Minnesota Mining & Manufacturing Co. 3M Center, St. Paul, MN 55101
56. Primer, Epoxy-Polyamide	MIL-PRF-23377		U.S. Paint, Lacquer and Chemical Co. St. Louis, MO
57. Urethane Paint		Matterhorn White No. 6160	U.S. Paint, Lacquer and Chemical Co. St. Louis, MO
58. Kerosene	VV-K-211		Obtain Locally.
59. Hexane			J.T. Baker Chemical Co. 222 Red School Lane Phillipsburg, NJ 08865
60. Plexiglass Polish and Cleaner	P-P-560	P/N 403D	Permotex Inc. Kansas City, KS 66115
		Parko Anti-Static Polish	Park Chemical Co. 8094 Military Ave. Detroit, MI 48204
		Meguiar's MGH-10	Mirror Bright Polish Co. Inc. P.O. Box 17177 Irvine, CA 92714
61. Paste Wax		Johnson's J-Wax Paste	S.C. Johnson & Son, Inc. 1521 Howe St. Racine, WI 53403
		Simonize	Simonize Co. P.O. Box 368 Greenville, SC 29602
62. Sealing/Locking, Hydraulic		545	Loctite Corp. 705 No. Mountain Rd. Newington, CT 06111
63. Sealant, Thread		PST 592	Loctite Corp. 705 N. Mountain Rd. Newington, CT 06111
64. Air Conditioning Refrigerant	R-134a		Obtain Locally.

65. Oil (R-134a Air Conditioner Compressor)	RL-100S	Ester Oil	ICI Americas Inc. 3411 Silverside Road Wilmington, DE 19850
66. Adhesive/Sealant		Loctite 209	Loctite Corp. 705 N Mountain Rd. Newington, CT 06111-1411
67. Locquic Primer		Primer N	Loctite Corp. 705 N Mountain Rd. Newington, CT 06111-1411
68. Adhesive		Loctite 660	Loctite Corp., 705 N Mountain Rd. Newington, CT 06111-1411
69. Spray Lubricant		WD-40	Obtain Locally.
70. Grease	MIL-T-83483	Royco-1MS	Royal Lubricants Co. River Road Hanover, NJ 07936
71. Cleaner/Disinfectant		QS4	Brulin and Company (317)923-3211
72. Water (Distilled)			Obtain locally.
73. Lubricating Grease (Wheel Bearing)		Mobil Aviation Grease SHC 100	Exxon Mobil Corp. 3225 Gallows Rd. Fairfax, VA 22037
74. Sealer	MIL-S-8802 Class A/B	CPS-890 Class A/B, CS-3204 Class A/B, PR-1440, or AC-236	PRC-DeSoto 5454 San Fernando Rd. P.O. Box 1800 Glendale, CA 91209 or Advanced Chemistry & Technology 950 Kingsland Ave. St. Louis, MO 63130
75. Sealer	MIL-S-8802 Type II, Class B	PR1425 Class B	PRC-DeSoto 5454 San Fernando Rd. P.O. Box 1800 Glendale, CA 91209
76. Sealer	MIL-S-8802 Class B1/2	CPS-890 Class B1/2 or CS-3204 Class B1/2	PRC-DeSoto 5454 San Fernando Rd. P.O. Box 1800 Glendale, CA 91209
77. Threadlocker		Loctite 242 (Blue)	Henkel Corp. - Industrial 1001 Trout Brook Crossing Rocky Hill, CT 06067
78. Grease	MIL-G-21164	AeroShell 17	Shell Oil Products US Houston, TX 77210-4453
79. Lubricant	MIL-PRF-32033	Brayco 300	Air BP Lubricants Parsippany, NJ 07054-4406
80. Lubricating Oil	SAE 20		Obtain Locally
81. Compound Jointing (Gasket Material)	BS201	Permatex Sealer #2	Permatex Inc 10 Columbus Blvd Hartford, CT 06106 USA
82. Silk Thread		P/N 641543	Teledyne Continental Motors, PO Box 90 Mobile, AL36601 USA

83. Chem Film	MIL-C-5541, Class 1A		EKA Chemical Inc, 1775 West Oak Commons Court Marietta, GA 30062
84. Brush Cad Plate	MIL-STD-865C		Obtain Locally
85. Sealant	MIL-S-4158D, Type I or II	Non-Hardening Sealant	Permatex Inc 10 Columbus Blvd Hartford, CT 06106 USA
86. Air Conditioning Refrigerant (Flushing)	BB-F-1421, Type II	R11	Racon Inc. 6040 South Ridge Rd. Wichita, KS 67215
87. Varglas Sleeving			Varflex Corporation 512 W. Court Street Rome, NY 13440
88. Spiral Wrap			Panduit Corporation 17301 Ridgeland Avenue Tinley Park, IL 60477-3093
			Tyco Electronics 1050 Westlakes Drive Berwyn, PA 19312
89. Raychem Helical Convolex Tubing (HCTE)			Raychem Corporation 300 Constitution Drive Menlo Park, CA 94025
90. Fire Resistant Tape			Armet Industries Corp. 7725 Jane Street Suite 205 Concord, Ontario L4K 181 Canada
91. Sealant	IS902	Paintable Sealant	Momentive Performance Materials Inc. 22 Corporate Woods Blvd Albany, NY 12211-2374
92. Lubricant, Special Preservative	VV-L-800	Brayco 300	Castrol, Inc. 16715 Von Karman Avenue Irvine, California 92714
* Only for airplane serials E-3630, E-3636 and After.			

B. Installation of Flared Fittings

When installing flare fittings, make sure they are properly lubricated in accordance with Table 3. Tighten the fittings in accordance with the FLARED FITTING TORQUE TABLE (Ref. [Chapter 20-06-00, Table 1](#)). Do not overtighten.

Table 2. Flared Fitting Torque Table (in-lbs)

Table 2 moved. Refer to Chapter 20-06-00, Table 1 .

Table 3. Thread Lubricants

Type of Line	Type of Thread	Type of Lubricant, Item, Table 1
Hydraulic		MIL-H-5606
		Loctite 545
Fuel	Alum, Brass, Steel	VV-P-236
Oil	Alum, Brass, Steel	VV-P-236
Oxygen	Tapered	MIL-T-27730 Size 1
	Straight	None
Pitot and Static	Tapered	Loctite 592

	Straight	None
Refrigerant R-12		Sunisco 5 GS or WF-100
Refrigerant R-134a		RL-100S Ester Oil
NOTE: Lubricate engine fittings only with the fluid that will flow through the lines. Air lines are not to be lubricated.		

Table 4. Torquing Coarse Threaded Bolts Loaded in Shear

Table 4 moved. Refer to Chapter 20-01-00, Table 2.
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Table 5. Fine Threaded Series, Class 3, Cadmium Plated and Non Lubricated (except as noted)

Table 5 moved. Refer to Chapter 20-01-00, Table 1.
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