* = REVISED, ADDED OR DELETED PAGE F = FOLDOUT PAGE

CHAPTER 57

WING

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WING - DESCRIPTION AND OPERATION

1. General

A. The wing is a cantilevered box beam, tapered in both planform and depth from root to tip and swept back at an angle of 35° at the quarter chord. The complete wing consists of wing tips (figure 1), outboard wing assemblies (figure 2) and the main wing. The main wing includes both the inboard wing assemblies (figure 3) and the wing center section (figure 4), the latter being that part of the wing which is the same width as, and fits into, the lower fuselage.

B. The wing primary structure is a box beam consisting of two spars, closely spaced inspar ribs, and longitudinally stiffened skins. (See figures 5 and 6). In the wing center section the ribs are replaced by full depth spanwise beams. The rear spar carries greater loads than the front spar due to the swept wing configuration and is therefore heavier. At two places along the rear spar the angle of sweep is increased slightly; once near the outboard end of the inboard spoiler and again just outboard of the outboard nacelle strut. This latter point of change in sweep is the production break at which the outboard wing assembly can be removed when necessary. The other removable part of the wing, the wing tip, can be taken off from a line perpendicular to the rear spar immediately outboard of the outboard aileron. Because of the long chordal distance between the spars the ribs are closely spaced. Most of them have non-perforated webs which are perpendicular to the rear spar with extruded vertical stiffeners to break down the rib panel sizes. Inboard of the inboard nacelle the rib alignment changes progressively until it is parallel to aircraft centerline at the main landing gear rib. All of the ribs inboard of the inboard nacelle, except those forming tank ends, have large rectangular cutouts at approximately mid chord which are spanned by the vertical stiffeners. In general the wing ribs have a peripheral gap the depth of the stringers, between the rib chords and the wing skin. There are exceptions to this generality such as tank end ribs, nacelle ribs, and landing gear ribs. On turbofan airplanes, lightning strike laminated armor panels are installed on each wing upper and lower surfaces between the front and rear spars from WS 939.312 to 959.312, and stainless steel straps are installed at RSS 211 and 232.

C. Special wing ribs at the nacelle struts distribute engine loads to the wing. These ribs, being parallel to aircraft centerline, intersect or cut across the normal (perpendicular to rear spar) ribs. Nacelle struts connect to faired in forgings on top and bottom exterior surfaces of wing. There forgings are bolted, through the skin, to the strengthened wing ribs.

D. The main landing gear legs are hinged to trunnions mounted on the inboard face of a torque box which is cantilevered aft from the wing rear spar. This torque box is held between forged fore and aft members known as beaver tails. The beaver tails lie along the top and bottom exterior surfaces of the wing, extending forward to about mid chord, and are bolted to the strengthened rib chords through the wing skins. In effect the main gear trunnion is held in a giant pair of long nosed pliers.

E. The primary structure of the wing box beam also serves as an integral fuel tank. Intermediate ribs act as baffles, the fuel being allowed to circulate through the spaces between the ribs and skin left by the depth of the stringers. Tank end ribs are full depth and divide the wing into left and right center, inboard, outboard and reserve tanks. Fuel tanks in the wing center section are of the conventional bladder cell type, interconnected through the root rib to the left and right center integral tanks. Access panels are provided along the under surface of the wing for inspection of the integral tanks. Part of the structure in both left and right wings acts as a dry bay in which the fueling station is located

Wing - Stringer Diagram / Skin Gages and Materials / Struct. Identification

Boeing pages 2 through 25 have been deleted.

For SRM (Structural Repair Manual) references see Conversion Table below.

PAGE N°	DATE	FIGURE N° / TITLE	REFERENCES S.R.M.
2	15/6/62	Figure 1 (Sheet 1 of 2) Wing Tip Structure	57-3-3 fig.5 (Sh. 2 of 3 and sh. 3 of 3) pages 30 & 31
2A	15/6/62	Figure 1 (Sheet 2 of 2) Wing Tip Structure	57-3-3 fig.6 (sheet 2 of 2) page 33
3	15/12/64	Figure 2 (Sheet 1) Outboard Wing	57-3-3 fig.1 (sheet 5 of 16) page 4
4	15/6/62	Figure 2 (Sheet 2 of 6) Outboard Wing Structure	57-5-3 fig.1 (sheet 9 of 16) page 9
4A	15/6/62	Figure 2 (Sheet 3 of 6) Outboard Wing Structure	57-5-3 fig.1 (sheet 10 of 16) page 10
4B	15/6/62	Figure 2 (Sheet 4 of 6) Outboard Wing Structure	57-4-3 fig.1 (sheet 7 of 14) page 7
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4D	15/6/62	Figure 2 (Sheet 6 of 6) Outboard Wing Structure	57-4-3 fig.1 (sheet 13 of 14) page 13
5	15/6/62	Figure 3 (Sheet 1 of 5) Inboard Wing Structure	57-3-3 fig.1 (sheet 4 of 16) page 3
6	15/6/62	Figure 3 (Sheet 2 of 5) Inboard Wing Structure	57-5-3 fig.1 (sheet 7 of 16) page 7
6A	15/6/62	Figure 3 (Sheet 3 of 5) Inboard Wing Structure	57-5-3 fig.1 (sheet 8 of 16) page 8

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6B	15/6/62	Figure 3 (sheet 4 of 5) Inboard Wing Structure	57-4-3 fig.1 (sheet 6 of 14) page 6
6C	15/12/63	Figure 3 (sheet 5 of 5) Inboard Wing Structure	57-4-3 fig.1 (sheets 11 & 12 of 14) pages 11 & 12
7	15/5/59	Figure 4 Center Wing	57-3-3 fig.2 (sheet 1 of 5) page 14
8	15/5/59	Figure 5 (sheet 1 of 6) Wing Stringer Diagram	57-3-3 fig.4 (sheet 1 of 6) page 23
9	15/5/59	Figure 5 (sheet 2 of 6) Wing Stringer Diagram	57-3-3 fig.4 (sheet 4 of 6) page 26
10	15/5/59	Figure 5 (sheet 3 of 6) Wing Stringer Diagram	57-3-3 fig.4 (sheet 5 of 6) page 27
11	15/7/63	Figure 5 (sheet 4 of 6) Wing Stringer Diagram	57-3-3 fig.4 (sheet 2 of 6) page 24
12	15/5/59	Figure 5 (sheet 5 of 6) Wing Stringer Diagram	57-3-3 fig.4 (sheet 3 of 6) page 25
13	15/5/59	Figure 5 (sheet 6 of 6) Wing Stringer Diagram	57-3-3 fig.4 (sheet 6 of 6) page 28
14	15/6/62	Figure 6 (sheet 1 of 10) Wing Skin Gages and Materials	57-3-1 fig.1, page 1
15	15/12/62	Figure 6 (sheet 2 of 10) Wing Skin Gages and Materials	57-3-1 fig.2 (sheet 1 of 3) page 2
16	15/12/62	Figure 6 (sheet 3 of 10) Wing Skin Gages and Materials	57-3-1 fig.2 (sheet 2 of 3) page 3
17	15/12/62	Figure 6 (sheet 4 of 10) Wing Skin Gages and Materials	57-3-1 fig.2 (sheet 3 of 3) page 4
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25	15/6/62	Figure 7 (sheet 2 of 2) Wing Tip Skin	57-3-3 fig.6 (sheet 2 of 2) page 33

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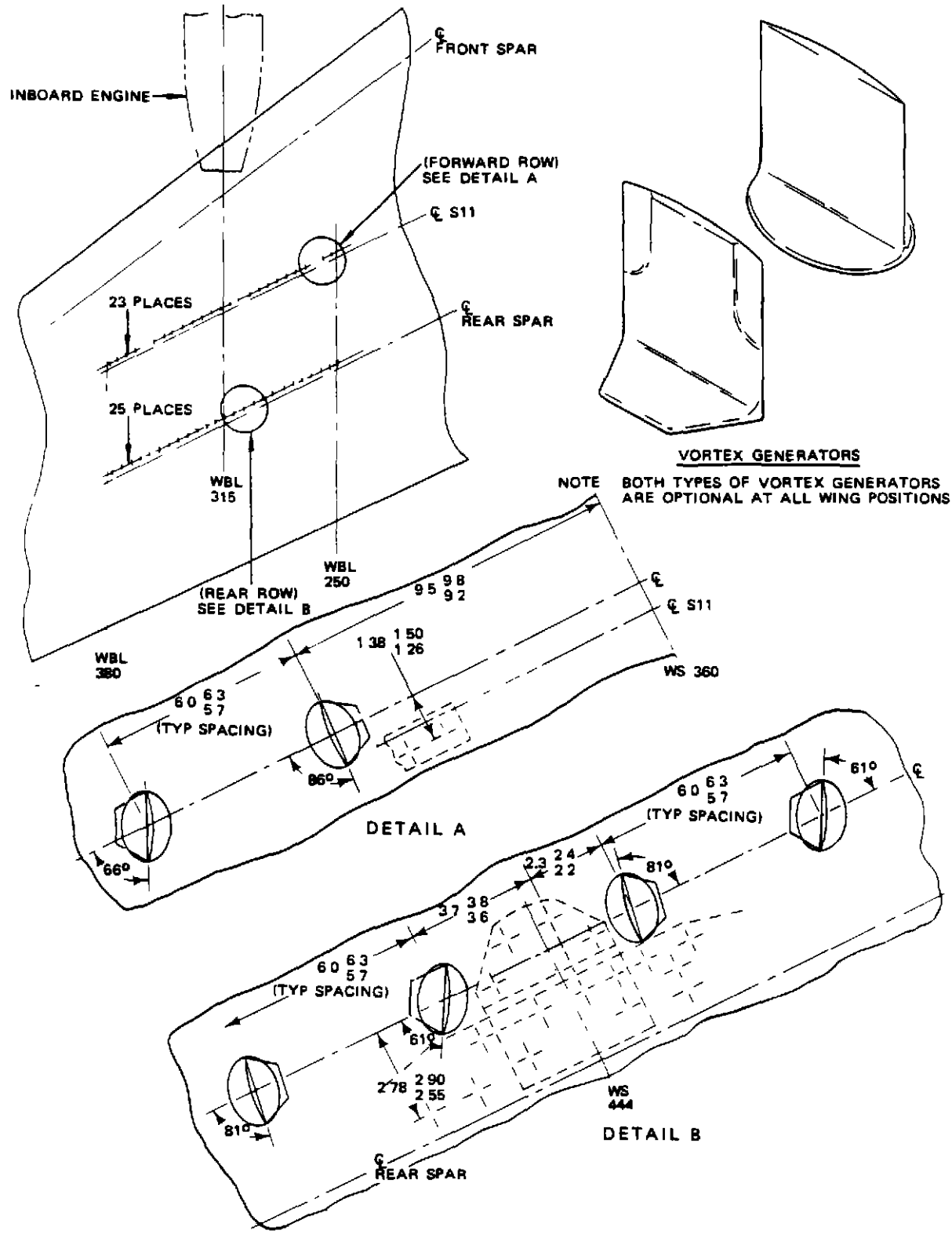
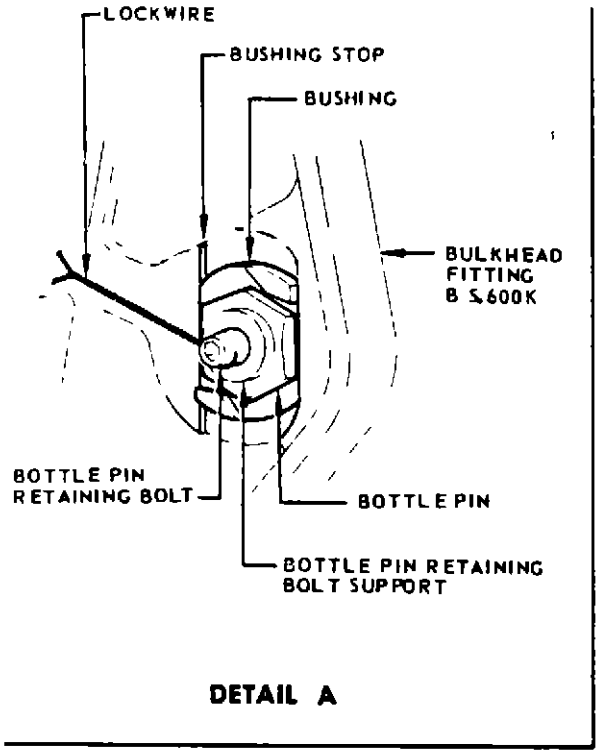
F. The secondary structure is cantilevered from the main box beam and consists of the leading edge and trailing edge assemblies. On turbojet airplanes, the underside of the leading edge, except locally at the nacelles and the area between the inboard and outboard nacelles occupied by the leading edge flap, is removable for access to the several systems inside. The leading edge upper surface has an inner and outer skin which leave a hollow space for the passage of the deicing hot air. The hot air exhausts overboard through louvers in the removable panels on the underside. On turbofan airplanes, the underside of the leading edge, except locally at the nacelles, is occupied by leading edge flaps, which can be lowered for access to the several systems inside. The leading edge upper surface, outboard of the inner engine, has an inner and an outer skin which leave a hollow space for the passage of deicing hot air. On all airplanes doors and removable panels provide access to controls and other items housed in the trailing edge. The trailing edge areas which are not taken up by movable surfaces are made of either bonded skin stiffener panels or honeycomb structure. The wing tip has front and rear spars, the latter being an auxiliary and not an extension of the wing rear spar, bonded skin panels and honeycomb trailing edge. Vortex generators, which improve flight performance, are cemented to the upper wing interspar surface above the inboard nacelle strut area. (See figure 8.)

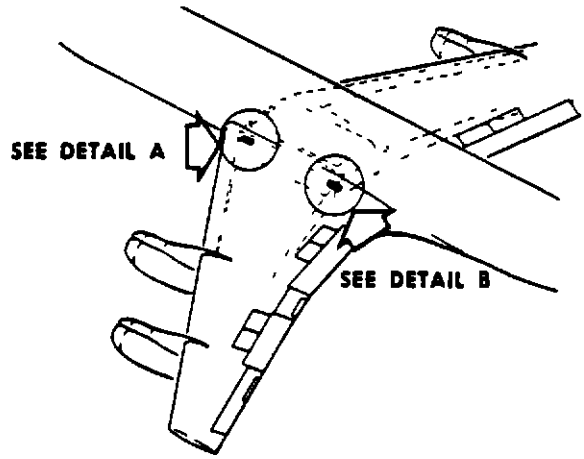
G. The main wing to body structural joints are made at four points by means of hollow bottle shaped pins. (See figure 9.) These pins are located at the intersection of front and rear wing spars with the wing root rib and bulkheads at body stations 600k and 820. The bottle pins pass through the fuselage bulkhead and the wing spar terminal fitting. Under wing deflection, the bottle pins will rotate slightly in the fuselage bulkhead. Rotation of the bottle pin should not occur in the wing spar terminal fitting. The bottle pins rest in a steel bushing in the bulkhead and to minimize friction, thus facilitating rotation, the bushing is treated with solid film dry lubricant and the bottle pin is silver plated. The bottle pins are retained in the joint by bolts which pass through the hollow bottle pins, concentric with their bore, and screw into plugs cross bolted into the wing spar terminal fittings. Retaining bolt heads are safety wired to the fuselage bulkheads. At the forward joint the bushing in the fuselage bulkhead is prevented from rotating by stops on the machined bulkhead which bear against flats on the bushing. The bottle pin is prevented from excessive rotation in a similar manner. Flats on the pin flange bear against stops on the bushing flange. At the rear joint both bushing and bottle pin are prevented from excessive rotation by flats on their flanges bearing against stops on the machined bulkhead. Rotation is limited to stop the retaining bolt from becoming progressively unscrewed and releasing the bottle pin.

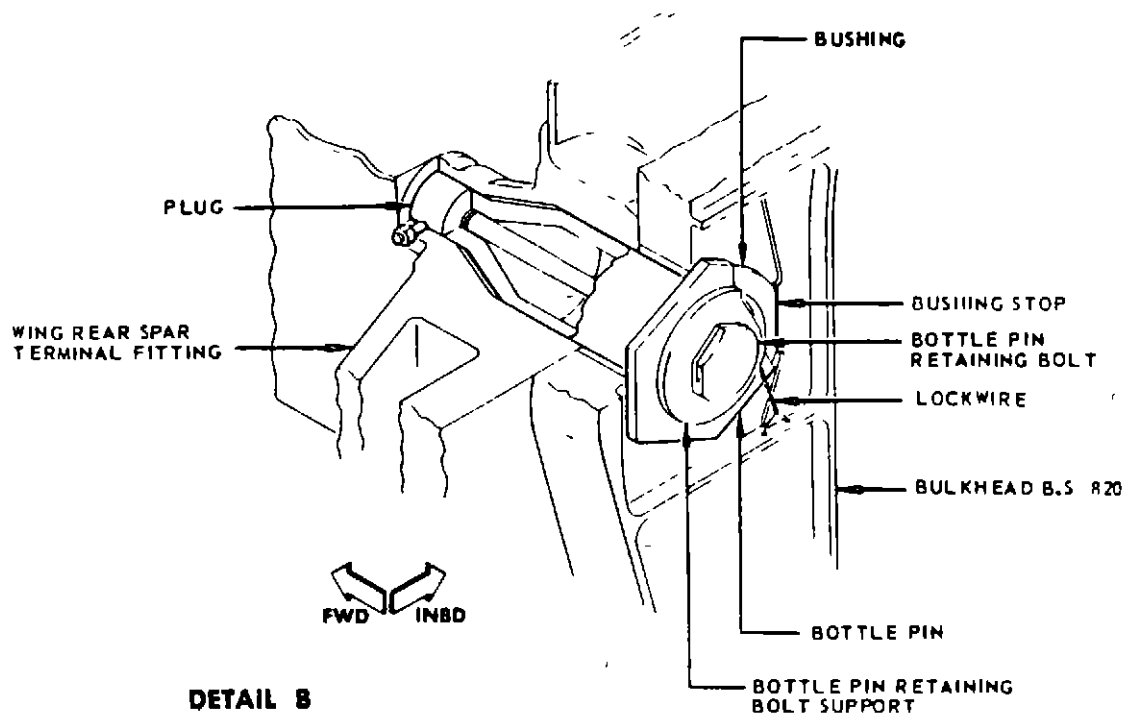


Wing Vortex Generator Location
Figure 8



DETAIL A





DETAIL B

Wing to Body Attachment Bottle Pins
Figure 9

1. Inspection/Check Wing

A. Equipment and Materials

(1) Downlock - Main Landing Gear Door - F71127 or equivalent

B. Access

(1) Refer to Access Doors and Panels, Chapter 12.

C. Examine Wing Structure for the following:

(1) Cracks and loose or missing fasteners in all interspar skin panels particularly at skin splices, access openings and boost pump cut outs.

(2) Fretting or deterioration of finish between panel or clamping ring and skin around fuel tank access openings; deterioration of seal around fuel tank access panel. Refer to Chapters 52 and 57 of the Structural Repair Manual for rework on fuel tank access panels and openings.

(3) Cracks and loose or missing fasteners in lower skin under wing fuselage fairing and wing center section particularly at skin splices, access openings and covered manufacturing openings; cracks in skin and splice plate tongue at inboard end of tongue in vicinity of rear spar.

(4) Cracks and corrosion in wing production joint fittings, nuts and bolts; condition of a representative sample of tension bolts and holes in fittings.

(a) Torque all bolts, all airplanes at 1000 (± 200) hours, one time only. See 57-2-1 (Turbojet) and 57-2-11 (Turbofan), Outboard Wing - Removal/Installation.

(5) Cracks and loose or missing fasteners in fuselage skin to wing root rib upper chord attachment, outboard side.

(6) Cracks and loose or missing fasteners in main landing gear aft support rib, beaver tail and torque box; cracks and corrosion in beaver tail attachment bolts and holes; cracks in wing lower skin in area of beaver tails. WBL 59.24.

(a) Remove five bolts from lower beaver tail, one at extreme aft end, one through rear spar chord, and one each from between S-1 and S-2, S-5 and S-6, S-8 and S-9. Examination of upper surface to be based on findings. If defect is found, contact Boeing for repair instructions.

(b) Install bolts and tighten to specified torque values. Refer to Standard Torque Values, Chapter 91.

(7) Cracks in stringers, spanwise beam chords and splice material at wing lower and upper surface splice WBL -6.

(a) Internal examination requires the removal of bladder cells and backing boards. Refer to Removable Fuel Cells, Chapter 28 and for backing boards, see Center Wing Cavity, Chapter 28.

(8) Cracks in stringers, skin and splice material at upper and lower surface splices WBL 59.24, WS 360 and wing production break.

(9) Cracks in stringers and boost pump housings at their connection, stringers to be examined up to 12 inches from each end of housing. WBL 6, WBL 48, WS 204, WS 345 and WS 368.

(10) Cracks at stringer bends, WS 643.50 lower surface, particularly in radius of flange adjacent to skin.

(11) Condition of front spar in region of web splice points, wing production break and inboard and outboard nacelle strut attachments, cracks and loose or missing fasteners in chords, webs and stiffeners, fretting, cracks or corrosion in continuous shim on lower chord particularly at edges of leading edge panels. Examination of balance of front spar to be based on findings.

(a) Internal examination of front spar in wing center section requires removal of bladder cells and backing boards. Refer to Removable Fuel Cells, Chapter 28 and for backing boards, see Center Wing Cavity, Chapter 28.

(b) Access to forward face of spar center section is via the forward cargo compartment. Remove three compartment closure panels and view spar across air conditioning duct compartment.

(12) Cracks, distortion and loose or missing fasteners in rear spar chords, web and stiffeners; condition of externally visible portion of vertical leg of center wing rear spar lower chord, particularly in area near the inboardmost bolt attaching chord to wing terminal forging at approximately BBL 59.0, condition of rear spar lower chord and web at attachment to wing terminal forging outboard end, particularly in plane of outboard row of fasteners of web-terminal splice

(a) Access to rear spar in center wing is through the zippered vapor seal and examination requires use of borescope.

(b) Internal examination of rear spar in wing center section requires removal of bladder cells and backing boards. Refer to Removable Fuel Cells, Chapter 28 and for backing boards, see Center Wing Cavity, Chapter 28.

(13) Cracks, distortion and loose or missing fasteners in wing rib webs, stiffeners and chords, particularly at stringer attachment points, cracks, distortion and loose or missing fasteners in wing center section spanwise beam chords, webs and stiffeners (one side of each beam).

(a) Internal examination of beams in wing center section requires removal of bladder cells and backing boards. Refer to Removable Fuel Cells, Chapter 28 and for backing boards, See Center Wing Cavity, Chapter 28.

(14) Cracks, distortion and loose or missing fasteners in wing fuselage breather webs, chords and stiffeners, particularly breather web stiffeners at attachment to delta beam near front and rear spar, and full length of lower chord of beam BL.12.78.

(15) Loose or missing fasteners in wing leading edge, panels, gap covers, fairings and general internal structure

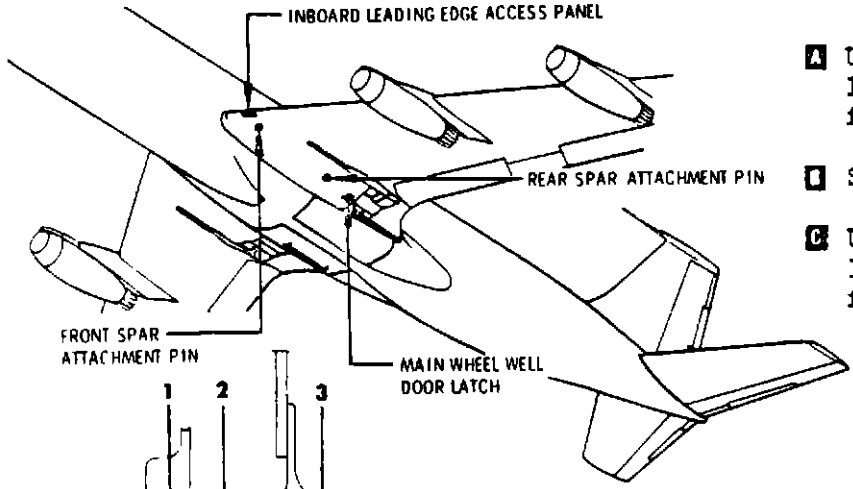
(16) Cracks, distortion and loose or missing fasteners in wing trailing edge rib chords, webs, rib to stiffener connections at rear spar, and splice plates; separation of bond between skin and stiffener in skin panels.

(17) Freedom from obstruction of wing lower surface drain holes

(18) Damaged or missing vortex generators on wing upper interspar surface above inboard nacelle strut area.

NOTE The airplane should not be flown if more than five percent of the generators are missing from either wing.

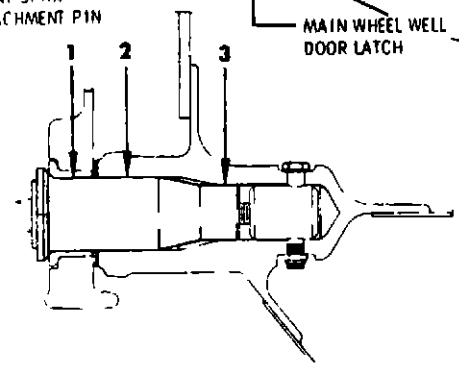
(19) On PAA airplanes N714PA thru N716PA, and BOAC airplane G-APFB, exposed surfaces of perforated-type honeycomb core in wing tip and fixed trailing edge assemblies for condition of sealer and evidence of moisture entrapment



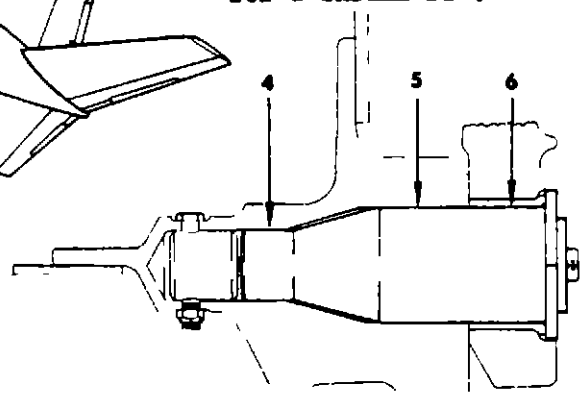
[A] USE P/N 90-5581 BUSHING Install using liquid nitrogen for a shrink fit.

[B] SEE "APPROVED REPAIRS TO WING"

[C] USE P/N 6-68029 BUSHING Install using liquid nitrogen for a shrink fit.



FRONT SPAR ATTACHMENT PIN



REAR SPAR ATTACHMENT PIN

INDEX NO	DIM.	DESIGN LIMITS DIAMETER MIN	DESIGN LIMITS DIAMETER MAX.	WEAR LIMITS MAX. WEAR DIM.	WEAR LIMITS MAX DIAM. CLEARANCE	REWORK LIMITS BUSHING OR PLATING PERMITTED YES	NO	MTL	OVERSIZE HOLE OR PLATING BUILD-UP MAX	BUSHING INTERFERENCE MIN	BUSHING INTERFERENCE MAX.
1	I/D	2.3802	2.3816		0.011	X		[C]	2.7015	0.001	0.0035
	O/D	2.3740	2.3750								
2	I/D	2.3770	2.3800		0.008	[B]				.0027	.0056
	O/D	2.3740	2.3750								
3	I/D	1.7520	1.7550		0.008	[B]					
	O/D	1.7490	1.7500								
4	I/D	2.2020	2.2050		0.008	[B]					
	O/D	2.1990	2.2000								
5	I/D	3.7520	3.7550		0.008	[B]				.0042	.0070
	O/D	3.7490	3.7500								
6	I/D	3.7565	3.7579		0.011	X		[A]	4.2515	0.0015	0.004
	O/D	3.7490	3.7500								

Wing Spar Terminal Attachments Allowable Wear and Rework
Figure 201

Boei Telex 6/7131/3417 dated Feb. 28, 67 SAB REV 27 MAR 1967

(20) Cracks and loose or missing fasteners in wing spar terminal forgings; broken lock wire at bottle pin retaining bolts indicating looseness; cracks, corrosion and wear of bottle pins and bushings; cracks in fillet flap support beam attachment to uplock support, BS 900, cracks in walking beam supports, BS 850 and 860.

(a) Open main gear wheel well door by pulling down and latching door release handle.

(b) Install ground door open lock, F71127 on door actuator.

(c) Remove inboard leading edge access panel.

(d) Examine pin retaining bolts for broken lockwire; examine pin stops for possible damage due to excessive rotation of bottle pin; examine bushing stops for possible damage due to rotation of bushing; examine bottle pin for contact with stops or any other evidence that indicates pin has rotated within wing spar fitting.

(e) Inspect bottle pins and bottle pin fittings.

1) Remove bottle pins. See 57-1-12, Bottle Pins and Bushings - Removal/Installation.

NOTE: No more than one bottle pin should be removed at the same time. During inspection and possible rework, other affected bottle pins should remain installed. Body and wing structure must be supported in such a way that all shear load is removed from the bottle pins prior to removal of bottle pins. Attach a dial indicator to the body bulkhead near the bottle pin installation, indexing the indicator pin to the wing terminal fitting. Set the dial to the "zero" reading. This "zero" reading should be maintained throughout the entire inspection and possible rework of the bottle pin and body-to-wing terminal fittings.

2) After removal of the body-to-wing terminal fitting bottle pin, the dial indicator should be checked to assure the reading is at zero.

NOTE: The same check applies if any bushing is removed, but no bushing should be removed unless necessary as per step 8).

3) Remove the bottle pin retaining sleeve from the wing terminal fitting.

4) Clean out the inside of the body and wing terminal fitting holes, removing all grease and possible contaminants.

5) Accomplish a visual inspection of the bottle pins for corrosion or pitting. Particular attention should be given to the area of the pin where it passes through the body-to-wing terminal fitting parting lines, where it passes through the body terminal fitting bushing withdrawal cavity, and near the bottle pin head. Inspect the bottle pin inner diameter and the retaining bolt.

6) Should inspection show no corrosion or pitting present on the bottle pin OD or ID or on the retaining bolt, pin and bolt may be reinstalled upon accomplishment of the body-to-wing terminal fitting bottle pin hole inspections.

7) Should inspection show corrosion or pitting present on the bottle pin, rework may be done according to paragraph 2, "Approved Repairs to Wing."

8) Visually inspect the fore and aft body bulkhead fitting holes for corrosion or pitting. Particular attention should be given to the body bulkhead fitting bushing area and to the body fitting parting line. Do not remove bushings unless conditions indicate corrosion may exist under bushing. Should inspection reveal corrosion in the affected areas, Boeing should be notified of the area involved and the extent of the corrosion.

9) Visually inspect the fore and aft wing terminal fitting hole. Particular attention should be given to the larger diameter hole area immediately adjacent to the conical bore and to the area of the wing terminal fitting parting line.

10) Should inspection of the wing terminal fitting hole show no corrosion or pitting, the bottle pin may be reinstalled.

11) Should inspection of the wing terminal fitting hole show corrosion or pitting, rework may be done according to paragraph 2, Approved Repairs to Wing.

12) If corrosion or pitting present is widespread, the wing terminal fitting hole may be reworked to incorporate a bushing. See paragraph 2, Approved Repairs to Wing.

(f) Install the bottle pin retaining sleeve.

(g) Install bottle pins. See 57-1-12, Bottle Pins and Bushings - Removal/Installation

(h) Install leading edge access panel.

(i) Check that wheel well area is clear, remove ground door open lock F71127, release wheel well door handle release latch and return handle to closed position.

WARNING: MAKE SURE THAT THE DOOR CLOSES AND LOCKS WITH HANDLE IN DOOR CLOSED POSITION HYDRAULIC SYSTEM MAY HAVE BEEN DEPRESSURIZED SINCE DOOR WAS OPENED AND MOVING HANDLE TO CLOSED WOULD NOT ACTIVATE DOOR. HOWEVER, ON PRESSURIZATION OF SYSTEM, DOOR WOULD SNAP SHUT WITH POSSIBLE INJURY TO PERSONNEL.

(21) Examine the upper wing surface magnesium trailing edge filler between trailing edge stations 187.369 and 266.542 for corrosion. See paragraph 2., Approved Repairs to Wing, for clean-up of the filler flange if corrosion exists.

2. Approved Repairs to Wing

A. General

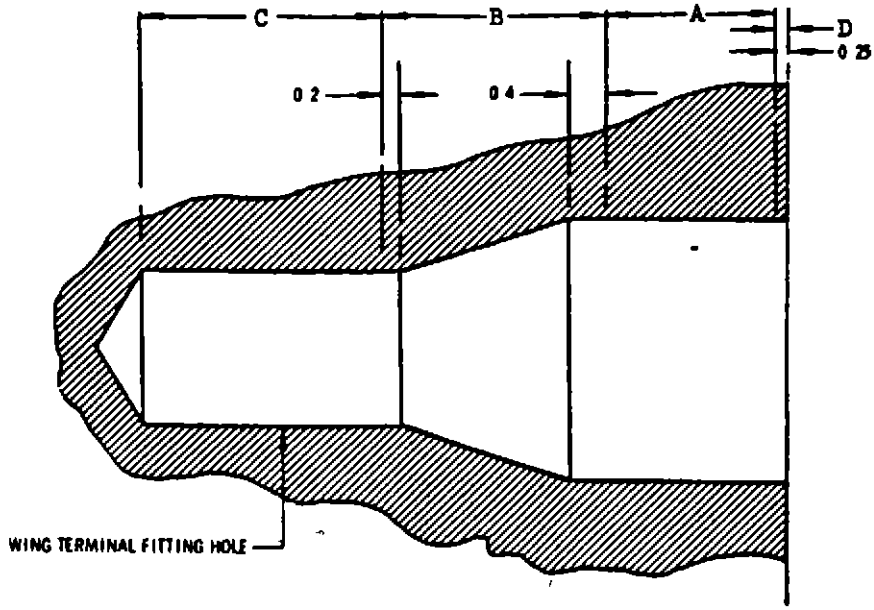
(1) A limited amount of rework may be performed to remove corrosion from the bores of the front and rear wing spar terminal fittings and the bottle pins. See figure 201.

B. Repair Front or Rear Wing Spar Terminal Fittings

(1) Using a rotary file or equivalent hand tools, rework corroded portions of the bores of these fittings in accordance with the limits shown in the following table. See figure 202.

CONDITIONS	A	B	C	D
Maximum depth of rework (inches)	0.05*	0.10	0.05	0.05
Minimum radius for rework (inches)	0.375	0.50	0.375	0.375
Maximum percent of bearing area which may be removed during local rework, top and bottom.	10	25	10	10
* If this figure is exceeded, please contact Boeing.				

NOTE: All reworked areas must have a finish comparable to the original surface and must be protected by brush treatment with alodine 1200. In addition, the tapered section of the hole must be primed with BMS10-11, Type 1, primer. For alodine treatment and priming, refer to Chapter 51, "Interior and Exterior Finishes - Maintenance Practices."



Wing Spar Terminal Fittings Allowable Rework
Figure 202

C. Rework Bottle Pins

(1) Bottle pins may have a maximum of three corrosion pits cleaned up. Should inspection reveal that the ID or the OD of the bottle pin has three corrosion pits or less, the pin may be cleaned up by hand rework, or by using a rotary file of 0.375 inch minimum radius. All of the ID and those areas of the OD that are not within 0.25 inch of the wing-body shear line, may have pits cleaned up to a maximum of 0.03 inch, provided the reworked areas do not meet · On the OD of the pin, within the area 0.25 inch on either side of the wing-body shear line, one pit with a maximum clean-up depth of 0 02 inch and two pits with maximum clean up of 0.005 inch are allowed. Surface corrosion on the bottle pin ID only may be reworked circumferentially by removing material to 0.005 inch maximum without regard to area.

WARNING: BOTTLE PINS HAVING MORE THAN THREE CORROSION PITS, OR HAVING A CORROSION PIT THAT EXCEEDS 0.03 INCH DEPTH AFTER CLEAN UP, OR HAVING PITS EXCEEDING THE LIMITS GIVEN ABOVE FOR THE WING-BODY SHEAR LINE AREA MUST BE DISPOSED OF IN ACCORDANCE WITH ESTABLISHED PROCEDURE. BOTTLE PIN RETAINING BOLTS SHOWING SIGNS OF CORROSION MUST BE REPLACED. SHOULD THE BOTTLE PIN OUTER DIAMETER REQUIRE REPLATING WITH SILVER, THE BOTTLE PIN INNER DIAMETER MUST BE SEALED TO ELIMINATE SILVER THROW IN.

NOTE: Interim inspection of bottle pin inner diameters should be accomplished at each major overhaul without removing the bottle pins. Pull end plates on rear spar bottle pins and clean and inspect ID of pins. Corrosion and rework limitations are as described above.

(2) Upon completion of any rework, the affected area must be protected using zinc chromate primer. After inspection or rework of pin inner diameter, fill pin cavity with MIL-G-7118 grease.

D. Rework for Wing Terminal Fitting Hole Bushing Installation

(1) Rework to prepare the wing terminal fitting hole for bushing installation may be done according to Service Bulletin 1845

E Repair Wing Upper Surface Magnesium Trailing Edge Filler Between Trailing Edge Stations 187 369 and 266.542.

(1) Corrosion of the filler may be cleaned up according to the following limits. See Chapter 51, "Structures - General," for corrosion removal procedure The filler flange is defined by the shaded area in figure 203.

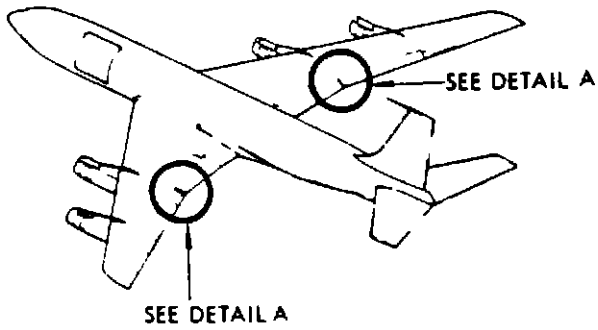
(a) 50 per cent of flange thickness for 4 inches symmetrical about rib attachment.

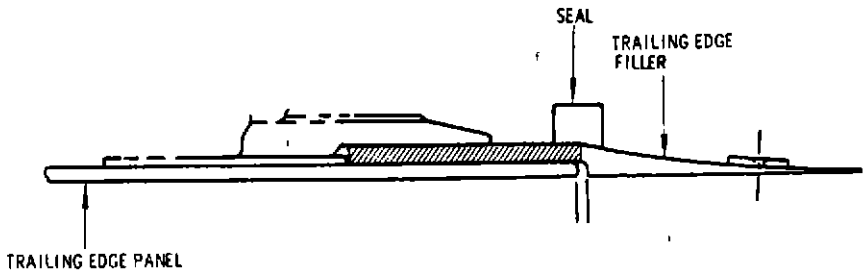
(b) Remaining distance between rib attachments

1) 25 per cent of flange thickness for full length.

2) 50 per cent of flange thickness for half of length

3) 100 per cent of flange thickness for 1/4 of length.





DETAIL A

BOTTLE PINS AND BUSHINGS - UNIT SERVICING

1. General

   A. Access to the forward bottle pins is gained by removing panel 1300. See Chapter 12, Access Doors and Panels. Access to the aft bottle pins is gained through the main landing gear wheel well.

2. Equipment and Materials

   A. Grease, MIL-G-23827

   B. Grease Gun (Alemite Gun with MS24203-1 Nozzle or Stewart-Warner Corp. Nozzle No. 314150)

3. Lubricate Bottle Pin and Wing Terminal Cavity (See figure 301.)

A. Inject grease through the lubrication fitting until some grease comes out between the wing terminal fitting and the body bulkhead.

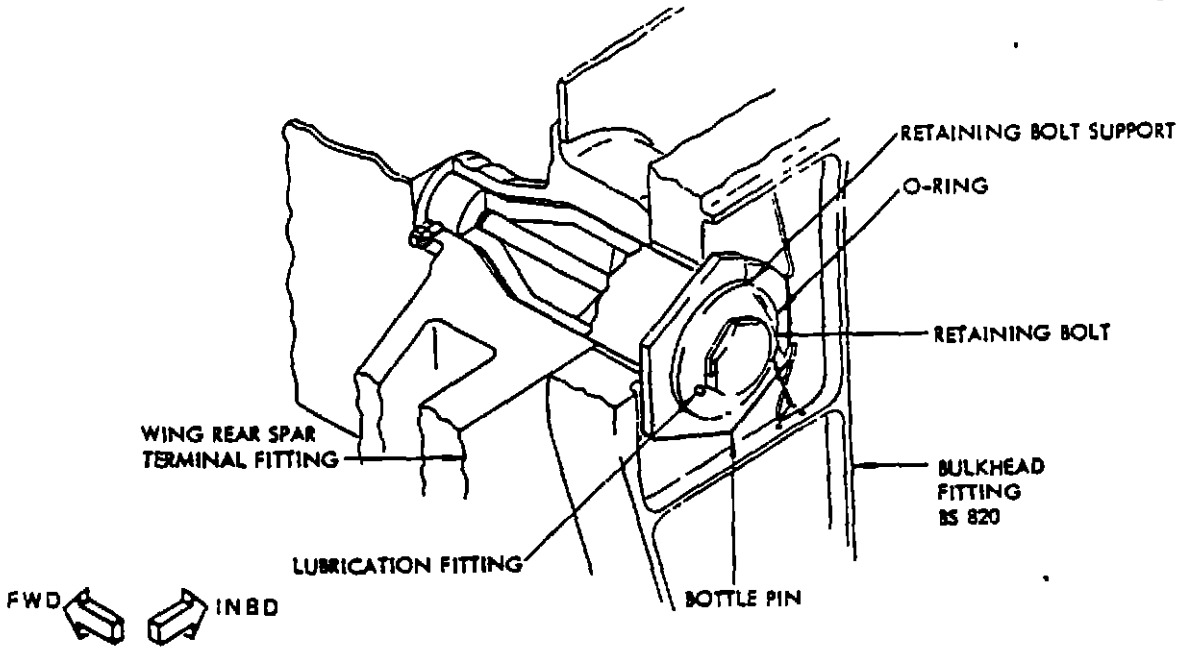
WARNING: GREASE PRESSURES IN EXCESS OF 3000 PSI MIGHT RESULT IN STRUCTURAL DAMAGE TO THE RETAINING BOLT OR TO THE BOTTLE PIN RETAINING BOLT SUPPORT.

CAUTION: TO AVOID EXCESSIVE GREASING PRESSURES, WHICH COULD RESULT IN POSSIBLE STRUCTURAL DAMAGE, LOOSEN THE RETAINING BOLT IN SUCCESSIVE STAGES SO THAT THE GREASE JUST FLOWS OUT BETWEEN THE WING-TO-BODY TERMINAL FITTING FAYING SURFACES UNDER ONLY MODERATE GREASE INJECTION PRESSURES. HOWEVER, TO AVOID A BLOWN O-RING SEAL AT THE BOTTLE PIN RETAINING BOLT SUPPORT, EXERCISE CARE NOT TO REDUCE THE RETAINING BOLT TENSION ALL THE WAY TO ZERO.

USE A HAND OPERATED GREASE GUN ONLY. DO NOT USE A POWER GUN UNDER ANY CIRCUMSTANCES. INJECT THE GREASE SLOWLY USING MODERATE HAND PRESSURE ON THE GUN. DO NOT FORCE THE GREASE QUICKLY USING HEAVY HAND PRESSURE ON THE GUN. IT MAY BE NECESSARY TO WAIT FOR SEVERAL MINUTES UNTIL THE GREASE FLOWS THROUGH THE JOINT AT ALLOWABLE PRESSURES.

NOTE: Gun must enter fitting in a normal direction or at an angle from normal of not over 15 degrees. Location of fitting depends on rotation of bolt support.

B. Retorque the retaining bolt within the range of 170 to 220 inch-pounds, and lockwire.



Bottle Pin and Bushing Lubrication
Figure 301

BOTTLE PINS AND BUSHINGS - REMOVAL/INSTALLATION

1. General

A. Access

(1) In addition to obtaining access to the head of each bottle pin, it will be necessary to gain entry to the interiors of the inboard wing and center wing structures alongside each bottle pin. This involves entry into fuel tank space and at least partial removal of the center wing bladder tanks, if fitted. Refer to Chapter 12, Access Doors and Panels, and the relevant sections of Chapter 28, FUEL Later airplanes have bushings with a snap ring groove provided.

2 Equipment and Materials

A. Puller Assembly, Front Spar: F70154 or F70154-13, Rear Spar: F70155 or F70155-19, or equivalent

NOTE Basic part number is used on airplanes without bushing snap ring groove, dash part number is used on airplanes with bushing snap ring groove

B Grease, MIL-G-23827

C O-rings and seal washers

3 Remove Wing Spar-Fuselage Attachment Bottle Pin

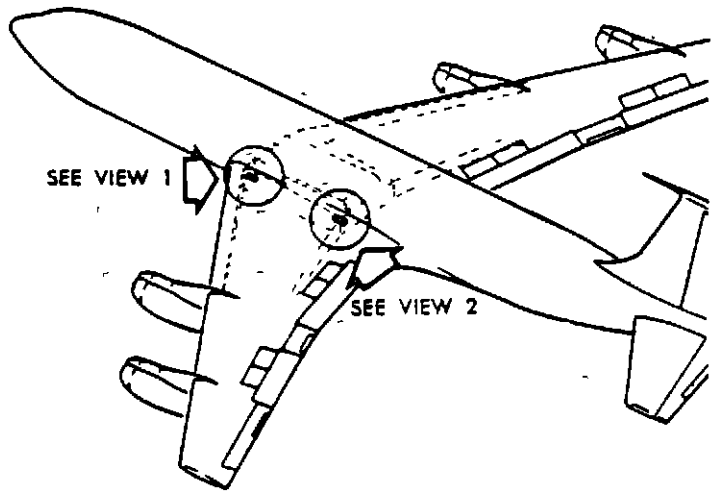
A Support wing. Refer to Structural Repair Handbook, Chapter 51, Support of Structure for Repair

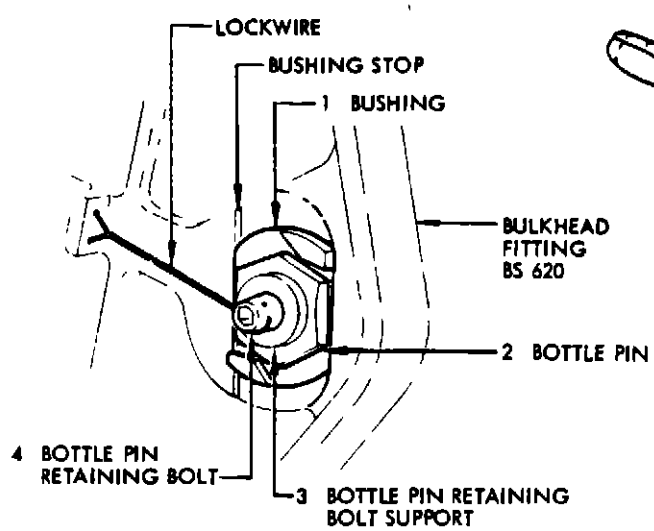
NOTE. This procedure is intended to relieve the bottle pin of all loads, but further small adjustments in wing position to permit free removal of the bottle pin may be necessary.

No more than one bottle pin should be removed at the same time. During inspection and possible rework, other affected bottle pins should remain installed. Body and wing structure must be supported in such a way that all shear load is removed from the bottle pins prior to removal of bottle pins Attach a dial indicator to the body bulkhead near the bottle pin installation, indexing the indicator pin to the wing terminal fitting Set the dial to the "zero" reading. This "zero" reading should be maintained throughout the entire inspection and possible rework of the bottle pin and body-to-wing terminal fittings. After removal of the body-to-wing terminal fitting bottle pin and the body fitting bushing, the dial indicator should be checked to assure the reading is at zero.

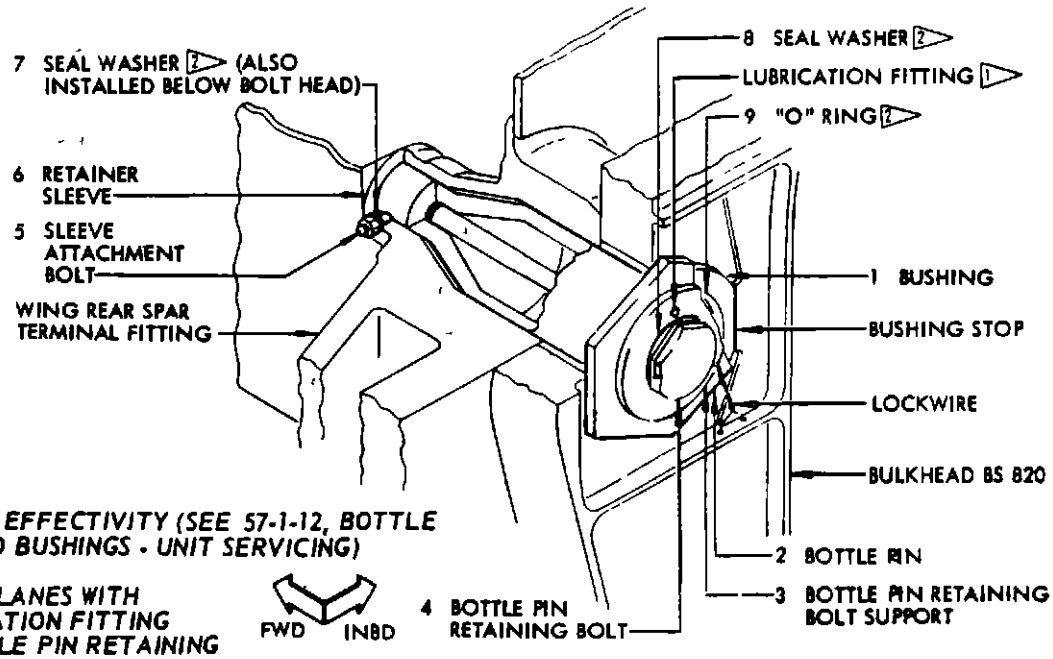
B Remove lockwire

C Remove bottle pin retaining bolt (4, figure 401).





VIEW 1



[1] *LIMITED EFFECTIVITY (SEE 57-1-12, BOTTLE PINS AND BUSHINGS - UNIT SERVICING)*

[2] *ON AIRPLANES WITH LUBRICATION FITTING IN BOTTLE PIN RETAINING BOLT SUPPORT*

FWD INBD

VIEW 2

Wing Spar - Fuselage Attachment Bottle Pin and Bushing Installation 2
Figure 401 (Sheet 1)

D. On bottle pins with lubrication fitting, remove seal washer (8).

E. Remove bottle pin retaining bolt support (3).

F On bottle pins with lubrication fitting, remove O-ring (9).

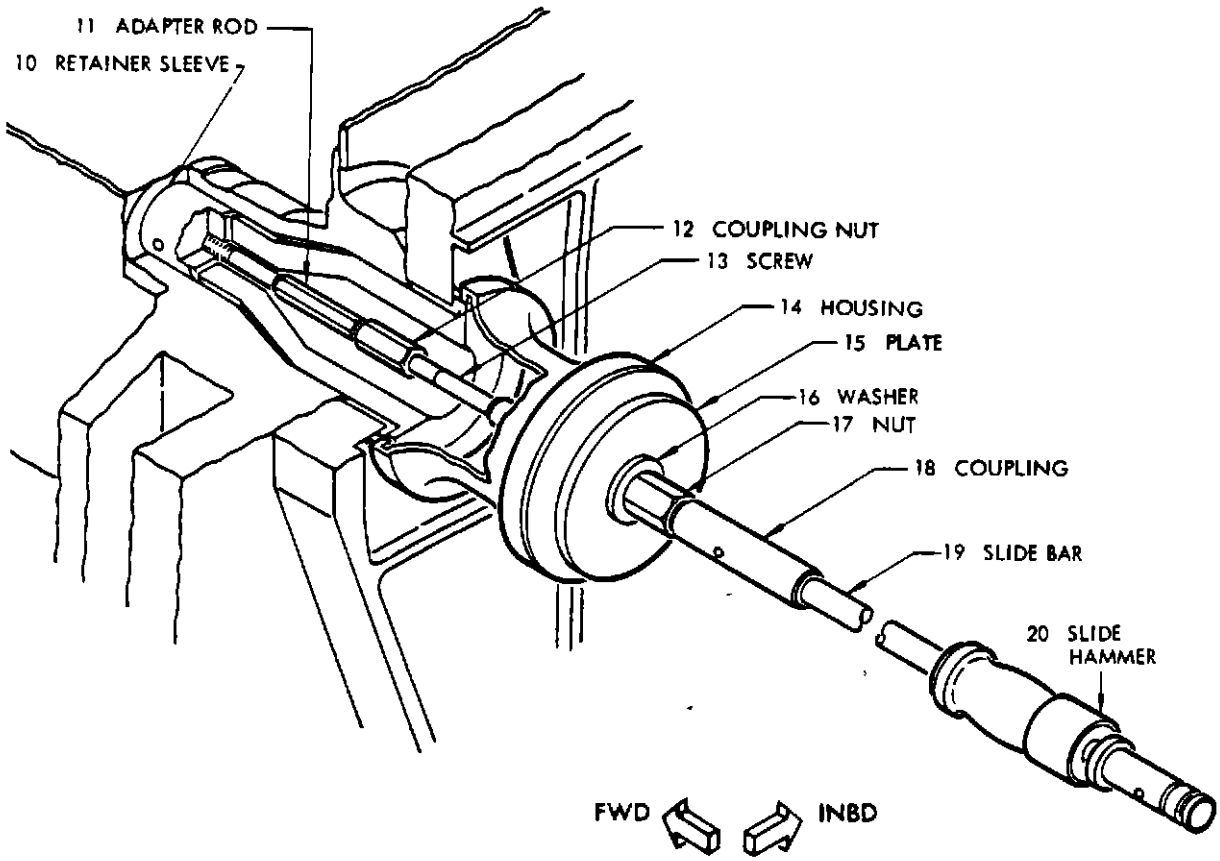
G. Couple adapter rod (11) to the screw (13) with the coupling nut (12).

H. Assemble housing (14), plate (15), washer (16) and nut (17) on screw shaft assembly (11, 12 and 13).

I. Screw adapter rod (11) into retainer sleeve (10).

J Enter fuel tank and remove sleeve attachment bolt (5) and, on bottle pins with lubrication fitting, seal washers (7).

K. Apply extraction force by tightening on the nut (17) while restraining the screw assembly from turning.



L If additional extraction force is required, the slide bar (19) and hammer (20) may be used. Attach these to the screw (13) with the long coupling (18). With the nut (17) tightened, extra force may be applied with the slide hammer (20).

NOTE: The blow with the slide hammer (20) should be delivered in a direction away from the bottle pin (2).

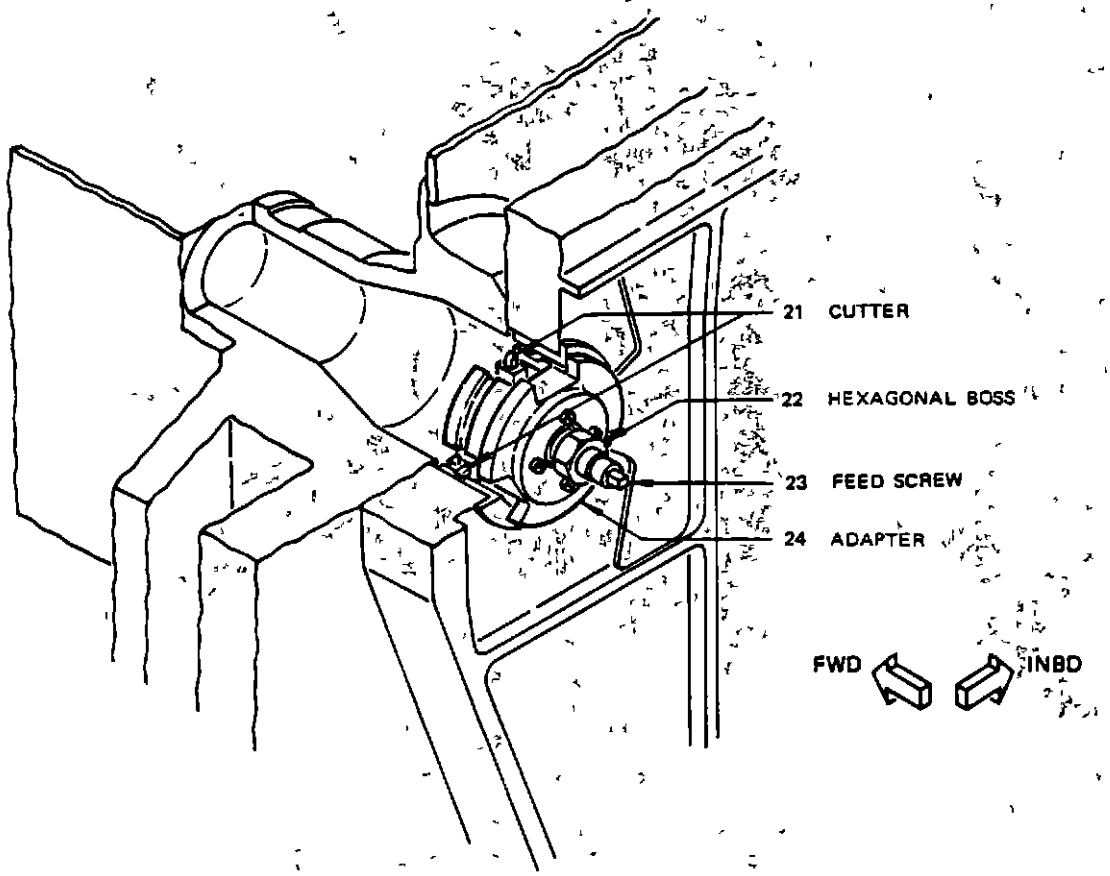
4 Bushing Removal

A Prepare for Bushing Removal (Applies only to airplanes without bushing snap ring groove).

(1) Assemble matched cutter set in the cutter assembly. Cutters (21, figure 401) should be retracted as far as possible.

(2) With the cutter assembly in position in the bushing (1), hold the cutter assembly stationary with a wrench on the large hexagonal boss (22) and feed the cutters (21) radially by turning very slowly on the square portion of the feed screw (23).

(3) Discontinue the radial feed as soon as the cutters (21) contact the bushing (1).



Wing Spar - Fuselage Attachment
Bottle Pin and Bushing Installation
Figure 401 (Sheet 3)

(4) Start cutting operation by turning on the hexagonal boss (22).

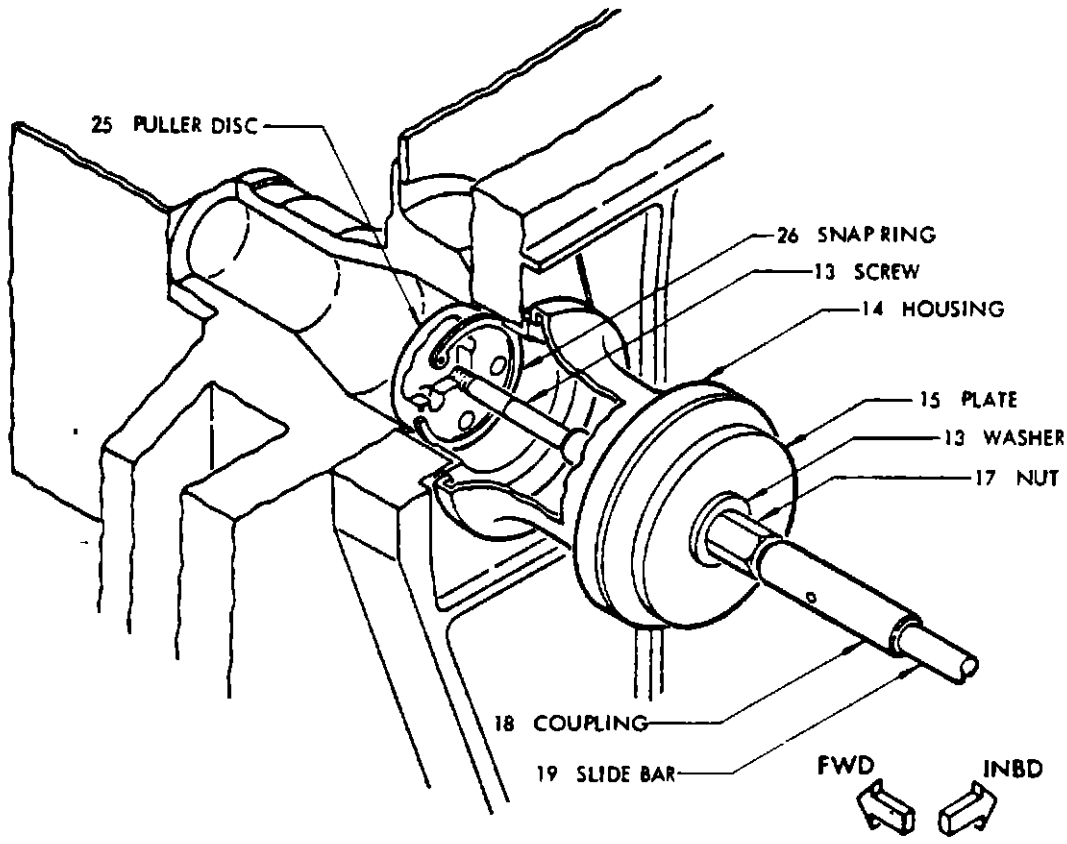
NOTE Extremely small increments of radial feed should be used until the groove is well started During the cutting operation cutting lubricant should be applied through the slots in the bushing adapter. A light machine oil is recommended

(5) Retract the cutter blades (21) by backing off the radial feed screw (23) and forcing the cutter blades (21) back with a screwdriver inserted through the slots in the adapter (24).

NOTE. Groove depth should be 0.110 min and 0.115 max It is suggested that some type of depth gage, prepared in advance, be inserted through the adapter slots.

B Remove Bushing

(1) Place puller disc (25) behind the snap ring groove



(2) Install snap ring (26) in groove.

(3) Screw long screw shaft (13) into puller disc (25).

(4) Remove bushing (14) by repeating procedure used to remove the bottle pin (2).

5. Install Wing Spar-Fuselage Attachment Bottle Pin and Bushing

A. Butter lubricate mating surfaces of pin (2, figure 401) and hole. Pack grease approximately 0.15 inch thick on sloping surface inside hole and approximately 0.50 inch thick at closed end of hole to help eleminate air pockets which form there.

B. Install bottle pin retainer sleeve (6) and its attachment bolt (5) using new seal washers (7) on airplanes with lubrication fitting. Torque nut within the range of 290 - 410 inch-pounds.

C. Seal bolt (5) against fuel leakage. Refer to Chapter 51, Sealing.

D. Install bushing (1) in fuselage bulkhead, so that flats on bushing flange are parallel to aircraft centerline.

E. Install bottle pin (2) so that a diametral line across the corners of the pin flange is parallel to aircraft centerline. After pin insertion, pack the bottle pin cavity completely full of grease MIL-G-23827.

F. On bottle pins with lubrication fitting, install new O-ring (9).

G. Install bottle pin retaining bolt support (3).

CAUTION: OPERATORS INSTALLING BOLT SUPPORT ASSEMBLIES WITH LUBRICATION FITTING SHOULD TAKE THE FOLLOWING PRECAUTION:

- SHOULD THESE PARTS BE INSTALLED WITHOUT REPLACING THE EXISTING BARREL NUT AND INSTALLING SEAL WASHERS (ACCESS BY ENTERING THE FUEL CELL IS REQUIRED TO ACCOMPLISH THIS), THE GREASE FITTING IN THE BOLT SUPPORT FITTINGS SHOULD BE REMOVED AND THE HOLE PLUGGED. THIS SHOULD BE DONE TO PREVENT INDISCRIMINATE GREASING AND PUMPING LARGE QUANTITIES OF GREASE IN THE FUEL CAVITY.

H. Install retaining bolt (4), using new seal washer (8) on airplanes with lubrication fitting.

I. Apply torque of 170 - 220 pound-inches to retaining bolt (4).

J. Lockwire retaining bolt (4) to bulkhead.

K. On bottle pins with lubrication fitting, lubricate bottle pin (2) and terminal cavity per 57-1-12 Unit Servicing Bottle Pins and Bushings.

OUTBOARD WING - REMOVAL/INSTALLATION

1. General

   A. The replacement of the ouboard wing is a major job in that it requires the use of heavy lifting equipment, several men in the ground crew, and the disconnection of airplane systems in addition to structural disconnecting. The electrical systems on this airplane do not have disconnects at the wing production break and thus the wire bundles must be disconnected at the equipment end and pulled through to the break. The hydraulic system for the leading edge must be broken as must the outboard aileron controls. The fuel system tubing in the integral tank area has to be disconnected which entails defueling and purging the tanks on either side of the production break. Structural disconnecting involves the removal of outboard nacelle strut fairings which cross the break.

2. Equipment and Materials

   A. Crane with minimum hook height of 18 feet and a lifting capability of 2000 pounds

   B. Sling Assembly - F71143-500, or equivalent

   C. Internal Wrenching Offset Adapter - F71151-12-7, or equivalent

   D. External Wrenching Adapter - F70016-500, or equivalent

   E. Torque Wrench with Adapter - 23MIT-5-73110, or equivalent

   F. Torque Wrench with Adapter - 24MIT-5-73110, or equivalent

3. Prepare for Removal

   A. Defuel and drain tanks number one and four and the respective reserve tanks. Refer to Chapter 28, Fuel System.

      WARNING: OBSERVE PRECAUTIONS IN CHAPTER 28, FUEL SYSTEM, PRIOR TO WORKING ON FUEL SYSTEM.

   B. Purge drained tanks. Refer to Chapter 28, Fuel System.

   C. Remove wing tip. Refer to 57-3-2, Wing Tip - Removal/Installation.

      NOTE: Steps 1 through 11 of the wing tip removal procedure are necessary even if the outboard wing is to be removed complete with wing tip.

D. Open the following circuit breakers:

(1) Open leading edge flight control system (flaps and slats) circuit breakers on P5.

(2) Open all fuel system circuit breakers.

E. Remove the following access panels:

(1) Lower wing: Outboard aileron control access panels 1366 and 1367, cove lip doors 1261, 1262 and 1263, gap cover 1266, jackpoint cover 1267, fuel tank access panels 1336 through 1339. In addition, aileron gap panel aft of panel 1366 must be removed.

(2) Upper wing: Gap cover 1460, outboard aileron control access panel 1412, outboard aileron mast fairing 1413.

(3) Nacelles. Strut trailing edge fairing 1747.

F. Lower leading edge slats.

G Lower outboard trailing edge flaps.

H. Disconnect wire bundles in outboard wing.

NOTE. Some wire bundles will have to be disconnected at splices.

I Free wire bundles from clamps along front spar and pull clear of outboard wing, gathering them in coils just inboard of production break.

J Remove clamp from thermal anti-icing duct in leading edge at production break.

K. Depressurize utility hydraulic system.

L Relieve tension in outboard aileron bus cables by slackening of turnbuckle. Refer to Chapter 27, Outboard Aileron, for location of components.

M. Disconnect and remove aileron lockout torque tube.

N. Remove bolts attaching aileron bus cable keepers to quadrant and free cables from outboard wing.

O Disconnect and plug hydraulic tubing at leading edge production break.

P. Gain access to fuel tank interior. Refer to Chapter 28, Integral Fuel Tanks.

WARNING: OBSERVE PRECAUTIONS IN CHAPTER 28, FUEL SYSTEM, PRIOR TO WORKING INSIDE INTEGRAL FUEL TANKS.

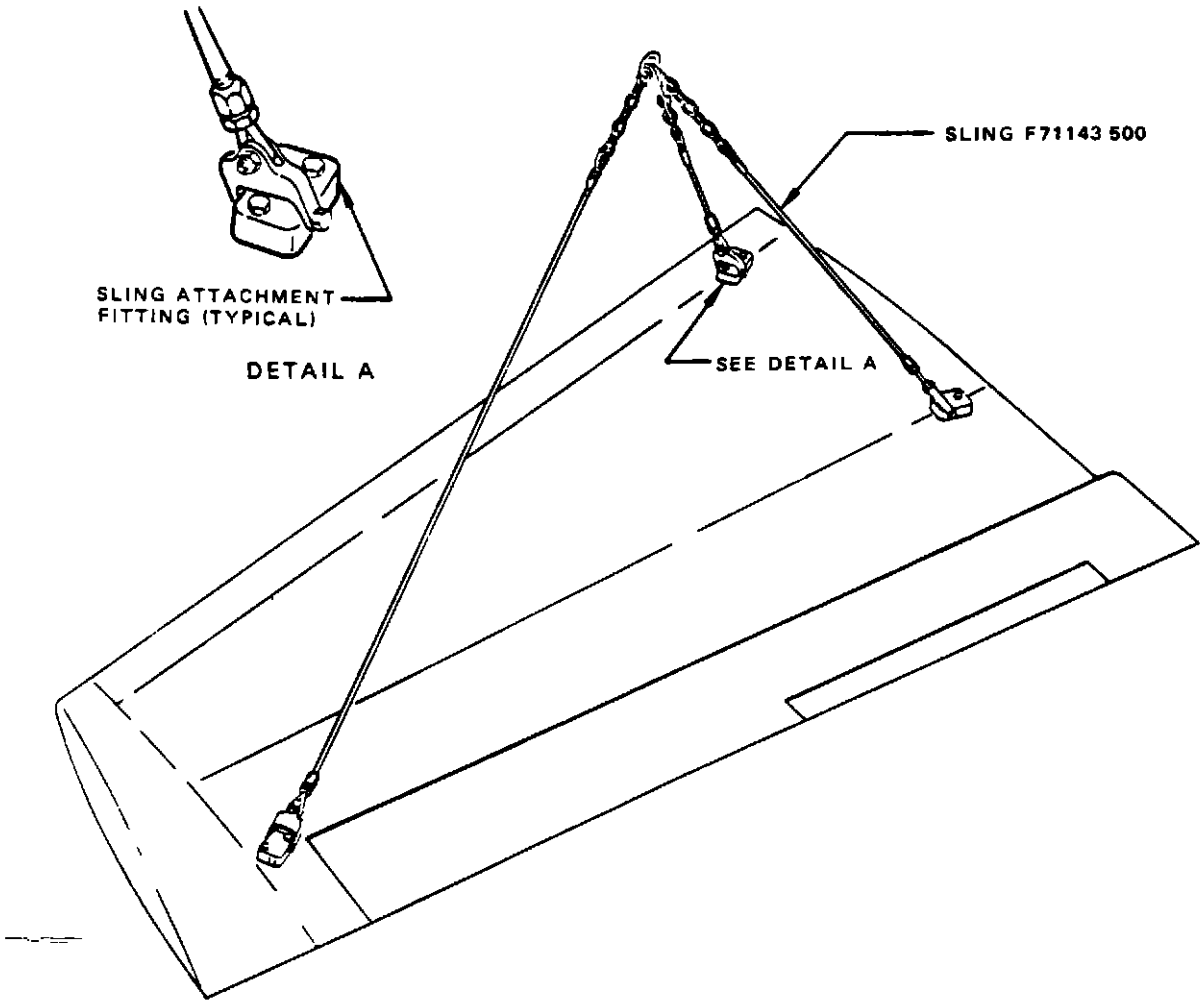
Q. Disconnect fuel transfer line bonding jumpers at production break.

R Remove sealant as necessary to remove production break bolts.

S. Disconnect fuel transfer line and drain fitting at production break. Make note of lockwires disconnected.

T Disconnect pressure fueling lines between main tank and reserve tank at production break. Make note of lockwires disconnected.

U. Remove bolts from wing surface at sling attachment points and using bolts which are stowed in sling attachment fittings, fasten sling F71143-500 to wing. (See figure 401.)



Attachment of Outboard Wing Sling
Figure 401

V Attach sling to crane hook and support weight of outboard wing during removal of outboard wing attachment bolts.

4. Remove Outboard Wing

A Remove bolts joining leading edge ribs at production break.

B. Remove rib joining bolts around vents and stringer terminal fittings at production break rib upper chord inside the wing. (See figure 403.)

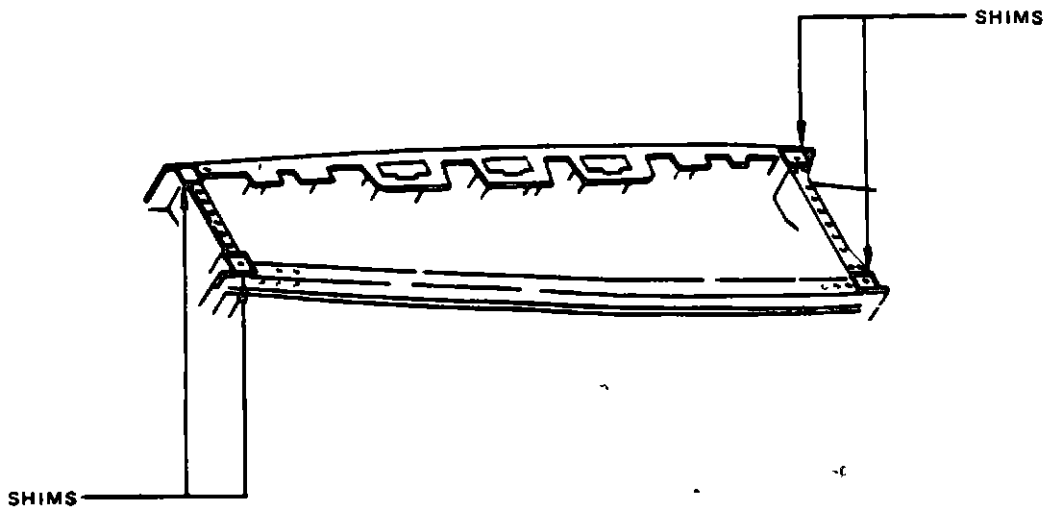
C. Remove front spar joining bolts in leading edge area.

D. Remove rear spar joining bolts in trailing edge area.

E Remove bolts joining lower inboard and outboard chord members, using external wrenching adapter, F70016-500.

F. Remove bolts joining upper inboard and outboard chord members, using internal wrenching adapter, F71151-12-7.

NOTE: If outboard wing being removed is to be reinstalled note installed position of tapered shims, if any, at front and rear spars. (See figure 402.)



Installation of Production Break Shims
Figure 402

G. Move the outboard wing clear of the airplane and lower on to a well padded cradle or on to sandbags placed under the spars.

H. Plug all fuel lines and vents.

I. Remove sling, stowing attachment fitting bolts in threaded holes in fittings. Reinstall structural bolts at sling attachment points.

5. Prepare for Installation

A. Check that the following circuit breakers are open:

(1) Circuit breakers listed in the installation procedure of 57-3-2, Wing Tip - Removal/Installation.

(2) Leading edge flight control system (flaps and slats) circuit breakers on P5.

(3) All fuel system circuit breakers.

B. Check that leading edge slats and outboard trailing edge flaps are lowered.

C. Check that utility hydraulic system is depressurized.

D. Examine fuel vent O-ring seals and replace with new ones if necessary.

E. Remove bolts from wing surface at sling attachment points and using bolts which are stowed in sling attachment fittings, fasten sling F71143-500 to wing. (See figure 401.)

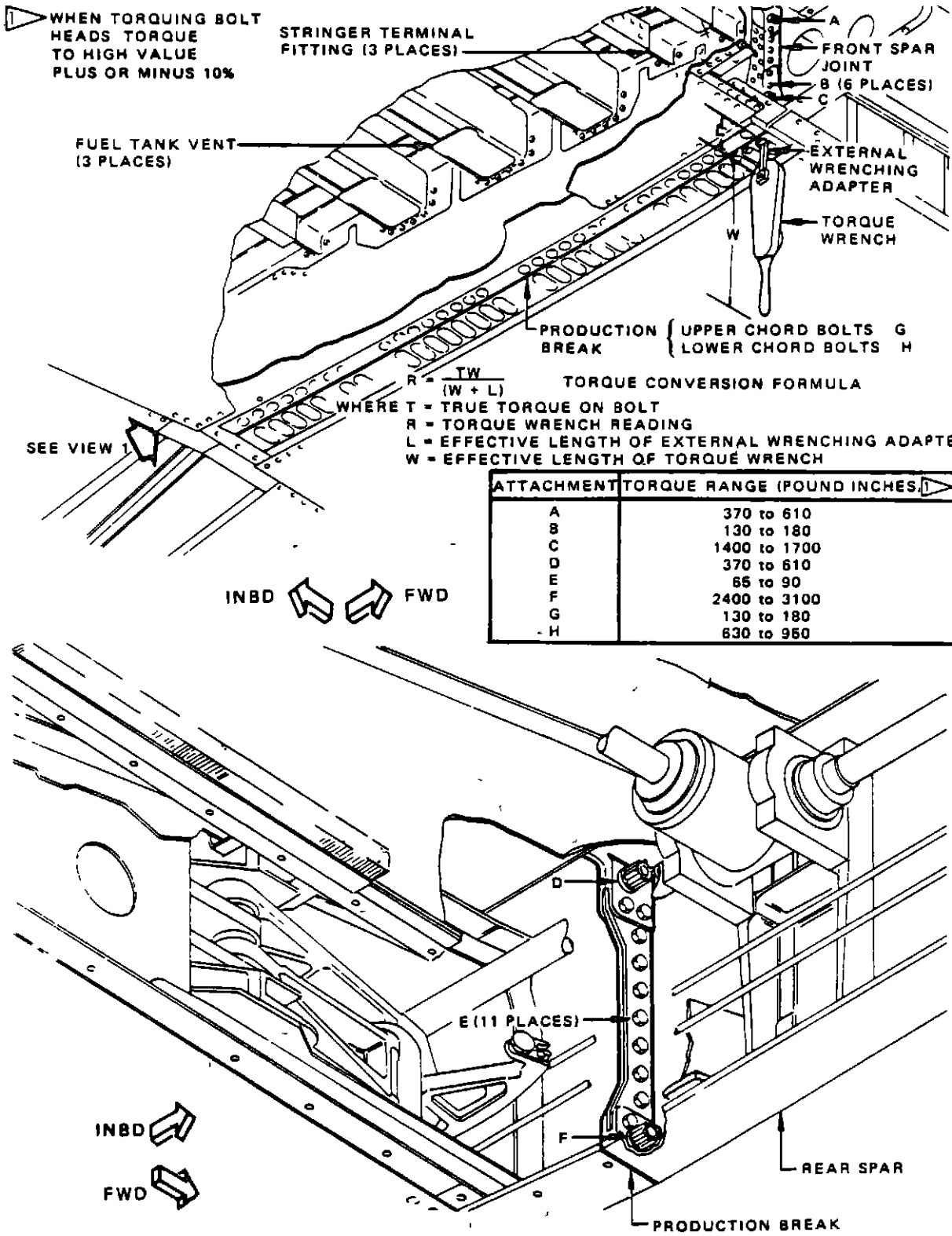
F. Remove plugs from fuel lines and vents.

G. Attach the sling to a crane hook and cautiously hoist the outboard wing into position.

6. Install Outboard Wing

A. Install the uppermost and lowermost front and rear spar joining bolts (A, C, D and F, figure 403) and tighten per figure 403.

NOTE: This step should only be performed at this stage if the outboard wing which was previously taken off the airplane is now being reinstalled, in which case the shims should be replaced in their original positions. (See figure 402.) If a new wing is being installed this step should be performed in accordance with steps D. and E.



ATTACHMENT	TORQUE RANGE (POUND INCHES) 1
A	370 to 610
B	130 to 180
C	1400 to 1700
D	370 to 610
E	65 to 90
F	2400 to 3100
G	130 to 180
H	630 to 960

VIEW 1

Installation of Production Break Joining Bolts
Figure 403

B. Install bolts (G, figure 403) joining the upper inboard and outboard production break rib chords. Use the internal wrenching adapter, F71151-12-7 to tighten bolts per figure 403.

C. Install bolts (H, figure 403) joining the lower inboard and outboard production break rib chords. Use the external wrenching adapter, F70016-500 to tighten bolts per figure 403.

D. Examine the production break joint at the uppermost and lowermost front and rear spar joining bolts. If a gap exists, then shim to fill the gap, tapering shims to suit installation. (See figure 402.)

NOTE: This step is applicable if the outboard wing being installed is not the one which was previously on the airplane.

E Install front and rear spar joining bolts (B and E, figure 403) tightening nuts per figure 403. Use tools 23MIT-5-73110 and 24MIT-5-73110 as necessary.

F. Install rib joining bolts around vents and stringer terminal fittings (figure 403) at production break rib upper chord inside the wing.

G. Install bolts joining leading edge ribs at production break.

7. Restore Airplane to Normal

A. Remove the sling, stowing attachment fitting bolts in threaded holes in fittings. Install structural bolts at sling attachment points.

B. Gain access to fuel tank interior. Refer to Chapter 28, Integral Fuel Tanks.

WARNING: OBSERVE PRECAUTIONS IN CHAPTER 28, FUEL SYSTEM, PRIOR TO WORKING INSIDE INTEGRAL FUEL TANK

C. Connect pressure fueling lines between main tank and reserve tank at production break. Use new O-rings. Lockwire installation.

D Connect fuel transfer line and drain fitting at production break. Use new O-rings. Lockwire installation.

E Apply sealant to all production break bolts per Chapter 28, Integral Fuel Tanks.

F. Connect fuel transfer line bonding jumpers at production break.

G Unplug and connect hydraulic tubing at leading edge production break.

H. Connect aileron bus cables to quadrant. Install bolts attaching aileron bus cable keepers to quadrant.

I. Connect aileron lockout torque tube.

J. Tension outboard aileron bus cables by tightening turnbuckle.

K. Pressurize utility hydraulic system.

L. Install clamp on thermal anti-icing duct in leading edge at production break.

M. Install wire bundles along front spar.

N. Connect wire bundles in outboard wing.

NOTE: Some wire bundles must be connected by splicing.

O. Install access panels.

P. Install wing tip (if removed) per 57-3-2, Wing Tip - Removal/Installation.

Q. Close leading edge flight control and fuel system circuit breakers.

R. Fuel tanks per Chapter 12, Fueling.

S. Adjust and/or test all systems disconnected:

(1) Leading edge slats per Chapter 27, Wing Flaps and Flap Control System.

(2) Utility hydraulic system for leaks at leading edge production joint.

(3) Retractable landing lights and navigation lights per Chapter 33, Retractable Landing Lights and Navigation Lights.

(4) Compass system per Chapter 34, Compass System.

(5) Fuel system per Chapter 28, Fuel.

(6) Outboard ailerons per Chapter 27, Aileron Tabs and Aleron Control System.

WING TIP - MAINTENANCE PRACTICES

EFFECTIVITY

TURBOFAN

1. Removal/Installation Wing Tip

A. Remove Wing Tip

(1) Check that the following circuit breakers are open

(a) For right wing tip maintenance: "RETRACTABLE LDG LTS. RIGHT" on P3, "LDG LIGHT MOTOR RIGHT" on P5, "NAVIGATION" on P1, "NAV" on P6, and "COMPASS NO.2" on radio and T-R circuit breaker panel.

(b) For left wing tip maintenance: "RETRACTABLE LDG. LIGHTS LEFT" on P3, "LDG LIGHT MOTOR LEFT" on P5, "NAVIGATION" on P1, "NAV" on P6, and "COMPASS NO. 1" on radio and T-R circuit breaker panel.

WARNING: THE OPENING AND LOCKING OPEN OF THE CIRCUIT BREAKERS IS IMPERATIVE SINCE THE FUEL TANKS VENT OUT THROUGH THE WING TIP AND THE PRESENCE OF COMBUSTIBLE VAPORS IS A POSSIBILITY.

FOR THE SAME REASON REWORKS INVOLVING DRILLING, FILING, ETC. WITH THE WING TIP STILL ON THE AIRPLANE ARE NOT PERMITTED UNLESS THE FUEL HAS BEEN DRAINED AND THE FUEL SYSTEM PURGED.

(2) Remove access panels 1260 and 1276 and fuel vent scoop panel 1265. See Access Doors and Panels, Chapter 12.

(3) Remove the leading edge tip rib access panel (12, figure 201) and aft tip rib access panel (7).

(4) Remove remote compass transmitter (5). Refer to Compass System, Chapter 34.

(5) Remove landing light (4). Refer to Exterior Lighting, Chapter 33.

(6) Remove screws securing navigation light lens retainer (2).

(7) Remove lamps.

(8) Remove lamp mounting bracket retaining screws and ease bracket (1) away from wing tip so that power lead terminal on inboard face becomes accessible.

(9) Disconnect navigation light power (14) and ground (15) leads and clear them from light mounting area.

(10) Remove screws holding electrical seal fittings (13) in place.

(11) Free all wires in wing tip from wire clamps and pull wires free of wing tip. Coil wire bundle just inboard of tip rib (10).

(12) Remove two bolts securing inboard end of vent scoop stiffener assembly (8) to tip rib.

(13) Remove ten bolts attaching vent duct (9) to tip rib.

(14) Remove screws attaching wing tip to upper and lower wing tip rib chords.

NOTE: Provide adequate support for wing tip.

(15) Remove five bolts attaching auxiliary spar (6) in wing tip to tip rib. Reach through aft tip rib access opening (7) to hold nuts.

(16) Remove nine bolts attaching the wing tip to the tip rib in the leading edge area. Reach through the leading edge tip rib access opening (12) to hold nuts.

(17) Remove wing tip by pulling outboard, away from wing structure

NOTE: Observe position of shim, if used, between skin of wing tip and wing tip rib chord at trailing edge.

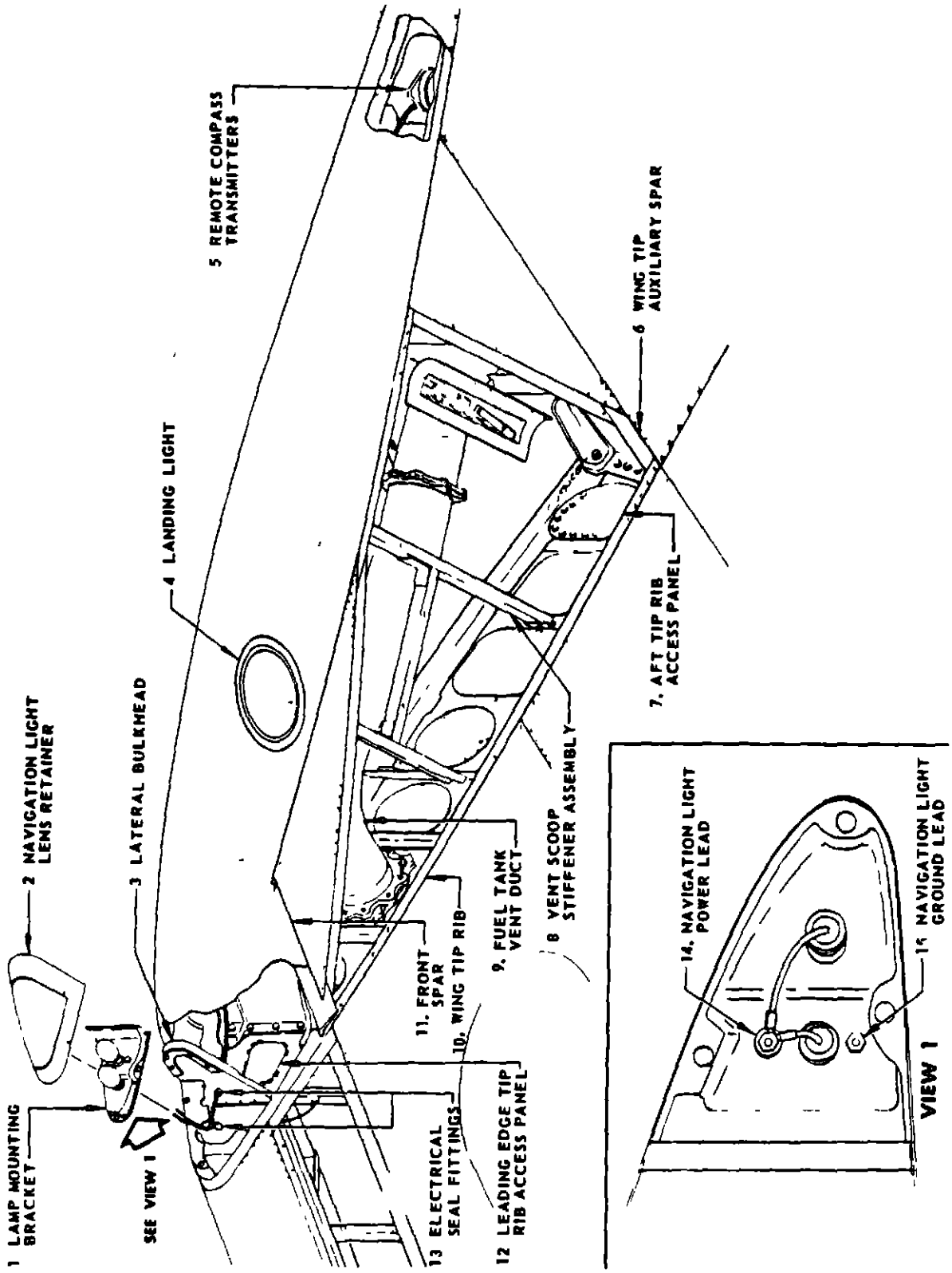
B. Install Wing Tip

(1) Check that the following circuit breakers are open.

(a) For right wing tip maintenance: "RETRACTABLE LDG LTS. RIGHT" on P3, "LDG LIGHT MOTOR RIGHT" on P5, "NAVIGATION" on P1, "NAV" on P6, and "COMPASS NO. 2" on radio and T-R circuit breaker panel.

(b) For left wing tip maintenance: "RETRACTABLE LDG LIGHTS LEFT" on P3, "LDG LIGHT MOTOR LEFT" on P5, "NAVIGATION" on P1, "NAV" on P6, and "COMPASS NO. 1" on radio and T-R circuit breaker panel.

WARNING: THE OPENING AND LOCKING OPEN OF THE CIRCUIT BREAKERS IS IMPERATIVE SINCE THE FUEL TANKS VENT OUT THROUGH THE WING TIP AND THE PRESENCE OF COMBUSTIBLE VAPORS IS A POSSIBILITY.


1 LAMP MOUNTING BRACKET
2 NAVIGATION LIGHT LENS RETAINER
3 LATERAL BULKHEAD
4 LANDING LIGHT
5 REMOTE COMPASS TRANSMITTERS
6 WING TIP AUXILIARY SPAR
7. AFT TIP RIB ACCESS PANEL
8 VENT SCOOP STIFFENER ASSEMBLY
9. FUEL TANK VENT DUCT
10. WING TIP RIB
11. FRONT SPAR
12 LEADING EDGE TIP RIB ACCESS PANEL
13 ELECTRICAL SEAL FITTINGS
SEE VIEW 1
14. NAVIGATION LIGHT POWER LEAD
15 NAVIGATION LIGHT GROUND LEAD
VIEW 1

(2) Remove access panel 1276 and fuel vent scoop panel 1265. See Access Doors and Panels, Chapter 12.

(3) Check the O-ring at the tip rib end of vent duct (9, figure 201) and replace it if necessary. To facilitate later assembly this O-ring should be cemented in place in groove using B. F. Goodrich No. 4 rubber cement or equivalent.

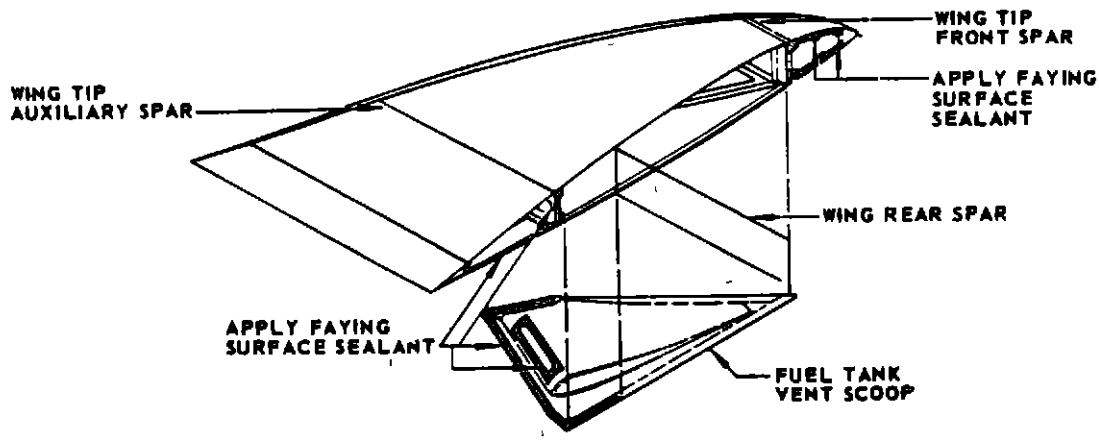
(4) Apply faying surface sealant to, inner surface of lower wing tip skin which fays with bottom chord of tip rib aft of wing rear spar, vertical face of auxiliary spar fitting in wing tip which fays with tip rib, and vertical faces of angles at upper and lower wing tip skins which fay with tip rib chords in leading edge area. (See figure 202.) Apply parting agent to tip rib surface in each case. Refer to Airplane Sealing, Chapter 51.

NOTE. Wing tip attachment bolts must be installed during work life of sealant.

(5) Support wing tip adequately at a distance about a hands width away from the tip rib (10, figure 201). Thread the wire bundle, at leading edge, through the tip rib and, by inserting hand in the gap mentioned, guide the compass transmitter leads and the landing light leads through the hole in the lateral bulkhead (3), and the navigation light leads through the hole in the rib just inboard of the light.

(6) Install nine bolts attaching wing tip leading edge to tip rib (figure 203). Reach through leading edge tip rib access opening (12, figure 201) to hold nuts. Torque top and bottom bolts, of five at front spar, to 220 to 360 pound-inches

CAUTION FOR THIS AND SUBSEQUENT STEPS IN WING TIP INSTALLATION NOTE POSITION OF ANY NON-MAGNETIC BOLTS BAC-B30BF, BAC-B30BG, AND NAS501 AND REPLACE ANY THAT ARE DAMAGED ONLY WITH BOLTS OF THE SAME TYPE. THIS IS IMPORTANT BECAUSE OF THE PROXIMITY OF THE REMOTE COMPASS TRANSMITTER.



Wing Tip Areas Requiring Faying Surface Sealant
Figure 202

(7) Install five bolts attaching auxiliary spar (6) in wing tip to tip rib. Reach through aft tip rib access opening (7) to hold nuts. Torque top bolt to 630 to 950 pound-inches, and bottom bolt to 1400 to 1700 pound-inches.

(8) Install screws at upper and lower surfaces of wing attaching wing tip skin panels to tip rib chords.

(9) Install the ten bolts attaching the vent duct (9) to the tip rib, at the same time making sure that the O-ring is satisfactorily seated. Torque bolts to 50 to 70 pound-inches using a staggered sequence.

(10) Install two bolts securing inboard end of vent scoop stiffener assembly (8) to tip rib.

(11) Remove wing tip access panel 1420 from upper surface of wing tip.

(12) Thread wire bundle out to landing light (4) and remote compass transmitter (5), installing clamps as necessary.

(13) Install electrical seal fittings (13) in two places and apply sealant. Refer to Airplane Sealing, Chapter 51.

(14) Connect navigation light power (14) and ground (15) leads to terminals on lamp mounting bracket (1) and install mounting bracket, lamps, and lens retainer (2).

(15) Install remote compass transmitter (5). Refer to Compass System, Chapter 34.

(16) Install landing light (4). Refer to Exterior Lighting, Chapter 33.

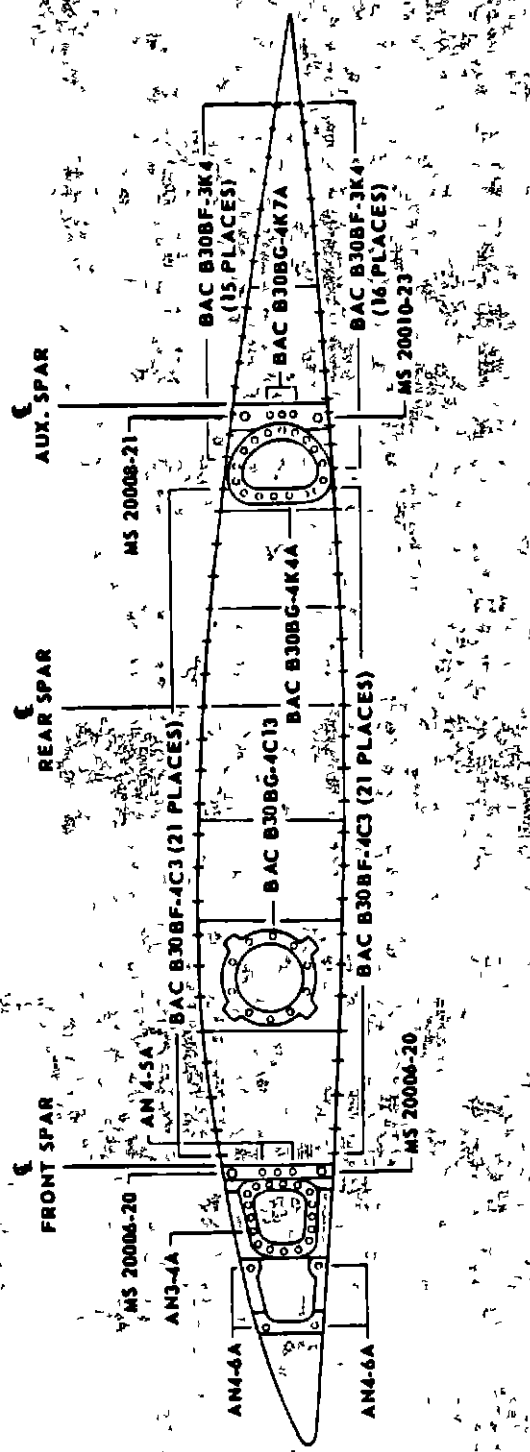
(17) Install wing tip access panel 1420 and aft tip rib access panel (7).

(18) Apply faying surface sealant to leading edge tip rib access panel (12) and those parts of the fuel vent scoop panel 1265 which are shown shaded in figure 202. Apply parting agent to fixed structure side of joint Refer to Airplane Sealing, Chapter 51.

NOTE. Attachment screws must be installed during work life of sealant.

(19) Install leading edge tip rib access panel, access panels 1260 and 1276, and fuel vent scoop panel 1265.

CAUTION USE ONLY NON-MAGNETIC BOLTS TO SECURE FUEL TANK VENT SCOOP THIS IS IMPORTANT BECAUSE OF PROXIMITY OF REMOTE COMPASS TRANSMITTER.



Wing Tip Attachment Bolts
Figure 203

WING VORTEX GENERATORS - REMOVAL/INSTALLATION

1 Equipment and Materials

A Adhesive - BMS 5-19, Type B-1

B Solvent BMS 11-7 or Methyl Ethyl Ketone

C Paint Stripper - Del Chem EZ

D Hardwood scraper

E Protractor

F Clean cheesecloth

2 Remove Vortex Generator

A Remove old vortex generator by prying faying surfaces apart.

CAUTION: TAKE CARE TO AVOID DAMAGE TO SKIN SURFACE

B Soften old adhesive with solvent and gently scrape from skin, using hardwood scraper to avoid damaging skin surface

C Thoroughly clean skin surface with solvent

CAUTION: CLEAN ONLY WITH OIL FREE MATERIAL SUCH AS NEW CHEESECLOTH.

3. Prepare for Installation

A Remove residual bonding agent with scraper and solvent.

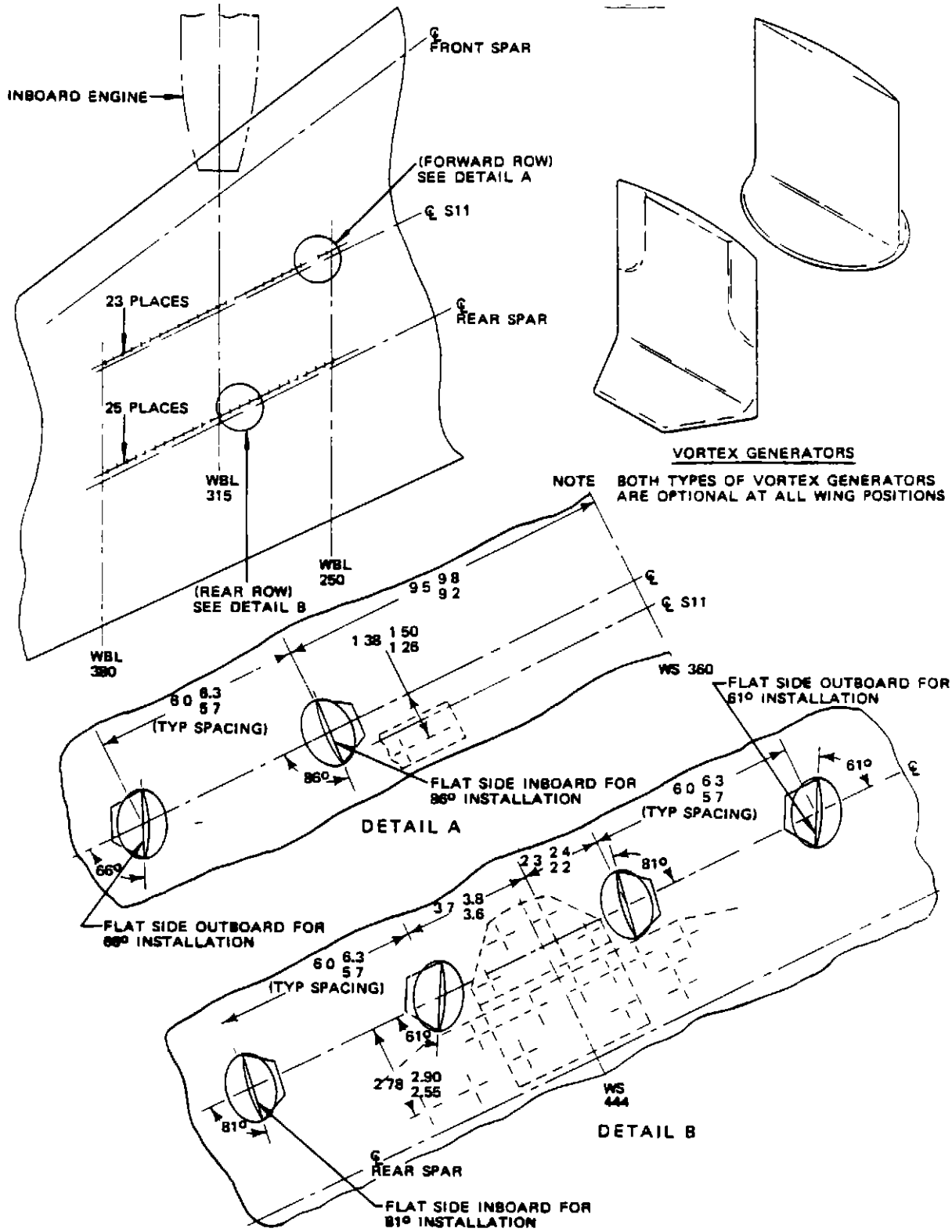
B Remove minimum amount of paint necessary to install vortex generator.

4 Install Vortex Generator

A Orient vortex generator per figure 401.

B Bond vortex generator to wing surface 100 percent coverage Form 0.06 inch by 0 06 inch fillet around edge of generator with excess adhesive

(1) Thoroughly blend the base compound with its activator in accordance with the manufacturer's instructions The adhesive shall not be thinned



Wing Vortex Generator Location
Figure 401

(2) Apply a thin, uniform coat of the blended adhesive to each faying surface.

(3) Assemble immediately, applying sufficient pressure to ensure complete contact of the faying surfaces. A continuous bead of extruded adhesive usually indicates proper contact.

5 Restore Airplane to Normal

A Cure at 75 to 80°F

(1) The time to obtain handling strength is 16 hours. Full cure is not obtained for a week or more.

(2) Curing may be accelerated by applying heat not to exceed a bond line temperature of 120°F As a rough rule of thumb the cure time will be reduced 50 percent for each 20°F rise in temperature Conversely, temperatures below 75°F will greatly increase the required cure time

B Apply paint to wing surface as required See Chapter 51, Structures.

LIGHTNING STRIKE ARMOR SKIN PANELS - REMOVAL/INSTALLATION

1. General

A. Added protection against lightning strikes on wing skin in fuel vent surge tank areas is provided by laminated aluminum and fiberglass scrim cloth panels bonded to the upper and lower wing surfaces between the front and rear spars and between WS 939.312 and WS 959.312. The panels are grounded to the rear spar by five conductive rivets.

2. Equipment and Materials

A. Alodine 1000 (clear)

B. BMS 10-11, Type 1, Primer

C. Clean white cotton gloves

D. Solvent

(1) BMS 3-2, Type 1 or 2

(2) Methyl ethyl ketone

E. Tape, RP52, Shuford Mills Incorporated, Hickory, North Carolina (Crown Zellerbach Corporation, Seattle, Washington) or P112 Aluminum Foil Tape, Permacel Tape Corporation, New Brunswick, New Jersey

F. Solvent brush-on paint stripper

G. Adhesive

(1) BMS 5-19, B-1/2, B-1, B-2 or B-4

(2) BMS 5-26, B-1/2 or B-2

H. Scrim Cloth, Thalco 196, Thalco Glass Fiber Products, Los Angeles, California

I. Polyethylene Film, 0.002 to 0.006 inch thick, Crown Zellerbach Corporation, Seattle, Washington

J. Plastic bags

K. Serrated plastic spreader

L. Vacuum bag

M. Rivets, BACR15DA4-2 and BACR15DA4-3

N. Paint, Corogard EC-843

O. Hardwood wedge

P. Clean gauze

3. Remove Lightning Strike Armor Skin Panel

A. Remove five conductive rivets by drilling.

B. Remove aluminum panel and scrim cloth panel by peeling panels off wing skin. Use hardwood wedge to start peeling process.

4. Prepare for Installation

A. Preparation of Surfaces

(1) Prepare aluminum sheet.

(a) Apply alodine 1000 (clear) to both sides of the aluminum sheet per 51-2-31, Alodizing, if this has not already been accomplished.

(b) Prime one side of the sheet with one coat of BMS 10-11, Type 1, primer per 51-2-51, Chemical and Solvent Resistant Finish.

(c) Allow primer to dry a minimum of 4 hours at 75°F before applying adhesive. This drying period may be reduced by use of heat. After a 15-minute flash-off time at 75°F, the following minimum drying periods are permissible.

1) 60 minutes at 120 (± 5)°F

2) 15 minutes at 150 (± 10)°F

3) 5 minutes at 200 (± 10)°F

(d) Keep primed surface from becoming contaminated during drying, handling and storage prior to application of adhesive. Handle unprotected panels with clean white cotton gloves.

(2) Preparation of wing skin.

(a) Clean the wing skin with BMS 3-2 to promote adhesion of masking tape.

(b) Mask off surface around the area to be covered by the aluminum sheet, allowing 1/4 inch to 3/8 inch excess over the net size of the sheet on all sides.

(c) Strip painted surfaces per 51-2-21, Paint Stripping, using a cold solvent brush-on stripper.

(d) Solvent clean unpainted surfaces and stripped surfaces using BMS 3-2.

(e) Apply one coat of BMS 10-11, Type 1, primer to the cleaned surface per 51-2-51, Chemical and Solvent Resistant Finish. Do not apply primer when temperature is below 50°F or relative humidity is over 85 percent.

(f) Allow primer to dry a minimum of 7 hours at 50°F, 4 hours at 75°F or 60 minutes at 120°F. Minimum drying times at intermediate temperatures may be determined by straight line interpolation.

(g) Protect primer from contamination from the time of coating until application of adhesive. Primer must be exposed to circulating air during drying period.

(3) Preparation of adhesive.

(a) Premixed frozen BMS 5-19 in Semco cartridges may be used. Warm adhesive to room temperature by immersing the cartridge in warm water for a few minutes before spreading.

(b) BMS 5-19 may also be mixed as needed. Note that the batch of base resin must be matched with the accelerator batch. Mix the adhesive in the ratio of 10 parts of accelerator to 100 parts of base resin by weight. Blend the adhesive thoroughly until the color is uniform. Approximately 5 minutes mixing by hand should be sufficient.

(c) BMS 5-19, Type B-1/2, B-1, B-2, or B-4 may be used. Types B-1/2 and B-1 are preferable because of their shorter cure times.

(4) Application of glass scrim cloth to primed aluminum sheet.

(a) Take care to keep the primer surface from becoming soiled. However, as an added precaution, solvent clean with BMS 3-2 just prior to application of the BMS 5-19.

(b) Apply an even coating of BMS 5-19 to the primed surface of the aluminum sheet. Use a notched plastic spreader for leveling the adhesive.

(c) Cut a sheet of scrim cloth about 2 inches larger on all sides than the aluminum sheet.

(d) Lay the scrim cloth in the wet adhesive, taking care to avoid forming folds or wrinkles in the cloth. Spread a parting film of polyethylene over the scrim cloth. Lightly roll or sweep over the film to thoroughly embed the cloth in the adhesive and to eliminate air inclusions. Apply pressure by any suitable means to obtain adhesive thickness of 0.014 (+0.011/-0.000) inch. Scrim cloth shall be tightly bonded to the adhesive, either embedded in the surface or entirely covered. On completed panel assemblies the cloth may be loose from the adhesive in no more than 5 percent of the area. A maximum of 5% of the panel area may have the primer surface visible through the adhesive.

(e) Minimum cure times for BMS 5-19 at 75°F are as follows:

B-1/2	16 hours
B-1	36 hours
B-2	48 hours
B-4	60 hours

Cure may be accelerated by raising the temperature. Each 20°F rise in cure temperature will cut the cure time approximately 50 percent. Conversely, lowering the temperature will increase the cure time. Do not cure below 50°F nor above 120°F.

(f) To avoid the necessity of recleaning the cured adhesive surface before installation, the following precautions should be observed:

1) Leave polyethylene parting film in place during cutting, handling, and storage.

2) If parting film comes loose, apply tape to hold it in place. Do not apply tape on adhesive coated surface.

3) Store parts in plastic bags.

4) Do not remove protective covering until immediately prior to application of the sheet to wing skin.

NOTE: If the adhesive surface is inadvertently soiled, it may be sponged with clean gauze dampened with methyl ethyl ketone. Allow all solvent to evaporate before proceeding.

5. Install Lightning Strike Armor Skin Panel

A. Clean primed area of skin with BMS 3-2.

B. Reapply masking tape around primed area on wing if necessary. The uncoated side of the aluminum sheet should be masked around the edges also. Masking will assist in adhesive cleanup after bonding.

C. Spread a thin even layer of BMS 5-19 over wing skin surface with a serrated plastic spreader. After spreading the adhesive, smooth down the ridges with the smooth edge of the spreader.

D. Remove parting film from bonding surface of the aluminum sheet.

E. Spread a thin layer of BMS 5-19 over the cured adhesive on the aluminum sheet. Be sure to fill any areas where the scrim cloth is not completely embedded in adhesive. Use additional adhesive to fill and level any concavity along the edge of the sheet.

F. Starting at one edge, roll the aluminum sheet down over the adhesive coated area on the wing. Avoid inclusion of air bubbles insofar as possible.

G. Apply pressure by means of a vacuum bag over the aluminum sheet. Maintain a vacuum of 10 to 25 inches of mercury throughout the cure. See paragraph 4.A.(4)(e) for cure time and for the effect of temperature on cure.

H. After adhesive cure is complete, remove the vacuum bag and the masking tape. It is not necessary to remove excess adhesive squeeze-out since this can be incorporated into the edge seal fillet.

I. After bonding, the surface of the aluminum sheet shall be smooth and free from dents. Edges shall be smooth and completely bonded with no delamination visible.

J. There shall be no detectable void larger than 1 square inch in area. Total void area under any sheet shall not exceed 15 square inches. No void shall be closer than 2 inches from the edge. Any two voids shall be at least 5 inches apart.

K. At the aft inboard corner of the armor panel, install five conductive rivets. Use BACR15DA-3 rivets on lower panel and use BACR15DA4-2 rivets on upper panel.

6. Restore Airplane to Normal

A. Application of edge seal and protective finish.

(1) Solvent clean a strip about 2 inches wide around the edge of the sheet and on the adjacent skin. Use BMS 3-2.

(2) Apply a bead of BMS 5-19 or BMS 5-26 around the periphery of the sheet. Smooth the bead with any suitable means so that it forms a fillet that fairs from the skin to the top surface of the sheet. The excess squeeze-out from bonding may be incorporated into this fillet. Width of fillet is not critical - 1/4 inch to 3/8 inch on the skin and approximately 1/8 inch on the sheet should be sufficient. Cover all green primer with sealant.

(3) After the edge seal has cured to a tack-free state, touch it up with a brush coat of EC-843 Corogard.

LIGHTNING STRIKE ARMOR SKIN PANELS - APPROVED REPAIRS

1. General

A. Loose or delaminated armor skin or scrim cloth should be trimmed to stop progressive delamination, reduce drag, and improve appearance until repair or replacement is made.

B No limits exist regarding repairs before a panel must be replaced. Repairs may be made until it becomes more practical to replace a panel

2. Equipment and Materials

A. Cheesecloth

B. Hardwood or plastic scraper

C Solvent - methyl ethyl ketone

D. Armor skin material (0.010 aluminum covered with BMS 5-19 adhesive and Thalco 196 scrim cloth)

E. Adhesive - BMS 5-19

F. Conductive tape - X-1170

G. Pressure sensitive tape - Scotch-Cal 630, 2 inches wide, chrome color

H Primer - BMS 10-11, Type 1

I. Rubber or plastic roller

J Vacuum bag

K Rivets - BACR15DA4-2 and BACR15DA4-3

L Scrim cloth - Thalco 196

M Aluminum sheet - Clad 2024-T3, QQ-A-362 T3 Temper, 0.010 or Clad 7075-T6, QQ-A-287 T6 Temper, 0.010

N. Paint - Corogard EC-843 or EC-843S

3. Repair Lightning Strike Armor Skin Panel

NOTE. The following procedures are provided for repair of delaminated armor skin. Either of the procedures may be used at the operator's option, and each provides the maximum protection for which the armor skin was designed.

A. Method A

NOTE: This repair is designed to prevent further separation of the shield for a limited time, and can be accomplished quickly. When sufficient time is available, the method C repair should be accomplished.

In this repair method, it is permissible to trim delaminated areas off the armor skin, provided that the trim does not extend any farther than one-half inch in from the edge of the armor skin. If the trim extends farther than one-half inch in from the edge of the armor skin use repair method B or method C.

(1) Trim the separated portion of the shield back to where the bond is still solid.

(2) Scrape off the exposed adhesive for one to two inches beyond the trimmed edge, using a hardwood or plastic scraper.

(3) Clean the scraped area of airplane skin and the adjacent armor skin using clean cheesecloth soaked with methyl ethyl ketone, and wipe dry. (Clean minimum of 2.0 inches of airplane skin and 2.0 inches of armor skin.)

(4) Seal all the edges of the armor skin by installing pressure sensitive tape over the trimmed edge with one inch of tape adhering to the airplane skin.

(5) Accomplish method C repair when sufficient airplane layup time is available.

B. Method B

NOTE: This repair method may be used when delamination extends more than one-half inch from the original outline of the armor skin, and can be accomplished quicker than the method C repair. When sufficient airplane layup time is available, the method C repair should be accomplished.

(1) Trim off the separated portion of the armor skin back to where the bond is still solid.

(2) Scrape off most of the remaining exposed adhesive from the wing skin, using a hardwood or plastic scraper.

NOTE: It is not necessary to remove all of the old adhesive unless it is contaminated with Skydrol or fuel, or has lost adhesion.

(3) Clean the entire scraped area and surrounding wing skin and armor skin using clean cheesecloth soaked with methyl ethyl ketone, and wipe dry.

(4) Cut a patch of armor skin material which fits the missing area with not more than 0.10 max gap between patch and existing armor skin, and extends to the original armor skin outline.

(5) Spread BMS 5-19 adhesive on the patch and the mating airplane skin area.

(6) Roll patch into place (0.10 max gap between patch and existing armor skin) and clean off all excess adhesive squeezeout. Fair adhesive between patch and existing armor skin.

(7) Apply conductive tape along the entire joint to ground the patch to the remaining armor skin.

(8) Cover the entire patch area with pressure sensitive tape as follows:

(a) Extend tape one inch onto the surrounding wing skin and one inch on the existing armor skin.

(b) The exposed edge of each tape lap should be toward the trailing edge

(c) Round the tape outer corners to a 1/4 to 1/2 inch radius

(d) Press (rub) the tape down thoroughly with a smooth rounded plastic scraper.

(9) Seal all exposed edges of the remaining armor skin and cover tape installed per step (8)(a) above by installing pressure sensitive tape to cover the edge, with approximately one inch of tape adhering to the airplane skin

(10) Accomplish method C repair when sufficient airplane layup time is available.

C. Method C

NOTE This procedure constitutes a permanent repair If the delamination area extends more than one-half inch from the original outline of the armor skin, a permanent patch should be installed.

(1) Trim off the separated portion of the shield back to where the bond is still solid.

(2) Construct a pattern of the removed armor skin area and cut a matching patch out of precoated armor skin material (0 010 aluminum covered with BMS 5-19 and scrim cloth). If armor skin material is not available, substitute 0.010 or 0.012 thick clad aluminum sheet (Maximum gap between patch and armor skin may not exceed 0.10 inch.)

(3) Exposed area may be contaminated with soot, Skydrol, etc. Therefore, the bulk of remaining adhesive should be scraped off with a hardwood or plastic scraper. Clean up the last traces of adhesive by rubbing with clean gauze soaked in methyl ethyl ketone Wipe the surface dry.

(4) Restore or apply primer BMS 10-11 Type 1 on all wing surfaces to be covered with BMS 5-19 adhesive. Provide primer for edge sealing per step (11) below. Mix BMS 10-11 Type 1 primer per figure 801

(5) Spread a generous continuous layer of BMS 5-19 adhesive on both wing skin and patch. If clad aluminum alone is being used as a patch, a layer of Thalco 196 glass scrim cloth (or equivalent) must be laid in the wet sealant on the patch and trimmed to size.

(6) Without letting coated surfaces touch, place coated patch in position with edge of patch next to trimmed edge of existing armor skin (gap not to exceed 0.10). Tape edge of patch to existing armor skin to hold it in position while rolling down. Starting at joint edge of patch, progressively roll it down, going slowly and carefully to eliminate as much air as possible. Use of a rubber or plastic roller is recommended. When patch is completely down, apply tape in several spots to keep the edges from lifting.

(7) Construct a vacuum bag over the patch with Osnaberg or similar cloth as a bleeder. Cure under 5 to 15 inches of mercury vacuum. The adhesive will be cured sufficiently in 16 hours at 70°F. Heat will accelerate cure. Warm air or heat lamps may be used to warm the adhesive to 130 degrees maximum. At this temperature the adhesive will build up enough strength in about 30 minutes to allow removal of the vacuum bag.

(8) Trim adhesive squeezed along outer edge of patch to provide a fillet about 1/4" wide which fairs into top surface of shield.

(9) Remove tape and clean off adhesive squeezeout along joint between patch and original armor skin. Scrape off bulk of material and clean up last traces with MEK. Apply conductive tape over entire joint to ground patch to armor skin.

(10) Replace the rivets installed for electrical grounding purposes if missing or loose. Use BACR15DA4-3 rivets on lower panel and use BACR15DA4-2 rivets on upper panel.

(11) Seal all the outer edges of the patch and the remaining armor skin as described in 57-5-1, Lightning Strike Armor Skin Panels - Removal/Installation.

System	Parts	Ratio Parts/Vol	Supplier
Finch System No. 1	Primer Base 463-4-4 Converter X-301 Thinner TL-52	3 1 max 1 max	Finch Paint & Chemical Co , Torrance, Cal.
Finch System No. 2	Primer Base 463-6-3 Converter X-305 Thinner TL-52	3 1 4/5 max	
DeSoto System No. 1	Primer Base 1910091 Converter 6108148A Thinner MEK	1 1 1/10 max	DeSoto Chemical Coatings, Inc., Berkely, Cal.
DeSoto System No. 2	Primer Base 1904062A Converter 6108148A Thinner MEK	1 1 1/10 max	

BMS 10-11 Type 1 Primer Mixing Chart
Figure 801

LOWER WING INBOARD DRY BAY ACCESS PANEL - REMOVAL/INSTALLATION

1. General

   A. Clamp latches on lower wing inboard dry bay access panels exist in three different configurations. Refer to figure 401 for configurations I, II and III.

      (1) Configuration I

         (a) Configuration I has phenolic rub strips, no checknuts, no latch caps and recesses, and no enamel to indicate locked position of the panel.

      (2) Configuration II

         (a) Configuration II has phenolic rub strips, one checknut, enamel to indicate locked position of the panel, but no latch caps and recesses.

      (3) Configuration III

         (a) Configuration III has two checknuts, enamel to indicate locked position of the panel, and latch caps and recesses.

2. Equipment and Materials

   A. Phenolic Rub Strip - Laminated Thermosetting Sheet Cotton Fabric, Phenolic Resin (MIL-P-15035, Type FBM or FBG), 0.050 inch thick (0.047 or 0.060 optional)

   B Adhesive - 3M EC2216

   C Hand Screwdriver - Phillips #3

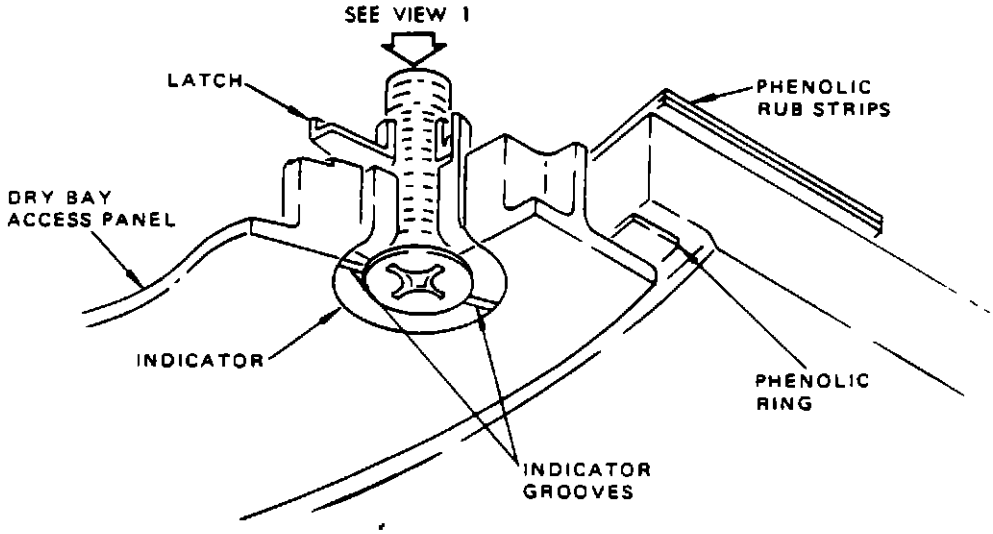
3. Remove Lower Wing Inboard Dry Bay Access Panel

   A. Unscrew fasteners with hand screwdriver until grooves on indicator are parallel with edge of skin cutout. (See figure 401.)

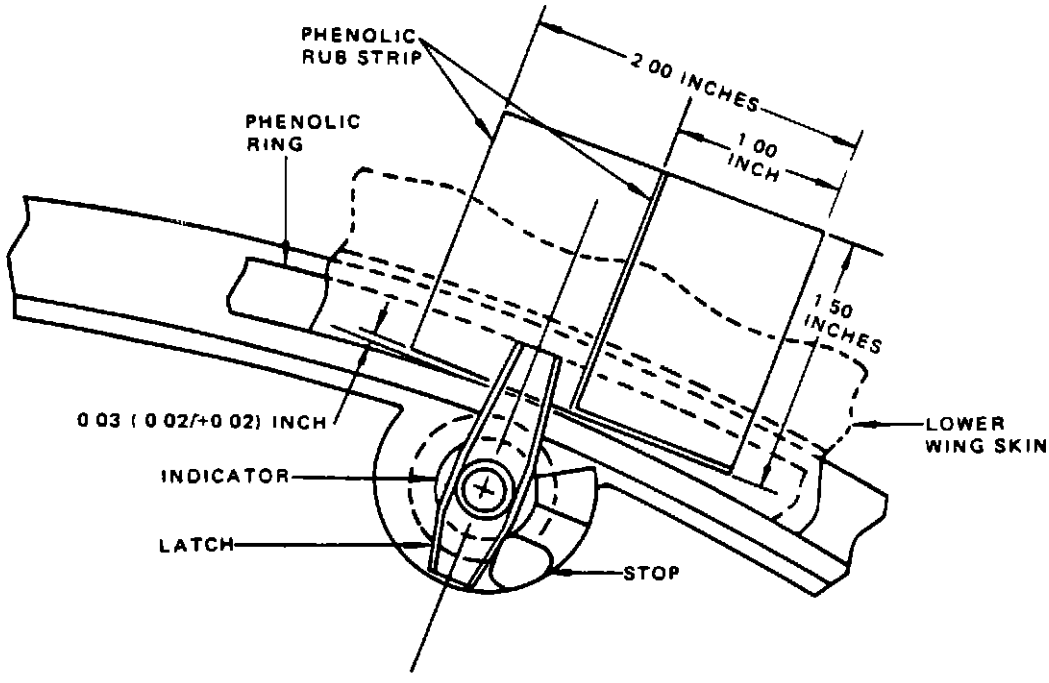
      NOTE. On later airplanes fasteners have checknut to prevent backing off fasteners.

   B. Disengage bonding jumper.

   C. Remove panel.

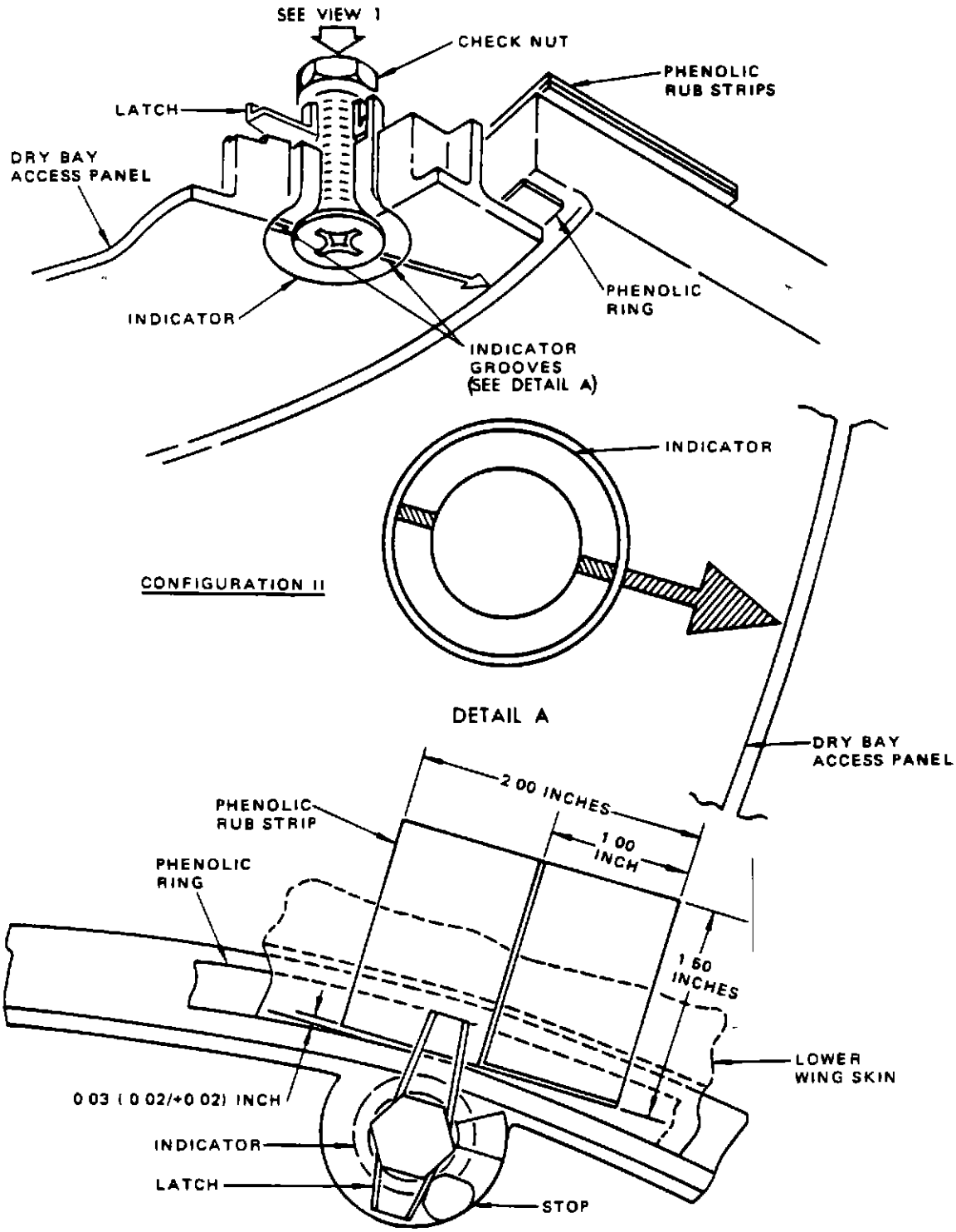


CONFIGURATION 1

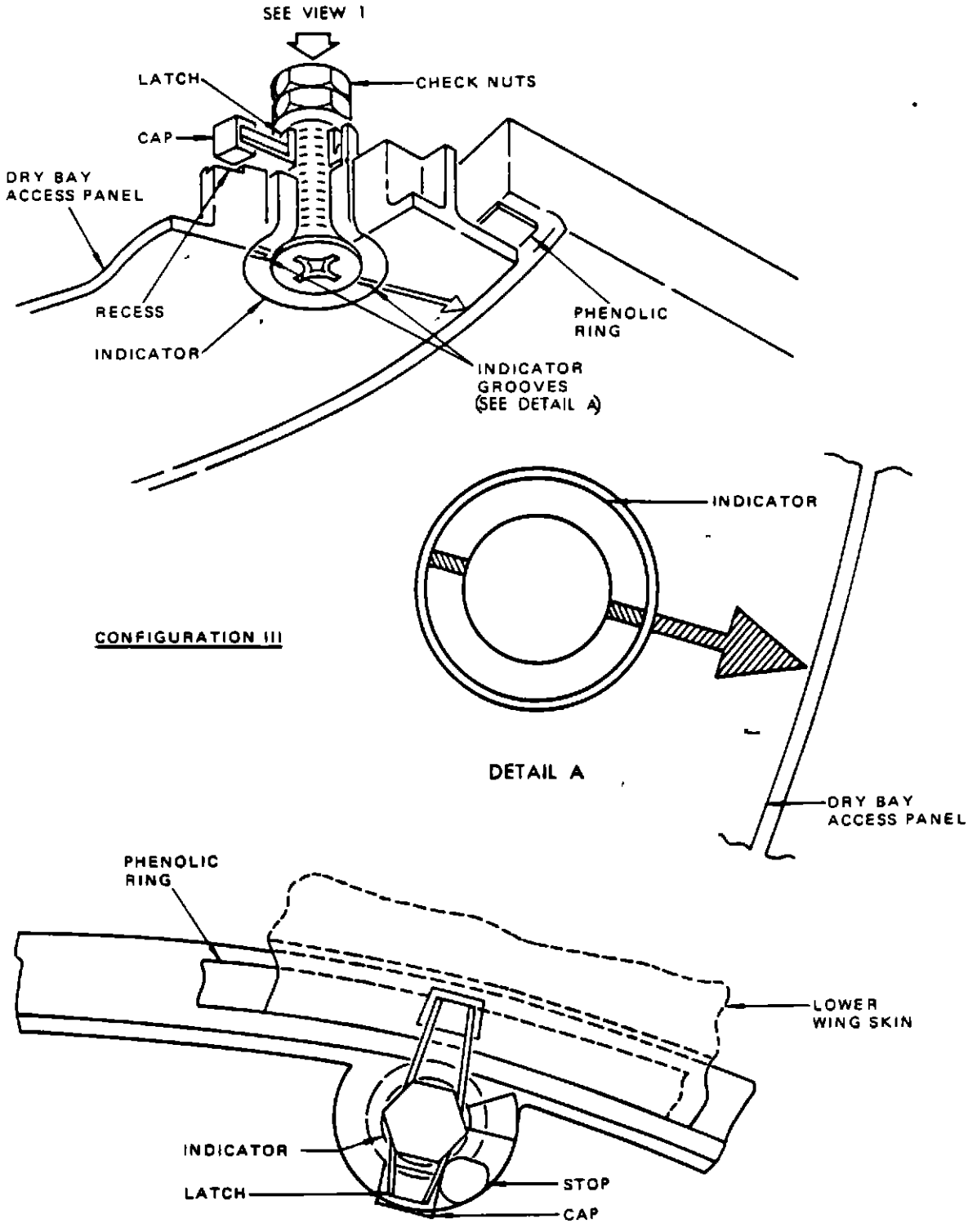


VIEW 1

Lower Wing Inboard Dry Bay Access Panel Latch
Figure 401 (Sheet 1)


SEE VIEW 1
CHECK NUT
PHENOLIC RUB STRIPS
LATCH
DRY BAY ACCESS PANEL
INDICATOR
PHENOLIC RING
INDICATOR GROOVES (SEE DETAIL A)
INDICATOR
CONFIGURATION II
DETAIL A
DRY BAY ACCESS PANEL
2 00 INCHES
1 00 INCH
PHENOLIC RUB STRIP
PHENOLIC RING
1 60 INCHES
LOWER WING SKIN
0 03 (0 02/+0 02) INCH
INDICATOR
LATCH
STOP

VIEW 1



Lower Wing Inboard Dry Bay Access Panel Latch
Figure 401 (Sheet 3)

4. Prepare to Install Lower Wing Inboard Dry Bay Access Panel (Configurations I and II only)

A. Check that phenolic rub strips are bonded to the inner wing skin surfaces. (See figure 401)

NOTE: On later airplanes the phenolic rub strips are replaced by a cap on the latch and a recess in the door to receive the cap.

B. If phenolic rub strips are missing, install new rub strips with adhesive. Clamp during curing.

NOTE Latches cannot hold securely if rub strips are missing

5. Install Lower Wing Inboard Dry Bay Access Panel

A. Install bonding jumper.

B Position long end of latch parallel to panel edges, place panel in position and tighten fasteners. (See figure 401.)

NOTE. Indicator will turn with latch when screw is tightened. When grooves in indicator are perpendicular to edge of skin cutout, latch is in the closed position. When the screws are tight, the panel is secure. On later airplanes red enamel in the indicator grooves and an arrow will show correct alignment of the latch.