

Aerolineas Argentinas

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CHAPTER 55 – STABILIZERS

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STABILIZERS - DESCRIPTION AND OPERATION

1. General

- A. The stabilizers comprise the empennage of the airplane and consist of a vertical stabilizer (fin), and a horizontal stabilizer. (See figure 1.) The vertical fin, a structure composed of front and rear spars with interconnecting ribs and skin, is attached to the fuselage. The left and right horizontal stabilizer outboard sections are attached to an adjustable center section truss located within the fuselage. The movable center section pivots on two hinge joints attached to a bulkhead in the fuselage and is operated by a jackscrew mounted at the front spar. Each horizontal outboard section consists of two spars with interconnecting ribs and skin forming a torsion and bending structure. A rudder is hinged from the vertical fin and elevators are hinged from the horizontal stabilizer. A dorsal fin fairs in the fuselage and the vertical fin.

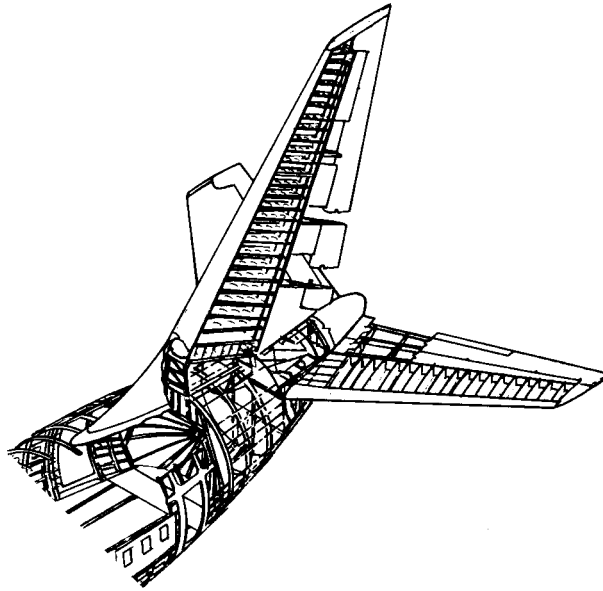
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Empennage
Figure 1

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HORIZONTAL STABILIZER – DESCRIPTION AND OPERATION

1. General

A. The horizontal stabilizer assembly consists of left and right outboard sections attached to a center section truss located within the fuselage. The stabilizer is pivoted on two hinge joints attached to a bulkhead in the fuselage. The angle of attack is adjusted by means of an electrically driven or manually operated ball nut and jackscrew attached to the forward side of the center section truss (Ref Chapter 27, Stabilizer Trim System). An aerodynamic seal fills the gap between the stabilizer left and right outboard sections and the fuselage. A sliding plate seal is located at points where the front and rear spars pass into the fuselage. A leading edge is attached to the front spar. The trailing edge and elevator hinge structure is attached at the rear spar.

2. Stabilizer Structure

- A. The front and rear spars, the ribs and the skin of the horizontal stabilizer outboard sections together with the center section truss form a beam which is the main structural member of the stabilizer. Attachment of the outboard sections and the center section is at the front and rear spars only, with no structural tie between the outboard section skin and the center section (Fig. 1, 2, and 3).
- B. The structure aft of the rear spar consists of ribs which incorporate hinge bearings for the elevator. The upper and lower surfaces of the area between the rear spar and the elevator hinge bearings are covered by skin panels attached to the ribs. Some of the skin panels are removable for maintenance purposes.
- C. The gimbals surrounding the jackscrew ball nut are supported by a rigidly built-up framework of members on the forward face of the center section truss front spar.
- D. On some airplanes, a vortex generator is attached by screws to the lower inboard forward section of the left and right horizontal stabilizer. On other airplanes, the vortex generators are installed on the aft body. Refer to Chapter 53 for information on body-mounted vortex generators.

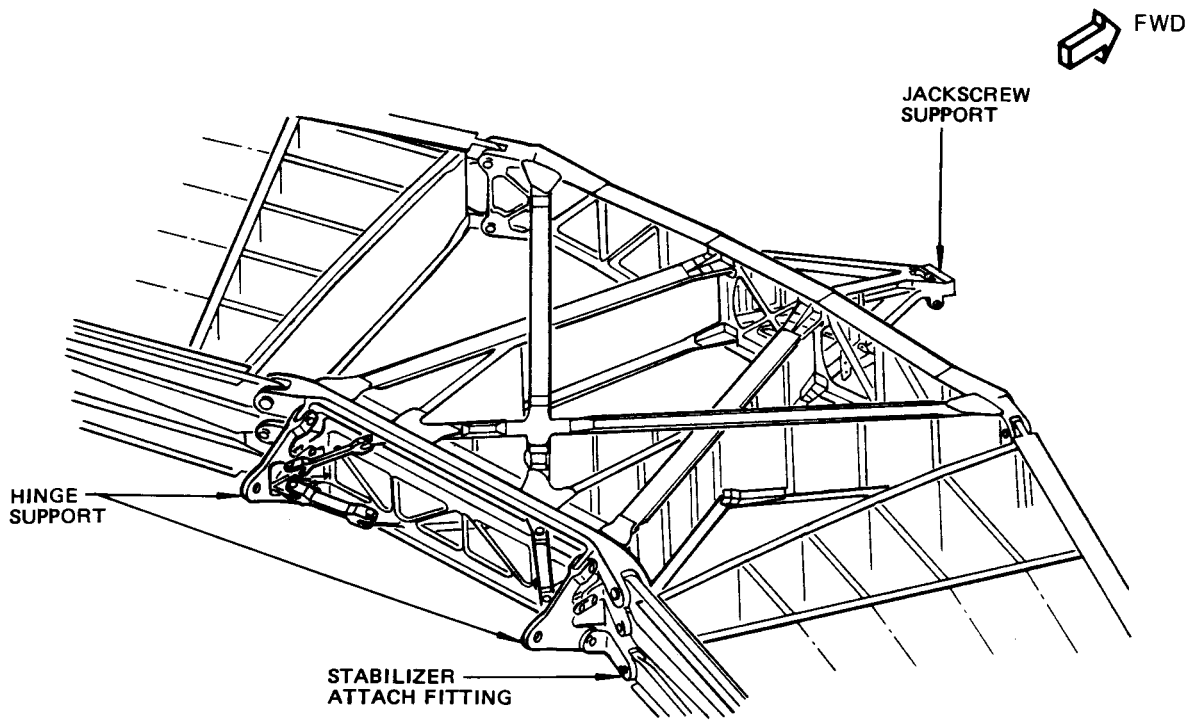
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Horizontal Stabilizer Outboard Section to Center Section Connection
 Figure 1

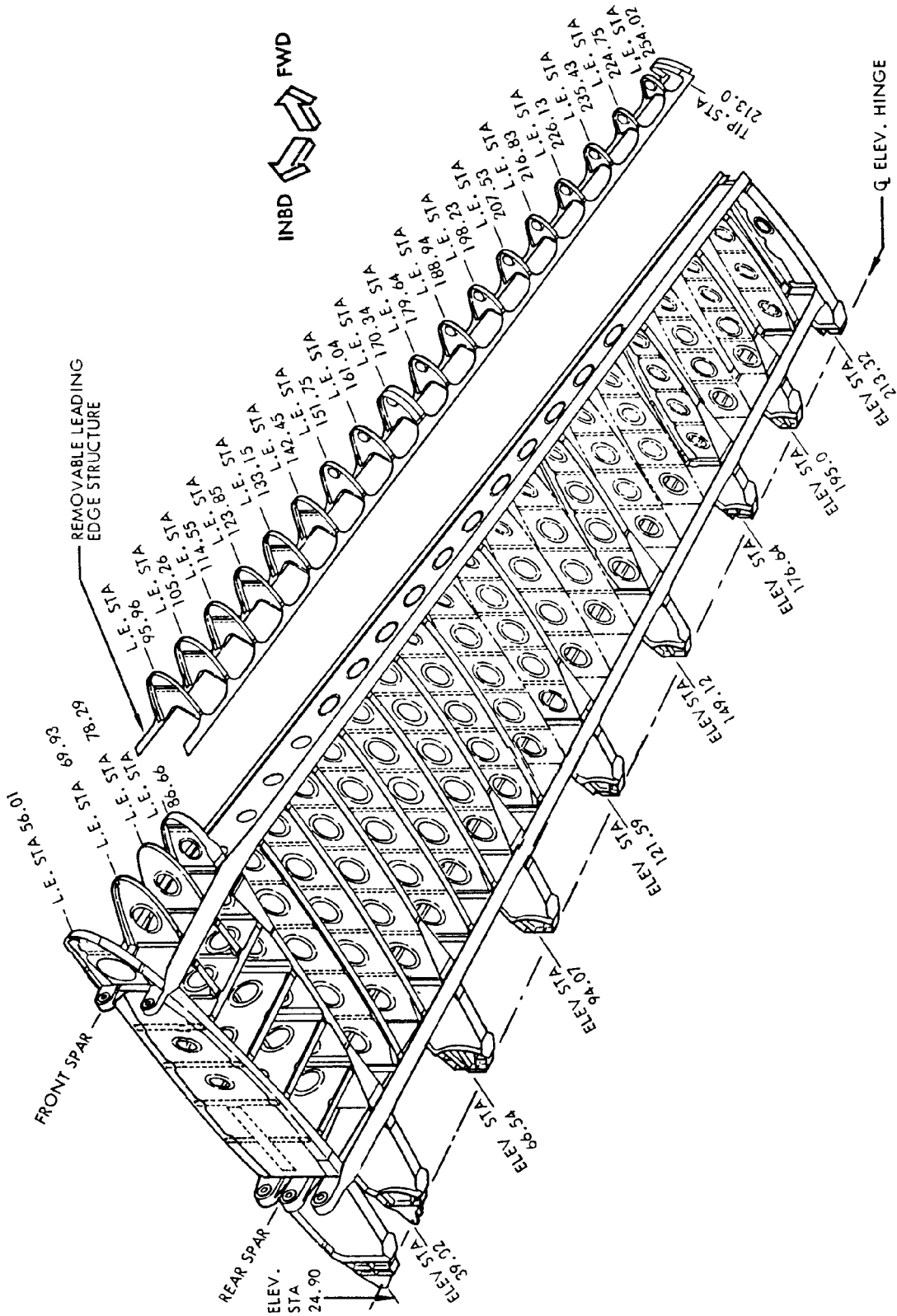
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Horizontal Stabilizer Structure
 Figure 2

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THRUST BRACE LINKS – REMOVAL/INSTALLATION

1. General
 - A. The thrust brace links are located at the rear spar of the horizontal stabilizer center section.
 - B. There are four thrust brace links, two on each side.
2. Prepare for Removal
 - A. We recommend to use suitable wood beams approximately 4-inch by 4-inch cross-section to support the center section at any approximately horizontal position (Fig. 402).
3. Equipment and Materials
 - A. Horizontal Stabilizer Trim Lock – F71336-501
4. Procedure
 - A. Position the horizontal stabilizer trim cutout switches to CUTOUT.
 - B. On Circuit Breaker Panel P6, open the following circuit breakers:
 - (1) Stabilizer Trim Actuator
 - C. Get access to the thrust brace links by opening stabilizer trim access door.
 - D. Install wood beams in center section.
 - E. Install horizontal stabilizer trim lock assembly on stabilizer trim wheel.
5. Thrust Brace Links Removal
 - A. Disconnect the upper inboard end.
 - (1) Remove the cotter pin (2) and nut (3).
 - (2) Remove washer (4), bolt (7) and bushing (6).
 - (3) Disconnect the thrust brace link (1) from the center section fitting.
 - B. Disconnect the lower inboard end.
 - (1) Remove the cotter pin (14) and nut (15).
 - (2) Remove washer (16), bolt (22) and bushing (21).
 - (3) Disconnect the thrust brace link (27) from the center section fitting.
 - C. Disconnect the upper outboard end.
 - (1) Remove the cotter pin (24) and nut (25).
 - (2) Remove washer (26) and bolt (8).
 - (3) Remove thrust brace link (1) from fitting (9).
 - D. Disconnect the lower outboard end.
 - (1) Remove the cotter pin (11) and nut (12).
 - (2) Remove washer (13) and bolt (23).
 - (3) Remove thrust brace link (27) from fitting (9).
6. Thrust Brace Links Installation
 - A. Connect the upper inboard end.
 - (1) Install the thrust brace link (1) to the center section fitting.
 - (2) Install bushing (6), bolt (7) and washer (4).
 - (3) Install nut (3) and cotter pin (2).
 - B. Connect the lower inboard end.
 - (1) Install the thrust brace link (27) to the center section fitting.
 - (2) Install bushing (21), bolt (22) and washer (16).
 - (3) Install nut (15) and cotter pin (14).
 - C. Connect the upper outboard end.
 - (1) Install the thrust brace link (1) to fitting (9).

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- (2) Install bolt (8), washer (26) and nut (25).
- (3) Install cotter pin (24).
- D. Connect the lower outboard end.
 - (1) Install the thrust brace link (27) to fitting (9).
 - (2) Install bolt (23), washer (13) and nut (12).
 - (3) Install cotter pin (11).
- 7. Return Aircraft to Normal Configuration
 - A. Remove wood beams from horizontal stabilizer center section.
 - B. Remove horizontal stabilizer trim lock assembly on stabilizer trim wheel.
 - C. On Circuit Breaker Panel P6, close the following circuit breakers:
 - (1) Stabilizer Trim Actuator
 - D. Close stabilizer trim access door.

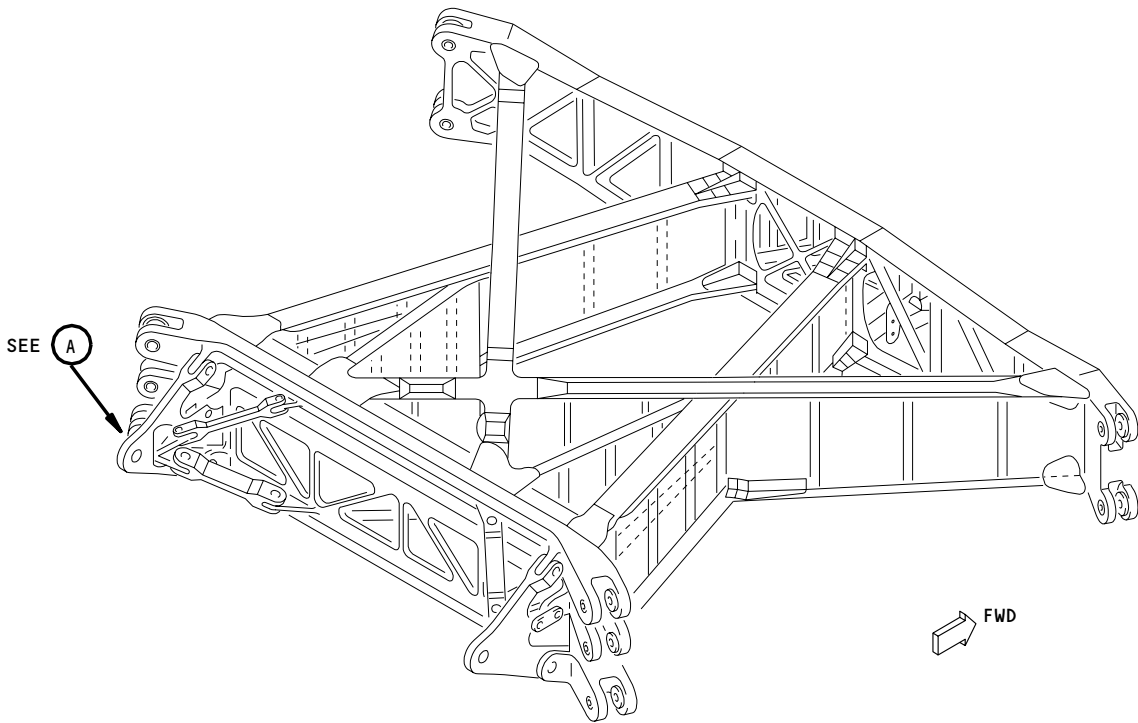
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Thrust Brace Link Assembly
 Figure 401 (Sheet 1)

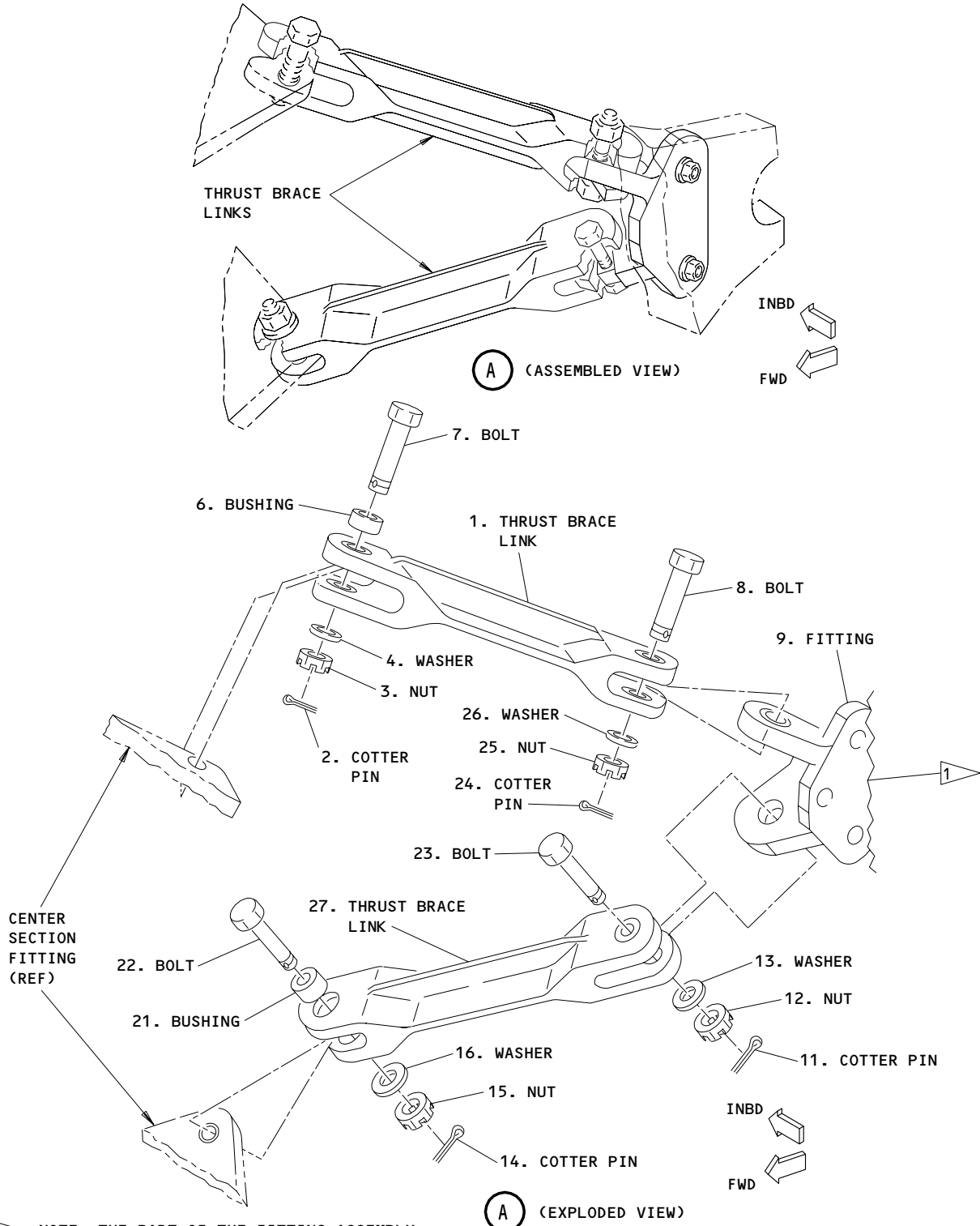
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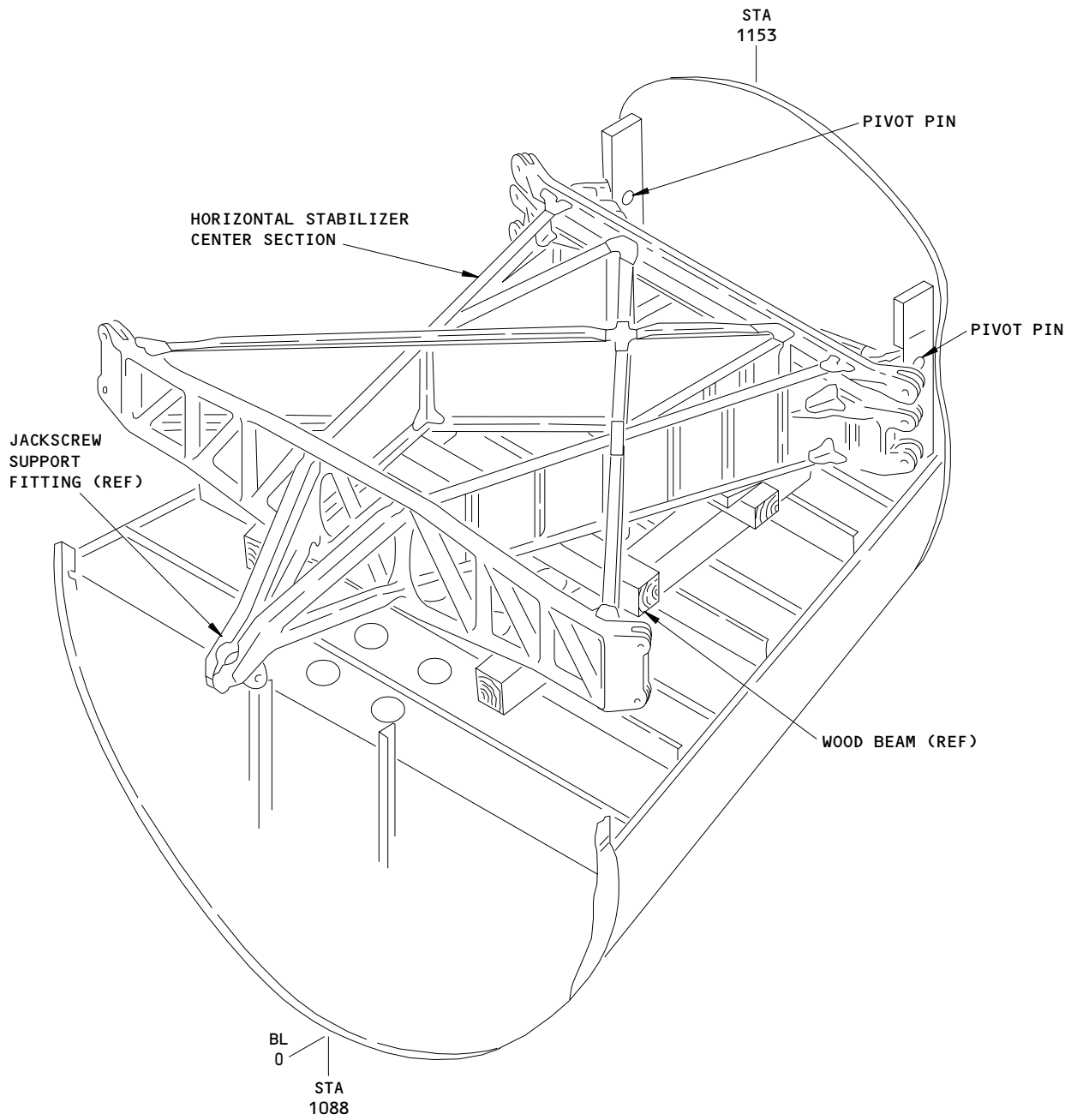
1 **NOTE:** THE PART OF THE FITTING ASSEMBLY, THRUST BRACE ATTACH IS ATTACHED TO THE HOUSING ASSEMBLY, HINGE.

Thrust Brace Link Assembly
Figure 401 (Sheet 2)

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Horizontal Stabilizer Center Section - Removal/Installation
 Figure 402

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ELEVATOR - DESCRIPTION AND OPERATION

1. General

A. The elevators are hinged on the aft edge of the stabilizer structure and include control tabs. Refer to Chapter 55 of the Structural Repair Manual for skin identification.

2. Elevators

A. The basic structure of the elevator is dual spar at the inboard end and mono spar at the outboard end, with all areas reinforced with ribs (Fig. 1). The elevators are attached to hinge ribs extending aft from the rear spar of the stabilizer by elevator hinges on the front spar of the elevator. The elevator nose and balance panels project forward of the hinge line and are housed in the spaces between the hinge ribs on the stabilizer rear spar.

3. Elevator Control Tabs

A. The elevator control tabs are single spar structures located in cutouts in the trailing edges of the elevators (Fig. 1). A honeycomb panel trailing edge is attached to the aft side of the spar and extends aft in a tapering shape.

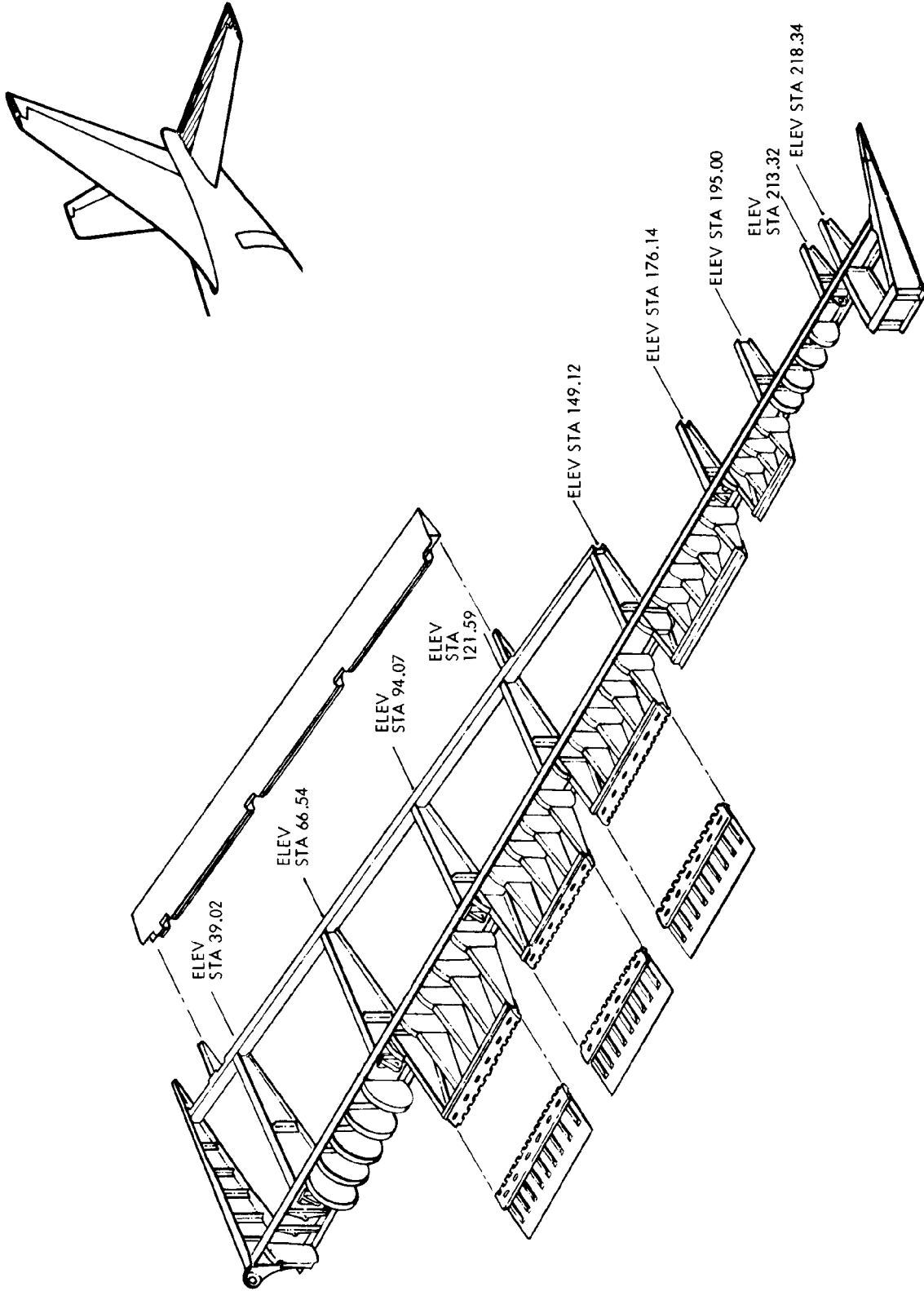
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Elevator and Tab Structure
 Figure 1

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VERTICAL STABILIZER (FIN) – DESCRIPTION AND OPERATION

1. General

A. The vertical fin is attached to body section 48. The fin may be removed from the airplane. The leading edge is detachable. The dorsal fin is not structurally connected to the main vertical fin and may be removed as a separate unit.

2. Vertical Fin Structure

- A. The front and rear spars, the ribs and the skin of the vertical fin form a beam which is the main structural member of the fin. (See figure 1.) Attachment of the fin to the fuselage is by front and rear spar fittings at body stations 1016 and 1088, with no structural tie between the fin skin and the fuselage. Refer to Chapter 55 of the Structural Repair Manual for skin identification.
- B. The structure aft of the rear spar consists of ribs which incorporate hinge bearings for the rudder. The left and right surfaces of the area between the rear spar and the rudder hinge bearings are covered by skin panels attached to the ribs to form a trailing edge fairing part of which is removable for maintenance purposes.
- C. A removable leading edge structure is attached to the forward side of the fin front spar. A fairing is attached at the top of the fin. Removable panels are provided to allow access by maintenance personnel to the interior of the fin structure and the systems contained within it.

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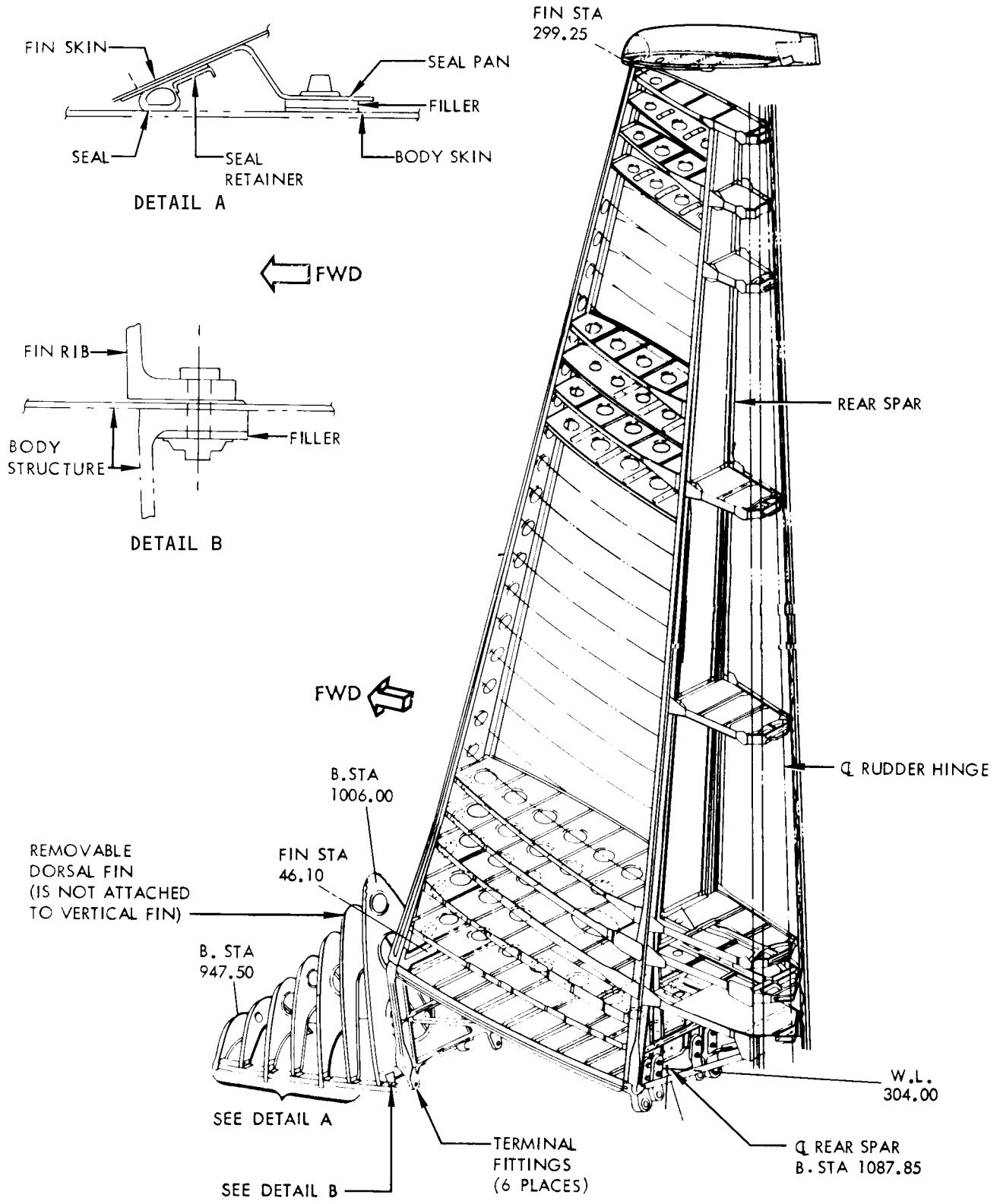
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Vertical Fin Structure
Figure 1

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VERTICAL STABILIZER (FIN) – REMOVAL/INSTALLATION

1. General

- A. There are two different sling assemblies which can be used to remove and install the fin. The F80035-() sling can be used with the rudder either installed or removed. After removal with the F80035-() sling, the fin must be supported in a vertical position. The C55004-1 sling can be used only with the rudder installed on the fin. After the fin is removed with the C55004-1 sling, the fin can be put on its side. This procedure must be performed in a hangar.

2. Equipment and Materials

- A. Overhead crane or a portable crane equipped with a 50-foot boom and capable of lifting 2400 pounds
B. Sling Assembly – F80035-() (Used if fin will not be placed on its side)
C. Sling Assembly – C55004-1 (Used if fin will be placed on its side)
D. Grease – BMS 3-33 (Ref 20-30-21) preferred
E. Grease – BMS 3-24 (Ref 20-30-21) alternative
F. Cleaning Solvent – Kerosene, VV-K-221 (Ref 20-30-31)
G. Corrosion Inhibiting Compound – BMS 3-23 (Ref 20-30-21)
H. Rigging Pin (centering unit output crank) R-5 – 0.311 +0.000/-0.002-inch diameter x 4 inches long (MS20392-4)

NOTE: Rigging pin is part of kit F70207-3, -52, -61, or -84.

- I. Alignment and Guide Pins – MIT 65-73716-1 (2) and MIT 65-73716-2 (4)
J. Rudder Gust Lock – SE27-2006 (Airplanes with 3 rudder balance weights, install across lower balance weight slot), or F80150-1

3. Prepare for Removal

- A. Open navigation system circuit breakers on P6 and/or P8. Open rudder control circuit breakers on P6.
B. Depressurize rudder hydraulic system (Ref Chapter 27, Rudder and Rudder Trim Control System – MP).

WARNING: RUDDER HYDRAULIC SYSTEM MUST BE DEPRESSURIZED BEFORE WORKING IN AREA OF RUDDER. HYDRAULIC OPERATION OF RUDDER MAY CAUSE PERSONNEL INJURY.

- C. Remove vertical fin access panels 9503, 9504, 9505, 9506, and open stabilizer jackscrew compartment door 3701.
D. Install rudder gust lock with warning streamer.

4. Remove Vertical Fin

- A. Disconnect and cap hydraulic lines at base of fin.
B. Disconnect the pitot static lines that go to the elevator pitot tubes.
(1) Put caps on the ends of the tubes.
C. Disconnect the electrical connectors from the flux valves
D. Disconnect the electrical connectors from the elevator probe heaters.

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- E. Disconnect following electrical cables:
 - (1) Disconnect VOR cables in stabilizer jackscrew compartment above and aft of pressure bulkhead.
 - (2) Disconnect rudder control cables at rudder control power unit.
- F. Disconnect rudder flight control cables as follows:
 - (1) Set rudder trim control wheel in control cabin to NEUTRAL.
 - (2) Install rudder centering unit output crank rigging pin.
 - (3) Disconnect rudder control and rudder trim control cables at turnbuckles in stabilizer jackscrew compartment. Clamp cables.
- G. If F80035-() sling assembly will be used, do the following:

NOTE: Vertical fin may be removed with or without rudder installed. For use of sling in either case, see Fig. 402.

- (1) Install two sling attachment fitting F80035-9 on the left side and two fittings F80035-10 the right side of the vertical fin. Store the sling attachment positioning screws.
 - (2) Attach the sling assembly to crane.
 - (3) Position the sling assembly and connect to the fin attachment fittings.
 - (4) Tension the sling assembly so that the load on fin attachment bolts is relieved.
- H. If you will use the C55004-1 sling assembly, do these steps:

NOTE: See Fig. 402 (Sheet 2) to use the sling.

- (1) If you will put the vertical fin on its right side, do these steps:
 - (a) Install each of the applicable adapters (1) to the left and right side along the front spar at locations A, B, C and D.
 - (b) Install the applicable adapter (8) to the left side at the front spar at location E.
 - (c) Install the applicable adapter (6) to the left side at the rear spar at location F.
 - (d) Install the applicable adapter (3) to the left side at the rear spar at location H.
 - (e) Install each of the strongbacks (2) to the applicable adapter (1) on the left and right side at the front spar at locations A, B, C and D.
 - (f) Install the strongback (10) on the left side to the applicable adapter (8) at the front spar at location E.
 - (g) Install the strongback (10) on the left side to the applicable adapter (6) at the rear spar at location F.
 - (h) Install the strongback (5) on the left side to the applicable adapter (6) at the rear spar at location F.
 - (i) Install the strongback (5) on the left side to the applicable adapter (3) at the rear spar at location H.

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- (j) Connect the crane link to the crane hook.
 - (k) Connect the fixed link to the cable from the crane structure.
 - (l) Connect the bridle hook A to the strongback (2) on the right side at location A.
 - (m) Connect the bridle hook C to the strongback (2) on the left side at location C.
 - (n) Connect the bridle hook H to the strongback (5) on the left side at location H.
 - (o) Connect the bridle hook G to the strongback (10) on the left side at location G.
- (2) If you put the vertical fin on its left side, do these steps:
- (a) Install each of the applicable adapters (1) to the left and right side along the front spar at locations A, B, C and D.
 - (b) Install the applicable adapter (9) to the right side at the front spar at location E.
 - (c) Install the applicable adapter (7) to the right side at the rear spar at location F.
 - (d) Install the applicable adapter (4) to the right side at the rear spar at location H.
 - (e) Install each of the strongbacks (2) to the applicable adapter (1) on the left and right side at the front spar at locations A, B, C and D.
 - (f) Install the strongback (10) on the right side to the applicable adapter (9) at the front spar at location E.
 - (g) Install the strongback (10) on the right side to the applicable adapter (7) at the rear spar at location F.
 - (h) Install the strongback (5) on the right side to the applicable adapter (7) at the rear spar at location F.
 - (i) Install the strongback (5) on the right side to the applicable adapter (4) at the rear spar at location H.
 - (j) Connect the crane link to the crane hook.
 - (k) Connect the fixed link to the cable from the crane structure.
 - (l) Connect the bridle hook A to the strongback (2) on the left side at location A.
 - (m) Connect the bridle hook C to the strongback (2) on the right side at location C.
 - (n) Connect the bridle hook H to the strongback (5) on the right side at location H.
 - (o) Connect the bridle hook G to the strongback (10) on the right side at location G.
- I. Remove locks and cotter pins (two places), self-locking nuts, washers and bolts (four places), attaching vertical fin to fuselage at rear spar (Fig. 403).

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- J. Remove cotter pins, self-locking nuts, washers, and bolts (two places) attaching vertical fin to fuselage at front spar.

NOTE: If fin is being removed for inspection purposes only, remove only one bolt at a time to retain alignment until fin installation.

- K. Hoist vertical fin clear of airplane. Ensure side loads are not imposed on sling attach points.
- L. If the F80035-() sling assembly is in use, lower the vertical fin onto a well padded cradle of sandbags placed under the spars. Support the fin in vertical position.
- M. If the C55004-1 sling assembly is in use, lower the crane hook. The fin will rotate to horizontal.
- N. Remove sling and sling attachment fittings.
- O. Install sling attachment positioning screws in fin surfaces.
- P. Install access panels.
- Q. Cover exposed structure on fuselage.
- R. Inspect leading edge for aerodynamic smoothness (Ref SRM 51-70).

5. Prepare Vertical Fin for Installation

- A. Check that navigation system circuit breakers on P6 and/or P18 are open. Check that rudder control circuit breakers on P6 are open.
- B. Check that rudder hydraulic system is depressurized. If not, depressurize system per Chapter 27, Rudder and Rudder Trim Control System - MP.

WARNING: RUDDER HYDRAULIC SYSTEM MUST BE DEPRESSURIZED BEFORE WORKING IN AREA OF RUDDER. HYDRAULIC OPERATION OF RUDDER MAY CAUSE PERSONNEL INJURY.

- C. Remove vertical fin access panels 9503, 9504, 9505, 9506, and open stabilizer jackscrew compartment door 3701.
- D. Clean fin attaching bolts and holes with solvent.
- E. Apply corrosion inhibiting compound to bushings at vertical stabilizer attach fittings.
- F. Check that rudder gust lock with warning streamer is installed.

6. Install Vertical Fin

- A. If sling assembly F80035-() is to be used, do the following:

NOTE: Vertical fin may be installed with or without rudder installed. For use of sling in either case, see Fig. 402.

- (1) Install two sling attachment fittings F80035-9 on left side, and two fittings F80035-10 on right side of vertical fin. Store sling attachment positioning screws.
- (2) Attach sling to crane and connect sling to attachment fittings.

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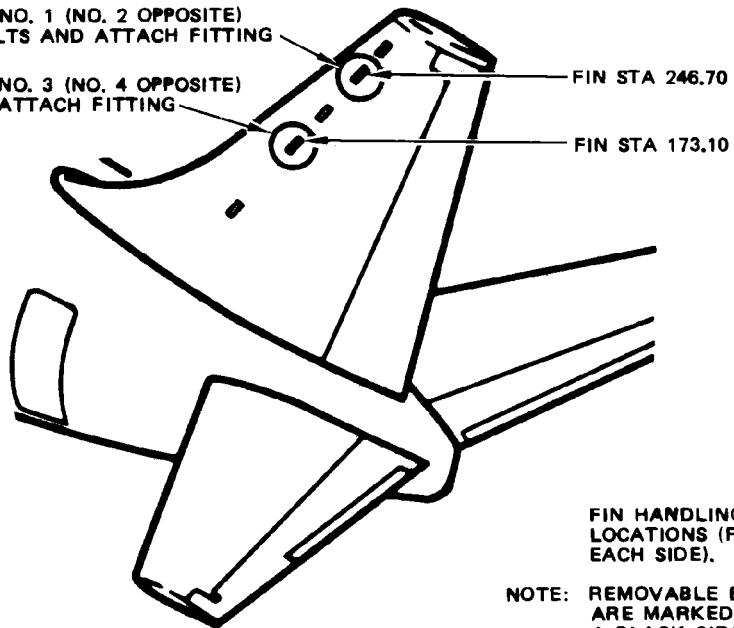
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SLING ATTACHMENT POINT NO. 1 (NO. 2 OPPOSITE)
 REMOVE FOUR BOTTOM BOLTS AND ATTACH FITTING

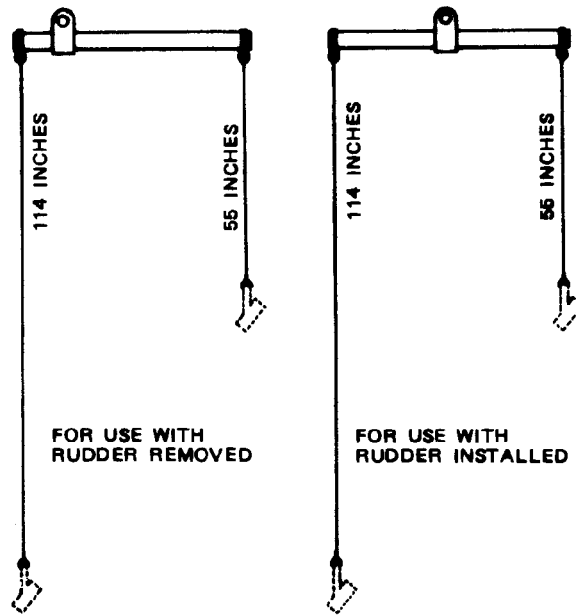
SLING ATTACHMENT POINT NO. 3 (NO. 4 OPPOSITE)
 REMOVE FOUR BOLTS AND ATTACH FITTING



FIN HANDLING HOLE LOCATIONS (FIVE PLACES EACH SIDE).

NOTE: REMOVABLE BOLTS ARE MARKED WITH A BLACK CIRCLE.

Sling Fitting Attachment Points
 Figure 401

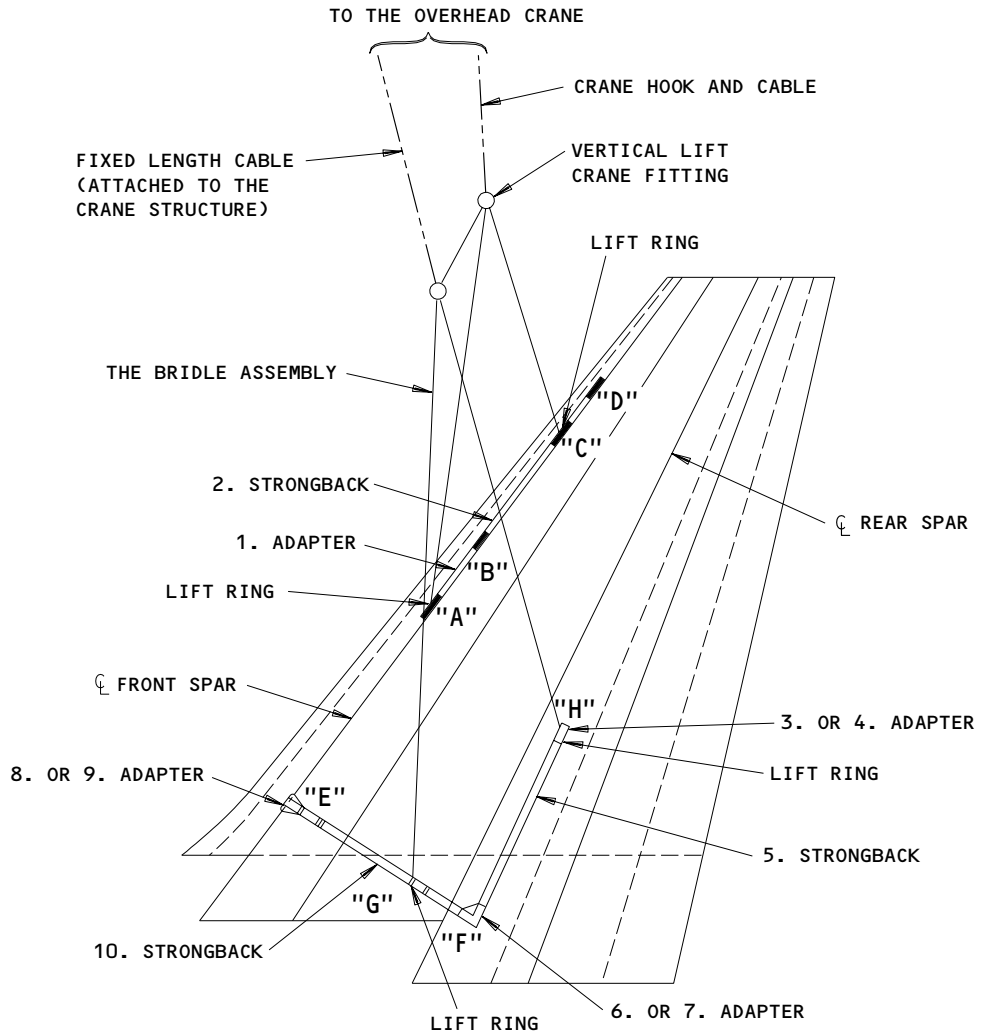


SLING ASSEMBLY F80035-()

Sling Assembly
 Figure 401

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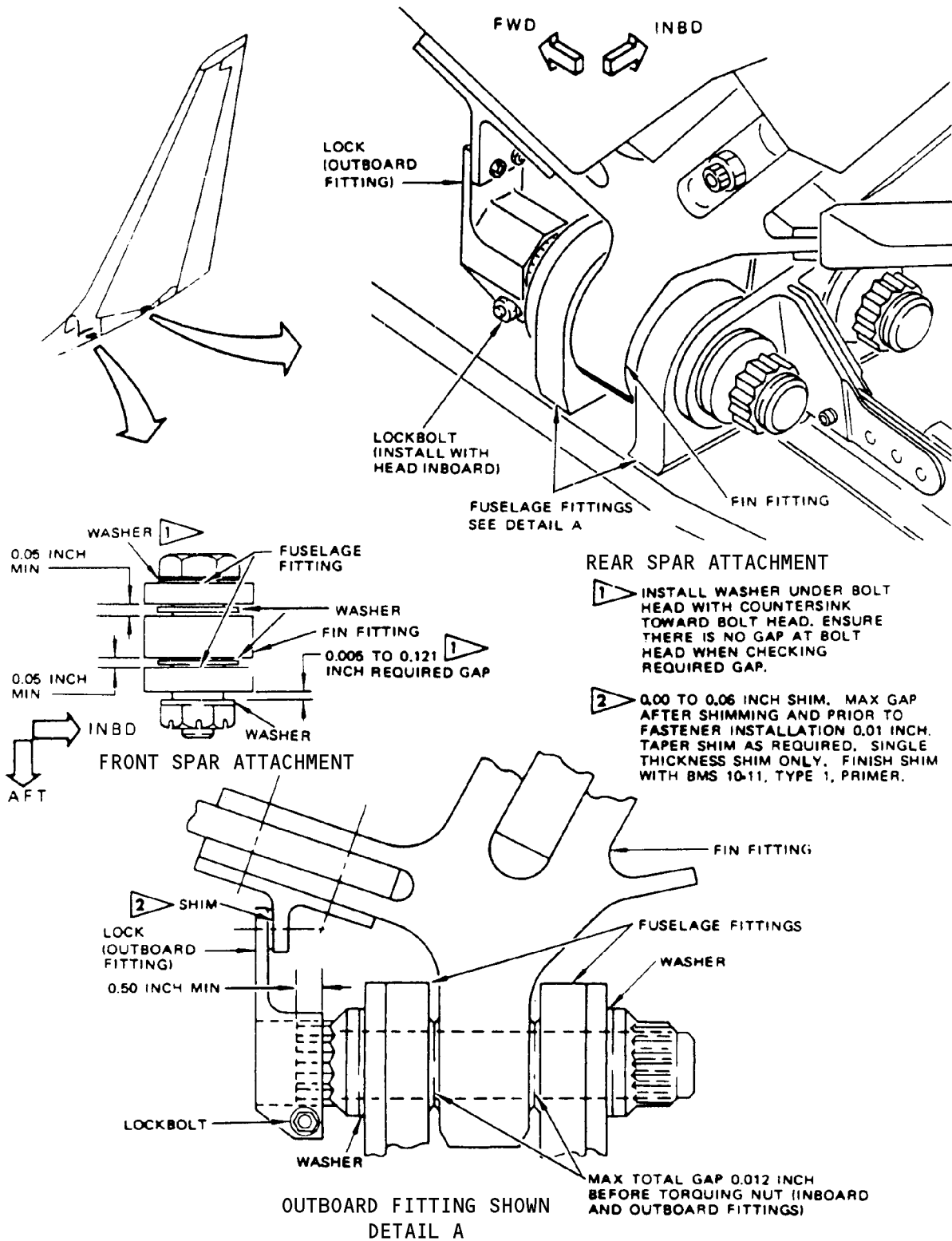
SLING ASSEMBLY C55004-1

Sling Assembly Installation
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Vertical Fin to Fuselage Attachment
 Figure 403

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B. If you will use the C55004-1 sling assembly, do these steps:

NOTE: See Fig. 402 (Sheet 2) to use the sling.

- (1) If you will put the vertical fin on its right side, do these steps:
 - (a) Connect the bridle hook G to the strongback (10) on the left side at location G.
 - (b) Connect the bridle hook H to the strongback (5) on the left side at location H.
 - (c) Connect the bridle hook C to the strongback (2) on the left side at location C.
 - (d) Connect the bridle hook A to the strongback (2) on the left side at location A.
 - (e) Connect the fixed link to the cable from the crane structure.
 - (f) Connect the crane link to the crane hook.
 - (g) Install the strongback (5) on the left side to the applicable adapter (3) at the rear spar at location H.
 - (h) Install the strongback (5) on the left side to the applicable adapter (6) at the rear spar at location F.
 - (i) Install the strongback (10) on the left side to the applicable adapter (6) at the rear spar at location F.
 - (j) Install the strongback (10) on the left side to the applicable adapter (8) at the front spar at location E.
 - (k) Install each of the strongbacks (2) to the applicable adapter (1) on the left and right side at the front spar at locations A, B, C and D.
 - (l) Install the applicable adapter (3) to the left side at the rear spar at location H.
 - (m) Install the applicable adapter (6) to the left side at the rear spar at location F.
 - (n) Install the applicable adapter (8) to the left side at the front spar at location E.
 - (o) Install each of the applicable adapters (1) to the left and right side along the front spar at locations A, B, C and D.
- (2) If you will put the vertical fin on its left side, do these steps:
 - (a) Connect the bridle hook G to the strongback (10) on the right side at location G.
 - (b) Connect the bridle hook H to the strongback (5) on the right side at location H.
 - (c) Connect the bridle hook C to the strongback (2) on the right side at location C.
 - (d) Connect the bridle hook A to the strongback (2) on the left side at location A.
 - (e) Connect the fixed link to the cable from the crane structure.
 - (f) Connect the crane link to the crane hook.

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- (g) Install the strongback (5) on the right side to the applicable adapter (4) at the rear spar at location H.
 - (h) Install the strongback (5) on the right side to the applicable adapter (7) at the rear spar at location F.
 - (i) Install the strongback (10) on the right side to the applicable adapter (7) at the rear spar at location F.
 - (j) Install the strongback (10) on the right side to the applicable adapter (9) at the front spar at location E.
 - (k) Install each of the strongbacks (2) to the applicable adapter (1) on the left and right side at the front spar at locations A, B, C and D.
 - (l) Install the applicable adapter (4) to the right side at the rear spar at location H.
 - (m) Install the applicable adapter (7) to the right side at the rear spar at location F.
 - (n) Install the applicable adapter (9) to the right side at the front spar at location E.
 - (o) Install each of the applicable adapters (1) to the left and right side along the front spar at locations A, B, C and D.
- C. Hoist fin into position.
- D. Align holes in fin and fuselage fittings using alignment and guide pins as required.
- E. Install bolts (two places), washers, nuts, and cotter pins attaching vertical fin to fuselage at front spar. Observe installation per Fig. 403. Tighten bolts 50 to 1500 pound-inches torque.

NOTE: Lubricate bolts with grease prior to installation.

- F. Install bolts (four places), washers, nuts, antirotation lock, antirattle washer and antirotation retainer bolt (Fig. 403). Tighten fin attachment bolts 3300 to 4300 pound-inches torque. Lockwire antirotation retainer bolt to antirotation lock.

NOTE: Lubricate fin attachment bolts with grease prior to installation. Inboard bolt requires self-locking nut and cotter pin. Install cotter pin after tightening nut. After incorporating SB 55-1026, cotter pin is not required with inconel bolts.

- G. Connect rudder flight control cables as follows:
- (1) Connect rudder control and rudder trim control cables at turnbuckles in stabilizer jackscrew compartment.
 - (2) Remove centering unit output crank rigging pin.
- H. Connect following electrical cables:
- (1) Connect VOR cables in stabilizer jackscrew compartment above and aft of pressure bulkhead.
 - (2) Connect rudder control cables at rudder control power unit.

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- (3) Connect the electrical connectors to the flux valves.
 - (4) Connect the electrical connectors to the elevator pitot tube heaters.
 - I. Connect hydraulic lines at base of fin.
 - J. Connect the pitot static lines to the elevator pitot tubes.
 - K. Remove sling and sling attachment fittings or strongbacks.
 - L. Install sling attachment positioning screws in fin surfaces.
 - M. Pressurize rudder hydraulic system and check for leaks (Ref Chapter 27, Rudder and Rudder Trim Control System - MP).
 - N. Remove rudder gust lock and warning streamer.
 - O. Rig rudder and check operation of rudder per Chapter 27, Rudder and Rudder Trim Control System - A/T.
 - P. Test VOR portion of VOR/GS system per Chapter 34, Navigation.
 - Q. Do a test of the elevator pitot static system (MM 27-31-212/501).
 - R. Do a test of the compass system (MM 34-21-0/501).
 - S. Do a test of the heaters on the elevator pitot tubes (MM 30-31-0/501).
7. Restore Airplane to Normal Configuration
- A. Close circuit breakers.
 - B. Install access panels.

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VERTICAL STABILIZER (FIN) - INSPECTION/CHECK

1. General

A. This data consists of illustrations and wear limits charts. Additional wear limits and repair are given in Component Overhaul Manual - Horizontal Tail Center Section Assembly, 55-10-05. There will be no procedure given in this section for gaining access to, or removing and replacing the component after inspection for wear. Refer to component removal/installation for this information.

2. Vertical Stabilizer (Fin) Wear Limits

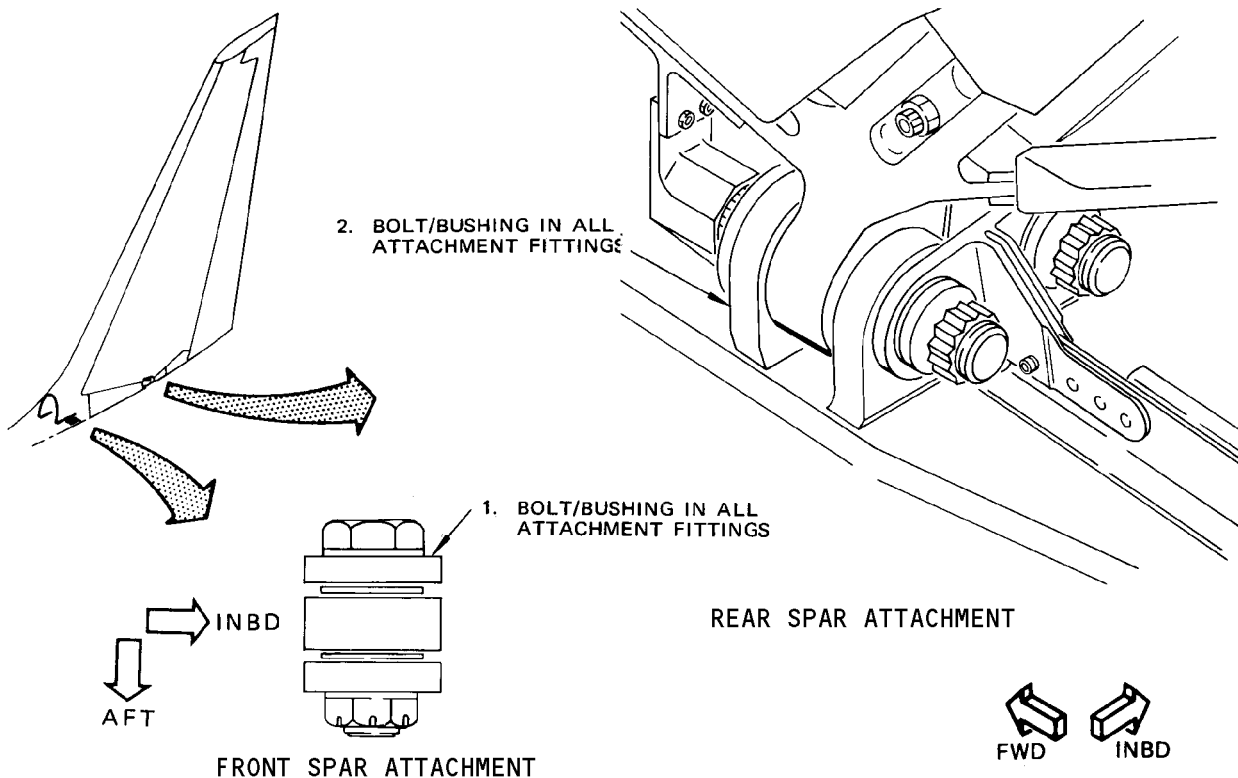
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INDEX NO.	PART NAME	DIM.	DESIGN LIMITS		WEAR LIMITS		REPLACE WORN PART	REPAIR WORN PART	REPAIR INSTR.
			DIAMETER		MAX WEAR DIM.	MAX DIAM CLEARANCE			
			MIN	MAX					
1.	Bushing	ID	0.8780	0.8790	0.8840	0.010	X		2
	Bolt	OD	0.8730	0.8740	0.8680		X	X	1
2.	Bushing	ID	1.2530	1.2540	1.2590	0.010	X		2
	Bolt	OD	1.2480	1.2490	1.2450		X	X	1

All dimensions are in inches.

1 STRIP EXISTING FINISH, CHROME PLATE TO DESIGN LIMITS.

2 REFER TO 55-30-11 APPROVED REPAIRS FOR BUSHING REPLACEMENT

Vertical Fin Wear Limits
 Figure 601

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VERTICAL STABILIZER (FIN) ATTACH FITTINGS – APPROVED REPAIRS

1. General

- A. Corrosion of vertical and horizontal stabilizer attachment lug bushings has been found on some airplanes. The corrosion is due to moisture collection and retention in the lugs of the attach fittings. Unchecked corrosion could result in cracked lugs or loose bushings requiring extensive unscheduled manhours and downtime to repair. For replacement of horizontal stabilizer bushings, refer to 27-41-131, Approved Repairs.
- B. This procedure provides special locating tooling to establish and maintain centerline location of hole in bushing being removed so that special reamers also provided can be used to ream hole in replacement bushing with identical hole centerline location as removed bushing. This is necessary because the bushings may have eccentric outer and inner diameters. Be careful when removing bolts to avoid bushing rotation.

2. Equipment and Materials

- A. Horizontal Stabilizer and Fin Bushing Replacement Kit – F80231
- B. Primer – BMS 10-11, Type 1 (Ref 20-30-41)
- C. Shimming putty
- D. Sealant – BMS 5-95 (Ref 20-30-11)

3. Replace Vertical Fin and Body Section Rear Spar Lug or Clevis Individual Bushing (Fig. 801)

- A. Remove vertical stabilizer (fin) (Ref 55-30-0).
- B. Prepare tooling for reaming operation (potting of reamer bushings).
 - (1) See section A-A to set up potting of P-48-16-1/2 and P-112-16-1.2530 reamer bushings. Install -105 and -120 spacers at the two primary clevis or lug locations.
 - (2) Clamp -101 tool frame assembly to the primary clevises or lugs only.
 - (3) Apply potting compound around P-48-16-1/2 and P-112-16-1.2530 bushings after -115 potting pins and bushings are in place. Install at three locations, two locations are for locating the tool and the third location for replacement bushing location.

NOTE: If the bushings are to be replaced in the lug and clevis at the same location, the tool need only to be potted to the spar lug or clevis, then use for its mate.

- (4) Remove tool assembly after potting compound is cured and firmly set.
- C. Ream oversize holes in clevis or lug.
 - (1) Mask or shield structure to prevent contamination with abrasive materials during abrasive blast cleaning or with shot during shot peening.

CAUTION: FOREIGN PARTICLES MAY CAUSE CORROSION TO STRUCTURE.

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- (2) Before removing existing defective bushings, measure and record the distance between the defective flange bushing face and clevis or lug. Mark the location of this measurement on the clevis or lug so that a repeated measurement can be obtained for the new bushing.
- (3) Remove existing defective bushing. Use CJ107 slide hammer and either -126 or -525 slide hammer adapter. If bushing is being removed from clevis, remove remaining bushing using -125 bushing removal drive pin.
- (4) Clean and deburr holes and adjacent surfaces thoroughly.
- (5) Oversize hole with Quickset reamer to minimum oversize in 0.010 inch increments up to maximum allowable to achieve corrosion removal (Ref Fig. 803 for maximum bore oversize). Contact Boeing if corrosion still exists.
- (6) Spotface lug or clevis flanges to provide seat for bushing flange to maximum depth of 0.01 inch. Contact Boeing if corrosion still exists in lug holes or on spotfaced surfaces. Remove corrosion products from other areas of lug per Structural Repair Manual, Chapter 51. Do not use chemical removal if solution can penetrate fay surfaces. Use chemical or dry abrasive surface.
- (7) Shot peen holes and spotfaced surfaces as follows:
 - (a) Shot peen (flap peen optional) minimum flat diameter of spot face per Overhaul Manual, Section 20-10-03. On aluminum parts, use shot number 230 to 550, intensity 0.014A, coverage 2.0. On steel parts, use shot number 170 to 460, intensity 0.016A, coverage 2.0.
 - (b) Shot peen (flap peen optional) hole in clevis or lug per Overhaul Manual, Section 20-10-03. For aluminum parts, use shot number 230 to 550, intensity 0.014A, coverage 2.0. For steel parts, use shot number 170 to 460, intensity 0.016A, coverage 2.0.
 - (c) Hone inside diameter maximum of 0.0004 inch with 63 microinch finish to achieve final hole size.
- (8) Finish hole of steel parts with two coats of primer or chemically treat hole in aluminum parts to meet requirements of MIL-C-5541 (colored film) and apply one coat of primer. Allow to dry one hour minimum.
- (9) Install steel sleeve bushing in hole of lug or clevis.

NOTE: Make the bushing from the dimensions on Fig. 803, Detail B, Section XX-XX.

- (10) Finish spotfaced and reworked surfaces of aluminum lugs (except holes) with manual application of colored chemical coating per BAC5719 and apply two coats of primer. Finish steel parts with two coats of primer.

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- D. Ream inside diameter of new flanged bushing (Section A-A)
- (1) Make a flanged bushing for an interference fit with the previously installed sleeve bushing.
- NOTE:** Make the flanged bushing from the dimensions on Fig. 803, Detail A, Section X-X.
- (2) Shrink fit bushing in lug with wet primer. Use -230 bushing installation tool.
 - (3) Secure -101 tool frame assembly to rear spar as shown in View 1 or View 2 with -115 potting pins and C-clamps.
 - (4) Ream bushings from aft side of spar with -112 arbor with -111 dowel press fit into arbor and -110 shell reamer. Continue to ream bushing using -124 reamer and -128 standard reamer provided.
 - (5) Hone internal diameter of bushing to diameter of 1.2530 to 1.2540 inches with machine finish 63 microinches AA. Use standard Sunnan hone.
- E. Machine new bushing flanges.
- (1) Remove -101 tool frame assembly from rear spar.
 - (2) After completion of bushing replacement per par. D, measure and record the distance between the new bushing flange face and clevis or lug in the same marked location. Subtract the previous measurement from this new measurement to obtain the amount of material to remove from the flange.
 - (3) Set up flange machining operation as shown in Section A-A and proceed as follows:
 - (a) Rotate -310 micrometer barrel assembly counterclockwise from bottomed out position to the "40" mark (or 10 graduations = 0.10 inch travel).
 - (b) With -107 facing cutter in place, rotate cutter by hand and advance -313 collar clamp assembly until cutter makes contact with highest point on new bushing flange. Tighten setscrew in -313 collar clamp assembly to hold -306 arbor firmly.
 - (c) Rotate micrometer barrel clockwise back to bottomed setting (this will give an additional 0.10 inch of clearance).
 - (d) Proceed to spotface by backing off (counterclockwise) -310 barrel assembly until amount of material determined in step (2) is removed.
- NOTE:** Make readings periodically to prevent overtravel.
- (e) Reverse set-up to spotface opposing flange to engineering specified dimension of 2.165 +0.001 inches between bushing faces of fin rear spar lug.
 - (f) Finish spotface surfaces per Fig. 803.

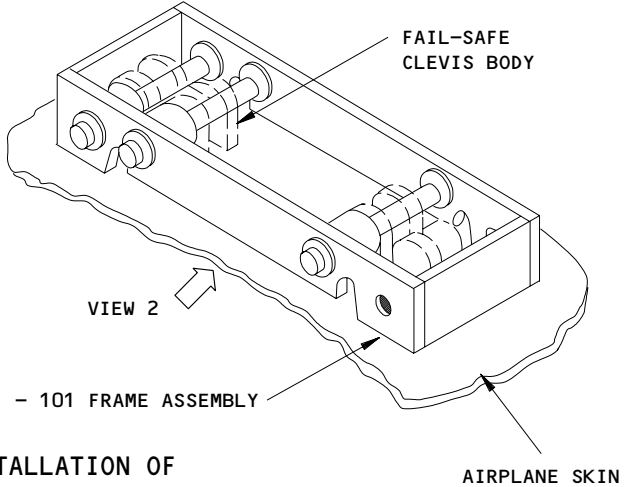
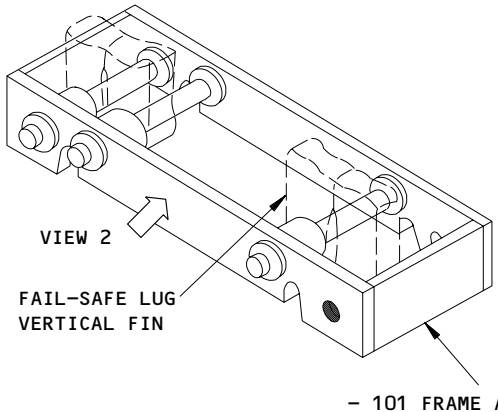
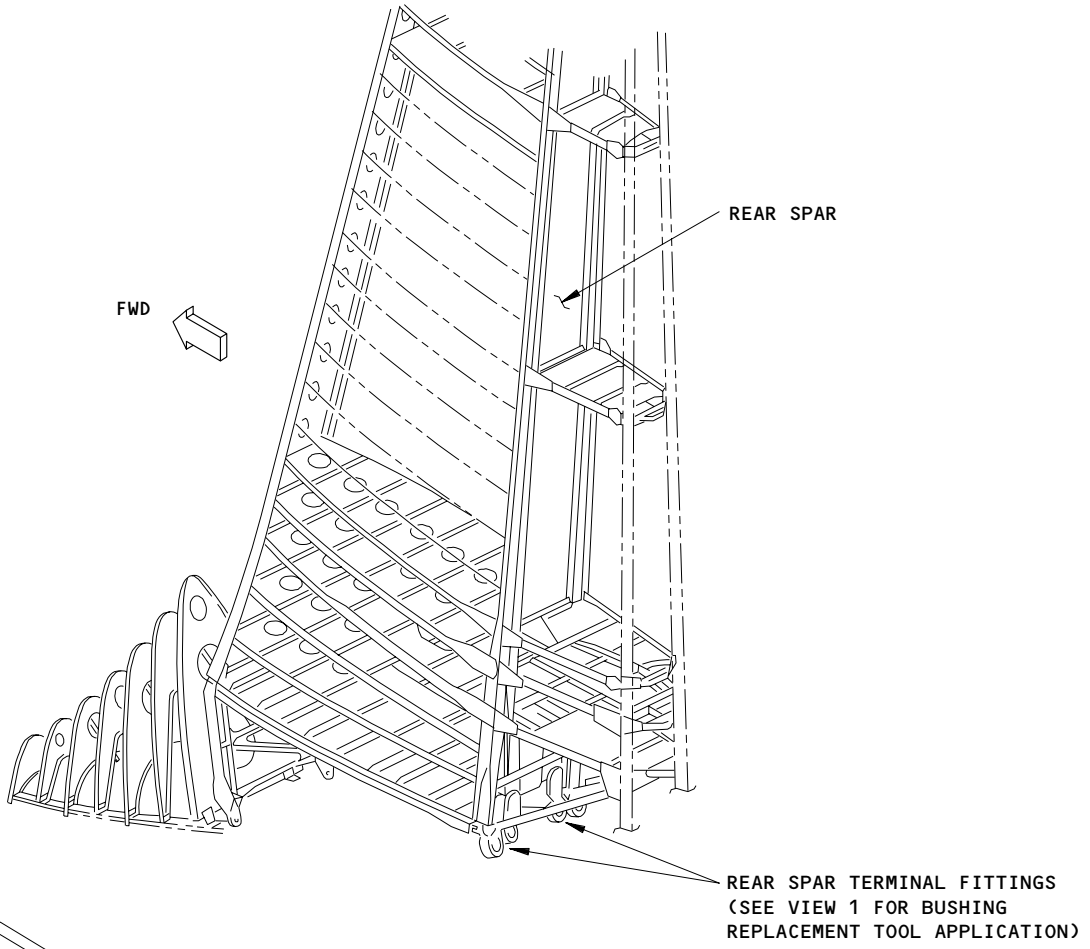
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TYPICAL INSTALLATION OF
 BUSHING REPLACEMENT TOOL
 VIEW I

Vertical Fin to Body Rear Spar
 Figure 801

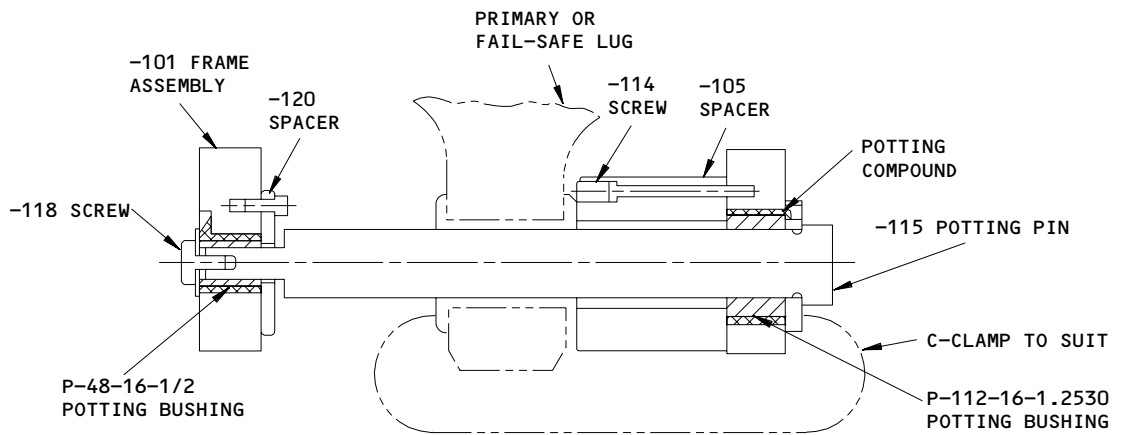
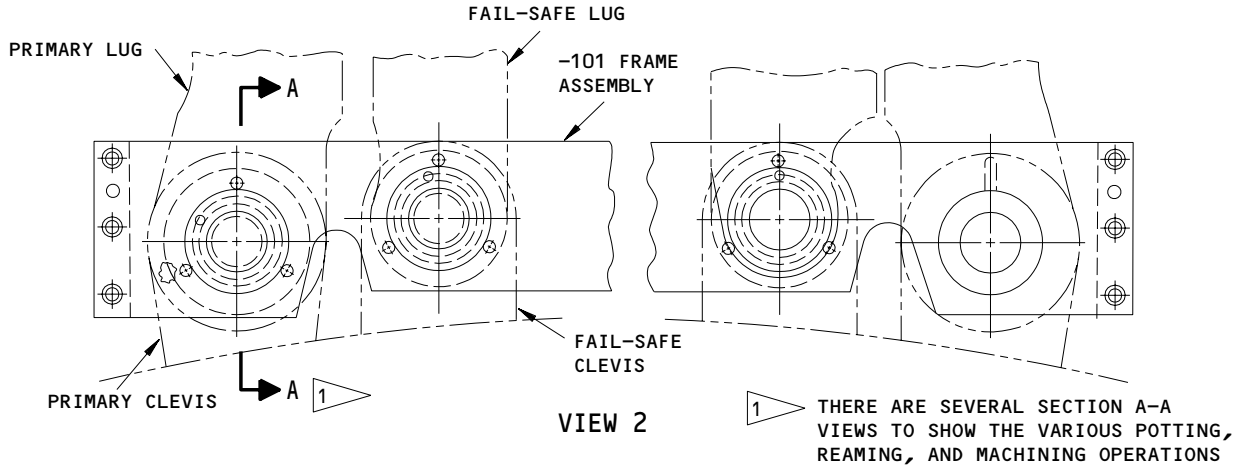
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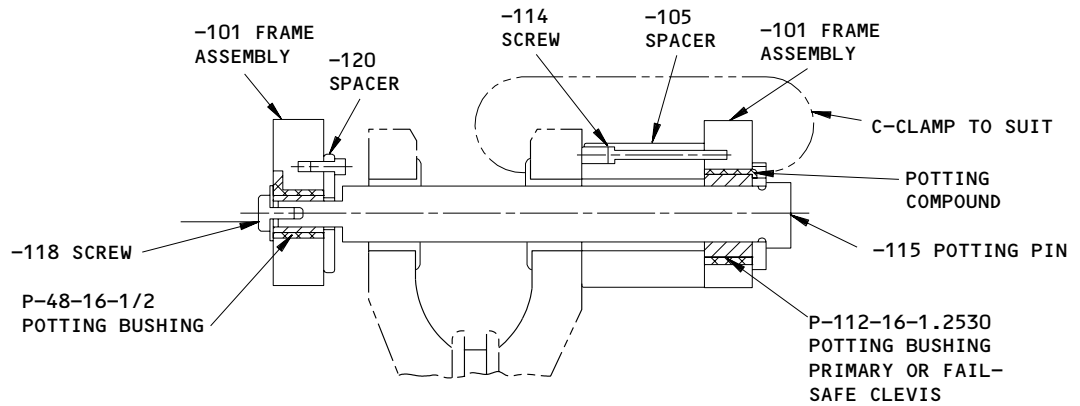
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(POTTING OF BUSHINGS -101 FRAME ASSEMBLY FOR LUG)
SECTION A-A



(POTTING OF BUSHINGS -101 FRAME ASSEMBLY FOR CLEVIS)
SECTION A-A

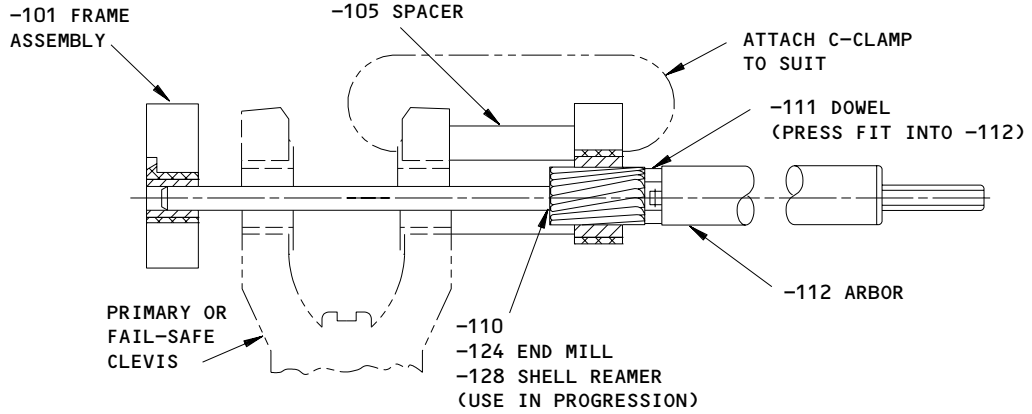
Vertical Fin to Body Rear Spar Attach Fitting Bushing Replacement
Figure 802

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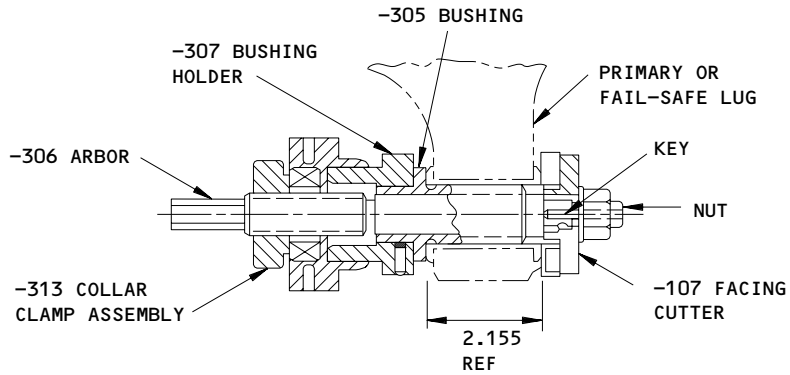
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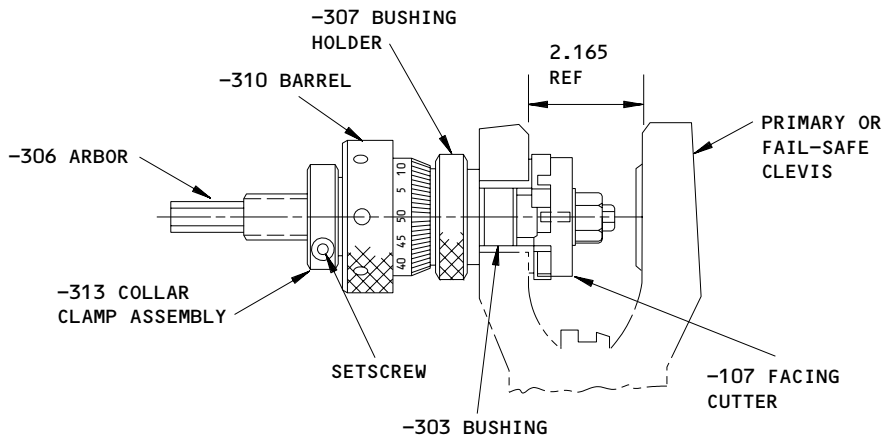
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(REAMING OF NEW FLANGE BUSHING IN LUG OR CLEVIS - CLEVIS SHOWN)
SECTION A-A



(VIEW SHOWING MACHINING NEW BUSHING FLANGE IN CLEVIS)
SECTION A-A



(VIEW SHOWING MACHINING BUSHING FLANGE IN CLEVIS)
SECTION A-A

Vertical Fin to Body Rear Spar
Figure 803 (Sheet 1)

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F. Seal bushings as follows:

- (1) Fillet seal around flange outside diameter and void at end of bushing with sealant. Apply primer topcoat over sealant.

G. Install vertical stabilizer (fin) (Ref 55-30-0).

4. Replace Vertical Fin and Body Section Front Spar Lug or Clevis Individual Bushing (Fig. 802)

A. Remove vertical stabilizer (fin) (Ref 55-30-0).

B. Prepare tooling for reaming operation (potting of reamer bushings).

- (1) See View 1, View 2, and View 3 for lug to set up potting of P40-16-3/8 and P-80-16-.8780 reamer bushings. Install -211 and -214 spacers at clevis or lug locations.
- (2) Clamp -201 tool frame assembly with C-clamp to body clevis or fin lug at replacement location and use -204 clamping pin as shown and -215 and -218 spacers as shown in Section A-A.
- (3) Apply potting compound around P-40-16-3/8 and P-80-16-.8780 bushings after -209 potting pins and bushings are in place. Lock the 5/16-inch socket set screws to clevis or lug and apply putty to ensure set screws will not back off.

NOTE: If bushings are to be replaced in lug and clevis at same location, the tool need only to be potted to the spar lug or clevis, then use for its mate.

- (4) Remove -201 tool assembly after potting compound is cured and firmly set.

C. Ream oversize hole in clevis or lug.

- (1) Remove existing defective bushing using -125 removal tool.
- (2) Clean and deburr holes and adjacent surface thoroughly.
- (3) Mask or shield structure to prevent contamination with abrasive materials during abrasive blast cleaning or with shot during shot peening.

CAUTION: FOREIGN PARTICLES MAY CAUSE CORROSION TO STRUCTURE.

- (4) Oversize hole with Quickset reamer to the minimum oversize in 0.010 inch increments up to maximum allowable to achieve corrosion removal (Ref Fig. 803 for maximum bore oversize). Contact Boeing if corrosion still exists.
- (5) Spotface lug or clevis flange to remove corrosion to maximum depth of 0.015 inch. Contact Boeing if corrosion still exists. Remove corrosion products from other area of lug per Structural Repair Manual, Chapter 51. Do not use chemical removal if solution can penetrate fay surface. Use chemical or dry abrasive surface.

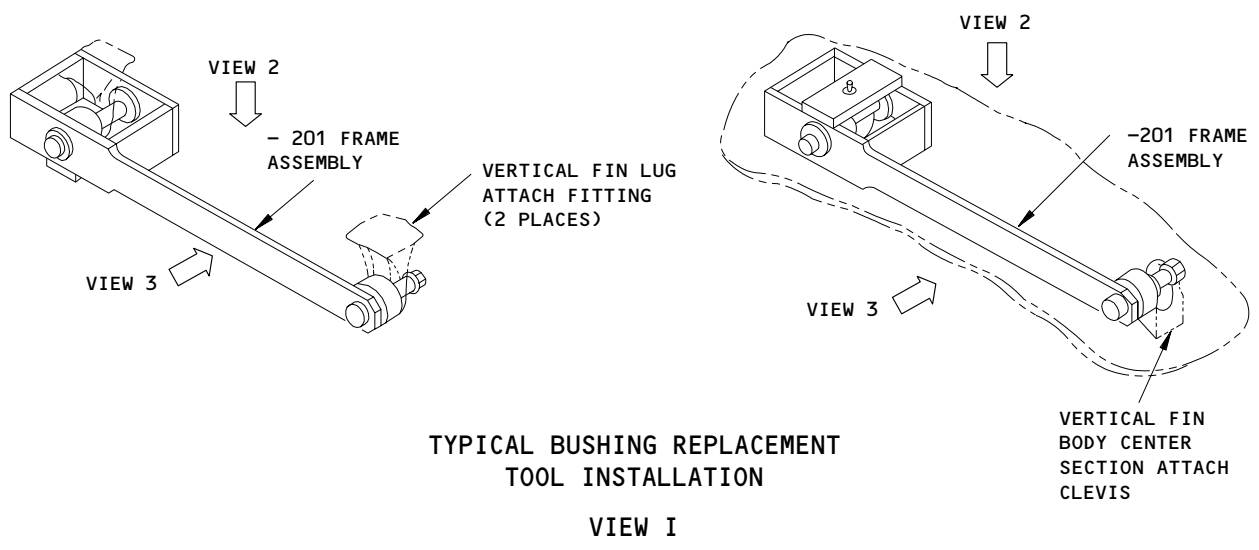
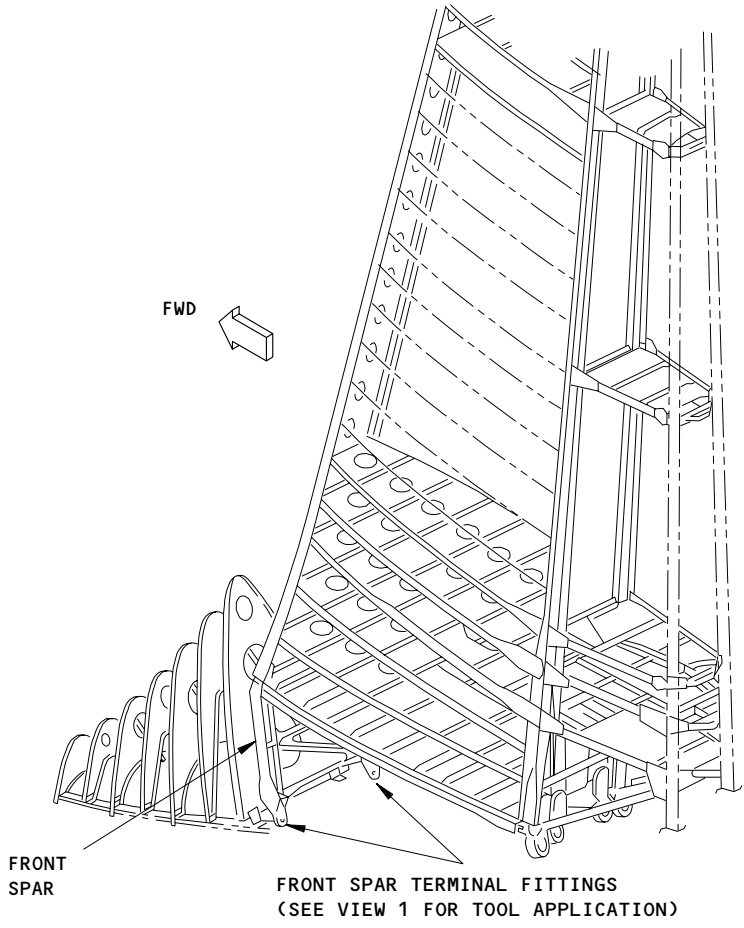
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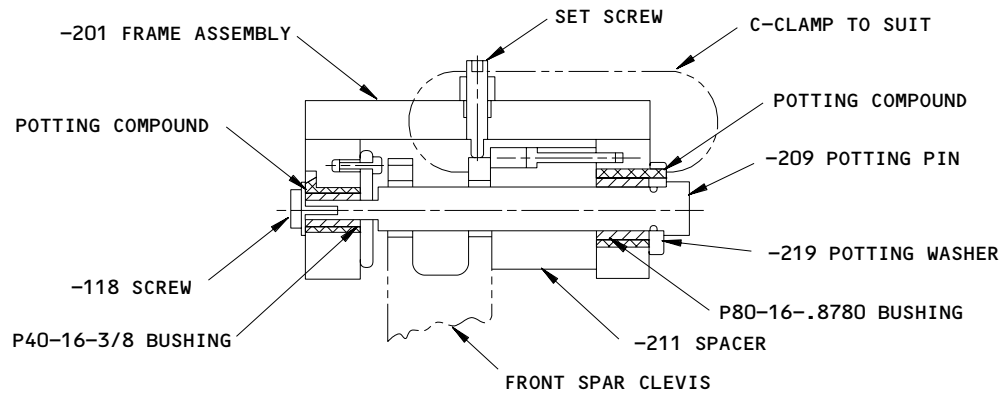
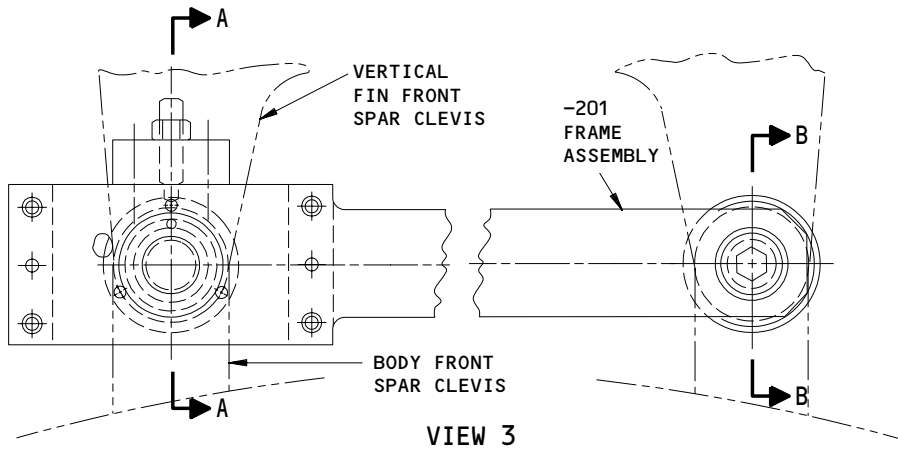
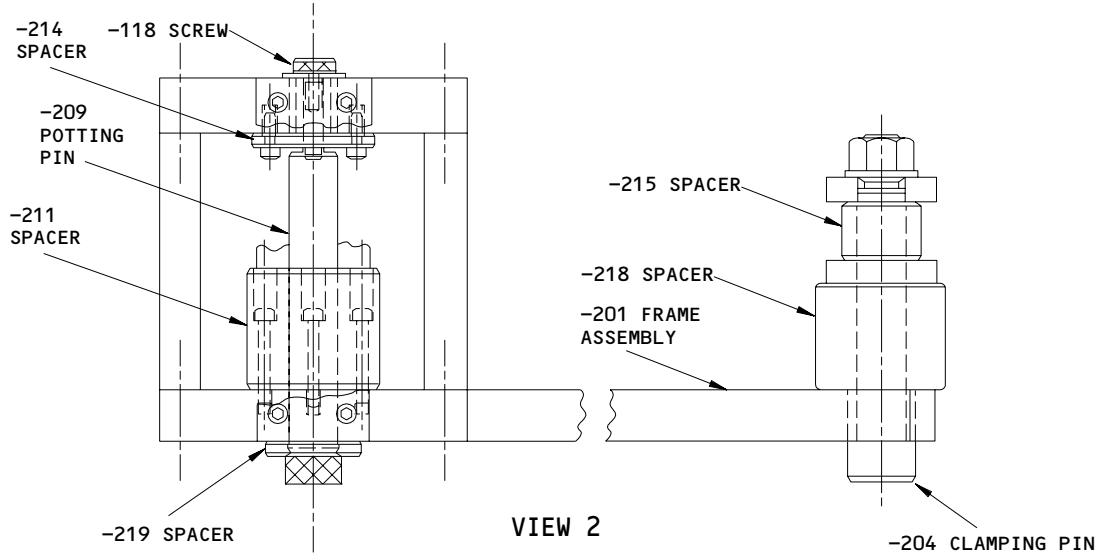


Vertical Fin to Body Rear Spar
 Figure 803 (Sheet 2)

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(POTTING OF BUSHINGS IN -201 FRAME ASSEMBLY FOR CLEVIS)
SECTION A-A

Vertical Fin to Body Front Spar
Figure 804 (Sheet 1)

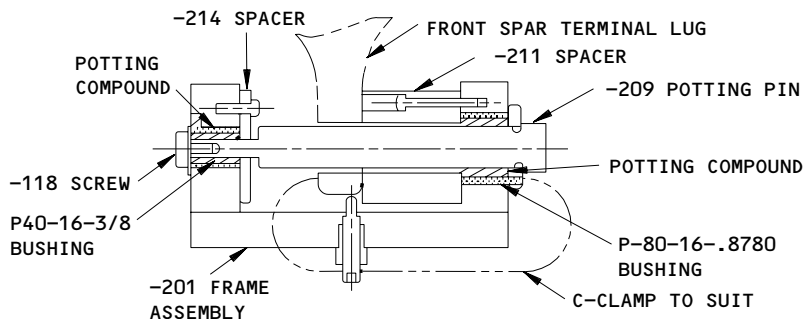
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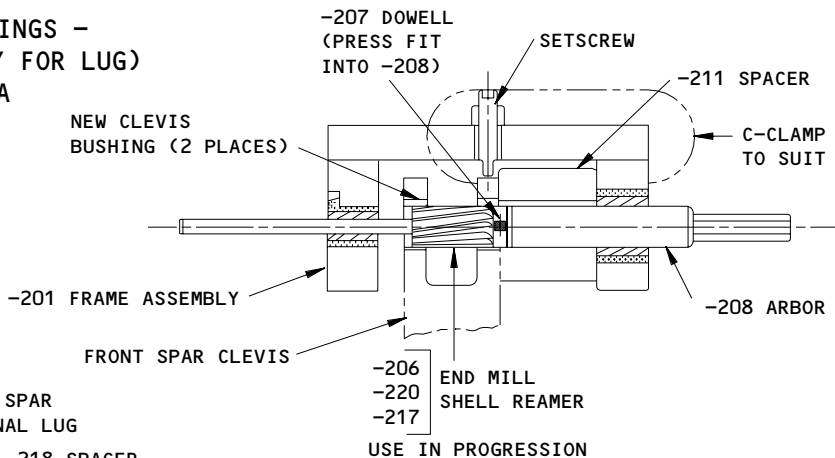
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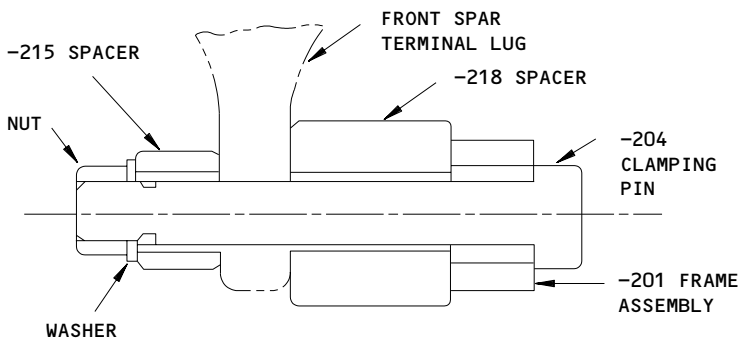
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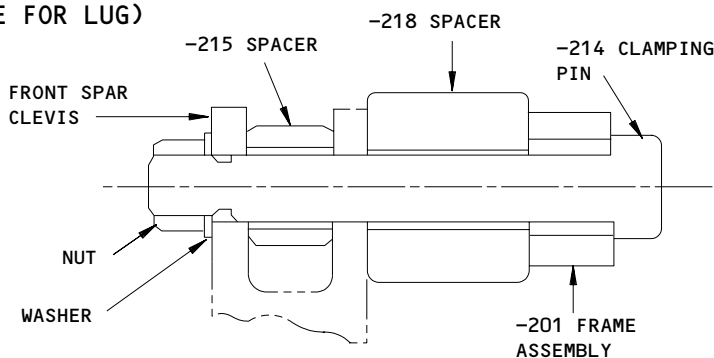
(POTTING OF BUSHINGS -
 -201 FRAME ASSEMBLY FOR LUG)
 SECTION A-A



(REAMING OF NEW BUSHING IN
 LUG OR CLEVIS - CLEVIS SHOWN)
 SECTION A-A



(VIEW SHOWING END HELD IN PLACE FOR LUG)
 SECTION A-A



(VIEW SHOWING END HELD IN PLACE FOR CLEVIS)
 SECTION A-A

Vertical Fin to Body Front Spar
 Figure 804 (Sheet 2)

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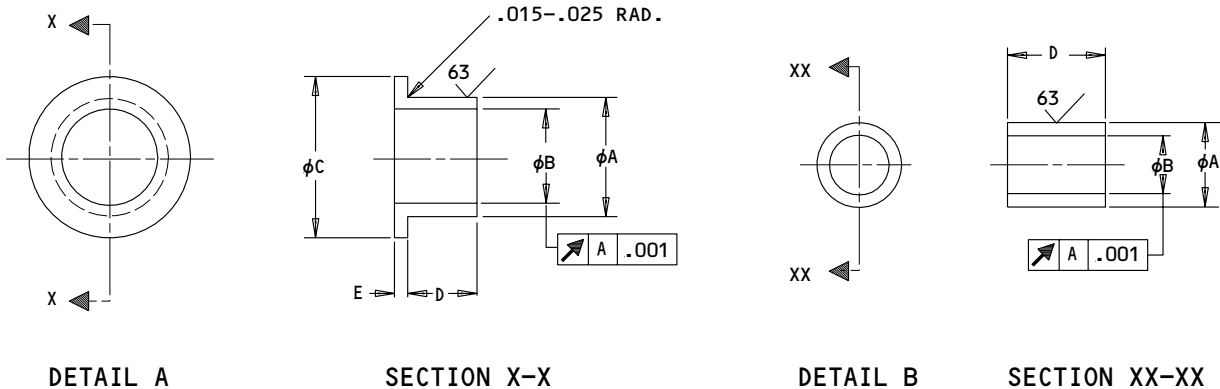
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LOCATION	DIA A	DIA B	DIA C	DIM D	DIM E	MATERIAL	FITTING BORE	REPLACES PART NO.	FITTING PART NO.	DETAIL	HOLE BUSHING
FIN R.SPAC - PRIMARY 2 5 6 7	1.5026 1.5017	1.3758 1.3750	—	1.975 1.970	—	CRES. 2	1.5008 1.5000	NONE	65-46872	B	—
FIN R.SPAC - FAILSAFE 2 5 6 7	1.5026 1.5017	1.3758 1.3750	—	1.975 1.970	—	CRES. 2	1.5008 1.5000	NONE	65-46874	B	—
FIN R.SPAC - PRIMARY 4 6 7	1.3776 1.3767	1.2540 1.2530	2.39 2.37	0.958 0.953	0.16 0.14	AL.NI.BR. 1	—	69-37995 -1	65-46872	A	1.3758 1.3750
FIN R.SPAC - FAILSAFE 4 6 7	1.3776 1.3767	1.2540 1.2530	2.01 1.99	0.958 0.953	0.16 0.14	AL.NI.BR. 1	—	69-38716 -501	65-46874	A	1.3758 1.3750
BODY R.SPAC - PRIMARY 3 5 6 7	1.5026 1.5017	1.2540 1.2530	2.12 2.10	0.910 0.905	0.19 0.17	CRES. 2	1.5008 1.5000	69-37481 -501	65-49558 65-49589	A	—
BODY R.SPAC - FAILSAFE 3 5 6 7	1.5026 1.5017	1.2540 1.2530	1.72 1.70	0.770 0.765	0.19 0.17	CRES. 2	1.5008 1.5000	69-37482 -502	65-50508 65-50509	A	—
FIN F.SPAC 4 6 7	1.0960 1.0952	0.8790 0.8780	—	0.855 0.845	—	AL.NI.BR. 1	1.0945 1.0938	69-38726 -1	65-47450	B	—
BODY F.SPAC 4 6 7	1.0647 1.0639	0.8790 0.8780	—	0.430 0.420	—	AL.NI.BR. 1	1.0632 1.0625	69-37461 -1	65-49892	B	—

NOTE: ALL DIMENSIONS ARE IN INCHES.



DETAIL A

SECTION X-X

DETAIL B

SECTION XX-XX

- 1 AL.NI.BR.- AMS 4640
- 2 CRES 15-5PH PER AMS5659 SOLUTION TREATED
- 3 HEAT TREAT CRES BUSHINGS TO 180-200 KSI PER BAC5619
- 4 PENETRANT INSPECT AL.NI.BR. BUSHINGS PER BAC5423 PRIOR TO PLATING
- 5 MAGNETIC PARTICAL INSPECT CRES BUSHINGS PER BAC5424 CL.C
- 6 CADMIUM PLATE ALL SURFACES, BORE OPTIONAL, TO MEET THE REQUIREMENTS OF QQ-P-416 (REF OVERHAUL MANUAL, 20-42-05)
- 7 MACHINE FINISH 125M INCHES AA EXCEPT AS NOTED

Replacement Bushing Fabrication
Figure 805

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- (6) Shot peen holes and spotfaced surfaces as follows:
 - (a) Shot peen (flap peen optional) minimum flat diameter of spot face per Overhaul Manual, Section 20-10-03. On aluminum parts, use shot number 230 to 550, intensity 0.014A, coverage 2.0. On steel parts, use shot number 170 to 460, intensity 0.016A, coverage 2.0.
 - (b) Shot peen (flap peen optional) hole in clevis or lug per Overhaul Manual, Section 20-10-03. For aluminum parts, use shot number 230 to 550, intensity 0.014A, coverage 2.0. For steel parts, use shot number 170 to 460, intensity 0.016A, coverage 2.0.
 - (c) Hone inside diameter maximum of 0.0004 inch with 63 microinch finish to achieve final hole size.
 - (7) Finish hole of steel parts with two coats of primer or chemically treat hole in aluminum parts to meet requirements of MIL-C-5541 (colored film) and apply one coat of primer. Allow to dry one hour minimum.
 - (8) Finish spotface and reworked surfaces of lugs (except holes) with manual application of colored chemical coating per BAC5719 and apply two coats of primer.
- D. Ream inside diameter of new bushing (Section A-A).
- (1) Fabricate oversize bushing per Fig. 803 for interference fit with lug or clevis.
 - (2) Install new bushing, shrink fit, with wet primer. Use -130 bushing installation tool.
 - (3) Secure -201 tool frame assembly to front spar with C-clamps and with -204 clamping pin and -215 and -218 spacers as shown in section A-A.
 - (4) Ream bushings from aft side of spar with -208 arbor, with -207 dowel press fit into -208, and -206 shell reamer. Continue to ream bushing using -220 reamer and -217 standard reamers provided.
 - (5) Hone internal diameter of bushing to 0.8780 to 0.8790 inch with machine finish 63 microinches AA.
- E. Seal bushing installation
- (1) Fill void at each end of bushing with sealant.
- F. Install vertical stabilizer (fin) (55-30-0).

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DORSAL FIN - REMOVAL/INSTALLATION

1. Remove Dorsal Fin

- A. Open front spar access doors 9503 and 9504 (Ref Access Doors and Panels, Chapter 12).
- B. Remove attachment bolts at aft end of fin (Fig. 401).
- C. Open forward access door in aft lowered ceiling.
- D. Remove section of air conditioning distribution duct above access door (Ref Passenger Cabin Conditioned Air Distribution System, Chapter 21).
- E. Open entry light lens on aft center portion of aft lowered ceiling.
- F. Remove entry light fixture by removing attaching screws.
- G. Remove insulation blankets within center portion of aft lowered ceiling to gain access to dorsal fin attachment bolts (Ref Ceiling Insulation, Chapter 25).
- H. Remove dorsal fin attachment bolts.

NOTE: To facilitate installation, note type and location of bolts.

I. Lift dorsal fin away from fuselage.

2. Install Dorsal Fin

- A. Position dorsal fin on fuselage.
- B. Install attachment bolts with pressure fillet sealant. For sealant application refer to Seals and Sealing, Chapter 51.
- C. Check gaps and mismatch tolerances as shown in Fig. 401.
- D. Replace front spar access door 9503 and 9504.
- E. Replace insulation blankets, air conditioning distribution duct section, and entry light fixture.
- F. Close aft lowered ceiling forward access door and entry light lens.

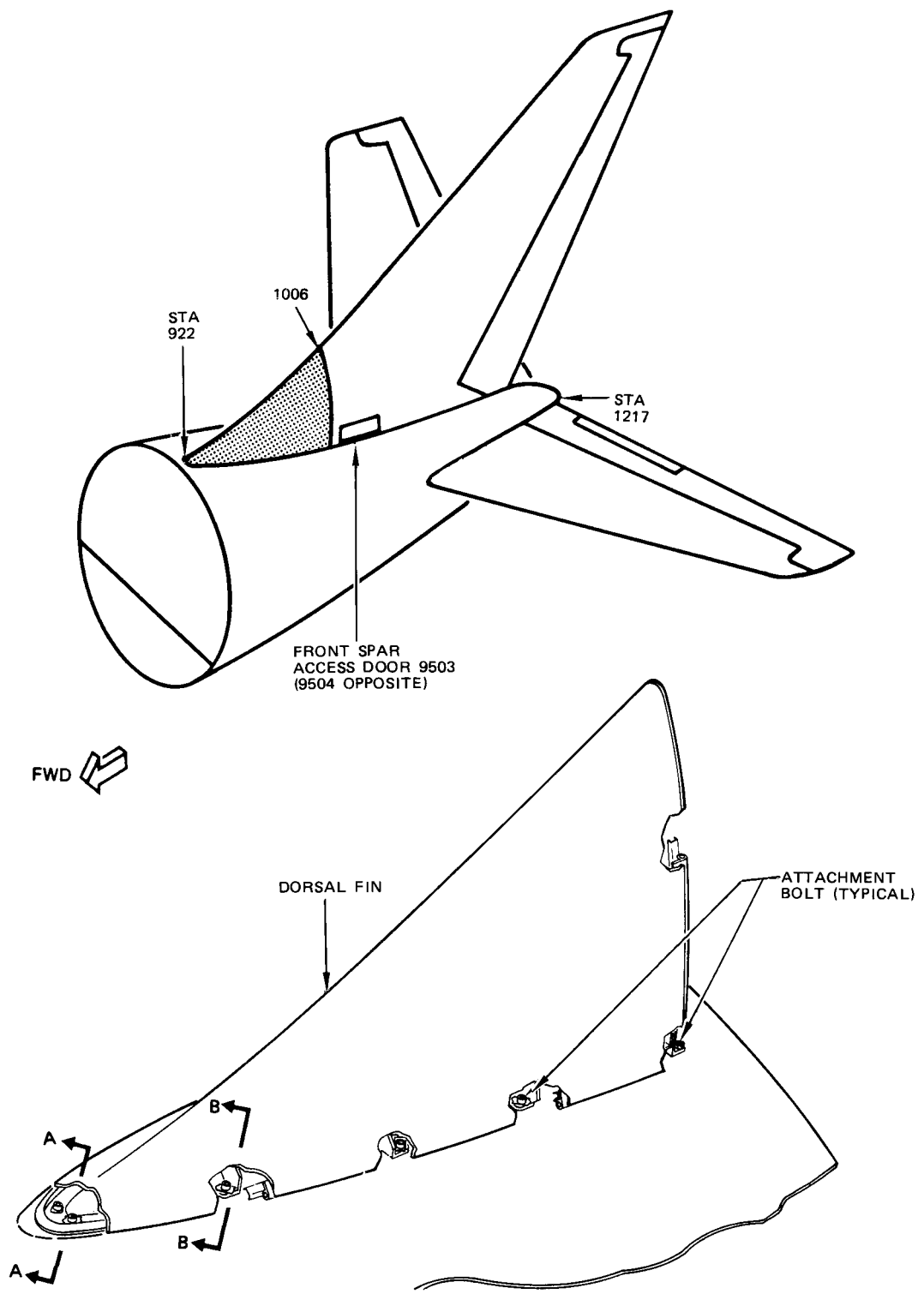
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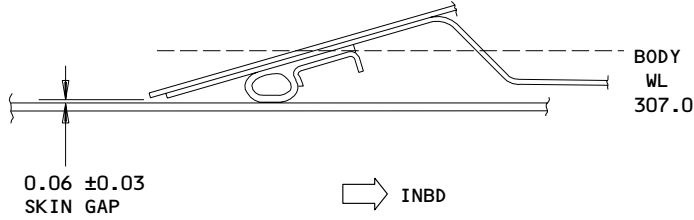
Dorsal Fin Installation
 Figure 401 (Sheet 1)

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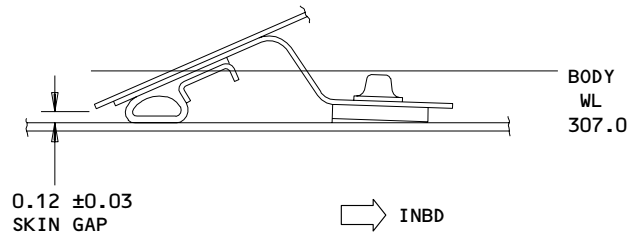
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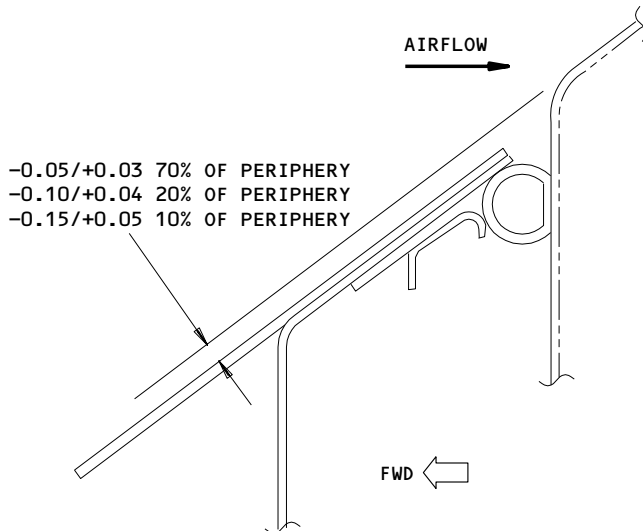
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A-A

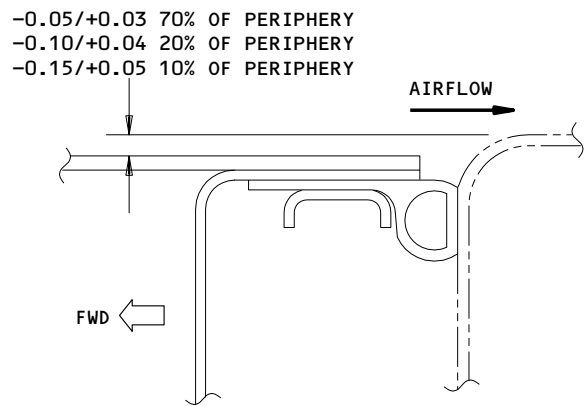


B-B



NOTE: AIRFLOW INTO MISFAIR IS DEFINED AS A POSITIVE (+) STEP.

C-C



NOTE: AIRFLOW INTO MISFAIR IS DEFINED AS A POSITIVE (+) STEP.

D-D

Dorsal Fin Installation
 Figure 401 (Sheet 2)

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VERTICAL STABILIZER (FIN) LEADING EDGE – REMOVAL/INSTALLATION

1. General

A. The fin leading edge is removable in one piece.

2. Remove Vertical Stabilizer (FIN) Leading Edge

NOTE: On airplanes with wire-type HF antennas, the antenna must be removed from the fin prior to removing the leading edge (Ref 23-11-21).

A. Remove fasteners securing vertical fin leading edge to airplane structure.

B. Remove leading edge.

C. Inspect leading edge for aerodynamic smoothness (Ref SRM 51-70).

3. Install Vertical Stabilizer (Fin) Leading Edge

NOTE: On airplanes with wire-type HF antennas, the antenna must be reinstalled following leading edge installation (Ref 23-11-21).
Assure that circuit breakers on panels P6 and P18 are open.

A. Place vertical fin leading edge into mounting position.

B. Secure leading edge to airplane structure with fasteners.

C. Tighten all fasteners, except uppermost six, 23 to 28 pound-inches.
Tighten remaining six fasteners to standard torque value.

NOTE: Fasteners shall be installed flush within a tolerance of 0.010 inch below skin level and 0.002 inch above skin level.

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VERTICAL STABILIZER (FIN) TIP - REMOVAL/INSTALLATION

1. General

- A. The fin tip consists of a forward, mid and aft fairing. The mid and aft fairings may be removed separately, but the forward fairing must be removed before the mid fairing can be removed.

2. Remove Vertical Stabilizer (Fin) Tip

- A. Open VOR/LOC-1 and VOR/LOC-2 circuit breakers on panels P18 and P6 respectively.
B. Remove fasteners from forward fairing and remove forward fairing.
C. Disconnect VOR antenna wiring.
D. Remove fasteners from midfairing and remove midfairing.
E. Remove fasteners from aft fairing and remove aft fairing.

3. Install Vertical Stabilizer (Fin) Tip

- A. Check that VOR/LOC-1 and VOR/LOC-2 circuit breakers on panels P18 and P6 respectively are open.
B. Install aft fairing by installing fasteners.
C. Install midfairing by installing fasteners.
D. Connect VOR antenna wiring.
E. Install forward fairing by installing fasteners.

NOTE: All fasteners forward of rear spar shall be installed flush within a tolerance of 0.010 inch below skin level and 0.002 inch above skin level. Fastener heads are not to be shaved.

- F. Close circuit breakers.

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RUDDER - DESCRIPTION AND OPERATION

1. General

A. The rudder is hinged from ribs mounted on the aft face of the vertical fin rear spar.

2. Rudder Structure

A. The rudder structure consists of a complete front spar and a partial rear spar, chordwise ribs and skin panels. (See figure 1.) The rudder has hinge fittings forward of its front spar. Forward of the rudder front spars are leading edge fairings and nose sections, which are housed within the vertical fin trailing edge fairing. Refer to Chapter 55 of the Structural Repair Manual for skin identification.

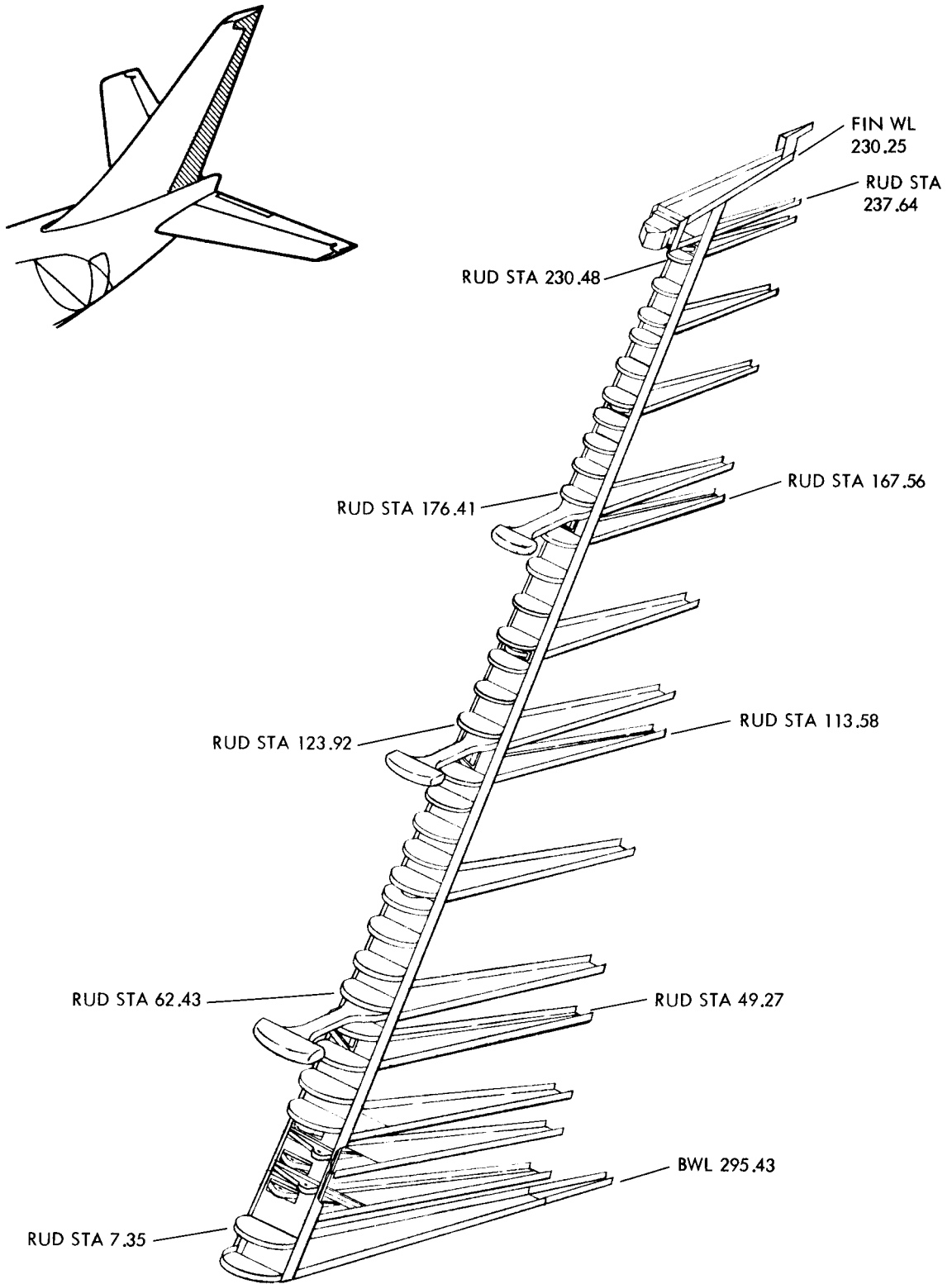
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Rudder Structure
 Figure 1

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ATTACH FITTINGS - DESCRIPTION AND OPERATION

1. General
 - A. Empennage flight control surface attach fittings are aluminum alloy forgings.
2. Horizontal Stabilizer Outboard Sections Attach Fittings
 - A. The fittings on which the horizontal stabilizer outboard sections are mounted to the center section truss are at the inboard ends of the outboard sections front and rear spars and at the outboard ends of the center section truss front and rear spars.
3. Horizontal Stabilizer Center Section Truss Attach Fittings
 - A. The fittings incorporating the hinges on which the center section truss pivots are mounted on the aft face of the truss rear spar and the bulkhead at body station 1156.
4. Elevator Attach Fittings
 - A. Fittings associated with the elevators include elevator and tab hinge fittings and fittings for the tab actuation mechanisms.
5. Vertical Fin Attach Fittings
 - A. The fittings on which the vertical fin is mounted are at body stations 1016 and 1088 and fin water line 0.
6. Rudder Attacch Fittings
 - A. The fittings on which the rudder is mounted are attached to ribs extending aft from the rear spar of the vertical fin.

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