SAFETY SUPPLEMENT

TECHNICAL MANUAL

MAINTENANCE INSTRUCTIONS

ORGANIZATIONAL

FLIGHT CONTROL SYSTEMS

A-7D

THIS PUBLICATION SUPPLEMENTS T.O. 1A-7D-2-8 DATED 15 JUNE 1976. Reference to this supplement will be made on the title page of the basic manual by personnel responsible for maintaining the publication in current status.

COMMANDERS ARE RESPONSIBLE FOR BRINGING THIS SUPPLEMENT TO THE ATTENTION OF ALL AFFECTED AF PERSONNEL.

Published under authority of the Secretary of the Air Force

8 JULY 1991

1. PURPOSE.

To update the basic manual.

2. INSTRUCTIONS.

On page 5-34A, after step c., add caution:

CAUTION

ENSURE CABLES ARE ROUTED ABOVE THE SIX DEGREE RUDDER STOP CONTROLLEX AND ARE FREE OF ALL OTHER COMPONENTS IN THE AREA. FAILURE TO DO SO MAY RESULT IN CHAFFED RUDDER CABLES.

THE END

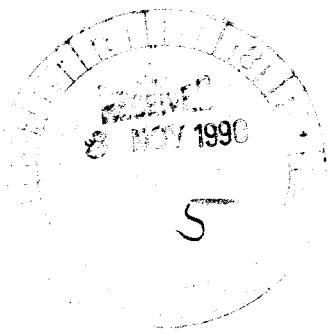
TECHNICAL MANUAL

MAINTENANCE INSTRUCTIONS

ORGANIZATIONAL

FLIGHT CONTROL SYSTEMS

A-7D



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Change 42 — 1 September 1990

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T.O. 00-25-172	Ground Servicing of Aircraft and Positioning of Equipment Status Grounding/Bonding
T.O. 1-1-1	Cleaning of Aerospace Equipment
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T.O. 1A-7D-2-2CL-1	Checklist, Egress and Survival Systems, Seat Removal and Installation
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T.O. 1A-7D-2-13CL-2	Accessory Installation: MER-10N, TER-9A, SUU-20 Series Dispenser, LAU-88/A and LAU-117/A Missile Launcher, and AERO-3B Missile Launcher Checklist
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T.O. 1A-7D-2-18-1-1	Integrated Avionic Systems (Airplanes After T.O. 1A-7-530), Theory of Operation
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TOOLS AND TEST EQUIPMENT REQUIRED.

Tools and test equipment required for a particular maintenance procedure are listed at the beginning of the procedure. The list does not include tools and equipment needed for access or common hand tools. Support equipment such as voltmeters and multimeters are included in the list.

REFERENCE PUBLICATIONS.

Publications generally related to subject matter in this manual, or specifically referenced in this manual, are listed in the table of reference publications.

TIME COMPLIANCE TECHNICAL ORDERS.

Time compliance technical orders for the system covered in this manual are listed in a table. The listing, in technical order numerical sequence, includes the basic date, title, ECP number, and date of the change or revision.

REVISION.

This manual has been revised to incorporate formalization changes.

LIST OF SYSTEMS MAINTENANCE MANUALS

T.O. 1A-7D-2-1	General Information and Airframe Group
T.O. 1A-7D-2-1CL-1	General Information and Airframe Group -- Ground Handling Checklist
T.O. 1A-7D-2-1CL-2	General Information and Airframe Group -- Servicing Checklist
T.O. 1A-7D-2-2	Egress and Survival Systems
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T.O. 1A-7D-2-10	Instrument Systems

INTRODUCTION

THIS MANUAL.

This manual contains descriptive material and organizational maintenance instructions for personnel to maintain the flight control systems of the A-7D Corsair II airplane.

This manual includes maintenance instructions on the following:

Control Stick and Grip	Section I
Aileron Control System	Section II
Roll Trim System	Section III
Spoiler/Deflector Control System	Section IV
Rudder Control System	Section V
UHT Control System	Section VI
Pitch Trim System	Section VII
Control Surface Position Indicating System	Section VIII
Flap System	Section IX
Speed Brake System	Section X

Each organizational maintenance manual, with the exception of T.O. 1A-7D-2-1, 1A-7D-2-16, 1A-7D-2-17, 1A-7D-2-18, is arranged to present organizational system and component maintenance coverage in a standard manner. A list of all A-7D organizational maintenance manuals is provided herein. Refer to T.O. 1A-7D-2-1 for the introduction to the complete series of A-7D manuals.

ARRANGEMENT AND USE OF THIS MANUAL.

The material and organizational maintenance information presented in this manual are divided into sections, one section for each major system covered.

In the description paragraphs, all major components are described and a brief explanation of their primary functions is provided. All system indicators and controls necessary to operate a system are depicted and their functions described in a controls and indicators illustration. System major components not covered by this controls and indicators illustration are shown in a system arrangement illustrati

Controls and indicators are not normally repeated in the system arrangement illustration.

In the operation paragraphs, a complete description of the system's operation is provided. Schematics and diagrams aid in the understanding of system theory. Where a system is complex, a block diagram provides a simplified overview of the system to assist understanding of the detailed descriptions and schematics. Each major component of the system is listed in a components table which summarizes its function and location.

In the operational checkout paragraphs, an operational checkout is provided to determine the operational status of the system. Where reference is made in the checkout to controls and indicators, capital (uppercase) letters of decal nomenclature are used for all test equipment and all airplane placard (decal) switch or control positions. All airplane system controls and indicators are referred to by their descriptive title in lowercase letters. Operational checkout procedural steps, which indicate a mandatory condition or result, are followed by a number or numbers in braces. These numbers are keyed to a system troubleshooting (malfunction) table which suggests corrective actions if a mandatory condition or result is not present. The corrective actions are in order of probable cause. When corrective actions call for the replacement of more than one component, replacement should be made in order of the listing. The operational checkout is usually repeated after each replacement until acceptable performance is obtained.

Removal and installation procedures are provided for each system component. These procedures reference access requirements with step by step instructions on how to accomplish the task. Also provided, as applicable, are repair and parts replacement, adjustment, cleaning, draining, lubrication, extreme environmental condition procedures, and nonroutine servicing. Routine servicing instructions are in T.O. 1A-7D-2-1.

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LIST OF ILLUSTRATIONS (Continued)

LIST OF ILLUSTRATIONS

RECORD OF TIME COMPLIANCE TECHNICAL ORDERS

Number	Date	Title	Change/Revision Date
1A-7-530	15 Mar 1988	Installation of Forward Looking infrared System on A-7 Aircraft (ECP 622)	1 Oct 1986
1A-7-562		Installation of Ring Laser Gyro Inertial Navigation System on A-7D/K Aircraft	15 Dec 1989
1A-7-572		Installation of Munitions Electrical Safety Switch	15 Dec 1989
1A-7D-756	21 June 1974	Replacement of Aileron Extension Units With Hoses, A-7D ACFT and MTS (ECP 495)	1 Jan 1975
1A-7D-765	1 Nov 1975	26 Degree Leading Edge Flap Travel Restriction, A-7D Aircraft and MTS (ECP 488)	15 Jun 1976

WARNING

To prevent possible serious injury to or death of personnel, ensure that all rocket, missile (except AIM-9), stores release, jettison, monitor and control circuits, and spin recovery and gunnery systems are safed, both electrically and mechanically, and all ejector rack cartridges are removed. AIM-9 missile cannot be electrically isolated when loaded on its launcher and must be unloaded before starting maintenance.

j. Open accesses 1232-1 and 2232-1.

k. Verify NWDC weight-off-gear bypass switch (access 1232-1) is in NORMAL.

l. On airplanes before T.O. 1A-7-562, position controls on tactical computer control (NWDC control) as follows:

Control	Position
Mode selector switch	PRES POS
Present position toggle switch	LAT-LONG
Fly to thumbwheel	0
LORAN switch	OFF
Power switch	PWR
Display brightness control	As desired

m. On airplanes after T.O. 1A-7-562, perform the following:

1. Place battery switch in BATT.

2. Place CDU system power switch in AUTO and observe the following:

(a) CMPTR fail light goes off.

(b) CDU FAIL and INS fail caution lights remain on.

(c) ADI OFF flag is in view.

(d) After 30 seconds (nominal), INS fail caution light goes off and INS NOT ALIGNED advisory light comes on.

(e) After 45 seconds (nominal), verify that CDU FAIL caution light goes off, NWDC top page is displayed on CDU, and ADI OFF flag is out of view (BSIU status is okay).

3. Select INS page using CDU left menu 3-INS pushbutton.

NOTE

Selecting inertial mode (INER) while INS NOT ALIGNED light is on (steady) causes entry into a attitude-only mode. If INS NOT ALIGNED light starts flashing before the inertial mode is selected, the INS alignment must be reinitialized by entering present position. Then, return to NWDC top page and repeat steps 3 and 4.

4. While INS NOT ALIGNED light is on (steady), select inertial mode using CDU right menu 2-INER pushbutton. Verify right menu 2 label changes to *INER.

n. Position controls on head-up display (HUD) unit as follows:

Control	Position
HUD power and symbol brightness control	Rotate clockwise from OFF (On airplanes after T.O. 1A-7-530, rotate SYM control upward to on.)
Self-test switch	OFF
Filter control (On airplanes before T.O. 1A-7-530)	As required
Panel lights control	As desired

o. On airplanes before T.O. 1A-7-562, place IMS mode select switch in MAG SL and adjust magnetic variation/latitude control for an indication of 000E/W on magnetic variation/latitude counter. Allow 2 minutes for system time in.

p. Adjust HUD power and symbol brightness control for desired display brightness.

q. Deselect all master function switches (white).

r. Place all armament select panel switches in OFF or SAFE.

s. Select SINGLE sequence, quantity of 01, and interval of 000 feet.

t. Place master arm switch in MASTER ARM.

u. Momentarily press armament-safety-disable switch to DISABLE.

v. On airplanes before T.O. 1A-7-562, verify CMPTR, IMS, and HUD FAIL caution lights are off and HSI and ADI power off flags are out of view.

w. Place air data computer in self-test as follows:

1. Press and release ADC SELF TEST SELECT switch until a steady 1 is displayed on ADC BIT panel display.

2. Press and release ADC SELF TEST run switch. Right digit of ADC BIT panel display will display a flashing 1 until all outputs have reached their preset values.

3. Verify right digit of ADC BIT panel displays a steady 1 after 10 seconds.

4. Open circuit breaker CB376.

x. Place weight-off-gear bypass switch in TEST and verify latitude and longitude values on NWDC display start changing.

y. Rotate angle-of-attack vane to position HUD FPM symbol wings even with horizon line.

z. Select NORM (VISUAL) ATTACK mode on MFS and verify NORM (VISUAL) ATTACK MFS comes on green.

aa. Place station 1 select switch in RDY and verify following:

1. BOMB SINGLE AND MECH FUZE advisory lights come on.

2. HUD indicates bombs attack with AR centered in FPM.

ab. Using C-4504A/ARW-77 control selector (BPC), slew HUD AR and BFL symbols below and to one side of the FPM symbol, then release BPC.

ac. Press and release armament release switch on stick grip. BFL symbol must separate from AR symbol and move to a position halfway between the AR and FPM symbols.

ad. Press and release target designate switch on pilot's stick grip. BFL and AR symbols must center on the FPM symbol.

ae. Turn off HUD, tactical computer, and IMS (airplanes before T.O. 1A-7-562) or INS (airplanes after T.O. 1A-7-562) and deselect NORM (VISUAL) ATTACK MFS.

WARNING

On airplanes before T.O. 1A-7-572, failure to place battery switch in OFF could result in injury to or death of personnel due to inadvertent firing of impulse cartridges installed in MAU-12 ejector racks.

CAUTION

On airplanes after T.O. 1A-7-572, failure to place battery switch in OFF before disconnecting external electrical power will result in excessive drain on battery.

af. Place battery switch in OFF.

WARNING

To Prevent firing of gun, ensure that electrical connector is disconnected from the gun control unit and clearing sector clamp is installed.

ag. Open access 1222-3 and ensure that electrical connector P209 is disconnected from the gun control unit and stowed.

ah. Open access 1222-8. Gain access through gun shroud cover and install clearing sector clamp (T.O. 1A-7D-2-13).

CAUTION

Turn handcrank in clockwise direction only. Turning crank counterclockwise may result in damage to the gun system.

ai. Open access 1222-6-2 and connect handcrank to drive socket. Rotate gun and ensure that gun bolts are in clearing cam path. Remove crank and close access.

aj. Place ASCU store type switch for stations 3 or 6 in BN. Select corresponding station (3 or 6).

ak. Place master arm switch in MASTER ARM.

al. Momentarily actuate armament safety disable switch (access 1232-1) to DISABLE.

am. Pull trigger to second detent, then release to first detent and hold.

an. While holding trigger in first detent, check that multimeter indicates 28 volts dc at pin 10 of 216-97732-101 adapter harness. If harness is not installed, check for 28 volts dc at pylon NO VOLTAGE TEST-STORES jack. Release trigger; multimeter should indicate 0 volts at either place.

ao. Place station 3 or 6 select switch in OFF.

ap. Place master armament switch in OFF.

aq. Close circuit breaker CB376.

ar. Disconnect external electrical power.

as. Place ASCU store type switch for station checked in AK.

at. Remove clearing sector clamp and close gun shroud cover.

au. Close access 1222-8, 1232-1, and 2232-1.

1-11. MECHANICAL CHECKOUT.

NOTE

This checkout should be performed only if control stick is replaced.

a. Perform aileron control system operational checkout (paragraph 2-25 or 2-26). Leave external electrical and hydraulic power connected.

b. Perform UHT control system operational checkout (paragraph 6-30).

1-12. TROUBLESHOOTING.

1-13. The control stick and grip is checked in conjunction with the aileron and UHT control systems. Refer to Sections II and VI for troubleshooting.

1-14. STICK GRIP REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
	GGG-W-686	Torque wrench, 10 to 150 pound-inches	Secure sensor to stick grip
	215-00407-1	Stick grip removal and installation tool	Loosen and tighten retainer nut
	54E602 or 55J753	Stick grip tester	Check out stick grip

1-15. REMOVAL. (See figure 1-1.)

a. Ensure that airplane is parked in accordance with T.O. 1A-7D-2-1.

WARNING

Ensure that internal gun, external stores, and bomb racks are safed in accordance with T.O. 1A-7D-33-1-2 and T.O. 11A-1-33. Accidental firing of gun or release of stores may cause death or serious injury to personnel.

b. Ensure that fuel master lever on left console is in OFF, and ensure that external electrical power is disconnected from airplane (T.O. 1A-7D-2-1).

c. Loosen and remove three setscrews (1).

d. Cut and remove lockwire securing nut (2).

NOTE

Install tool with recessed area facing down and positioned over stick force sensor.

e. Place stick grip removal and installation tool over retaining nut (2) and align knurled knob screws on tool with two setscrew holes in nut.

f. Screw knob screws into retaining nut finger-tight.

g. Place torque wrench with 1/4-inch drive into hole provided in tool.

h. While holding stick grip firmly to prevent twisting, loosen retaining nut (2). Remove tool from nut.

CAUTION

Do not turn stick grip or damage to electrical components may result.

i. Pull upward on stick grip (3) while unscrewing nut (2) to aid in separating stick grip connector from sensor (4).

j. Remove stick grip from airplane.

1-16. INSTALLATION. (See figure 1-1.)

CAUTION

Before installation of stick grip, a complete checkout of the stick grip must be performed using a stick grip tester or multimeter. The stick grip must pass all technical checks before installation or damage to airplane may result.

NOTE

If stick grip checkout cannot be accomplished using either the tester or multimeter, it will be necessary to accomplish electrical operational checkout in accordance with paragraph 1-10 after stick grip is installed.

a. Perform checkout of stick grip using 54E602 or 55J753 stick grip tester. If necessary, alternate checkout of stick grip may be performed using a multimeter and procedures in T.O. 16C1-27-15-2.

a-1. Position stick grip (3) on stick force sensor (4) so that key (5) aligns with keyway (6).

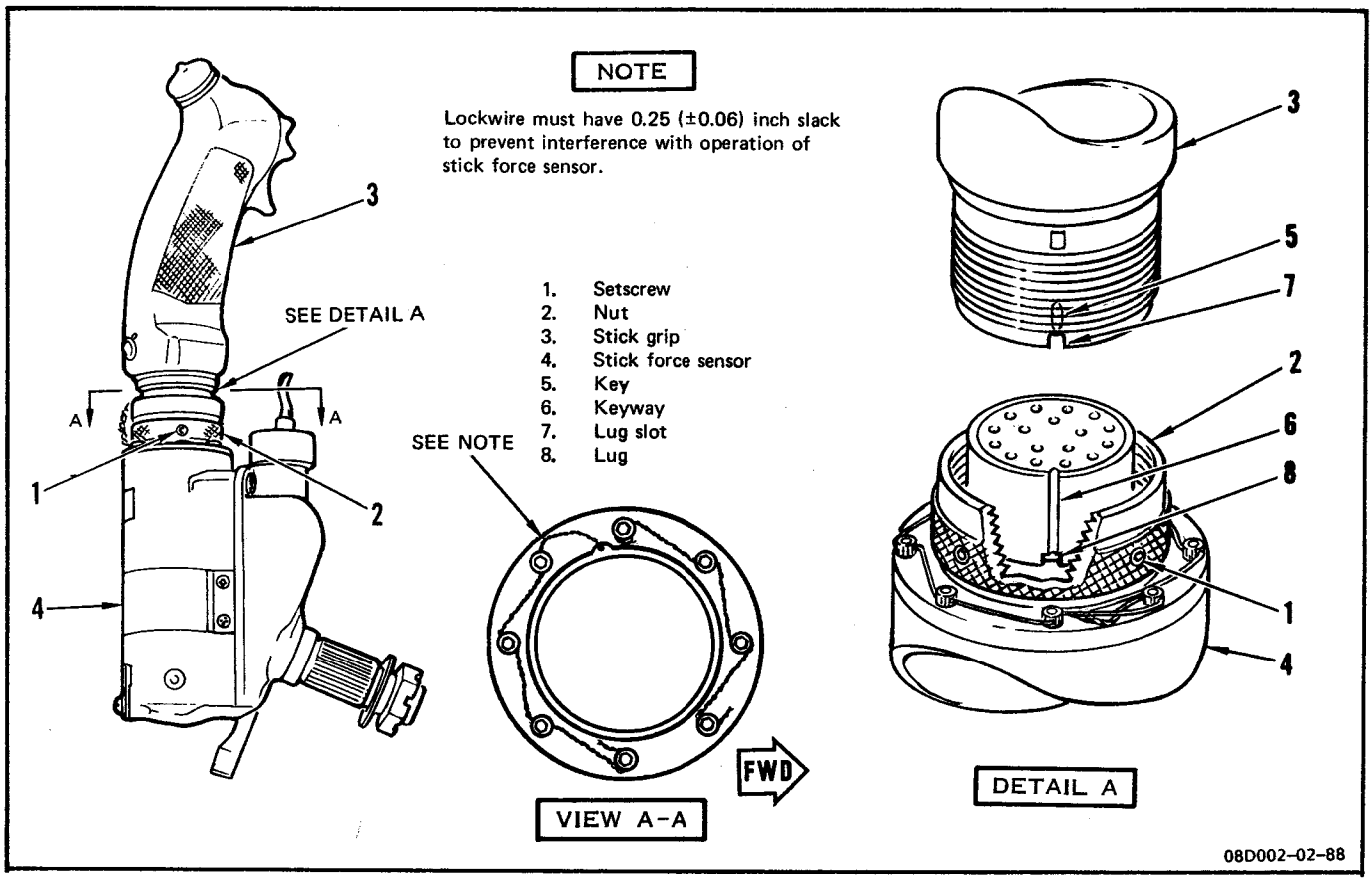

Figure 1-1. Stick Grip Removal and Installation

CAUTION

Do not turn stick grip or damage to electrical components may result.

NOTE

Press downward slightly on stick grip while tightening nut (2) to aid in seating connector.

b. Seat connector and handtighten retaining nut (2) until lug slots (7) seat on lugs (8) or retaining nut will no longer turn by hand.

c. Check that gap between retaining nut and flange of stick grip is approximately 1/4 inch. If gap exceeds 1/4 inch, repeat step b to obtain desired gap.

NOTE

Install tool with recessed area facing down and positioned over stick force sensor. To ensure correct torque is applied, install torque wrench 90° to centerline of tool.

d. Using stick grip removal and installation tool, tighten retaining nut (2) to 135 (±5) pound-inches torque. Remove tool from nut.

e. Install and tighten setscrews (1) to 16 (±2) pound-inches torque.

f. Secure retaining nut (2) to convenient screw on sensor (4) with MS20995C20 lockwire. Leave 0.25 (±0.06) inch radius loop in lockwire to prevent interference with operation of stick force sensor. Ensure that all other nuts on sensor (4) are secured with MS20995C20 lockwire using approved methods in T.O. 1-1A-8.

g. If stick grip was not checked out using a stick grip tester or multimeter, perform electrical operational checkout (paragraph 1-10).

1-17. STICK GRIP INSPECTION AND REPAIR.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	54E602 or 55J753	Stick grip tester	Support stick grip for test
	L30 or L30M	Pull/push tester kit	Adjust finger force on trigger

1-17A. STICK GRIP INSPECTION.

WARNING

Ensure that internal gun, external stores, and bomb racks are safed in accordance with T.O. 1A-7D-33-1-2 and T.O. 11A-1-33. Accidental firing of gun or release of stores may cause death of or serious injury to personnel.

a. Remove pilot's stick grip, part No. A218-961767-03, in accordance with paragraph 1-14.

b. Inspect stick grip for cracks and for damaged mounting threads. Then, inspect stick grip roll and pitch trim switch for loose, broken, or missing button.

1-17B. STICK GRIP TRIGGER TEST.

a. Install stick grip on tester, part No. 54E602 or 55J753.

b. Using pull/push tester (part No. L30, National Stock No. 6635-00-578-5286) with V push adapter, push trigger, part No. 192-400649-00, until both lights illuminate.

CAUTION

Before installation of stick grip, ensure a complete check-out of the stick grip is performed using stick grip tester or multimeter. The stick grip must pass all technical checks before installation or damage to airplane may result.

c. Perform checkout and install stick grip in accordance with paragraph 1-14.

All data on page 1-6B deleted.

1-17C. STICK GRIP REPAIR.

a. Inspect stick grip roll and pitch trim switch for loose, broken, or missing button.

b. If button is broken or missing, replace entire roll and pitch trim switch (T.O. 16C1-27-15-2).

c. If button is loose, repair by applying MIL-A-8623 Type 1 epoxy adhesive evenly and thinly to threads and internal lockwasher located inside the top of button. Cure for 24 hours at no less than 70°F. To accelerate cure time, use heat lamp.

1-18. CONTROL STICK REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	GGG-W-686	Torque wrench, 100 to 750 pound-inches	Secure bearing retainer to stick assembly

1-19. REMOVAL. (See figure 1-2.)

a. Remove ejection seat (T.O. 1A-7D-2-2).

b. Open accesses 1123-1, 1123-4, 1211-2, 2123-3, 2211-2, and 2211-3.

c. Remove tactical computer control (T.O. 1A-7D-2-14) and oxygen control panel (T.O. 1A-7D-2-3).

d. Remove screws attaching boot (1) to base of control stick (2).

e. Release boot fasteners and remove boot.

f. Disconnect relief tube and hose from cover installation at base of control stick.

g. Remove armor plate and coverings around base of control stick (T.O. 1A-7D-2-1).

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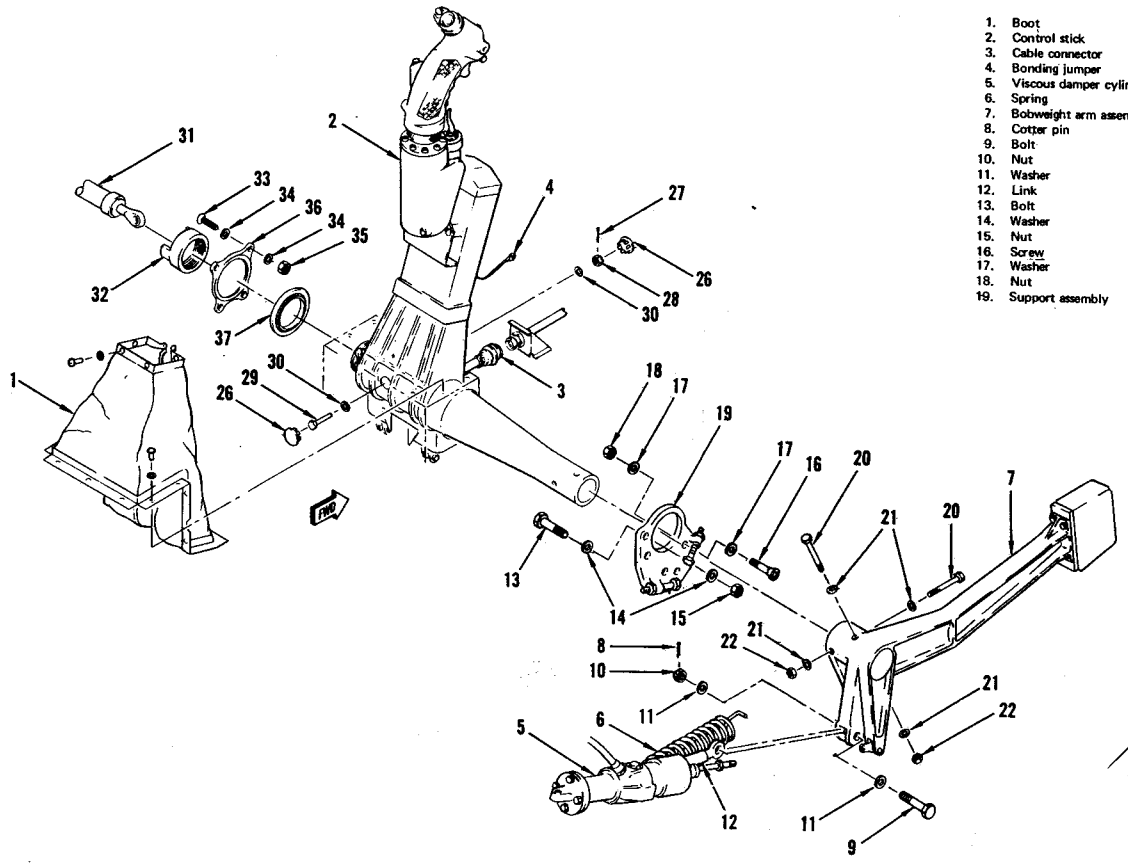

1. Boot
2. Control stick
3. Cable connector
4. Bonding jumper
5. Viscous damper cylinder
6. Spring
7. Bobweight arm assembly
8. Cotter pin
9. Bolt
10. Nut
11. Washer
12. Link
13. Bolt
14. Washer
15. Nut
16. Screw
17. Washer
18. Nut
19. Support assembly
20. Bolt
21. Washer
22. Nut
23. Load limiting link
24. Input link
25. Arm
26. Plug button
27. Cotter pin
28. Nut
29. Bolt
30. Washer
31. Aileron link
32. Retainer
33. Screw
34. Washer
35. Nut
36. Retainer
37. Bearing

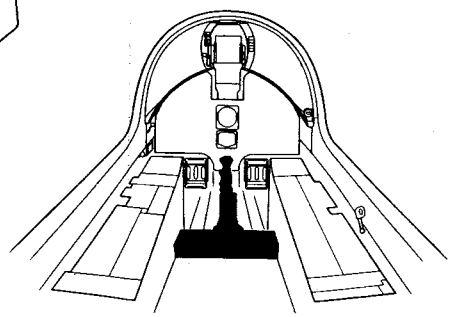

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Figure 1-2. Control Stick Assembly Removal and Installation (Sheet 1)

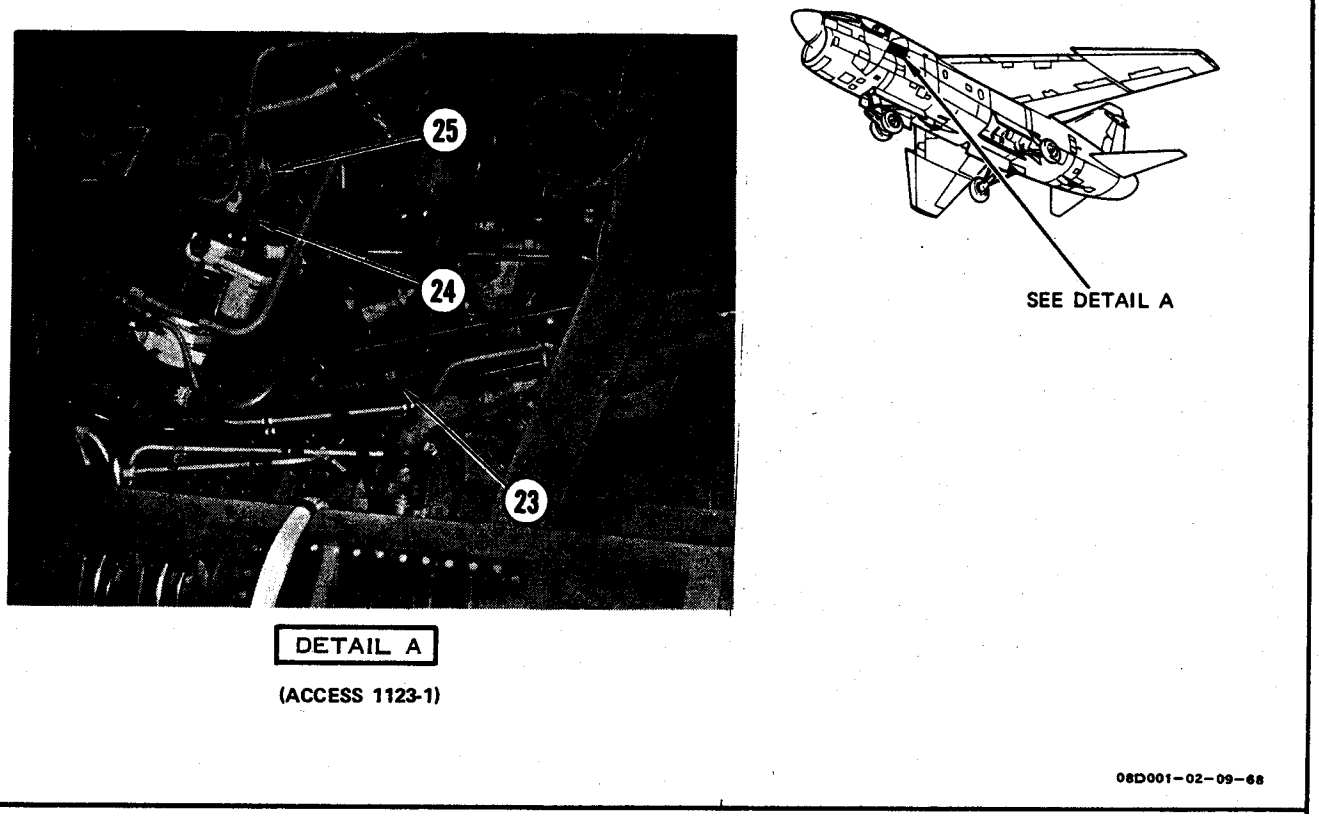


Figure 1-2. Control Stick Assembly Removal and Installation (Sheet 2)

h. Remove floor boards.

i. Disconnect control stick cable connector (3) and bonding jumper (4) at cockpit floor opening forward of control stick.

j. Disconnect viscous damper cylinder (5) from bobweight arm assembly by cutting lockwire and loosening rod end jamnut until locking tab washer is free. Unscrew piston rod from rod end.

NOTE

Note hole in which spring (6) is connected for use during installation.

k. Disconnect spring (6) from bobweight arm assembly (7).

l. Remove cotter pin (8), nut (10), bolt (9), and two washers (11) and disconnect link (12) from bobweight arm assembly (7).

m. Remove two bolts (13), four washers (14), two nuts (15), three screws (16), six washers (17), and three nuts (18) attaching support assembly (19) to floor structure.

NOTE

The bobweight arm assembly is attached to the control stick torque tube by two close-tolerance bolts. If bolts are difficult to remove, drill heads off bolts and drive them out.

n. Remove two bolts (20), four washers (21), and two nuts (22) attaching arm assembly to control stick shaft and move assembly outboard.

o. Disconnect forward end of forward load-limiting link (23) from bellcrank.

p. Disconnect input link (24) for aileron viscous damper cylinder from arm (25).

q. Remove two plug buttons (26) for access to aileron link connection inside base of control stick.

r. Remove cotter pin (27), nut (28), bolt (29), and two washers (30) to disconnect aileron link (31).

s. Cut lockwire and unscrew retainer (32).

t. Remove four screws (33), eight washers (34), and four nuts (35) and remove retainer (36) from center control stick support.

CAUTION

To prevent damage, support bearing housing while bearing is being removed.

u. Remove bearing (37) from center control stick bearing housing.

NOTE

Stick and bobweight arm are a matched set and should not be interchanged with other sticks or arms.

v. Remove control stick and bobweight arm assembly from cockpit. Bobweight arm assembly must be removed through top of console.

1-20. INSTALLATION. (See figure 1-2.)

WARNING

Alodine is moderately toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate.

Epoxy primer is highly toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate.

a. Coat mounting surface of support assembly (19) and faying surfaces between support assembly and control stick shaft and faying surfaces between bobweight arm assembly and control stick shaft with MIL-C-5541 (Alodine 1200s) conversion coat with epoxy primer applied in accordance with T.O. 1-1-2, paragraph 6-10.d., NOTE.

b. Install MIL-T-23142 tape on mounting surface of support assembly (T.O. 1A-7D-23).

c. Place control stick (2), support assembly (19), and bobweight arm assembly (7) in position in cockpit.

WARNING

Corrosion preventive compound is flammable and slightly toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate.

d. Coat heads and shanks of screws (16) and bolts (13) with MIL-C-16173, grade 1, corrosion preventive compound and secure support assembly to cockpit floor with two bolts (13), four washers (14), two nuts (15), three screws (16), six washers (17), and three nuts (18).

e. Coat center stick support bearing bore with MIL-C-5541 (Alodine 1200s) conversion coat with epoxy primer applied in accordance with T.O. 1-1-2, paragraph 6-10.d., NOTE and install bearing (37).

f. Install MIL-T-23142 tape between retainer (36) and mounting surface. Coat heads and shanks of screws (33) with MIL-C-16173, grade 1, corrosion preventive compound (T.O. 1A-7D-23) and install retainer with four screws (33), eight washers (34), and four nuts (35).

g. Coat retainer (32) with MIL-C-16173, grade 1, corrosion preventive compound and screw retainer onto control stick shaft. Tighten retainer to 175 (±25) pound-inches torque. Secure retainer with MS20995C32 lockwire.

h. Coat plug buttons (26) and mating surface with MIL-C-5541 (Alodine 1200s) conversion coat with epoxy primer applied in accordance with T.O. 1-1-2, 6-10.d., NOTE and connect aileron link (31) to bellcrank inside control stick with bolt (29), two washers (30), and nut (28). Install cotter pin (27) and plug buttons (26).

i. Coat heads and shanks of bolts (20) with MIL-C-16173, grade 1, corrosion preventive compound and secure bobweight arm assembly (7) to stick shaft with two bolts (20), four washers (21), and two nuts (22).

j. Touch up all bare areas on support stick shaft with MIL-C-5541 (Alodine 1200s) conversion coat with epoxy primer applied in accordance with T.O. 1-1-2, paragraph 6-10.d., NOTE.

k. Connect viscous damper cylinder (5) to bobweight arm assembly (7) by screwing piston rod into rod end until distance between center of rivet and shoulder on piston rod is 1.75 (±0.03) inches. Engage lockwasher tab in slot, tighten jamnut and secure with MS20995C32 lockwire.

l. Connect link (12) to bobweight arm assembly (7) with bolt (9), two washers (11), nut (10), and cotter pin (8).

m. Connect spring (6) (in same hole noted during removal) to bobweight arm assembly (7).

n. Connect forward end of forward load-limiting link (23) to bellcrank.

o. Connect input link (24) to arm (25).

p. Connect control stick cable connector (3) and bonding jumper (4) at cockpit floor opening forward of control stick. Check that cable has sufficient slack to be fully suspended with stick in full aft position.

q. Install tactical computer control (T.O. 1A-7D-2-14) and oxygen control panel (T.O. 1A-7D-2-3).

r. Install floor boards.

s. Install coverings and armor plates around base of control stick (T.O. 1A-7D-2-1).

t. Install relief tube and hose on coverings and stick base.

u. Position boot (1) around stick base and secure with screws. Engage boot snap fasteners.

v. Perform operational checkout (paragraph 1-9).

w. Install ejection seat (T.O. 1A-7D-2-2).

x. Close accesses 1123-1, 1123-4, 1211-2, 2123-3, 2211-2, and 2211-3.

1-21. CONTROL STICK REPAIR.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	215-00110-4	Rigging pin No. 25	Rig linkage
	GGG-W-686	Torque wrench, 10 to 150 pound-inches	Tighten nut
			TT08D161-09-72

NOTE

Disassemble only to extent required for repair or replacement of defective parts.

1-22. DISASSEMBLY. (See figure 1-3.)

NOTE

Ejection seat does not have to be removed if only the stick grip or stick force sensor is being replaced.

a. Remove ejection seat (T.O. 1A-7D-2-2).

b. Remove screws attaching boot (1) to base of control stick. Release fasteners and remove boot.

c. Disconnect relief tube and hose from cover at base of control stick.

d. Remove armor plates and coverings around base of control stick (T.O. 1A-7D-2-1).

e. Disconnect control stick cable connector (2) from receptacle and remove connector from cable (T.O. 1A-7D-2-11).

f. Remove cotter pin (3), nut (4), washer (5), clamp (6), and washer (7) from control stick housing (8). Leave bolt (9) and washer (10) in place for later removal. Remove clamp from harness.

g. Remove three screws (11) and cap (12) from top of control stick housing.

h. Remove cotter pin (13), nut (14), washers (15), and bolt (16) from arm (17).

i. Remove stick grip (18) (paragraph 1-14).

j. Cut lockwire and remove nut (19) and washers (20 and 21).

k. Remove stick force sensor (22) and cable from control stick.

l. Cut lockwire and remove screws (22B and 22D) and washers (22C and 22E) from adapter (22A).

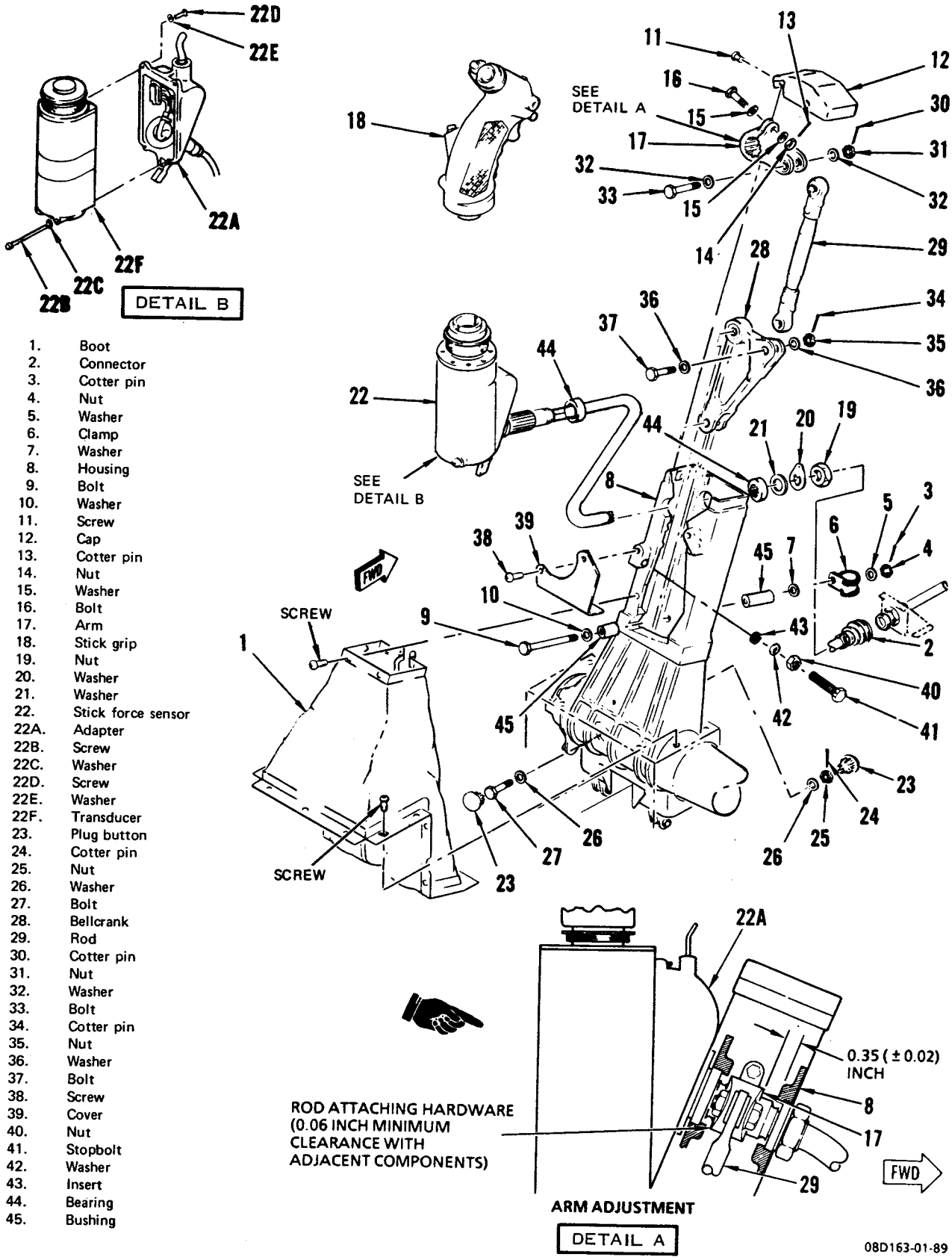
m. Remove adapter (22A) from transducer (22F).

n. Remove plug buttons (23), cotter pin (24), nut (25), washers (26), and bolt (27) to disconnect bellcrank (28) from aileron link.

o. Remove bolt (9) and washer (10), and lift arm (17), rod (29), and bellcrank from housing.

p. Remove cotter pin (30), nut (31), washers (32), and bolt (33) to disconnect arm from rod.

q. Remove cotter pin (34), nut (35), washers (36), and bolt (37) to disconnect rod from bellcrank.



1. Boot
2. Connector
3. Cotter pin
4. Nut
5. Washer
6. Clamp
7. Washer
8. Housing
9. Bolt
10. Washer
11. Screw
12. Cap
13. Cotter pin
14. Nut
15. Washer
16. Bolt
17. Arm
18. Stick grip
19. Nut
20. Washer
21. Washer
22. Stick force sensor
22A. Adapter
22B. Screw
22C. Washer
22D. Screw
22E. Washer
22F. Transducer
23. Plug button
24. Cotter pin
25. Nut
26. Washer
27. Bolt
28. Bellcrank
29. Rod
30. Cotter pin
31. Nut
32. Washer
33. Bolt
34. Cotter pin
35. Nut
36. Washer
37. Bolt
38. Screw
39. Cover
40. Nut
41. Stopbolt
42. Washer
43. Insert
44. Bearing
45. Bushing

Figure 1-3. Control Stick Repair

r. Remove two screws (38) and cover (39) from housing.

s. Loosen nuts (40) and remove stopbolts (41) and washers (42) from left and right stop lugs.

t. Remove inserts (43) from stop lugs.

u. Press out bearings (44) and bushings (45) from housing.

1-23. CLEANING AND INSPECTION.

WARNING

P-D-680 is combustible and moderately toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate.

a. Clean all parts except stick grip (18) and stick force sensor (22) in P-D-680 drycleaning solvent.

b. Inspect parts for cracks, dents, nicks, distortion, corrosion (T.O. 1A-7D-23), wear, and other damage.

1-24. REPAIR.

a. Clean minor corrosion from parts (T.O. 1A-7D-23). Replace excessively corroded parts.

b. Replace defective parts with provisioned parts.

c. Press defective bearings or bushings from parts.

1-25. ASSEMBLY. (See figure 1-3.)

a. Apply MIL-C-5541 (Alodine 1200s) conversion coat with epoxy primer applied in accordance with T.O. 1-1-2, paragraph 6-10.d., NOTE and press bushings (45) into housing.

b. Line-ream bushings 0.2500 (±0.005) inch diameter and spot-face outer end flush with housing.

c. Apply wet MIL-C-5541 (Alodine 1200s) conversion coat with epoxy primer applied in accordance with T.O. 1-1-2, paragraph 6-10.d., NOTE and press bearings (44) into housing.

d. Apply wet MIL-C-5541 (Alodine 1200s) conversion coat with epoxy primer applied in accordance with T.O. 1-1-2, paragraph 6-10.d., NOTE and install inserts (43) into left and right stop lugs three-fourths to one turn below surface of lug. Remove tang.

e. Install washers (42), stopbolts (41), and nuts (40) in stop lugs.

f. Connect bellcrank (28) to rod (29) with bolt (37), with head aft, washers (36), and nut (35).

g. Install new cotter pin (34).

h. Connect arm (17) to rod (29) with bolt (33), with head aft, washers (32), and nut (31).

i. Install new cotter pin (30).

j. Lower arm, rod, and bellcrank assembly into housing. Install bolt (9) and washer (10) through housing and bellcrank. Temporarily install nut (4) to keep bolt in place.

k. Connect lower end of bellcrank to aileron control link with bolt (27), with head aft, washers (26), and nut (25).

l. Install new cotter pin (24).

m. Install plug buttons (23) in access holes.

n. Install adapter (22A) on transducer (22F) with screws (22B and 22D) and washers (22C and 22E). Secure screws with MS20995C20 lockwire per MS33540.

o. Run cable through housing and arm (17). Align index-marked spline of stick force sensor shaft with index-marked spline of arm (17) and install stick force sensor (22).

CAUTION

Over tightening of nut (19) will cause excessive friction in system.

p. Install washers (20 and 21) and nut (19). Thread nut far enough onto shaft to remove end play, but do not tighten. Check for free rotation of shaft in bearings.

q. Secure nut (19) with MS20995C32 lockwire.

r. Install connector (2) on end of cable (T.O. 1A-7D-2-11) and connect to receptacle.

s. Install clamp (6) on cable and secure to housing (8) with washer (7) and bolt (9), washer (5) and nut (4). Install thin washer under bolt head and under clamp.

t. Install new cotter pin (3).

u. Check that cable is freely suspended with stick in full aft position.

v. Install stick grip (18) (paragraph 1-14) except do not perform operational checkout at this time.

w. Install bolt (16), with head left, in arm (17) with washers (15) and nut (14). Do not tighten nut.

x. Position arm (17) on stick force sensor shaft so hardware attaching rod (29) to arm clears adjacent components by minimum of 0.06 inch when stick grip is moved.

y. Torque nut (14) 16 to 20 pound-inches and install new cotter pin (13).

z. Cycle control stick grip laterally and ensure that no interference exists between housing boss and nut (14) or cotter pin (13).

aa. Check stick grip centering as follows:

1. Insert rigging pin No. 25 through housing and bellcrank (28).

2. Check that stick grip is in alignment with stick assembly.

3. If angle of stick grip appears to vary from that of stick assembly, recheck indexing of stick force sensor shaft splines with splines in arm (17).

4. Remove rigging pin.

ab. Install cap (12) on top of control stick housing with three screws (11).

ac. Install armor plates and coverings around base of control stick.

ad. Reconnect relief tube and hose on cover at base of control stick.

ae. Position boot (1) around base of control stick and secure with washers and screws.

af. Rig roll control stick stops (paragraph 2-45).

ag. Perform operational checkout (paragraph 1-9).

ah. Install cover (39) with two screws (38).

ai. Install ejection seat (T.O. 1A-7D-2-2).

Section II

AILERON CONTROL SYSTEM

2-1. DESCRIPTION.

2-2. The aileron control system is a hydromechanical system used to produce airplane movement about the roll axis. System inputs are provided by lateral movement of the control stick, series trim signals, and signals from the automatic flight control system.

2-3. The aileron surfaces are installed across the wing outer panel trailing edge and may be fully cycled while the outer panels are folded. Roll control is obtained through a tandem hydraulic cylinder installed in each wing outer panel. Artificial control stick feel forces are provided by a mechanical spring arrangement. A roll feel isolation actuator, located downstream of the system feel spring, isolates the control stick from forces induced by spoiler load-limiting links and reactions from the stabilization actuator.

2-4. In addition to the aileron control surfaces, roll control is also provided through the spoiler/deflector control system. The same control linkage, up to the aileron trim and mixing linkage, is used for both systems. For more information on the spoiler/deflector control system, refer to paragraph 4-1.

2-5. For system controls and indicators, see figure 2-1. For system arrangement, see figure 2-2.

2-6. OPERATION. (See figures 2-3 and 2-4.)

2-7. Lateral movement of the control stick is mechanically transmitted to the aileron and spoiler/deflector control linkage.

2-8. A viscous damper cylinder is installed in the lateral control linkage between the control stick and the forward load-limiting link. The viscous damper resists control stick movement in the lateral direction in proportion to stick velocity.

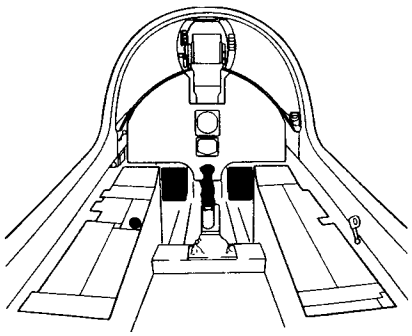
2-9. A load-limiting link is installed in the lateral control linkage between the viscous damper and the roll feel isolation actuator. The load-limiting link normally acts as a fixed-length link, but has a breakout force. When loads on the control linkage exceed the breakout force of the load-limiting link, it extends or compresses to prevent linkage or actuator servo valve damage.

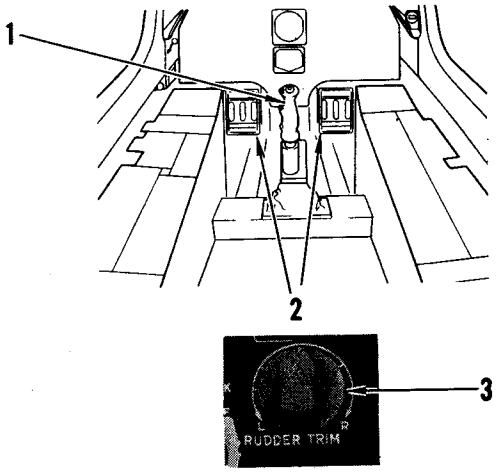
2-10. A bobweight is installed in the lateral control system linkage between the viscous damper and the roll feel isolation actuator to balance the mass of the stick grip and force sensor during lateral acceleration.

2-11. Movement of the stick laterally displaces a mechanical feel spring assembly, which provides simulated feel forces at the grip. The feel spring returns the control stick to neutral when the stick is deflected and released.

2-12. A roll feel isolation actuator is installed downstream of the feel spring assembly to isolate the control stick from forces induced by load-limiting links and from AFCS actuator reactions. When the control stick is moved, it strokes the feel isolation actuator servo valve. The servo valve slider is repositioned to direct hydraulic fluid to the actuator cylinder. The actuator piston rod is connected to the structure so that, as the actuator is pressurized, the cylinder housing moves in the appropriate direction corresponding to stick deflection, providing an input into the remaining control linkage. The servo valve is an integral part of the actuator. As the cylinder housing moves, the servo valve slider is returned to neutral where the valve blocks fluid flow to and from the actuator.

2-13. Downstream of the roll feel isolation actuator, an AFCS roll actuator is connected into the control linkage by a scissors linkage. When the roll AFCS is not operating, the scissors linkage acts as an idler. When the AFCS actuator moves, the scissors linkage acts as a





INDEX NO.	CONTROL/INDICATOR	FUNCTION
1	Control stick	Provides aileron and spoiler/deflector control system inputs when positioned laterally.
		Provides UHT control system inputs when positioned forward and aft.
2	Rudder pedals	Provides left or right rudder control inputs when applicable rudder pedal is pushed forward.
3	Rudder trim control (RUDDER TRIM)	L or R — provides yaw trim signal inputs to AFCS yaw amplifier computer to trim rudder.

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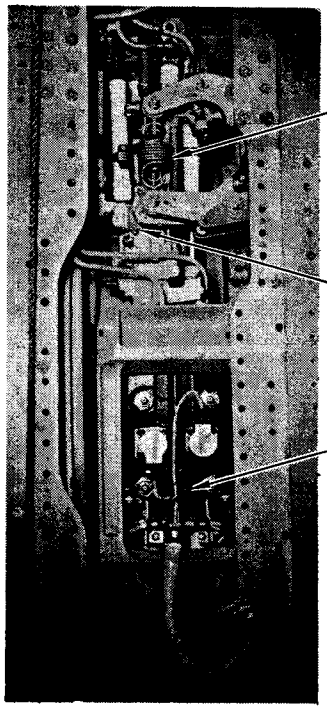
Figure 2-1. Aileron, Rudder, and UHT Control System Controls

variable-length link. This produces control system inputs independent of the control stick. For additional information on the automatic flight control system, refer to T.O. 1A-7D-2-9.

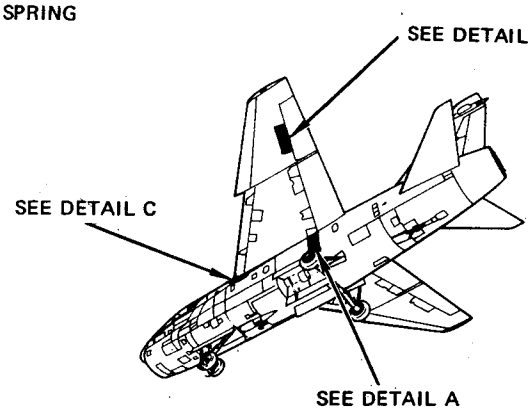
2-14. Output motion from the AFCS actuator is transmitted through the control system to the aileron trim and mixing linkage. The mixing linkage consists of scissors, with one end of one leg pivoted to structure and the opposite end connected to the left and right spoiler/deflector wing control linkage, through dead band stops. These stops allow 2°30' (±0°15') of aileron trailing edge up travel before spoiler/deflector motion begins. The other leg of the scissors is connected to an electromechanical roll trim actuator at one end and to the left and right wing aileron control linkage at the other end. Aileron trim operation thus does not affect spoiler/deflector positioning, as commanded by AFCS and/or pilot inputs. For more information on the spoiler/deflector control system, refer to paragraph 4-1.

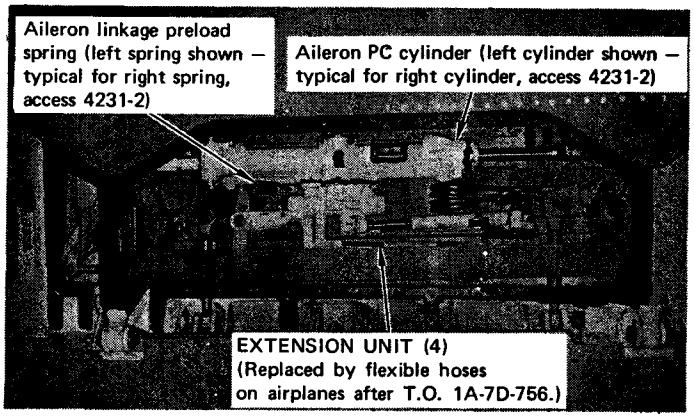
2-15. The roll trim actuator acts as a fixed ground point, the position of which shifts with roll trim inputs. This produces only aileron control system inputs independent of the control stick. For additional information on the roll trim system, refer to paragraph 3-1.



DETAIL A

(ACCESS 5113-1)

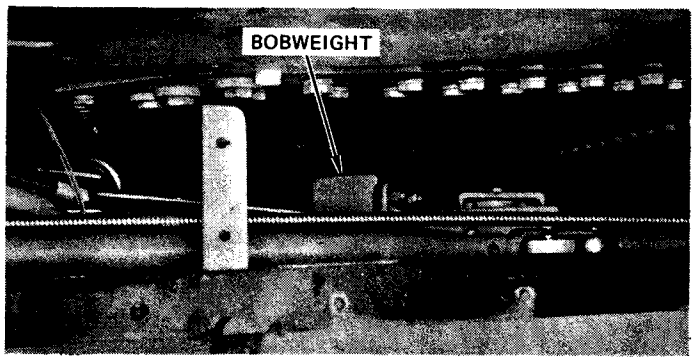




DETAIL B

(ACCESS 3232-1)

FWD



DETAIL C

(ACCESS 1132-1)

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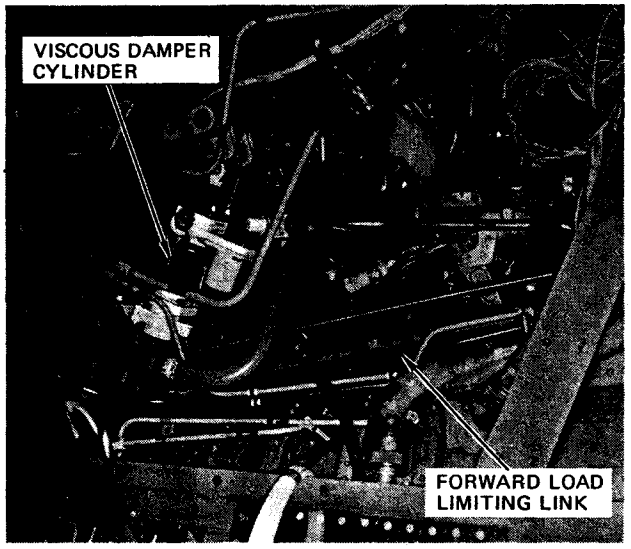
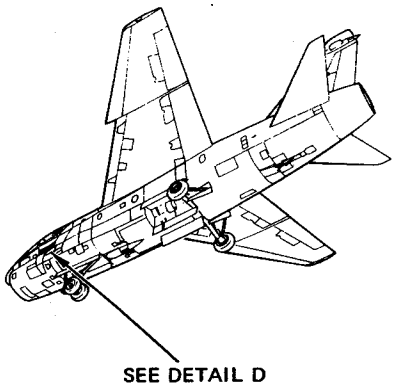
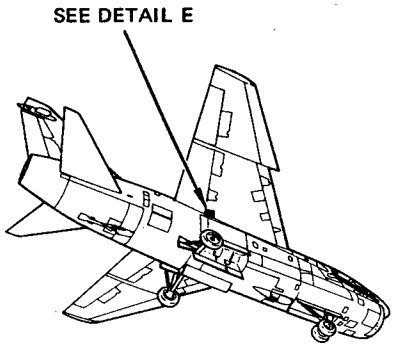
Figure 2-2. Aileron Control System Arrangement (Sheet 1)

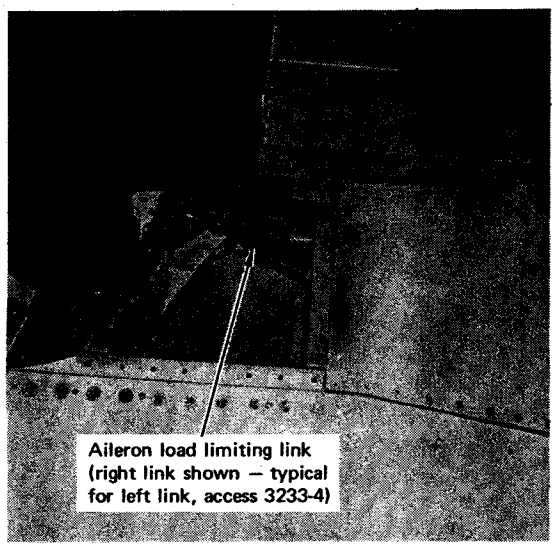


DETAIL D

(ACCESS 1123-1)







DETAIL E

(ACCESS 4233-4)

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Figure 2-2. Aileron Control System Arrangement (Sheet 2)

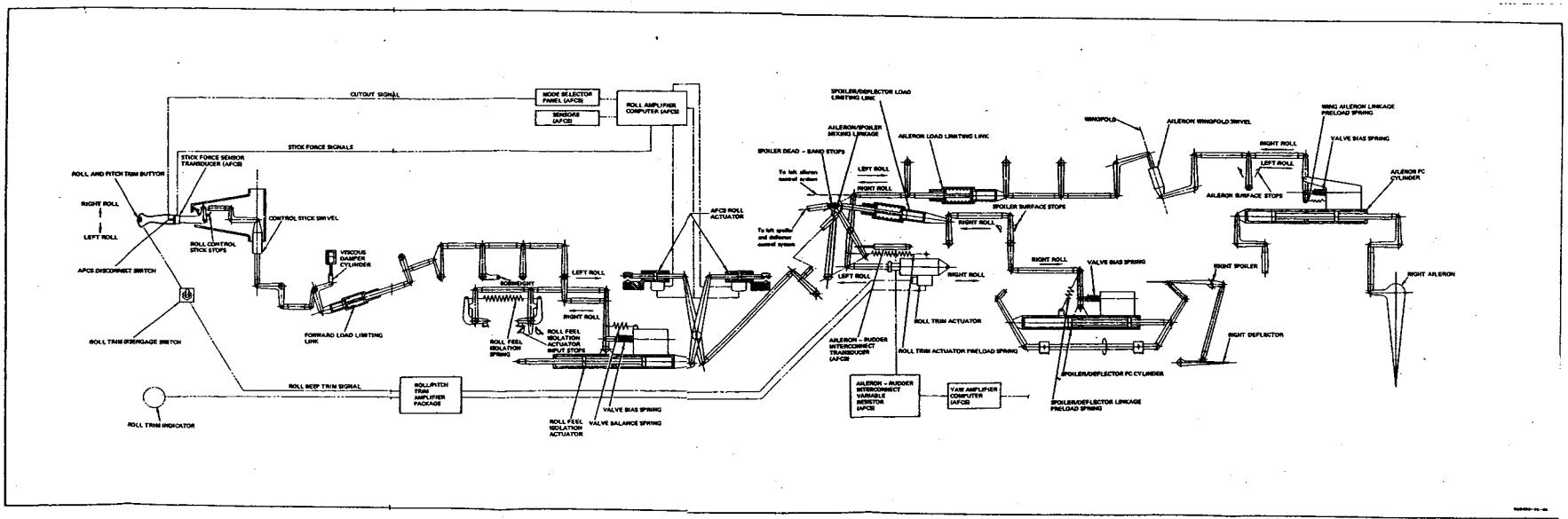


Figure 2-3. Aileron and Spoiler/Deflector Control System Schematic Diagram

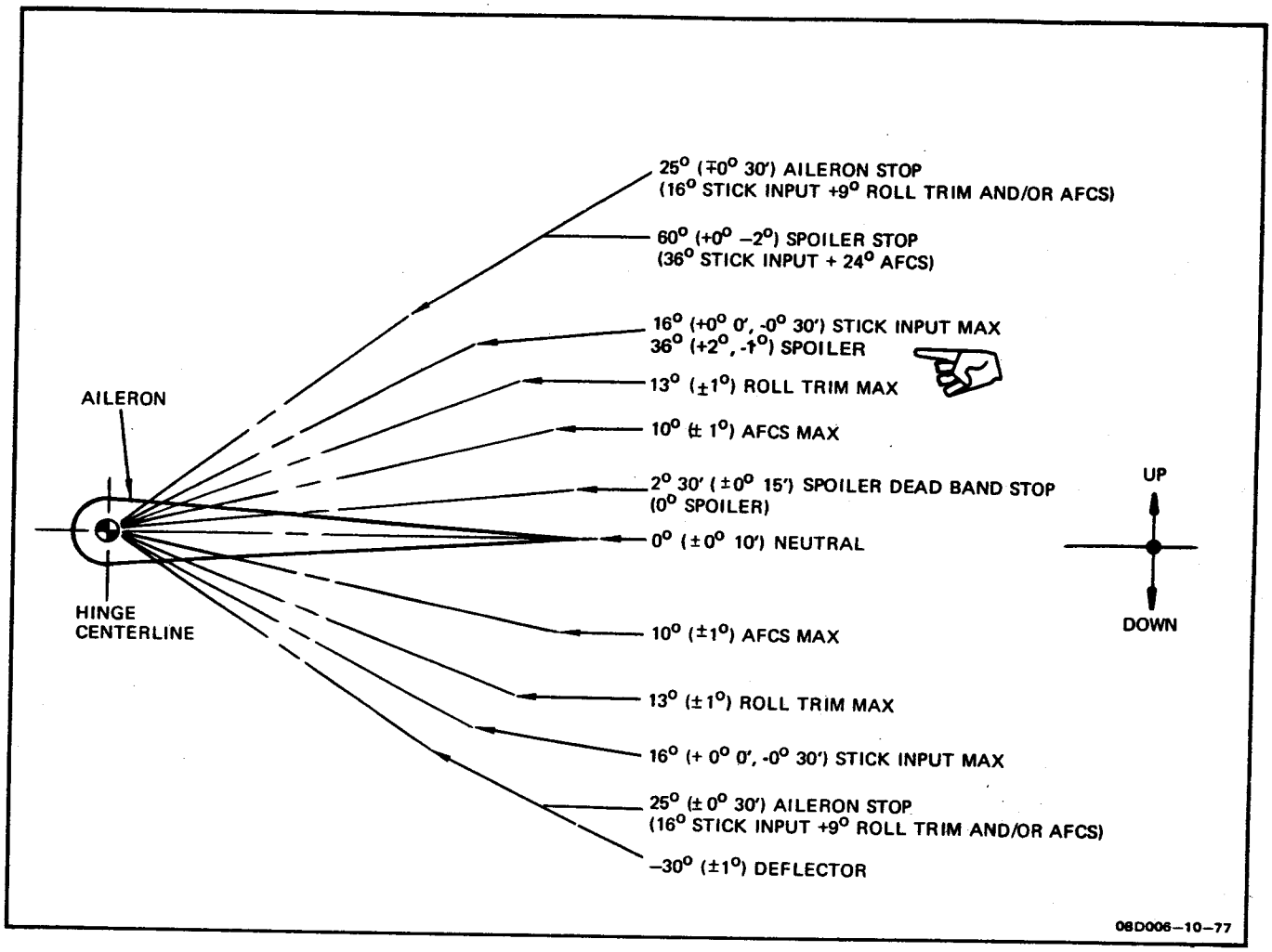


Figure 2-4. Aileron, Spoiler, and Deflector Throws

2-16. An aileron load-limiting link is installed in the right and left aileron control linkage downstream of the aileron trim and mixing linkage. The load-limiting links have a high breakout force so that they normally act as fixed-length links. When excessive loads are imposed on the control linkage, these links will compress or extend to absorb these loads. This prevents damage to the control linkage.

2-17. The ailerons are positioned by tandem power control (PC) cylinders. The input control linkage is connected to the PC cylinder servo valve control arm. Movement of the servo valve control arm positions the valve slider to direct hydraulic pressure to extend or retract the PC cylinder piston rod.

2-18. The PC cylinder is mounted between two bellcranks which are connected to aileron actuating links. As the PC cylinder retracts, the actuating links are moved aft causing the aileron to move down. As the PC cylinder extends, the actuating links are moved forward causing the aileron to move up. Since control rod movement is in opposite directions in the two sides of the wing, the PC cylinders move the ailerons in opposite directions.

2-19. The servo valve is an integral part of the PC cylinder. As the PC cylinder piston rod extends or retracts, the cylinder housing and servo valve move in the opposite direction. Movement of the servo valve causes the valve control arm to be repositioned. When aileron position equals demanded input, the servo valve slider is repositioned to neutral. In neutral position, the servo valve blocks all hydraulic fluid flow to and from the PC cylinder. This prevents further aileron movement until a new control system input repositions the servo valve control arm.

2-20. Each PC cylinder consists of a dual tandem hydraulic cylinder and a four-way dual servo valve which ports a different PC hydraulic system pressure to each section of the tandem cylinder. Both pressure supplies normally operate at all times and the dual configuration of the PC cylinders and servo valves ensures aileron operation if one PC hydraulic system fails.

2-21. On airplanes through AF69-6196, half of the servo valve directs PC No. 1 system pressure to the corresponding half of the PC cylinder and the other half of the servo valve directs PC No. 2 system pressure to the other half of the PC cylinder. If either PC hydraulic system fails, both ailerons continue to operate.

2-22. On airplanes AF69-6197 and subsequent, for the left aileron, one half of the servo valve directs PC No. 1 system pressure to the corresponding half of the PC cylinder and the other half of the servo valve directs PC No. 3 system pressure to the other half of the PC cylinder. For the right aileron, hydraulic pressure is supplied from the PC No. 1 and PC No. 2 hydraulic systems. This arrangement provides operation of both ailerons when hydraulic pressure is supplied by all PC hydraulic systems or by PC No. 2 and PC No. 3. If PC No. 2 alone is supplying pressure, only the right aileron will operate; if PC No. 3 alone is supplying pressure, only the left aileron will operate. When PC No. 1 hydraulic system alone is operating, the ailerons will not respond to control stick inputs but will respond to AFCS inputs.

2-23. COMPONENTS.

2-24. For a list of system components, their locations (accesses), and functions, refer to table 2-1.

2-25. OPERATIONAL CHECKOUT. (Airplanes Through AF69-6196.)

Test Equipment Required

Figure & Index No.	*Name*	*AN Type Designation*	*Use and Application*
	Equipment for connecting external hydraulic power		Connect hydraulic power
	Equipment for connecting external electrical power		Connect electrical power
			TT08D003-12-68

NOTE

A number, or numbers, enclosed in braces at the end of a step in the following test is a reference to a corresponding number in trouble-shooting table 2-2.

a. Ensure viscous damper is properly serviced (T.O. 1A-7D-2-1) before performing operational checkout.

b. Install aileron protractors (paragraph 2-98).

c. Install spoiler protractors (paragraph 4-22).

d. Connect external electrical power (T.O. 1A-7D-2-1).

e. Connect external hydraulic power to both PC systems (T.O. 1A-7D-2-1).

f. Place yaw stabilization engage switch in STAB.

g. Place AFCS engage switch in CONT AUG.

h. Place roll trim disengage switch in ON.

i. Using control stick, cycle aileron control system two or more times. Aileron and spoiler/deflectors shall move freely and smoothly with no apparent binding or abrupt changes in feel forces. {1, 2}

j. Actuate roll and pitch trim button laterally and observe that ailerons respond correctly. {3} Trim ailerons to neutral.

Table 2-1. Aileron Control System Components

Component	Access	Function
Actuator, roll feel isolation	5113-1	Isolates control stick from load-limiting link forces spoiler and AFCS actuator reactions.
Aileron (left/right)	Wing outer panel (left/right)	Provides roll movements on airplane.
Bobweight	1132-1	Counteracts lateral control system acceleration.
Cylinder, viscous damper	1123-1	In proportion to velocity, resists control stick movement in the roll direction and prevents too rapid movement of the aileron control system.
Cylinder, aileron PC (left/right)	3232-1, 4231-2	Positions ailerons in response to system inputs.
Link, aileron load-limiting	3233-4, 4233-4	Absorbs excessive loads in the aileron control linkage downstream of the isolation actuator.
Link, forward load-limiting	1123-1	Absorbs excessive loads in the control linkage upstream of the isolation actuator.
Spring, roll feel isolation	5113-1	Provides simulated roll feel forces at the control stick.
Spring, wing aileron linkage preload (left/right)	3232-1, 4231-2	Preloads wing aileron linkage to eliminate effects of free play in joints.
Swivel, aileron wingfold (left/right)	Wingfold	Allows folding of wing outer panels while retaining full aileron motion.
Swivel, control stick	Cockpit	Allows control stick to be rotated fore and aft.

k. Shut down hydraulic pressure to PC No. 2 system.

NOTE

To minimize the entrance of air when all PC hydraulic systems are not pressurized during control cycling, operate the controls slowly and cycle only the minimum number of times necessary to verify correct operation.

l. Cycle aileron and spoiler/deflector controls with PC No. 1 hydraulic system pressure applied.

m. Note that controls move freely and smoothly with no apparent binding or abrupt change in feel forces. {4, 5}

n. Note that control surface movements coincide properly. {6, 7}

o. Note control stick forces are not too high. {8, 9}

p. Release control stick after cycling controls. Stick should return to neutral {10}.

q. Shut down hydraulic pressure to PC No. 1 system. Apply hydraulic pressure to PC No. 2 system.

r. Cycle aileron and spoiler/deflector controls with PC No. 2 hydraulic system pressure applied and repeat steps m through p.

s. Apply hydraulic pressure to PC No. 1 system.

NOTE

Full control stick throws will not give full aileron and spoiler/deflector deflections. Combinations of stick, AFCS, and trim are required.

The aileron load-limiting link will normally break out when combinations of stick, AFCS, and trim input cause aileron deflection exceeding 25°.

The spoiler load-limiting link will normally compress when aileron deflection is trailing edge down.

t. Move control stick full left and apply full left trim. Left aileron shall be at 25° (±0°30') trailing edge up, left spoiler must open to 60° (+0°, -2°), and left deflector shall open. Right aileron shall be at 25° (±0°30') trailing edge down. {11, 12}

u. Apply full left trim and place control stick in neutral. Left aileron shall be at 13° (±1°) trailing edge up. {11}

v. Move control stick full right and apply full right trim. Right aileron shall be 25° (±0°30') trailing edge up; right spoiler shall open to 60° (+0°, -2°), and right deflector shall open. Left aileron shall be at 25° (±0°30') trailing edge down. {11, 12}

w. Apply full right trim and place control stick in neutral. Right aileron shall be at 13° (±1°) trailing edge up. {11}

x. Return surfaces to trim neutral.

y. Place yaw stabilization engage switch in OFF.

z. Place roll trim disengage switch in OFF.

aa. Move control stick full left. Left aileron shall be at 16° (+0°0', -0°30') trailing edge up, and left spoiler shall open to 36° (+2°, -1°). Right aileron shall be at 16° (+0°0', -0°30') trailing edge down. Move control stick slowly to neutral. Both ailerons shall return to neutral within 0° (±0°10'). {11, 12}

ab. Move control stick full right. Right aileron shall be 16° (+0°0', -0°30') trailing edge up, and right spoiler shall open to 36° (+2°, -1°). Left aileron shall be at 16° (+0°0', -0°30') trailing edge down. Move control stick slowly to neutral. Both ailerons shall return to neutral within 0° (±0°10'). {11, 12}

ac. Move control stick until right aileron is 2°30' (±0°15') trailing edge up and check that right spoiler is closed. {13}

ad. Repeat step ac for left aileron and left spoiler.

ae. Perform hydraulic system air check (T.O. 1A-7D-2-1).

af. Disconnect external electrical and hydraulic power (T.O. 1A-7D-2-1).

ag. Remove aileron and spoiler protractors.

2-26. OPERATIONAL CHECKOUT. (Airplanes AF69-6197 and Subsequent.)

Test Equipment Required

Figure & Index No.	*Name*	*AN Type Designation*	*Use and Application*
	Equipment for connecting external hydraulic power		Connect hydraulic power
	Equipment for connecting external electrical power		Connect electrical power
			TT08D144-04-70

NOTE

A number, or numbers, enclosed in braces at the end of a step in the following checkout is a reference to a corresponding number in troubleshooting table 2-2.

a. Ensure viscous damper is properly serviced (T.O. 1A-7D-2-1) before performing operational checkout.

b. Install aileron protractors (paragraph 2-98).

c. Install spoiler protractors (paragraph 4-22).

d. Connect external electrical power (T.O. 1A-7D-2-1).

e. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

f. Place yaw stabilization engage switch in STAB.

g. Place AFCS engage switch in CONT AUG.

h. Place roll trim disengage switch in ON.

i. Using control stick, cycle aileron control system two or more times. Ailerons and spoiler/deflectors must move freely and smoothly with no apparent binding or abrupt changes in feel forces or play in control stick. {1, 2}

j. Actuate roll and pitch trim button laterally and check aileron up and down trim. {3} Trim stick to neutral.

k. Shut down hydraulic pressure to PC No. 2 hydraulic system.

NOTE

To minimize the entrance of air when all PC hydraulic systems are not pressurized during control cycling, operate the controls slowly and cycle only the minimum number of times necessary to verify correct operation.

l. Cycle aileron and spoiler/deflector controls with PC No. 1 and PC No. 3 hydraulic system pressure applied.

m. Note that controls move freely and smoothly with no apparent binding or abrupt changes in feel forces. {4, 5}

n. Note that control surface movements coincide properly. {6, 7}

o. Note that control stick forces are not too high. {8, 9}

p. Release control stick after cycling controls. Stick should return to neutral. {10}

q. Shut down pressure to PC No. 1 hydraulic system. Apply pressure to PC No. 2 hydraulic system.

r. Cycle aileron and spoiler/deflector controls with PC No. 2 and PC No. 3 hydraulic systems pressure applied and repeat steps m through p.

s. Shut down pressure to PC No. 3 hydraulic system.

t. Cycle aileron and spoiler/deflector controls with PC No. 2 hydraulic system pressure applied and repeat steps m, o, and p, while observing right aileron and right spoiler/deflector only.

u. Apply pressure to PC No. 1 and PC No. 3 hydraulic systems.

NOTE

Full control stick throws will not give full aileron and spoiler deflections. Combinations of stick, AFCS, and trim are required.

The aileron load-limiting link will normally break out when combinations of stick, AFCS, and trim input exceed ±25° aileron deflection.

The spoiler load-limiting link will normally compress when aileron deflection is trailing edge down.

v. Move control stick full left and apply full left trim. Left aileron must be at 25° (±0°30') trailing edge up, left spoiler must open to 60° (+0°, -2°), and left deflector must open. Right aileron must be at 25° (±0°30') trailing edge down. {11, 12}

w. With full left trim applied, move control stick to neutral. Left aileron must be at 13° (±1°) trailing edge up. {11}

x. Move control stick full right and apply full right trim. Right aileron must be 25° (±0°30') trailing edge up, right spoiler must open to 60° (+0°, -2°) and right deflector must open. Left aileron must be at 25° (±0°30') trailing edge down. {11, 12}

y. With full right trim applied, move control stick to neutral. Right aileron must be at 13° (±1°) trailing edge up. {11}

z. Return all control surfaces to trim neutral.

aa. Place yaw stabilization engage switch in OFF.

ab. Place roll trim disengage switch in OFF.

ac. Move control stick full left. Left aileron must be at 16° (+0°0', -0°30') trailing edge up and left spoiler must be open to 36° (+2°, -1°). Right aileron must be at 16° (+0°0', -0°30') trailing edge down. Move control stick slowly to neutral. Both ailerons must return to neutral within 0° (±0°10'). {11, 12}

ad. Move control stick full right. Right aileron must be 16° (+0°0', -0°30') trailing edge up and right spoiler must open to 36° (+2°, -1°). Left aileron must be at 16° (+0°0', -0°30') trailing edge down. Move control stick slowly to neutral. Both ailerons must return to neutral within 0° (±0°10'). {11, 12}

ae. Move control stick until right aileron is 2°30' (±0°15') trailing edge up and check that spoiler remains closed. Spoiler must operate within the above tolerance limits.

af. Repeat step ae for left aileron and left spoiler.

ag. Perform hydraulic system air check (T.O. 1A-7D-2-1).

ah. Disconnect external electrical and hydraulic power (T.O. 1A-7D-2-1).

ai. Remove aileron and spoiler protractors.

2-27. TROUBLESHOOTING.

2-28. Refer to table 2-2 for troubleshooting information. Malfunctions in the table are listed numerically and are related to a corresponding number, or numbers, following a step in the operational checkout.

Table 2-2. Aileron Control System Troubleshooting

Probable Cause	Isolation Procedure	Remedy
1. Controls do not move freely and smoothly.		
Low surge damper accumulator pressure	None.	Check accumulator pressure (T.O. 1A-7D-2-1).
Air in PC hydraulic system.	Perform hydraulic system air check (T.O. 1A-7D-2-1).	Bleed affected systems (T.O. 1A-7D-2-1).
Feel spring binding.	Check that feel springs and arms move freely when control stick is deflected and that no end play exists at neutral.	Determine cause of binding and replace defective parts or springs as required.
Binding of linkage forward of feel isolation actuator.	Disconnect linkage at stick and at feel isolation actuator. Manually stroke linkage and check for evidence of binding.	Replace damaged bushing or bent link to eliminate interference.

Table 2-2. Aileron Control System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
Viscous damper binding.	Disconnect viscous damper link and check that no binding occurs when stick is moved right and left.	Replace defective viscous damper.
Load limiting link binding.	Check load limiting links for breakout and return to normal length while cycling control stick.	Replace defective load limiting link.
Control stick linkage binding.	Disconnect linkage at control stick and check that no binding occurs when stick is moved left and right.	Check nut (19, figure 1-3) for excessive torque. Back off, if necessary, and rethread nut far enough onto shaft to remove end play, but do not tighten. Check for free rotation of shaft in bearings.
2. Play in control stick (aileron control).		
Loss of adjustment in aileron link (31, figure 1-2).	Remove plug button (26, figure 1-2) and check for play at rod end when control stick is moved right and left, and check for presence of rivet through shank of rod end and threaded portion on which rod end is mounted.	If play is evident, or rivet is missing, replace link.
Excessive wear in control linkage.	Check for excessive play in linkage between control stick and roll feel isolation actuator.	Replace link having excessive play.
3. Ailerons do not move when pitch and roll trim button is pushed to right or left. (Refer to paragraph 3-12.)		
4. Control surface movement erratic.		
Air in PC hydraulic system.	Shut down pressurized PC system and apply pressure to other PC system. If erratic condition no longer exists, perform air check of PC system causing erratic operation (T.O. 1A-7D-2-1).	Perform hydraulic system bleeding (T.O. 1A-7D-2-1).
Roll feel isolation actuator is defective.	Erratic condition exists after bleeding PC system.	Replace defective roll feel isolation actuator.

Table 2-2. Aileron Control System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
5. No response when control stick is deflected, or erratic control surface movement with hydraulic pressure applied to both PC systems.		
If no surface response occurs, roll feel isolation actuator defective or PC No. 3 hydraulic system failure.	Check hydraulic pressure.	Troubleshoot PC No. 3 hydraulic system (T.O. 1A-7D-2-4) or replace roll feel isolation actuator (paragraph 2-63).
If surfaces on left wing only operate, PC No. 1 hydraulic system failure.	Check hydraulic pressure.	Troubleshoot PC No. 1 hydraulic system (T.O. 1A-7D-2-4).
Binding of linkage in wing.	Check load-limiting links for breakout as stick is deflected. If breakout is noticed, disconnect link at mixing linkage and at PC actuator servo. Manually stroke linkage to determine which linkage or bellcrank is binding.	Replace damaged bushings, or replace link/bellcrank as required.
6. Control surfaces do not move at same time.		
Excessive wear of linkage, bearings, or attaching hardware of link on PC cylinder package.	**Check load-limiting links for breakout.** **Disconnect and manually operate linkage.** **Check aileron control system slop (paragraph 2-33).**	**Replace defective components.**
7. Erratic movement of one control surface, but other surface acts normal.		
Defective actuator.	Disconnect actuator input link. Using 300-500 psi hydraulic pressure, cycle actuator.	Replace defective actuator (paragraph 2-83).
Linkage binding between mixing linkage and control surface.	Check linkage for binding (paragraph 2-29).	Relieve binding as necessary.

Table 2-2. Aileron Control System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
8. Moderately high control stick forces.		
Incorrectly rigged feel spring.	Disconnect feel spring input link and check stick forces.	Rig feel spring.
9. Very high control stick forces.		
Binding and interference of control linkage.	Perform binding check (paragraph 2-29).	Replace defective parts.
10. Control stick does not return to neutral, when released, after cycling ailerons.		
Roll feel spring and arm are incorrectly installed.	Check that arms are installed with adjustment lugs of stops inboard.	Install arms correctly with adjustment lugs inboard.
Roll feel spring is improperly rigged.	Check roll feel spring rigging (paragraph 2-37).	Rig roll feel spring (paragraph 2-37).
Defective roll feel spring.	None.	Replace roll feel spring.
Control stick linkage binding.	Disconnect linkage at control stick and check that no binding occurs when stick is moved left and right.	Check nut (19, figure 1-3) for excessive torque. Back off, if necessary, and rethread nut far enough onto shaft to remove end play, but do not tighten. Check for free rotation of shaft in bearings.
11. Insufficient or excessive aileron surface travel.		
Aileron controls incorrectly rigged.	None.	Perform rigging checkout (paragraph 2-35) and rig as necessary.
12. Insufficient or excessive spoiler/deflector surface travel.		
Spoiler/deflector control linkage incorrectly rigged.	None.	Rig spoiler/deflector control linkage (paragraph 4-24).

Table 2-2. Aileron Control System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
13. Spoiler not closed when aileron is 2°30' (±0°15') trailing edge up.		
Dead band stop out of adjustment.	**None.**	Rig dead band stop (paragraph 2-44).

2-29. BINDING CHECKS.

Test Equipment Required

Figure & Index No.	Name	AN Type Designation	Use and Application
	Equipment for connecting external hydraulic power		Connect hydraulic power
			TT08D004-12-68

CAUTION

To prevent damage, hydraulic power shall not be applied to control systems until after all mechanical linkages have been checked for binding.

a. Check cables, fairleads, pulleys, and push-pull links for kinks or restrictions.

b. Manually move surfaces and check for binding.

c. Disconnect linkage at control stick. Check that no binding occurs as stick is moved left and right. If binding occurs, check nut (19, figure 1-3) for excessive torque. Back off nut, if necessary, and rethread nut far enough onto shaft to remove end play, but do not tighten. Check for free rotation of shaft in bearings.

d. Disconnect suspected control system from cockpit controls.

e. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

f. Manually actuate power control slider valve and check for erratic movement of actuator.

g. Disconnect external hydraulic power.

2-30. MEASURING CONTROL STICK FORCES.

Tools Required

Figure & Index No.	Part Number	Nomenclature	Use and Application
		Equipment for connecting external electrical power	Connect electrical power

Tools Required (Continued)

Figure & Index No.	Part Number	Nomenclature	Use and Application
		Equipment for connecting external hydraulic power	Connect hydraulic power
	0013	Spring scale, 0 to 50 pounds	Measure stick forces
			TT08D005-05-69

2-31. PREPARATION.

a. Open access 5113-1.

b. Connect external electrical power (T.O. 1A-7D-2-1).

c. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

d. Trim control surfaces to neutral. Align aileron with wingtip fairing.

e. Place yaw stabilization engage switch in OFF.

f. Place AFCS engage switch in OFF.

g. Place roll and pitch trim disengage switches in OFF.

NOTE

When measuring control stick force, the stick shall be deflected from neutral position to the position from which the force is to be measured without relaxing the applied force on the measuring instrument. If the stick overshoots the position at which the force is to be measured, the stick shall be returned to the neutral position and the measuring operation repeated.

h. Place control stick in neutral. Place a compression point contact spring scale (accurate within 2%) at a point 2.90 (±0.12) inches below top of stick grip and in a station plane at a right angle to control stick.

2-32. STICK BREAKOUT FORCES.

a. Applying force to the spring scale, deflect control stick to the left until a 0.002-inch feeler gage can just be inserted at feel spring linkage upper stopbolt on the bulkhead (access 5113-1). Record force on spring scale.

b. Applying force to spring scale, deflect control stick to right until a 0.002-inch feeler gage can just be inserted at feel spring linkage lower stopbolt on the bulkhead. Record force on spring scale.

c. The forces recorded shall be between 1.00 and 2.25 pounds in both right and left directions. The higher force, if any, shall always be in the left direction.

d. Excessively high control stick forces indicate binding and/or interference in the control system.

NOTE

The loads applied to the feel springs during rigging are directly related to control stick forces.

e. Low or moderately high control stick forces indicate that feel spring linkages are incorrectly rigged. Rig in accordance with paragraph 2-37.

f. Disconnect external electrical and hydraulic power (T.O. 1A-7D-2-1).

g. Close access 5113-1.

2-33. AILERON POWER CONTROL SLOP CHECK. (See figure 2-5.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
2-5	80D	Spring scale, 0 to 25 pounds	Measure force applied to aileron
2-5	MIL-I-18422	Dial indicator	Measure movement of aileron

TT08D006-05-69

a. Connect external electrical power (T.O. 1A-7D-2-1).

b. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1). Maintain hydraulic oil temperature of 125°F (±10°F) as measured at pressure line of test stand.

c. Place roll trim disengage switch in ON.

d. Trim control surfaces to neutral.

e. Place roll trim disengage switch in OFF.

f. Place AFCS switches in OFF.

g. Mount dial indicator on outer panel as shown.

h. Apply approximately 10 pounds downward force on aileron by hand to ensure surface is at lower end of slop band. While applying downward force, adjust the dial indicator to zero.

i. Position wood block and spring scale on lower surface of aileron 18.5 inches from aileron hinge line on rib midway between aileron ends. (Approximately 0.5 inch forward of trailing edge.)

j. Apply upward force of 15.0 (±0.5) pounds and record aileron deflection reading from dial indicator.

k. The aileron deflection shall not exceed 0.0410 inch as measured with the dial indicator. This value consists of the 1/8 degree free play (slop) limit in the PC installation plus spring rate deflection resulting from the applied load. If this value exceeds 0.0410 inch, the installation is unacceptable and parts shall be checked for excessive slop. Defective parts shall be replaced until the 0.0410 inch maximum value is obtained.

NOTE

Invalid dial indicator readings can be obtained under small external load applications if there is excessive friction in the PC installation. If this condition is suspect, the PC installation components should be investigated for freedom of movement.

l. Remove dial indicator and spring scale.

m. Disconnect external hydraulic and electrical power.

2-34. RIGGING PRECAUTIONS.

CAUTION

When rigging flight control linkages, check witness holes either visibly or with a piece of safety wire to ensure rod end threads cover the holes.

NOTE

Accurate rigging or rigging checkout cannot be accomplished if airplane is on wing jacks, or if stores are loaded on pylons.

a. Check that airplane is not on jacks.

b. Check that wing pylons are empty.

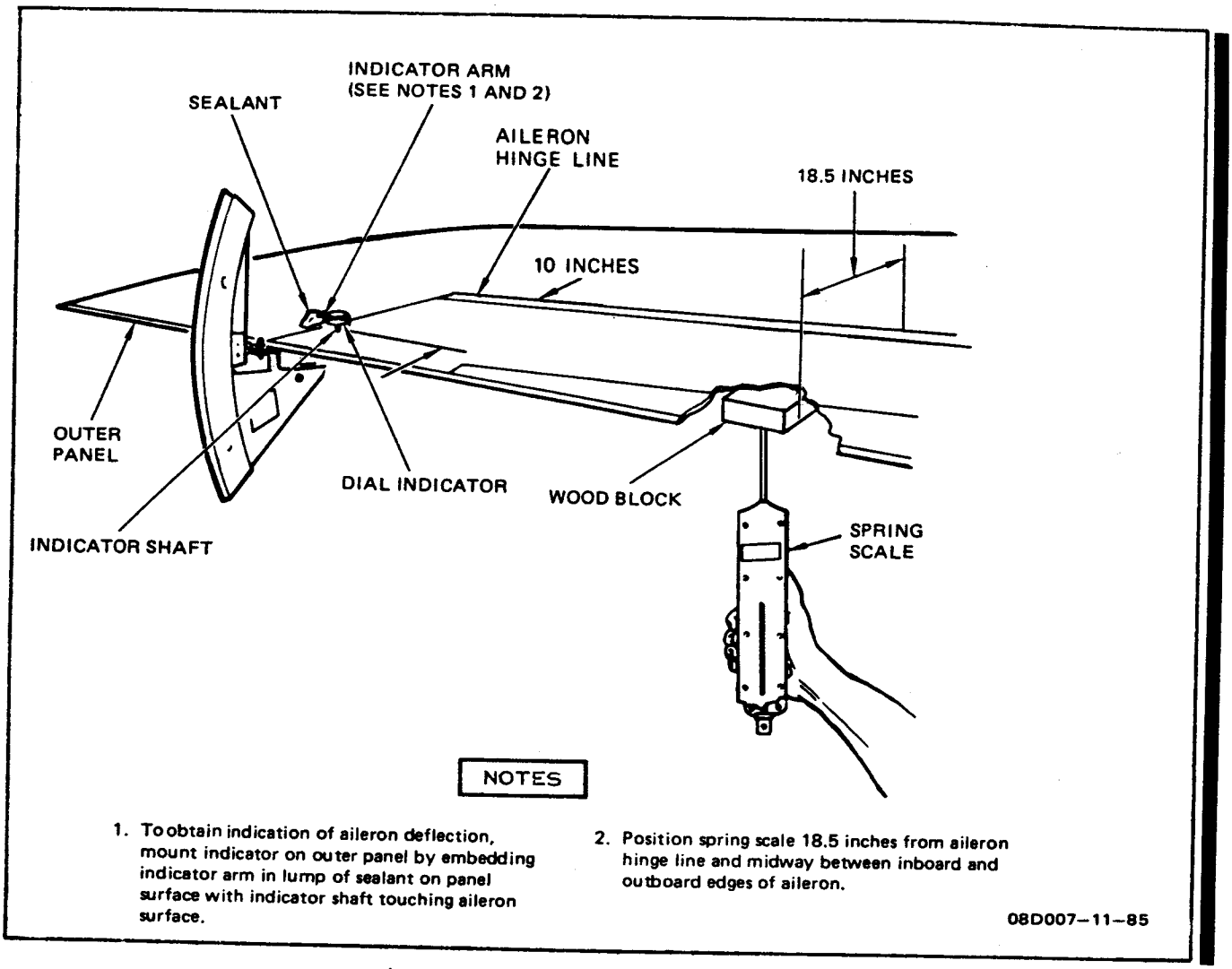


Figure 2-5. Aileron PC Slop Check

2-35. RIGGING CHECKOUT. (See figure 2-6.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
2-6	215-00110-3	Rigging pins No. 27 and 32	Rig aileron linkage
2-6	215-00110-4	Rigging pins No. 25 and 34	Rig aileron linkage

Tools Required (Continued)

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
2-6	215-00110-5	Rigging pins No. 28, 29, 30, 33, and 35	Rig aileron linkage
2-6	215-00110-7	Rigging pin No. 26	Rig aileron linkage
2-6	215-00110-8	Rigging pin No. 31	Rig aileron linkage

TT08D007-07-70

a. Connect external electrical power (T.O. 1A-7D-2-1).

CAUTION

All rigging pins shall be removed from the control system before applying hydraulic power and operating the system.

b. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

c. Place roll trim disengage switch in ON.

d. Place yaw stabilization engage switch in STAB.

e. Install aileron protractors (paragraph 2-98).

f. Install spoiler protractors (paragraph 4-22).

g. Trim all control surfaces to neutral.

h. Place roll trim disengage switch in OFF.

i. Place yaw stabilization engage switch in OFF.

NOTE

See figure 2-6 for rigging pin location.

j. Open accesses 1123-4, 1121-3, 3123-1, 5113-1, 5111-4, 4233-2, 4233-3, 4231-2, 3233-2, 3232-1, 3233-3, and 1123-1.

k. Insert rigging pins No. 25, 26, and 35 to check control stick linkage. Adjust if necessary (paragraph 2-36) and remove pins.

l. Insert rigging pins No. 26 and 27 to check connecting linkage to roll feel actuator. Adjust if necessary (paragraph 2-36) and remove pins.

m. Insert rigging pins No. 28, 29, 30, and 31 to check feel spring and roll feel actuator linkage. Adjust if necessary (paragraphs 2-37 and 2-38) and remove pins.

n. Insert rigging pins No. 31, 32, and 34 to check aileron/spoiler mixing linkage. Adjust if necessary (paragraphs 2-41 and 2-42) and remove pins.

o. Insert rigging pin No. 33 to check aileron input linkage. Adjust if necessary (paragraphs 2-42 and 2-43) and remove pins.

p. Disconnect external electrical and hydraulic power (T.O. 1A-7D-2-1).

q. Remove aileron protractors.

r. Remove spoiler protractors.

s. Close accesses 1123-4, 1121-3, 3123-1, 5113-1, 5111-4, 4233-2, 4233-3, 4231-2, 3233-2, 3232-1, 3233-3, and 1123-1.

2-36. RIGGING LINKAGE FROM CONTROL STICK TO FEEL ISOLATION ACTUATOR AND ROLL AFCS PACKAGE. (See figure 2-6.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
2-6	215-00110-3	Rigging pin No. 27	Rig linkage
2-6	215-00110-4	Rigging pin No. 25	Rig linkage
2-6	215-00110-5	Rigging pins No. 28 and 35	Rig linkage
2-6	215-00110-7	Rigging pin No. 26	Rig linkage

TT08D008-08-69

a. Open accesses 1121-3, 1123-1, 1123-4, 1221-1, 5111-1, and 5111-4.

b. Unfasten front of control stick protective cover.

c. Insert rigging pin No. 25.

d. Adjust link (2) or load-limiting link (3) until rigging pin No. 26 can be inserted.

e. Adjust viscous damper link (4) until rigging pin No. 35 can be inserted.

f. Remove rigging pins No. 25 and 35.

g. Fasten front of control stick protective cover.

h. Adjust link (5) until rigging pin No. 27 can be inserted.

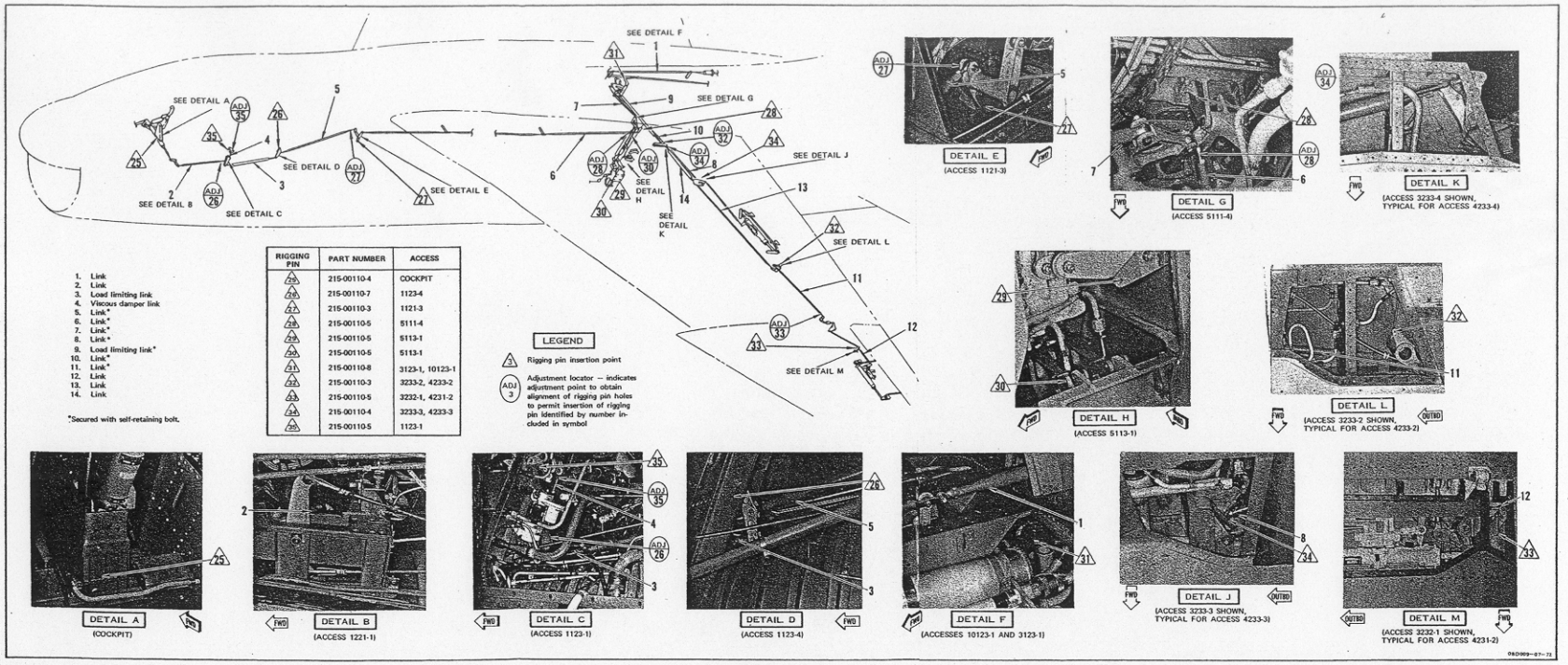


Figure 2-6. Aileron Control System Rigging

i. Remove rigging pin No. 26 and adjust link (6) until rigging pin No. 28 can be inserted.

j. Remove rigging pins No. 27 and 28.

k. Close accesses 1121-3, 1123-1, 1123-4, 1221-1, 5111-1, and 5111-4.

2-37. RIGGING ROLL FEEL SPRINGS. (See figure 2-7.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
2-6 and 2-7	215-00110-5	Rigging pins No. 28, 29 and 30	Rig roll feel spring
	719-5	Spring scale, 0 to 5 pounds	Apply a load to adjust stops
			TT08D009-10-70

a. Open accesses 5111-1, 5111-4, and 5113-1.

WARNING

Do not disconnect any linkage while hydraulic pressure is applied to power control systems. Failure to shut down hydraulic pressure before disconnecting the linkage may result in injury to personnel or damage to control system components. Hydraulic control valves are spring loaded and may move actuator to full throw when linkage is disconnected. After disconnecting linkage and reapplying hydraulic pressure to power control system, avoid rapid bottoming of actuating cylinder.

b. Disconnect lower end of link (1) from arm (2).

c. Insert rigging pin No. 29.

d. Cut lockwire and loosen stopbolts (7 and 8) until all pressure on springs is released.

e. With stop pads (3) in contact between arms (2 and 4), cut lockwire and adjust lower stopbolt (5) to contact stop pad (5A).

f. Remove rigging pin No. 29.

g. Connect spring scale to upper arm (6) at spring level. Apply 2.50 (+0.25, -0.00) pound upward load and adjust stopbolt (7) until a 0.002-inch clearance exists between stopbolt and stop pad (7A).

h. Disconnect spring scale.

i. Adjust stopbolt (8) until no vertical, free movement exists in arm (2).

j. Recheck clearance (steps f and g).

k. Using a 0.002-inch feeler gage, check each of the four feel spring linkage stops (3, 5, 7, and 8). If the feeler gage can be inserted at any stop, the feel spring is incorrectly rigged. Rerig feel spring as required.

NOTE

See figures 2-6 and 2-7 for rigging pin and link locations for following steps.

l. Insert rigging pins No. 28, 29, and 30.

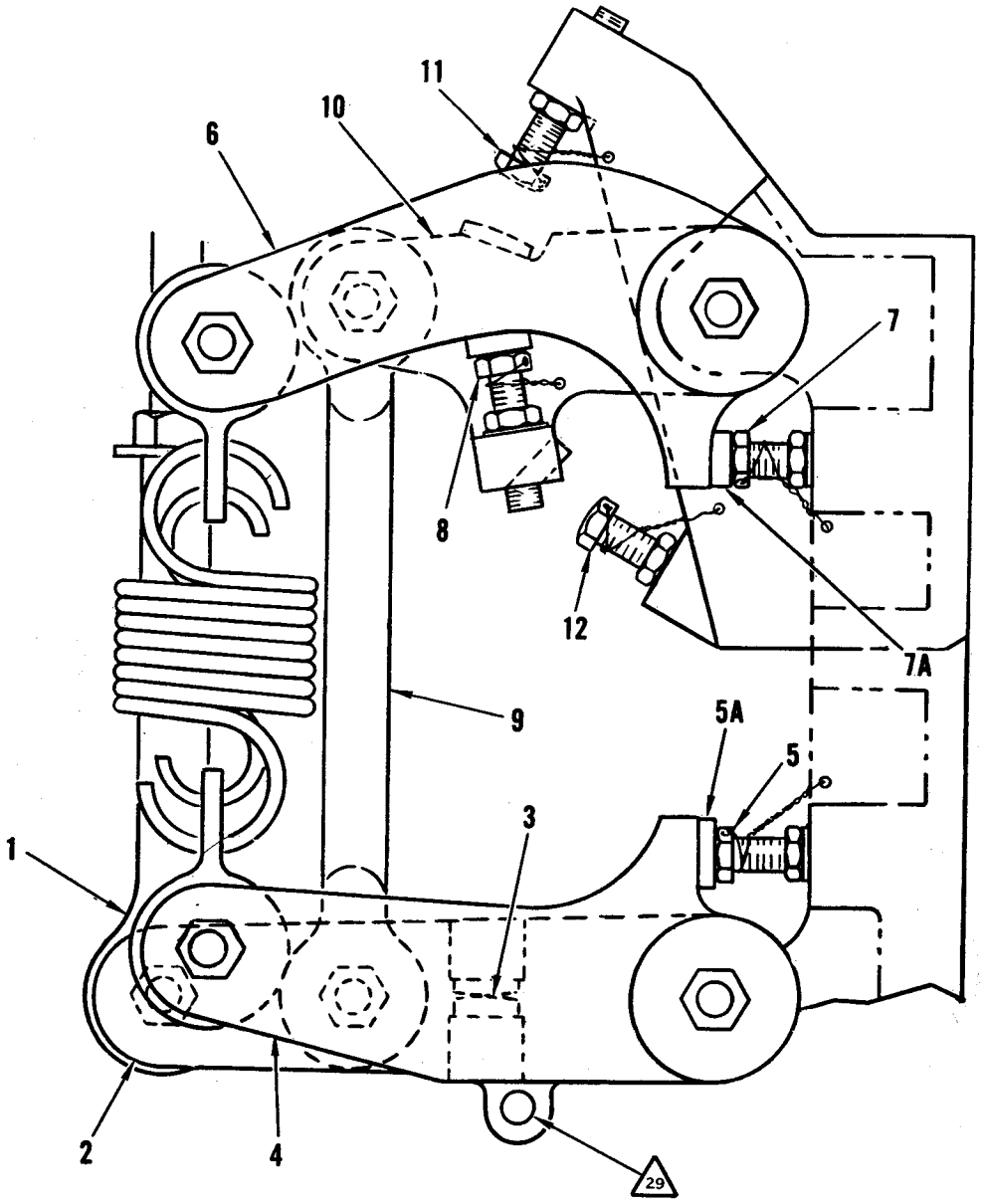
m. Adjust and connect link (1).

n. Remove rigging pins No. 28, 29, and 30.

o. Check control stick breakout forces (paragraph 2-30).

p. Secure stopbolts (5, 7, and 8) with MS20995C32 lockwire.

q. Close accesses 5111-1, 5111-4, and 5113-1.



1.	Link	7.	Stopbolt
2.	Arm	7A.	Stop pad
3.	Stop pad	8.	Stopbolt
4.	Arm	9.	Link
5.	Stopbolt	10.	Arm
5A.	Stop pad	11.	Roll feel isolation actuator upper stopbolt
6.	Arm	12.	Roll feel isolation actuator lower stopbolt

29 Rigging pin No. 29 rigging hole

08D015-11-74

Figure 2-7. Rigging Roll Feel Springs

2-38. RIGGING ROLL FEEL ISOLATION ACTUATOR.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external hydraulic power	Connect hydraulic power
2-6	215-00110-5	Rigging pins No. 28, 29 and 30	Rig linkage
			TT08D010-12-68

WARNING

Do not disconnect any linkage while hydraulic pressure is applied to power control systems. Failure to shut down hydraulic pressure before disconnecting the linkage may result in injury to personnel or damage to control system components. Hydraulic control valves are spring-loaded and may move actuator to full throw when linkage is disconnected. After disconnecting linkage and reapplying hydraulic pressure to power control systems, avoid rapid bottoming of actuating cylinder.

a. Open accesses 5111-1 and 5113-1.

b. Ensure that electrical power is not connected to airplane.

c. Verify that roll AFCS actuator locks are engaged, ensuring that actuator is positioned in neutral.

d. Disconnect link (7, figure 2-6).

e. Disconnect link (1, figure 2-7) from arm (2).

NOTE

See figure 2-6 for rigging pin locations.

f. Insert rigging pin No. 28.

g. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

h. Cut lockwire and loosen upper and lower jamnuts on link (21, figure 2-9).

CAUTION

When hydraulic pressure is applied to the power control systems, insert and remove rigging pin No. 30 only as directed. Failure to remove rigging pin No. 30 as directed may result in damage to linkage.

i. Adjust link until rigging pin No. 30 can be inserted.

j. Remove rigging pin No. 30.

k. Tighten jamnuts and secure with MS20995C32 lockwire.

l. Insert rigging pin No. 29.

m. With rigging pin hole No. 30 aligned, adjust and connect link (1, figure 2-7) to arm (2).

n. Connect link (7, figure 2-6).

o. Remove rigging pins No. 29 and 28.

p. Disconnect external hydraulic power.

q. Close accesses 5111-1 and 5113-1.

2-39. RIGGING ROLL AFCS PACKAGE. (See figure 2-7A.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
2-7B	(Local fabrication)	Roll AFCS package rigging tool	Rigging roll AFCS package
	NAS927-4-64	Jig pin (2)	Attach rigging tool to AFCS package
	215-00110-5	Rigging pin No. 30	Rig roll AFCS package
			TT08D177-10-77

a. Install AFCS actuator in roll package (T.O. 1A-7D-2-9).

b. Attach locally fabricated rigging tool (figure 2-7B) to roll AFCS package using three NAS927-4-64 jig pins or equivalent.

c. Check that both actuators are in neutral (locks engaged).

d. Check package rigging by inserting rigging pin No. 30 through holes in tool and package. If rigging pin can be inserted, remove rigging tool, and install package (paragraph 5-19). If rigging pin cannot be inserted, proceed to step e for rigging.

NOTE

Adjust either or both rod ends individually, as required. Rotate rod ends only in increments of 180°, and do not adjust beyond point where threads cannot be seen in witness hole. Each 180° rotation changes length approximately 0.018 inch.

e. Adjust rod end of either or both actuator pistons, as necessary, until rigging pin No. 30 can be inserted while maintaining 2.52 (±0.02) inches between centerline of rod end and face of actuator. If adjustment can be performed as specified, tighten and lock-wire rod ends, remove rigging tool, and install package (paragraph 5-19). If adjustment cannot be performed, proceed to step f.

f. Cut lockwire and loosen actuator sleeve jamnut.

g. Manually retract locking piston and hold retracted with c-clamp.

NOTE

If the rod end could not be adjusted to maximum allowable dimension (2.54 inches) because threads were not visible in witness hole or if an adjustment was not an increment of 180°, the actuator extend stroke should probably be reduced.

h. Reduce actuator extend stroke by alternately adjusting sleeve counterclockwise and rod end clockwise as viewed from rod end of actuator. As adjustment proceeds, rotate actuator piston in small increments as necessary to maintain sleeve locking notch in alignment with locking piston and rod end in alignment with bellcrank. Adjust until rigging pin No. 30 can be inserted with rod end connected to bellcrank, the 2.52 (±0.02) inch dimension maintained, and piston lock engaged. If necessary to reduce retract stroke, rotate sleeve clockwise and rod end counterclockwise.

i. Tighten rod end and sleeve jamnuts.

j. Fully engage locking piston with sleeve notch by releasing c-clamp.

k. Mark actuator piston so travel can be checked, and retract locking piston using c-clamp.

l. Check that 0.50 (±0.06) inch actuator travel is available on each side of locked position. If travel is not within tolerance, repeat steps h through l. Replace actuator if dimensions cannot be attained. Remove c-clamp.

m. Lockwire rod end and sleeve jamnuts.

n. If sleeve was adjusted, adjust actuator lock switch as follows:

1. Ensure that locking piston is fully extended.

NOTE

Actuation of lock switch produces a distinct clicking sound which can easily be detected.

2. Loosen switch mounting screws, move switch away from locking piston until actuating arm does not actuate switch, and then move toward piston until switch actuates. Mark switch position.

3. Move switch 0.07 (±0.02) inch toward locking plunger while ensuring that minimum clearance of 0.02 inch is maintained between switch actuating arm and switch housing.

4. Adjust lateral position of switch so end of actuating arm is 0.03-inch minimum past centerline of locking piston.

o. Install roll AFCS package (paragraph 2-67).

2-40. Deleted.

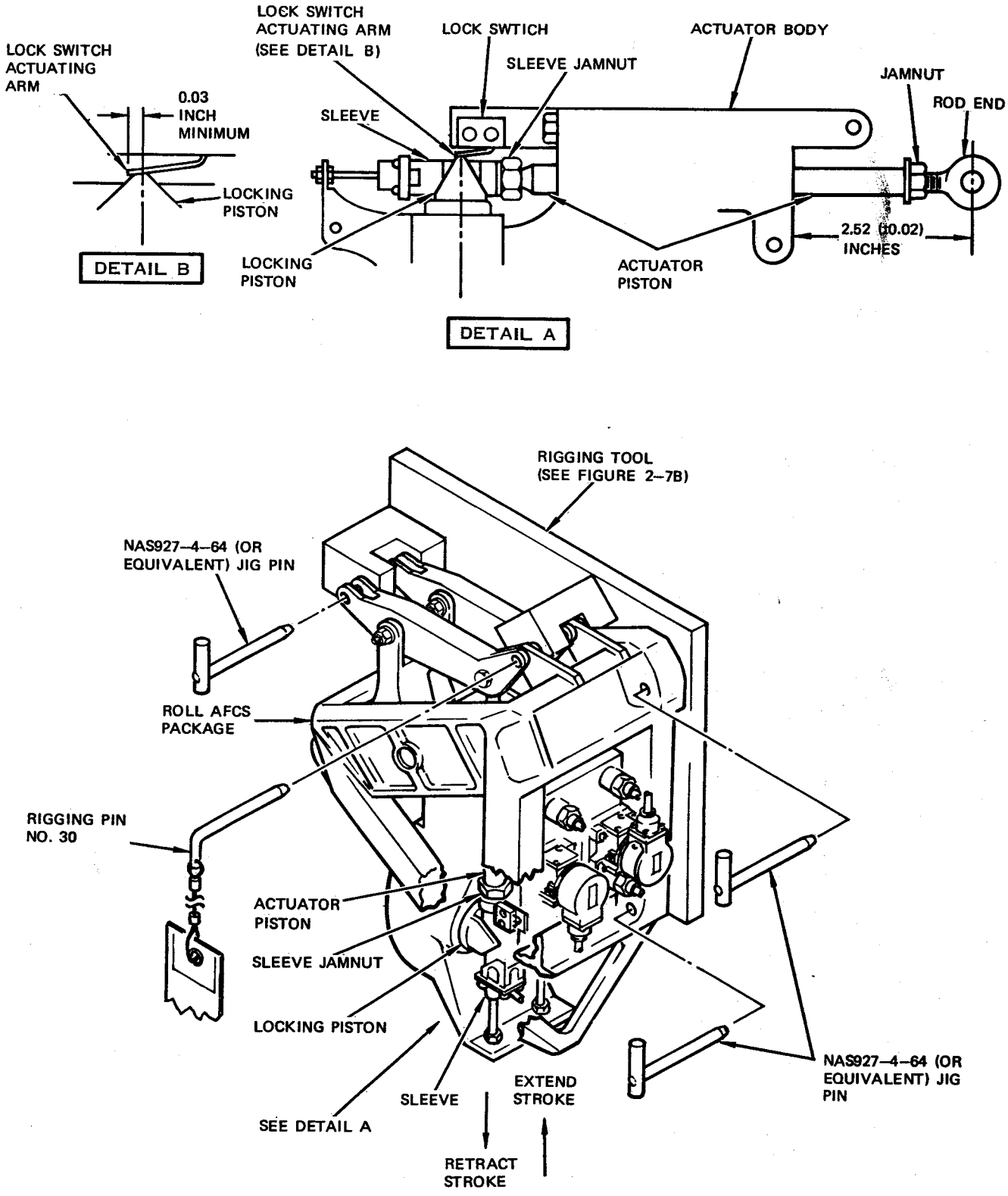
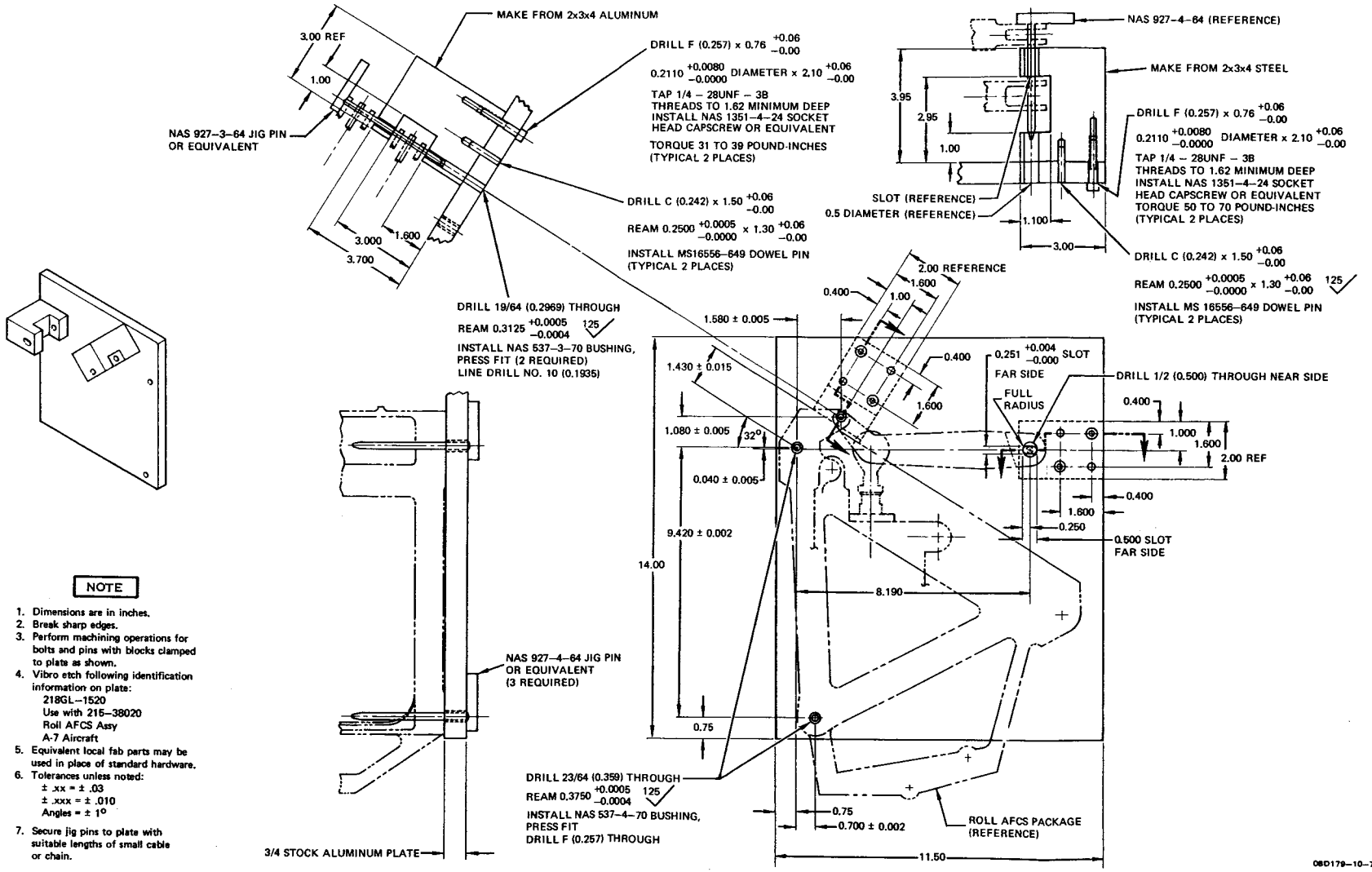


Figure 2-7A. Roll AFCS Package Rigging



NOTE

1. Dimensions are in inches.
2. Break sharp edges.
3. Perform machining operations for bolts and pins with blocks clamped to plate as shown.
4. Vibro etch following identification information on plate:
   218GL-1520
   Use with 215-38020
   Roll AFCS Assy
   A-7 Aircraft
5. Equivalent local fab parts may be used in place of standard hardware.
6. Tolerances unless noted:
   ± .xx = ± .03
   ± .xxx = ± .010
   Angles = ± 1°
7. Secure jig pins to plate with suitable lengths of small cable or chain.

Figure 2-7B. Roll/Yaw AFCS Package Rigging Tool

2-41. RIGGING AILERON/SPOILER MIXING LINKAGE INPUT LINK. (See figure 2-6.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
2-6	215-00110-5	Rigging pin No. 30	Rig linkage
2-6	215-00110-8	Rigging pin No. 31	Rig linkage

TT08D011-12-68

a. Open accesses 5111-1, 5111-4, 5113-1, and 10123-1.

b. Connect external electrical power (T.O. 1A-7D-2-1).

c. Place yaw stabilization engage switch in OFF.

WARNING

Do not disconnect any linkage while hydraulic pressure is applied to power control systems. Failure to shut down hydraulic power before disconnecting the linkage may result in injury to personnel or damage to control system components. Hydraulic control valves are spring-loaded and may move actuator to full throw when linkage is disconnected. After disconnecting linkage and reapplying hydraulic pressure to power control systems, avoid rapid bottoming of actuating cylinder.

d. Disconnect link (7) at aileron/spoiler mixing linkage.

e. Insert rigging pin No. 30.

f. Disconnect forward end of link (1) and move link to one side to gain access to rigging pin No. 31 hole.

g. Place roll trim disengage switch in ON and actuate roll and pitch trim button until rigging pin No. 31 can be inserted.

h. Adjust as necessary and connect link (7) to aileron/spoiler mixing linkage.

i. Remove rigging pins No. 30 and 31.

j. Connect forward end of link (1) with bolt, two washers, nut, and new cotter pin.

k. Disconnect external electrical power.

l. Close accesses 5111-1, 5111-4, 5113-1, and 10123-1.

2-42. RIGGING LINKAGE FROM AILERON/SPOILER MIXING LINKAGE TO SPOILER/DEFLECTOR AND AILERON LINKAGE STOPS. (See figure 2-6.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
2-6	215-00110-3	Rigging pin No. 32	Rig linkage
2-6	215-00110-4	Rigging pin No. 34	Rig linkage
2-6	215-00110-5	Rigging pin No. 33	Rig linkage
2-6	215-00110-8	Rigging pin No. 31	Rig linkage

TT08D013-12-68

a. Open accesses 5111-1, 10123-1, 3233-3, 3233-1, 4233-1, 4233-3, 3233-2, 4233-2, 3232-1, and 4231-2.

b. Back off spoiler linkage stops at bellcranks (access 3233-3 and 4233-3).

c. Connect external electrical power (T.O. 1A-7D-2-1).

d. Disconnect forward end of link (1) and move link to one side.

e. Place yaw stabilization engage switch in OFF.

f. Place roll trim disengage switch in ON.

g. Actuate roll trim button until rigging pin No. 31 can be inserted.

h. Adjust link (8) until rigging pin No. 34 can be inserted without deflecting load-limiting link (9).

i. Adjust link (10) until rigging pin No. 32 can be inserted.

j. Remove rigging pins No. 31, 32, and 34.

k. Install spoiler protractors (paragraph 4-22).

CAUTION

If spoiler/deflector rigging is not known to be correct, disconnect deflector rods (1, figure 4-4) to prevent possible damage to deflector when hydraulic power is applied. Also, if spoiler/deflector linkage is far out of rig, rigging of stops may be impossible until spoiler is rigged (paragraph 4-24).

l. Adjust outboard spoiler stop until stop contacts spoiler bellcrank and rigging pin No. 34 can be inserted.

m. Remove rigging pin No. 34.

n. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

o. Move spoiler bellcrank against inboard stop and adjust stopbolt until the spoiler is open 60° (+0°, -2°). Check that deflector is open.

p. Insert rigging pin No. 32.

q. Adjust link (11) (access 3233-1 and 3233-2, or 4233-1 and 4233-2) until rigging pin No. 33 can be inserted.

r. Remove rigging pins No. 32 and 33.

s. Connect forward end of link (1) with bolt, two washers, nut, and new cotter pin.

t. Disconnect external hydraulic power (T.O. 1A-7D-2-1).

u. Place roll trim disengage switch in OFF.

v. Disconnect external electrical power.

w. Remove spoiler protractors.

x. Close accesses 10123-1, 3233-1, 3233-3, 4233-1, 4233-2, 4233-3, 3233-2, 3232-1, 5111-1, and 4231-2.

2-43. RIGGING AILERON AND AILERON LINKAGE STOPS. (See figure 2-6.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
2-6	215-00110-5	Rigging pin No. 33	Rig linkage

TT08D014-12-68

a. Open accesses 3232-1 and 4231-2.

b. Install aileron protractors (paragraph 2-98).

c. Back off aileron linkage stops (accesses 3232-1 and 4231-2).

d. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

e. Connect external electrical power (T.O. 1A-7D-2-1).

f. Place yaw stabilization engage switch in STAB.

CAUTION

Shut down hydraulic power before adjusting rod end. Do not rotate piston rod in relation to cylinder. Rotation will damage internal seals and cause leakage.

g. Slowly stroke aileron actuator input linkage and bottom actuator in the retracted position. Aileron shall be at 26° 30' (±0°15') trailing edge down. Adjust piston rod end until aileron is positioned within tolerance. (One-half

turn on rod end is equal to approximately 15' of aileron deflection.)

h. Slowly stroke aileron actuator input linkage and bottom the actuator in the extended position. Aileron shall be at 26°00' minimum trailing edge up. Actuator shall be replaced if this position cannot be obtained.

i. Slowly return input linkage to neutral.

j. Insert rigging pin No. 33.

k. Adjust link (12) until aileron is at 0° (±0°10').

l. Remove rigging pin No. 33.

m. Actuate aileron to stop pad at trailing edge up position, and adjust stopbolt until aileron is at 25° (±0°30').

n. Actuate aileron to stop pad at trailing edge down position, and adjust stopbolt until aileron is at 25° (±0°30').

o. Return ailerons to neutral.

p. Place yaw stabilization engage switch in OFF.

q. Disconnect external electrical and hydraulic power (T.O. 1A-7D-2-1).

r. Torque jam nut to 108 pounds-feet, secure nut and locking device with MS20995C32 lockwire.

s. Remove aileron protractors.

t. Close accesses 3232-1 and 4231-2.

2-44. RIGGING SPOILER DEAD BAND STOPS. (See figure 2-6.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
2-6	215-00110-8	Rigging pin No. 31	Rig linkage
			TT08D015-12-68

a. Install aileron protractors (paragraph 2-98).

b. Connect external electrical power (T.O. 1A-7D-2-1).

c. Place roll trim disengage switch in ON.

d. Place yaw stabilization engage switch in OFF.

e. Open accesses 10123-1, 5111-1, and 6111-1.

f. Disconnect forward end of link (1) and move link to one side.

CAUTION

To prevent damage to linkage, do not apply hydraulic pressure to power control systems with rigging pin No. 31 installed.

g. Actuate roll trim until rigging pin No. 31 can be inserted.

h. Remove rigging pin No. 31.

i. Connect forward end of link (1) with bolt, two washers, nut, and new cotter pin.

j. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

k. Position left aileron at 2°30' (±0°15') trailing edge up. Adjust right dead band stop until stop contacts stop pad (access 5111-1).

l. Position right aileron at 2°30' (±0°15') trailing edge up. Adjust left dead band stop until stop contacts stop pad (access 6111-1).

m. Place roll trim disengage switch in OFF.

n. Disconnect external hydraulic power.

o. Disconnect external electrical power.

p. Remove aileron protractors.

q. Close accesses 5111-1, 6111-1, and 10123-1.

2-45. RIGGING ROLL CONTROL STICK STOPS. (See figure 2-6.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
2-6	215-00110-4	Rigging pin No. 25	Rig linkage
2-6	215-00110-5	Rigging pin No. 30	Rig linkage
2-6	215-00110-8	Rigging pin No. 31	Rig linkage

TT08D016-08-69

a. Open accesses 3123-1, 5111-1, 5113-1, and 10123-1.

b. Insert rigging pin No. 25.

c. Back off roll feel isolation actuator input stops.

d. Insert rigging pin No. 30.

e. Connect external electrical power.

f. Place roll trim disengage switch in ON.

g. Disconnect forward end of link (1) and move to one side.

h. Actuate roll trim button and extend or retract roll trim actuator until rigging pin No. 31 can be inserted.

i. Disconnect electrical power.

j. Remove rigging pins No. 25, 30, and 31.

k. Install aileron protractors (paragraph 2-98).

l. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

m. Adjust left control stick stopbolt to contact stop pad when left aileron trailing edge up position is 18° (+0°30',-0°0').

n. Adjust right control stick stopbolt to contact stop pad when right aileron trailing edge up position is 18° (+0°30',-0°0').

o. Connect forward end of link (1) with bolt, two washers, nut, and new cotter pin.

p. Adjust roll feel isolation actuator input stops (paragraph 2-46).

q. Remove aileron protractors.

r. Disconnect external hydraulic power.

s. Close accesses 3123-1, 5111-1, 5113-1, and 10123-1.

2-46. RIGGING ROLL FEEL ISOLATION ACTUATOR INPUT STOPS.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
2-6	215-00110-8	Rigging pin No. 31	Rig linkage

TT08D017-12-68

a. Connect external electrical power (T.O. 1A-7D-2-1).

b. Open accesses 10123-1, 3123-1, 5111-1, 5113-1, and 6111-1.

c. Place yaw stabilization engage switch in OFF.

d. Disconnect forward end of link (1, figure 2-6) and move link to one side to gain access to rigging pin No. 31 hole.

CAUTION

To prevent damage to linkage, do not apply hydraulic pressure to power control systems with rigging pin No. 31 installed.

e. Place roll trim disengage switch in ON. Actuate roll trim button until rigging pin No. 31 (figure 2-6) can be inserted.

f. Remove rigging pin No. 31.

g. Connect forward end of link (1) with bolt, two washers, nut, and new cotter pin.

h. Install aileron protractors (paragraph 2-98).

i. Install spoiler protractors (paragraph 4-22).

j. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

k. Move control stick slowly to the left, adjust upper stopbolt (11, figure 2-7) until left aileron is at 16° (+0°0', -0°30') trailing edge up. The left spoiler should be open 36° (+2°, -1°).

NOTE

If spoiler throw is not obtained, check for aileron neutral trim indication. If throw is still not obtained, check spoiler dead band stops (paragraph 2-44).

l. Move control stick slowly to the right and adjust lower stopbolt (12, figure 2-7) until right aileron is at 16° (+0', -30') trailing edge up. The right spoiler should be open 36° (+2°, -1°).

m. Place roll trim disengage switch in OFF.

n. Disconnect external electrical and hydraulic power (T.O. 1A-7D-2-1).

o. Remove aileron protractors.

p. Remove spoiler protractors.

q. Close accesses 10123-1, 3123-1, 5111-1, 5113-1, and 6111-1.

2-47. SERVICING.

2-48. For servicing of aileron system lateral viscous damper, refer to T.O. 1A-7D-2-1.

2-49. BLEEDING ROLL AFCS ACTUATOR.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
	AN/ASM-245A	AFCS flight line test set	Select fluid ports in AFCS actuator
	GGG-W-686	Torque wrench, 0 to 15 pound-inches	Tighten bleed fitting

TT08D018-03-76

a. Open access 5113-1.

b. Remove roll control amplifier (T.O. 1A-7D-2-9).

c. Connect plug P5 of test cable W3 to test set connector J1.

d. Connect plug P6 of test cable to rack-mounted control amplifier receptacle.

e. Connect external electrical power (T.O. 1A-7D-2-1).

f. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1) with test stand set for closed system operation. Do not apply hydraulic pressure.

g. Rotate TEST SIG control on test set to zero.

h. Cut lockwire on all four bleed fittings, and connect bleed tubes to bleed fittings on channel 1 side of actuator.

i. Submerge ends of bleed tubes in container of clean hydraulic fluid.

j. Place AFCS yaw stab switch in STBY for power to test set.

k. Place TEST CHANNEL switch in position 1 and HYDRO switch in BYPASS. Place AFCS SERVO switch in SERVO and hold.

l. Increase hydraulic pressure to unlock actuator, and decrease pressure to approximately 500 psi.

m. Slowly rotate TEST SIG control clockwise. When actuator starts extension, open bleed fitting on rod end side of actuator. Continue clockwise rotation of TEST SIG control until actuator bottoms, and close bleed valve.

n. Slowly rotate TEST SIG control counterclockwise. When actuator starts to retract, open bleed fitting on lug side of actuator. Continue counterclockwise rotation of TEST SIG control until actuator bottoms, and close bleed fitting.

o. Repeat steps m and n until air-free fluid flows from both bleed valves.

p. Rotate TEST SIG control to zero.

q. Release AFCS/SERVO switch.

r. Connect bleed tubes to bleed fittings on channel 2 side of actuator with ends submerged in hydraulic fluid.

s. Place TEST CHANNEL switch in position 2. Place AFCS SERVO switch in SERVO and hold. Perform steps m through q for the other pair of bleed plugs.

t. Remove bleed tubes.

u. Tighten bleed fittings to 10 (±5) pound-inches torque. Check for minimum gap of 0.010 inch between bleed fitting and retainer. If gap is less than 0.010 inch, replace bleed fitting.

v. Secure bleed fittings with MS20995C32 lockwire.

w. Disconnect test set from airplane.

x. Perform hydraulic system air check (T.O. 1A-7D-2-1).

y. Install roll control amplifier (T.O. 1A-7D-2-9).

z. Perform roll AFCS operational checkout (T.O. 1A-7D-2-9).

aa. Close access 5113-1.

2-50. VISCOUS DAMPER CYLINDER REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
2-6	215-00110-5	Rigging pin No. 35	Rig linkage TT08D146-07-70

2-51. REMOVAL.

a. Open access 1123-1.

b. Install rigging pin No. 35 in damper upper mounting bracket and arm assembly.

c. Remove cotter pin, nut, two washers, and bolt connecting upper end of link on damper to arm assembly.

d. Remove nut, two washers, and bolt attaching lower end mounting bracket to airplane structure.

e. Remove four nuts and four washers attaching damper to support and remove boot retainer plate.

f. Disengage boot from damper mounting bolts and remove damper from airplane.

g. Release clamp and remove clamp and boot from damper rod.

2-52. INSTALLATION.

a. Install No. 473 pressure sensitive vinyl tape (Minnesota Mining and Manufacturing Company) on damper upper mounting area that will interface with support when damper is installed.

b. Check that support is clean and free from foreign material in damper mounting area.

c. Install rubber boot over damper rod end.

d. Insert damper rod end through opening in damper support and push bottom of boot through opening. Check that vinyl tape is positioned to prevent direct contact between damper and support.

e. Seat damper on support and engage holes in boot with damper studs.

f. Install boot retainer plate and secure damper to support with four washers and four nuts. Lubricate nuts with MIL-G-6711 dry film lubricant during installation.

g. Secure lower end mounting bracket to airplane structure with bolt, two washers, and nut. Lubricate nut with dry-film lubricant during installation.

CAUTION

If necessary to adjust rod end to permit insertion of bolt, do not adjust more than 0.12 inch either side of damper neutral to prevent bottoming.

h. Secure upper end of damper link to arm assembly with bolt, two washers, nut, and new cotter pin.

i. Remove rigging pin No. 35.

j. Position and hold pilot control stick so damper is fully extended and install boot around damper rod with ratchet clamp so that top of boot is approximately 1/4 inch below start of rod end flareout. Release control stick.

k. Check damper cylinder for proper servicing (T.O. 1A-7D-2-1). Ensure filler cap is retained with safety chain or lockwire.

l. Perform aileron control system operational checkout (paragraph 2-25 or 2-26).

m. Close access 1123-1.

2-53. FORWARD LOAD-LIMITING LINK REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external hydraulic power	Connect hydraulic power
2-6	215-00110-4	Rigging pin No. 25	Rig linkage
2-6	215-00110-7	Rigging pin No. 26	Rig linkage

TT08D019-07-70

2-54. REMOVAL.

a. Open accesses 1123-1 and 1123-4.

WARNING

Ensure that link position is neutral and that link is not binding structure.

b. Remove cotter pins, nuts, washers, and bolts at both ends of link, and remove link.

2-55. INSTALLATION.

a. Connect nonadjustable end of link to forward support assembly with bolt, (head inboard), washers, and nut. Tighten nut and install new cotter pin.

NOTE

See figure 2-6 for rigging pin locations.

b. Install rigging pins No. 25 and 26.

c. Align rod end with bellcrank holes by adjusting rod end or link (2, figure 2-6). Tighten jamnut and secure with MS20995C32 lockwire.

d. Connect rod end to bellcrank with bolt (head inboard), washers, and nut. Tighten nut and install new cotter pin.

e. Remove rigging pins No. 25 and 26.

f. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

g. Cycle aileron control system and check for smooth operation with no interference or binding.

h. Release stick and check that stick returns approximately to neutral. Move ailerons to trim neutral.

i. Disconnect external hydraulic power (T.O. 1A-7D-2-1).

j. Close accesses 1123-1 and 1123-4.

2-56. BOBWEIGHT REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external hydraulic power	Connect hydraulic power TT08D135-09-69

2-57. REMOVAL.

a. Open access 1132-1.

b. Remove nuts, washers, and bolts attaching bobweight assembly to arm assembly. Remove bobweight and shim.

2-58. INSTALLATION.

WARNING

Alodine is moderately toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate.

Epoxy primer is highly toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate.

a. Apply two coats of MIL-P-6889, Type I, or MIL-C-5541 (Alodine 1200s) conversion coat with epoxy primer applied in accordance with T.O. 1-1-2, paragraph 6-10.d., NOTE to bobweight surface which will contact shim (T.O. 1A-7D-23).

WARNING

Corrosion preventive compound is flammable and slightly toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate.

b. Apply MIL-C-16173 corrosion-preventive compound to bobweight attaching bolts.

c. Install bobweight and shim on arm assembly with bolts, washers (all washers under boltheads), and nuts.

d. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

e. Cycle aileron control system and check for smooth operation without binding or interference. Release stick and check that ailerons and stick return approximately to neutral.

f. Disconnect external hydraulic power (T.O. 1A-7D-2-1).

g. Close access 1132-1.

2-59. ROLL FEEL SPRING AND ARM REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external hydraulic power	Connect hydraulic power TT08D135-09-69

2-60. REMOVAL. (See figure 2-8.)

a. Open access 5113-1.

b. Remove upper spring mounting bolt (1) and remove spring (2).

c. Remove cotter pin, nut, washer, and bolt securing feel spring input link (3) at lower end.

d. Remove cotter pin, nut, washers, and bolt securing lower arm to support and remove arm (4).

e. Remove cotter pin, nut, washers, and bolt securing upper arm and remove arm (5).

2-61. INSTALLATION. (See figure 2-8.)

NOTE

Install upper arm (5) and lower arm (4) as shown in figure 2-8 with adjustment lugs inboard.

a. Install upper arm (5) and secure with bolt, washers, nut, and new cotter pin.

b. Install spring (2) and secure with upper spring-mounted bolt (1).

c. Install lower arm (4) with bolt, washers, nut, and new cotter pin.

d. Install feel spring input link (3) with bolt, washers, nut, and new cotter pin.

e. Rig roll feel spring (paragraph 2-37).

f. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

g. Cycle control stick from stop to stop checking for smooth control response.

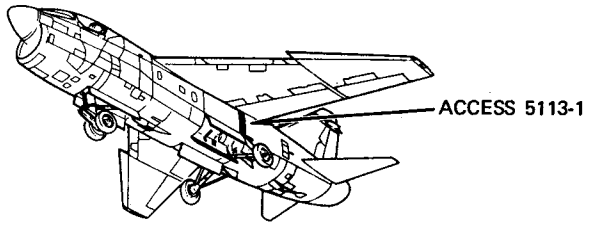
h. Deflect control stick to left and release. Check that ailerons return to neutral.

i. Deflect control stick to right and release. Check that ailerons return to neutral.

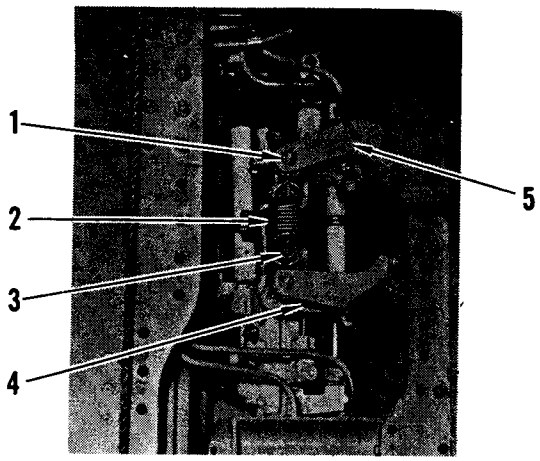
j. Disconnect external hydraulic power (T.O. 1A-7D-2-1).

k. Close access 5113-1.

2-62. ROLL FEEL ISOLATION EXTENSION UNIT REMOVAL AND INSTALLATION. (Refer to T.O. 1A-7D-2-4.)



1. Bolt
2. Spring
3. Link
4. Lower arm
5. Upper arm



08D008-04-68

Figure 2-8. Roll Feel Spring and Arm Removal and Installation

2-63. ROLL FEEL ISOLATION ACTUATOR REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external hydraulic power	Connect hydraulic power
	GGG-W-686	Torque wrench, 0 to 300 pound-inches	Tighten extension unit fittings
			TT08D021-11-74

2-64. REMOVAL. (See figure 2-9.)

a. Dump reservoir accumulator hydraulic pressure (T.O. 1A-7D-2-1).

b. Open accesses 5113-1 and 5111-4.

c. Remove cotter pin, nut, and washer from outboard end of lower feel spring bellcrank attach bolt (1).

d. Remove cotter pin, nut, and washer from outboard end of upper feel spring bellcrank attach bolt (2).

e. Remove cotter pin (3), nut (4), counterbored washer (5), washer (6), and self-retaining bolt (7) connecting feel spring bellcrank link (8) to lever (9). See paragraph 2-95 for removal of self-retaining bolt.

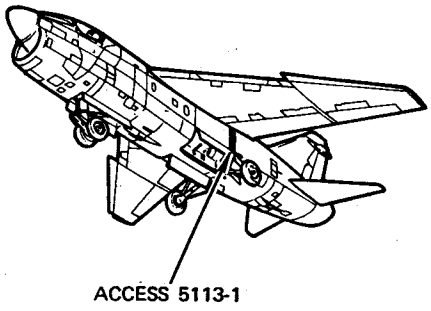
f. Remove upper and lower feel spring bellcrank attach bolts (1 and 2), then remove bellcrank from airplane.

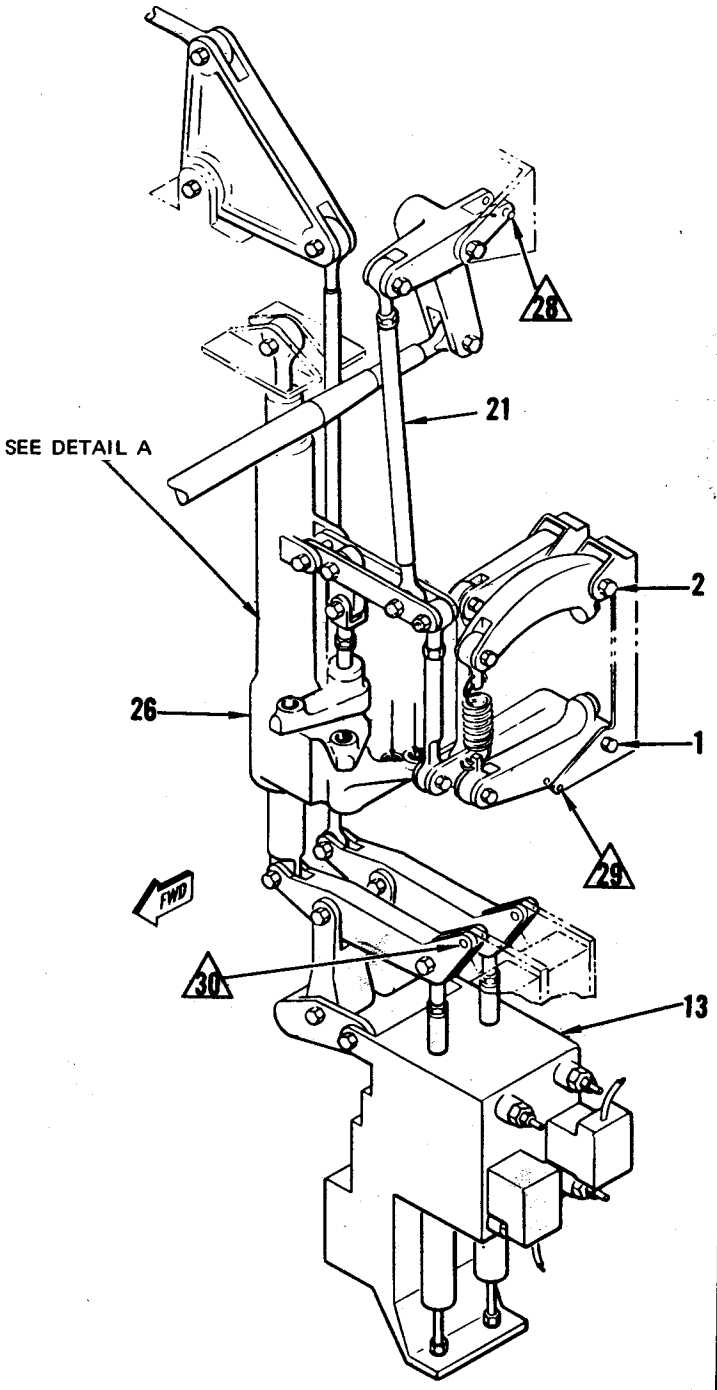
g. Disconnect lower ends of two forward hydraulic extension units (10) from isolation actuator servo valve (11). Discard O-rings (12), and plug or cap open ports and fittings. Extension units will remain in airplane.

h. To facilitate removal of isolation actuator, disconnect lower ends of two hydraulic lines from roll stabilization actuator (13) and upper ends from structure mounting. Remove both lines from airplane. Cap or plug open ports and fittings.

i. Disconnect lower ends of two aft hydraulic extension units (14) from isolation actuator servo valve (11). Discard O-rings (15), and plug or cap open ports and fittings. Extension units will remain in airplane.

j. Remove cotter pin (16), nut (17), counterbored washer (18), washer (19), and self-retaining bolt (20) connecting control linkage input rod (21) to lever (9).





1. Lower attach bolt
2. Upper attach bolt
3. Cotter pin
4. Nut
5. Counterbored washer
6. Washer
7. Self-retaining bolt
8. Feel spring bellcrank link
9. Lever
10. Forward hydraulic extension units
11. Servo valve
12. O-ring
13. Roll stabilization actuator
14. Aft hydraulic extension units
15. O-ring
16. Cotter pin
17. Nut
18. Counterbored washer
19. Washer
20. Self-retaining bolt
21. Control linkage input rod
22. Cotter pin
23. Nut
24. Washers
25. Bolt
26. Roll feel isolation actuator
27. Cotter pin
28. Nut
29. Counterbored washer
30. Washer
31. Self-retaining bolt
32. AFCS input linkage

△ Rigging pin holes

08D011-01-03-76

Figure 2-9. Roll Feel Isolation Actuator Removal and Installation (Sheet 1)

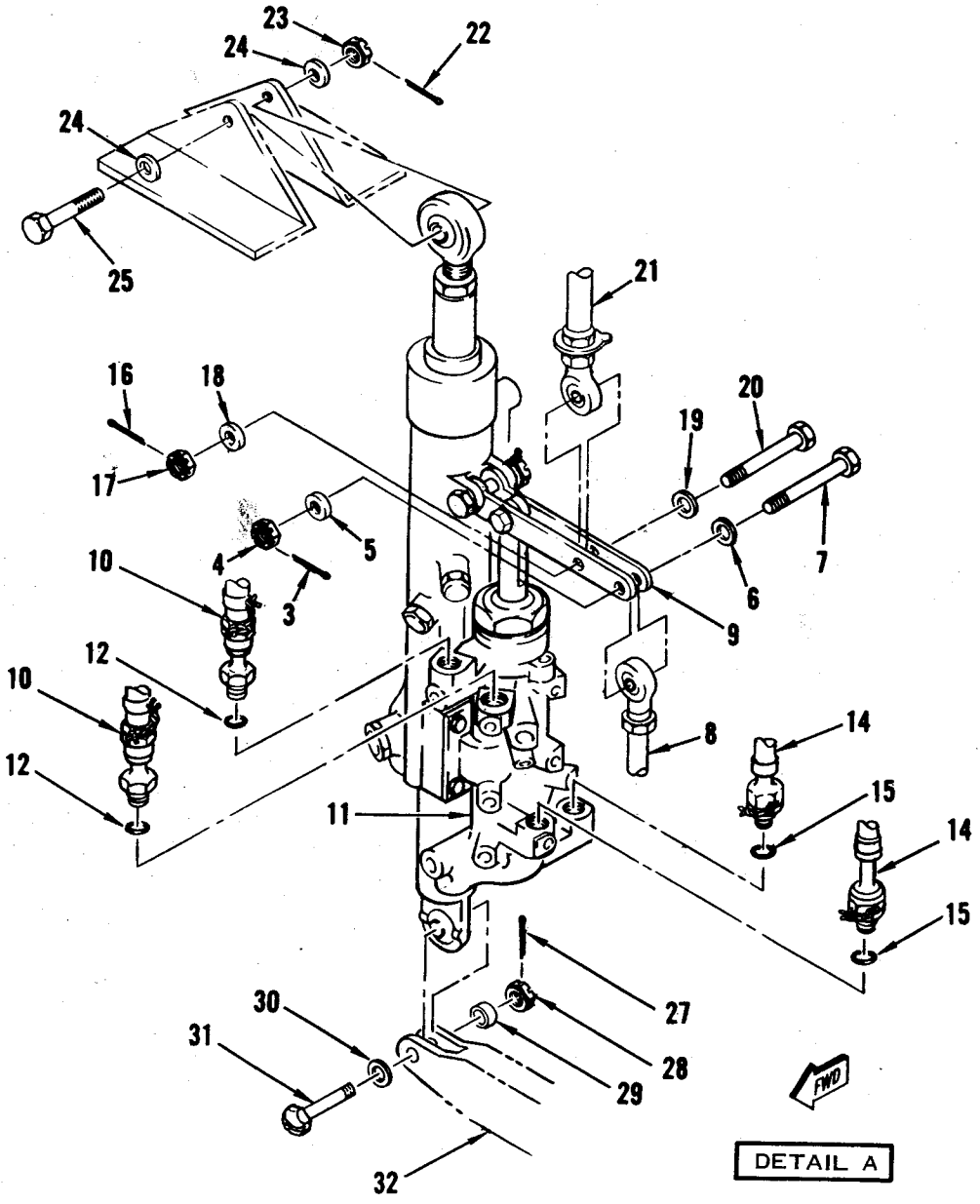


Figure 2-9. Roll Feel Isolation Actuator Removal and Installation (Sheet 2)

k. Remove cotter pin (22), nut (23), two washers (24), and bolt (25) connecting rod end of roll feel isolation actuator (26) to airplane structure.

l. Remove cotter pin (27), nut (28), counterbored washer (29), washer (30), and self-retaining bolt (31) connecting lug end of actuator to AFCS input linkage (32).

m. Remove actuator from airplane.

2-65. INSTALLATION. (See figure 2-9.)

NOTE

Checking actuator rod end for proper adjustment before installing actuator will reduce amount of time required to complete installation. Replacement cylinders should have been previously adjusted to correct length.

a. Drain preservative fluid and fill actuator with hydraulic fluid.

b. With actuator piston fully retracted, check that length between center of rod end and lug end mounting holes is 16.03 inches. Check that MIL-S-8802 sealant is present on rod end jamnut/keyway area to prevent entrance of moisture and that rod end jamnut is secured with MS20995C32 lockwire.

c. Position actuator in airplane with lug end aligned in clevis of AFCS input linkage (32) and rod end aligned between connecting points of airplane structure.

d. Secure rod end of actuator (26) to airplane structure with bolt (25), two washers (24), nut (23), and new cotter pin (22).

e. Secure lug end of actuator to AFCS input linkage with self-retaining bolt (31), washer (30), counterbored washer (29), nut (28), and new cotter pin (27). Refer to paragraph 2-95 for removal of self-retaining bolt.

f. Remove caps or plugs from lower ends of four hydraulic extension units (10 and 14) and mating ports on isolation actuator servo valve (11).

g. Install new O-rings (12) and (15), and then connect extension units to servo valve and tighten to 150 (±50) pound-inches torque.

h. Remove plugs from hydraulic lines and install lines in airplane.

i. Position feel spring bellcrank in airplane and insert upper and lower attach bolts (1 and 2).

CAUTION

Ensure that self-retaining bolt (7) is installed with thread end forward to prevent damage to extension unit.

j. Secure feel spring bellcrank link (8) to isolation actuator lever (9) with self-retaining bolt (7), washer (6), counterbored washer (5), nut (4), and new cotter pin (3).

k. Secure feel spring bellcrank by installing washer, nut, and new cotter pin on both attach bolts (1 and 2).

l. Bleed roll feel isolation actuator (paragraph 2-66). Leave hydraulic power connected.

m. Back off actuator upper and lower stopbolts (11 and 12, figure 2-7).

n. Move control stick full left, read left aileron up position, and then move control stick full right, read right aileron up position. Ailerons should be a minimum of 16°30' on each side.

o. If aileron minimum movement was not obtained in step n, perform the following:

1. Remove actuator from airplane (paragraph 2-64).

WARNING

Do not rotate the piston rod in relation to the cylinder. Rotation will result in mislocation of internal piston seals causing excessive leakage past piston.

2. Obtain aileron minimum movement by centering actuator piston stroke. This can be accomplished by adjusting actuator rod end in 180° increments so that with hydraulic power applied, both left and right aileron trailing edge up deflections are 16°30' minimum.

NOTE

Adjusting rod end out will decrease left aileron up throw. One 180° turn is equivalent to approximately 30' of surface movement.

3. Tighten rod end jamnut to 95 to 110 pound-inches torque and secure jamnut with MS20995C32 lockwire.

4. Apply MIL-S-8802 sealant on rod end jamnut/keyway area to prevent entrance of moisture.

5. Install actuator on airplane (steps c through l, n and subsequent).

p. If aileron minimum movement was obtained in step n, rig actuator input stops (paragraph 2-46).

q. Perform aileron control system operational checkout (paragraph 2-26).

r. Check hydraulic fittings and lines for leaks.

s. Close accesses 5113-1 and 5111-4.

2-66. BLEEDING ROLL FEEL ISOLATION ACTUATOR. (See figure 2-9.)

Tools Required

Figure & Index No.	Part Number	Nomenclature	Use and Application
		Equipment required for connecting external hydraulic power	Connect hydraulic power
	GGG-W-686	Torque wrench, 10 to 150 pound-inches	Tighten bleed fittings
			TT08D147-07-70

WARNING

To avoid injury to personnel or damage to equipment, ensure that personnel and equipment are clear of aileron and spoiler/deflector surfaces before applying hydraulic power or moving servo valve input rod lever.

a. Open access 5113-1.

b. Disconnect control linkage input rod (21) from lever (9).

c. On airplanes through AF69-6196 connect external hydraulic power to PC No. 1 and PC No. 2 hydraulic systems (T.O. 1A-7D-2-1). Slowly apply 400 (±100) psi hydraulic pressure with test stand set for closed system operation.

d. On airplanes AF69-6197 and subsequent, connect external hydraulic power to PC No. 2 and PC No. 3 hydraulic systems (T.O. 1A-7D-2-1). Slowly apply 400 (±100) psi hydraulic pressure with test stand set for closed system operation.

e. Connect bleed hoses to bleed fittings.

f. Open bleed fittings C2 and C4 on servo valve and allow fluid to flow until free of air. Do not close fittings.

CAUTION

To prevent high speed bottoming of cylinder piston, hold servo valve control rod securely during actuation of valve. The valve is spring loaded to drive the actuator to the retracted position.

g. Manually move servo valve rod to extend actuator. As actuator bottoms, close bleed fittings C2 and C4 and, while holding valve rod in same position, open valve bleed fittings C1 and C3. Allow fluid to flow from C1 and C3 until free of air. Do not close fittings.

h. Move servo valve rod to retract actuator. As cylinder bottoms, close bleed ports C1 and C3.

i. Repeat steps f, g, and h until air-free fluid flows from bleed fittings.

j. Remove bleed hoses.

k. Tighten bleed fittings to 10 (±5) pound-inches torque and secure with MS20995C32 lockwire.

l. Perform hydraulic system air check (T.O. 1A-7D-2-1).

m. Disconnect external hydraulic power.

CAUTION

Ensure that self-retaining bolt (20) is installed with thread end forward to prevent damage to extension unit.

n. Secure control linkage input rod (21) to isolation actuator lever (9) with self-retaining bolt (20), washer (19), counterbored washer (18), self-locking castellated nut (17), and new cotter pin (16).

o. Close access 5113-1.

2-67. ROLL AFCS PACKAGE REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
2-6	215-00110-5	Rigging pins No. 28 and 30	Rig linkage
2-6	215-00110-8	Rigging pin No. 31	Rig linkage
2-11	(Local fabrication)	AFCS package installation tool	Remove and install bolt
			TT08D022-10-77

2-68. REMOVAL. (See figure 2-10.)

a. Open accesses 5111-1, 5111-4, 5113-1, and 10123-1.

b. Disconnect and remove hydraulic lines from roll AFCS actuator and airplane structure.

c. Disconnect electrical connector from bulkhead bracket.

d. Remove self-retaining bolt (paragraph 2-95) attaching link assembly (1) to bellcrank (2).

e. Remove self-retaining bolt attaching roll feel isolation actuator (3) to bellcrank (4).

f. Cut lockwire on bolt (7). Using a long open end wrench or locally fabricated tool (figure 2-11), loosen bolt (7) until threads disengage. Remove bolts (5 and 6) attaching package to airplane.

NOTE

Ensure roll feel isolation actuator is in neutral position to prevent binding of AFCS actuator upon removal.

g. Remove AFCS roll package (8) from airplane.

h. Remove hydraulic line fittings from roll AFCS actuator.

2-69. INSTALLATION. (See figure 2-10.)

a. Rig roll AFCS package (paragraph 2-39).

a-1. Drain preservative fluid and fill actuator with hydraulic fluid.

b. Install hydraulic line fittings on roll AFCS actuator.

c. Insert bolt (7) in AFCS roll package and position package in airplane.

d. Tilt package to gain access and start bolt (7) by hand.

e. Install bolts (6 and 5).

f. Tighten bolt (7) using a long open end wrench or locally fabricated tool (figure 2-11). Secure bolt with MS20995C32 lockwire.

g. Install self-retaining bolt (paragraph 2-95) securing roll feel isolation actuator (3) to bellcrank (4).

h. Install self-retaining bolt securing link assembly (1) to bellcrank (2).

i. Connect hydraulic lines and electrical connector to package.

j. Connect external electrical power (T.O. 1A-7D-2-1).

NOTE

Ensure that roll trim system is trimmed to neutral and that yaw stabilization engage switch is in OFF.

k. Bleed roll AFCS actuator (paragraph 2-49).

NOTE

See figure 2-6 for rigging pin and link locations. If rigging pins cannot be inserted in steps l and n, rig roll feel isolation actuator (paragraph 2-38).

l. Insert rigging pins No. 28 and 30.

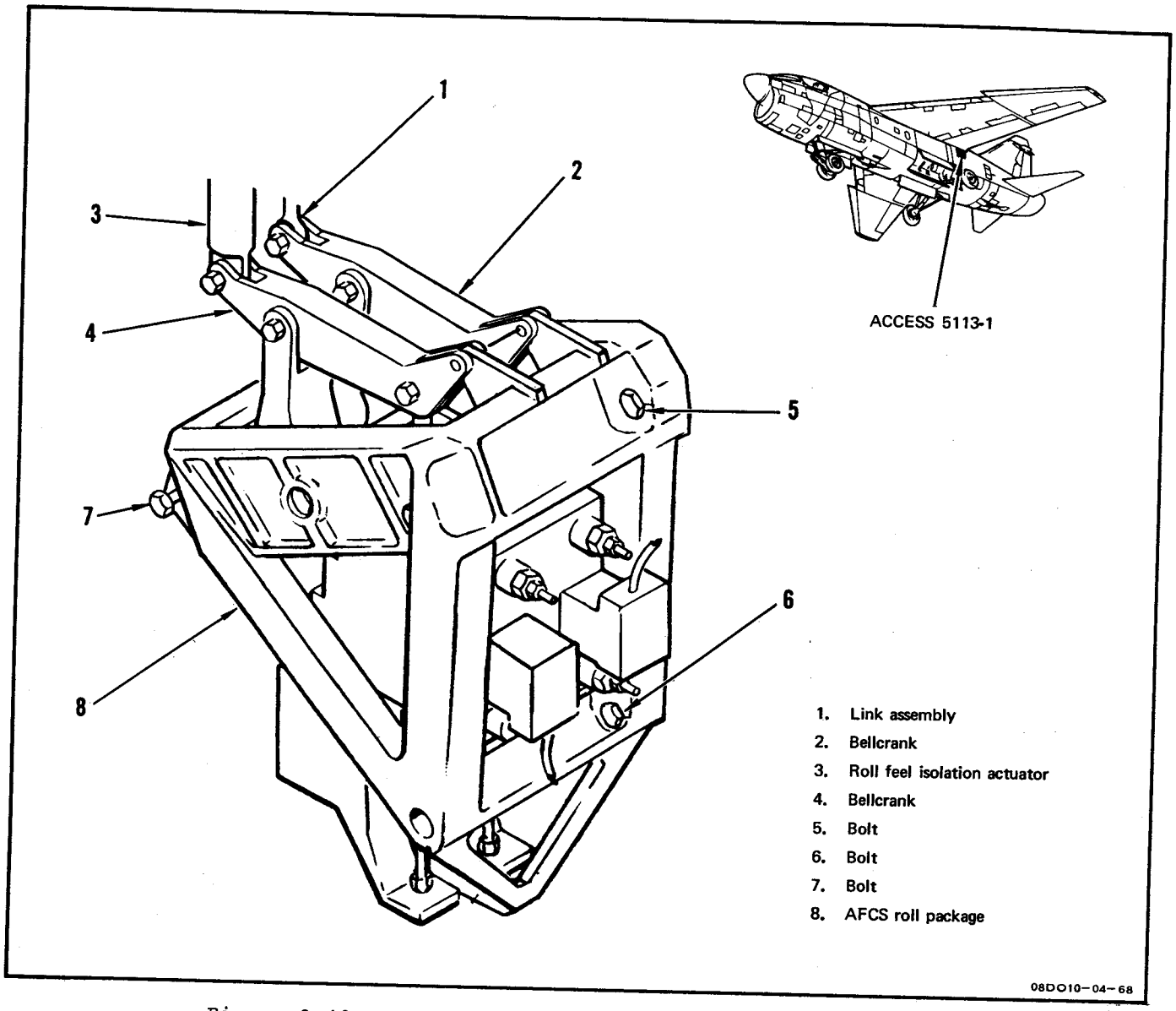


Figure 2-10. Roll AFCS Package Removal and Installation

m. Disconnect forward end of link (1, figure 2-6) and move link to one side.

n. Insert rigging pin No. 31.

o. Remove rigging pins No. 28, 30, and 31.

p. Connect forward end of link (1, figure 2-6) with bolt, washers, nut, and new cotter pin.

q. Perform preparation, roll AFCS actuator test, and posttest portions of AFCS roll axis troubleshooting (T.O. 1A-7D-2-9).

r. Perform AFCS roll axis adjustment (T.O. 1A-7D-2-9).

s. Perform AFCS roll axis operational checkout (T.O. 1A-7D-2-9).

t. Close accesses 5111-1, 5111-4, 5113-1, and 10123-1.

2-70. AILERON/SPOILER MIXING LINKAGE REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
2-6	215-00110-3	Rigging pin No. 32	Rig linkage
2-6	215-00110-4	Rigging pin No. 34	Rig linkage
2-6	215-00110-5	Rigging pin No. 30	Rig linkage
2-6	215-00110-8	Rigging pin No. 31	Rig linkage
	403B	AC voltmeter	Measure voltage

TT08D153-7-72

2-71. REMOVAL. (See figure 2-12.)

a. Defuel airplane (T.O. 1A-7D-2-1).

b. Open accesses 3123-1, 3233-2, 3233-4, 4123-1, 4233-2, 4233-4, 5111-1, 5111-2, 5111-4, 5111-5, 5113-1, 6111-1, 6111-2, 6111-3, 6111-4, and 10123-1.

WARNING

Ensure electrical power is disconnected from airplane and that static ground cable is installed before removing fuel lines to prevent ignition of fuel vapors.

c. Remove fuel lines (1, 2, 3, and 4) and cap lines.

d. Remove fuel line (5) and air pressure line (6); cap lines.

e. Remove roll trim actuator (paragraph 3-26).

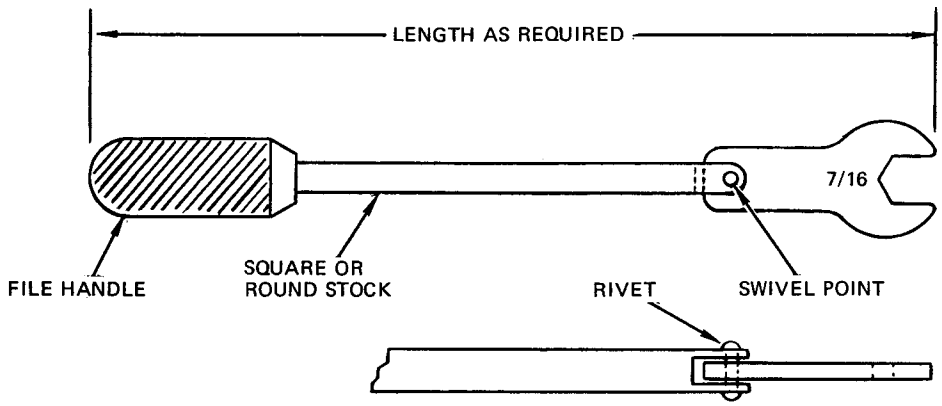
f. Disconnect aileron-rudder interconnect transducer (7) from mixing linkage by removing cotter pin, nut, washers, and bolt.

g. Disconnect left and right links (8) from upper arm of mixing linkage by removing cotter pins, nuts, counterbored washers, self-retaining bolts (paragraph 2-95), and washers.

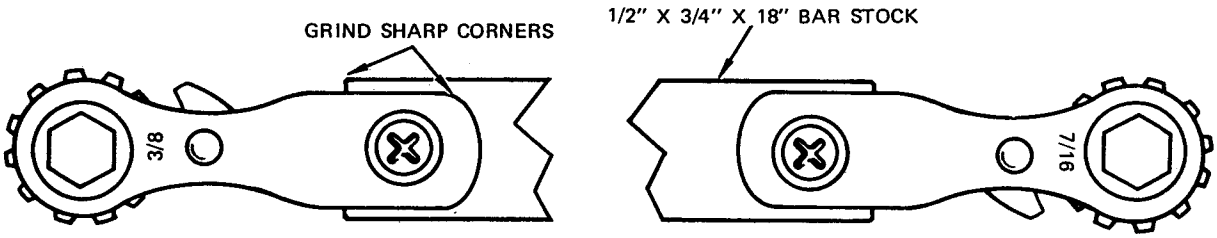
MAJOR CHANGE

NOTE

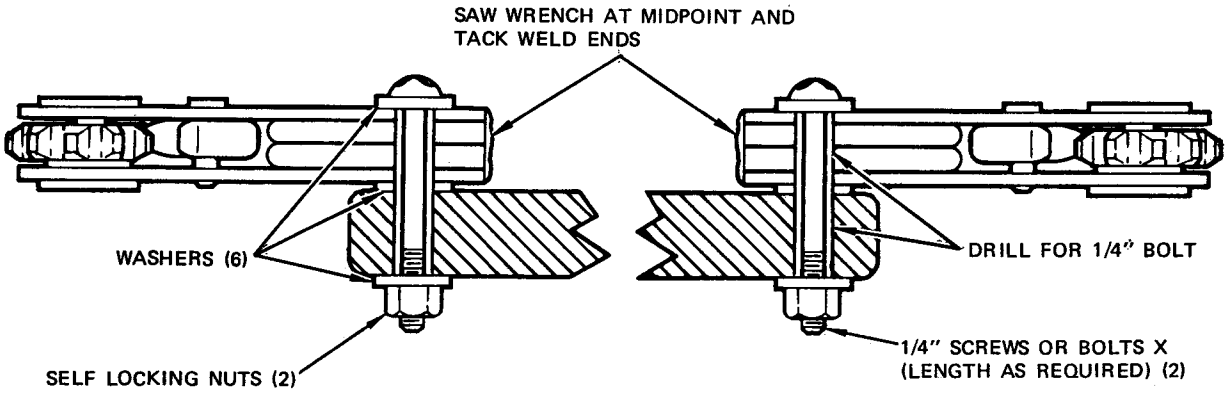
Fabricate either tool as convenient. The ratchet type tool with the 3/8-inch end can also be used in removing and installing the yaw AFCS package (T.O. 1A-7D-2-9).



ROLL AFCS PACKAGE INSTALLATION TOOL



3/8" X 7/16" BOX REVERSIBLE RATCHET WRENCH
(GSA STOCK NO. 5120-00-831-1054)



ROLL/YAW AFCS PACKAGE INSTALLATION TOOL

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Figure 2-11. AFCS Package Installation Tool

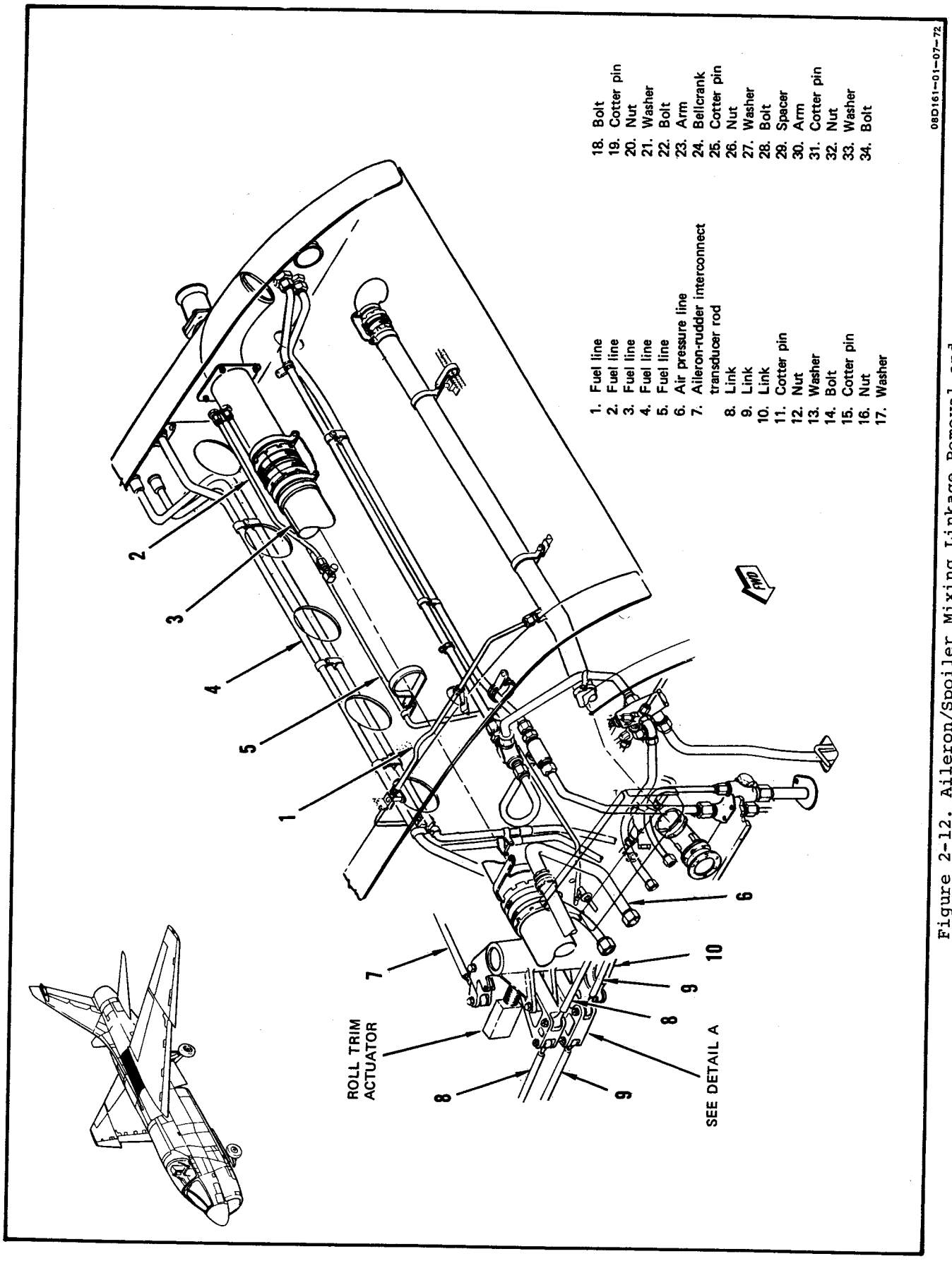

Figure 2-12. Aileron/Spoiler Mixing Linkage Removal and Installation (Sheet 1)

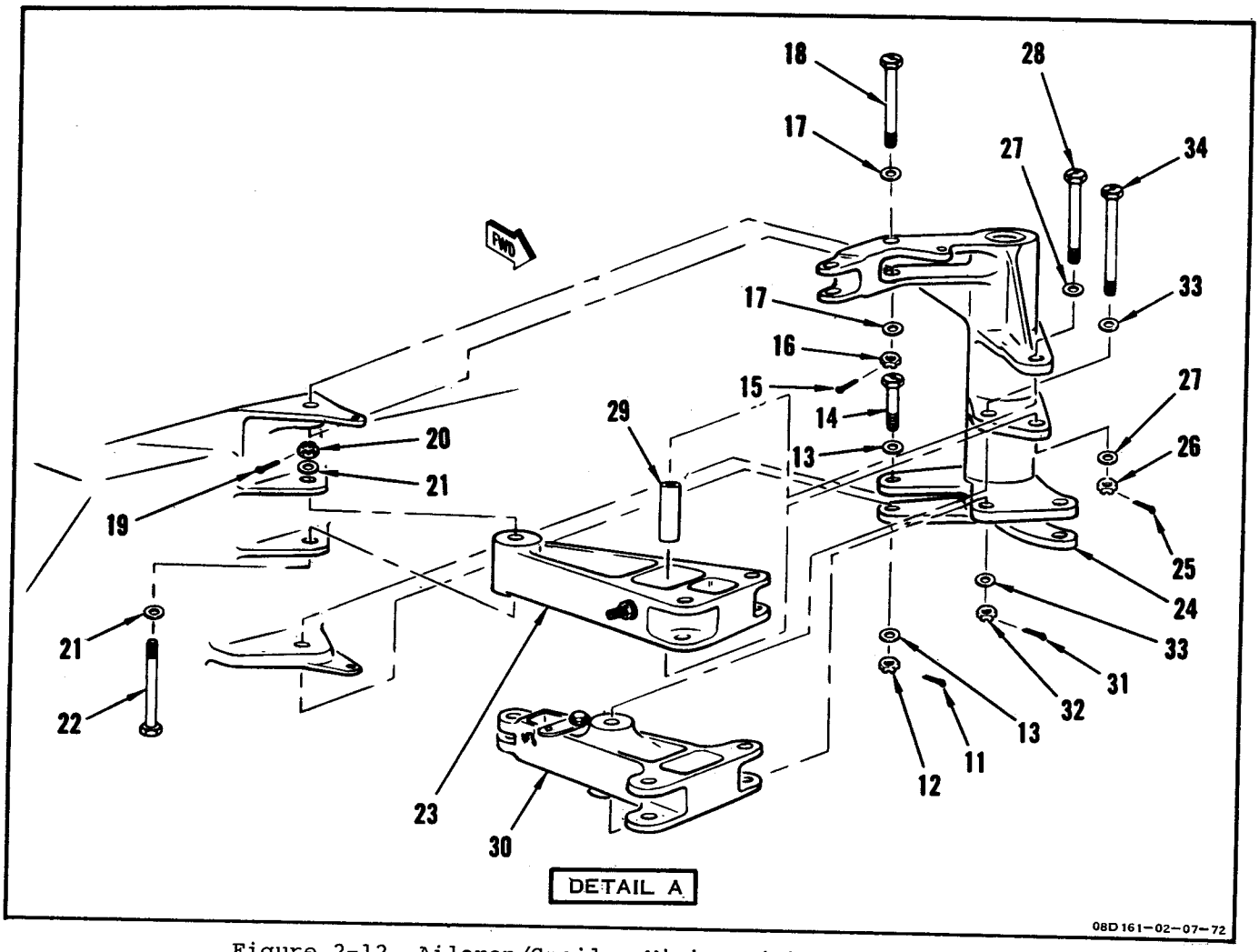

Figure 2-12. Aileron/Spoiler Mixing Linkage Removal and Installation (Sheet 2)

h. Disconnect left and right links (9) from lower arm of mixing linkage by removing cotter pins, nuts, counterbored washers, self-retaining bolts (paragraph 2-95), and washers.

i. Disconnect link (10) from bellcrank of mixing linkage by removing cotter pin, nut, counterbored washer, self-retaining bolt (paragraph 2-95), and washer.

j. Remove cotter pin (11), nut (12), washers (13), and bolt (14).

k. Remove cotter pin (15), nut (16), washers (17), and bolt (18).

l. Cut lockwire securing head of bolt (22) and remove cotter pin (19), nut (20), washers (21), and bolt (22). Remove mixing linkage from airplane.

m. Disassemble mixing linkage as follows:

1. Disconnect upper arm (23) from bellcrank (24) by removing cotter pin (25), nut (26), washers (27), bolt (28), and spacer (29).

2. Disconnect lower arm (30) from bellcrank (24) by removing cotter pin (31), nut (32), washers (33), and bolt (34).

2-72. INSTALLATION. (See figure 2-12.)

a. Assemble mixing linkage as follows:

NOTE

When linkage is properly assembled and positioned in airplane, the part numbers embossed on arms (23 and 30) will be facing up.

1. Connect lower arm (30) to bellcrank (24) with washers (33), bolt (34), nut (32), and new cotter pin (31).

2. Connect upper arm (23) to bellcrank (24) with spacer (29), washers (27), bolt (28), nut (26), and new cotter pin (25).

NOTE

Install bolt (22) with threaded end up.

b. Position mixing linkage in airplane with hole in arm (23) aligned with holes in mounting lugs and secure arm to lugs with washers (21), bolt (22), nut (20), and new cotter pin (19). Secure bolthead to lug with MS20995C32 lockwire.

c. Align holes in bellcrank (24) with holes in mounting lugs and secure bellcrank to upper lug with washers (17), bolt (18), nut (16), and new cotter pin (15).

d. Secure bellcrank (24) to lower mounting lug with washers (13), bolt (14), nut (12), and new cotter pin (11).

NOTE

See figure 2-6 for rigging pin locations.

e. Insert rigging pins No. 30 and 31.

f. Adjust rod end of link (10) to align with holes in bellcrank (24).

g. Secure rod end to bellcrank with washer, self-retaining bolt (paragraph 2-95), counterbored washer, nut, and new cotter pin.

h. Remove rigging pin No. 30.

i. Insert rigging pin No. 32 in both sides of wing.

j. Adjust left or right link (9) so that link can be connected to lower arm (30) without deflecting link (14, figure 2-6).

k. Secure link to arm with washer, self-retaining bolt (paragraph 2-95), counterbored washer, nut, and new cotter pin.

l. Repeat steps j and k for opposite link.

m. Remove rigging pins No. 32 from both sides of wing.

n. Insert rigging pins No. 34 on both sides of wing.

o. Adjust left or right link (8, figure 2-6) so that link (8, figure 2-12) can be connected to upper arm (23) without deflecting link (8, figure 2-12).

p. Secure link to arm with washer, self-retaining bolt (paragraph 2-95), counterbored washer, nut, and new cotter pin.

q. Repeat steps o and p for opposite link.

r. Remove rigging pins No. 34 from both sides of wing.

s. Adjust rod end of transducer (7) to align with hole in bellcrank (24). Snug jamnut, but do not secure.

t. Cut secondary wires 5-22, 6-22, 7-22, and 8-22 at splices of transducer (7).

u. Using a small piece of insulating material, secure wires 5-22 and 6-22 so that open ends cannot contact each other or metal structure.

v. Connect ac voltmeter leads to wires 7-22 and 8-22.

w. Connect external electrical power (T.O. 1A-7D-2-1).

x. Place yaw stabilization engage switch in AFCS panel in STAB.

y. Place AFCS engage switch on AFCS panel in CONT AUG.

z. Adjust rod end of transducer so that attachment to bellcrank can be made with a null indication on voltmeter.

aa. Tighten rod end jamnut and secure with MS20995C32 lockwire.

ab. Secure rod end to bellcrank with washers, bolt, nut, and new cotter pin.

ac. Place yaw stabilization engage switch and AFCS engage switch in OFF.

ad. Disconnect external electrical power.

ae. Remove voltmeter and splice transducer wires 5-22, 6-22, 7-22, and 8-22 to airplane wiring.

af. Install roll trim actuator (paragraph 3-26), except do not perform operational checkouts.

ag. Install air pressure line (6) and fuel (5).

ah. Install fuel lines (4, 3, 2, and 1).

ai. Perform aileron control system operational checkout (paragraph 2-25 or 2-26).

aj. Perform roll trim system operational checkout (paragraph 3-12).

ak. Perform AFCS operational checkout (T.O. 1A-7D-2-9).

al. Fuel airplane (T.O. 1A-7D-2-1) and check connections for leaks.

am. Close accesses 3123-1, 3233-2, 3233-4, 4123-1, 4233-2, 4233-4, 5111-1, 5111-2, 5111-4, 5111-5, 5113-1, 6111-1, 6111-2, 6111-3, 6111-4, and 10123-1.

2-73. SPOILER/DEFLECTOR LOAD-LIMITING LINK REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment required for connecting external electrical power	Connect electrical power
		Equipment required for connecting external hydraulic power	Connect hydraulic power
2-6	215-00110-4	Rigging pin No. 34	Rig linkage
2-6	215-00110-8	Rigging pin No. 31	Rig linkage

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2-74. REMOVAL.

a. If left spoiler/deflector load-limiting link is being removed, open accesses 10123-1, 5111-1, 5111-4, 3123-1, 3233-4, and 3233-3. If right link is being removed, open accesses 10123-1, 6111-1, 6111-3, 4123-1, 4233-4, and 4233-3.

b. Remove self-retaining bolt (paragraph 2-95) securing inboard end of load-limiting link to arm assembly.

c. Remove cotter pin, nut, washers, and bolt securing outboard end of link.

2-75. INSTALLATION.

a. Position link so that nonadjustable end is outboard and link and arm assembly boltholes are aligned.

b. Connect nonadjustable end of link to arm assembly with bolt (headup), washers, and nut. Tighten nut and install new cotter pin.

c. Connect external electrical power (T.O. 1A-7D-2-1).

NOTE

See figure 2-6 for rigging pin and link locations.

d. Disconnect forward end of link (1) and move link to one side.

e. Place roll trim disengage switch in ON and trim roll trim system to neutral.

f. Install rigging pins No. 31 and 34.

g. Adjust link to align link end and arm assembly attaching holes. Tighten rod and jamnut and secure with MS20995C32 lockwire.

h. Install self-retaining bolt (paragraph 2-95) securing link to arm assembly.

i. Remove rigging pins No. 31 and No. 34.

j. Connect forward end of link (1) with bolt, washers, nut, and new cotter pin.

k. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

l. Cycle aileron control system and check for smooth operation with no binding or interference. Release stick and check that ailerons and stick return approximately to neutral.

m. Disconnect external hydraulic power and electrical power (T.O. 1A-7D-2-1).

n. Close accesses.

2-76. AILERON LOAD-LIMITING LINK REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
2-6	215-00110-3	Rigging pin No. 32	Rig linkage
2-6	215-00110-8	Rigging pin No. 31	Rig linkage
			TT08D024-12-68

2-77. REMOVAL.

a. To remove left link, open accesses 3233-2, 3233-3, and 3233-4. To remove right link, open accesses 4233-2, 4233-3, and 4233-4.

b. Remove screws, drill out blind rivets, and remove panel between accesses 3233-3 and 3233-4, or between accesses 4233-3 and 4233-4.

WARNING

Support ailerons in neutral position to prevent injury to personnel or damage to control linkage. Ensure that load-limiting link is neutral and not binding.

c. Remove cotter pins, nuts, washers, and bolts at both ends of link, and remove link.

2-78. INSTALLATION.

a. Connect external electrical power (T.O. 1A-7D-2-1).

b. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

c. Trim ailerons to neutral.

d. Shut down, but do not disconnect, hydraulic power.

e. Open accesses 5111-1 and 10123-1.

NOTE

See figure 2-6 for location of rigging pins and link.

f. Disconnect forward end of link (1) and move link to one side.

g. Insert rigging pins No. 31 and 32.

h. Place adjustable end of link through access. Align nonadjustable end with bolthole in outboard arm assembly.

i. Connect nonadjustable end of link to arm assembly with bolt (head-up), washers, and nut. Install new cotter pin.

j. Adjust link to align link end and inboard arm assembly attaching holes. Tighten rod end jamnut and secure with MS20995C32 lockwire.

k. Connect link end to arm assembly with bolt (head-up), washers, and nut. Tighten nut and install new cotter pin.

l. Remove rigging pins No. 31 and 32.

m. Connect forward end of link (1) to push-pull rod yoke with bolt, washers, nut, and new cotter pin.

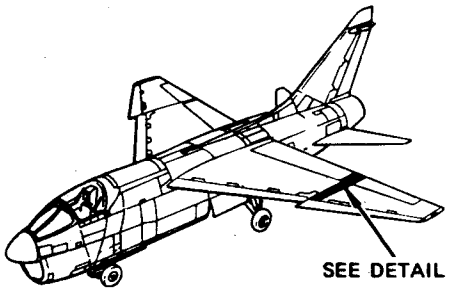
n. Apply hydraulic power to all PC systems.

o. Cycle aileron control system and check for smooth operation with no binding or interference. Release control stick and check that ailerons and stick return approximately to neutral.

p. Disconnect external hydraulic power and electrical power (T.O. 1A-7D-2-1).

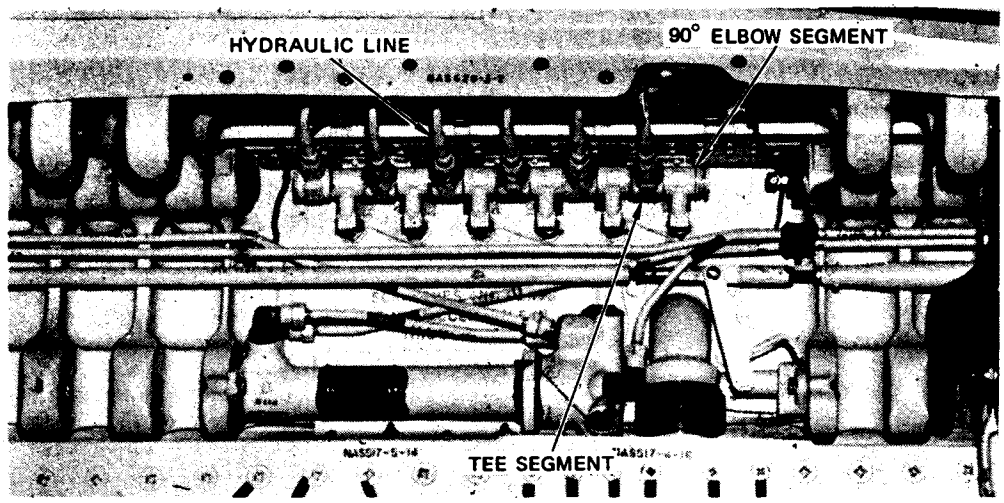
q. Install panel between accesses 3233-3 and 3233-4, or 4233-3 and 4233-4; secure with screws and rivets.

r. Close accesses 10123-1, 5111-1, and 3233-2, 3233-3, and 3233-4 if left link was installed or 4233-2, 4233-3, and 4233-4 if right link was installed.



CAUTION

To prevent extensive hydraulic line damage when wings are spread, ensure swivel joint is properly installed. A swivel joint is properly positioned for connecting when a 90° elbow segment is aft and all swivel joint fittings align with wing tubing.



DETAIL A

LEFT SWIVEL SHOWN, RIGHT TYPICAL

Figure 2-13. Wingfold Swivel Joint Removal and Installation

2-79. WINGFOLD SWIVEL JOINT REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
	215-00255-12	Wingfold support struts (2)	Hold wings folded while removing/ installing swivels

TT08 D025-12-68

2-80. REMOVAL. (See figure 2-13.)

a. Connect external electrical power (T.O. 1A-7D-2-1).

b. Connect external hydraulic power to all PC hydraulic systems. Apply pressure only to PC No. 2 hydraulic system (T.O. 1A-7D-2-1).

c. Fold wing outer panels and install wingfold support struts (T.O. 1A-7D-2-1).

d. Shut down hydraulic power to PC No. 2 system.

e. Dump accumulator hydraulic pressures (T.O. 1A-7D-2-1).

CAUTION

Extra care must be exercised to prevent bending of the brazed tube assemble, particularly in the heat softened zone adjacent to the brazed area at the end of fittings. Use back up wrench.

f. Back nuts off swivel joint tees. Cap or plug lines.

g. Beginning at either end, back nuts off swivel joint elbows, alternately turning each nut one turn until all nuts are disconnected. As each bulkhead line is disconnected from elbow, rotate elbow on swivel. Cap or plug lines and elbows.

h. Remove swivel joint from airplane.

2-81. INSTALLATION. (See figure 2-13.)

CAUTION

To prevent extensive hydraulic damage when wings are spread, ensure swivel joint is properly installed. A swivel joint is properly positioned for connecting when a 90° elbow segment is aft and all swivel joint fittings align with wing tubing.

a. Position swivel joint in airplane with a 90° elbow segment aft.

CAUTION

Extra care must be exercised to prevent bending of the brazed tube assemble, particularly in the heat softened zone adjacent to the brazed area at the end of fittings. Use back up wrench.

b. Start all tubing nuts on swivel elbows and tighten each nut one-half turn until all are snug. Do not tighten at this time.

c. Start all tubing nuts on swivel tees and tighten each nut one-half turn until all are snug. Leave nuts loose for bleeding.

d. Tighten all nuts on swivel elbows.

e. Apply 100 psi hydraulic pressure to all PC systems.

f. When air-free fluid flows from each swivel tee connection, tighten connection.

g. After all connections are tightened, increase pressure to 3,000 psi and check for evidence of leakage.

h. Remove wingfold support struts and cycle wing outer panels five times, checking for leaks between cycles.

i. Cycle flaps and ailerons and check for free operation.

j. Service PC hydraulic systems (T.O. 1A-7D-2-1).

k. Disconnect external hydraulic power and electrical power (T.O. 1A-7D-2-1).

2-82. AILERON EXTENSION UNIT REMOVAL AND INSTALLATION. (Refer to T.O. 1A-7D-2-4.)

2-83. AILERON PC CYLINDER REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	GGG-W-686	Torque wrench, 10 to 150 pound-inches	Tighten bleed plug and aileron PC cylinder nuts
	GGG-W-686	Torque wrench, 0 to 300 pound-inches	Tighten extension units
	215-00110-5	Rigging pin No. 33	Rig linkage
			TT08D026-10-77

2-84. REMOVAL. (See figure 2-14.)

a. Open access 3232-1 or 4231-2 for left or right cylinder, respectively; open access hole cover on upper wing skin above outboard bellcrank.

b. Remove cotter pin, nut, washers, and bolt securing input link (1) to bellcrank (2).

c. Loosen jamnut (3), and rotate input link (1) until backed free of rod end (4).

NOTE

To simplify disconnecting extension units, disconnect in following order: lower forward, lower aft, upper aft, and upper forward.

d. On airplanes before T.O. 1A-7D-756, disconnect four hydraulic extension units (11) from servo valve. Remove and discard packings (12). Plug or cap valve and extension unit ports.

e. On airplanes after T.O. 1A-7D-756, perform the following:

1. Disconnect four hoses from servo valve. Plug hose fittings.

2. Remove two unions and two reducers from servo valve ports. Plug valve ports.

f. Remove cotter pin (5), nut (6), two retainers (7), bolt (8), and pin (9) securing cylinder to bellcrank adapter (10).

g. Remove cotter pin (13), nut (14), two washers (15), and bolt (16) securing bellcrank (17) to wing structure. Remove

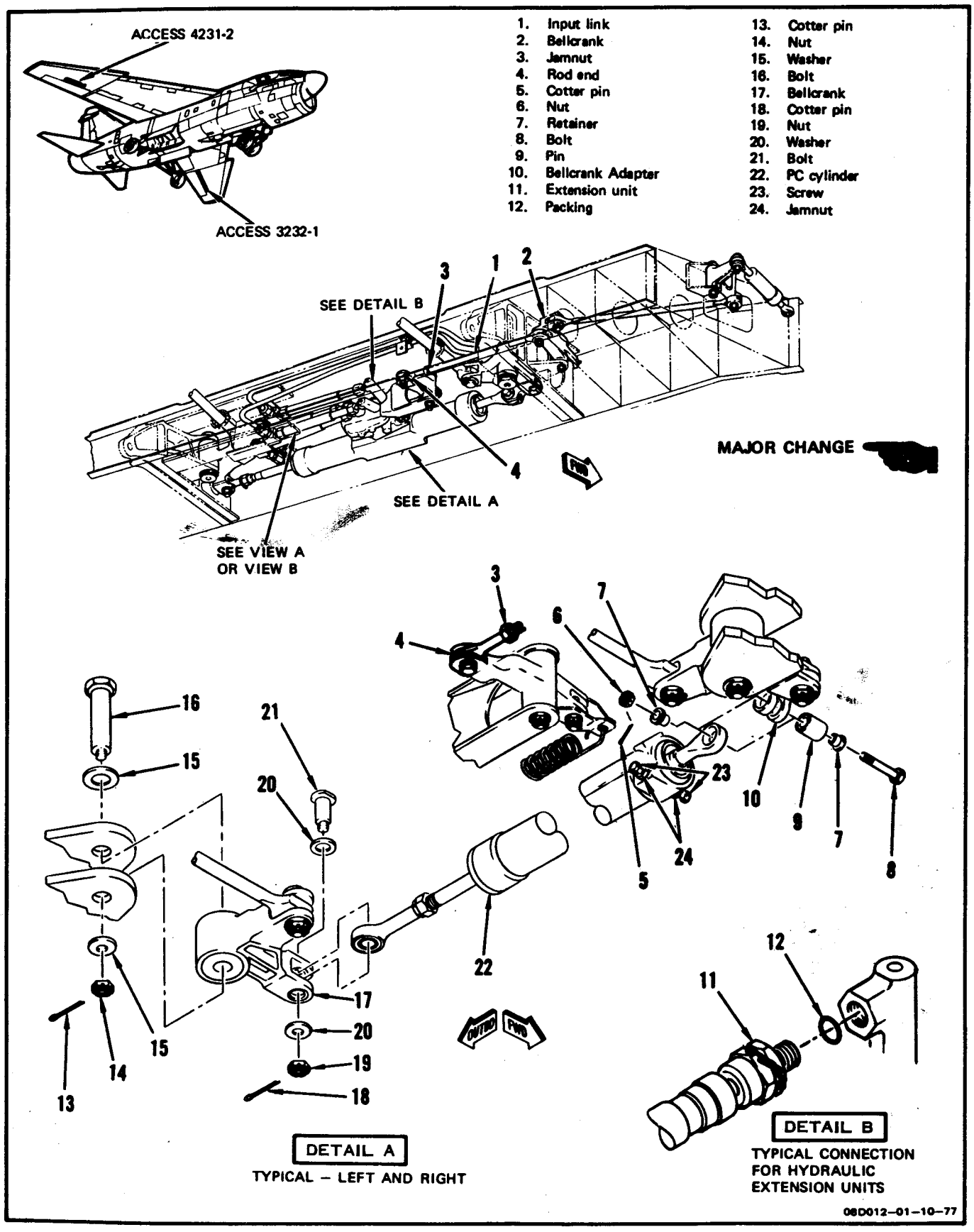


Figure 2-14. Aileron PC Cylinder Removal and Installation (Sheet 1)

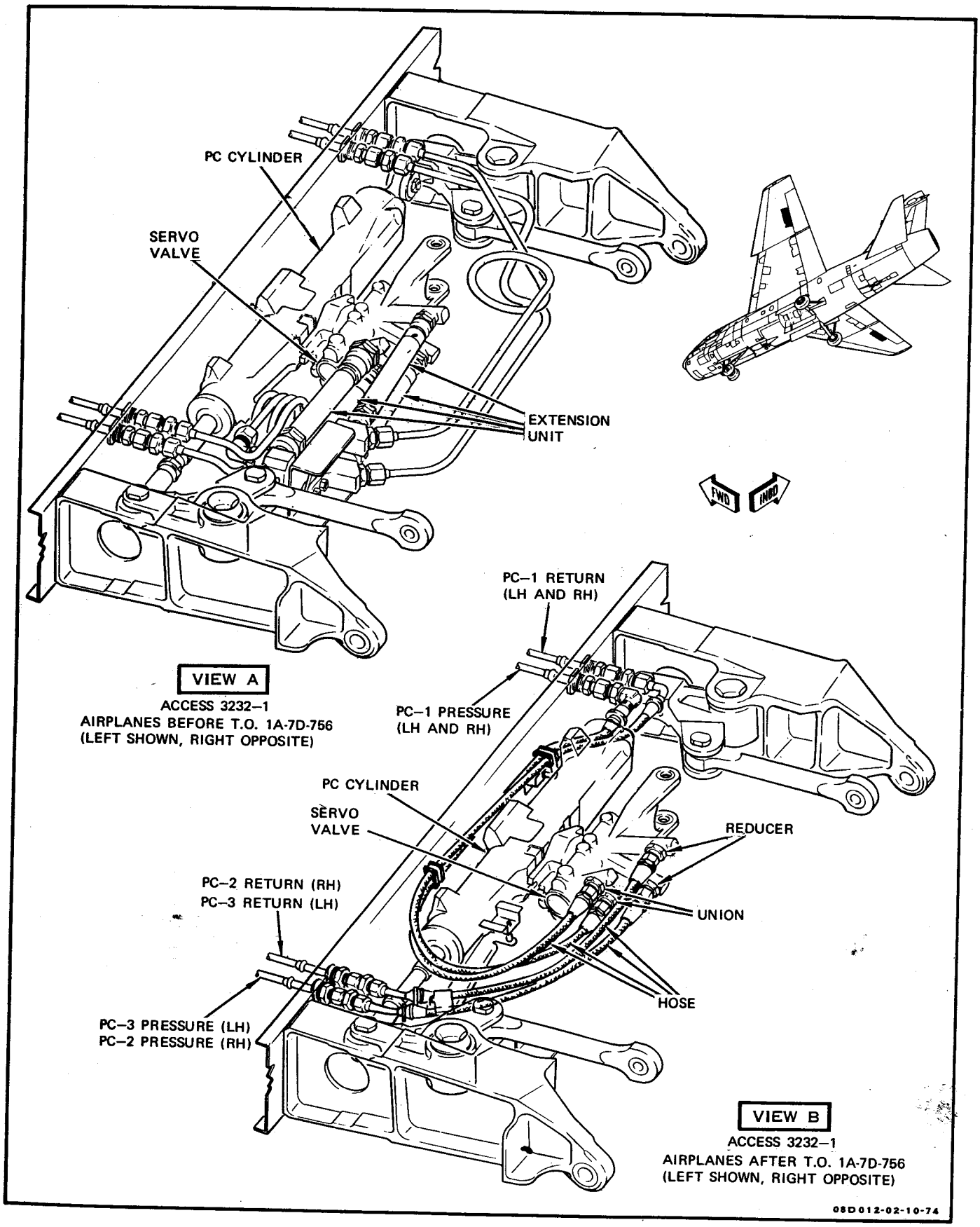


Figure 2-14. Aileron PC Cylinder Removal and Installation (Sheet 2)

bolt (16) through access hole in upper wing skin, and slip bellcrank forward.

h. Remove cotter pin (18), nut (19), two washers (20), and bolt (21) securing bellcrank to cylinder (22).

i. Remove cylinder from airplane.

2-85. INSTALLATION. (See figure 2-14.)

a. Measure distance between end of preload spring hook and nearest spring coil at both ends of spring. Replace preload spring if either dimension exceeds 0.50 inch.

CAUTION

To provide necessary operating clearance, ensure that the bolt securing rod end (4) is installed with the bolt head on the bottom.

b. Position cylinder (22) in airplane and secure to bellcrank (17) with bolt (21), two washers (20), nut (19). Tighten nut to 35 (±5) pound-inches torque and install new cotter pin (18).

c. Secure bellcrank to airframe with bolt (16), two washers (15), nut (14), and new cotter pin (13).

d. Position cylinder end in bellcrank adapter (10) and secure with pin (9), bolt (8), two retainers (7), and nut (6). Tighten nut to 35 (±5) pound-inches torque and install new cotter pin (5).

e. With aileron approximately flush with wing surface, screw input link (1) into rod end (4) until opposite end of link can be connected to bellcrank (2). Do not connect link.

f. Position aileron at full travel in trailing edge down and trailing edge up positions, and measure clearance between bolthead at rod end (4) and structure at both extremes of travel. Clearance shall be 0.10 inch minimum to 0.25 maximum. If clearance is not as specified, adjust as follows:

1. Cut lockwire securing screws (23).

2. Loosen jamnuts (24).

NOTE

Turning in aft screw on left wing while backing off forward screw increases clearance. Turning in aft screw on right wing while backing off forward screw decreases clearance.

3. Adjust clearance between bolthead and structure to specified tolerance by backing off one screw not more than 1/2 turn and advancing the opposite screw. If specified clearance cannot be obtained by adjusting screws, replace actuator.

4. Tighten screws and jamnuts, and lock-wire screws.

g. Ensure that rod end of PC cylinder (22) will not rotate by applying downward pressure at rod end (4).

h. On airplanes before T.O. 1A-7D-756, perform the following:

1. Remove caps or plugs from hydraulic extension units.

2. Install new packings (12) on extension unit fittings.

3. Lubricate extension unit fitting threads with MIL-G-23827 grease.

4. Connect extension units (11) to servo valve and tighten 150 (±50) pound-inches torque.

i. On airplanes after T.O. 1A-7D-756, perform the following:

1. Remove caps or plugs from servo valve ports.

2. Using new packings, install unions and reducers in valve ports.

3. Remove caps or plugs and connect hoses to unions and reducers.

j. Bleed aileron PC cylinder (paragraph 2-91), and shut down, but do not disconnect, external hydraulic power.

k. Install aileron protractors (paragraph 2-98).

l. Apply hydraulic pressure, install rigging pin No. 33, and adjust input link (1) to aileron neutral 0°0' (±0°10'). Tighten jamnut at each end of link and secure with MS20995C32 lockwire. Connect link to bellcrank (2) with washers, bolt, and nut. Secure nut with new cotter pin.

m. Shut down external hydraulic power.

n. Remove rigging pin No. 33.

o. Hydraulically charge emergency accumulators (T.O. 1A-7D-2-1).

p. Perform aileron control system operational checkout (paragraph 2-25 or 2-26, as applicable).

q. Close access 3232-1 or 4231-2, and install access hole cover on upper wing skin.

2-86. AILERON PC CYLINDER REPAIR.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	GGG-W-686	Torque wrench, 10 to 150 pound-inches	Tighten bolts

TT06D168-11-74

2-87. DISASSEMBLY. (See figure 2-15.)

a. Remove aileron PC cylinder from airplane (paragraph 2-83).

b. Unhook spring (3) from link and clip (4) and remove.

c. Remove bolts (1), washer (2), and clip (4).

d. Remove bolts (6) and washers (7).

e. Separate servo valve (5) from cylinder (8).

f. Remove packings (9), retainers (10), and plugs (11). Discard retainers and packings.

2-88. CLEANING.

WARNING

P-D-680 is combustible and moderately toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate.

a. Clean exterior of servo valve and cylinder with P-D-680 drycleaning fluid. Remove sealant from edges of mating surfaces.

b. Clean mating surfaces of servo valve and cylinder, connecting passages for plugs (11, figure 2-15), and plugs with MIL-H-46170 hydraulic preservative fluid. Clean plugs ultrasonically if necessary.

2-89. INSPECTION.

a. Inspect threads for damage.

b. Inspect mating surfaces of servo valve and cylinder for cracks and distortion.

c. Check passages for cleanness and freedom from foreign material.

d. Inspect plugs (11, figure 2-15) for distortion, wear, and misalignment.

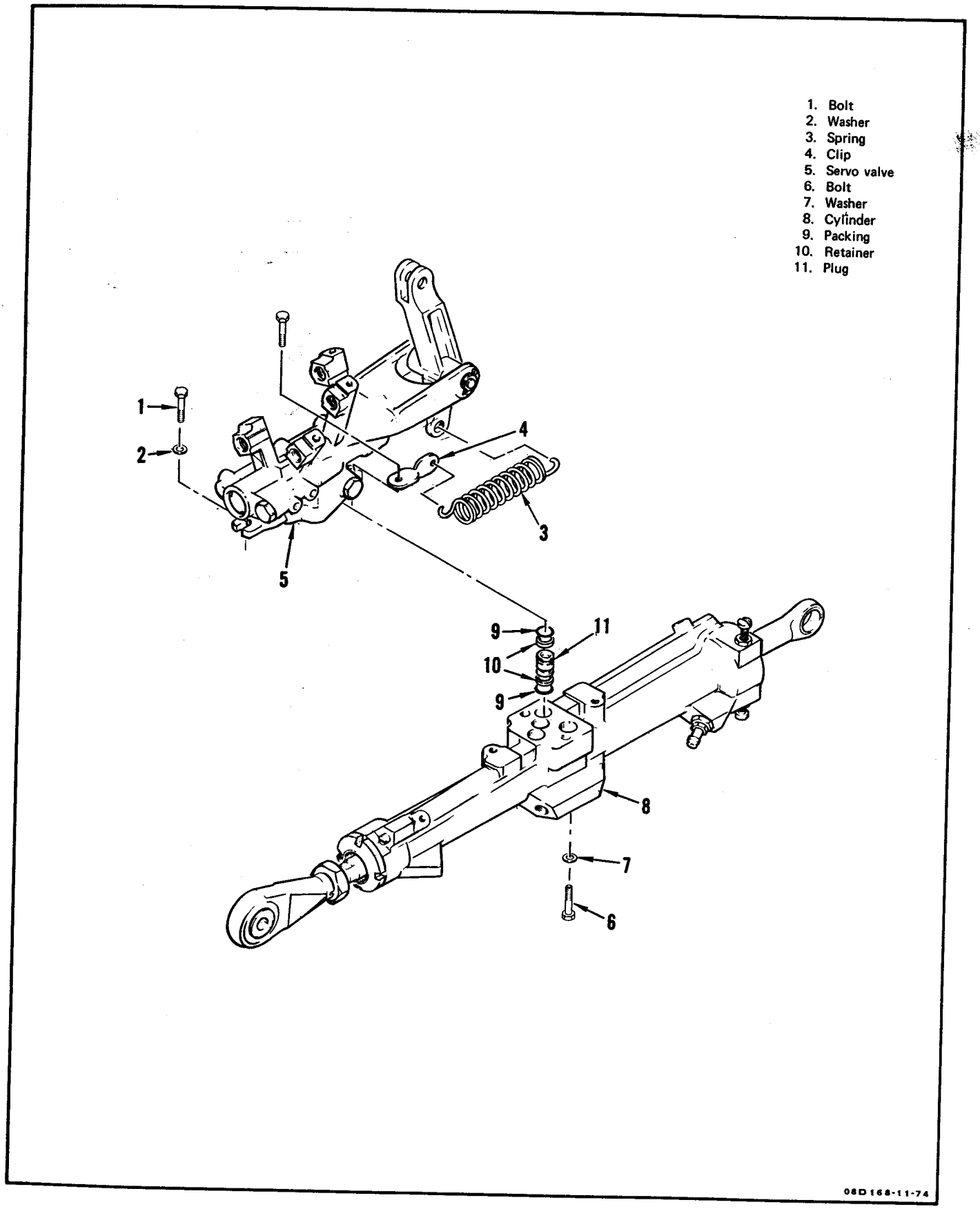


Figure 2-15. Aileron PC Cylinder Repair

e. If replacing cylinder, stretch spring (3) to 3.25 inches and release. Check that spring returns to free length of 2.10 (±0.06, -0.00) inches. Check that gap between end of spring hook and first coil is 0.31 to 0.50 inch.

2-90. ASSEMBLY. (See figure 2-15.)

a. Lubricate packings (9) with MIL-H-5606 hydraulic fluid and install packings and retainers (10) on each end of plugs (11).

b. Insert plug assemblies in passages of cylinder.

c. Mate valve (5) with cylinder with input rod end of valve over lug end of cylinder. Use care to avoid damage to retainers, packings, and plugs.

d. Install washers (7) and bolts (6). Install washer (2), clip (4), and bolts (1). Tighten bolts (6) to 50 to 70 pound-inches torque and bolts (1) to 20 to 25 pound-inches torque.

e. Secure bolts with MS20995C32 lockwire.

f. Install spring (3) between clip and link.

WARNING

Sealant MIL-S-8802 is flammable and moderately toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate.

g. Seal parting seam between valve and cylinder with MIL-S-8802 sealant.

h. Install aileron PC cylinder (paragraph 2-83).

2-91. BLEEDING AILERON PC CYLINDER.

a. Open access 3232-1 to bleed left cylinder or access 4231-2 to bleed right cylinder.

WARNING

To avoid injury to personnel or damage to equipment, ensure that personnel and equipment are clear of aileron, spoiler/deflector, and control linkage before moving input link or applying hydraulic power.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external hydraulic power	Connect hydraulic power
2-6	215-00110-5	Rigging pin No. 33	Rig linkage
	GGG-W-686	Torque wrench, 0 to 150 pound-inches	Tighten bleed plugs

TT08D169-02-75

a-1. Disconnect servo valve input link (1, figure 2-14) from bellcrank (2), if connected. Do not cut lockwire on rod end jamnuts.

b. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1). Apply 400 (±100) psi pressure.

c. Cut lockwire and open two extend bleed plugs on cylinder. Retract cylinder by stroking servo valve input lever. Close extend bleed plugs.

d. Cut lockwire and open two retract bleed plugs on cylinder. Extend cylinder by stroking servo valve input lever. Close retract bleed plugs.

e. Repeat steps c and d until air-free fluid flows from bleed plugs.

f. Shut down, but do not disconnect, hydraulic power.

g. Install aileron protractors (paragraph 2-98).

h. With hydraulic pressure on, install rigging pin No. 33 and adjust input link to aileron neutral (0°, ±10'). Tighten jamnut at each end of link and secure with MS20995C32 lockwire. Remove rigging pin No. 33.

i. Shut down external hydraulic power.

j. Tighten bleed plugs to 10 (±5) pound-inches torque. Check that gap under bleed plug is 0.010 inch minimum. If gap is less than 0.010 inch, bleed plug must be replaced.

k. Secure bleed plugs with MS20995C32 lockwire.

NOTE

If bleeding is being accomplished in connection with installation of the aileron PC cylinder, omit remaining steps of bleeding procedure and perform remaining steps of installation procedure.

k-1. Connect servo valve input link (1) to bellcrank (2). Secure nut with new cotter pin.

l. Disconnect external hydraulic power (T.O. 1A-7D-2-1).

m. Close access 3231-1 or 4231-2 and install access hole cover on upper wing skin.

2-92. AILERON REMOVAL AND INSTALLATION.

2-93. REMOVAL.

a. To remove left aileron, open access 3232-1; for right aileron, open access 4231-2.

b. Support aileron in neutral position.

c. Remove cotter pins, nut, bolts, and washers attaching aileron to control linkage. Remove support and allow aileron to swing down. Remove bonding jumpers.

d. Support aileron and remove cotter pin, nut, bolt, and washers attaching aileron at outboard hinge fitting to outer panel fitting through access slots in aileron and outer panel mating edges.

e. Remove cotter pins, nuts, bolts, and washers attaching aileron inboard hinge fittings to outer panel fittings.

f. Remove aileron.

2-94. INSTALLATION.

a. Lubricate attaching bearing surface and attaching bolts with MIL-G-23827 grease.

b. Support aileron and install bolts, washers, nuts, and new cotter pins to attach aileron at hinge points to outer panel fittings (T.O. 1A-7D-4-8). Tighten nuts finger-tight only and back off, if necessary, to install cotter pins.

c. Install bonding jumpers.

d. Support aileron in neutral position and install bolts, washers, and nuts to attach aileron to control linkage. Tighten nuts and install cotter pins.

e. Manually cycle aileron. Check that no binding or interference exists.

f. Perform aileron control system operational checkout (paragraph 2-25 or 2-26).

g. Close access 3232-1 or 4231-2.

2-95. SELF-RETAINING BOLT REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	GGG-W-686	Torque wrench, 0 to 150 pound-inches	Tighten counterbored washer nut

TT08D163-07-73

2-96. REMOVAL. (See figure 2-16.)

a. Remove cotter pin (1), nut (2), and counterbored washer (3).

b. Depress locking plunger in bolthead, releasing locking balls in self-retaining bolt shank. Remove self-retaining bolt (4) and washer (5).

2-97. INSTALLATION. (See figure 2-16.)

a. Depress locking plunger in bolthead and install washer (5) and self-retaining bolt (4). Insert bolt through linkage. Check that clearance between washer and mating surface is 0.010 inch minimum.

b. Check maximum clearance (dimension X) of locking balls to ensure counterbored washer will not bear against locking balls.

CAUTION

Counterbored washer must be installed with larger inside diameter facing bolthead. Improper installation will cause loss of locking function.

NOTE

After tightening nut, bolt (4) must be flush with nut or extend no more than two threads through nut.

c. Install counterbored washer (3) and new nut (2). Tighten nut to proper torque.

d. Install new cotter pin (1).

2-98. AILERON PROTRACTOR INSTALLATION. (See figure 2-17.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
2-17	215-00182-1	Left aileron protractor	Check aileron deflection
2-17	215-00182-2	Right aileron protractor	Check aileron deflection

TT08D027-03-76

a. Install protractor base (2) on each wing outer panel (1) with thumbscrews (3).

b. Install indicator (5) on each aileron (4) with thumbscrews (6).

c. Install protractor scale (7) on protractor base with thumbscrews (8).

d. Place aileron in neutral.

e. Maintain aileron neutral position and adjust protractor scale to align zero on scale with zero on indicator.

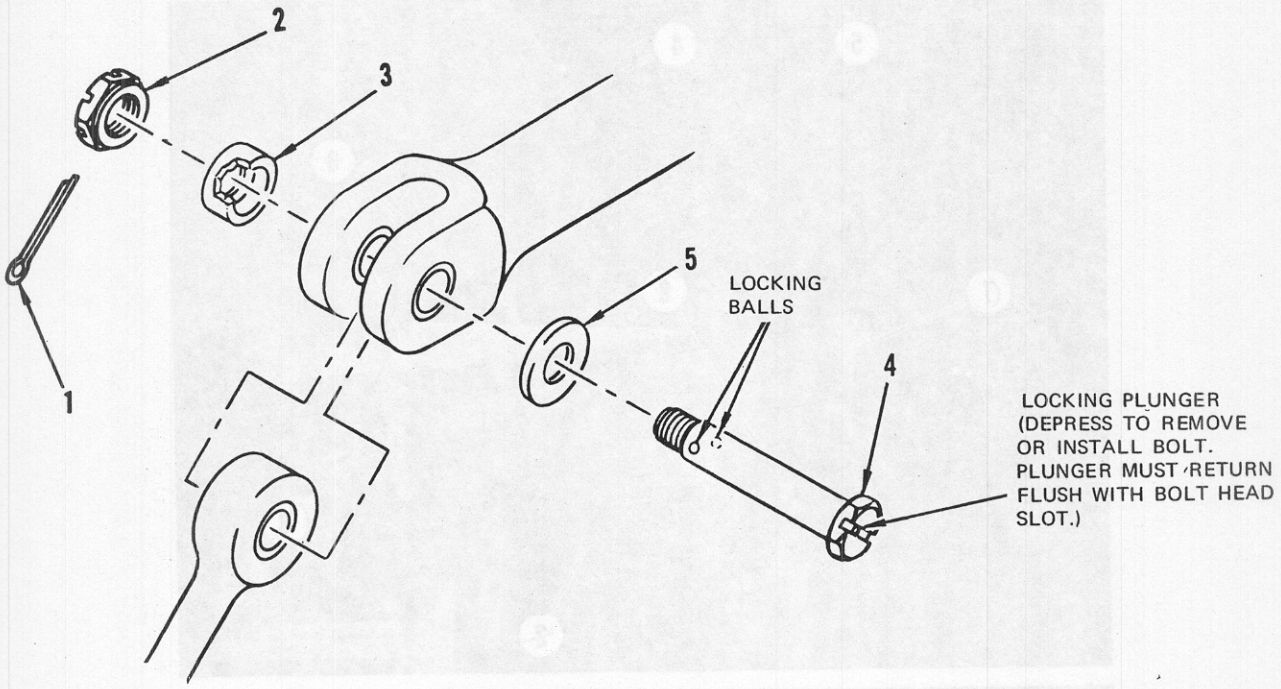
f. Check clearance through full travel of aileron between protractor scale and indicator with gage (9).

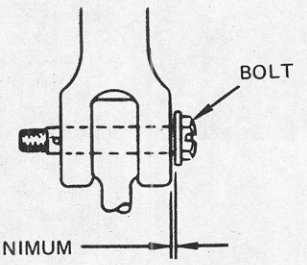
2-99. AILERON PROTRACTOR INDICATIONS. (See figure 2-18.)

NOTE

The example shown in figure 2-18 is also typical for the UHT and rudder protractors.

2-100. Instructions for determining the values indicated on the aileron protractor are given in figure 2-18.



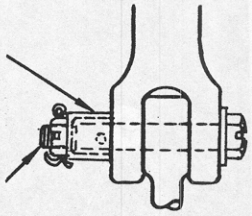


APPLY FINGER PRESSURE TO HOLD LOCKING BALLS AGAINST LINK WHEN MAKING CLEARANCE CHECK.

STEP 1

(SEE NOTE)

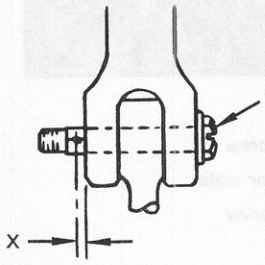
INSTALL WASHER WITH LARGE INSIDE DIAMETER FACING BOLTHEAD.



AFTER TIGHTENING NUT, BOLT END TO BE FLUSH WITH NUT OR PROTRUDING WITH MAXIMUM OF TWO THREADS SHOWING.

STEP 3

(SEE NOTE)



APPLY FINGER PRESSURE TO HOLD BOLTHEAD AND WASHER SEATED AGAINST SURFACE

STEP 2

(SEE NOTE)

1. Cotter pin
2. Nut
3. Counterbored washer
4. Self-retaining bolt
5. Washer

NOTE

SELECTION OF PROPER GRIP LENGTH AND USE OF WASHERS UNDER BOLTHEAD WILL BE USED TO CONTROL CLEARANCES. NO MORE THAN TWO WASHERS SHALL BE USED.

BOLT SIZE	DIMENSION X (MAXIMUM)	TORQUE (POUND-INCHES)
10–32	0.094	12 to 15
1/4–28	0.125	30 to 40
5/16–24	0.156	60 to 80
3/8–24	0.171	95 to 110
7/16–20	0.202	270 to 300
1/2–20	0.234	290 to 410
9/16–10	0.265	480 to 600

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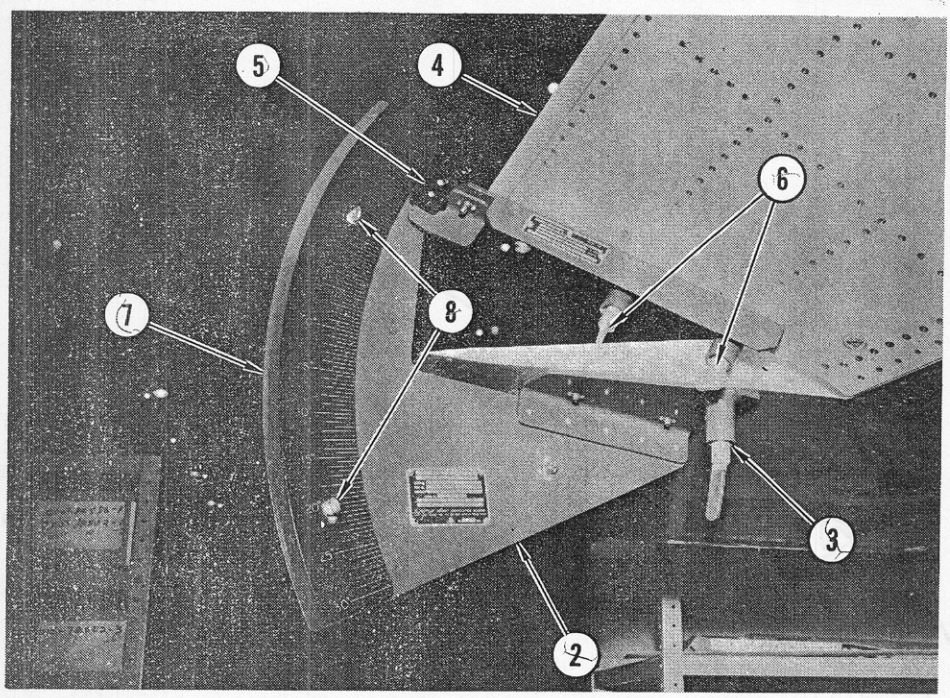
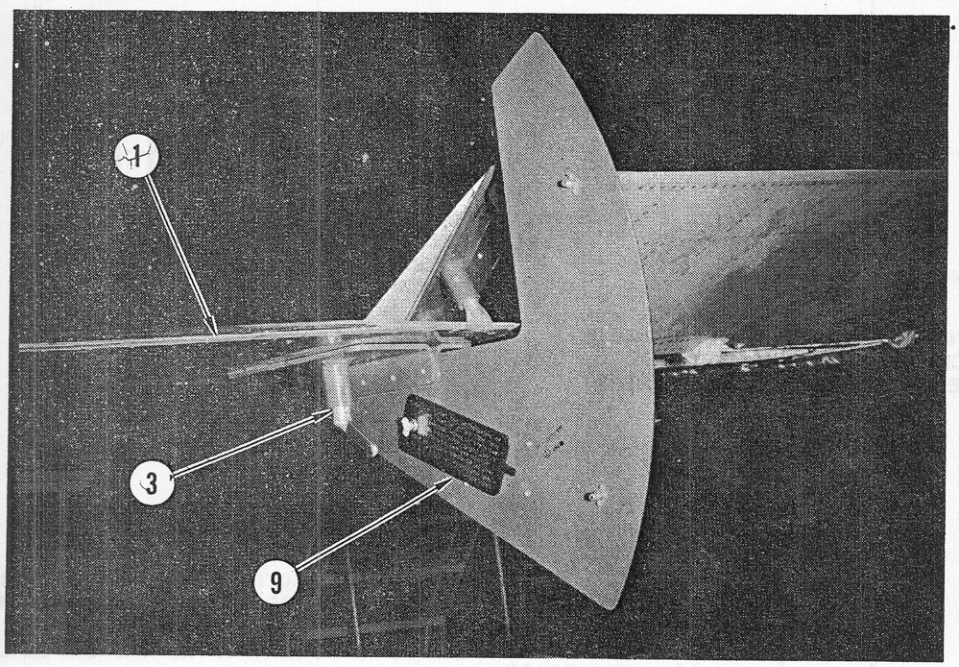
Figure 2-16. Self-Retaining Bolt Removal and Installation





1. Wing outer panel
2. Protractor base
3. Thumbscrew
4. Aileron
5. Indicator
6. Thumbscrew
7. Protractor scale
8. Thumbscrew
9. Gage

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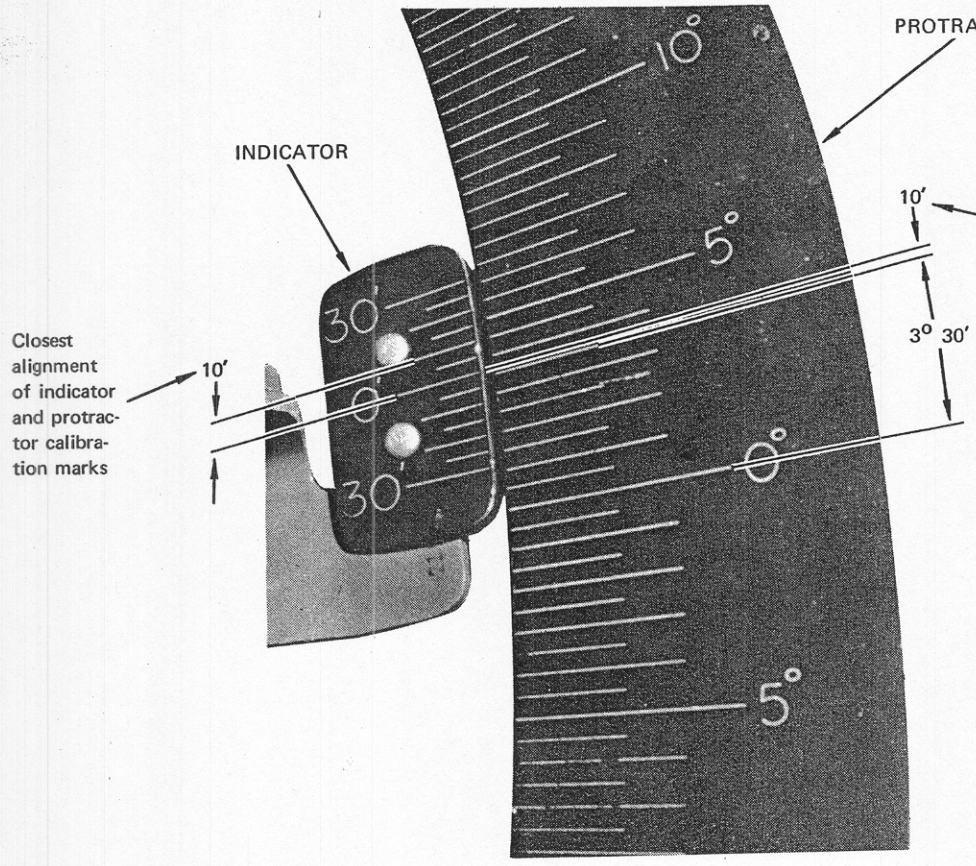
Figure 2-17. Aileron Protractor Installation



3° 40′ INDICATION

EXAMPLE OF THROW INDICATED

Indicator indicates 3° 40′, obtained as follows:

a. Read 3° 30′ as indicated on protractor scale. (Scale is calibrated in 30′ increments.)

b. Since indication does not fall exactly on calibrated mark of protractor scale, look for closest alignment of indicator and protractor calibrated marks in direction of indicator travel. Read value from 0′ mark on indicator scale to closest alignment, which is 10′.

c. Add 3° 30′ and 10′ to obtain indication of 3° 40′.

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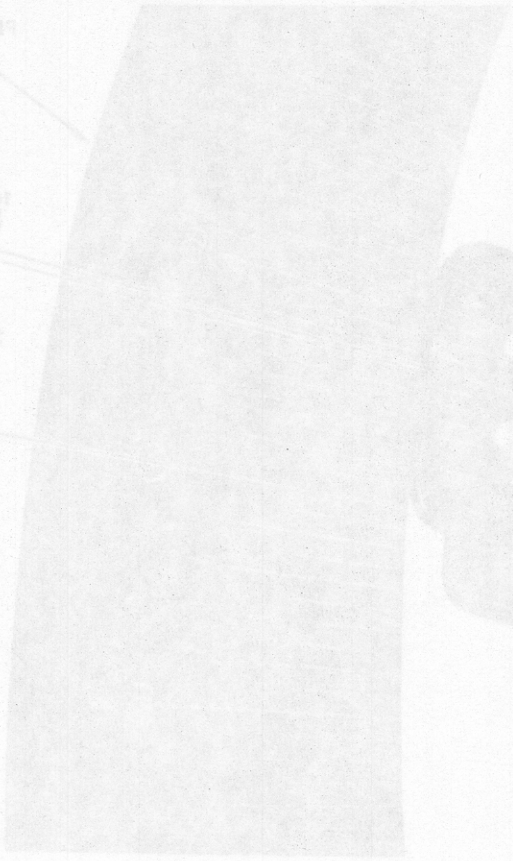
Figure 2-18. Aileron Protractor Indications



Section III
ROLL TRIM SYSTEM

3-1. DESCRIPTION.

3-2. The roll trim system is a flight control system used to position the aileron control surfaces without deflecting the control stick. The system consists of a linear electromechanical trim actuator, a combination roll and pitch trim amplifier package, a four-position roll and pitch trim button on the stick grip, and a roll trim disengage switch. The trim actuator is located in the aileron trim and mixing linkage and normally acts as a series-connected, fixed-length rod in the aileron control system (paragraph 2-1). Trim actuator inputs are provided by right or left movement of the trim button. A maximum of 13° (±1°) aileron up and 13° (±1°) aileron down trim can be obtained. Spoiler/deflector position is not affected by roll trim inputs. There are no provisions for emergency roll trim. Roll trim indication is provided by a dual roll and pitch trim indicator. For information on the trim indicating system, refer to paragraph 8-1.

3-3. For system controls and indicators, see figure 3-1. For system arrangement, see figure 3-2. For aileron control system schematic, see figure 2-3.

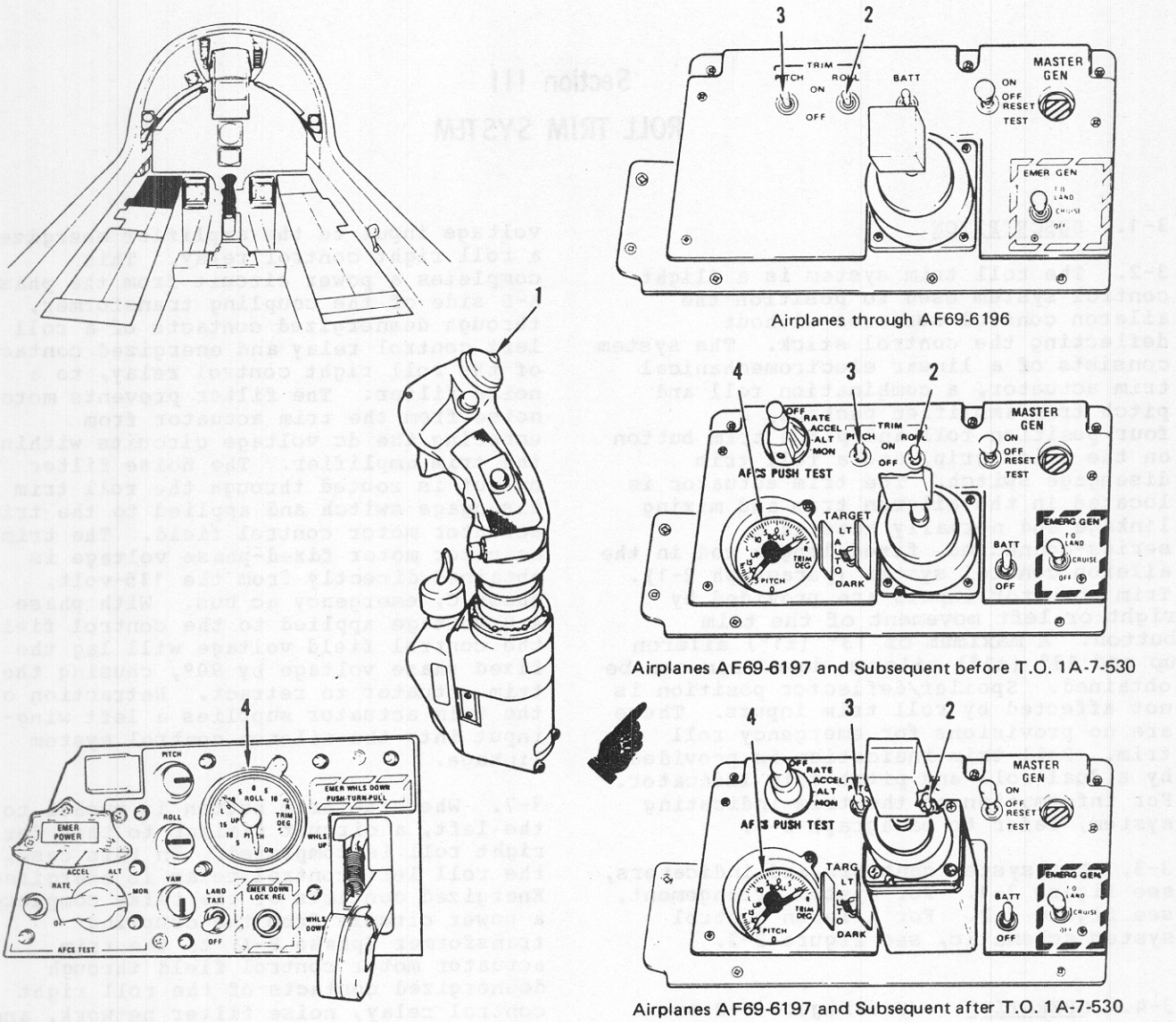
3-4. OPERATION. (See figure 3-3 or 3-4.)

3-5. With the roll trim disengage switch in OFF, the trim actuator motor control field and brake coil are shorted to ground. The trim system is disengaged and the actuator cannot be stroked. When the roll trim disengage switch is placed in ON, a power circuit from the trim amplifier to the actuator motor control field and brake is completed, engaging the roll trim system.

3-6. Pushing the trim button to the right completes a power circuit which applies 28 volts dc to the trim amplifier. The dc voltage is routed through the amplifier and roll trim disengage switch and is applied to the trim actuator brake coil, causing the brake to release. In addition, the dc voltage input to the amplifier energizes a roll right control relay. This completes a power circuit from the phase A-B side of the coupling transformer, through deenergized contacts of a roll left control relay and energized contacts of the roll right control relay, to a noise filter. The filter prevents motor noise from the trim actuator from entering the dc voltage circuits within the trim amplifier. The noise filter output is routed through the roll trim disengage switch and applied to the trim actuator motor control field. The trim actuator motor fixed-phase voltage is obtained directly from the 115-volt, phase C, emergency ac bus. With phase A-B voltage applied to the control field, the control field voltage will lag the fixed phase voltage by 90°, causing the trim actuator to retract. Retraction of the trim actuator supplies a left wing-up input into the aileron control system linkage.

3-7. When the trim button is pushed to the left, a circuit similar to that for right roll is completed. In this case, the roll left control relay is energized. Energized contacts of the relay complete a power circuit from the coupling transformer (phase B-A) to the trim actuator motor control field through deenergized contacts of the roll right control relay, noise filter network, and roll trim disengage switch. With phase B-A voltage applied to the control field, the control field voltage leads the fixed phase voltage, causing the actuator to extend. Extension of the trim actuator supplies a left wing-down input to the aileron control system linkage.

3-8. When the desired amount of trim (left or right) is obtained, the trim button is released, allowing it to return to the center position. This interrupts the dc voltage circuit to the trim amplifier, causing the applicable roll control relay to deenergize. Deenergized contacts of the relay interrupt the power circuit from the coupling transformer to the trim actuator motor control field. In addition, without a dc voltage input to the trim amplifier, the trim actuator



Airplanes through AF69-6196

Airplanes AF69-6197 and Subsequent before T.O. 1A-7-530

Airplanes AF69-6197 and Subsequent after T.O. 1A-7-530

INDEX NO.	CONTROL/INDICATOR	FUNCTION
1	Roll and pitch trim button	Pushed up or down, provides pitch beep trim signals.
		Pushed left or right, provides roll beep trim signals.
2	Roll trim disengage switch (ROLL TRIM)	ON – engages roll trim system.
		OFF – disengages roll trim system.
3	Pitch trim disengage switch (PITCH TRIM)	ON – engages pitch trim system.
		OFF – disengages pitch trim system.
4	Roll and pitch trim indicator (TRIM DEG)	Indicates continuous roll and pitch trim actuator positions.

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Figure 3-1. Roll and Pitch Trim System Controls and Indicators

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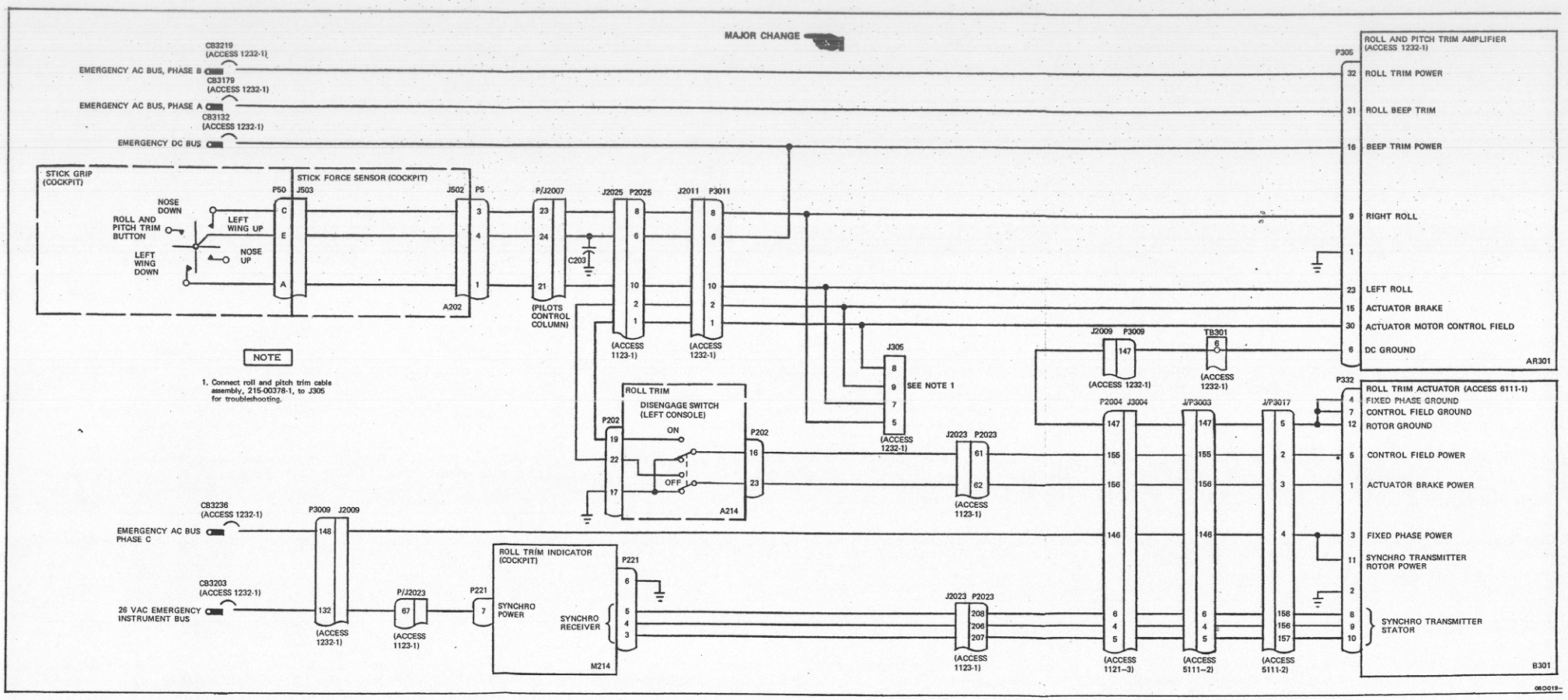
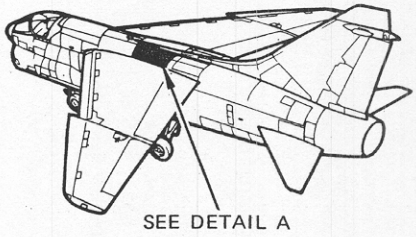
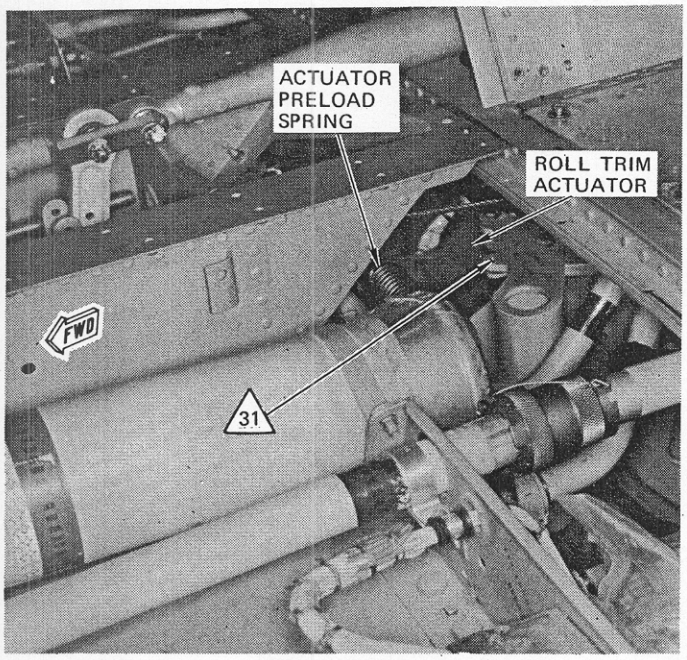


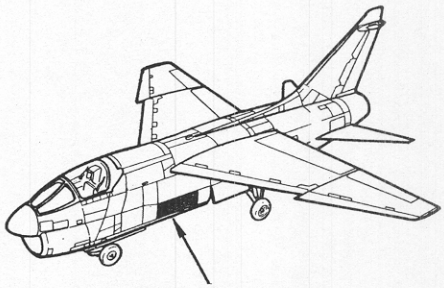
Figure 3-3. Roll Trim Control and Indicating System Schematic Diagram (Airplanes Through AF69-6196)

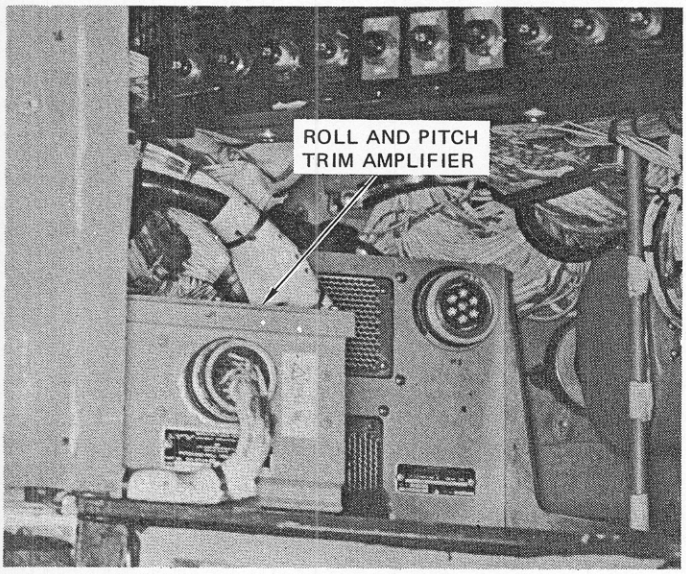




DETAIL A

(ACCESS 3123-1)





DETAIL B

(ACCESS 1232-1)

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Figure 3-2. Roll Trim System Arrangement

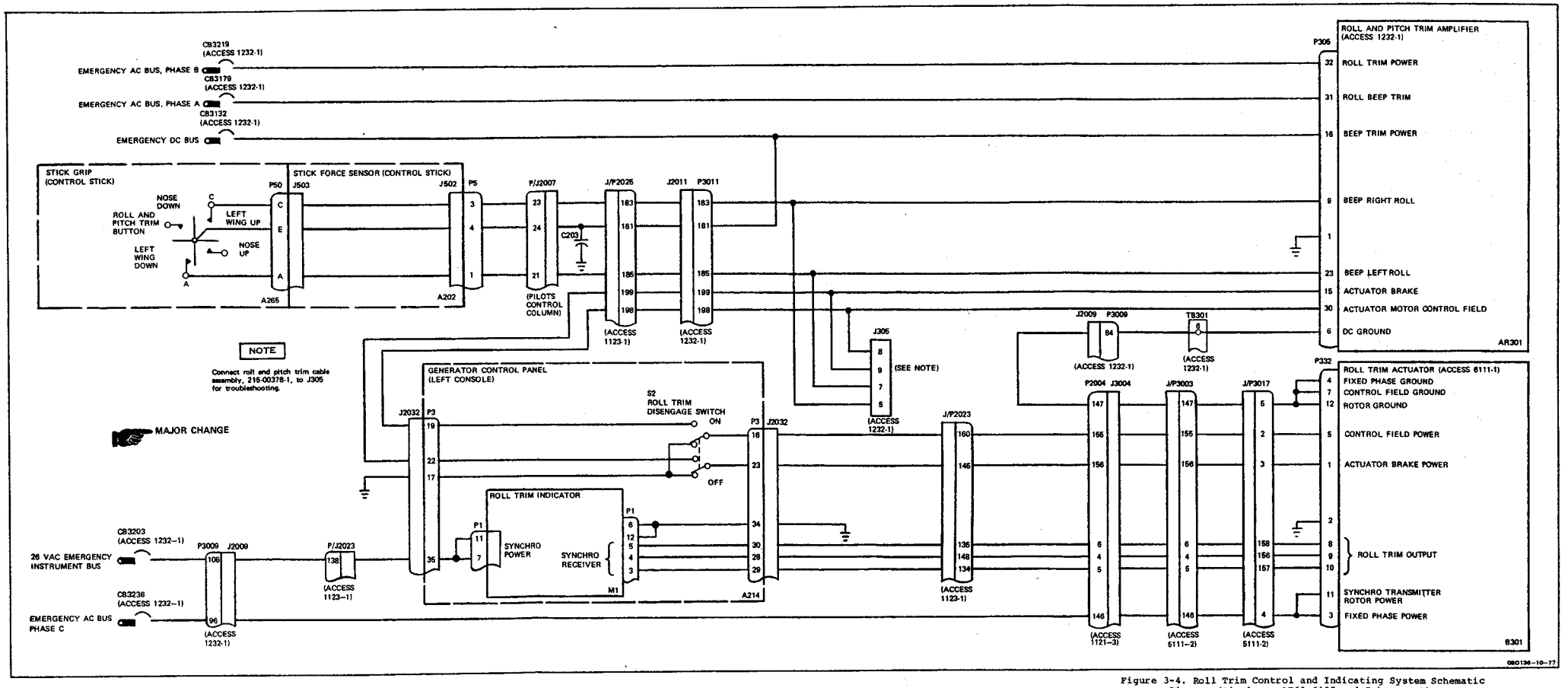

Figure 3-4. Roll Trim Control and Indicating System Schematic Diagram (Airplanes AF69-6197 and Subsequent)

brake coil power circuit is interrupted, causing the brake to engage. With the brake engaged and no control field power, the trim actuator will maintain the existing aileron trim position until the trim button is again actuated. The actuator will also remain at the existing trim position should the system be disengaged by placing the roll trim disengage switch in OFF.

3-9. In case of roll trim actuator runaway, the actuator may be stopped by moving the roll trim disengage switch to OFF. With the switch in this position, the actuator motor control field and brake coil are shorted to ground. There are no emergency provisions for returning the trim actuator to neutral. The actuator will remain in the position existing at the time roll trim disengage was selected.

3-10. COMPONENTS.

3-11. For a list of system components, their locations (accesses), and functions, refer to table 3-1.

3-12. OPERATIONAL CHECKOUT.

Test Equipment Required

Figure & Index No.	*Name*	*AN Type Designation*	*Use and Application*
	Equipment for connecting external electrical power		Connect electrical power
	Equipment for connecting external hydraulic power		Connect hydraulic power
	Stopwatch	GG-S-764A	Time operation of trim system

TT08D028-12-68

NOTE

A number, or numbers, enclosed in braces at the end of a step in the following test is a reference to a corresponding number in troubleshooting table 3-2.

a. Install left and right aileron protractors (paragraph 2-98).

b. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

c. Connect external electrical power (T.O. 1A-7D-2-1).

d. Place roll trim disengage switch in ON.

e. Push right on roll and pitch trim button and hold until maximum right roll trim is obtained. Left aileron shall move to 13° (±1°) trailing edge down. {1 and 2}

f. Check that trim indicator indicates within 1°30' of left aileron position. {3}

g. Push left on pitch and roll trim button and release before maximum trim is obtained. Check that aileron movement does not exceed 1° after releasing pitch and roll trim button. {4}

h. Push left on trim button and hold until maximum left roll trim is obtained. Right aileron shall move to 13° (±1°) trailing edge down. {2 and 5}

i. Check that trim indicator indicates within 1°30' of right aileron position. {6}

j. Push right on trim button and hold until maximum right roll is obtained. Record time required for right aileron to move from full down to full up position.

k. Push left on trim button and hold until maximum left roll is obtained. Record time required for right aileron to move from full up to full down position.

l. Repeat step j. Compute average time. Average must be 23.7 (±6.0) seconds. {7}

m. Push left on trim button until indicator indicates neutral.

n. Disconnect external electrical and hydraulic power (T.O. 1A-7D-2-1).

o. Remove left and right aileron protractors.

Table 3-1. Roll Trim System Components

Component	Access	Function
Actuator, roll trim	6111-1	Positions aileron control surfaces in response to trim inputs.
Amplifier, roll and pitch trim	1232-1	Controls electrical circuits to roll trim actuator.
Button, roll and pitch trim	Stick grip	Supplies roll trim signals to roll and pitch trim amplifier.
Capacitor (C203)	Cockpit	Eliminates radio frequency interference during beep trim operation.
Circuit breaker CB3132	1232-1	Applies 28-volt dc power from emergency bus to roll and pitch trim button and to beep trim circuits of roll and pitch trim amplifier.
Circuit breaker CB3179	1232-1	Applies 115-volt ac, phase A power from emergency bus to roll beep trim circuit of roll and pitch trim amplifier.
Circuit breaker CB3203	1232-1	Applies 26-volt ac power from emergency instrument bus to roll trim indicator.
Circuit breaker CB3219	1232-1	Applies 115-volt ac, phase B power from emergency bus to roll trim circuit of roll and pitch trim amplifier.
Circuit breaker CB3236	1232-1	Applies 115-volt ac, phase C power from emergency bus to roll trim actuator motor fixed field.
Spring, roll trim actuator preload	6111-1	Preloads roll trim actuator and connecting linkage to reduce free play.
Switch, roll trim disengage	Left console	Controls electrical circuits to roll trim actuator.

3-13. TROUBLESHOOTING. (See figure 3-3 or 3-4.)

Test Equipment Required

Figure & Index No.	*Name*	*AN Type Designation*	*Use and Application*
	Equipment for connecting external electrical power		Connect electrical power
	Multimeter	AN/PSM-6	Measure voltage and resistance
	Cable assembly, roll and pitch trim	215-00378-1	Check voltage and resistance between pins of test receptacle

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3-14. Refer to table 3-2 for troubleshooting information. Malfunctions in the table are listed numerically and are related to a corresponding number, or numbers, following a step in the operational checkout.

3-15. ROLL TRIM ACTUATOR RIGGING CHECK. (See figure 2-6.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
2-6	215-00110-8	Rigging pin No. 31	Rig linkage
	403B	AC voltmeter	Measure voltage

TT08D030-03-70

a. Open accesses 10123-1, 3123-1, 5111-1, and 6111-1.

b. Place roll trim disengage switch in ON.

c. Disconnect forward end of link (1) and move link to one side to gain access to rigging pin hole No. 31.

d. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

e. Connect external electrical power (T.O. 1A-7D-2-1).

f. Position roll trim actuator to approximate neutral by actuating roll trim button until rigging pin No. 31 can be installed.

g. Shut down, but do not disconnect external electrical and hydraulic power.

h. Deleted.

i. Verify actuator electrical neutral as follows:

1. Remove pitch and roll trim indicator (paragraph 8-13).

2. Apply external electrical power.

3. On airplanes through AF69-6196, check that a null voltage (less than 10 mv) is indicated between pins 3 and 4 of trim indicator connector P221.

4. On airplanes AF69-6197 and subsequent, check that a null voltage (less than 10 mv) is indicated between pins 3 and 4 of trim indicator connector P1.

5. Shut down, but do not disconnect external electrical power.

6. If a null voltage was not indicated, rig actuator (paragraph 3-16).

7. Install pitch and roll trim indicator (paragraph 8-13).

j. Disconnect external electrical and hydraulic power (T.O. 1A-7D-2-1).

k. Connect link (1) that was disconnected in step c.

l. Place roll trim disengage switch in OFF.

m. Close accesses 10123-1, 3123-1, 5111-1, and 6111-1.

Table 3-2. Roll Trim System Troubleshooting

Probable Cause	Isolation Procedure	Remedy
	NOTE Before proceeding with troubleshooting, connect external electrical power and hydraulic power. Connect roll and pitch trim cable assembly (215-00378-1) to test connector J305 to provide test jacks. Place roll trim disengage switch in ON.	
1. Ailerons do not move when pitch and roll trim button is pushed right (right roll trim).		
Defective pitch and roll trim switch.	Push right on trim button and check for 28 volts dc between J5 and J19 of test cable. If voltage is not present, remove grip from control stick and check for 28 volts dc between pin E of connector J503 and ground.	Replace defective control stick grip.
Defective roll and pitch trim amplifier.	Push right on trim button. Check for 28 volts dc between J9 and J19 of test cable. Check for 36 volts ac between J8 and J19 of test cable. If voltage is not present, disconnect connector P305 from amplifier. Check for 115 volts ac between pins 31 and ground and 32 and ground of connector P305.	Replace roll and pitch trim amplifier.
	NOTE Before continuing with troubleshooting, visually check that actuator moves in both directions when operating roll trim switch to right and left positions. If operation is satisfactory, proceed with malfunction 2. If no movement is observed, proceed with next step. Gain access to connector P332 by removing low-pressure bleed duct as described in roll trim actuator removal (paragraph 3-26).	

Table 3-2. Roll Trim System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
Defective roll trim actuator.	Push right on trim button and check for 28 volts dc between pins 1 and 2 of connector P332. Check for 36 volts ac between pins 7 and 5 of connector P332. Check for 115 volts ac between pins 3 and 4 of connector P332.	Replace roll trim actuator.
Defective roll trim disengage switch.	Check for continuity between pin 1 of connector P332 and J9 of test cable. Check for continuity between pin 5 of connector P332 and J8 of test cable.	Replace roll trim disengage switch.
2. Aileron trim movement not within limits.		
Improper roll trim rigging.	None.	Rig roll trim actuator. If aileron trim movement is not within limits, check for defective roll trim actuator.
Defective roll trim actuator.	None.	Replace defective roll trim actuator.
3. Roll trim indicator indicates right roll trim incorrectly.		
Defective pitch and roll trim indicator.	Refer to paragraph 8-11.	
Defective roll trim actuator.	Refer to paragraph 8-11.	
4. Aileron movement exceeds 1° after releasing trim switch.		
Defective roll trim actuator.	None.	Replace roll trim actuator.

Table 3-2. Roll Trim System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
5. Ailerons do not move when pitch and roll trim button is pushed left (left roll trim).		
Defective pitch and roll trim switch.	Push left on trim button and check for 28 volts dc between J7 and J19 of test cable. If voltage is not present, remove grip from control stick and check for 28 volts dc between pin E of connector J503 and ground.	Replace defective control stick grip.
Defective roll and pitch trim amplifier.	Push left on roll trim button. Check for 28 volts dc between J9 and J19 of test cable. Check for 36 volts ac between J8 and J19 of test cable. If voltage is not present, disconnect connector P305 from amplifier. Check for 115 volts ac between pins 31 and ground and 32 and ground of connector P305.	Replace roll and pitch trim amplifier.
6. Roll trim indicator does not indicate left roll trim correctly.		
Defective pitch and roll trim indicator.	Refer to paragraph 8-11.	
Defective roll trim actuator.	Refer to paragraph 8-11.	
7. Ailerons move too fast or too slow in response to roll trim button.		
Defective roll trim actuator.	None.	Replace defective roll trim actuator.

3-16. RIGGING ROLL TRIM ACTUATOR.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
2-6	215-00110-8	Rigging pin No. 31	Rig linkage
			TT08D012-04-70

a. Open accesses 3123-1, 4113-11, 4123-1, 5111-1, 6111-1, and 10123-1.

b. Remove bleed air duct (T.O. 1A-7D-2-3).

c. Disconnect one end of spring from mounting lug.

d. Disconnect electrical connector from receptacle on actuator.

e. Remove cotter pin, nut, washer, and bolt connecting lug end of actuator to mounting structure.

f. Loosen jamnut on actuator rod end.

g. Pivot actuator forward about installed rod end attach bolt until clearance is sufficient to permit actuator to be unscrewed from rod end.

h. Unscrew actuator from rod end.

i. Loosen clamp and remove boot from actuator.

j. Temporarily connect electrical connector to actuator receptacle.

k. Support actuator so that actuating rod can be moved without interference.

l. Connect and apply external electrical power (T.O. 1A-7D-2-1).

m. Actuate roll trim button on stick grip until scribe mark on actuating rod aligns with end of support housing within ±0.01 inch.

n. Shut down, but do not disconnect external electrical power.

o. Disconnect electrical connector from receptacle.

p. Slide boot onto actuating rod until it butts against actuator housing. Tighten clamp to secure boot to actuator housing.

q. Place washer on rod end.

r. Position actuator in airplane with actuating rod aligned with installed rod end. Screw actuator onto rod end.

s. Disconnect forward end of link (1, figure 2-6) and move link to one side to gain access to rigging pin hold No. 31.

t. Move mixing linkage, by ailerons if necessary, and install rigging pin No. 31.

u. Pivot actuator aft about installed rod end bolt and position trunnion end in mounting structure.

NOTE

If mounting holes do not align, screw actuator onto rod end until holes align.

v. Secure actuator lug end with bolt, washer, nut, and new cotter pin.

w. Tighten rod end jamnut.

x. Remove rigging pin No. 31.

y. Connect link that was disconnected in step s.

z. Connect electrical connector to receptacle on actuator.

aa. Connect loose end of spring to mounting lug.

ab. Perform roll trim system operational checkout (paragraph 3-12).

ac. Install bleed air duct (T.O. 1A-7D-2-3).

ad. Close accesses 3123-1, 4113-11, 4123-1, 5111-1, 6111-1, and 10123-1.

3-17. ROLL TRIM DISENGAGE SWITCH REMOVAL AND INSTALLATION. (Airplanes through AF69-6196.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment required for connecting external electrical power	Connect electrical power
		Equipment required for jacking airplane	Jack airplane
		Equipment required to connect hydraulic power	Connect hydraulic power
			TT08D031-11-72

3-18. REMOVAL.

a. Jack airplane (T.O. 1A-7D-2-1).

b. Connect external electrical power (T.O. 1A-7D-2-1).

c. Place landing gear handle in WHLS UP.

d. Shut down external electrical power.

e. Remove edge-lighted panel assembly from control panel.

f. Remove screws securing control panel. Lift panel and disconnect electrical connectors.

g. Disconnect wires from roll trim disengage switch.

h. Remove nut and washer securing switch to control panel and remove switch.

3-19. INSTALLATION.

a. Install roll trim disengage switch on control panel with washer and nut.

b. Connect control panel wires to switch.

c. Connect console electrical harness connectors to control panel.

d. Install control panel on console with screws.

e. Install edge-lighted panel assembly.

WARNING

Landing gear must be cycled before lowering airplane and removing jacks to ensure gear is in down and locked position.

f. Cycle gear and lower airplane in accordance with jacking procedures (T.O. 1A-7D-2-1).

g. Perform roll trim system operational checkout (paragraph 3-12).

3-20. ROLL TRIM DISENGAGE SWITCH REMOVAL AND INSTALLATION. (Airplanes AF69-6197 and Subsequent.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment required for jacking airplane	Jack airplane
			TT08D162-11-72

3-21. REMOVAL.

CAUTION

Ensure landing gear downlocks are installed and landing gear handle is not moved from WHLS DOWN position. If landing gear handle is inadvertently moved to WHLS UP position, landing gear may retract and extensive damage to airplane may occur.

a. Remove screw from landing gear handle knob and remove knob.

b. Loosen screw and remove AFCS control knob from generator control panel.

c. Remove screws and remove edge-lighted panel from control panel.

CAUTION

To prevent damage to captive screws or panel components, loosen all screws in sequence and rotate no more than three turns at one time.

d. Disengage captive screws securing control panel. Lift panel and disconnect electrical connectors.

e. Disconnect wires from roll trim disengage switch.

f. Remove nut and washer securing switch to control panel and remove switch.

WARNING

If landing gear handle was inadvertently moved during control panel removal, the landing gear may not be locked. To prevent collapse of landing gear, airplane must be jacked (T.O. 1A-7D-2-1) and landing gear must be completely cycled (T.O. 1A-7D-2-7).

3-22. INSTALLATION.

a. Install roll trim disengage switch on generator control panel with washer and nut.

b. Connect control panel wires to switch.

c. Connect console electrical harness connectors to control panel.

CAUTION

To prevent damage to captive screws or panel components, tighten all screws in sequence and rotate no more than three turns at one time.

d. Install control panel on console with captive screws.

e. Position edge-lighted panel on control panel and secure with screws.

f. Install AFCS control knob and secure with setscrew.

g. Install landing gear handle knob and secure with screw.

h. Perform roll trim system operational checkout (paragraph 3-12).

WARNING

If landing gear handle was inadvertently moved during control panel installation, the landing gear may not be locked. To prevent collapse of landing gear, airplane must be jacked (T.O. 1A-7D-2-1) and landing gear must be completely cycled (T.O. 1A-7D-2-7).

3-23. ROLL/PITCH TRIM AMPLIFIER REMOVAL AND INSTALLATION.

3-24. REMOVAL.

a. Open access 1232-1.

b. Remove electrical connector from amplifier.

c. Cut lockwire and remove bolt, washer, and mounting clamp. Slide amplifier from equipment shelf.

3-25. INSTALLATION.

a. Position amplifier on equipment shelf. Slide amplifier inboard until aft mounting clamp is contacted.

b. Install mounting clamp, bolt, washer, and lockwire.

c. Connect electrical connector.

d. Perform roll and pitch trim system operational checkouts (paragraphs 3-12 and 7-14).

e. Perform AFCS roll and pitch axis operational checkouts (T.O. 1A-7D-2-9).

f. Close access 1232-1.

3-26. ROLL TRIM ACTUATOR REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
2-6	215-00110-8	Rigging pin No. 31	Rig linkage
	GGG-W-686	Torque wrench, 10 to 150 pound-inches	Tighten couplings
			TT08D032-07-70

3-27. REMOVAL. (See figure 3-5.)

a. Open accesses 3123-1, 4113-11, 4123-1, 5111-1, 6111-1, and 10123-1.

b. Remove bleed air duct (T.O. 1A-7D-2-3).

c. Disconnect one end of spring (1) from mounting lug.

d. Disconnect electrical connector (2) from receptacle (3) on actuator (4).

e. Remove cotter pin (5), nut (6), washer (7), and bolt (8) connecting lug end of actuator to mounting structure.

f. Loosen jamnut (9) on actuator rod end.

g. Pivot actuator forward about installed rod end attach bolt until clearance is sufficient to permit actuator to be unscrewed from rod end.

h. Unscrew actuator from rod end.

i. Remove washer (10) from rod end. Leave clamp (11) and boot (12) on actuator.

j. Remove cotter pin (13), nut (14), washers (15), and bolt (16) attaching rod end to mixing linkage clevis. Remove rod end (17).

k. Install rod end on removed actuator to maintain complete assembly and tighten jamnut.

3-28. INSTALLATION. (See figure 3-5.)

a. Loosen jamnut on replacement actuator rod end and remove rod end.

b. Apply MIL-G-81322 grease to rod end (17), shank of bolt (16), jamnut (9), and threads under jamnut.

c. Install rod end (17) in mixing linkage clevis and secure with bolt (16), washers (15), nut (14), and new cotter pin (13).

d. Loosen clamp (11) and remove boot (12) from actuator.

e. Check that scribe mark on actuating rod aligns with end of support housing within ±0.01 inch. If not, position actuator to neutral as follows:

1. Connect electrical connector (2) to receptacle (3).

2. Connect external electrical power (T.O. 1A-7D-2-1).

3. Place roll trim disengage switch in ON.

4. Actuate roll trim button until scribe mark aligns within ±0.1 inch.

5. Place roll trim disengage switch in OFF.

6. Shut down external electrical power.

7. Disconnect electrical connector (2) from receptacle (3).

f. Slide boot (12) over actuating rod until it butts against actuator housing. Tighten clamp (11) to secure boot to actuator housing.

g. Place washer (10) on rod end.

h. Position actuator in airplane with rod aligned with installed rod end; screw actuator (4) cnto rod end.

i. Disconnect forward end of link (1, figure 2-6) and move link to one side to gain access to rigging pin hold No. 31.

j. Move mixing linkage, by ailerons if necessary, and install rigging pin No. 31.

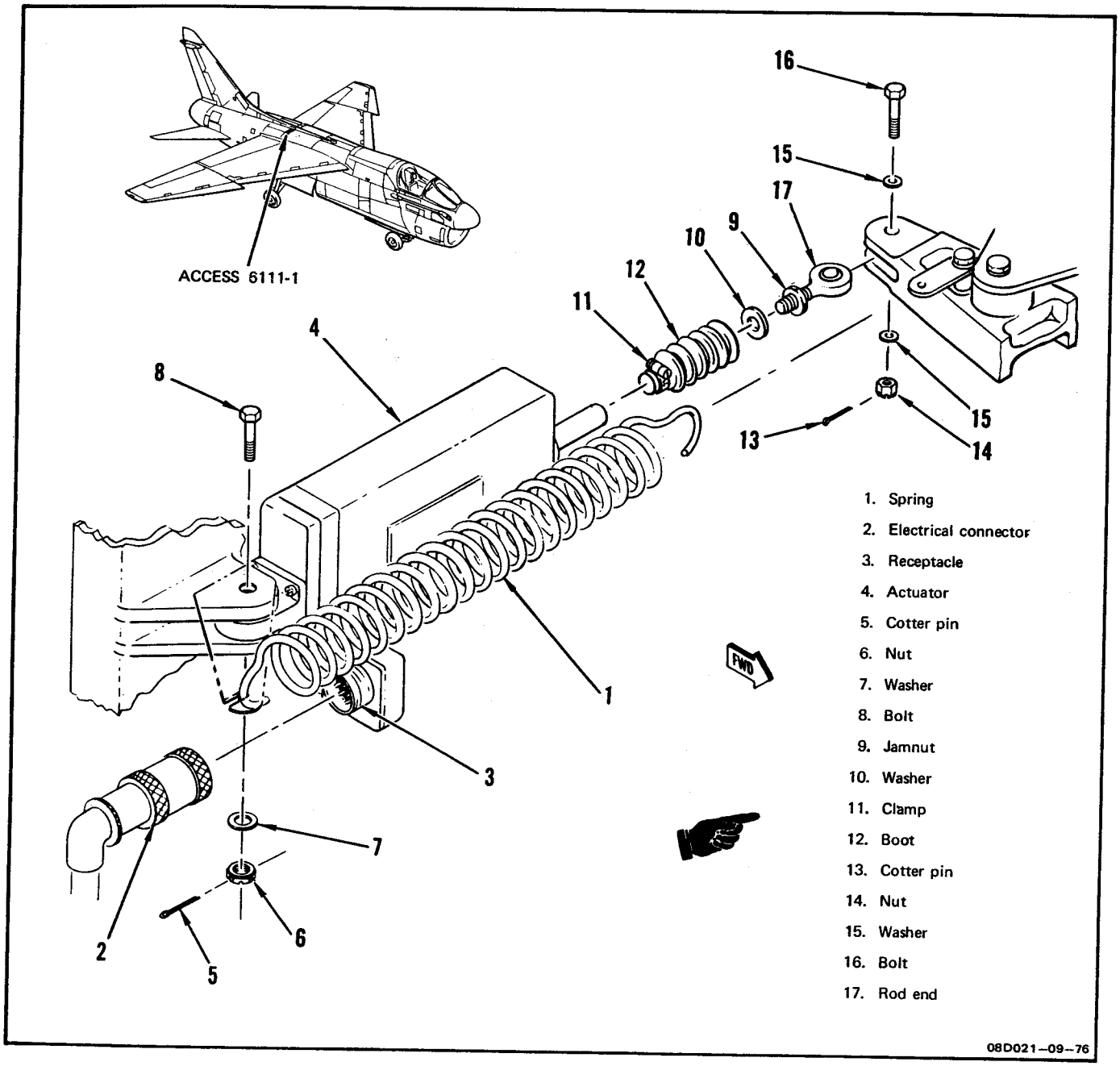


Figure 3-5. Roll Trim Actuator Removal and Installation

k. Pivot actuator aft about installed rod end bolt and position trunnion end in mounting structure.

l. Apply MIL-G-81322 grease to shank of bolt (8).

NOTE

If mounting holes do not align, screw actuator onto rod end until holes align.

m. Secure actuator lug end with bolt (8, figure 3-5), washer (7), nut (6), and new cotter pin (5).

n. Tighten jamnut (9).

o. Remove rigging pin No. 31.

p. Connect link that was disconnected in step i.

q. Connect electrical connector (2) and receptacle (3).

r. Connect loose end of spring (1) to mounting lug.

s. Perform roll trim system operational checkout (paragraph 3-12).

t. Install bleed air duct (T.O. 1A-7D-2-3).

u. Close accesses 10123-1, 3123-1, 4113-11, 4123-1, 5111-1, and 6111-1.

Section IV

SPOILER/DEFLECTOR CONTROL SYSTEM

4-1. DESCRIPTION.

4-2. The spoiler/deflector control system is a primary flight control system which operates in conjunction with the aileron control system to provide increased roll rate. The spoiler/deflector surfaces are operated by tandem hydraulic actuators with each section of the tandem actuators supplied by a different PC hydraulic system. The hydraulic actuators are located in the left and right wing center sections directly forward of the trailing edge flaps.

4-3. The left spoiler/deflector operates in conjunction with upward movement of the left aileron and the right spoiler/deflector with upward movement of the right aileron. The spoiler extends up into the airstream, which causes decreased lift on the wing. The deflector extends down into the airstream and acts as a scoop to direct airflow up through the wing and over the wing surface aft of the spoiler, preventing flow separation in that area. System inputs are provided by lateral movement of the control stick grip and signals from the automatic flight control system. Roll trim signals do not affect the position of the spoiler/deflectors. The same control linkage, up to the aileron trim and mixing linkage, is used for operation of the spoiler/deflectors and ailerons.

4-4. For system controls and indicators, see figures 2-1 and 3-1. For system arrangement, see figure 4-1.

4-5. OPERATION. (See figure 2-3.)

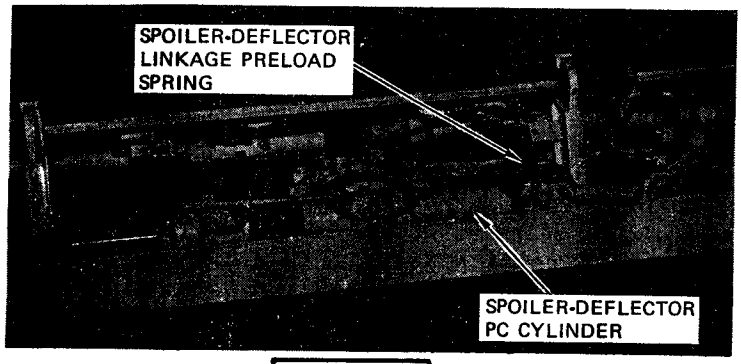
4-6. Lateral deflection of the stick is mechanically transmitted to the aileron and spoiler/deflector control linkage. The same control linkage, up to a mixing linkage, is used for operation of the ailerons and spoiler/deflectors. For information on operation of the control system up to the aileron trim and mixing linkage, refer to paragraph 2-6.

4-7. The aileron trim and mixing linkage receives inputs from the control stick and the AFCS roll actuator. Output signals from the mixing linkage are directed to the left and right ailerons and to the left and right spoiler/deflectors. Spoiler deadband stops are installed on a spoiler/deflector input bellcrank located in the mixing linkage. The stops allow the bellcrank to rotate through an angle corresponding to 2°30' (±15') aileron throw without providing an input into the spoiler/deflector linkage. When a stop bottoms out against its stop pad, the spoiler/deflector control linkage will begin to move. Movement of the spoiler/deflector control linkage with inputs from control stick and AFCS is limited to 60° (+0°, -2°) spoiler deflection by a stopbolt installed on a control bellcrank. With control stick inputs only, spoiler travel is limited to 36° (+2°, -1°). The deflector is mechanically slaved to the spoiler and will be deflected 30° (±1°) when the spoiler is at its maximum throw of 60°.

4-8. A load-limiting link interconnects the mixing linkage and the spoiler/deflector control linkage. The load-limiting link acts as a fixed length link when the rod system acts to open the spoiler/deflector. When the left spoiler/deflector opens, the right spoiler/deflector remains closed, and the right load-limiting link collapses and absorbs the linkage motion. The left load-limiting link absorbs the linkage motion when the right spoiler/deflector is opened.

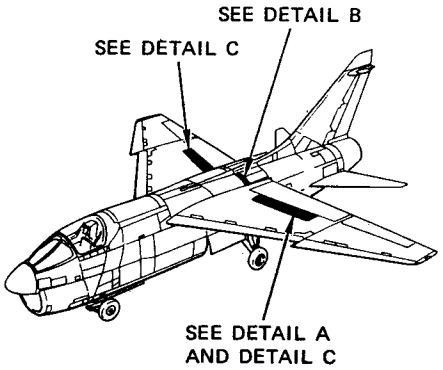
4-9. Each spoiler is positioned by a tandem power control (PC) cylinder. The input control linkage is connected to the PC cylinder servo valve control arm. Movement of the control arm positions the valve slider to direct hydraulic pressure to extend or retract the PC cylinder piston rod.

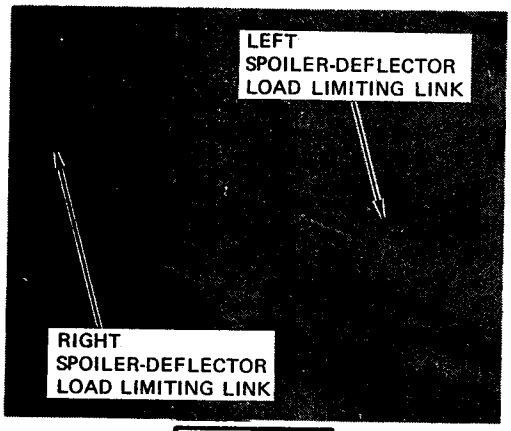
4-10. The PC cylinder is mounted between two spoiler actuating links. As the PC cylinder retracts, the actuating links



DETAIL A

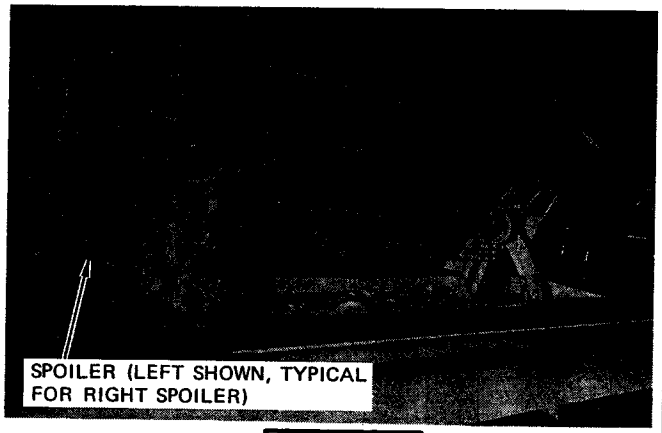
(SPOILER CAVITY – LEFT SHOWN, TYPICAL FOR RIGHT CAVITY)



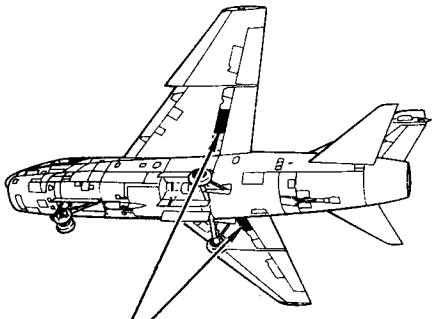


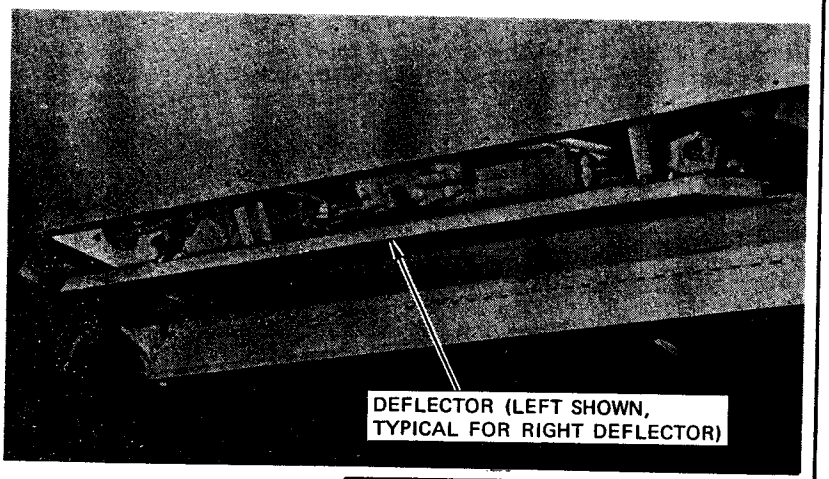
DETAIL B

(ACCESS 5111-1 AND 5111-4)



DETAIL C





DETAIL D

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Figure 4-1. Spoiler/Deflector Control System Arrangement

are moved toward each other, causing the spoiler to move up. As the spoiler moves up, a connecting link installed between the spoiler and deflector is forced down, causing the deflector to move down. As the PC cylinder extends, the actuating links are moved apart, causing the spoiler to close. The connecting link is moved up, causing the deflector to close.

4-11. The servo valve is an integral part of the PC cylinder. As the PC cylinder piston rod extends or retracts, the cylinder housing and servo valve move in the opposite direction. Movement of the servo valve due to cylinder pressurization is in the direction that causes the valve control arm to be repositioned toward neutral. In the neutral position, the servo valve blocks hydraulic fluid flow to and from the PC cylinder. This prevents further movement of the spoiler until a new control system input repositions the servo valve control arm.

4-12. Each PC cylinder consists of a dual tandem hydraulic cylinder and a four-way dual servo valve which ports a different PC hydraulic system to each section of the tandem cylinder. Both PC systems normally operate at all times and the dual configuration of the PC cylinders and servo valves ensures continuous aileron control if one PC system fails.

4-13. On airplanes through AF69-6196 hydraulic operation of both spoiler/deflectors is identical. Half of the servo valve directs PC No. 1 hydraulic system pressure to the corresponding half of the PC cylinder and the other half of the servo valve directs PC No. 2 system pressure to the other half of the PC cylinder. If either PC system fails, both spoiler/deflectors continue to operate.

4-14. On airplanes AF69-6197 and subsequent, the hydraulic supply for spoiler/deflector operation is not identical for both wings. For the left wing, one half of the servo valve directs PC No. 1 hydraulic pressure to the corresponding half of the PC cylinder and the other half of the servo valve directs PC No. 3 hydraulic system pressure to the other half of the PC cylinder. For the right wing, the assembly is supplied hydraulic pressure by PC No. 1 and PC No. 2 hydraulic systems. This arrangement provides operation of both spoiler/deflectors when hydraulic pressure is supplied by all PC hydraulic systems, by PC No. 2 and PC No. 3 together, or by PC No. 1 in conjunction with PC No. 2 or PC No. 3. If PC No. 2 system alone is supplying pressure, only the right spoiler/deflector will operate. If PC No. 3 system alone is supplying hydraulic pressure, only the left spoiler/deflector will operate. If only PC No. 1 is supplying hydraulic pressure, the spoiler/deflectors will not respond to control stick movement but will respond to AFCS control inputs.

4-15. COMPONENTS.

4-16. For a list of system components, their locations (accesses), and functions, refer to table 4-1.

4-17. OPERATIONAL CHECKOUT.

4-18. The spoiler/deflector control system is checked in conjunction with the aileron control system. Refer to paragraph 2-25 or 2-26 for operational checkout.

4-19. TROUBLESHOOTING.

4-20. The spoiler/deflector control system is checked in conjunction with the aileron system. Refer to table 2-2 for troubleshooting information. Malfunctions in the table are listed numerically and are related to a corresponding number, or numbers, following a step in the operational checkout.

Table 4-1. Spoiler/Deflector Control System Components

Component	Access	Function
Cylinder, spoiler/ deflector PC (left/ right)	Spoiler cavity (left/right)	Actuates spoiler in response to system demands.
Deflector (left/right)	Wing center section (left/right)	Prevents airflow separation aft of the spoiler.
Link, spoiler/ deflector load-limiting	5111-1, 5111-4	Absorbs linkage lost motion travel when the opposite spoiler/deflector is actuated.
Spoiler (left/right)	Wing center section (left/right)	Disrupts airflow over the wing to increase roll rate.
Spring,spoiler/ deflector linkage preload (left/right)	Spoiler cavity (left/right)	Preloads spoiler/deflector control linkage to reduce free play.

4-21. SPOILER/DEFLECTOR POWER CONTROL SLOP CHECK. (See figure 4-2.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment required for connecting external hydraulic power	Connect hydraulic power
4-2	80D	Spring scale, 0 to 80 pounds	Apply force to surface
4-2	MIL-I-18422	Dial indicator	Record deflection
			TT08D033-05-69

a. Install spoiler protractors (paragraph 4-22).

b. Connect and apply external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

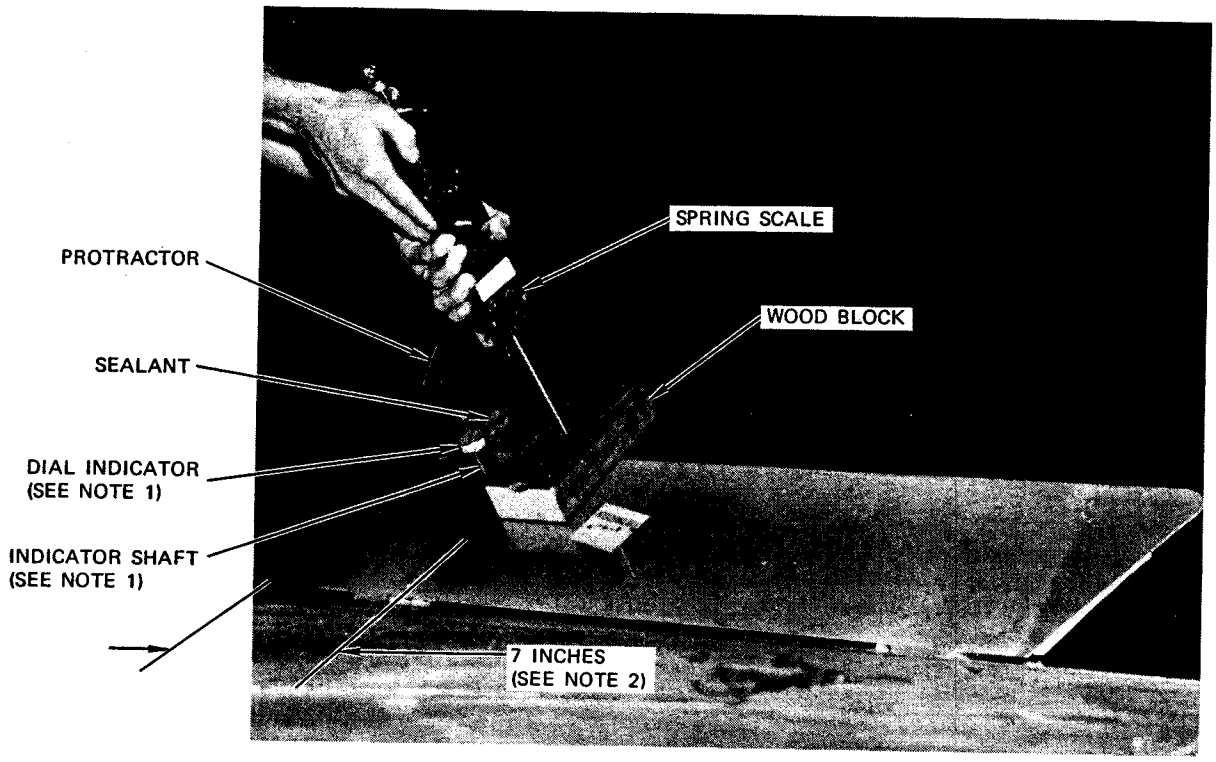
c. Actuate control stick to position spoiler at 45° (±30'). Secure aileron control, holding spoiler position at 45° (±30').

d. Mount dial indicator on protractor above spoiler as shown in figure 4-2 and as close as practical to the spoiler trailing edge.

e. Position block and spring scale on spoiler upper surface approximately 7 inches from inboard edge of spoiler.

f. Apply downward force of 50 (+5, -0) pounds perpendicular to spoiler surface. Slowly reduce force and record dial indicator reading as force reaches zero.

g. Hook spring scale on edge of spoiler approximately 7 inches from inboard edge of spoiler so force may be applied upward.



NOTES

1. Mount dial indicator on protractor by embedding indicator arm in lump of sealant. Check that indicator shaft is depressed to provide an indication that reflects up or down movement of spoiler.

2. Position wood block so spring scale force can be applied approximately 7 inches from inboard edge of spoiler and in line with trailing edge.

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Figure 4-2. Spoiler/Deflector PC Slop Check

h. Pull upward, perpendicular to spoiler, with a force of 50 (+5, -0) pounds. Slowly reduce force and record dial indicator reading as force reaches zero.

i. Difference between indications (total slop) must not exceed 0.057 inch.

j. Remove dial indicator, block, and spring scale.

k. Repeat steps c through j for opposite spoiler.

l. Remove spoiler protractors.

m. Disconnect external hydraulic power.

4-22. SPOILER PROTRACTOR INSTALLATION. (See figure 4-3.)

Tools Required

Figure & Index No.	Part Number	Nomenclature	Use and Application
4-3	215-00183-1	Left spoiler protractor	Check spoiler deflection
4-3	215-00183-2	Right spoiler protractor	Check spoiler deflection
	5220-00-212-8747	Bubble protractor	Alternate for checking spoiler deflection
			TT08D034-09-76

NOTE

Bubble protractor may be used as alternate to 215-00183 spoiler protractor to check spoiler deflection.

a. Remove protective screws (NAS 517-3-00) from wing center section (1).

b. Install protractor (2) with special screw assembly (3) on wing center section.

c. Adjust protractor to provide clearance, through full travel of spoiler, between protractor and edge of spoiler (4).

d. After adjustment, replace protective screws in wing center section.

4-23. RIGGING PRECAUTION.

NOTE

Accurate rigging cannot be accomplished if airplane is on wing jacks, or if stores are loaded on pylons.

a. Check that airplane is not on jacks.

b. Check that wing pylons are empty.

4-24. RIGGING SPOILER/DEFLECTOR. (See figure 4-4.)

Tools Required

Figure & Index No.	Part Number	Nomenclature	Use and Application
		Equipment for connecting external hydraulic power	Connect hydraulic power
2-6	215-00110-4	Rigging pin No. 34	Rig linkage
	GGG-W-686	Torque wrench, 0 to 250 pound-feet	Tighten cylinder piston rod end
4-4		Spoiler Door Rigging Tool	Rig and adjust Spoiler/Cylinder piston rod end and spoiler servo input rod.
			TT08D035-07-70

CAUTION

To prevent failure of spoiler rod end bearing from overtravel, ensure that linkage from aileron/spoiler mixing linkage to spoiler/deflector linkage stops has been properly rigged before rigging spoiler/deflector.

NOTE

Open access 3233-3 to rig left spoiler/deflector. To rig right spoiler/deflector, open access 4233-3.

a. Ensure that linkage from aileron/spciler mixing linkage to spoiler/deflector stops is properly rigged (paragraph 2-42).

b. Open spoiler manually.

CAUTION

Ensure that all sealant between spoiler door and wing structure is removed. Check that no sealant exists in spoiler well that would limit spoiler door closing. If spoiler door is rigged in the closed position, while contacting the sealant, damage to spoiler mechanism may result.

c. Remove all sealant between spoiler and wing substructure. Touch up any damaged finish (T.O. 1A-7D-3).

d. Disconnect deflector rod (1) from spoiler (2) by removing cotter pins, nuts, washers, and bolts. Support rod to prevent striking other parts during rigging.

CAUTION

Do not rotate piston to make adjustment; rotate rod end. Piston rotation will distort piston packings and retainers, and cylinder may leak internally.

e. Check and adjust bellcrank vertical alignment dimension of 0.10 (±0.01) inch using spoiler door rigging tool as follows:

1. Manually hold the spoiler door open to its maximum travel.

2. Position the 0.4375 radius cutoff over the flats of the AN320-8 nut attaching the rod end bellcrank to the aircraft structure.

3. Position the 0.3125 radius cutout over the head of the 215-78404 bolt attaching the link to the spoiler door.

4. The 0.4375 radius cutout on the side of the tool (facing the actuator) should rest against the head of the 215-78400-2 bolt attaching the cylinder rod end to the bellcrank.

5. If the 0.4375 radius cutout does not rest against the 215-78500-2 bolt, remove the bolt and adjust the rod end as required.

6. Reinstall the rod end attachment bolt and recheck for proper adjustment.

7. Turn the tool over and repeat substeps 1. thru 4. to check the lug end for overcenter travel.

f. Tighten rod end jamnut to 100 (±8) pound-feet torque and secure with MS20995C32 lockwire.

g. If adjustment was required, install bolt, washers, nut, and new cotter pin to attach rod end of cylinder to bellcrank.

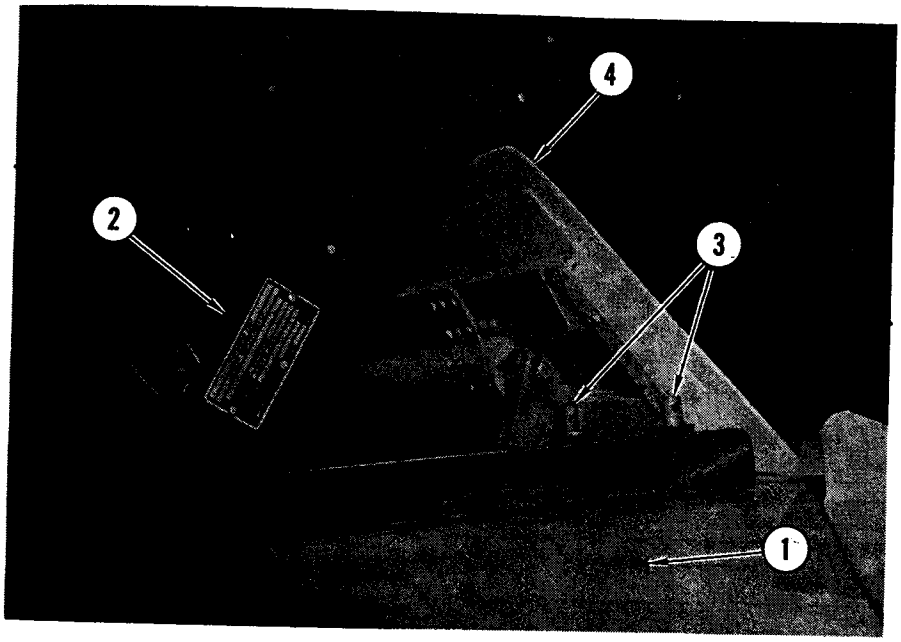


Figure 4-3. Spoiler Protractor Installation

WARNING

Ensure that hydraulic power is disconnected when adjusting turnbuckle, to prevent injury or equipment damage. If input linkage is moved with hydraulic power applied, cylinder piston will actuate.

h. Remove lockwire and adjust input rod (3) turnbuckle several turns to lengthen rod and assure that spoiler will not close fully when hydraulic power is applied.

i. Connect external hydraulic power to all systems (T.O. 1A-7D-2-1). Apply approximately 200 psi and gradually increase to full pressure.

j. Check spoiler input rod assembly (3) and wing flap down tube assembly for interference. If interference exists, reduce hydraulic pressure to zero and perform the following:

1. Protect area from hydraulic fluid spillage. Loosen nut and union of tube assembly and rotate tube assembly away from spoiler input rod assembly. Tighten nut and union.

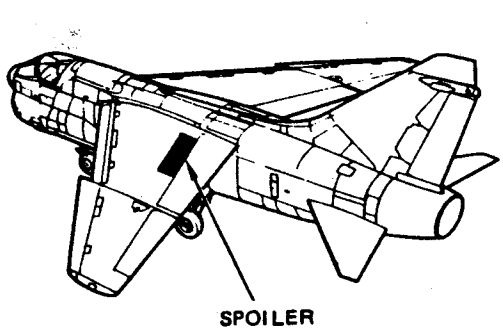
2. Apply hydraulic pressure and check for leakage.

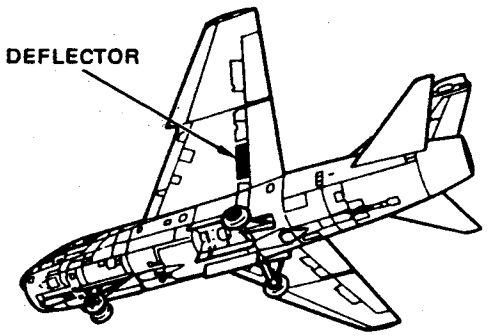
3. Operate spoiler door and check for continued interference.

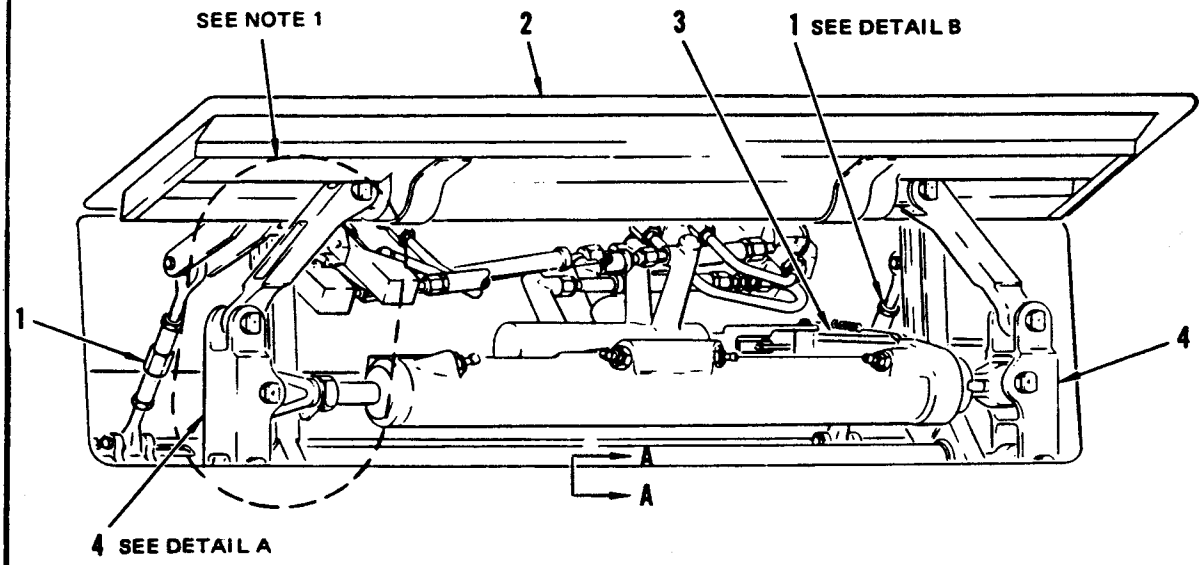
4. If interference still exists, remove and replace spoiler/deflector cylinder assembly (paragraph 4-26).

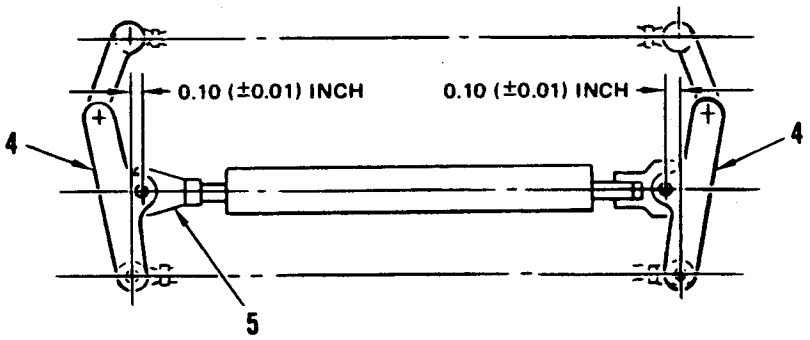
k. For obtaining measurements required in step n, provide blade type feeler gages so that a 90° bend exists approximately 1/2 inch from tip of feeler gage to permit insertion between spoiler and wing substructure.

l. Apply 3,000 psi hydraulic power with oil temperature at 125°F (52°C) (±10°F (6°C)) measured at pressure line on test stand, and cycle spoiler input linkage approximately 25 times. If temperature reading means are not available, cycle spoiler input linkage approximately 15 minutes to ensure adequate flow of heated oil to all components.









DETAIL A

NOTE

1. VERTICAL ALIGNMENT OF BELLCRANK TO BE WITHIN TOLERANCES SHOWN.
2. FABRICATE TOOL FROM 0.125 STAINLESS STEEL-ALLOY AND HEAT TREAT AS AVAILABLE.
3. ALL DIMENSIONS FOR RIGGING TOOL ARE IN INCHES.

1. Deflector rod
2. Spoiler
3. Input rod
4. Bellcrank
5. Rod end
6. Deflector
7. Wing

08D028-01-11-85

Figure 4-4. Spoiler/Deflector Rigging (Sheet 1)

NOTE

See figure 2-6 for rigging pin location.

m. Install rigging pin No. 34.

NOTE

Clearances shall be measure within 1 inch inboard or outboard of the two points directly aft of the hinges.

n. Adjust spoiler servo input rod turnbuckle until spoiler trailing edge is within 0.060 (+0.020, -0.010) inch of touching wing structure. After rigging the trailing edge gap, there shall be 0.002 inch minimum clearance between the remaining spoiler edge periphery and wing substructure.

NOTE

The spoiler trailing edge may be crimped a maximum of 0.12 inch beginning approximately 1 inch from the tip to obtain the required clearances.

o. If dimensions cannot be met rework or replace spoiler door as required.

p. **Remove rigging pin No. 34.**

q. **Shut down hydraulic power. Open and hold spoiler at 60° (+0°, -2°). Connect deflector rods (1) to spoiler with bolts, washers, and nuts and adjust deflector rod turnbuckles to position deflector at 3.90 (±0.05) inches as shown.**

WARNING

To avoid overstressing the deflector rods, which could fail and jeopardize safe aircraft operation, ensure that the deflector does not close before the spoiler, prior to final deflector rigging.

r. **Apply hydraulic power and slowly cycle spoiler/deflector to neutral.**

s. **Insert rigging pin No. 34 and check that deflector matches wing contour all around with spoiler in rigged position. If necessary, hold spoiler open (step o) and readjust deflector rod turnbuckles in 1/4-turn increments until contours match with hydraulic power applied and rigging pin No. 34 installed.**

t. Recheck spoiler rigging per step n.

u. **Remove rigging pin No. 34.**

v. **Shut down external hydraulic power.**

WARNING

Sealant MIL-S-8802 is flammable and moderately toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate.

NOTE

Do not apply sealant between spoiler and wing substructure. A plastic knife may be used to cut along edge of spoiler to remove excess sealant.

w. **Apply caulking seal of MIL-S-8802 sealant in gap between spoiler edge and wing surface. (Refer to T.O. 1A-7D-23 for sealant application instructions.)**

NOTE

When hydraulic power is shut down, a slight gap will exist between spoiler and wing surface. This is normal and does not indicate improper rigging.

x. **After sealant has cured, scrape sealant flush with spoiler. Remove any**

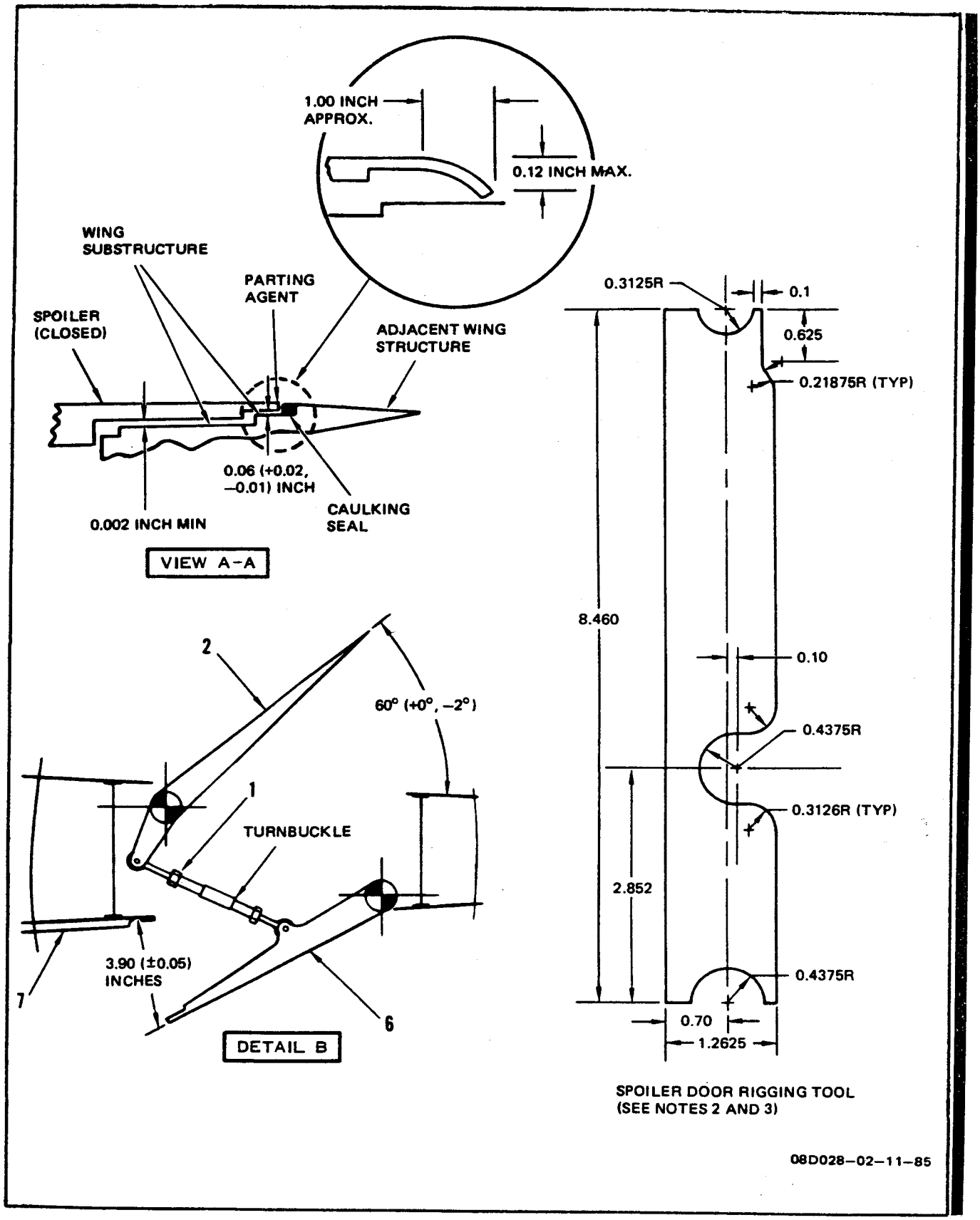


Figure 4-4. Spoiler/Deflector Rigging (Sheet 2)

sealant between spoiler and wing substructure.

y. Manually open spoiler and deflector.

z. Install new cotter pins to secure deflector rod connecting hardware.

aa. Secure input rod (3) turnbuckle with MS20995C32 lockwire.

ab. Secure deflector rod turnbuckles (2) with MS20995C32 lockwire.

ac. Repeat rigging for opposite wing, if required.

ad. Apply hydraulic power and cycle ailerons with control stick. Check that spoiler opens 36° (+2°, -1°) and deflector opens with full lateral stick travel, and spoiler and deflector close flush with wing when stick is returned to neutral. There must be no binding or interference.

ae. Disconnect external hydraulic power.

af. Close access 3233-3 or 4233-3.

ag. Remove spoiler protractor.

4-25. SPOILER/DEFLECTOR EXTENSION UNIT REMOVAL AND INSTALLATION. (Refer to T.O. 1A-7D-2-4.)

4-26. SPOILER/DEFLECTOR PC CYLINDER REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external hydraulic power	Connect hydraulic power
	GGG-W-686	Torque wrench, 0 to 250 pound-feet	Tighten jamnut
	GGG-W-686	Torque wrench, 0 to 300 pound-inches	Tighten extension unit fittings
	GGG-W-686	Torque wrench, 10 to 150 pound-inches	Tighten bleed plugs.

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4-27. REMOVAL. (See figure 4-5.)

NOTE

Removal and installation procedure is typical for left and right spoiler/deflector cylinders.

a. Manually lift spoiler to maximum open position.

b. Remove cotter pins (1), nuts (2), washers (3), and bolts (4) connecting spoiler upper links (5) to spoiler/deflector cylinder bellcranks (6). Secure spoiler in maximum open position.

CAUTION

Servo valve is spring loaded. Use care when disconnecting input rod to prevent hard bottoming of valve which could result in valve damage.

c. Remove spring (7) between bolt and bracket on cylinder.

d. Remove cotter pin (8), nut (9), bolt (10), washers (11), spacer (12) and washer (13) connecting input rod end (14) to servo valve control lever.

e. Cut lockwire and remove cotter pins (15), nuts (16), washers (17), and bolts (18) securing deflector rods (19) to spoiler (20). Support rods to prevent striking other parts during rigging.

f. Disconnect hydraulic extension units (21) at servo valve connections. Remove and discard packings (21A).

g. Remove cotter pin (22), nut (23), washers (24), and bolt (25) attaching rod end (26) of cylinder to bellcrank (6).

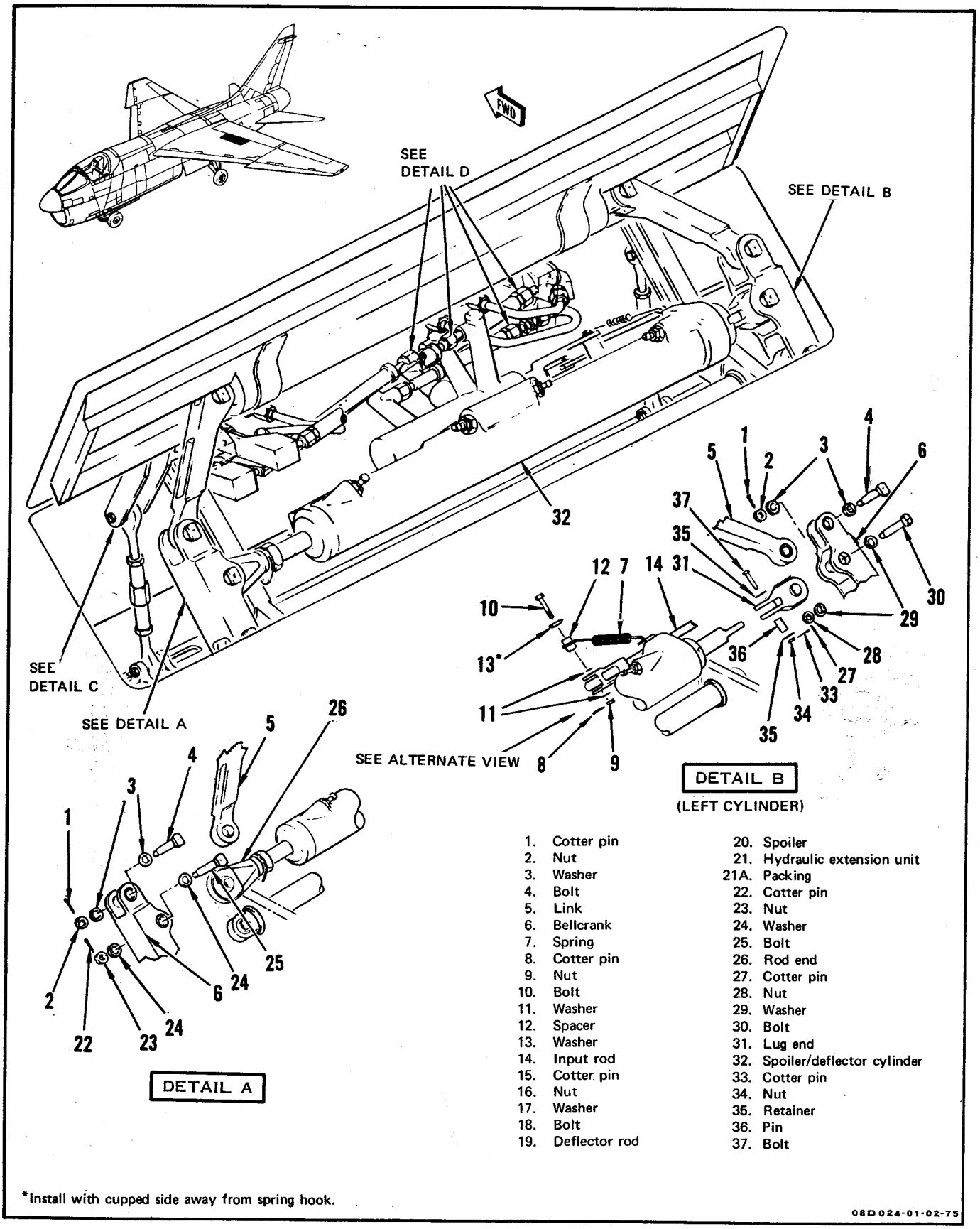
h. Remove cotter pin (27), nut (28), washers (29), and bolt (30) attaching lug end (31) of cylinder to bellcrank and remove cylinder (32).

i. Remove lug end (31) from cylinder (32) by removing cotter pin (33), nut (34), retainers (35), pin (36), and bolt (37).

j. Manually bottom piston in retracted position.

k. Note distance between centers of cylinder attaching holes for use during installation.

l. Install plugs in hydraulic ports.



1. Cotter pin
2. Nut
3. Washer
4. Bolt
5. Link
6. Bellcrank
7. Spring
8. Cotter pin
9. Nut
10. Bolt
11. Washer
12. Spacer
13. Washer
14. Input rod
15. Cotter pin
16. Nut
17. Washer
18. Bolt
19. Deflector rod
20. Spoiler
21. Hydraulic extension unit
21A. Packing
22. Cotter pin
23. Nut
24. Washer
25. Bolt
26. Rod end
27. Cotter pin
28. Nut
29. Washer
30. Bolt
31. Lug end
32. Spoiler/deflector cylinder
33. Cotter pin
34. Nut
35. Retainer
36. Pin
37. Bolt

*Install with cupped side away from spring hook.

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Figure 4-5. Spoiler/Deflector PC Cylinder Removal and Installation (Sheet 1)

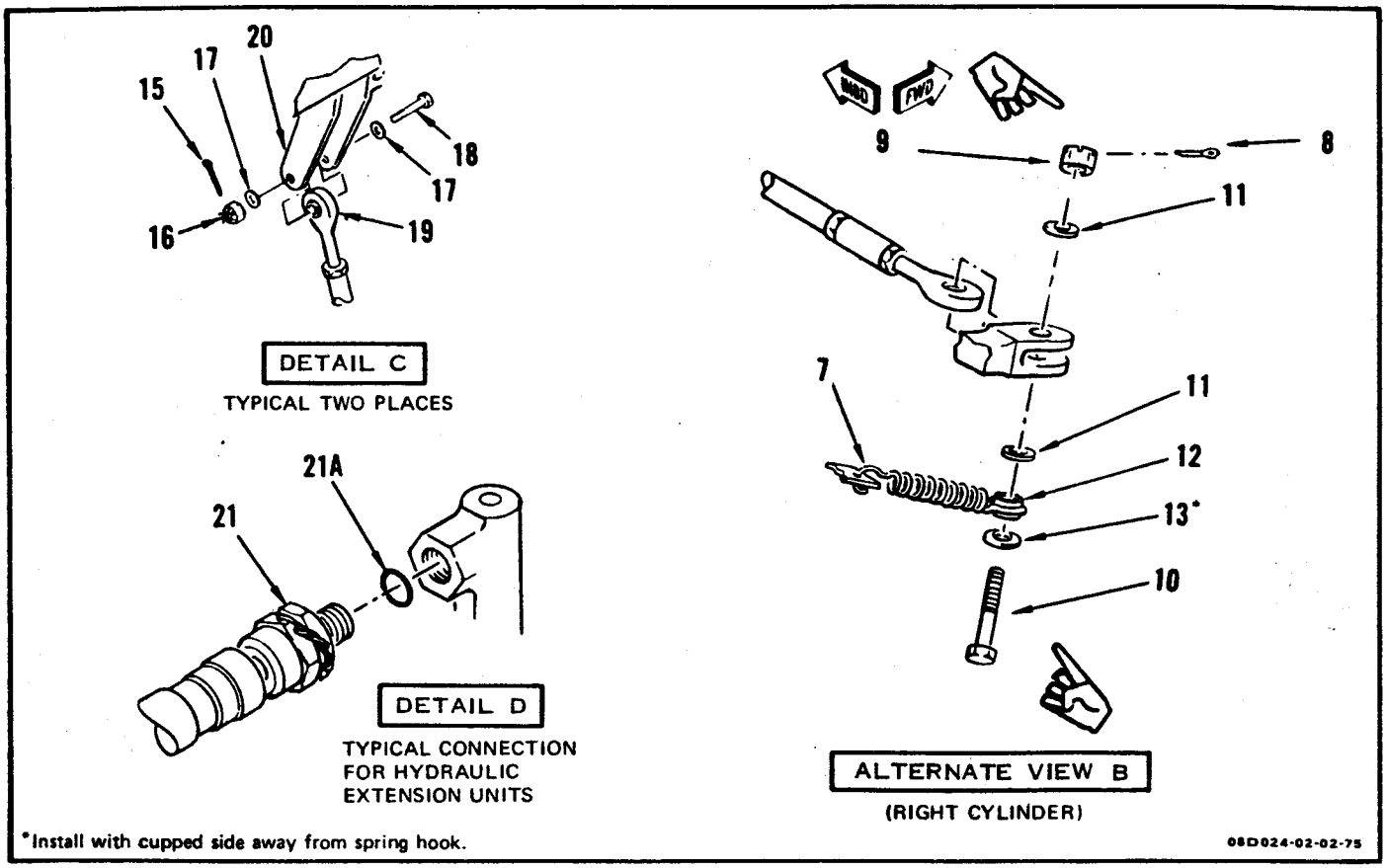


Figure 4-5. Spoiler/Deflector PC Cylinder Removal and Installation (Sheet 2)

4-28. INSTALLATION. (See figure 4-5.)

a. Attach lug end (31) to replacement cylinder with bolt (37), pin (36), retainers (35), and nut (34).

b. Adjust rod end (26) to length noted during removal and tighten jamnut to 100 (±8) pound-feet torque.

c. Remove plugs from hydraulic ports.

d. Drain preservative fluid and fill cylinder with hydraulic fluid.

e. Lubricate cylinder attaching bolts and bushings with MIL-G-23827 grease.

f. Install bolt (30), washers (29), nut (28), and new cotter pin (27) to attach lug end (31) to bellcrank (6).

g. Install bolt (25), washers (24), and nut (23) to attach rod end (26) of cylinder to bellcrank (6). Do not install cotter pin at this time.

h. Connect hydraulic extension units (21) to servo valve using new packings (21A). Tighten extension unit fittings to 150 (±50) pound-inches torque.

NOTE

Remaining items will be connected during bleeding and rigging procedures.

i. Bleed spoiler/deflector cylinder (paragraph 4-34). Leave hydraulic power connected.

j. Rig spoiler/deflector (paragraph 4-24).

k. Check that piston rod end jamnut has been secured with MS20995C32 lockwire and new cotter pin (22) has been installed in rod end attaching bolt (25).

l. Check that lines and fittings which were disconnected are not leaking.

m. Perform aileron system operational checkout (paragraph 2-25 or 2-26).

4-29. SPOILER/DEFLECTOR PC CYLINDER REPAIR.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	GGG-W-686	Torque wrench, 10 to 150 pound-inches	Tighten bolts
			TT08D166-11-74

4-30. DISASSEMBLY. (See figure 4-6.)

a. Remove spoiler/deflector PC cylinder from airplane (paragraph 4-26).

b. Remove bolts (1) and washers (2).

c. Remove bolt (8), bolt (9), and washers (10). Note position of bolts for reinstallation purposes.

d. Separate servo valve (3) from cylinder (7).

e. Remove plugs (6), packings (4), and retainers (5). Discard retainers and packings.

4-31. CLEANING.

WARNING

P-D-680 is combustible and moderately toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate.

a. Clean exterior of servo valve and cylinder with P-D-680 drycleaning fluid. Remove sealant from edges of mating surfaces.

b. Clean mating surfaces of servo valve and cylinder, connecting passages for plugs (6, figure 4-6), and plugs with MIL-H-46170 hydraulic preservative fluid. Clean plugs ultrasonically if necessary.

4-32. INSPECTION.

a. Inspect threads for damage.

b. Inspect mating surfaces of servo valve and cylinder for cracks and distortion.

c. Check passages for cleanness and freedom from foreign material.

d. Inspect plugs (6, figure 4-6) for distortion, wear, and misalignment.

4-33. ASSEMBLY. (See figure 4-6.)

a. Lubricate packings (4) with MIL-H-83282 hydraulic fluid and install packings and retainers (5) on each end of plugs (6).

b. Insert plug assemblies in passages of cylinder (7).

c. Mate valve (3) with cylinder so input rod end of valve is over lug end of cylinder. Use care to avoid damage to retainers, packings, and plugs.

d. Install washers (10) and bolts (9 and 8) and washers (2) and bolts (1). Tighten bolts (9 and 8) to 50 to 70 pound-inches torque and bolts (1) 20 to 25 pound-inches.

e. Secure bolts with MS20995C32 lockwire.

WARNING

Sealant MIL-S-8802 is flammable and moderately toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate.

f. Seal parting seam between valve and cylinder with MIL-S-8802 sealant.

g. Install spoiler/deflector PC cylinder (paragraph 4-26).

4-34. BLEEDING SPOILER/DEFLECTOR PC CYLINDER. (See figure 4-5.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external hydraulic power	Connect hydraulic power
	GGG-W-686	Torque wrench, 5 to 50 pound-inches	Tighten bleed plugs
			TT08D171-02-75

a. Manually open spoiler.

b. Remove cotter pins (1), nuts (2), washers (3), and bolts (4) connecting spoiler upper links (5) to bellcranks (6).

c. Support upper links (5) clear of bellcranks (6).

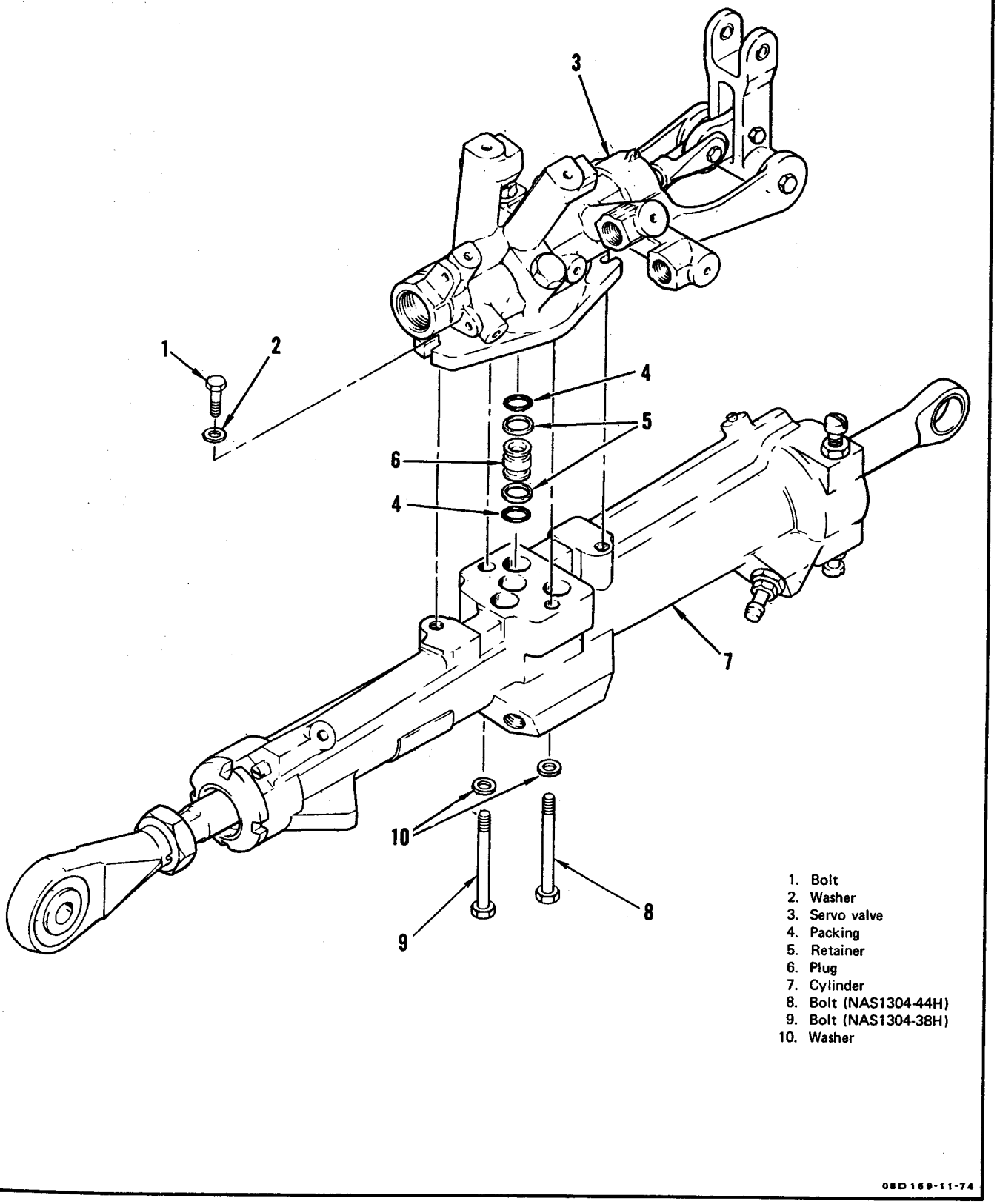


Figure 4-6. Spoiler/Deflector PC Cylinder Repair

WARNING

To prevent injury to personnel or damage to equipment, do not disconnect input rod when hydraulic power is connected. The servo valve is spring loaded and will cause the cylinder piston to extend.

NOTE

It is not necessary to disconnect the servo valve input rod to perform the bleeding. Instead, the cylinder may be cycled by means of the pilot's control stick. However, disconnecting the input rod permits bleeding to be accomplished by one man.

d. Unhook spring (7) and remove cotter pin (8), nut (9), bolt (10), washers (11), spacer (12), and washer (13) connecting input rod end to servo valve control lever.

e. Connect bleed hoses to cylinder bleed fittings.

WARNING

When applying hydraulic pressure, increase pressure slowly to prevent high speed bottoming of cylinder piston in extended position which could cause injury to personnel or damage to equipment.

f. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1). Apply 400 (±100) psi hydraulic pressure to systems with test stand set for closed system operation.

WARNING

When stroking servo valve ensure that perscnnel and equipment are clear of bellcrank travel to prevent injury to personnel or damage to equipment.

g. Manually stroke servo valve lever to retract the cylinder piston. Do not release servo valve lever.

h. Open bleed plugs at extend end of cylinder half and allow hydraulic fluid to flow until free of air. Close bleed plugs.

i. Manually stroke servo valve lever to extend position and open bleed plugs at retract end of each cylinder half as piston starts to extend. Close bleed plugs as soon as piston bottoms. Slowly release servo valve lever.

j. Manually stroke servo valve lever to retract position and open bleed plugs at extend end of each cylinder half as piston starts to retract. Close bleed plugs as scon as piston bottoms.

NOTE

Slow stroking of the valve is important to prevent foaming of the hydraulic oil and permit effective bleeding.

k. With all bleed valves closed, slowly stroke servo valve through approximately 10 cycles allowing cylinder piston to fully extend and retract on each stroke. Stop stroking with cylinder piston retracted and hold servo valve lever to prevent piston extension.

l. Repeat steps i and j until air-free fluid flcws from bleed plugs. Repeat step k after repeating steps i and j if air appears in fluid when performing either step.

m. Shut down, but do not disconnect, hydraulic power.

n. Remove bleed hoses.

o. Torque bleed plugs 5 to 15 pound-inches. Check that minimum gap under bleed plugs is 0.010 inch and secure with MS20995C32 lockwire.

p. Perform hydraulic system air check (T.O. 1A-7D-2-1).

WARNING

Ensure that hydraulic power is disconnected before connecting input rod to prevent injury to personnel or damage to equipment. Moving servo valve control lever with hydraulic power applied will actuate cylinder piston.

NOTE

Install washer (13) with outer edges cupped away from spring hook.

q. On left cylinder installation, connect end of input rod (14) to servo valve control lever with washer (13), spacer (12), washer (11), bolt (10), washer (11), nut (9), and new cotter pin (8).

r. On right cylinder installation, connect end of input rod (14) to servo valve control lever with washer (11), bolt (10), washer (11), spacer (12), washer (13), nut (9), and new cotter pin (8).

s. Connect spring (7) to bracket on cylinder and to spacer (12) between washer (11) and washer (13).

t. Connect spoiler upper links (5) to bellcranks (6) with bolts (4), washers (3), and nuts (2).

u. Install new cotter pins (1).

v. Check spoiler deflector opening for cleanness and freedom from foreign objects.

w. Close spoiler.

4-35. SPOILER REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	MIL-G-3859	Grease gun	Grease spoiler after installation

TT08D038-07-70

4-36. REMOVAL. (See figure 4-7.)

a. Open spoiler manually.

b. Disconnect two bonding jumpers from spoiler.

c. Disconnect spoiler links (1) from bellcranks (2) by removing cotter pins, nuts, washers, and bolts.

d. Disconnect deflector rods (3) from spoiler by removing cotter pins (4), nuts (5), washers (6), and bolts (7).

e. Remove cotter pins (8), nuts (9), washers (10), and bolts (11) attaching spoiler (12) to wing hinge (13). Remove spoiler.

f. Remove cotter pins, nuts, bolts, and washers attaching spoiler links (1) to spoiler (12).

4-37. INSTALLATION. (See figure 4-7.)

a. Connect spoiler links (1) to spoiler (12) with bolts, washers, nuts, and new cotter pins.

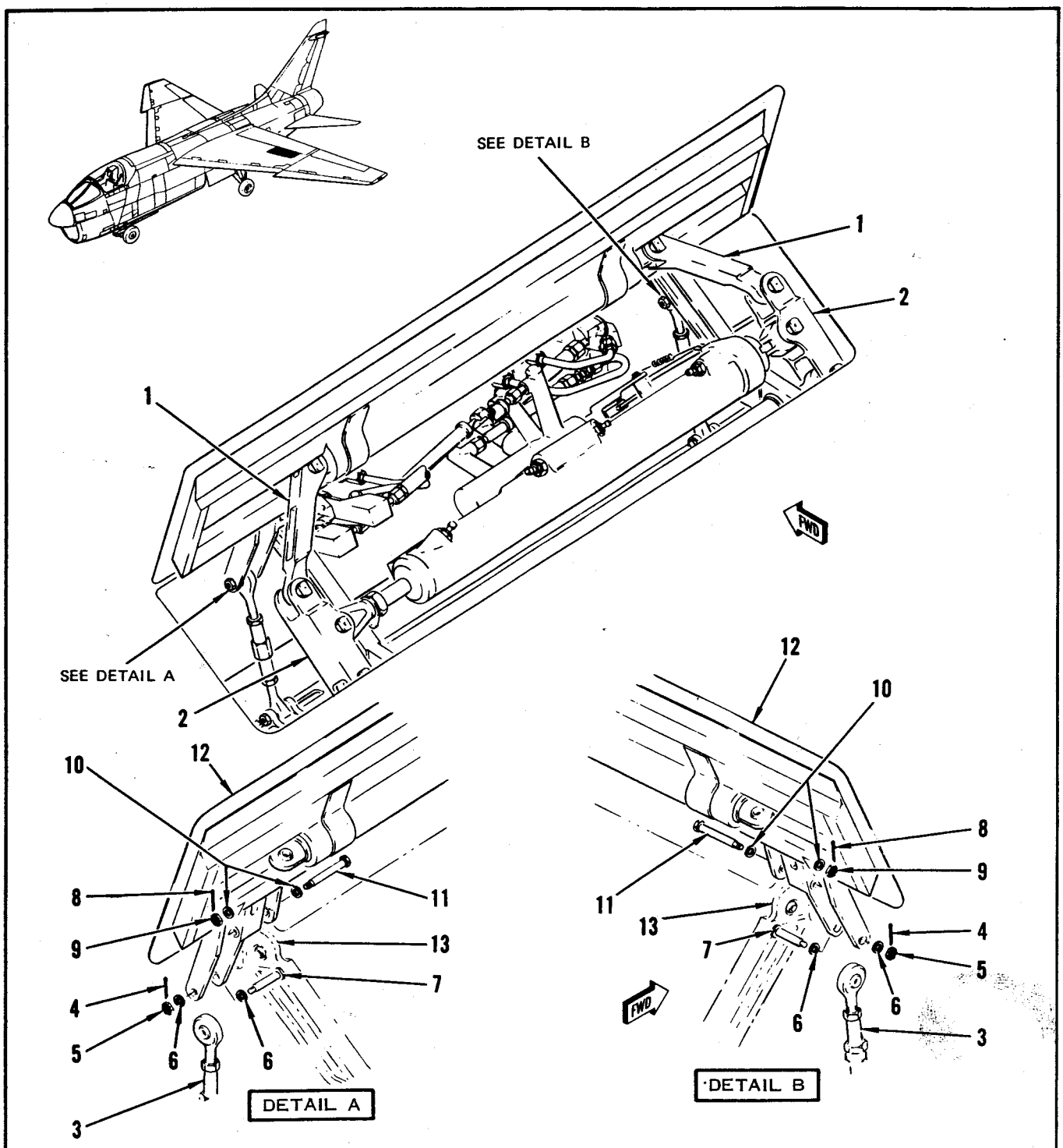
NOTE

Bolt must be installed with head on aft side of link. Ensure that washer with large hole is placed under bolthead and washer with small hole is placed under nut.

b. Rotate link (1) through its full range of travel to ensure nut and bolt do not chafe against spoiler (12). Shim head of bolt as required to remove interference.

c. Clean hinge bolts and apply MIL-L-7866 dry lubricant to bolts. Apply thin coat of MIL-G-81322 grease to bolts after dry lubricant application.

d. Temporarily attach spoiler assembly to wing hinge (13) with bolt (11). Check spoiler assembly lateral (inboard/outboard) movement. If movement exceeds 0.015 inch, install spacers at spoiler assembly hinge points in accordance with T.O. 1A-7D-3, figure 5-52A. If movement is less than 0.015 inch, permanently attach spoiler assembly to wing hinge (13) with bolts (11), washers (10), nuts (9) and cotter pins (8). Tighten nuts finger-tight only and back off, if necessary, to install cotter pins.



1. Spoiler link
2. Bellcrank
3. Deflector rod
4. Cotter pin
5. Nut
6. Washers
7. Bolts
8. Cotter pin
9. Nut
10. Washer
11. Bolt
12. Spoiler
13. Wing hinge

Figure 4-7. Spoiler Removal and Installation

e. Connect bonding jumpers to spoiler.

f. Connect spoiler links (1) to bellcranks (2) by installing bolts, washers, nuts, and new cotter pins.

NOTE

Deflector rods (3) are connected to spoiler with bolts (7), washers (6), nuts (5), and new cotter pins (4) in rigging.

g. Rig spoiler/deflector (paragraph 4-24).

h. Lubricate fittings at both ends of spoiler and deflector fittings with MIL-G-23827 grease.

4-38. SPOILER ROD END REMOVAL AND INSTALLATION. (Refer to T.O. 1A-7D-3.)

4-39. DEFLECTOR REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external hydraulic power	Connect hydraulic power
	GGG-W-686	Torque wrench, 0 to 250 pound-feet	Tighten deflector bolts after installation

TT08D039-07-70

4-40. REMOVAL. (See figure 4-8.)

a. Manually open spoiler.

b. Disconnect rods (1) connected between deflector and spoiler by removing cotter pins (2), nuts (3), washers (4), and bolts (5) at deflector end of rods.

c. Disconnect bonding jumpers from deflector by removing attaching screws.

d. Remove cotter pins (6), nuts (7), washers (8), and bolts (9) attaching deflector (10) to wing hinge (11). Remove deflector.

4-41. INSTALLATION. (See figure 4-8.)

a. Attach deflector (10) to wing hinge (11) with bolts (9), washers (8), nuts (7), and new cotter pins (6). Tighten nuts finger-tight only and back off, if necessary, to install cotter pins.

b. Connect bonding jumpers to deflector with screws.

c. Connect deflector rods (1) to deflector with bolts (5), washers (4), nuts (3), and new cotter pins (2). Tighten nuts finger-tight only and back off, if necessary, to install cotter pins.

d. Rig spoiler/deflector (paragraph 4-24).

e. Lubricate fittings at both ends of spoiler/deflector fittings with MIL-G-23827 grease.

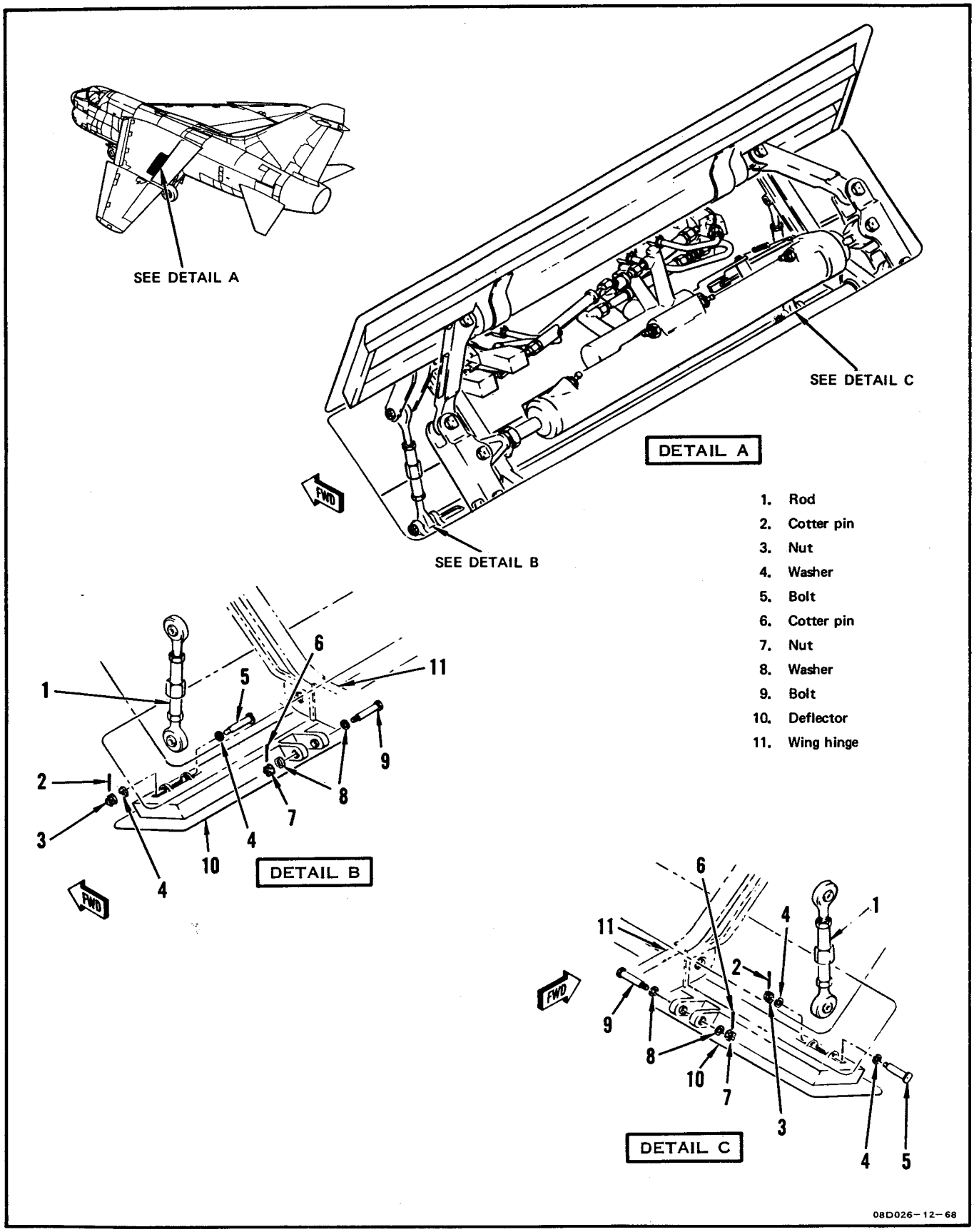


Figure 4-8. Deflector Removal and Installation

Section V

RUDDER CONTROL SYSTEM

5-1. DESCRIPTION.

5-2. The rudder control system is a conventional hydromechanical system used to provide airplane movement in yaw. System inputs are provided by rudder pedal movement, a yaw trim actuator, or signals from the automatic flight control system. Rudder motion is obtained through a tandem hydraulic actuator in a power control package attached to the rudder. Artificial rudder pedal feel forces are provided by a mechanical spring arrangement which supplies different force gradients for the cruise (clean) and landing condition of the airplane. Rudder throw is restricted to 6° either side of neutral by a stop mechanism that is engaged when main landing gear is retracted. Rudder trim is provided through actuation of the yaw stabilization electrohydraulic actuator. The rudder system is capable of a maximum surface throw of 24° (+0°30', -1°0') either side of neutral when main landing gear is extended (landing condition).

5-3. For system controls and indicators, see figures 2-1 and 3-1. For system arrangement, see figure 5-1.

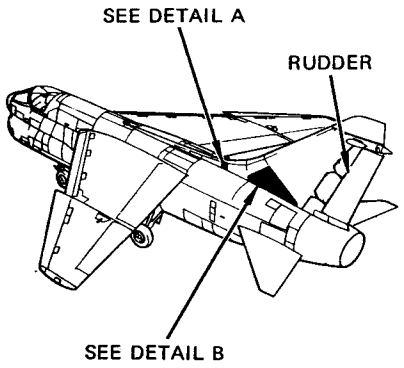
5-4. OPERATION. (See figures 5-2 and 5-3.)

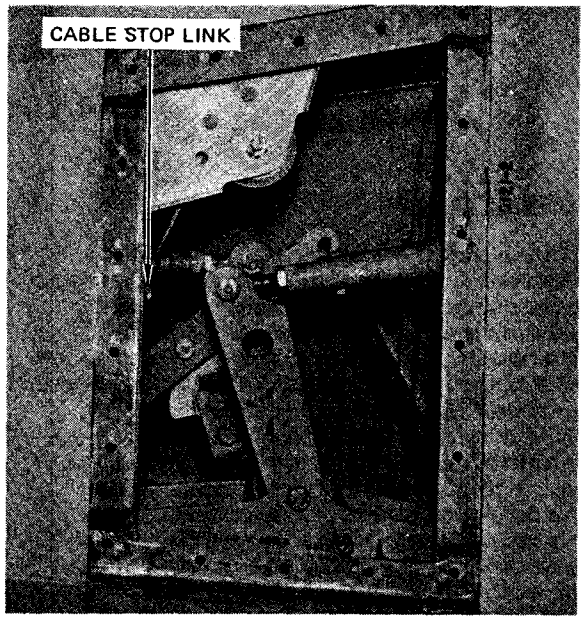
5-5. Forward and aft movement of the rudder pedals is mechanically transmitted to the rudder control cables. Rudder pedal movement is limited by a stopbolt for each rudder pedal bellcrank. The stopbolts allow the rudder pedals to overtravel slightly after the landing condition (24°) stops in the fin bottom out. The two rudder pedals are connected by a jumper cable assembly which completes the cable loop. Two tension regulators in the jumper cable assembly compensate for variations in cable tension due to temperature and structural deformation.

5-6. Rudder pedal movement is transmitted by cables to a clean condition (6°) stops assembly. A cable attached to the right upper main landing gear door releases the 6° stops when landing gear is extended. The landing condition stops then become the system travel limit stops. When main landing gear is retracted, the cable permits a spring to engage the roller with the fishmouth cam. This holds the stops in a fixed position (engaged) and the rudder input is limited to 6° of rudder travel either side of neutral. A spring strut in the release cable absorbs system overtravel and maintains proper cable tension under temperature changes and structural deflections. A leaf spring in the stops assembly increases feel forces when the stops are engaged.

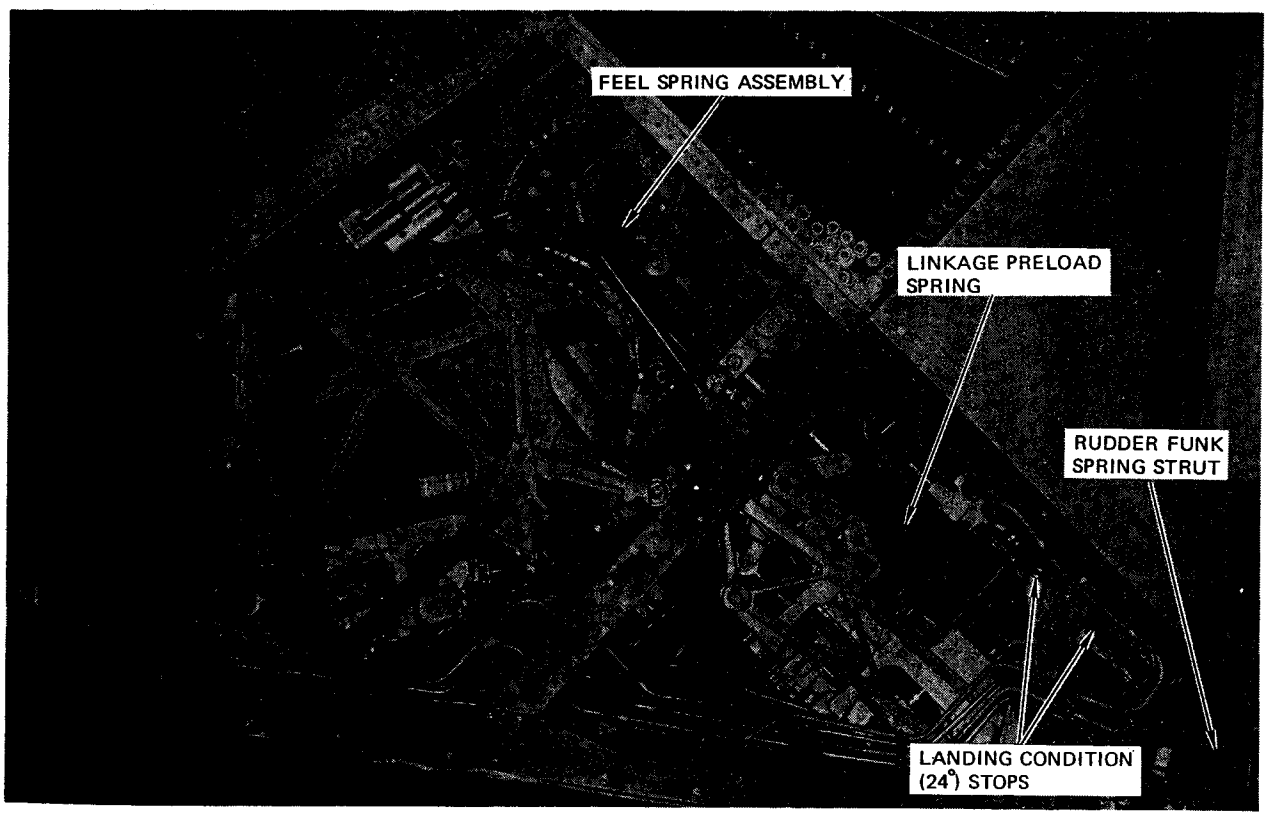
5-7. The clean condition (6°) stops assembly is connected by a link to a main feel spring. Movement of the pushrod linkage exerts a tension load on the spring to simulate airload forces at the rudder pedals. The feel spring will return the rudder pedals to neutral when the pedals are released.

5-8. An AFCS yaw actuator is connected into the pushrod system downstream of the main feel spring by a scissors linkage. With pedal inputs only, this linkage acts as a simple idler. When the AFCS yaw actuator receives signals from the automatic flight control or trim system, it moves the pivot points of the scissors linkage which then acts as a





DETAIL A
(ACCESS 5121-2)



DETAIL B
(ACCESS 9113-2 and 9123-1)

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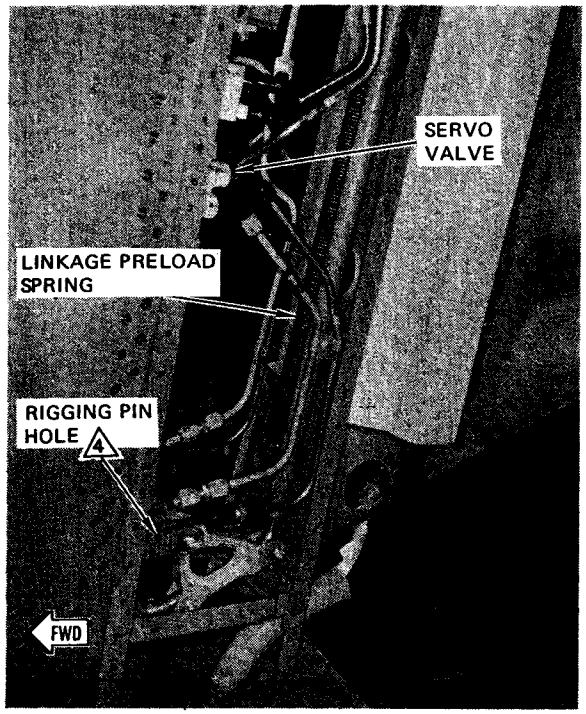
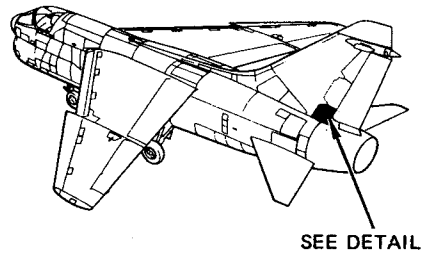
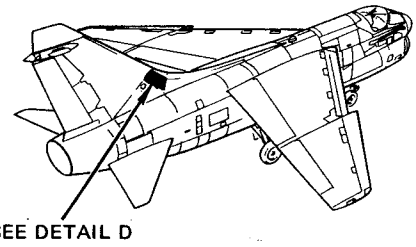
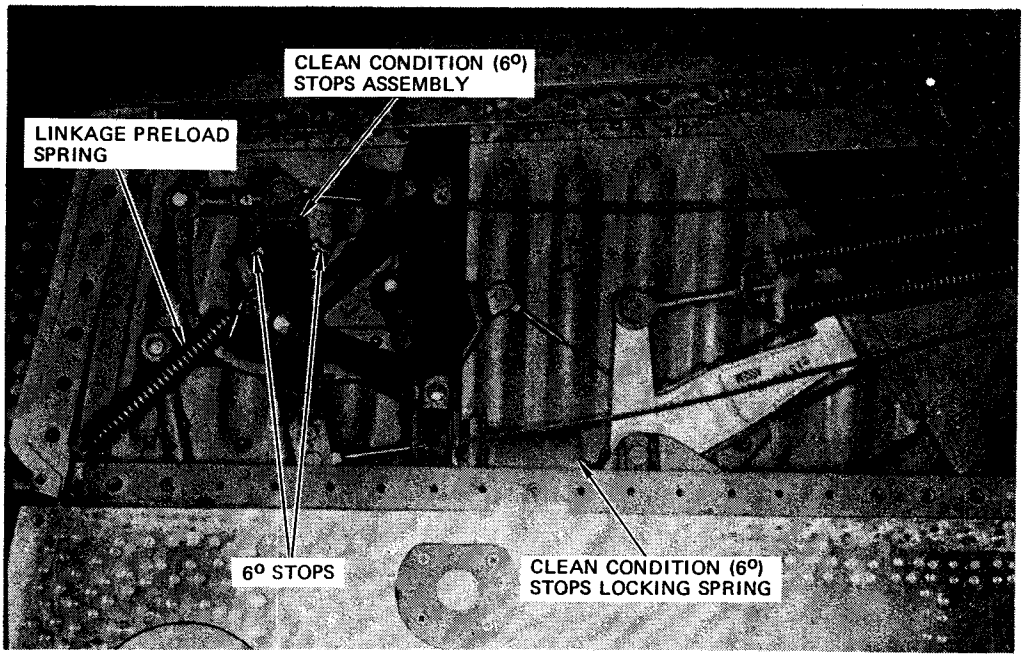
Figure 5-1. Rudder Control System Arrangement (Sheet 1)



DETAIL C
(ACCESS 9133-1)







DETAIL D
(ACCESS 9113-1)

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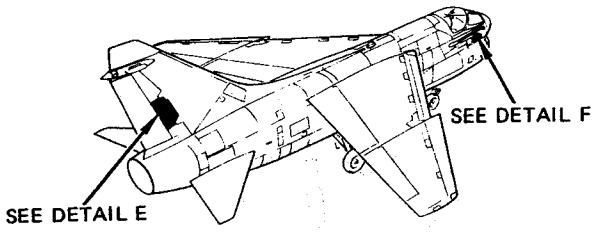
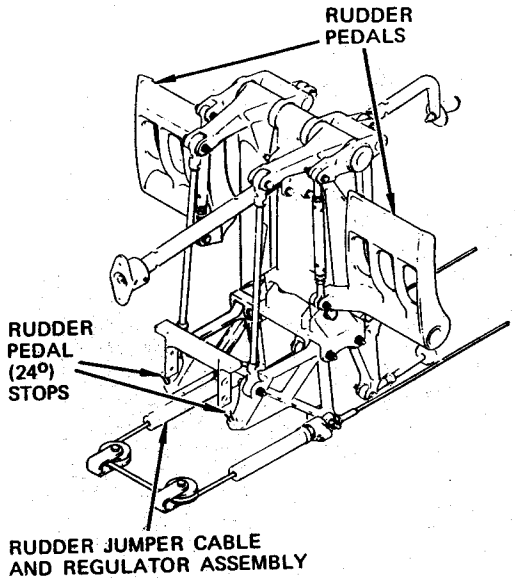
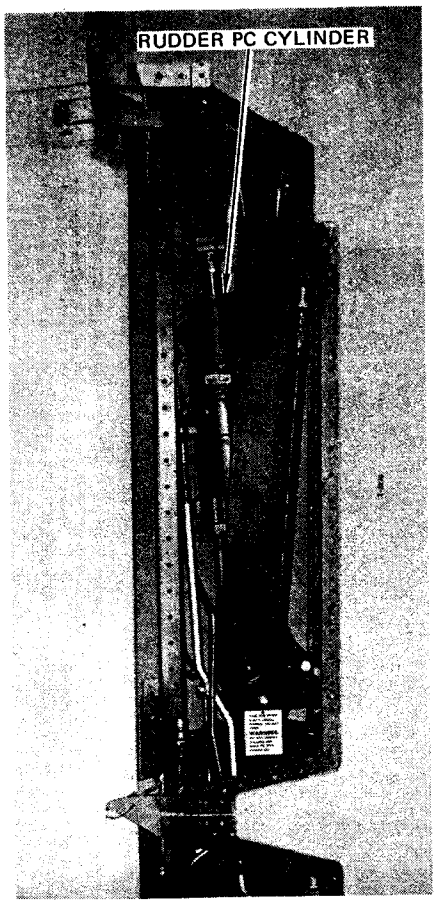
Figure 5-1. Rudder Control System Arrangement (Sheet 2)





DETAIL F

(ACCESS 2211-2 AND 1211-2)



DETAIL E

(ACCESS 9132-2)

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Figure 5-1. Rudder Control System Arrangement (Sheet 3)

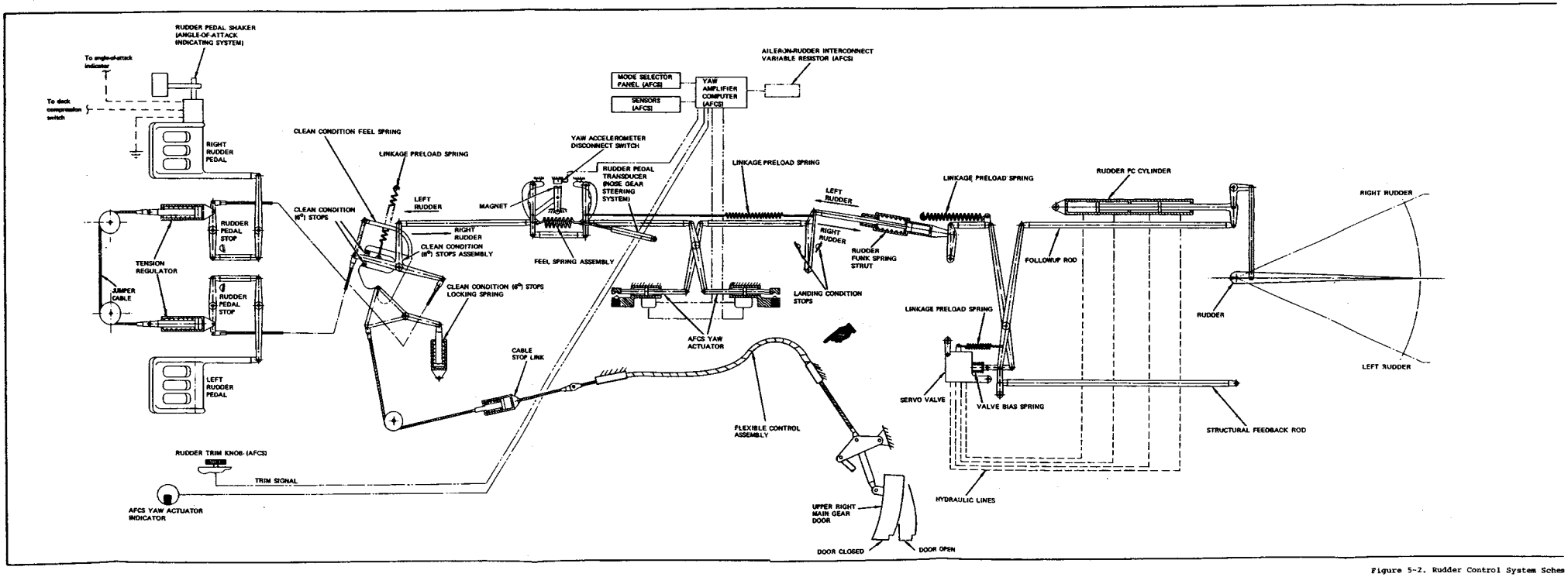

Figure 5-2. Rudder Control System Schem

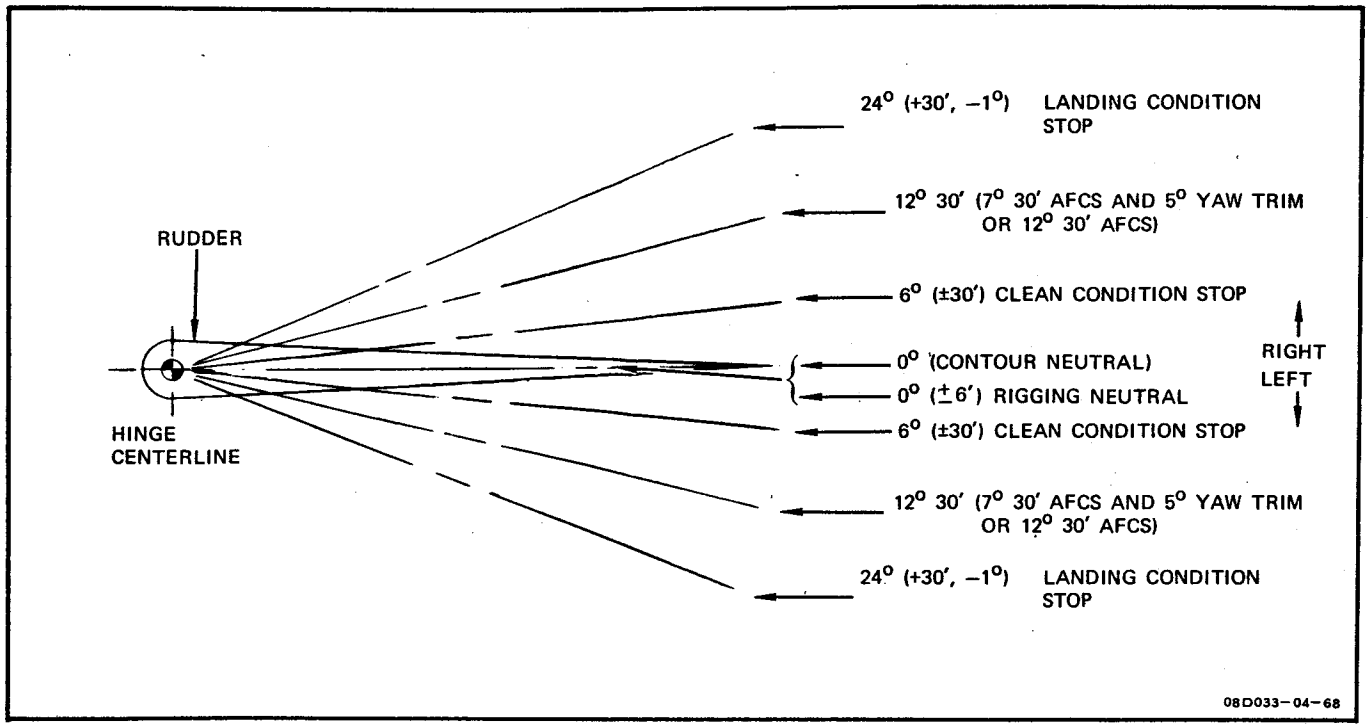

Figure 5-3. Rudder Throws

variable-length link. This produces system inputs independent of the rudder pedals. For additional information on the automatic flight control system, refer to T.O. 1A-7D-2-9.

5-9. With main landing gear down, rudder throw is limited to 24° (+0°30', -1°0') either side of neutral by stopbolts mounted on a bellcrank downstream of the AFCS yaw actuator.

5-10. A rudder funk spring strut is installed in the linkage downstream of all stops. Normally, the funk spring strut acts as a fixed-length link. When hydraulic power is off and an external force attempts to move the rudder beyond stop limits, the funk spring strut will compress or extend to prevent damage to the servo valve and control linkage.

5-11. The rudder is positioned by a power control (PC) package. The PC package input rod is connected to the servo valve by a scissors linkage. Movement of the input rod moves one side of the scissors linkage, positioning the servo valve to apply hydraulic pressure to the PC cylinder. Surface motion is transmitted to the other side of the scissors linkage by a followup rod. Movement of this half of the scissors linkage shuts off hydraulic pressure to the cylinder until input rod movement again repositions the scissors linkage.

5-12. Structural movement in the fin is transmitted tc the servo valve scissors linkage ground by a structural feedback rod. This movement repositions the servo valve scissors linkage to compensate for any structural movement of the PC package in relation to the input control linkage.

5-13. On airplanes through AF69-6196, PC No. 1 and PC No. 2 hydraulic systems supply the rudder power control package. On airplanes AF69-6197 and subsequent, PC No. 2 and PC No. 3 hydraulic systems supply the rudder power control package.

5-14. COMPONENTS.

5-15. For a list of system components, their locations (accesses), and functions, refer to table 5-1.

Table 5-1. Rudder Control System Components

Component	Access	Function
	Mechanical Components	
Assembly, clean condition (6°) stops	9113-1	Limits rudder throw to 6° when airplane is in clean condition.
Assembly, feel spring	9113-2	Provides artificial rudder pedal feel forces
Assembly, rudder jumper cable, and regulator	1211-2, 2211-2	Completes rudder control cable loop and maintains tension in rudder control cables.
Pedal, rudder (left and right)	Cockpit	Permits pilct movement of rudder control system.
Rudder	At vertical fin	Flight ccntrol surface effective in yaw.
Spring, clean condition (6°) stops locking	9113-1	Engages 6° stops assembly when airplane is in clean condition.
Springs, linkage preload (3)	9113-1, 9123-1, 9132-1	Preload rudder control linkage to eliminate effects of joint clearance.
Strut, cable stop link	5121-2	Maintains proper tension on 6° stops release cable and absorbs overtravel.
Strut, rudder funk spring	9123-1	Absorbs rudder control linkage overloads.
	Hydraulic Components	
Cylinder, rudder PC	9132-1, 9132-2	Positions rudder surface according to system ccmmands.
Valve, servo	9133-1, 9133-2	Controls hydraulic fluid flow to rudder PC cylinder.

5-16. OPERATIONAL CHECKOUT

Test Equipment Required

Figure & Index No.	*Name*	*AN Type Designation*	*Use and Application*
	Equipment required for connecting external electrical power		Connect electrical power for rudder system operational checkout
	Equipment required for connecting external hydraulic power		Connect hydraulic power for rudder system operational checkout
			TT08D100-12-68

NOTE

A number, or numbers, enclosed in braces at the end of a step in the following checkout is a reference to a corresponding number in troubleshooting table 5-2.

a. Connect external electrical power (T.O. 1A-7D-2-1).

b. On airplanes through AF69-6196, connect external hydraulic power to PC No. 1 and PC No. 2 systems (T.O. 1A-7D-2-1).

c. On airplanes AF69-6197 and subsequent, connect external hydraulic power to PC No. 2 and PC No. 3 systems (T.O. 1A-7D-2-1).

d. Install rudder protractor (paragraph 5-23).

e. Deleted.

f. Place yaw stabilization engage switch on AFCS panel in STBY. After approximately 30 seconds, place switch in STAB and check that yaw stabilization advisory light goes off.

g. Place rudder trim control in neutral.

h. Check that rudder is in neutral position with no pressure on rudder pedals.

i. Deleted.

j. Cycle rudder pedals and check that pedals can be positioned against stops.

k. Cycle rudder pedals and check that rudder movement corresponds to pedal movement.

l. Push either right or left rudder pedal full throw and check that rudder deflection is 24° (+30', -1°). {1}

m. Perform step l for opposite rudder pedal.

n. Deleted.

o. Disconnect both right upper main landing gear doors (T.O. 1A-7D-2-7). Hold forward door closed against aft stop and push right rudder pedal and check that rudder deflection is 6°(±30'). Repeat check for left rudder pedal. {2}

p. Repeat steps l through o and check for positive rudder response, and absence of binding or sluggishness. {3}

q. Release rudder pedals and check that rudder returns to hydraulic neutral position (figure 5-4). {4, 5}

r. Connect right upper main landing gear doors.

s. Shut down but do not disconnect hydraulic pressure from PC No. 2 system.

NOTE

To minimize the entrance of air when all PC hydraulic systems are not pressurized during rudder control cycling, operate the controls slowly, cycle only the minimum number of times necessary to verify correct operation and do not cycle UHT.

t. With only PC No. 1 or PC No. 3 system pressurized, cycle rudder pedals and check for positive rudder response and absence of binding or sluggishness. {3}

u. Release rudder pedals and check that rudder returns to neutral position. {4, 5}

v. Apply hydraulic pressure to PC No. 2 system.

va. Place yaw stabilization engage switch OFF. Yaw stabilization advisory light must come on.

w. On airplanes through AF69-6196, remove hydraulic pressure from PC No. 1 system.

x. On airplanes AF69-6197 and subsequent, remove hydraulic pressure from PC No. 3 system.

y. With only PC No. 2 system pressurized, cycle rudder pedals and check for positive rudder response and absence of binding or sluggishness. {3}

z. Release rudder pedals and check that rudder returns to neutral position. {4, 5}

aa. Deleted.

ab. Disconnect external hydraulic and electrical power (T.O. 1A-7D-2-1).

ac. Remove rudder protractor.

ad. Perform hydraulic system air check (T.O. 1A-7D-2-1).

5-17. TROUBLESHOOTING.

5-18. Refer to table 5-2 for system troubleshooting information. Malfunctions in the table are listed numerically and are related to a corresponding number, or numbers, following a step in the operational checkout.

5-19. For troubleshooting information on electrical components of the automatic flight control system, which also function in the rudder control system, refer to T.O. 1A-7D-2-9.

Table 5-2. Rudder Control System Troubleshooting

Probable Cause	Isolation Procedure	Remedy
1. Insufficient rudder deflection with landing gear extended.		
6° stops roller not clearing cam.	Check that clearance between cam roller and fishmouth exists.	Rig clean condition stops.
6° stops cable broken or disconnected.	Inspect condition of cable.	Replace, reconnect as applicable and rig clean condition stops.
Rudder pedal stops not properly rigged.	Check that not more than 0.002 inch gap exists at landing condition stop with full throw at pedal.	Rig rudder pedals.
Landing condition stops not properly rigged.	Check that pedal stops are engaged prior to landing condition stops when pedal is pushed.	Rig landing condition stops.
2. Excessive rudder deflection with right upper landing gear door closed.		
Clean condition stops assembly roller and cam are not engaged.	Inspect that engaging roller is bottomed in fishmouth cam slot.	Rig clean condition stops.
6° stops cable not properly rigged.	Check that cable tension is between 15 and 20 pounds.	Rig clean condition stops.
6° stops cable broken or disconnected.	Inspect condition of cable.	Replace, reconnect as applicable and rig clean condition stops.

Table 5-2. Rudder Control System Troubleshcoting (Continued)

Probable Cause	Isolation Procedure	Remedy
3. Rudder movement rough, erratic or sluggish.		
Air in system.	Perform hydraulic system air check (T.O. 1A-7D-2-1).	Bleed system (T.O. 1A-7D-2-1).
Interference in linkage.	None.	Perform binding check.
Internal leak in actuator.	Feel for excessive heat at actuator.	Replace actuator.
4. Rudder does not return to neutral when rudder pedals are released.		
Actuator is not set at neutral.	None.	Rig rudder PC package (paragraph 5-30).
Excessive system slop.	None.	Perform system centering check.
Linkage interference.	None.	Perform system binding check.
Funk spring binding.	Check that rigging pins 2, 3, and 4 can be inserted.	Replace funk spring.
Feel spring not properly rigged.	Check that 0.002 inch feeler gage cannot be inserted between stopbolt and pad.	Rig feel spring.
5. Rudder travels to extreme throw after being positicned in neutral.		
Slider valve input linkage bent or broken.	Inspect condition of linkage and input arm.	Replace linkage as necessary and rerig.
Internal leak in slider valve.	None.	Replace valve.

5-20. BINDING CHECK.

Test Equipment Required

Figure & Index No.	*Name*	*AN Type Designation*	*Use and Application*
	Equipment for connecting external electrical power		Connect electrical power
	Equipment for connecting external hydraulic power		Connect hydraulic power

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5-21. If, during ground operations in which the rudder control system is being cycled, binding or jamming is indicated by erratic or excessive rudder pedal forces, perform the following:

a. Make no effort to free controls by use of excessive pedal forces. Maintain a light restrictive force against jamming and make an immediate inspection of control system.

b. On airplanes through AF69-6196, if operating on engine power, hold rudder pedals in place, shut down engine (T.O. 1A-7D-2-1), and immediately connect external hydraulic power to PC No. 1 and PC No. 2 hydraulic systems (T.O. 1A-7D-2-1).

c. On airplanes AF69-6197 and subsequent, if operating on engine power, hold rudder pedals in place, shut down engine (T.O. 1A-7D-2-1), and immediately connect external hydraulic power to PC No. 2 and PC No. 3 hydraulic systems (T.O. 1A-7D-2-1).

d. Progressively open all accesses necessary to expose rudder control system cables and linkage from the rudder pedals to the power control package.

e. Inspect all control cables and linkages for evidence of binding or jamming. If trouble is located, determine cause and take appropriate corrective action.

WARNING

Do not disconnect linkage with hydraulic power applied. Injury to personnel and damage to airplane may result.

f. If trouble cannot be isolated by other means, systematically disconnect control linkages between clean condition stops assembly and power control package, and manually actuate system until binding or jamming linkage or faulty hydraulic component is located. If trouble is isolated to a malfunctioning component or assembly, remove and replace component or assembly.

g. Perform rudder system rigging checkout (paragraph 5-24), and/or rudder control system operational checkout (paragraph 5-16).

h. Close accesses.

5-22. RUDDER SURFACE CENTERING CHECK. (See figures 5-4 and 5-6.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
2-6	215-00110-4	Rigging pin No. 2	Rig linkage

TT08D101-07-70

a. Install rudder protractor (paragraph 5-23).

b. Connect external electrical power (T.O. 1A-7D-2-1).

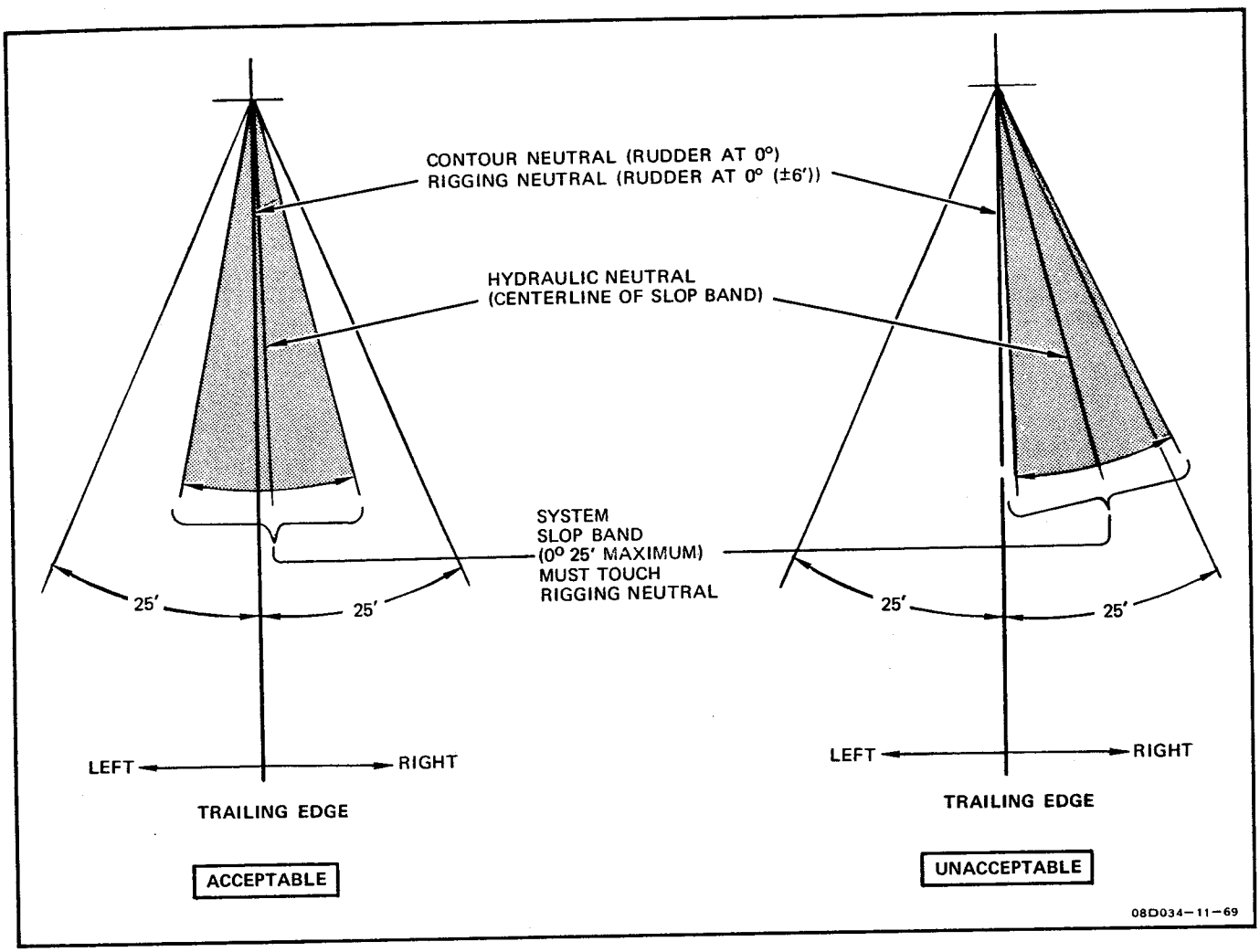

Figure 5-4. Rudder Surface Centering Slop Band Limits

c. On airplanes through AF69-6196, connect external hydraulic power to PC No. 1 and PC No. 2 hydraulic systems (T.O. 1A-7D-2-1).

d. On airplanes AF69-6197 and subsequent, connect external hydraulic power to PC No. 2 and PC No. 3 hydraulic systems (T.O. 1A-7D-2-1).

e. Deleted.

f. Depress rudder pedal for full left rudder deflection. Allow rudder to return slowly to neutral. Record rudder position.

g. Depress rudder pedal for full right rudder deflection. Allow rudder to return slowly to neutral. Record rudder position.

h. Compute angle between rudder positions recorded in steps f and g to obtain power control system slop bandwidth. Angle must not exceed 0°25' and shall include rigging neutral.

i. If bandwidth computed in step h is within tolerance and includes rigging neutral, proceed to step l. If bandwidth exceeds 0°25' or does not include rigging neutral, proceed to next step.

j. Check rudder control system for excessive friction, including alignment of rudder cable seals at pilots seat bulkhead, and correct as necessary. If no excessive friction is found or if reducing friction does not reduce bandwidth to 0°25' or less, rig balance spring (paragraph 5-35).

k. Repeat steps f through i to ensure bandwidth is within tolerance.

l. Deleted.

m. Disconnect both right upper main landing gear doors (T.O. 1A-7D-2-7). Hold forward door closed against aft stops.

n. Repeat steps f through h.

o. If angle computed in step h does not exceed 0°25', and if both rudder positions recorded are within 0°25' of rudder neutral (0°00' (±0°6')), proceed to step u. If angle exceeds 0°25', check rudder control linkage for excess friction and correct as necessary. If either rudder position recorded in steps f and g is more than 0°25' from rudder neutral, proceed to next step.

p. Insert rigging pin No. 2.

NOTE

Increasing length of link (48) will move rudder centering to the left. Decreasing length will move rudder centering to the right.

q. Loosen jamnut (51) and move rudder toward neutral by rotating adapter (50) a maximum one-half turn. Tighten jamnut.

r. Remove rigging pin No. 2, apply hydraulic power, and check that rudder returns to within 0°25' of neutral when rudder pedals are depressed and released. Repeat step q as necessary, while observing that accumulated adjustments of adapter (50) do not exceed one-half turn.

s. Secure jamnut (51) with MS20995C32 lockwire.

t. Connect right upper main landing gear doors.

u. Disconnect external electrical power.

v. Disconnect external hydraulic power.

w. Remove rudder protractor.

5-23. RUDDER PROTRACTOR INSTALLATION. (See figure 5-5.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
5-5	215-00187-1	Rudder protractor	Check rudder deflection

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a. Remove protective screws (CVC128-10R6) from fairing (1) below rudder (2).

b. Install protractor base (3) on fairing below rudder with thumbscrews (4).

c. Remove protective screws (CVC241A4-7) and washers (CVC769B8) at lower portion of rudder.

d. Install indicator (5) on rudder with thumbscrews (6).

e. Install protractor scale (7) on protractor base with thumbscrews (8).

f. Align rudder in contour neutral by aligning the top of the rudder with the trailing edge of the upper portion of the vertical fin (figure 5-4).

g. Manually hold the rudder in contour neutral, loosen the thumbscrews on the protractor scale, and set the scale to align the zero mark with the zero mark on the indicator.

h. Check for 0.080-inch clearance between protractor scale and indicator with gage (9) through full travel of rudder.

5-24. RIGGING CHECKOUT.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
5-6	215-00110-10	Rigging pin No. 1	Rig linkage
5-6	215-00110-4	Rigging pins No. 2 and 4	Rig linkage
5-6	215-00110-7	Rigging pin No. 3	Rig linkage
	215-00110-9	Alternate rigging pin No. 3	
5-6	215-00110-5	Rigging pin No. 5	Rig linkage
			TT08D103-09-76

a. Open accesses 1211-2, 9113-1, 9123-1, 9132-2, and 9133-2.

NOTE

See figure 5-6 for rigging pin locations.

If rigging pin No. 3 cannot be inserted, a 5/32-inch rigging pin (215-00110-9) may be used instead.

b. Check that rigging pins No. 1, 2, 3, 4, and 5 can be inserted in order and removed without moving rudder.

c. Perform rudder surface centering check (paragraph 5-22).

d. Check cotter pin and lockwire installations.

e. Close accesses 1211-2, 9113-1, 9123-1, 9132-2, and 9133-2.

f. Perform rudder control system operational check (paragraph 5-16).

5-25. RIGGING RUDDER PEDALS AND RUDDER PEDAL JUMPER CABLE. (See figure 5-6.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
5-6	215-00110-10	Rigging pin No. 1	Rig rudder pedals and rudder pedal jumper cable
	215-01796-1	Rudder jumper cable gage set	Rig rudder pedals and rudder pedal jumper cable
			TT08D104-07-70

a. Open accesses 1211-2, 2211-2, 5111-5, 6111-1, and 6111-2.

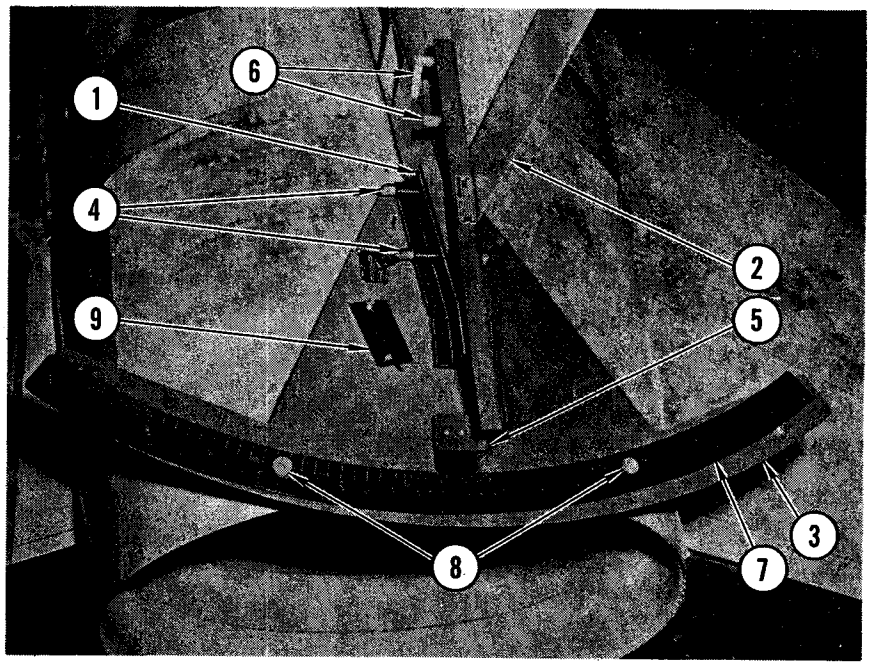
b. Remove radar pressurization system desiccator (T.O. 1A-7D-2-14).

c. Remove armor plate and covering around base of control stick (T.O. 1A-7D-2-1).

d. Remove left and right floor sections and rudder pedal curtains to gain access tc rudder pedal jumper cable.

e. Remove locking clips and relieve rudder cable (2) tension at turnbuckles (3) (accesses 5111-5, 6111-1, and 6111-2).

f. Disconnect left tension regulator (4) from bellcrank (5), leaving bolt in hole.



1. Fairing
2. Rudder
3. Protractor base
4. Thumbscrew
5. Indicator
6. Thumbscrew
7. Protractor scale
8. Thumbscrew
9. Gage

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Figure 5-5. Rudder Protractor Installation

g. Rotate rudder pedal adjusting screw handle (6) until rudder column (9) is positioned 90° (±1°) to cockpit floor at centerline.

h. Insert rigging pin No. 1.

i. Check that brake pedal is rigged properly (T.O. 1A-7D-2-7).

j. Select jumper cable gap gage appropriate to ambient temperature.

NOTE

Jumper cable gap larger than gage selected is acceptable if jumper cable assembly is adjusted to maximum length.

k. Install the drilled end of gap gage over the regulator attaching bolt on the bellcrank, secure with nut, and insert the pin end of the gap gage into the lug end of the cable tension regulator.

l. Adjust tension regulators equally until there is slight tension on the gap gage. Adjustment shall be made so the exposed thread length is the same on each end of the cable within 0.06 inch.

m. Remove gap gage.

n. Remove rigging pin No. 1.

o. Using new cotter pin, secure tension regulator to bellcrank. Install left and right floor sections and rudder pedal curtains.

p. Check rudder cable rigging (paragraph 5-26).

q. Install armor plate and covering around control stick.

r. Install radar pressurization system desiccator (T.O. 1A-7D-2-14).

s. Secure rudder cable turnbuckles with locking clips.

t. Close accesses 1211-2, 2211-2, 5111-5, 6111-1, and 6111-2.

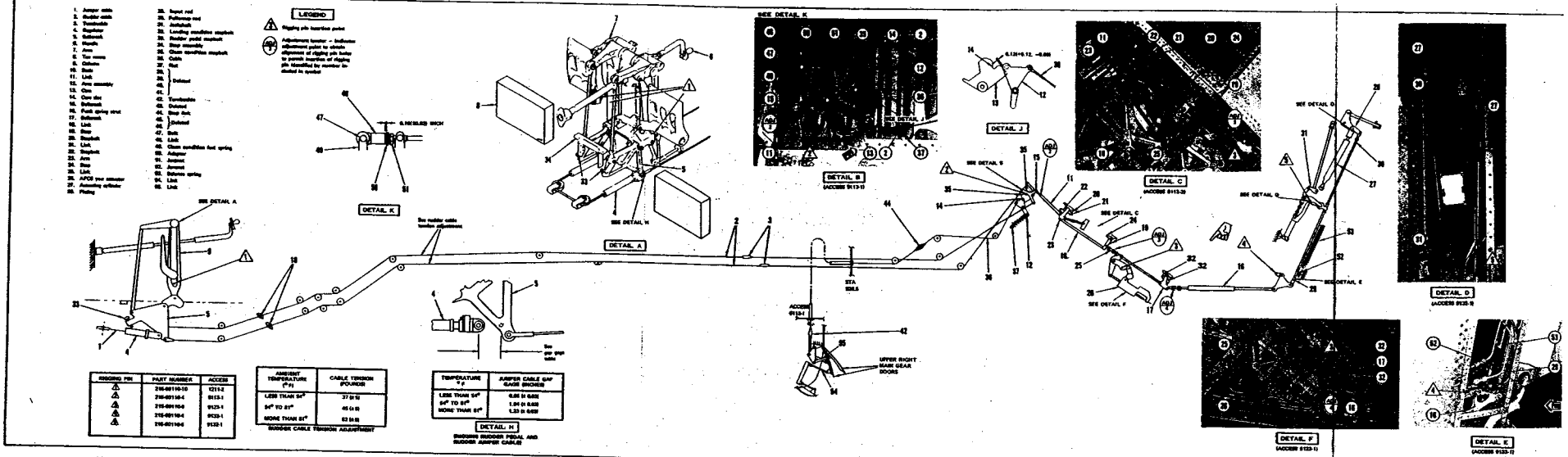


Figure 5-6. Rudder Control System Rigging

5-26. RIGGING RUDDER CABLES. (See figure 5-6.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
5-6	215-00110-10	Rigging pin No. 1	Rig rudder cables
5-6	215-00110-4	Rigging pin No. 2	Rig rudder cables
	T60-1001-C8-00	Cable tensiometer	Check cable tension
			TT08D105-07-70

a. Open accesses 1211-2, 5111-5, 6111-1, 6111-2, 6111-4, and 9113-1.

b. Rotate rudder pedal adjusting screw handle (6) until rudder column (9) is positioned 90° (±1°) to cockpit floor at centerline. Insert rigging pin No. 1.

c. Loosen screws securing rudder cable ball seals (10) to permit alignment of seals with cables.

d. Adjust link (11) as required to insert rigging pin No. 2. Insert rigging pin.

e. Deleted.

f. Adjust rudder cable turnbuckles (accesses 6111-1, 6111-4, and 5111-5) to obtain tension appropriate to ambient temperature.

g. Check that ball seals (10) do not deflect cables from straight run, and tighten seal mounting screws.

h. Check that rigging pin No. 1 can be inserted and removed freely. Adjust jumper cable, if necessary, to line up rigging holes.

i. Secure turnbuckles with MS20995C32 lockwire.

j. Remove rigging pins No. 1 and 2.

k. Perform rudder rigging checkout (paragraph 5-24).

l. Close accesses 1211-2, 5111-5, 6111-1, 6111-2, 6111-4, and 9113-1.

5-27. RIGGING RUDDER SYSTEM LANDING CONDITION FEEL SPRING ASSEMBLY. (See figure 5-6.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	0013	Spring scale, 0 to 50 pounds	Rig rudder system feel spring assembly
5-6	215-00110-4	Rigging pin No. 2	Rig linkage
			TT08D106-07-70

a. Open accesses 9113-1 and 9113-2.

b. Disconnect rod end of funk spring strut (16) from bellcrank (17).

c. Disconnect link (11). Ensure clearance between forward stopbolt (22) and its pad until stopbolt adjustment (step f).

d. Connect spring scale to feel spring linkage input arm (23) at same radius from grounded pivot as link (11).

e. Adjust feel spring aft stopbolt (20) until a force of 8.6 (±0.5) pounds, applied parallel to direction of link (11) before disconnection, is required to pull aft stopbolt from stop. After adjustment, remove spring scale.

f. Adjust feel spring forward stopbolt (22) until stop just contacts pad and no free play is in link (18).

g. Attempt to insert a 0.002-inch feeler gage between stopbolts (22 and 20) and respective pads. If feeler gage can be inserted, repeat steps c through g until feeler gage cannot be inserted.

h. Insert rigging pin No. 2.

i. Adjust link (11) until link end bolt can be inserted without force. Repeat step g.

j. Remove rigging pin No. 2.

k. Reconnect rod end of funk spring strut (16).

l. Check yaw accelerometer disconnect switch adjustment (T.O. 1A-7D-2-9).

m. Perform rudder rigging checkout (paragraph 5-24).

n. Close accesses 9113-1, 9113-2, and 9123-1.

5-28. RIGGING RUDDER FUNK SPRING STRUT. (See figure 5-6.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
5-6	215-00110-4	Rigging pins No. 2 and 4 (2)	Rig rudder funk spring strut
5-6	215-00110-7	Rigging pin No. 3	Rig linkage
	215-00110-9	Alternate rigging pin No. 3	
			TT08D107-09-76

a. Open accesses 9113-1, 9123-1, and 9133-1.

b. Insert rigging pin No. 2.

c. Insert rigging pin No. 3. A 5/32-inch rigging pin (215-00110-9) may be used in place of 3/16-inch rigging pin No. 3 (215-00110-7) if pin No. 3 will not fit.

c-1. If rigging pin cannot be inserted, adjust rod end of link (25) to permit insertion.

NOTE

Loosen only the jamnut adjacent to the forward rod end when adjusting the funk spring strut. Otherwise, the strut must be replaced with a unit having the two jamnuts adjacent to the strut body already secured with lockwire.

d. Adjust rod end of funk spring strut (16) until rigging pin No. 4 can be inserted.

e. Remove rigging pins No. 2, 3, and 4.

f. Perform rudder rigging checkout (paragraph 5-24).

g. Close accesses 9113-1, 9123-1, and 9133-1.

5-29. RIGGING YAW AFCS PACKAGE TO RUDDER CONTROL SYSTEM. (See figure 5-6.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
5-6	215-00110-4	Rigging pin No. 2	Rigging yaw AFCS package to rudder control system
5-6	215-00110-7	Rigging pin No. 3	Rig linkage
	215-00110-9	Alternate rigging pin No. 3	
			TT08D108-09-76

a. Open accesses 9113-1 and 9123-1.

b. Disconnect link (25) from system feel spring linkage.

c. Insert rigging pin No. 2.

d. Insert rigging pin No. 3. If 3/16-inch rigging pin No. 3 (215-00110-7) cannot be inserted, a 5/32-inch rigging pin (215-00110-9) may be used instead.

e. Adjust rod end of link (25) until rod end and system feel spring linkage boltholes align and tighten jamnut. If more than one turn of rod end is necessary to produce alignment, perform the following:

1. Remove rigging pin No. 3.

2. Remove rivet from rod end and remove turnbuckle.

3. Center new turnbuckle between rod ends and then adjust until rigging pin No. 3 can be inserted. Tighten jamnuts.

4. Drill new turnbuckle through aft rod end for 3/32-inch rivet and install rivet.

f. Connect link (25) to feel spring linkage.

g. Remove rigging pins No. 2 and 3.

h. Perform rudder rigging checkout (paragraph 5-24).

i. Close accesses 9113-1 and 9123-1.

5-30. RIGGING RUDDER POWER CONTROL PACKAGE. (See figure 5-6.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment required for connecting external hydraulic power	Connect hydraulic power
	GGG-W-686	Torque wrench, 700 to 1,600 pound-inches	Tighten rod end jamnut
5-6	215-00110-4	Rigging pin No. 4	Rig linkage
5-6	215-00110-5	Rigging pin No. 5	Rig linkage
			TT08D109-10-77

a. Open accesses 9132-1 and 9133-1.

b. Install rudder protractor (paragraph 5-23).

c. Without hydraulic pressure applied, manually move rudder to extreme left and right positions, causing piston in power control cylinder (27) to bottom in each direction. Record position of each extreme as indicated on rudder protractor.

d. Adjust rod end fitting (28) on power control cylinder (27) in 360° increments until rudder travel is equal in both directions within 1°15'. Tighten rod end jamnut to 1,150 (±150) pound-inches torque.

NOTE

Without hydraulic pressure, the rudder can be deflected to approximately 26°, but with hydraulic pressure, rudder deflection is limited to 24° (+0°30', -1°0') by the landing condition stops.

e. Insert rigging pin No. 4.

f. Adjust rudder power control package input rod (29) until rigging pin No. 5 can be inserted.

g. Adjust power control actuating cylinder followup rod (30) to position rudder at rigging neutral, which is 0°0' (±0°6').

h. Remove rigging pins No. 4 and 5.

i. On airplanes through AF69-6196 connect hydraulic power to PC No. 1 and PC No. 2 hydraulic systems (T.O. 1A-7D-2-1).

j. On airplanes AF69-6197 and subsequent, connect hydraulic power to PC No. 2 and PC No. 3 hydraulic systems (T.O. 1A-7D-2-1).

NOTE

Fluid temperature of hydraulic test stand shall be 125° (±10°) F.

k. Cycle rudder pedals six times to increase system hydraulic fluid temperature.

l. Insert rigging pin No. 4 and adjust followup rod until rudder is at rigging neutral.

m. Press jackshaft (31) in feedback linkage in one direction and release slowly (3 seconds minimum). Record rudder position.

n. Perform step m for opposite direction.

o. Compute package friction and slop band by finding difference between positions observed in steps m and n.

p. Check that width of package friction and slop band (figure 5-7) does not exceed 0°20' and contains rigging neutral.

NOTE

Readjust followup rod, if necessary, until hydraulic neutral (centerline of package slop band) coincides with rigging neutral as close as possible.

q. Remove rigging pin No. 4.

r. Perform rudder rigging checkout (paragraph 5-24).

s. Disconnect external hydraulic power.

t. Close accesses 9132-1 and 9133-1.

u. Remove rudder protractor.

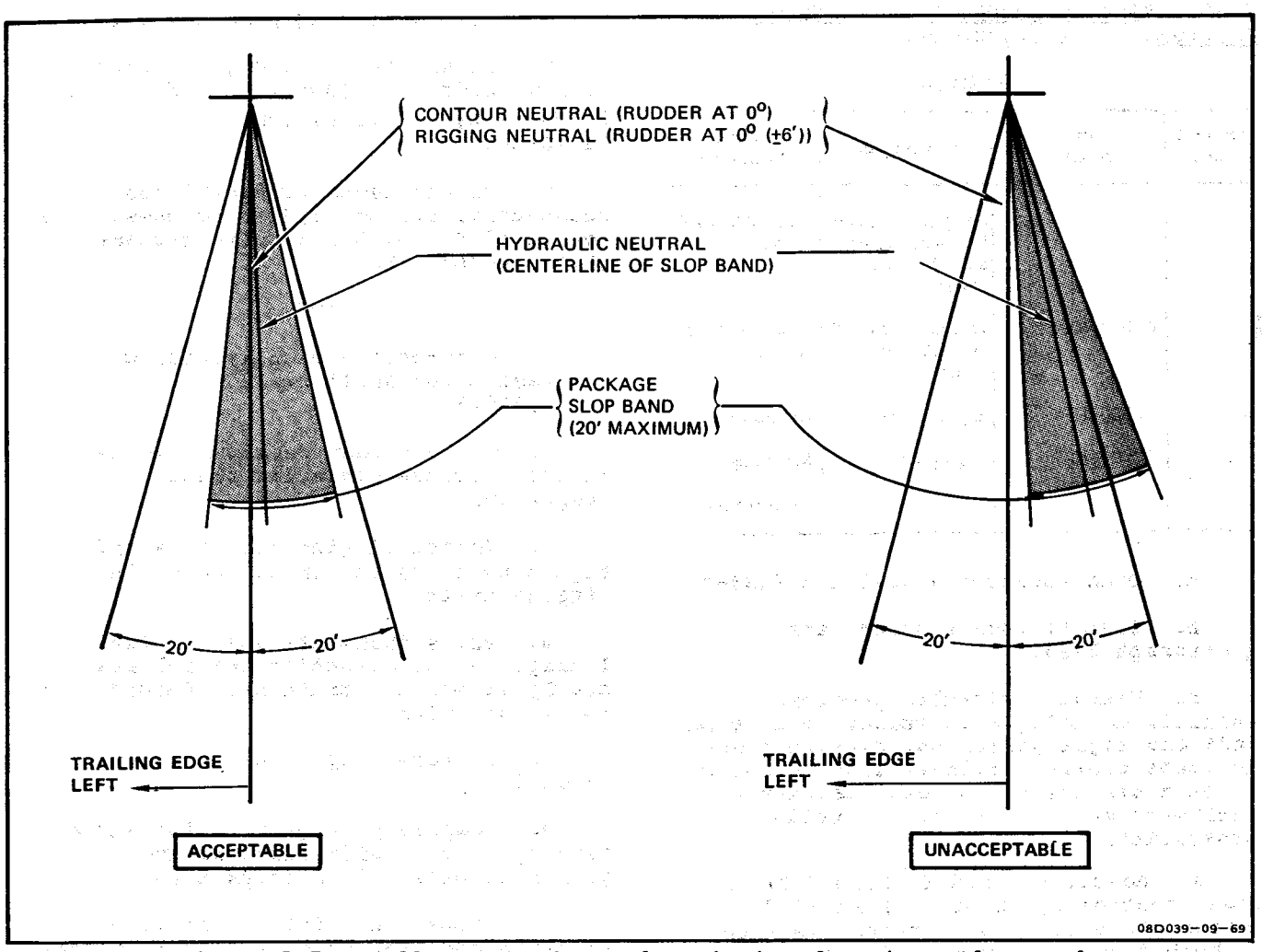


Figure 5-7. Rudder PC Package Slop Check and Package Slop Band Limits

5-31. RIGGING LANDING CONDITION STOPS. (See figure 5-6.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment required for connecting external hydraulic power	Connect hydraulic power
			TT08D110-07-70

a. Install rudder protractor (paragraph 5-23).

b. Open access 9123-1.

c. On airplanes through AF69-6196, connect external hydraulic power to PC No. 1 and PC No. 2 hydraulic systems (T.O. 1A-7D-2-1).

d. On airplanes AF69-6197 and subsequent, connect external hydraulic power to PC No. 2 and PC No. 3 hydraulic systems (T.O. 1A-7D-2-1).

e. Deleted.

f. Hold either landing condition stopbolt (32) against mating pad with rudder pedals, cut lockwire, and adjust bolt until rudder is deflected 24° (+0°30', -1°0'). Secure stopbolt with MS20995C32 lockwire.

g. Perform step f for other landing condition stopbolt.

h. Deleted.

i. Disconnect external hydraulic power (T.O. 1A-7D-2-1).

j. Close access 9123-1.

k. Remove rudder protractor.

5-32. RIGGING RUDDER PEDAL STOPS. (See figure 5-6.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment required for connecting external hydraulic power	Connect hydraulic power
5-6	215-00110-10	Rigging pin No. 1	Rig linkage
			TT08D111-07-70

a. Open accesses 1211-2, 9123-1, and 2211-2.

b. Rotate rudder pedal adjusting screw handle (6) until column (9) is positioned 90° (±1°) to cockpit floor at centerline. Check that rigging pin No. 1 can be inserted and removed freely.

c. On airplanes through AF69-6196, connect external hydraulic power to PC No. 1 and PC No. 2 hydraulic system (T.O. 1A-7D-2-1).

d. On airplanes AF69-6197 and subsequent, connect external hydraulic power to PC No. 2 and PC No. 3 hydraulic systems (T.O. 1A-7D-2-1).

e. Deleted.

f. Depress left rudder pedal until landing condition stop (32) is engaged.

g. Cut lockwire and adjust left rudder pedal stopbolt (33) so it engages rudder pedal stop assembly (34) before landing condition stop is engaged. Adjust pedal stopbolt until gap of 0.002 to 0.010 inch exists between landing condition stopbolt (32) and pad upon contact.

h. Rotate pedal stopbolt 2 (+1/4, -0) turns clockwise and tighten jamnut.

i. Apply full left rudder and observe position of landing condition stop. If a 0.002-inch feeler gage can be inserted between landing condition stopbolt and pad, repeat steps g and h and recheck adjustment.

j. Check pedal adjustment at both full aft and full forward positions of arm (7). Secure stopbolts with MS20995C32 lockwire.

k. Repeat steps f through j for right pedal stop.

l. Perform rudder rigging checkout (paragraph 5-24).

m. Close accesses 2211-2, 1211-2, and 9123-1.

5-33. RIGGING CLEAN CONDITION STOPS AND CABLES. (See figure 5-6.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external hydraulic power	Connect hydraulic power
5-6	215-00110-4	Rigging pin No. 2	Rig spring stop
	80D	Spring scale, 0 to 80 pounds	Check locking spring force
			TT08D143-07-70

a. Open accesses 6113-1, 9113-1, and 9113-2.

NOTE

With rigging pin No. 2 inserted, clean condition stops output link can be adjusted with gear or flaps in any position.

b. Insert rigging pin No. 2 and release cable (36) so follower on arm assembly (12) engages cam (13).

c. Remove bolt (47) connecting link (48) to clean condition feel spring (49).

d. Loosen jamnut (51). While holding position of adapter (50) relative to large rod end (detail K), adjust link (48) to approximate final length by rotating adapter (50) and large rod end together until aligned with bolthole in clean condition feel spring (49).

e. Adjust link to final length by holding large rod end and rotating adapter (50) in turnbuckle-fashion until bolt (47) can be freely inserted through rod end and feel spring (49) without deflecting spring or stops (19, 20, 22, 24). Then, lengthen link (48) by rotating adapter (50) out 1/4 turn.

NOTE

Precise alignment of bolthole is essential due to high stiffness of clean condition feel spring.

f. Tighten jamnut (51) and recheck fit of bolt (47). If bolt fits without

deflecting spring or stops, proceed to step g. If bolt cannot be freely inserted without deflecting spring or stops (19, 20, 22, 24), repeat steps b and e.

g. Check that 0.002-inch feeler gage cannot be inserted at stops (19, 20, 22, 24). If gage can be inserted, repeat steps b through f.

h. Check that threads appear in thread witness hole in link. If threads do not appear in witness hole, repeat steps b through f. Turn rod end out of adapter if necessary to obtain correct length while maintaining 0.10 (±0.02) inch gap (detail K).

i. Secure jamnut (51) with MS20995C32 lockwire, and remove rigging pin No. 2.

j. Engage and disengage arm assembly (12) with cam (13) several times and note that landing feel spring does not deflect and that 0.002-inch feeler gage cannot be inserted at stops (19, 20, 22, 24). If spring deflects or feeler gage can be inserted, repeat steps d through h.

k. Complete bolt (47) installation to secure link (48).

l. Disconnect upper aft main landing gear door link (55) at door (T.O. 1A-7D-2-7). Allow door to rest on shock strut.

CAUTION

Do not rotate door more than normal door open position as this will result in damage to clean condition stops control system.

m. Disconnect upper forward main landing gear door link (54) at door (T.O. 1A-7D-2-7).

n. Close forward door against aft stop and check that cam follower on arm assembly (12) fully engages cam slot (14). If cam follower does not engage fully, adjust turnbuckle (42) as required to obtain full engagement.

o. Install rudder protractor (paragraph 5-23).

p. On airplanes through AF69-6196, connect external hydraulic power to PC No. 1 and PC No. 2 hydraulic systems (T.O. 1A-7D-2-1).

q. On airplanes AF69-6197 and subsequent, connect external hydraulic power to PC No. 2 and PC No. 3 hydraulic systems (T.O. 1A-7D-2-1).

r. With cam follower engaging cam slot, cycle rudder pedals and note rudder deflection. Adjust clean condition stop bolts (35) as required to provide 6° (±0° 30') left and right rudder deflection.

s. Shut down, but do not disconnect external hydraulic power.

t. Connect spring scale to arm assembly (12) at cable (36) attaching point.

u. With cam follower on arm assembly bottomed in cam slot, cut lockwire and adjust clean condition stops locking spring nut (37) until a force of 43 (±3) pounds applied to arm assembly parallel with cable, will just start cam follower moving from bottom of cam slot. Disconnect spring scale. Tighten nut and secure with MS20995C32 lockwire.

v. Temporarily connect door link (54).

w. Apply hydraulic power.

x. Push rudder pedal for full right throw.

y. With rudder at full right throw, adjust turnbuckle (42) until cam follower on arm assembly (12) clears cam (13) by 0.12 (+0.12, -0.0) inch.

z. Disconnect link (54) and close door against aft stop. Check that cam follower fully engages cam slot (14).

aa. Disconnect external hydraulic power.

ab. Connect links (54 and 55) (T.O. 1A-7D-2-7).

ac. Check that push-pull controlex cable is not bottomed out by pulling cable (access 6113-1) against spring tension and noting slack.

ad. Secure turnbuckle (42) with locking clip.

ae. Remove rudder protractor.

af. Close accesses 6113-1, 9113-1, and 9113-2.

5-34. Deleted.

All data on pages 5-23 and 5-24 deleted.

5-35. RIGGING BALANCE SPRING. (See figure 5-6.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment required for connecting external hydraulic power	Connect hydraulic power
	80D	Spring scale, 0 to 80 pounds	Check rudder system forces
			TT08D137-07-70

a. Open accesses 9132-1 and 9133-1.

b. Adjust eyebolt (52) securing lower end of balance spring (53) to approximate midpoint of adjustment range.

c. Insert 0.002-inch feeler gage between stopbolt (22) and pad.

d. On airplanes through AF69-6196, connect external hydraulic power to PC No. 1 and PC No. 2 hydraulic systems (T.O. 1A-7D-2-1).

e. On airplanes AF69-6197 and subsequent, connect external hydraulic power to PC No. 2 and PC No. 3 hydraulic systems (T.O. 1A-7D-2-1).

WARNING

To avoid injury to personnel or damage to equipment, ensure that personnel and equipment are clear of rudder and rudder power control linkage before moving control linkage.

f. While holding feeler gage with very light tension, apply a right rudder (aft) force along link (11) using a spring scale. Gradually increase force along link and record scale indication at moment feeler gage becomes free.

g. Repeat step f two additional times and calculate average of three scale indications obtained.

h. Remove feeler gage and insert between stop (19) and stop pad.

i. While holding feeler gage with very light tension, apply a left rudder (forward) force along link (11) using spring scale. Gradually increase force along link and record scale indication at moment feeler gage becomes free.

j. Repeat step i two additional times and calculate average of three scale indications.

k. Compare average breakout forces obtained in steps g and j. If forces differ by more than 0.5 pound, adjust balance spring (53) as follows:

NOTE

Approximately 1 1/2 turn of jamnut will provide a 0.10 pound change in the breakout force.

1. If average right rudder (aft) breakout force is higher than average left rudder (forward) force, lengthen balance spring by adjusting jamnuts on eyebolt (52).

2. If average left rudder (forward) breakout force is higher than average right rudder (aft) force, shorten balance spring by adjusting jamnuts on eyebolt (52).

3. Shutdown but do not disconnect hydraulic power. Repeat steps c through k until averages of forward and aft forces required to free feeler gage differ by no more than 0.5 pound and a 0.002-inch feeler gage cannot be inserted between stops and stop pads (19, 20, 22, 24).

l. Perform rigging checkout (paragraph 5-24).

m. Close accesses 9132-1 and 9133-1.

5-36. RUDDER POWER CONTROL SYSTEM BLEEDING.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external hydraulic power	Connect hydraulic power
	GGG-W-686	Torque wrench, 5 to 50 pound-inches	Tighten bleed plugs
			TT08D121-05-69

a. Open accesses 9123-1 and 9132-1.

b. Cut lockwire on bleed plugs of rudder power control cylinder and connect bleed hoses to plugs.

CAUTION

Release rudder funk spring strut slowly when disconnecting strut to prevent high-speed bottoming and possible damage to servo valve.

c. Disconnect rudder funk spring strut from stops assembly.

d. On airplanes through AF69-6196, connect external hydraulic power to PC No. 1 and PC No. 2 hydraulic systems (T.O. 1A-7D-2-1) and apply 400 (±100) psi.

e. On airplanes AF69-6197 and subsequent, connect external hydraulic power to PC No. 2 and PC No. 3 hydraulic systems (T.O. 1A-7D-2-1) and apply 400 (±100) psi.

f. Open extend port bleed plugs and slowly bottom power control cylinder in retracted position. Close bleed plugs.

g. Open retract port bleed plugs and slowly bottom power control cylinder in extended position. Close bleed plugs.

h. Repeat steps f and g until fluid is free of air.

i. Disconnect bleed hoses from plugs.

j. Tighten bleed plugs to 10 (±5) pound-inches torque and check for gap of at least 0.010 inch under bleed plug. If gap is less than 0.010 inch, bleed plug must be replaced.

k. Secure bleed plugs with MS20995C32 lockwire.

l. Connect rudder funk spring strut to stops assembly.

m. Perform hydraulic system air check (T.O. 1A-7D-2-1).

n. Disconnect external hydraulic power (T.O. 1A-7D-2-1).

o. Close accesses 9123-1 and 9132-1.

5-37. RUDDER PEDAL ASSEMBLY REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
5-6	215-00110-10	Rigging pins No. 1 (2)	Rig linkage
	MIL-G-3859	Grease gun	Grease pedal fittings
	CV15-206205-1	Grease gun adapter	Grease pedal fittings
			TT-08D113-07-70

5-38. REMOVAL. (See figure 5-8.)

a. Open accesses 1211-2 and 2211-2.

b. Remove screws securing rudder pedal shaker electrical lead clamps to rudder pedal assembly.

c. Remove screws (1) securing rudder pedal shaker to bracket.

d. Remove screws (2), nuts (3), washers (4), rudder pedal shaker (5), and adapter (6).

e. Move rudder pedal shaker and electrical leads clear of rudder pedal assembly. Note routing of leads.

f. Remove cotter pin (7), nut (8), bolt (9), and two washers (10) from upper end of aft brake pushrod (11).

g. Remove cotter pin (12), nut (13), bolt (14), and two washers (15) from upper end of rudder pushrod (16).

h. Remove armor plate from forward radar compartment bulkhead (T.O. 1A-7D-2-1).

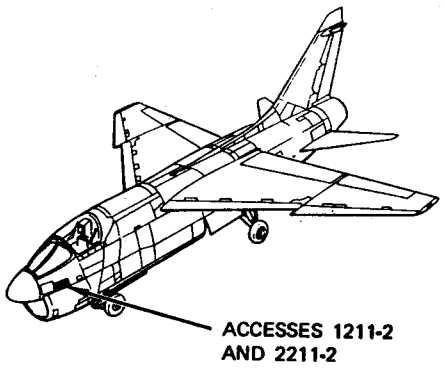
i. Remove bolts (17) and washers (18) from jackscrew (19).

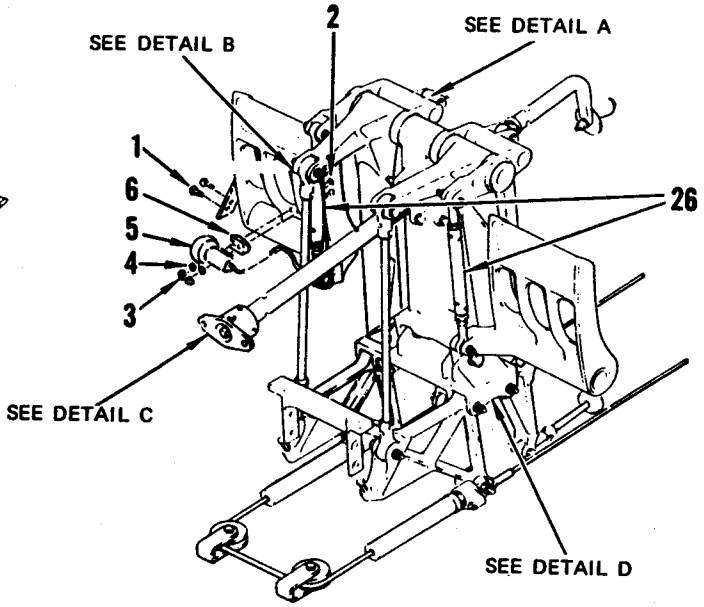
j. Remove cotter pin (20), nut (21), bolt (22), washers (23), and bushing (24) from rudder pedal column (25) at pivot point.

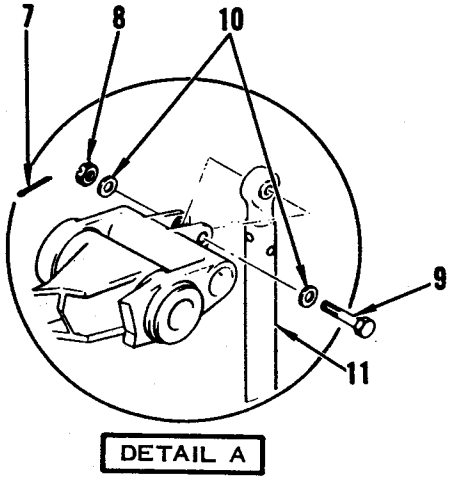
k. Repeat steps f, g, and j for opposite components.

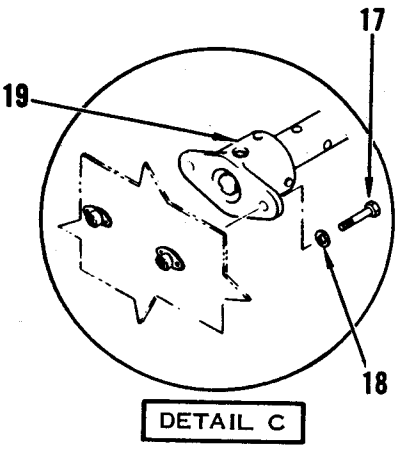
l. Remove rudder pedal assembly from airplane.

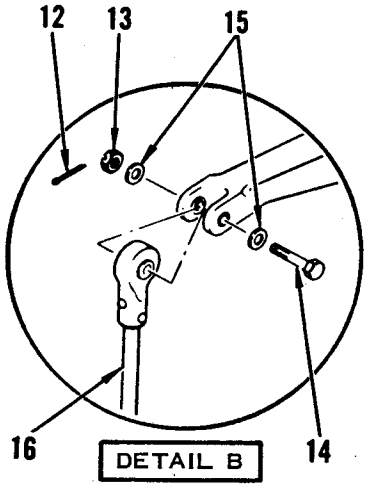
m. Measure and record length of forward brake pushrod (26).











1. Screw
2. Screw
3. Nut
4. Washer
5. Pedal shaker
6. Adapter
7. Cotter pin
8. Nut
9. Bolt
10. Washer
11. Aft brake push rod
12. Cotter pin
13. Nut
14. Bolt
15. Washer
16. Rudder push rod
17. Bolt
18. Washer
19. Jackscrew
20. Cotter pin
21. Nut
22. Bolt
23. Washer
24. Bushing
25. Rudder pedal column
26. Forward brake push rod

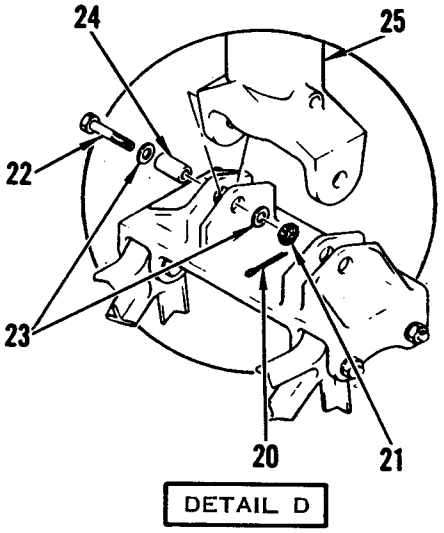


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Figure 5-8. Rudder Pedal Assembly Removal and Installation

5-39. INSTALLATION. (See figure 5-8.)

a. Adjust each forward brake pushrod (26) to length recorded during removal.

b. Position rudder pedal assembly in airplane.

c. Lubricate bushing (24) with MIL-G-81322 grease and connect pivot points of rudder pedal column (25) to support assembly with bolt (22), bushing (24), two washers (23), nut (21), and new cotter pin (20). Repeat for opposite side.

d. Connect jackscrew (19) to bulkhead with bolts (17) and washers (18) on each side.

e. Position upper end of rudder pushrod (16) in arm assembly and secure with bolt (14), two washers (15), nut (13), and new cotter pin (12). Repeat for opposite pushrod.

f. Position aft brake pushrod (11) in arm assemblies and secure with bolt (9), two washers (10), nut (8), and new cotter pin (7). Repeat for opposite pushrod.

g. Lubricate rudder pedal assembly at grease fittings with MIL-G-81322 grease.

h. Position rudder pedal column (25) 90° (±1°) to cockpit floor at centerline by adjusting handcrank.

NOTE

See figure 5-6 for rigging pin location.

i. Insert rigging pin No. 1 in pedal and column rigging holes.

j. Connect forward brake pushrods (26).

k. Remove rigging pin No. 1.

l. With rudder pedal shaker (5) in mounting position, and electrical leads routed as noted during removal, secure shaker to bracket with screws (1). Do not tighten screws.

m. Secure pedal shaker to rudder pedal with adapter (6), screws (2), washers (4), and nuts (3).

n. Tighten screws (1).

o. Secure pedal shaker electrical leads to rudder pedal assembly.

p. Cycle rudder pedals and ensure that no tension is placed on electrical leads.

q. Perform operational checkout of wheel brakes (T.O. 1A-7D-2-7).

r. Install armor plate on forward radar compartment bulkhead (T.O. 1A-7D-2-1).

s. Perform operational checkout (paragraph 5-16).

t. Close accesses 1211-2 and 2211-2.

5-40. RUDDER PEDAL ASSEMBLY REPAIR. (See figure 5-9.)

5-41. DISASSEMBLY.

a. Remove rudder pedal assembly from airplane (paragraph 5-37).

b. Remove cotter pins (1), nuts (2), bolts (3), and washers (4) from upper and lower ends of rods (5) and remove rods. Measure and record rod lengths.

c. Remove nut (6) and washer (7), and remove jackscrew handle screw (8), washer (9), spacer (10), handle knob (11), and bushing (12).

d. Loosen nuts (13) at top and bottom of jackscrew retainer plates.

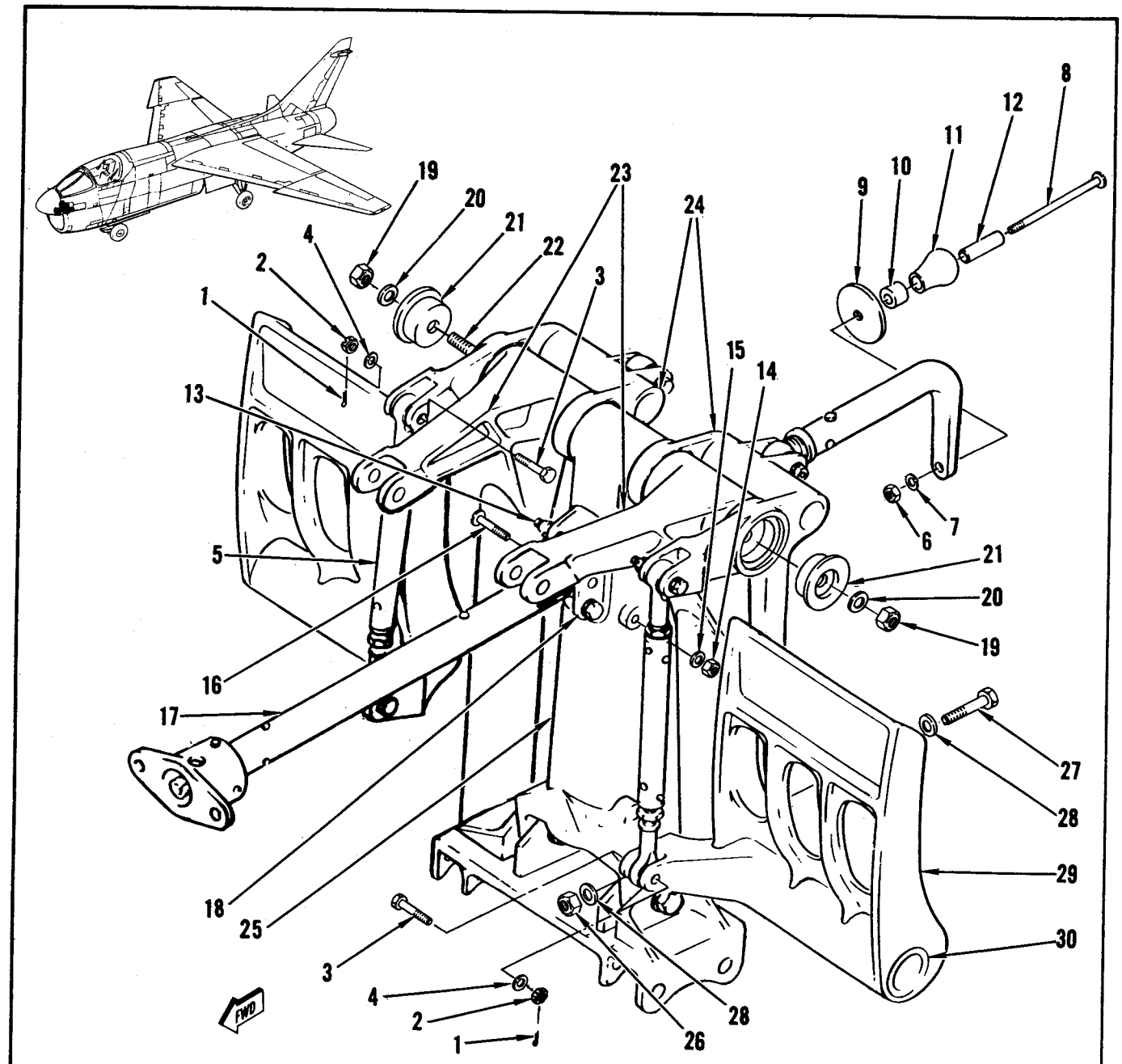
e. Support jackscrew and remove nuts (14), washers (15), and screws (16) from both sides of column.

f. Remove nuts, bolts, and washers securing top of jackscrew retainer plates to inside of column and remove jackscrew (17) and retainer plates (18) through forward side of column.

g. Remove nuts (13), bolts, and washers securing jackscrew retainer plates.

h. Remove nuts (19), washers (20), retainers (21), and rod (22).

i. Remove rudder control arm assemblies (23) and brake control arm assemblies (24) from rudder pedal column (25).



1. Cotter pin
2. Nut
3. Bolt
4. Washer
5. Rod
6. Nut
7. Washer
8. Screw
9. Washer
10. Spacer
11. Handle knob
12. Bushing
13. Nut
14. Nut
15. Washer
16. Screw
17. Jackscrew
18. Retainer plate
19. Nut
20. Washer
21. Retainer
22. Rod
23. Rudder control arm assembly
24. Brake control arm assembly
25. Rudder pedal column
26. Nut
27. Bolt
28. Washer
29. Rudder pedal
30. Tube

Figure 5-9. Rudder Pedal Assembly Repair

NOTE

Do not remove rudder pedal attaching hardware or rudder pedals unless replacement is necessary.

j. Remove nuts (26), bolts (27), and washers (28), securing rudder pedals (29) to rudder control arm assembly.

k. Press rudder pedals from control arm assemblies and remove tubes (30).

5-42. ASSEMBLY.

a. If old rudder pedal mounting tube (30) is being installed, proceed as follows:

1. Insert old rudder pedal mounting tube through rudder pedal (29).

WARNING

Alodine is moderately toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate.

Epoxy primer is highly toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate.

2. Apply MIL-C-5541 (Alodine 1200s) conversion coat with epoxy primer applied in accordance with T.O. 1-1-2, paragraph 6-10.d., NOTE to portion of mounting tube engaging rudder control arm assembly (T.O. 1A-7D-23).

3. Align boltholes in tube with boltholes in arm assembly and press tube into arm assembly until boltholes align and 0.02 (±0.01) inch clearance exists between rudder pedal and arm assembly around circumference of tube.

4. Proceed to step c.

b. If new rudder pedal mounting tube (30) is being installed, proceed as follows:

1. Insert new rudder pedal mounting tube (30) through rudder pedal (29).

2. Apply MIL-C-5541 (Alodine 1200s) conversion coat with epoxy primer applied in accordance with T.O. 1-1-2, paragraph 6-10.d., NOTE to portion of mounting tube engaging arm assembly (T.O. 1A-7D-23). Press tube into arm assembly until 0.02 (±0.01) inch clearance exists between rudder pedal and arm assembly around circumference of tube.

3. With drill inserted through bolthole in arm assembly, drill 0.250 inch hole through both sides of tube.

c. Install washers (28), bolts (27), and nuts (26) securing rudder pedal mounting tube to arm assembly.

d. Install rudder control arm assembly (23) and brake control arm assembly (24) on rudder pedal column (25) and secure with rod (22), retainers (21), washers (20), and nuts (19).

e. Insert handle end of jackscrew (17) through rudder pedal column from forward side until ball nut is just forward of column.

f. Rotate ball nut on jackscrew so that flat side of nut is up. Place a retainer plate (18) on each side of ball nut with depression in plates engaging nut and with long edge of plates aft of nut. Install washers, bolts, and nuts (13) at upper and lower holes at forward edge of plates.

NOTE

Ensure that nuts (13) are loose enough to permit plates to lay flat against inner surfaces of column when nuts (14) are tightened.

g. Move jackscrew and plates aft until aft end of plates are inside cutout in rudder pedal column and boltholes in plates and column are aligned. Secure plates at bottom holes with screws (16), washers (15), and nuts (14). Install screws so that nuts will be outside column.

h. Secure plates at upper holes inside column with washers, bolts, and nuts, with bolts inserted so nuts are inside column.

i. Install bushing (12), handle knob (11), spacer (10), and washer (9) on

screw (8) and install on jackscrew (17). Secure with washer (7) and nut (6).

j. Check that rods (5) are the same length as recorded during removal and adjust if necessary. If adjustment is necessary, install new cotter pins.

k. Install rods (5) and secure at both ends with washers (4), bolts (3), and nuts (2). Install bolts with threads inward toward center of airplane.

l. Secure nuts (2) with new cotter pins (1).

m. Install rudder pedals in airplane (paragraph 5-37).

5-43. RUDDER PEDAL JUMPER CABLE ASSEMBLY REMOVAL AND INSTALLATION.

5-44. REMOVAL. (See figure 5-10.)

a. Open accesses 1211-1, 1211-2, 2211-2, 6111-1, 6111-4, and 9113-1.

b. Remove radar pressurization system desiccator (T.O. 1A-7D-2-14).

c. Remove left and right floor sections and rudder pedal curtains to gain access to rudder pedal jumper cable.

d. Relieve rudder cable tension at turnbuckles (accesses 6111-1 and 6111-4).

e. Remove cotter pin (1), nut (2), bolt (3), and washers (4) securing left tension regulator (5) to bellcrank (6).

f. Remove tension regulator from bellcrank.

g. Remove cockpit air pressure regulator (T.O. 1A-7D-2-3).

h. Remove cockpit air safety valve (T.O. 1A-7D-2-3).

i. Remove cotter pin (7), nut (8), bolt (9), and two washers (10) from pulley (11) and mounting bracket (12). Remove pulley.

j. Remove cotter pin, nut, bolt, and two washers from pulley (13) and mounting bracket (14). Remove pulley.

k. Remove cotter pin, nut, bolt, and two washers from right tension regulator (15) and bellcrank (16).

l. Remove cable (17) from airplane.

5-45. INSTALLATION. (See figure 5-10.)

a. Position right tension regulator (15) on bellcrank (16). Lubricate bolt with MIL-G-81322 grease and install bolt, two washers, nut, and a new cotter pin.

b. Position cable (17) in pulley (13), then position cable and pulley in mounting bracket (14). Lubricate bolt with MIL-G-81322 grease and install bolt, two washers, nut, and a new cotter pin.

c. Position cable in pulley (11), then position pulley in mounting bracket (12). Lubricate bolt (9) with MIL-G-81322 grease and install bolt, two washers (10), nut (8), and a new cotter pin (7).

d. Rig rudder pedal jumper cable (paragraph 5-25).

e. Install cockpit air pressure regulator (T.O. 1A-7D-2-3).

f. Install cockpit air safety valve (T.O. 1A-7D-2-3).

g. Close accesses 1211-1, 1211-2, 2211-2, 6111-1, 6111-4, and 9113-1.

5-46. FORWARD RUDDER CONTROL CABLE REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	AT520JK	Swaging machine	Install new rudder cables
	AT520CTK	Cable test kit	Check cable fittings

TT08D114-03-71

5-47. REMOVAL. (See figure 5-11.)

a. Open accesses 1211-2, 1123-1, 1123-4, 1123-3, 1121-4, 2211-2, 10113-1, 10123-1, 5111-1, 5111-5, 6111-4, and 6111-1.

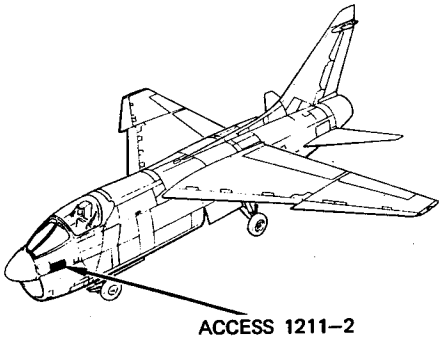
b. Remove ejection seat (T.O. 1A-7D-2-7).

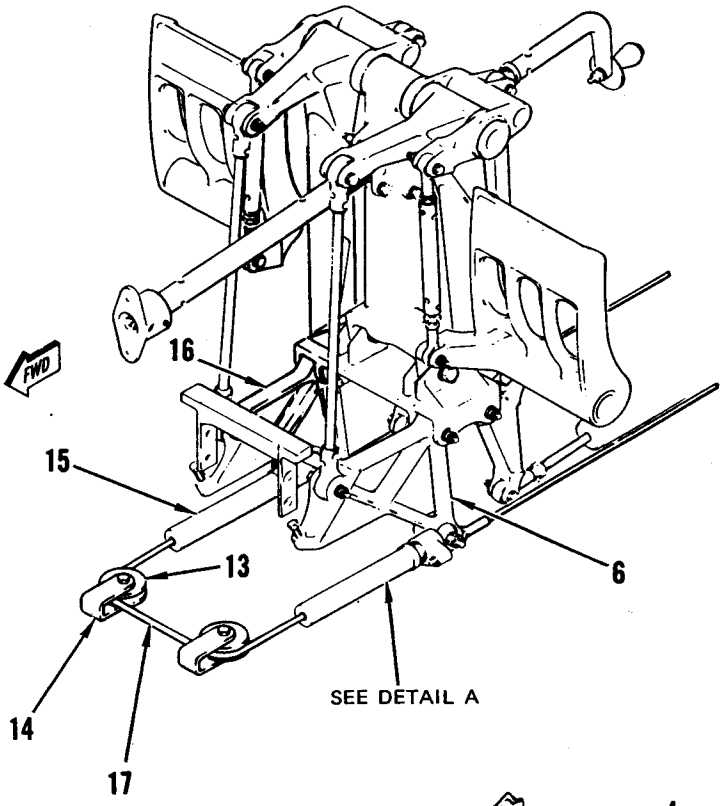
c. Remove left and right cockpit floor sections and rudder pedal curtains.

d. On airplanes through AF69-6196, remove radar pressurization system desiccator (T.O. 1A-7D-2-14).

e. Remove rudder cable pressure seal retainer attaching bolts (1) at cockpit aft pressure bulkhead.

f. Remove rudder cable pressure seal retainer (2) and seal (3).





1. Cotter pin
2. Nut
3. Bolt
4. Washer
5. Left tension regulator
6. Bellcrank
7. Cotter pin
8. Nut
9. Bolt
10. Washer
11. Pulley
12. Mounting bracket
13. Pulley
14. Mounting bracket
15. Right tension regulator
16. Bellcrank
17. Cable

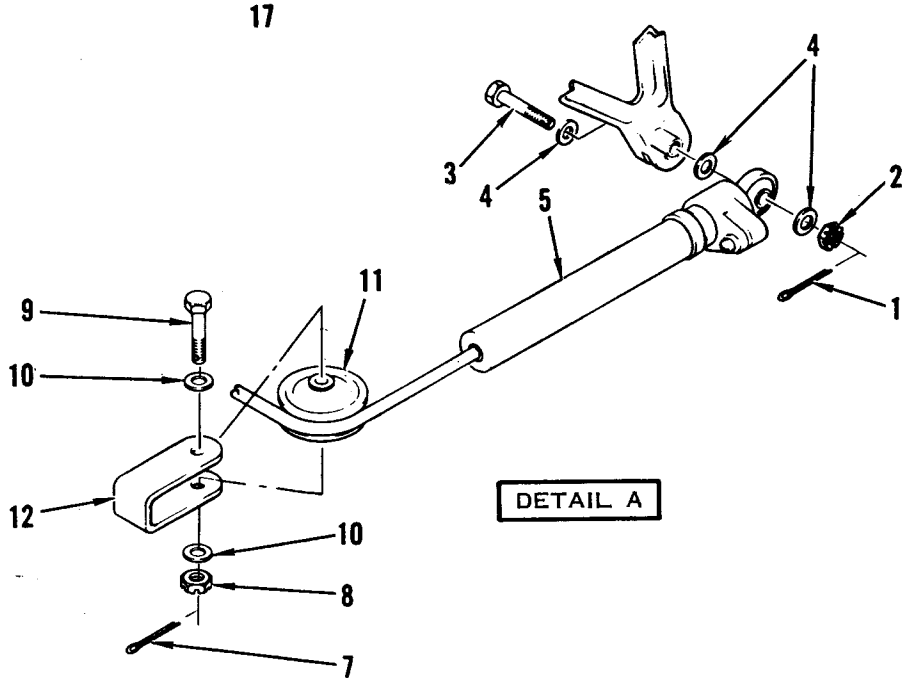


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Figure 5-10. Rudder Pedal Jumper Cable Assembly Removal and Installation

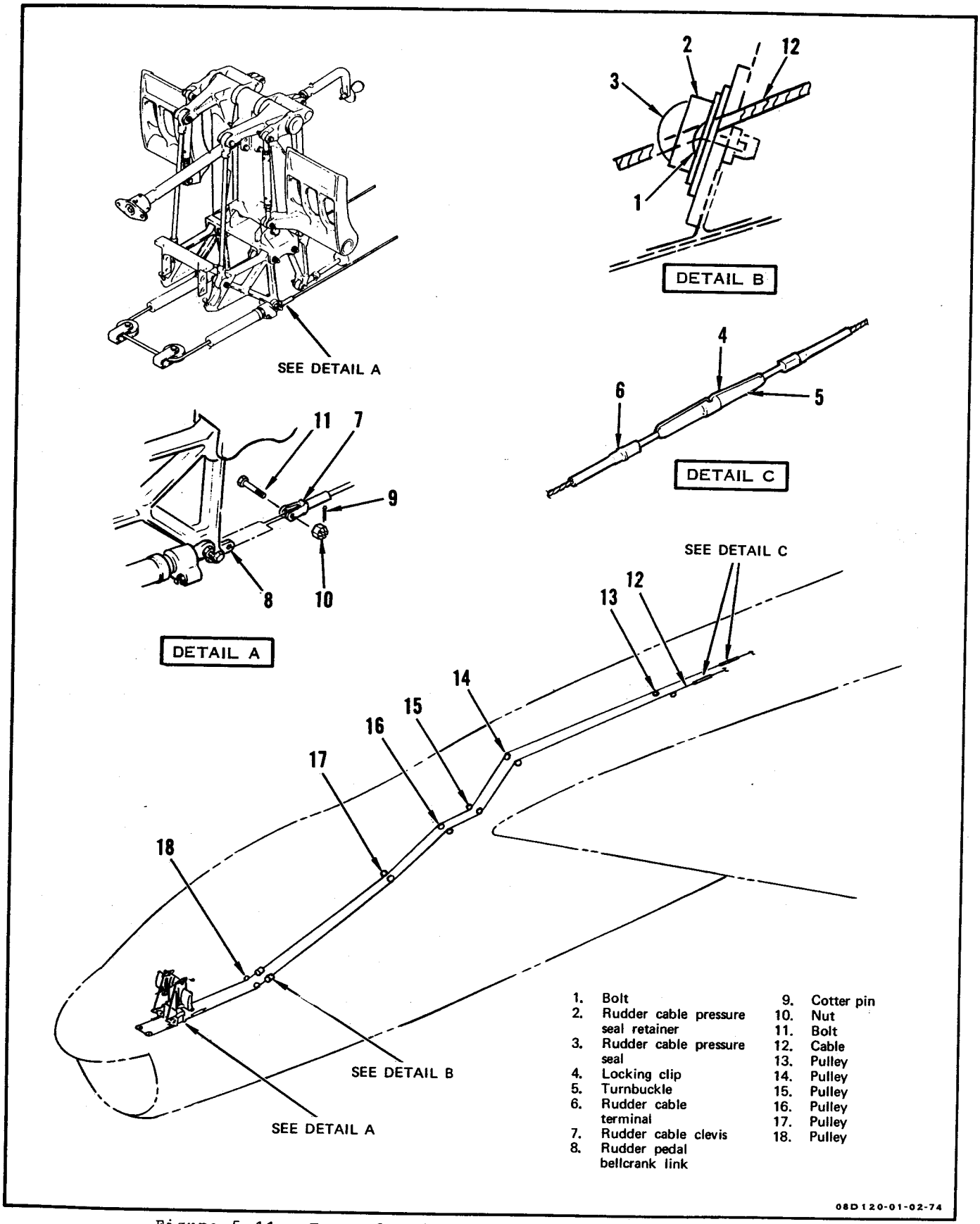
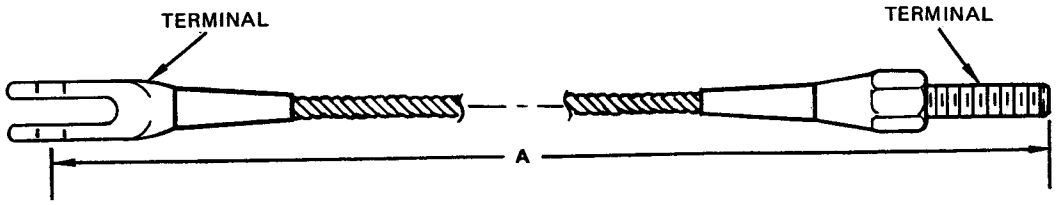


Figure 5-11. Forward Rudder Cable Removal and Installation (Sheet 1)



LOCATION	TERMINAL 1	CABLE			TERMINAL 2
		LENGTH A (INCHES)	DIA (INCHES)	TYPE	
LEFT	MS20667	294.25 (±0.20)	5/32	7 X 19	MS21260L
RIGHT	MS20667	273.75 (±0.20)	5/32	7 X 19	MS21260L

08D120-02-07-69

Figure 5-11. Forward Rudder Cable Removal and Installation (Sheet 2)

WARNING

Before disturbing rudder control linkage, ensure that hydraulic power is disconnected. Disconnecting or moving linkage with hydraulic power connected will actuate rudder which could cause injury to personnel or damage to equipment.

g. Through accesses 6111-1 and 6111-4, remove rudder cable turnbuckle locking clip (4) and disconnect rudder cable turnbuckle (5).

h. Pull cable back to access 5111-5 and cut off rudder cable swaged terminal end (6).

i. Tie a retriever line to end of rudder cable.

j. Disconnect rudder cable clevis end (7) from rudder pedal bellcrank link (8) by removing cotter pin (9), nut (10), and bolt (11).

CAUTION

To prevent damage to pulleys, remove cables carefully.

k. Maintaining constant tension on retriever line, pull rudder cable (12) forward through pulleys (13 through 17), through pressure seal retainer and pressure seal, and out through cockpit area.

l. Disconnect retriever line and secure at both ends.

5-48. INSTALLATION. (See figure 5-11.)

NOTE

Ensure rudder cable is prestretched. Do not swage terminal (6) until cable has been installed.

a. Fabricate cable as shown, but do not swage terminal (6) to cable.

b. Maintaining constant tension on retriever line, attach line to new cable.

CAUTION

To prevent damage to pulleys, thread cable through pulleys carefully.

c. Pull rudder cable through pulleys (16 through 13).

d. Disconnect retriever line.

e. Swage new threaded terminal end (6) to rudder cable for turnbuckle connection (MIL-T-6117B).

f. Check swaged fittings with cable testing machine (MIL-T-6117B).

g. Connect rudder cable clevis end (7) to rudder pedal bellcrank link (8) using bolt (11), nut (10), and new cotter pin (19).

h. Install rudder cable pressure seal (3) and retainer (2) with bolts (1).

WARNING

Before disturbing rudder control linkage, ensure that hydraulic power is disconnected. Disconnecting or moving linkage with hydraulic power connected will actuate rudder which could cause injury to personnel or damage to equipment.

i. Connect rudder cable turnbuckle (5), taking up most of cable slack.

NOTE

Check AFT rudder cables for proper routing through engine bay pulleys.

j. Check rudder cable pulleys (13 through 16) for correct cable alignment.

k. Rig rudder cables (paragraph 5-26).

NOTE

Check that rudder cable clearance, through cockpit structural frames forward of pulley (16), and through cockpit pressure bulkhead, is a minimum of 0.08 inch. Rework structural frames as necessary (T.O. 1A-7D-3).

l. Secure rudder cable turnbuckle (5) with locking clip (4).

m. Install radar pressurization system desiccator (T.O. 1A-7D-2-14).

n. Install left and right cockpit floor sections and rudder pedal curtains.

o. Install ejection seat (T.O. 1A-7D-2-2).

p. Close accesses 1211-2, 1123-1, 1123-4, 1123-3, 1121-4, 2211-2, 10113-1, 10123-1, 5111-1, 5111-5, 6111-4, and 6111-1.

5-48A. AFT RUDDER CONTROL CABLE REMOVAL AND INSTALLATION.

5-48B. REMOVAL. (See figure 5-11A.)

a. Open accesses 5111-5, 6111-1, 6111-4, and 9113-1.

WARNING

Before disturbing rudder control linkage, ensure that hydraulic power is disconnected. Disconnecting or moving linkage with hydraulic power connected will actuate rudder which could cause injury to personnel or damage to equipment.

b. Through accesses 6111-1 and 6111-4, remove rudder cable turnbuckle locking clip (2) and disconnect rudder cable turnbuckles (4). Secure and maintain tension on forward cable.

c. Disconnect rudder cable terminal (4A) from bellcrank (7) by removing cotter pin (8), nut (9), washers (10), and bolt (11).

CAUTION

To prevent damage to pulleys, remove cables carefully.

NOTE

If engine is installed, perform steps d through f. If engine is not installed, proceed to step g.

d. Open access 6222-3.

1. Rudder cable forward
2. Locking clip
3. Turnbuckle
4. Rudder cable terminal (turnbuckle)
4A. Rudder cable terminal (aft)
5. Rudder cable aft
6. Pulley
7. Bellcrank
8. Cotter pin
9. Nut
10. Washer
11. Bolt

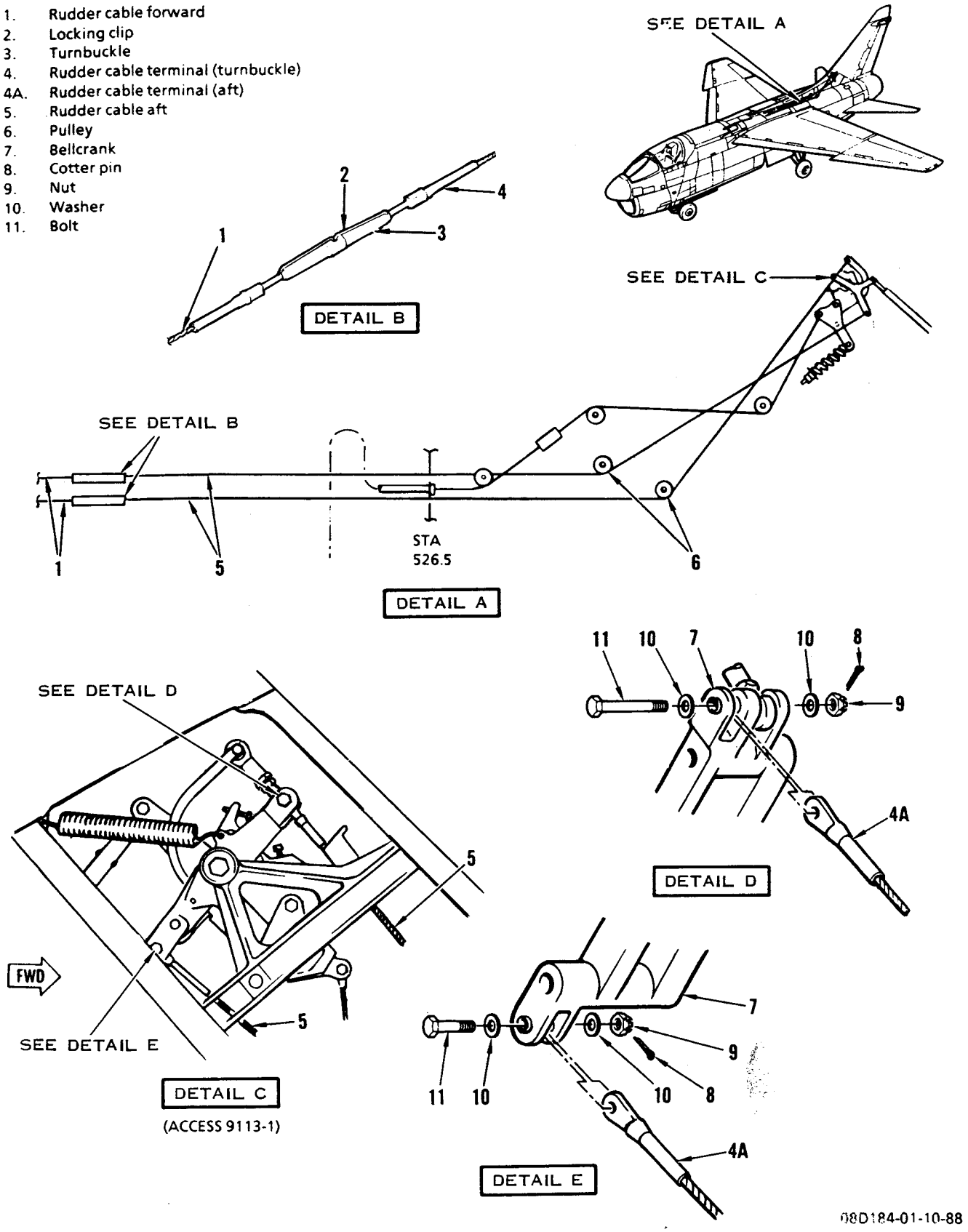
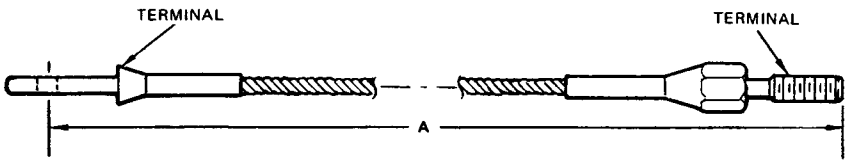


Figure 5-11A. Aft Rudder Control Cable Removal and Installation (Sheet 1)



LOCATION	TERMINAL 1	CABLE			TERMINAL 2
		LENGTH A (INCHES)	DIA (INCHES)	TYPE	
LEFT	MS20668	102.00 (±0.12)	5/32	MIL-W-83420	MS21260L
RIGHT	MS20668	122.75 (±0.12)	5/32	MIL-W-83420	MS21260L

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Figure 5-11A. Aft Rudder Control Cable Removal and Installation (Sheet 2)

e. Remove battery (T.O. 1A-7D-2-11).

f. Gain access to pulley (6) through access 6222-3.

g. Through engine compartment, remove nuts, washers, spacers, and bolts securing pulley (6) bracket. Pull cable aft through pulley (6).

h. Remove cable from airplane through access 9113-1.

5-48C. INSTALLATION. (See figure 5-11A.)

NOTE

Ensure replacement rudder cable is prestretched before installing in airplane.

a. Install rudder cable through access 9113-1.

CAUTION

To prevent damage to pulleys, thread cable through pulleys carefully.

b. Route cable forward through pulley (6) and out of accesses 6111-1 and 6111-4.

c. Install bolts, spacers, washers, and nuts in pulley (6) bracket.

d. Connect rudder cable terminal (4A) to bellcrank (7) using bolt (11), washers (10), nut (9), and cotter pin (8).

WARNING

Before disturbing rudder control linkage, ensure that hydraulic power is disconnected. Connecting or moving linkage with hydraulic power connected will actuate rudder which could cause injury to personnel or damage to equipment.

e. Connect rudder cable turnbuckle (3) by taking up most of cable slack.

f. Check rudder cable pulley (6) for correct cable alignment.

g. Rig rudder cables (paragraph 5-26).

h. Secure rudder cable turnbuckle (4) with new locking clip (2).

NOTE

If engine is installed, perform step i.

i. Install battery (T.O. 1A-7D-2-11). Close access 6222-3.

j. Perform rudder control system operational checkout (paragraph 5-16).

k. Close accesses 5111-5, 6111-1, 6111-4, and 9113-1.

5-49. CLEAN CONDITION STOPS ASSEMBLY REMOVAL AND INSTALLATION.

5-50. REMOVAL. (See figure 5-12.)

WARNING

Before disturbing rudder control linkage, ensure that hydraulic power is disconnected,. Disconnecting or moving linkage with hydraulic power connected will actuate rudder which could cause injury to personnel or damage to equipment.

a. Open accesses 9113-1, 5111-5, 5111-1, 6111-1, and 6111-4.

b. Ensure that wing flaps are up.

c. Remove locking clips and loosen rudder cable and 6^{o} stop turnbuckles.

d. Remove cotter pin (1), nut (2), bolt (3), and two washers (4) and disconnect control cable end (5) and link assembly (6) from bellcrank.

e. Remove cotter pin (7), nut (8), bolt (9), and two washers (10); disconnect control cable end (11) from bellcrank.

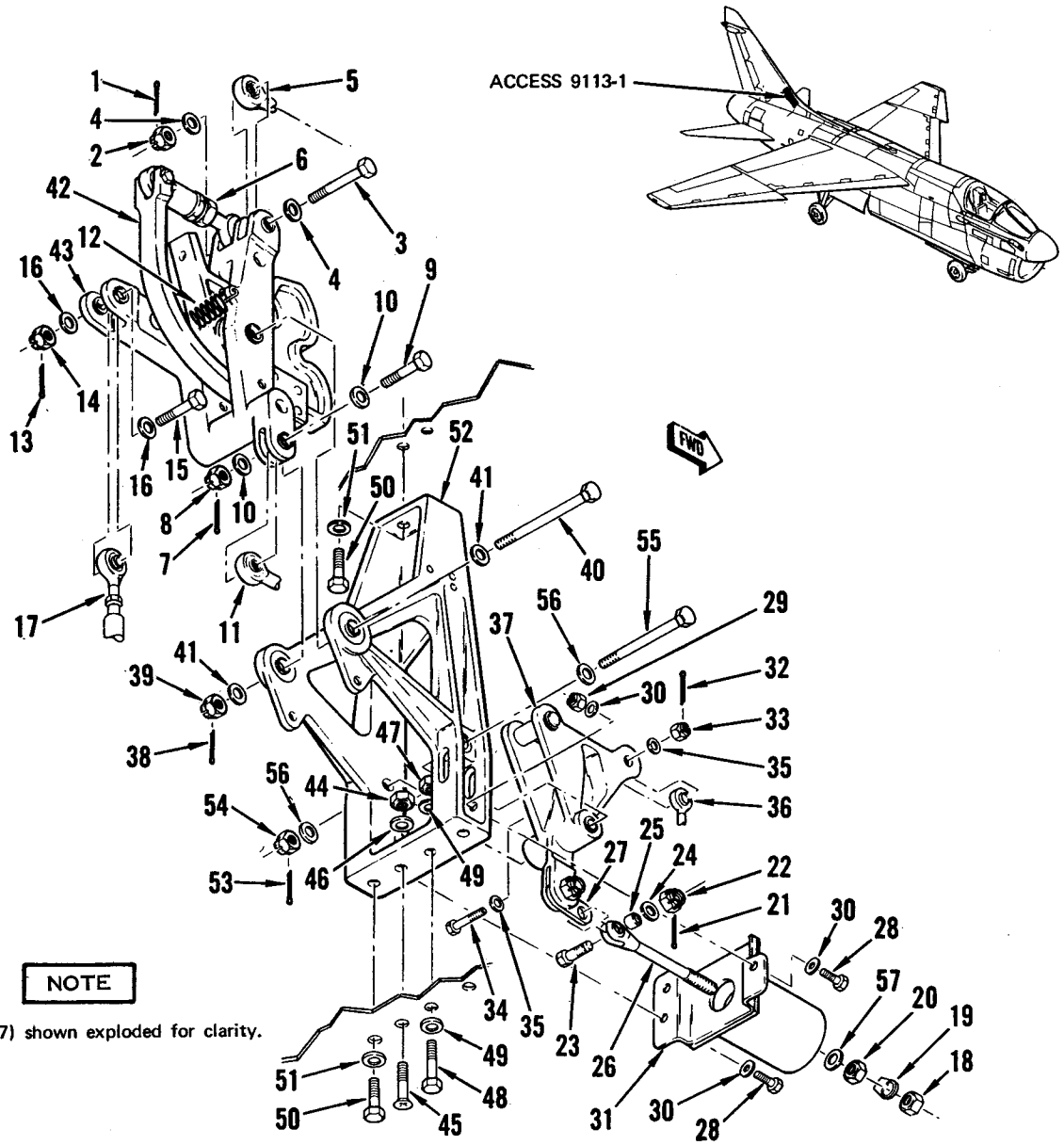
f. Remove backlash spring (12).

g. Remove cotter pin (13), nut (14), bolt (15), and two washers (16) and disconnect output rod end (17) from aft arm of bellcrank.

WARNING

Remove only the first nut at bottom of spring housing assembly. Removal of both nuts will allow ejection of spring retainer and springs which could cause injury to personnel.

h. Cut lockwire and remove nut (18) and lockwasher (19) at bottom of spring



1. Cotter pin
2. Nut
3. Bolt
4. Washer
5. Control cable end
6. Link assembly
7. Cotter pin
8. Nut
9. Bolt
10. Washer
11. Control cable end
12. Backlash spring
13. Cotter pin
14. Nut
15. Bolt
16. Washer
17. Output rod end
18. Nut
19. Lockwasher
20. Nut
21. Cotter pin
22. Nut
23. Bolt
24. Washer
25. Bushing
26. Rod
27. Link
28. Bolt
29. Nut
30. Washer
31. Housing assembly
32. Cotter pin
33. Nut
34. Bolt
35. Washer
36. Control cable end
37. Bellcrank (SEE NOTE)
38. Cotter pin
39. Nut
40. Bolt
41. Washer
42. Stop assembly
43. Bellcrank
44. Nut
45. Screw
46. Washer
47. Nut
48. Bolt
49. Washer
50. Bolt
51. Washer
52. Support assembly
53. Cotter pin
54. Nut
55. Bolt
56. Washer
57. Washer

Figure 5-12. Clean Condition Stops Assembly Removal and Installation

housing assembly. Reduce spring tension by loosening nut (20) until bottom of nut is flush with end of rod.

WARNING

Relieve spring tension on bushing when removing, by pressing up on spring retainer secured by nut (20). Release pressure slowly after removing bushing to prevent ejection of the spring-loaded rod which could cause injury.

i. Remove cotter pin (21), nut (22), bolt (23), washer (24), and bushing (25) and disconnect rod (26) from link (27).

j. Remove bolts (28), nut (29), and washers (30) from spring housing assembly (31) and remove housing assembly including rod (26) and internal springs. Secure rod components together to prevent separation.

k. Remove cotter pin (32), nut (33), bolt (34), and washers (35) from control cable end (36) and bellcrank (37).

l. Remove cotter pin (38), nut (39), bolt (40), and washers (41) and remove stop (42) and bellcrank (43) assemblies.

m. Remove aft viscous damper cylinder (paragraph 6-73).

n. Remove nut (44), screw (45), and washer (46).

o. Remove nuts (47), bolts (48), and washers (49).

p. Remove bolts (50) and washers (51), and remove support assembly (52).

q. Temporarily install housing assembly (31), stop assembly (42), and bellcrank assembly (43) on support assembly (52) and install washer (19) and nut (18) on rod (26).

5-51. INSTALLATION. (See figure 5-12.)

a. Remove housing assembly (31), stop assembly (42), and bellcrank assembly (43) from support assembly (52).

b. Install vinyl tape on all support assembly surfaces that will contact airplane structure.

WARNING

Corrosion preventive compound is flammable and slightly toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate.

c. Apply MIL-C-16173, Grade I corrosion prevention compound to head and shank of bolts (48 and 50) and screw (45).

d. Position support assembly (52) in airplane and secure at each end with washers (51) and bolts (50). Install screw (45), washer (46), and new nut (44) and install bolts (48), washers (49), and new nuts (47).

e. Install aft viscous damper cylinder (paragraph 6-73).

f. Install stop (42) and bellcrank (43) assemblies in support assembly and secure with washers (41), bolt (40), and nut (39).

g. Secure nut (39) with new cotter pin (38).

h. Connect control cable end (36) to bellcrank (37) with washers (35), bolt (34), and nut (33).

i. Secure nut (33) with new cotter pin (32).

j. Install housing assembly (31) on support assembly (52) and secure with washers (30), bolts (28), and new nut (29).

NOTE

Before connecting rod, ensure that top of small spring in housing is inserted through large diameter inner hole at top of housing and that the bottom end is inside the vertical flanges of the spring retainer. Ensure that the large spring is outside the flanges.

k. Remove nut (18) and washer (19) from rod (26) and back off nut (20) until bottom of nut is flush with end of rod.

l. Press up on spring retainer secured by nut (20), and connect rod (26) to link (27) with bushing (25), bolt (23), washer (24), and nut (22). Release pressure on retainer after inserting bushing.

m. Secure nut (22) with new cotter pin (21).

n. Install lockwasher (19) and nut (18). Do not secure with lockwire.

WARNING

Before connecting rudder control linkage, ensure that hydraulic power is disconnected. Movement of the linkage with hydraulic power connected will actuate the rudder which could cause injury to personnel or damage to equipment.

o. Connect output rod end (17) to bellcrank assembly (43) with washers (16), bolt (15), and nut (14).

p. Secure nut (14) with new cotter pin (13).

q. Connect control cable end (11) to bellcrank assembly with washers (10), bolt (9), and nut (8).

r. Secure nut with new cotter pin (7).

s. Connect link assembly (6) and control cable end (5) to bellcrank assembly with washers (4), bolt (3), and nut (2).

t. Secure nut (2) with new cotter pin (1).

u. Install backlash spring (12).

v. Rig clean condition stops and cables (paragraph 5-33 or 5-34).

w. Rig rudder cables (paragraph 5-26).

x. Perform operational checkout (paragraph 5-16).

y. Ensure that turnbuckles are secured and that new cotter pins are installed.

z. Close accesses 5111-1, 5111-5, 6111-1, 6111-4, and 9113-1.

5-52. CLEAN CONDITION STOPS ASSEMBLY REPAIR. (See figure 5-13.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	215-00110-4	Rigging pin No. 2	Rig linkage TT08D115-07-70

5-53. DISASSEMBLY.

NOTE

Disassemble only to extent required for replacement of defective parts.

a. Remove cotter pin (1), nut (2), washer (3), and bolt (4) and remove link assembly (5).

b. Remove bolts (6), washers (7), nut (8), bolt (9), and washers (10) and remove housing assembly (11) from support assembly (12).

c. Remove rod (13), large diameter spring (14), and small diameter spring (15) from housing assembly.

d. Remove nut (16), lockwasher (17), nut (18), washer (19), and spring retainer (20) from rod (13).

e. Remove cotter pin (21), nut (22), bolt (23), and washers (24) and remove stop assembly (25) and bellcrank assembly (26) from support assembly.

f. Remove cotter pin (27), nut (28), bolt (29), and washers (30) and remove arm assembly (31) from support assembly.

g. Remove stopbolt (32), washer (33), and jamnut (34).

5-54. CLEANING AND INSPECTION.

a. Clean parts in P-D-680 drycleaning solvent and dry with a clean, soft cloth.

b. Inspect parts for cracks, dents, nicks, distortion, corrosion (T.O. 1A-7D-23), excessive wear, and other damage.

c. Check bearings for freedom of rotation.

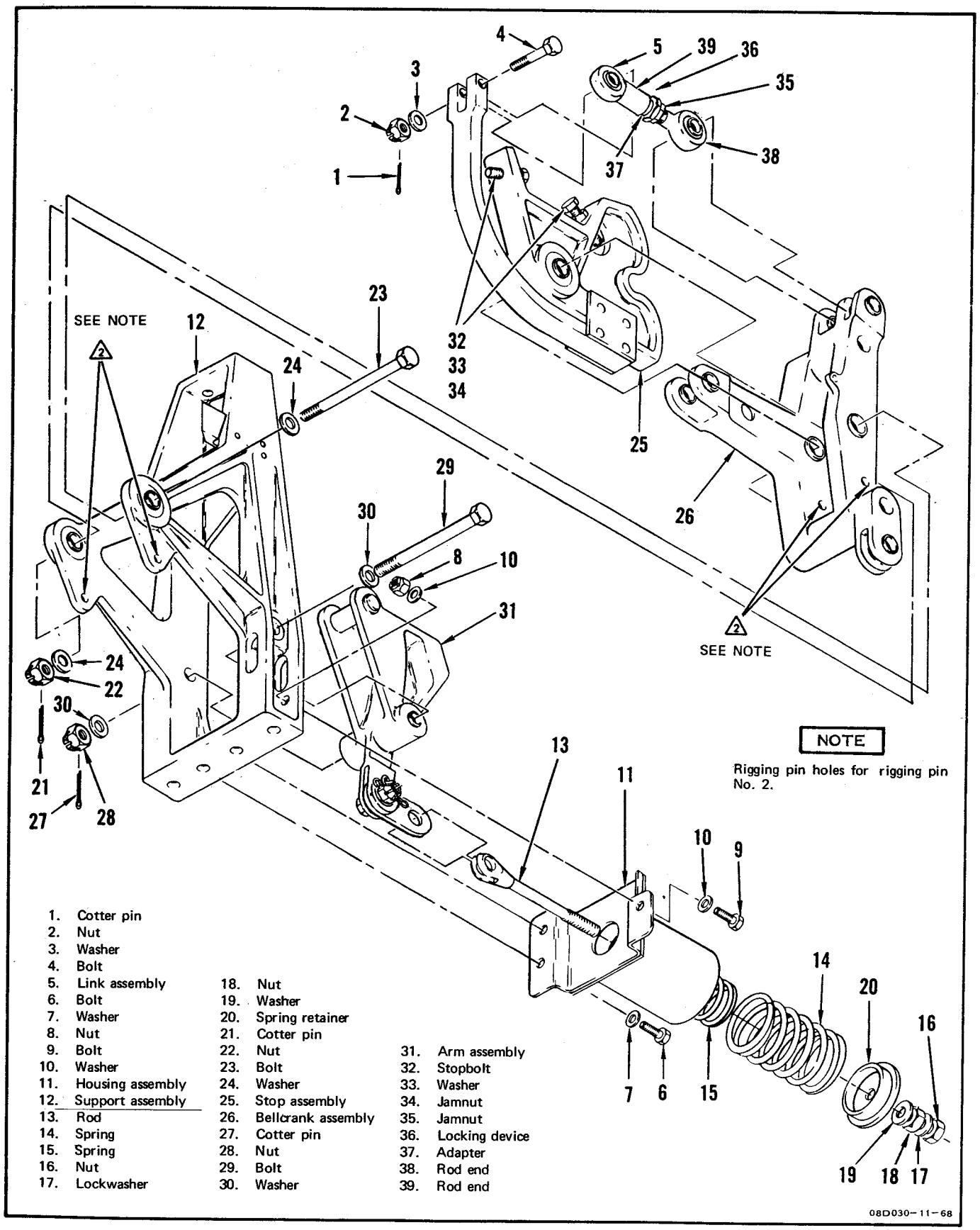
5-55. REPAIR.

a. Clean minor corrosion from parts (T.O. 1A-7D-23). Replace excessively corroded parts.

b. Replace cracked, broken, distorted, or excessively worn parts.

5-56. REASSEMBLY.

a. Install jamnut (34) on stopbolt (32) and install washer (33) and stopbolt in stop assembly (25).



1. Cotter pin
2. Nut
3. Washer
4. Bolt
5. Link assembly
6. Bolt
7. Washer
8. Nut
9. Bolt
10. Washer
11. Housing assembly
12. Support assembly
13. Rod
14. Spring
15. Spring
16. Nut
17. Lockwasher
18. Nut
19. Washer
20. Spring retainer
21. Cotter pin
22. Nut
23. Bolt
24. Washer
25. Stop assembly
26. Bellcrank assembly
27. Cotter pin
28. Nut
29. Bolt
30. Washer
31. Arm assembly
32. Stopbolt
33. Washer
34. Jamnut
35. Jamnut
36. Locking device
37. Adapter
38. Rod end
39. Rod end

Figure 5-13. Clean Condition Stops Assembly Repair

b. Install arm assembly (31) in support assembly and secure with washers (30), bolt (29), and nut (28).

c. Secure nut (28) with new cotter pin (27).

d. Temporarily install stop assembly (25) and bellcrank assembly (26) in support assembly and secure with washer (24), bolt (23), and nut (22). Cotter pin (21) will be installed after installation of stop assembly in airplane.

e. Install spring retainer (20), washer (19), nut (18), lockwasher (17), and nut (16) on rod (13).

f. Spread light coat of MIL-G-81322 lubricant on inside walls of housing assembly (11) and install large diameter spring (14), small diameter spring (15), and rod (13) in housing assembly. Temporarily secure rod and spring retainer to housing assembly with tape or cord.

g. Temporarily secure housing assembly (11) to support assembly (12) with washers (7), bolts (6), washers (10), bolt (9), and nut (8).

h. Secure link assembly (5) to stop assembly (25) with bolt (4), washer (3), and nut (2).

i. Secure nut (2) with new cotter pin (1).

j. Install rigging pin No. 2.

k. Fully engage cam follower on arm assembly (26) with cam depression on stop assembly (25) and secure or hold in this position.

l. Cut lockwire on link assembly (5) and loosen jamnut (35) enough to disengage locking device (36) from adapter (37).

m. Engage rod end (38) with connecting point on bellcrank assembly (26) and rotate adapter (37) until rod end bolthole is aligned with boltholes in bellcrank assembly without stop assembly spring being deflected.

n. Check that threads of adapter can be seen through thread witness hole of rod end (39). If threads cannot be seen, adjust rod end (38) in adapter and repeat step m.

o. Engage locking device (36) with adapter (37) and tighten jamnut (35). Do not secure with lockwire until after installation in airplane.

p. Remove rigging pin No. 2.

5-57 through 5-59. Deleted.

5-60. CABLE STOP LINK REMOVAL AND INSTALLATION.

5-61. REMOVAL.

a. Open accesses 5121-2, 6113-1, and 9113-1.

b. Remove engine (T.O. 1A-7D-2-5).

CAUTION

Restrain cam release arm at 6° stops while disconnecting turnbuckle to prevent roller of cam release arm from rapidly engaging cam slot and possibly causing damage to the system.

c. Disconnect controlex turnbuckle (access 6113-1).

d. Disconnect cable from controlex at engine compartment bulkhead station 526.5.

e. Disconnect cable from 6° stops and tie a retriever line to end of cable.

f. Remove cable pulley through access 9113-1, upper pulley through access 5121-2, and lower pulley from engine compartment.

g. Pull link assembly and cable through access 5121-2. Disconnect retriever line.

5-62. INSTALLATION.

a. Connect retriever line to aft end of link assembly and cable.

b. Through access 9113-1, pull cable into compartment with retriever line. Position cable and install pulley with bolt, two washers, nut, and new cotter pin.

c. Connect cable to 6° stops with bolt (bolthead inboard), two washers, nut, and new cotter pin.

d. Install upper pulley in access 5121-2 with bolt, washers, nut, and new cotter pin.

e. Position link assembly and forward end of cable into engine compartment. Install lower pulley and connect cable to controlex at engine compartment bulkhead station 526.5.

f. Rig clean condition stops (paragraph 5-33).

g. Install engine (T.O. 1A-7D-2-5).

h. Close accesses.

5-63. RUDDER FUNK SPRING STRUT ASSEMBLY REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	215-00110-4	Rigging pin No. 4	Rig linkage
	215-00110-7	Rigging pin No. 3	Rig linkage
	215-00110-9	Alternate rigging pin No. 3	

TT08D116-09-76

5-64. REMOVAL.

a. Open accesses 9123-1, 9132-1, and 9133-1.

b. Remove self-retaining bolt (paragraph 2-95), securing funk spring strut assembly to stops bellcrank.

c. Dump reservoir accumulator hydraulic pressure (T.O. 1A-7D-2-1).

d. Disconnect and cap two hydraulic lines outboard of rudder funk spring strut (access 9123-1).

e. Remove cotter pin, nut, bolt, and two washers from aft end of strut assembly and remove strut assembly from airplane.

5-65. INSTALLATION.

NOTE

See figure 5-6 for rigging pin and link locations.

A 5/32-inch rigging pin (215-00110-9) may be used in place of 3/16-inch rigging pin No. 3 (215-00110-7) if pin No. 3 will not fit.

a. Install rigging pins No. 3 and 4.

b. Lightly lubricate sliding surfaces of strut assembly with MIL-G-81322 grease.

c. Position strut assembly in airplane, fixed end aft, and secure with bolt (head left), two washers, nut, and new cotter pin.

CAUTION

Loosen only the jamnut adjacent to the forward rod end. Loosening of the other jamnuts will destroy internal adjustment of spring strut.

d. Position adjustable end of strut in stops bellcrank arm. Loosen jamnut adjacent to rod end and adjust to align boltholes. Tighten jamnuts and secure with MS20995C32 lockwire.

e. Install self-retaining bolt (paragraph 2-95) securing strut assembly to stops bellcrank.

f. Connect hydraulic lines.

g. Remove rigging pins No. 3 and 4.

h. Bleed rudder power control system (paragraph 5-36).

i. Perform rudder control system operational checkout (paragraph 5-16).

j. Close accesses 9123-1, 9132-1, and 9133-1.

5-66. SERVO VALVE REMOVAL AND INSTALLATION.

5-67. REMOVAL. (See figure 5-14.)

a. Dump reservoir accumulator hydraulic pressure (T.O. 1A-7D-2-1).

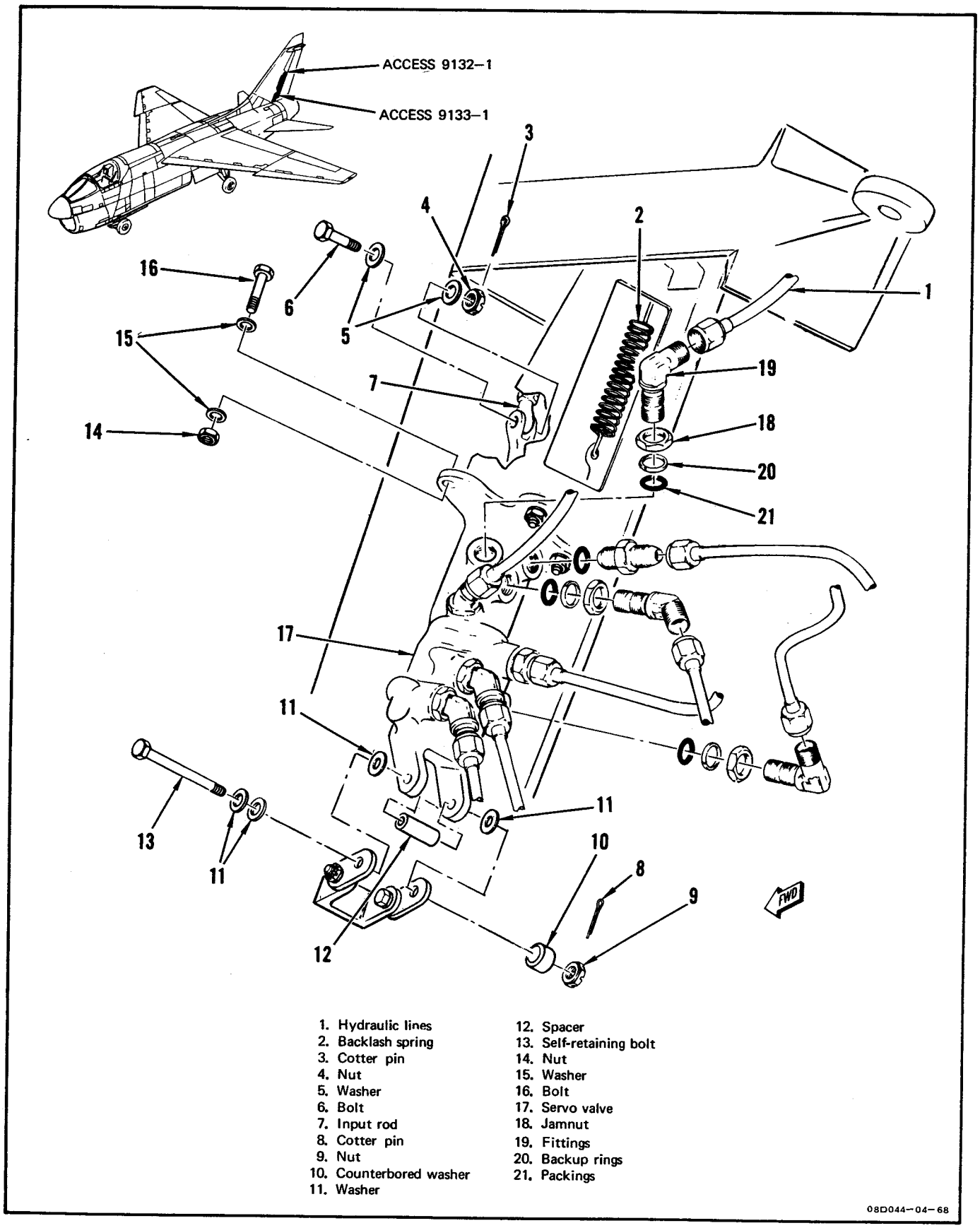
b. Open access 9133-1, 9133-2, 9132-1, and 9132-2.

c. Identify and disconnect eight hydraulic lines (1) from servo valve.

d. Remove backlash spring (2) between servo valve and scissors linkage.

e. Remove cotter pin (3), nut (4), washers (5), and bolt (6) to disconnect servo valve input rod (7).

f. Disconnect servo valve at lower mounting by removing cotter pin (8), nut (9), counterbored washer (10), washers (11), spacer (12), and self-retaining bolt (13) (paragraph 2-95). Note position of washers for installation.



1. Hydraulic lines
2. Backlash spring
3. Cotter pin
4. Nut
5. Washer
6. Bolt
7. Input rod
8. Cotter pin
9. Nut
10. Counterbored washer
11. Washer
12. Spacer
13. Self-retaining bolt
14. Nut
15. Washer
16. Bolt
17. Servo valve
18. Jamnut
19. Fittings
20. Backup rings
21. Packings

Figure 5-14. Servo Valve Removal and Installation

g. Disconnect servo valve at upper end by removing nut (14), washers (15), and mounting bolt (16).

h. Remove servo valve (17) from airplane.

i. Loosen jamnuts (18) and remove eight fittings (19), backup rings (20), and packings (21). Discard backup rings and packings.

5-68. INSTALLATION. (See figure 5-14.)

a. Install new packings (21), new backup rings (20), jamnuts (18), and fittings (19) in servo valve (17).

b. Drain preservative from valve and fill with hydraulic fluid.

c. Position servo valve in airplane and install upper mounting bolt (16), washer (15), and nut (14).

NOTE

Install same number of washers between valve lug and link as between link and bulkhead lug.

d. Align servo valve lower mounting lug with airplane fitting and secure with self-retaining bolt (13) (paragraph 2-95), washers (11), spacer (12), counterbored washer (10), nut (9), and new cotter pin (8). Joint shall be free to rotate.

e. Connect input rod (7) to servo valve using bolt (6), washers (5), nut (4), and new cotter pin (3).

f. Install backlash spring (2).

g. Connect hydraulic lines (1) to servo valve fittings.

h. Bleed rudder power control system (paragraph 5-36).

i. Perform rudder control system operational checkout (paragraph 5-16).

j. Close accesses 9133-1, 9133-2, 9132-1, and 9132-2.

5-69. RUDDER PC CYLINDER REMOVAL AND INSTALLATION. (See figure 5-15.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	MIL-G-3859	Grease gun	Grease rudder pedal fittings

TT08D117-12-68

5-70. REMOVAL. (See figure 5-15.)

a. Dump reservoir accumulator hydraulic pressure (T.O. 1A-7D-2-1).

b. Open accesses 9132-1, 9133-1, 9132-2, and 9133-2.

c. Disconnect false beam (1, figure 5-17) access to rudder PC cylinder rod end.

d. Manually move rudder extreme left to retract cylinder rod end.

CAUTION

Hold followup rod (5, figure 5-15) firmly while removing bolt (3). Bottom piston slowly to prevent damage.

e. Remove cotter pin (1), nut (2), bolt (3), and two washers (4) securing followup rod (5) to cylinder rod end.

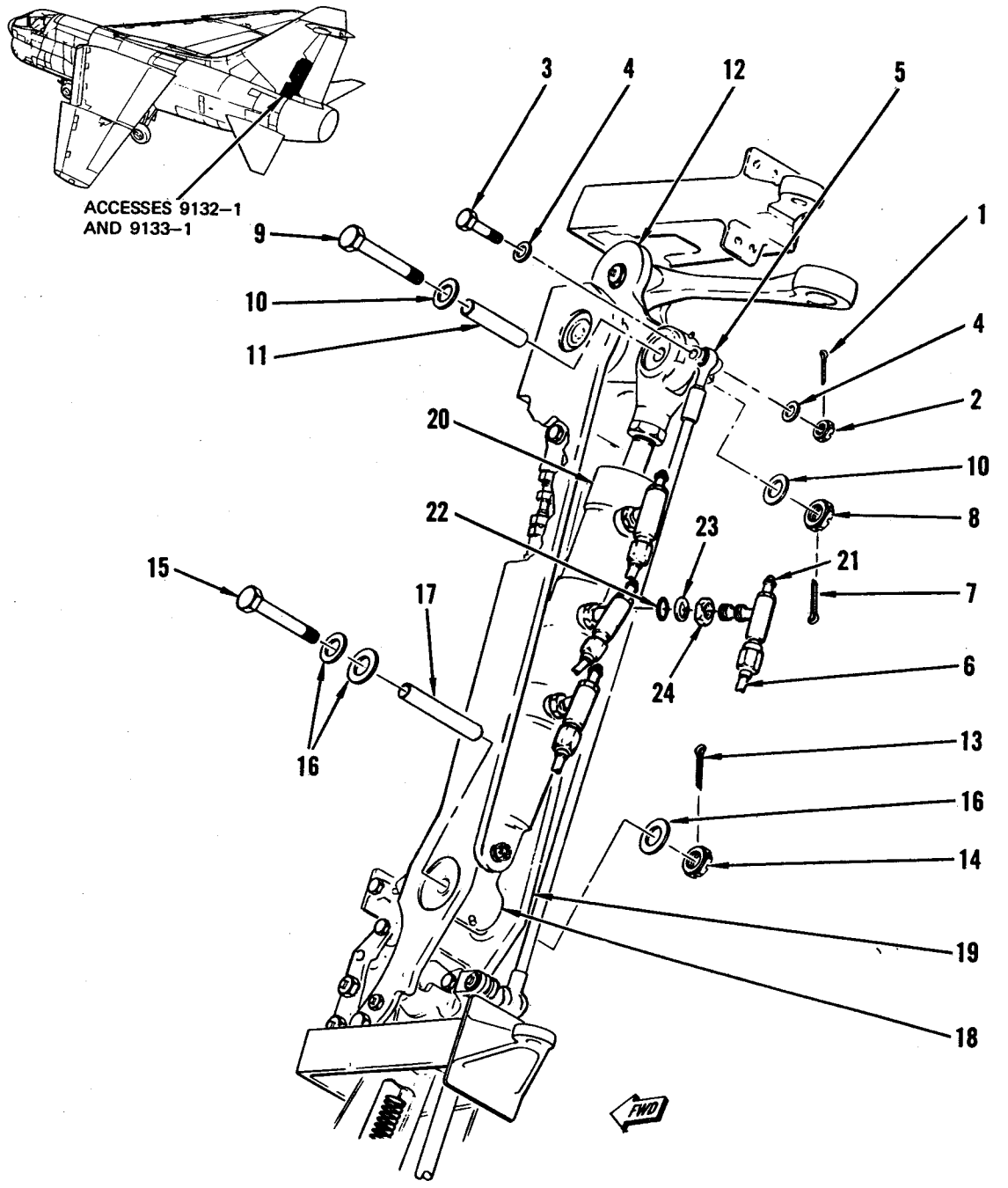
f. Disconnect four hydraulic lines (6) from cylinder.

g. Remove cotter pin (7), nut (8), bolt (9), two washers (10), and pin (11), securing bellcrank (12) to cylinder rod end.

h. Remove cotter pin (13), nut (14), bolt (15), three washers (16), and pin (17) from trunnion assembly (18) and fitting assembly (19).

i. Remove PC cylinder (20).

j. Secure loose end of followup rod (5) to support fitting.



1. Cotter pin
2. Nut
3. Bolt
4. Washers
5. Followup rod
6. Hydraulic lines
7. Cotter pin
8. Nut
9. Bolt
10. Washers
11. Pin
12. Bellcrank
13. Cotter pin
14. Nut
15. Bolt
16. Washers
17. Pin
18. Trunnion assembly
19. Fitting assembly
20. PC cylinder
21. Fittings
22. Gaskets
23. Rings
24. Nuts

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Figure 5-15. Rudder PC Cylinder Removal and Installation

k. Fully retract cylinder piston. Measure and record distance between cylinder rod end and lug end holes.

l. Loosen nuts and remove four fittings (21), gaskets (22), rings (23), and nuts (24). Cap or plug open ports and fittings.

5-71. INSTALLATION. (See figure 5-15.)

a. Remove caps or plugs from cylinder ports and fittings. Install nuts (24), rings (23), new gaskets (22), and fittings (21) in cylinder (20).

b. Drain preservative fluid and retract cylinder piston. Adjust rod end to measurement noted during removal.

c. Fill cylinder with hydraulic fluid.

d. Remove tie from upper end of followup rod (5).

e. Lubricate sides of trunnion bushings with MIL-G-81322 grease.

NOTE

Install trunnion assembly with grease fitting aft to ensure access for lubrication.

f. Place cylinder in airplane and align trunnion (18) with fitting (19).

g. Lubricate trunnion bolt (15) with MIL-G-81322 grease. Install pin (17), bolt (15), washers (16) with small washer under bolthead, nut (14), and a new cotter pin (13).

h. Align cylinder rod end with bellcrank (12) and secure with pin (11), bolt (9), two washers (10), nut (8), and new cotter pin (7).

i. Lubricate cylinder rod end pin (11) with MIL-G-81322 grease through grease fitting.

j. Connect four hydraulic lines (6).

k. Connect adjustable end of followup rod (5) to cylinder rod end using bolt (3), washers (4), nut (2), and new cotter pin (1).

l. Install false beam.

m. Perform hydraulic system air check (T.O. 1A-7D-2-1).

n. Rig rudder power control package (paragraph 5-30).

o. Close accesses 9132-1, 9133-1, 9132-2, and 9133-2.

5-72. RUDDER PC CYLINDER ROD END SEAL REPLACEMENT.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	E10385	Hydraulic servicing cart	Pressure check cylinder
	GGG-W-686	Torque wrench, 700 to 1,600 pound-inches	Tighten rod end jamnut
	413-900-020	Torque wrench, 100 to 700 pound-inches	Tighten retainer nut
			TT08D150-10-77

5-73. REMOVAL. (See figure 5-16.)

a. Open accesses 9132-1 and 9132-2, 9133-1, and 9133-2.

b. Remove false beam (1, figure 5-17) to gain access to rudder PC cylinder rod end.

c. Measure and record distance from shoulder of rod end to polished part of piston rod.

d. Loosen jamnut (1, figure 5-16) on rod end.

e. Manually move rudder to extreme left to retract PC cylinder rod.

CAUTION

Bottom followup rod slowly after disconnecting to prevent possible damage to servo valve.

f. Remove cotter pin (2), nut (3), bolt (4), and two washers (5) securing followup rod (6) to rod end.

g. Remove cotter pin (7), nut (8), bolt (9), two washers (10), and pin (11) securing bellcrank (12) to rod end.

h. Manually move rudder to extreme right.

i. Remove rod end (13). Do not turn piston in cylinder.

j. Remove lockring (14) and jamnut (1) from piston rod.

k. Remove retainer nut (15) from cylinder.

l. Disconnect hydraulic line (16) from top cylinder bleed fitting and plug line.

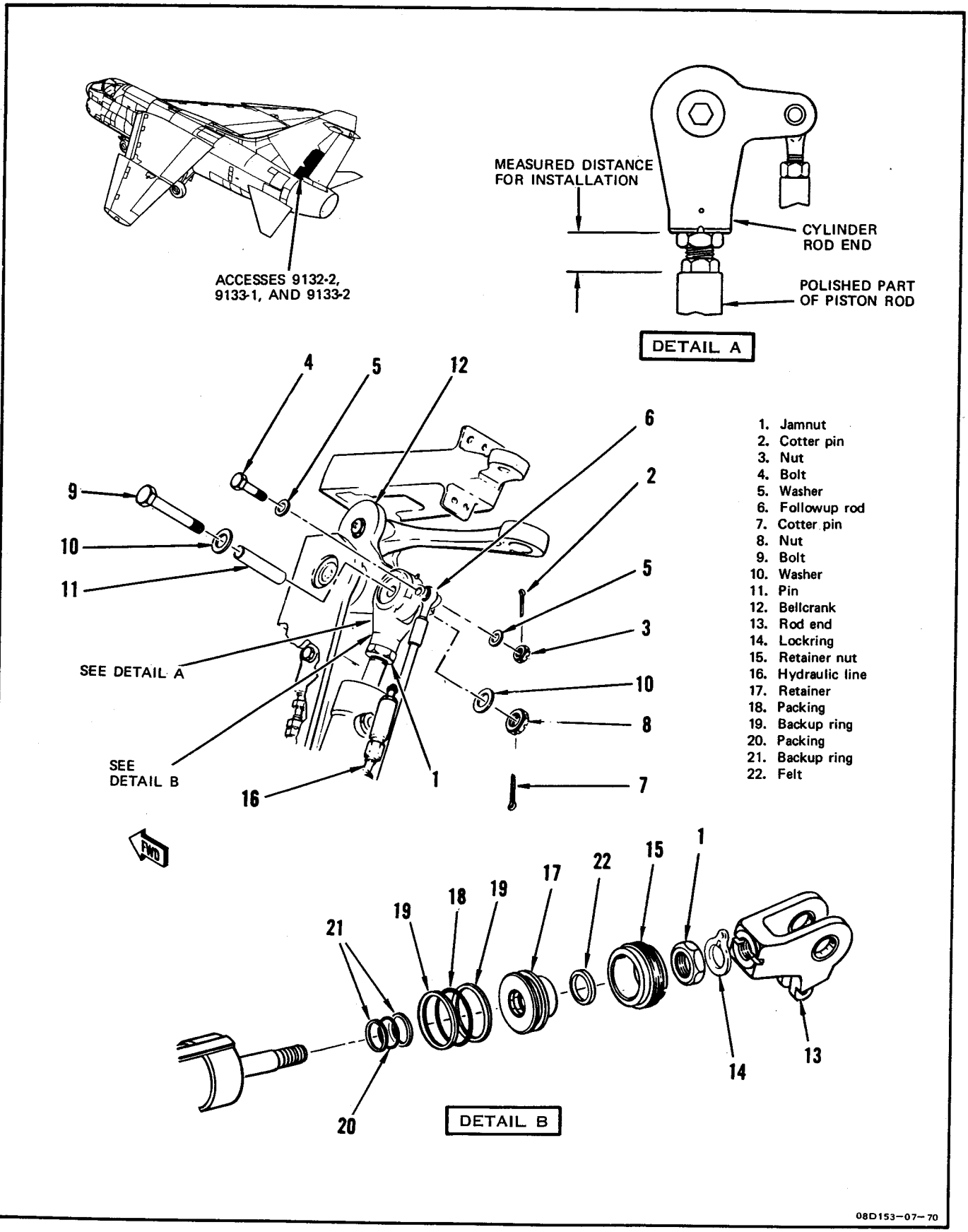


Figure 5-16. Rudder PC Cylinder Rod End Seal Replacement

m. Connect hydraulic test stand to cylinder port.

n. Apply low hydraulic pressure to release retainer (17). Remove retainer from piston rod.

o. Remove packing (18), backup rings (19), packing (20), backup rings (21), and felt (22) from retainer (17).

5-74. INSTALLATION. (See figure 5-16.)

a. Soak new packings and felt in hydraulic fluid.

b. Install packing (18) with backup rings (19) on each side in outer groove of retainer.

c. Install packing (20) with backup rings (21) on each side in inner groove of retainer.

d. Squeeze out excessive hydraulic fluid and install felt (22) in small end of retainer.

e. Install retainer (17) on piston rod and into cylinder.

f. Install retainer nut (15) in cylinder. Tighten nut to 600 (±100) pound-inches torque and secure with MS20995C32 lockwire.

g. Install jamnut (1) and lockring (14) on rod end (13) and turn down to bottom threads on piston rod.

h. Install rod end on piston rod and adjust to dimension recorded in step c (removal).

i. Manually move rudder to extreme left to align rudder bellcrank with rod end.

j. Install pin (11), two washers (10), bolt (9), and nut (8) to connect rod end (13) to rudder bellcrank (12). Do not install cotter pin.

k. Tighten jamnut (1) to 1,150 (±150) pound-inches torque against rod end shoulder. Do not install lockwire.

l. Lubricate pin (11) with MIL-G-81322 grease through grease fitting on bellcrank.

m. Connect followup rod end (6) to rod end (13) with two washers (5), bolt (4), and nut (3). Do not install cotter pin.

n. Disconnect fill and check stand from top cylinder port and connect hydraulic line (16) to PC cylinder.

o. Temporarily install false beam (1, figure 5-17).

p. Bleed rudder power control system (paragraph 5-36).

q. Perform system operational checkout (paragraph 5-16).

r. Install cotter pins (2 and 7, figure 5-16) to secure rod end (13) to bellcrank (12).

s. Install false beam.

t. Close accesses 9132-1, 9132-2, 9133-1, and 9133-2.

5-75. RUDDER POWER CONTROL PACKAGE REMOVAL AND INSTALLATION.

5-76. REMOVAL. (See figure 5-17.)

a. Dump reservoir accumulator hydraulic pressure (T.O. 1A-7D-2-1).

b. Open accesses 9133-1, 9133-2, 9132-1, and 9132-2.

c. Remove cotter pin (1), nut (2), two washers (3), bolt (4), and pin (5) attaching rudder control link to rudder.

d. Remove nuts (6), washers (7), bolts (8), nut (9), three washers (10), and bolt (11) securing lug of bonding jumper and lower end of center beam (12) to airframe.

e. Remove bolts (13) and washers (14) securing upper end of center beam (12) to airframe and remove center beam.

f. Disconnect and cap hydraulic lines.

g. Disconnect spring (15).

h. Remove cotter pin (16), nut (17), two washers (18), and bolt (19) attaching input rod (20) to bellcrank.

i. Remove servo valve (21) (paragraph 5-66).

j. Remove eight screws (22) securing upper end of PC package to airplane skin.

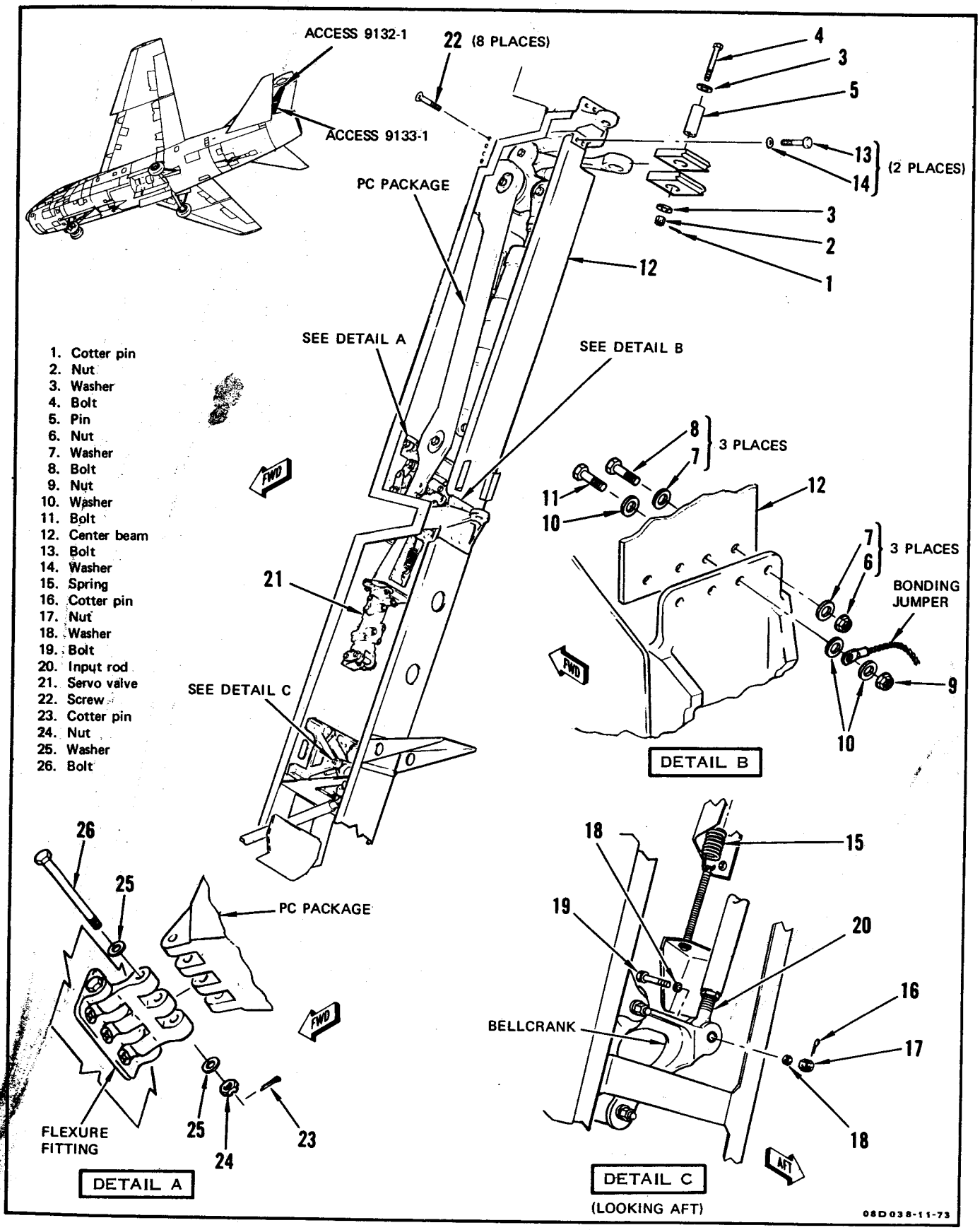


Figure 5-17. Rudder PC Package Removal and Installation

k. Remove cotter pin (23), nut (24), two washers (25), and bolt (26) attaching PC package to flexure fitting.

l. Position rudder full left and remove PC package from airplane.

5-77. INSTALLATION. (See figure 5-17.)

a. Install No. 473 pressure-sensitive vinyl tape (Minnesota Mining and Manufacturing Company) on upper end of PC package in forward and side areas that will butt airplane structure. Do not cover holes or alignment pins.

b. Drain preservative fluid from power control package and fill with hydraulic fluid.

c. With rudder full left, position PC package in airplane.

d. Align lugs on PC package with flexure fitting and install two washers (25), bolt (26), nut (24), and new cotter pin (23).

e. Align upper end of PC package with screw holes in airplane skin, then install eight screws (22).

f. Install servo valve (21) (paragraph 5-66).

g. Attach input rod (20) to bell crank with two washers (18), bolt (19), nut (17), and new cotter pin (16).

h. Connect spring (15).

i. Connect hydraulic lines.

j. Position center beam (12) in airplane and secure upper end of center beam to airframe with washers (14) and bolts (13).

WARNING

Install bolts (11 and 8) with heads toward PC package. Improperly installed bolts will interfere with bellcranks causing rudder to jam.

k. Secure lower end of center beam with three washers (10), bolt (11), lug of bonding jumper, nut (9), washers (7), bolts (8), and nuts (6).

l. Attach rudder control link to rudder with pin (5), washers (3), bolt (4), nut (2), and new cotter pin (1).

m. Bleed rudder power control system (paragraph 5-36).

n. Rig power control package (paragraph 5-30).

o. Close accesses 9132-1, 9132-2, 9133-1, and 9133-2.

5-78. RUDDER POWER CONTROL PACKAGE SLOP CHECK.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment required for connecting external hydraulic power	Connect hydraulic power
5-6	215-00110-4	Rigging pin No. 4	Rig linkage
5-6	215-00110-5	Rigging pin No. 5	Rig linkage
	80D	Spring scale, 0 to 80 pounds	Measure force applied to rudder

TT08D118-07-70

a. Install rudder protractor (paragraph 5-23).

b. Open accesses 9132-1 and 9133-1.

NOTE

If rigging pins cannot be inserted, or if rudder is not at rigging neutral, perform rudder power control package rigging (paragraph 5-30).

c. Check that rigging pins No. 4 and 5 can be inserted and that rudder is at rigging neutral, which is 0° (±6').
Remove rigging pins.

d. On airplanes through AF69-6196, connect external hydraulic power to PC No. 1 and PC No. 2 hydraulic systems (T.O. 1A-7D-2-1).

e. On airplanes AF69-6197 and subsequent, connect external hydraulic power to PC No. 2 and PC No. 3 hydraulic systems (T.O. 1A-7D-2-1).

f. Accurately record position of rudder in reference to protractor scale.

g. Using a spring scale and holding a wooden block between scale plunger and rudder surface, apply a force equivalent to 50 (+10, -0) pound-feet torque about the rudder hinge centerline. Slowly reduce force to zero and record amount rudder lacks returning to position recorded in step f.

h. Repeat step g on opposite side of rudder.

i. Add the two values obtained in steps g and h. If the total exceeds 0°8', replace rudder power control package.

j. Disconnect external hydraulic power.

k. Remove rudder protractor.

l. Close accesses 9132-1 and 9133-1.

5-79. RUDDER ASSEMBLY REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
			TT08D119-07-70

5-80. REMOVAL. (See figure 5-18.)

a. Remove cotter pin (1), nut (2), bolt (3), and washers (4) attaching rudder control arm (5) to horn (6). Tag washers (4) to show their location with respect to bolthead or nut.

b. Remove pin (7) using a phenolic rod or drift pin.

c. Manually move rudder to extreme left.

d. Open upper and lower hinge access doors. Remove screws and center hinge access door for access to bonding jumpers and hinge bolts.

e. Disconnect three bonding jumpers, one at each hinge point.

f. Remove cotter pin (8), nut (9), bolt (10), and two washers (11) from lower hinge.

g. Support rudder and remove cotter pin (12), nut (13), bolt (14), and two washers (15) from center hinge.

h. Remove cotter pin (16), nut (17), bolt (18), and two washers (19) from upper hinge.

CAUTION

Use care when removing rudder to prevent damage through interference with adjacent surfaces.

i. Remove rudder (20).

5-81. INSTALLATION. (See figure 5-18.)

a. Temporarily install replacement rudder (20) with hinge bolts (10, 14, and 18).

b. Measure gap between top and bottom edges of rudder and vertical fin fairing for 0.25 (+0.06, -0.00) inch clearance. Mark for trimming.

c. Measure gap between each hinge fitting and rudder leading edge fairing for minimum clearance of 0.10 inch. Mark for trimming.

d. Remove rudder and trim as required.

e. Treat and refinish trimmed area (T.O. 1A-7D-3).

f. Lubricate attaching bolts (3, 10, 14, and 18) and pin (7) with MIL-L-7870 oil.

g. Attach rudder (20) at top and bottom hinge fittings with bolts (18 and 10), washers (19 and 11), nut (17 and 9), and new cotter pins (16 and 8). Connect bonding jumpers.

h. Attach rudder at center hinge fitting with bolt (14), washers (15) (washer with larger inside diameter under bolthead), nut (13), and new cotter pin (12). Connect bonding jumper.

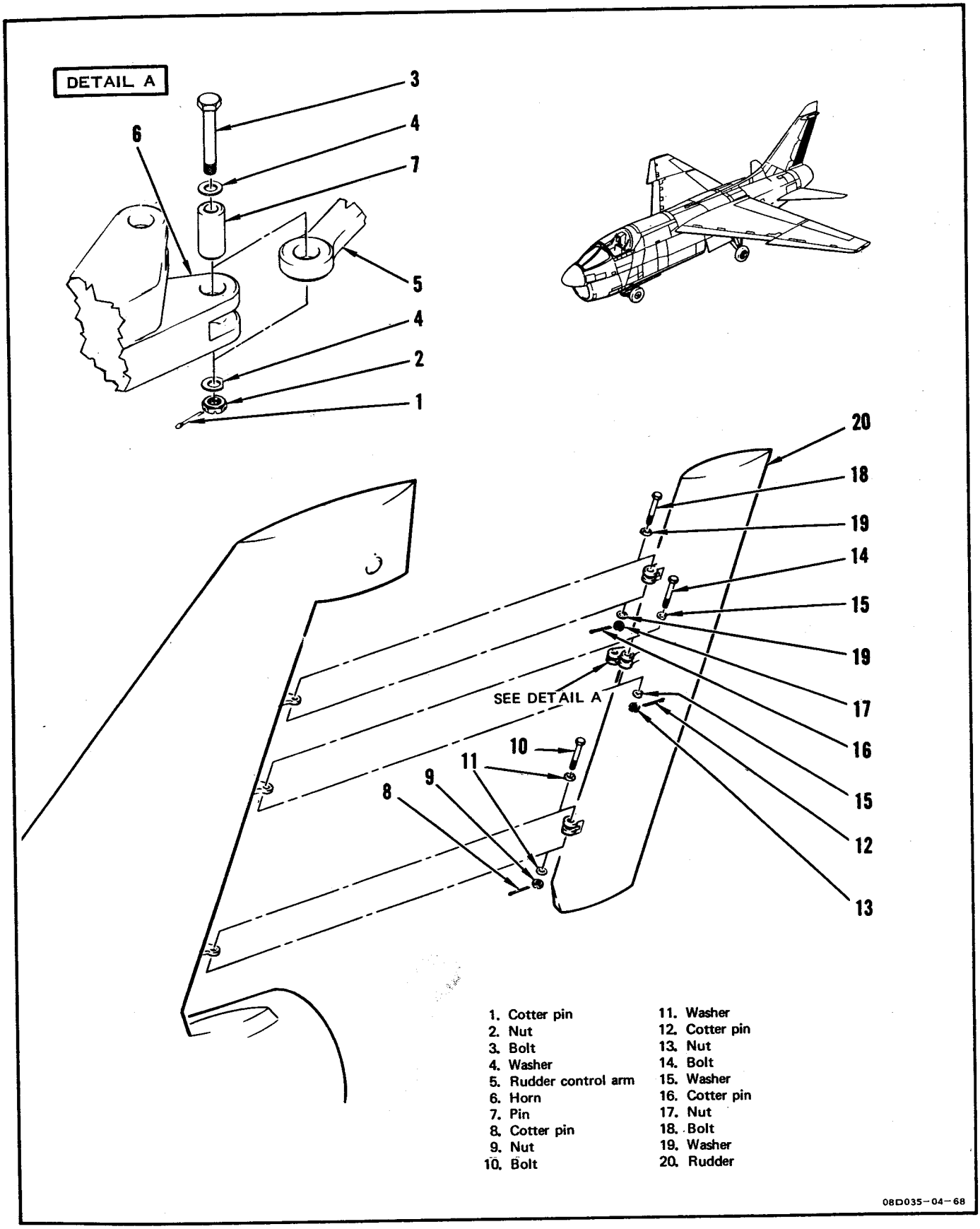


Figure 5-18. Rudder Assembly Removal and Installation

i. Close hinge doors.

j. Connect rudder horn (6) to arm (5) with pin (7), washers (4) (positioned as noted during removal), bolt (3), nut (2), and new cotter pin (1). Install center hinge access door and secure with screws.

k. Install rudder protractor (paragraph 5-23).

l. Connect external electrical power (T.O. 1A-7D-2-1).

m. On airplanes through AF69-6196, connect external hydraulic power to PC No. 1 and PC No. 2 hydraulic systems (T.O. 1A-7D-2-1).

n. On airplanes AF69-6197 and subsequent, connect external hydraulic power to PC No. 2 and PC No. 3 hydraulic systems (T.O. 1A-7D-2-1).

o. Deleted.

p. Cycle rudder. Check that rudder movement, full left and right, is 24° (+30', -1°).

q. Disconnect external hydraulic and electrical power (T.O. 1A-7D-2-1).

r. Remove rudder protractor.

5-82. RUDDER CLEAN CONDITION STOPS PUSH-PULL CONTROL ASSEMBLY REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	GGG-W-686	Torque wrench, 10 to 150 pound-inches	Tighten nuts
			TT08D158-09-71

CAUTION

To prevent damage to controlex units, observe controlex handling precautions (T.O. 1A-7D-2-1) during removal and installation of the control assembly.

5-83. REMOVAL. (See figure 5-19.)

a. Remove engine (T.O. 1A-7D-2-5).

b. Open accesses 6111-1, 6111-3, 6111-4, and 6113-1.

c. Disconnect upper forward main landing gear door link (1) at door (T.O. 1A-7D-2-7).

CAUTION

Push-pull control assembly (3) is under approximately 80 pounds tension. Restrain link (2) when disconnecting to prevent possible damage to system.

d. Restrain upper aft main landing gear door link (2) and disconnect link at door (T.O. 1A-7D-2-7). Slowly allow link to retract until tension is relaxed to prevent damage to clean condition stop system. Allow aft door to rest on shock strut.

CAUTION

Use wrench flats as backup when disengaging turnbuckle to prevent rotation of control assembly.

e. Remove locking clip and disconnect turnbuckle (4).

f. Remove three cable clamps (5) through accesses 6111-1 and 6111-3.

g. Disconnect control assembly (3) from wire cable assembly by removing cotter pin (6), nut (7), and bolt (8).

h. Cut lockwire and remove key (9), jamnut (10), and washer (11) securing control assembly to bulkhead.

i. Cut lockwire and remove key (12) and jamnut (13) securing control assembly to bearing.

j. Carefully draw control assembly from airplane through access 6111-1 or 6111-3. Remove washer (14) from control assembly.

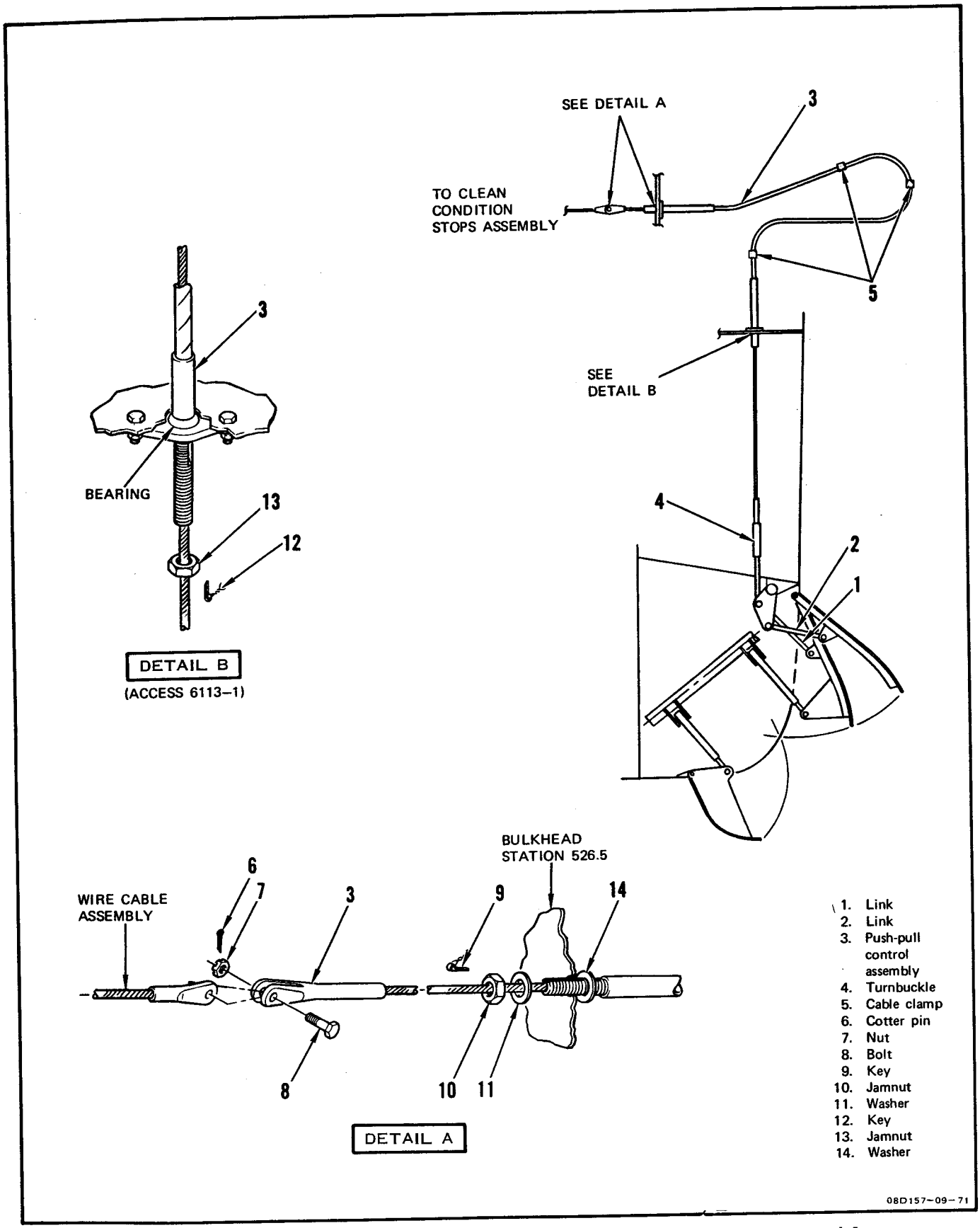


Figure 5-19. Rudder Clean Condition Stops Push-Pull Control Assembly Removal and Installation

5-84. INSTALLATION. (See figure 5-19.)

a. Install push-pull control assembly through access 6111-1 or 6111-3.

b. Install washer (14) and route terminal end of control assembly through hole in bulkhead. Route opposite end through bearing (access 6113-1).

c. Secure control assembly to bulkhead with washers (14 and 11) and jamnut (10). Tighten jamnut to 35 (±5) pound-inches torque and secure nut with key (9) and MS20995C32 lockwire.

d. Secure control assembly to bearing with jamnut (13). Tighten jamnut to 35 (±5) pound-inches torque and secure nut with key (12) and MS20995C32 lockwire.

e. Connect control assembly to wire cable assembly with bolt (8), nut (7), and new cotter pin (6).

CAUTION

Use wrench flats as backup when engaging turnbuckle to prevent rotation of control assembly.

f. Connect turnbuckle (4). Do not install locking clip.

g. Install cable clamps (5).

h. Connect link (1) to forward landing gear door (T.O. 1A-7D-2-7).

i. Close accesses 6111-1, 6111-3, 6111-4, and 6113-1.

j. Rig clean condition stops and cables (paragraph 5-33).

Section VI

UHT CONTROL SYSTEM

6-1. DESCRIPTION.

6-2. The UHT control system is a hydromechanical flight control system used to control airplane movement about the pitch axis. Control system inputs are provided by fore and aft movement of the control stick, parallel pitch trim signals, or signals from the automatic flight control system. Pitch control is obtained through two tandem hydraulic cylinders, each installed in a power control package and attached to one independent half of a unit horizontal tail.

6-3. The two power control packages are hydraulically synchronized by their input signal linkage, so that the two horizontal tail surfaces move as one. Artificial control stick feel forces are provided by bobweights, viscous dampers, and mechanical springs. The system is capable of producing maximum surface deflections of 6°45' (+45', -15') trailing edge down and 26°30' (+1°30', -1°) trailing edge up.

6-4. On airplanes AF69-6197 and subsequent, a backup system mechanically connects both horizontal tail horns through links and a yoke structure mounted above the engine on pivot pins. This arrangement ensures operation of both UHT surfaces if one power control package becomes inoperative. In addition, the backup system provides a mechanical connection between the UHT PC package input arms of both UHT power control packages through a controlex cable. The package input arms are connected to the UHT input control rods and operate the servo valves in the power control packages. Consequently, the controlex cable interconnect ensures operation of both power control packages if continuity is lost in either the left or right control linkage downstream of the UHT feel and trim linkage package. Load limiting links between each end of the controlex and the package input arms prevent jamming of the normal UHT control linkage if binding occurs in the controlex. When both UHT surfaces are operating normally, the backup system does not perform any function.

6-5. Check valves are installed at PC system pressure inlet ports of both power control cylinders. If PC system pressure is lost, the check valves retain hydraulic fluid in the power control cylinder for a few minutes. This prevents the piston from suddenly moving fully aft, pitching the airplane into a sharp nosedown attitude.

6-6. For system controls and indicators, see figure 3-1. For system arrangement, see figure 6-1.

6-7. OPERATION. (See figures 6-2 and 6-3.)

6-8. Forward or aft movement of the control stick rotates a torque tube assembly, resulting in movement of the pushrod linkage. Control stick travel is limited by two longitudinal stick stops that engage a fixed arm attached to the torque tube. The stops are adjusted to allow the control stick to overtravel slightly after the control linkage bottoms against the aft linkage stops. These stick stops prevent excessive horizontal tail rotation should the aft linkage stops fail or be misrigged.

6-9. Forward and aft bobweights provide feel forces at the control stick in proportion to the rate of change of pitch of the airplane about its center of gravity and the normal acceleration of the center of gravity. Pure vertical accelerations of the airplane cause the bobweights to oppose each other, but with unequal effect. The net result at the stick is an increase of feel force with vertical acceleration. Rotational acceleration of the airplane about its center of gravity causes the bobweights to act together to increase stick feel force. The increase in this case is greater than that for pure vertical acceleration.

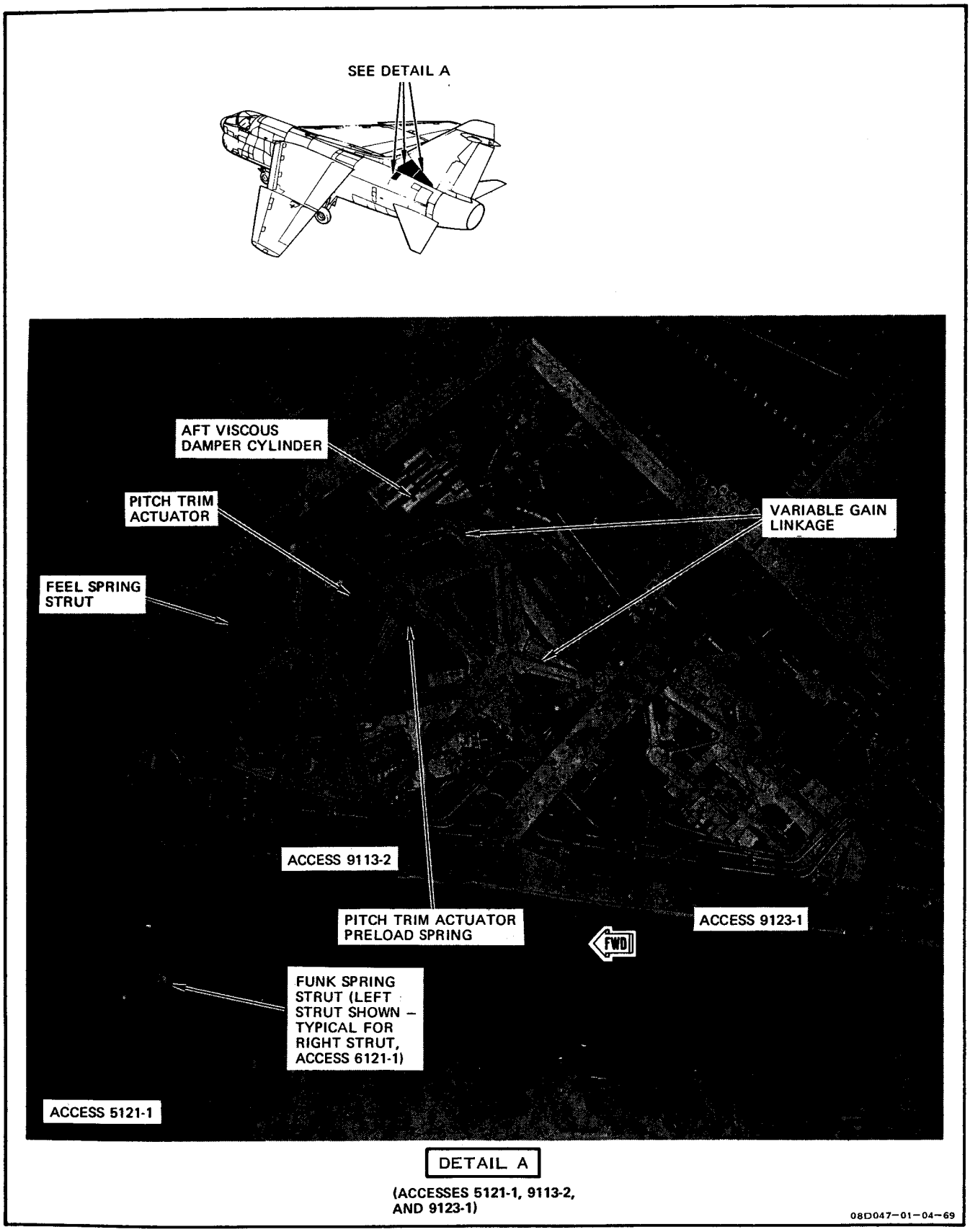
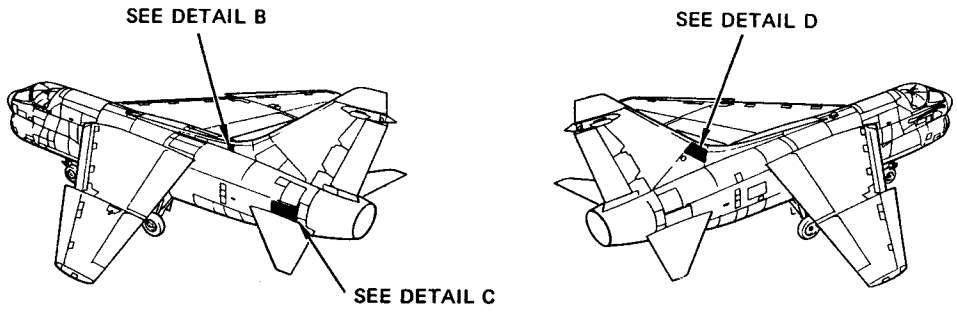
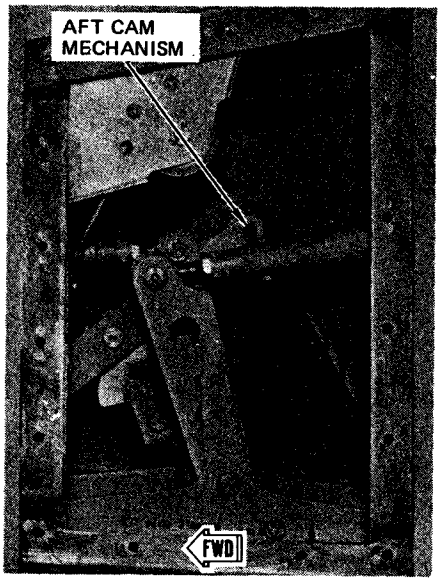
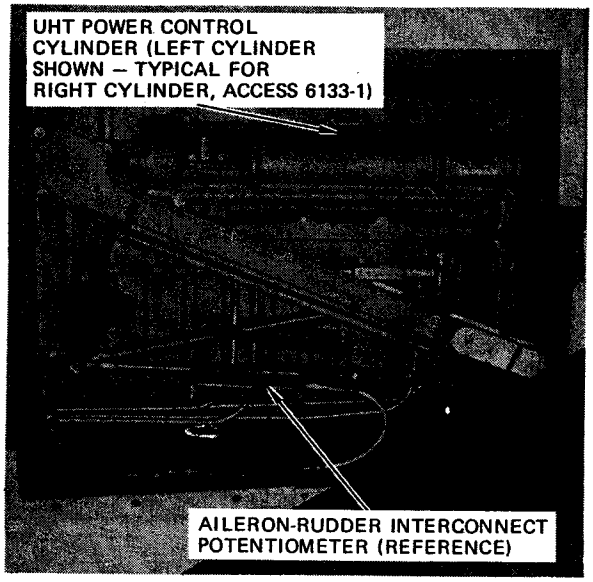


Figure 6-1. UHT Control System Arrangement (Sheet 1)

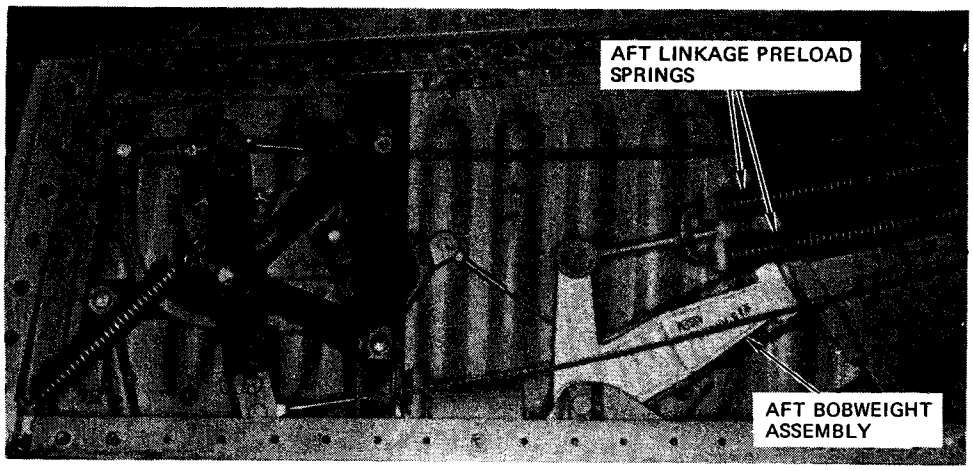




DETAIL B
(ACCESS 5121-2)



DETAIL C
(ACCESS 5133-1)



DETAIL D
(ACCESS 9113-1)

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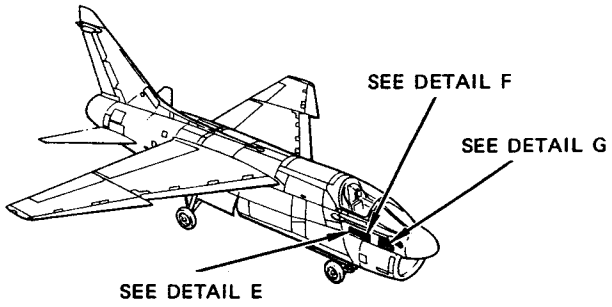
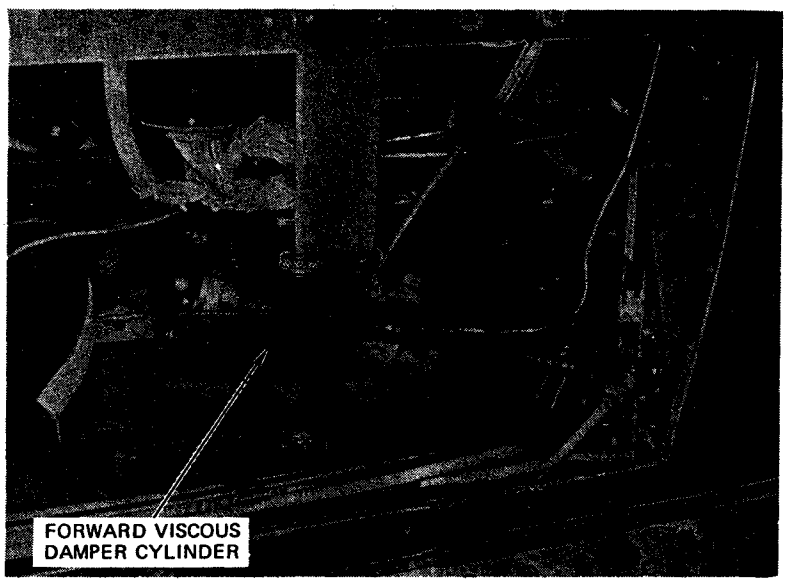
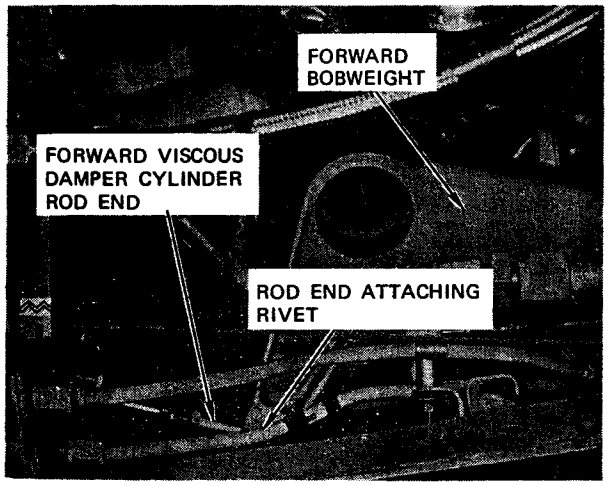
Figure 6-1. UHT Control System Arrangement (Sheet 2)

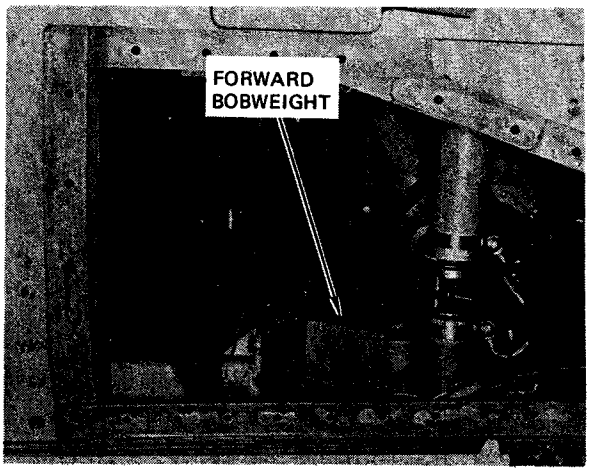




DETAIL E
(ACCESS 2221-1)



DETAIL F
(ACCESS 2211-3)



DETAIL G
(ACCESS 2211-2)

08D047-03-11-69

Figure 6-1. UHT Control System Arrangement (Sheet 3)

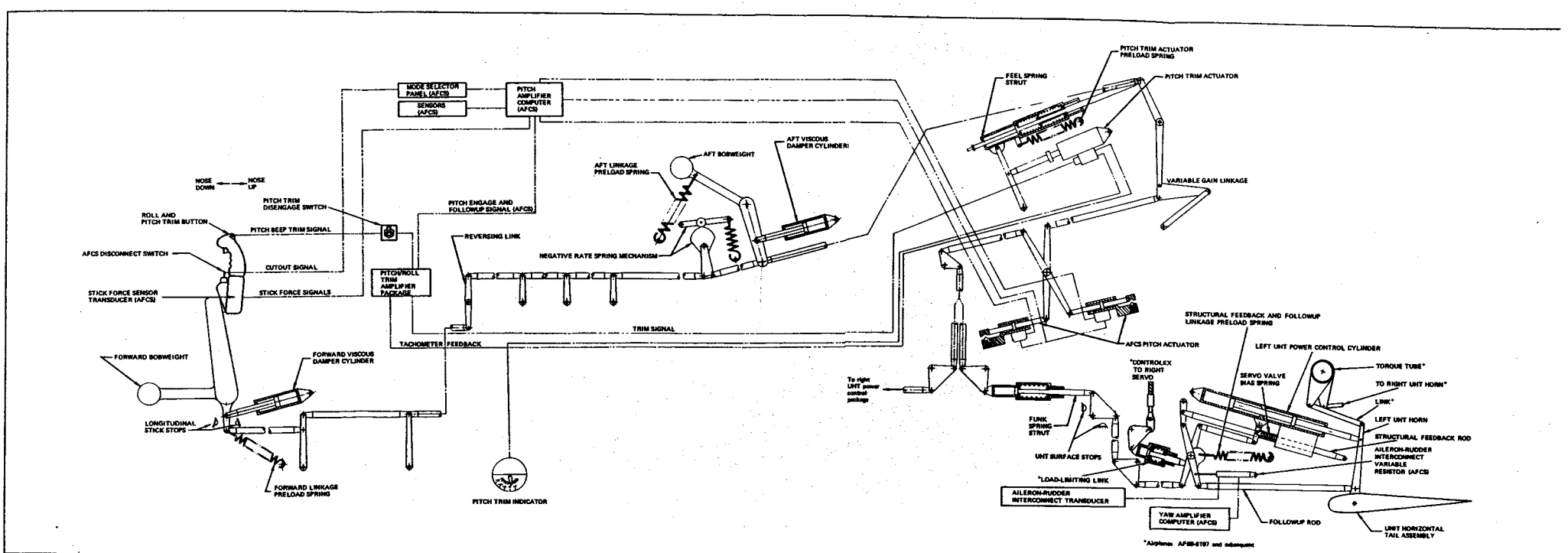
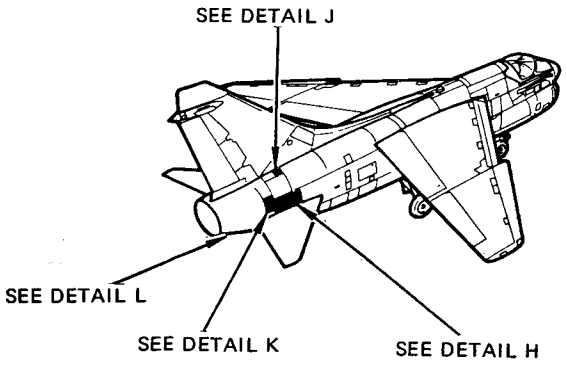
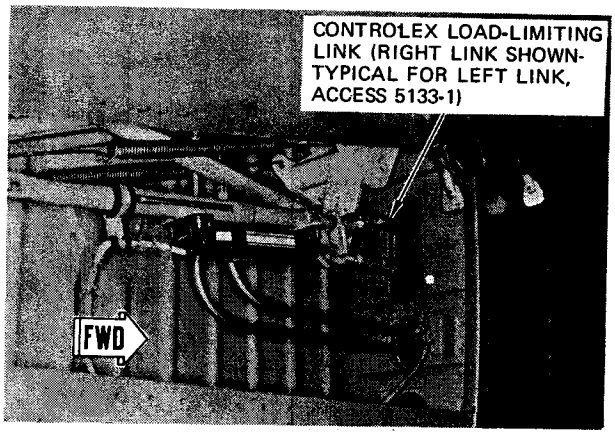


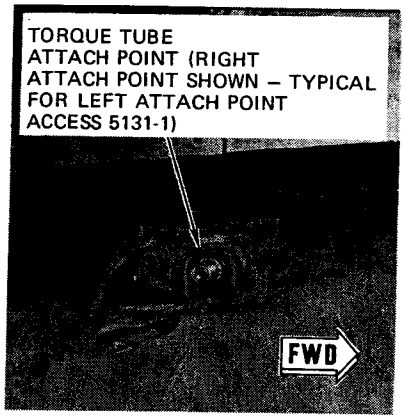
Figure 6-2. UHT Control System Schematic Diagram





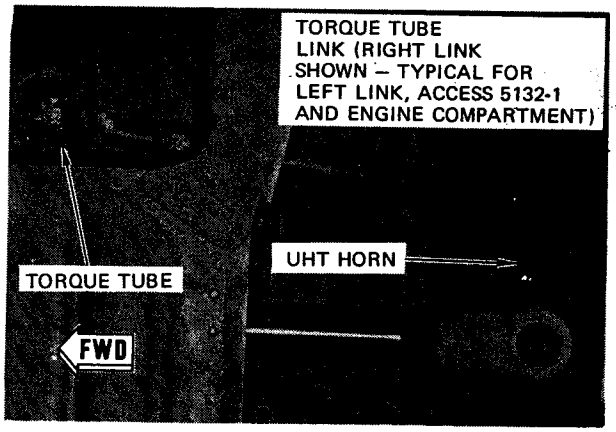
DETAIL H

ACCESS 6133-1
(SEE NOTE)



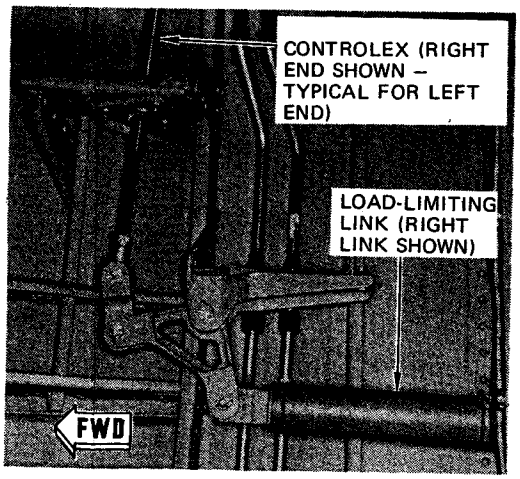
DETAIL J

ACCESS 6131-1
(SEE NOTE)



DETAIL K

ACCESS 6132-1 AND
ENGINE COMPARTMENT
(SEE NOTE)



DETAIL L

ENGINE COMPARTMENT
(SEE NOTE)

NOTE

Details H thru L on airplanes AF69-6197 and subsequent.

08D047-04-03-76

Figure 6-1. UHT Control System Arrangement (Sheet 4)

h. Cycle control stick. If feeling of sponginess of binding exists, replace aft viscous damper cylinder.

i. Disconnect external hydraulic power (T.O. 1A-7D-2-1).

j. Close access 9113-2.

6-35. UHT PROTRACTOR INSTALLATION. (See figure 6-4.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
6-4	215-00186-1 or 215-00186-27	Left UHT protractor	Check UHT deflection
	215-00186-2 or 215-00186-26	Right UHT protractor	Check UHT deflection
			TT08D089-12-68

a. Remove protective screws (CVC241-4-10 or CVC128-416R10) from fuselage (1) forward of UHT leading edge.

b. Install protractor base (2) on fuselage with thumbscrews (3).

c. Remove protective screws (CVC 241-3-4) from UHT near inboard edge.

d. Install indicator (4) on UHT with thumbscrews (5).

e. Install protractor scale (6) on protractor base with thumbscrews (7).

f. Manually align UHT leading edge to zero index as indicated by black triangle adjacent to drill hole in fuselage.

g. Adjust protractor scale to align zero on scale with zero indicator.

h. Check clearance between protractor scale and indicator with gage (8) through full travel of UHT.

6-36. RIGGING CONTROL STICK PRELOAD. (See figure 6-5.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	0013	Spring scale, 0 to 50 pounds	Measure force at control stick
6-5	215-00110-5	Rigging pin No. 10	Rig control stick preload
			TT08D091-08-69

a. Open accesses 2211-3 and 2221-1.

b. Disconnect forward viscous damper cylinder (1) by unscrewing piston rod from rod end.

c. Secure cylinder clear of linkage.

CAUTION

The UHT system is loaded in stick forward direction by the weight of the tail surfaces which tend to drop the trailing edge with power off. Deflect stick 2 or 3 inches aft before disconnecting linkage between stick and aft bobweight. Ease stick against forward stop after disconnecting linkage.

d. Disconnect link (2).

e. Insert rigging pin No. 10.

f. Attach spring scale 3.32 (±0.25) inches below top of control stick.

g. Pull aft along line perpendicular to vertical axis of stick and note force required to free rigging pin. Adjust forward linkage preload spring (3) as required to obtain force of 15.7 (±0.5) pounds to free pin. Spring tension may be adjusted by inserting the aft end of spring in one of the various holes provided in the structure.

h. Remove spring scale from stick.

6-33. BACKUP CONTROLS TORQUE TUBE LINK CHECKOUT. (Airplanes AF69-6197 and Subsequent.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment required for connecting external hydraulic power	Connect hydraulic power TT08D160-01-72

NOTE

Hydraulic power used in the following checkout may be provided by the EPP or external power source.

a. Connect external hydraulic power to PC No. 3 hydraulic system (T.O. 1A-7D-2-1) or prepare EPP for operational checkout (T.O. 1A-7D-2-11).

b. Determine integrity of left and right torque tube links as follows:

NOTE

Avoid rapid movement of control stick to prevent air from entering PC No. 1 and PC No. 2 hydraulic systems.

1. Slowly pull control stick aft until UHT is approximately 10° trailing edge up. If right surface does not move, the right link is broken.

2. Slowly return UHT to neutral. If right surface does not return to neutral or lags behind left surface, the left link is broken.

3. Synchronous movements in both directions indicate links are intact.

c. Perform hydraulic system air check (T.O. 1A-7D-2-1).

d. Disconnect external hydraulic power or disconnect equipment required for EPP ground operation.

e. If either link is determined to be defective, replace defective link (paragraph 6-101).

6-34. DEFECTIVE FORWARD AND AFT VISCOUS DAMPER CYLINDER ISOLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external hydraulic power	Connect hydraulic power TT08D087-12-68

NOTE

If, after proper bleeding and servicing of the viscous dampers (T.O. 1A-7D-2-1), a feeling of sponginess or binding exists during control stick cycling, perform the following isolation procedure to determine which damper is defective.

a. Open access 9113-2.

b. Disconnect rod end of aft viscous damper cylinder from bobweight arm. Tie cylinder up to prevent damage to cylinder and surrounding structure during control stick cycling.

c. Ensure forward viscous damper cylinder is properly serviced (T.O. 1A-7D-2-1).

d. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

e. Move control stick forward. If feeling of sponginess or binding exists at control stick, replace forward viscous damper cylinder.

f. When forward viscous damper cylinder operation is satisfactory reconnect aft viscous damper cylinder.

g. Ensure aft viscous damper cylinder is properly serviced (T.O. 1A-7D-2-1).

Table 6-2. UHT Control System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
11. UHT surface positions noted after cycling control stick are not equal within 0°45'.		
Forward linkage preload spring improperly rigged.	Check forward linkage preload spring rigging.	Rig forward linkage preload spring.
Aft linkage preload spring improperly rigged.	Check aft linkage preload spring rigging.	Rig aft linkage preload spring.
12. Average UHT position in full up and full down trim not within limits after each of two control stick cycles.		
Forward and aft viscous dampers not properly serviced.	Check forward and aft viscous dampers for proper servicing (T.O. 1A-7D-2-1).	Service forward and aft viscous dampers (T.O. 1A-7D-2-1). Perform UHT control system operational checkout. If controls are not normal, check for defective viscous damper.
Defective forward or aft viscous damper.	Perform viscous damper isolation procedure.	Replace defective viscous damper.
Excessive friction in feel and trim linkage.	Inspect linkage for binding.	Repair or replace defective linkage.
13. Rigging pin No. 15 cannot be inserted.		
Feel and trim input link not properly adjusted.	Check feel and trim input link adjustment.	Adjust feel and trim input link until rigging pin No. 15 can be inserted, then retrim surfaces to 3° (±30') leading edge down. If surfaces cannot be trimmed to 3° (±30'), adjust pitch trim actuator.

* Airplanes AF69-6197 and subsequent

Table 6-2. UHT Control System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
8. UHT movement is not smooth.		
PC system surge damper accumulator not properly serviced.	Check PC system accumulators for proper servicing (T.O. 1A-7D-2-1).	If accumulators are properly serviced, check for air in system. If accumulators are not properly serviced, service system accumulators (T.O. 1A-7D-2-1).
Air in PC systems.	None.	Bleed UHT PC cylinders.
9. UHT surfaces not within 0°12' of each other.		
Surfaces not synchronized.	None.	Synchronize UHT surfaces.
		NOTE Engine removal is optional for the following remedy. Refer to removal procedures (paragraph 6-99) for alternate access to controlex.
Excessive friction in backup controls controlex assembly.	Remove access 5222-3 (T.O. 1A-7D-2-1) and disconnect controlex rod ends from bellcrank links. Disconnect bellcrank from right load-limiting link to provide access for spring scale. Determine force required to move the sliding part of controlex through full travel in both directions.	If force exceeds 4.0 pounds, remove engine (T.O. 1A-7D-2-5) and adjust cable clamp spacers and screw lengths as required to reduce friction; then recheck with spring gage. If adjustments fail to reduce force to less than 4.0 pounds, immerse each end of controlex in trichloroethane or methyl chloroform and stroke controlex to remove contamination. If cleaning does not eliminate binding, replace controlex.
10. UHT surface throws are not within limits.		
Longitudinal stick stops improperly rigged.	Check longitudinal stick stops rigging.	Rig longitudinal stick stops.
UHT surface stops improperly rigged.	Check surface stops rigging.	Rig UHT surface stops.
UHT PC cylinder improperly rigged.	Check UHT PC cylinder rigging.	Rig UHT PC cylinder.

Table 6-2. UHT Control System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
6. Excessive force required to break out control stick or control stick binds.		
Defective forward viscous damper.	Open access 9113-2. Disconnect input links to feel and trim linkage. Cycle control stick.	If binding does not exist, check for defective aft viscous damper.
	If binding exists, disconnect forward viscous damper. Cycle control stick.	If binding does not exist, check forward viscous damper for overservicing (T.O. 1A-7D-2-1). If properly serviced, replace forward viscous damper.
		If binding exists, check for defective linkage forward of feel trim input link.
Defective feel spring strut.	Cycle control stick slowly and smoothly and check UHT for jerky movement.	If jerky movement exists, replace feel spring strut.
Defective linkage forward of feel and trim input link.	Inspect linkage between control stick and input rod.	Replace defective linkage.
Defective aft viscous damper.	Connect input links to feel and trim linkage. Disconnect aft viscous damper. Cycle control stick.	If binding does not exist, check aft viscous damper for overservicing (T.O. 1A-7D-2-1). If properly serviced, replace defective aft viscous damper. If binding exists, check for defective linkage aft of input link to feel and trim linkage.
Defective linkage aft of input link to feel and trim linkage.	Inspect linkage aft of input link to feel and trim linkage.	Replace defective linkage.
7. UHT surface can be moved manually more than 1°0' from neutral with pitch trim neutral and PC system pressurized.		
Defective UHT PC package.	None.	Replace defective UHT PC package.
Worn linkage components.	Inspect linkage for looseness.	Replace worn components.

Table 6-2. UHT Control System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
		NOTE Engine removal is optional for the following remedy. Refer to removal procedures (paragraph 6-99) for alternate access to controlex.
Excessive friction in backup controls controlex assembly.*	Remove access 5222-3 (T.O. 1A-7D-2-1) and disconnect controlex rod ends from bellcrank links. Disconnect bellcrank from right load-limiting link to provide access for spring scale. Determine force required to move the sliding part of controlex through full travel in both directions.	If force exceeds 4.0 pounds, remove engine (T.O. 1A-7D-2-5) and adjust cable clamp spacers and screw lengths as required to reduce friction; then recheck with spring gage. If adjustments fail to reduce force to less than 4.0 pounds, immerse each end of controlex in trichloroethane or methyl chloroform and stroke controlex to remove contamination. If cleaning does not eliminate binding, replace controlex.
5. Control stick does not have positive neutral position.		
Broken forward viscous damper shearpin.	Open access 2211-3. Check forward viscous damper shearpin.	If forward viscous damper shearpin is broken, replace forward viscous damper.
Forward and aft viscous dampers not properly serviced.	Check forward and aft viscous dampers for proper servicing (T.O. 1A-7D-2-1).	Service forward and aft viscous dampers (T.O. 1A-7D-2-1).
		NOTE Engine removal is optional for the following remedy. Refer to removal procedures (paragraph 6-99) for alternate access to controlex.
Excessive friction in backup controls controlex assembly.	Remove access 5222-3 (T.O. 1A-7D-2-1) and disconnect controlex rod ends from bellcrank links. Disconnect bellcrank from right load-limiting link to provide access for spring scale. Determine force required to move the sliding part of controlex through full travel in both directions.	If force exceeds 4.0 pounds, remove engine (T.O. 1A-7D-2-5) and adjust cable clamp spacers and screw lengths as required to reduce friction; then recheck with spring gage. If adjustments fail to reduce force to less than 4.0 pounds, immerse each end of controlex in trichloroethane or methyl chloroform and stroke controlex to remove contamination. If cleaning does not eliminate binding, replace controlex.

Table 6-2. UHT Control System Troubleshooting

Probable Cause	Isolation Procedure	Remedy
1. Pitch trim indicator does not indicate correctly.		
Pitch trim actuator not properly adjusted.	Check pitch trim actuator adjustment.	If pitch trim actuator is not properly adjusted, replace actuator.
Defective pitch trim indicator or pitch trim actuator.	Troubleshoot pitch trim indicator system.	Replace pitch trim indicator or pitch trim actuator.
2. UHT does not move when control stick is moved.		
UHT power control cylinder check valve reversed.	Open access 5133-1 or 6133-1 (T.O. 1A-7D-2-2). Check flow direction arrows on power control cylinder check valves.	Install check valve so free flow arrow points toward cylinder.
3*. With power to only PC No. 2 or PC No. 3, only one UHT surface has normal response to stick movement.		
Torque tube link broken.	Open access 5132-1 and/or 6132-1 and check for broken link.	Replace link (paragraph 6-101).
4. Control stick is spongy, hesitates, movement is jerky or rapid, or overshoots when returning to neutral.		
Forward and aft viscous dampers not properly serviced.	Check forward and aft viscous dampers for proper servicing (T.O. 1A-7D-2-1).	Service forward and aft viscous dampers (T.O. 1A-7D-2-1). Perform UHT control system operational checkout. If controls are not normal, check for defective viscous damper.
Defective forward or aft viscous dampers.	Perform viscous damper isolation procedure.	Replace defective viscous damper.
Air in system.	Perform hydraulic system air check (T.O. 1A-7D-2-1).	Bleed system.

m. Pull control stick fully aft. UHT position shall be 26°30' (+1°30', -1°0') leading edge down. (10)

n. Move control stick 1 1/2 inches forward of neutral and release. Note UHT position.

o. Move control stick 1 1/2 inches aft of neutral and release. Note UHT position. Position shall not be more than 0°45' from position noted in step n. (11)

p. Trim UHT for full nose up.

q. Move control stick 1 1/2 inches forward of neutral and release. Note UHT position.

r. Move control stick 1 1/2 inches aft of neutral and release. Note UHT position.

s. Calculate average UHT position from positions noted in steps q and r. Average position shall be 14°30' (+2°0', -1°0') leading edge down. (12)

t. Trim UHT for full nose down. Repeat steps q and r.

u. Calculate average UHT position. Average position shall be 2°0' (±1°0') leading edge up. (12)

v. Attach spring scale to control stick at 3.32 (±0.25) inches from top of stick (center of grip).

NOTE

Force shall be applied perpendicular to the centerline of control stick.

w. Gradually apply force in the forward direction. Note breakout force the instant UHT movement begins.

x. Gradually apply force in aft direction. Note breakout force the instant UHT movement begins. Breakout force in either direction shall be 3 (±1) pounds. (6)

y. Open accesses 2211-3 and 9113-2.

z. Trim UHT surfaces to 3° (±0°30') leading edge down, and then insert rigging pin No. 10.

aa. Insert rigging pin No. 15. (13)

ab. Remove rigging pins No. 10 and 15.

NOTE

To minimize the entrance of air when all PC hydraulic systems are not pressurized during control cycling, operate the controls slowly and cycle only the minimum number of times necessary to verify correct operation.

ac. Shut down external hydraulic power. Apply full pressure to PC No. 1 system only. Repeat steps f through j.

ad. On airplanes AF69-6197 and subsequent, shut down external hydraulic power to PC No. 1 hydraulic system, and apply full pressure to PC No. 2 and PC No. 3 hydraulic systems.

ae. Repeat steps f through j.

af. On airplanes AF69-6197 and subsequent, perform backup controls torque tube link checkout (paragraph 6-33).

ag. Perform hydraulic system air check (T.O. 1A-7D-2-1).

ah. Disconnect external electrical and hydraulic power.

ai. Remove UHT protractors.

aj. Close accesses.

6-31. TROUBLESHOOTING.

Test Equipment Required

Figure & Index No.	*Name*	*AN Type Designation*	*Use and Application*
	Spring scale, 0 to 5 pounds	719-5	Measure force required to operate controlex

TT08D164-11-73

6-32. Refer to table 6-2 for troubleshooting information. Malfunctions in the table are listed numerically and are related to a corresponding number, or numbers, following a step in the operational checkout.

g. Move control stick fully forward and release. Move stick fully aft and release. Stick shall return slowly, without hesitation, to neutral position and UHT surfaces shall respond to stick movement. {2, 3, 4, and 5}

h. Cycle control stick three to five times with pitch trim indicating $3^{\circ}0'$ ($\pm 0^{\circ}30'$) pitch up, then with full noseup trim, and with full nosedown trim. There shall be no binding as stick is cycled. Pitch trim indication shall change as trim is changed. {1 and 6}

i. With pitch trim indication of $3^{\circ}0'$ ($\pm 0^{\circ}30'$) pitch up, attempt to move each UHT surface manually. Surfaces must not move more than $1^{\circ}0'$ with all other rigging requirements met. {7}

j. Cycle control stick and check for smooth response. {8}

k. Trim UHT and check for synchronization within $0^{\circ}12'$ of UHT surfaces at $14^{\circ}30'$ (full trim), 10°, 8°, 6°, 4°, 3°, and 2° leading edge down, and at 2° (full trim) leading edge up. Return trim to $3^{\circ}0'$ ($\pm 0^{\circ}30'$) leading edge down after checks. {9}

l. Push control stick fully forward. UHT position shall be $6^{\circ}45'$ ($+0^{\circ}45'$, $-0^{\circ}15'$) leading edge up. {10}

6-28. MAINTENANCE PRECAUTIONS.

WARNING

To prevent injury to personnel or aircraft damage, do not attempt to block or restrain UHT while hydraulic power is applied. Before maintenance, ensure three minutes has been allowed for pressure bleed down after shut down of hydraulic power.

NOTE

For removal of access screws and access panels 5133-1 or 6133-1, the UHT must be manually moved to full nose down position by applying upward force against trailing edge while the control stick is moved AFT.

6-29. The following precautions shall be observed when performing UHT control system maintenance and rigging.

a. Apply hydraulic pressure to PC hydraulic systems only when specified in the applicable procedure.

b. Apply specific hydraulic pressure as indicated in the procedure; it is imperative that no greater pressure be applied.

c. Do not move any components in UHT PC package with hydraulic pressure applied. With 3,000 psi hydraulic pressure applied, UHT surface movement rate is 98.9° per second. Because of this rapid movement rate, it is imperative that hydraulic pressures specified in UHT package rigging procedures be strictly adhered to.

d. Do not connect external hydraulic power or apply hydraulic pressure before ensuring that the area surrounding UHT surfaces is clear.

e. Prevent inadvertent movement of the control stick or control linkage while UHT rigging is in progress.

f. Do not move control surfaces either with control stick or manually when rigging pins are installed, except as specified in the procedure.

6-30. OPERATIONAL CHECKOUT.

Test Equipment Required

Figure & Index No.	*Name*	*AN Type Designation*	*Use and Application*
	Equipment for connecting external electrical power		Connect electrical power
	Equipment for connecting external hydraulic power		Connect hydraulic power
	Spring scale, 0 to 5 pounds	719-5	Measure control stick breakout force
	Rigging pin No. 10	215-00110-5	Check rigging
	Rigging pin No. 15	215-00110-7	Check rigging

TT08D086-10-70

NOTE

A number, or numbers, enclosed in braces at the end of a step in the following checkout is a reference to a corresponding number in troubleshooting table 6-2.

a. Install UHT protractors (paragraph 6-35).

a-1. Ensure FOR and AFT viscous dampners are properly serviced (T.O. 1A-7D-2-1) before performing operational checkout.

b. Connect external electrical power (T.O. 1A-7D-2-1).

c. On airplanes through AF69-6196, connect external hydraulic power to PC No. 1 and PC No. 2 hydraulic systems (T.O. 1A-7D-2-1). Apply 3,000 psig hydraulic pressure.

d. On airplanes AF69-6197 and subsequent, connect external hydraulic power to PC No. 1, PC No. 2, and PC No. 3 hydraulic systems (T.O. 1A-7D-2-1). Apply 3,000 psig hydraulic pressure.

e. Place pitch trim disengage switch in ON.

f. Trim pitch control system to obtain 3° (±30') pitch up indication on pitch trim indicator. {1}

Table 6-1. UHT Control System Components

Component	Access	Function
Actuator, pitch trim	9113-2	Repositions UHT in response to trim signals.
Bobweight, aft	9113-1	Counteracts pitch oscillations.
Bobweight, forward	2211-2	Counteracts pitch oscillations.
Control assembly, push-pull, backup controls*	Engine compartment	Provides operation of both UHT PC packages if normal control linkage to one package fails.
Cylinder, aft viscous damper	9113-2	Resists rapid or abrupt control stick movement to prevent overcontrol of the UHT.
Cylinder, forward viscous damper	2221-5	Resists rapid or abrupt control stick movement to prevent overcontrol of the UHT.
Cylinder, UHT power control (left/right)	5133-1, 6133-1	Positions UHT in response to system demands.
Link, drag, backup controls (2)*	Engine compartment	Connects torque tube to UHT horn.
Link, load-limiting, backup controls (2)*	Engine compartment	Allows operation of normal UHT control linkage if push-pull control assembly binds.
Linkage, variable gain	9113-2	Increases control surface sensitivity at low control stick deflections.
Spring, aft linkage preload	9113-1	Prevents forward bobweight from providing a control stick force during level flight.
Spring, forward linkage preload	2221-5	Prevents aft bobweight from providing a control stick force during level flight.
Strut, feel spring	9113-2	Simulates conventional feel forces at the control stick.
Strut, funk spring (left/right)	5121-1, 6121-1	Protects linkage and PC cylinder servo valve from excessive loading.
Spring mechanism negative rate	5121-2	Compensates for inertia loads on the control linkage.
Torque tube, backup controls*	5131-2, 6131-2	Mechanically connects UHT horns to provide operation of both UHT surfaces if one UHT package fails.
Unit horizontal tail (left/right) assembly	Aft fuselage	Controls pitch attitude of airplane.

*Airplanes AF69-6197 and subsequent

deflections create a small increase in stick force.

6-16. A pitch trim actuator in the control linkage acts as a fixed-length link, but with inputs from the pitch trim system this length is changed to reposition the horizontal tail. For information on the pitch trim system, refer to paragraph 7-1.

6-17. An AFCS pitch actuator is connected in the linkage system, downstream of the variable gain linkage, by a walking beam linkage. The walking beam linkage acts as a fixed-length link and simple idler in the system. When the AFCS pitch actuator receives signals from the automatic flight control system, it changes the pivot points of the walking beam linkage and the linkage acts as a variable-length link. This produces control system inputs independent of the control stick. For information on the automatic flight control system, refer to T.O. 1A-7D-2-9.

6-18. Downstream of the AFCS actuator, the control system linkage divides into identical right and left linkages which are routed around the fuselage contour and aft to a power control package. The two horizontal tail surfaces are hydraulically synchronized to act as a single control surface.

6-19. Any combination of control stick, pitch trim, or AFCS actuator travel beyond that permitted by the aft linkage stops will deflect the funk spring struts in the linkage. Because of their high breakout force, the struts normally act as fixed-length links.

6-20. Stops in the linkage downstream of the funk spring struts limit the linkage travel to approximately 6°45' trailing edge down and 26°30' trailing edge up tail position.

6-21. Each horizontal tail is positioned by a power control package. The PC package input linkage is connected to the servo valve input rod so that movement of the rod will cause the valve to direct hydraulic fluid to extend or retract the PC cylinder piston rod. The piston rod is connected to a horizontal tail horn which is attached to the horizontal tail by a torque tube. As the piston extends or retracts, the horn and the horizontal tail are rotated about their axis.

6-22. On airplanes AF69-6197 and subsequent, a backup system is provided to ensure operation of both UHT surfaces if either UHT power control package becomes inoperative, or if continuity is lost in the control linkage between the UHT feel and trim linkage package and either power control package. The backup system provides a direct mechanical link between both UHT assemblies and between the linkage arms which operate the servo valve input rods in the UHT power control packages.

6-23. A followup rod is attached to the horizontal tail horn and is connected at the forward end to a followup arm. The followup arm is connected to the PC package input linkage. Movement of the horizontal tail horn is transmitted through the followup rod and arm to oppose motion of the PC package input linkage. The servo valve is returned to its neutral position by this arrangement when the horizontal tail reaches the selected throw.

6-24. On airplanes t' gh AF69-6196 the servo valve and PC cylinder assemblies are redundant tandem units to ensure control of the UHT if one PC hydraulic system fails. Half of the servo valve directs PC No. 1 hydraulic pressure to the corresponding half of the PC cylinder, and the other half of the servo valve directs PC No. 2 hydraulic pressure to the other half of the PC cylinder. Normally the two systems work together to position the UHT halves, but if one system fails, the other system continues to operate the cylinder.

6-25. On airplanes AF69-6197 and subsequent, the right UHT package is supplied by PC No. 1 and PC No. 2 hydraulic systems. The left package is supplied by PC No. 1 and PC No. 3 hydraulic systems.

6-26. COMPONENTS.

6-27. For a list of system components, their locations (accesses), and functions, refer to table 6-1.

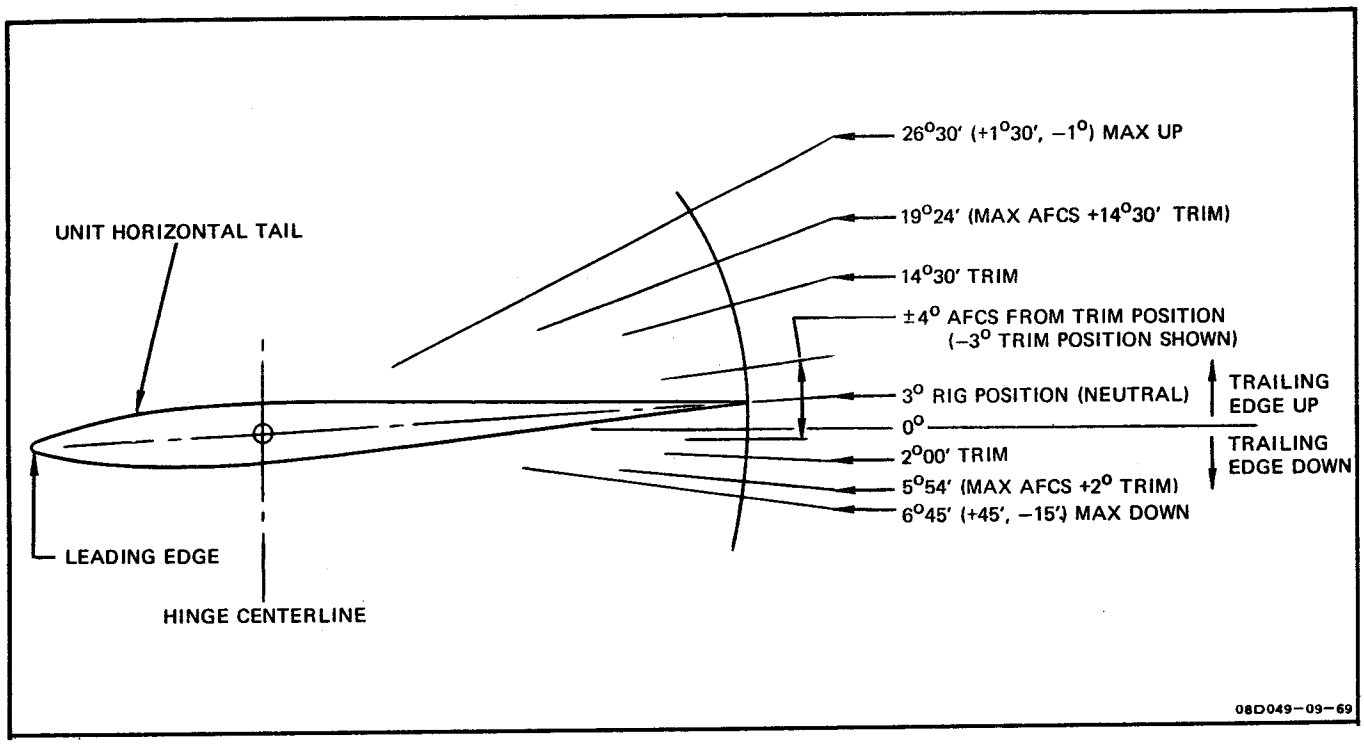


Figure 6-3. UHT Throws

6-10. Forward and aft linkage preload springs approximately balance each other. This arrangement keeps the linkage between the springs under load and eliminates effects of the system slop.

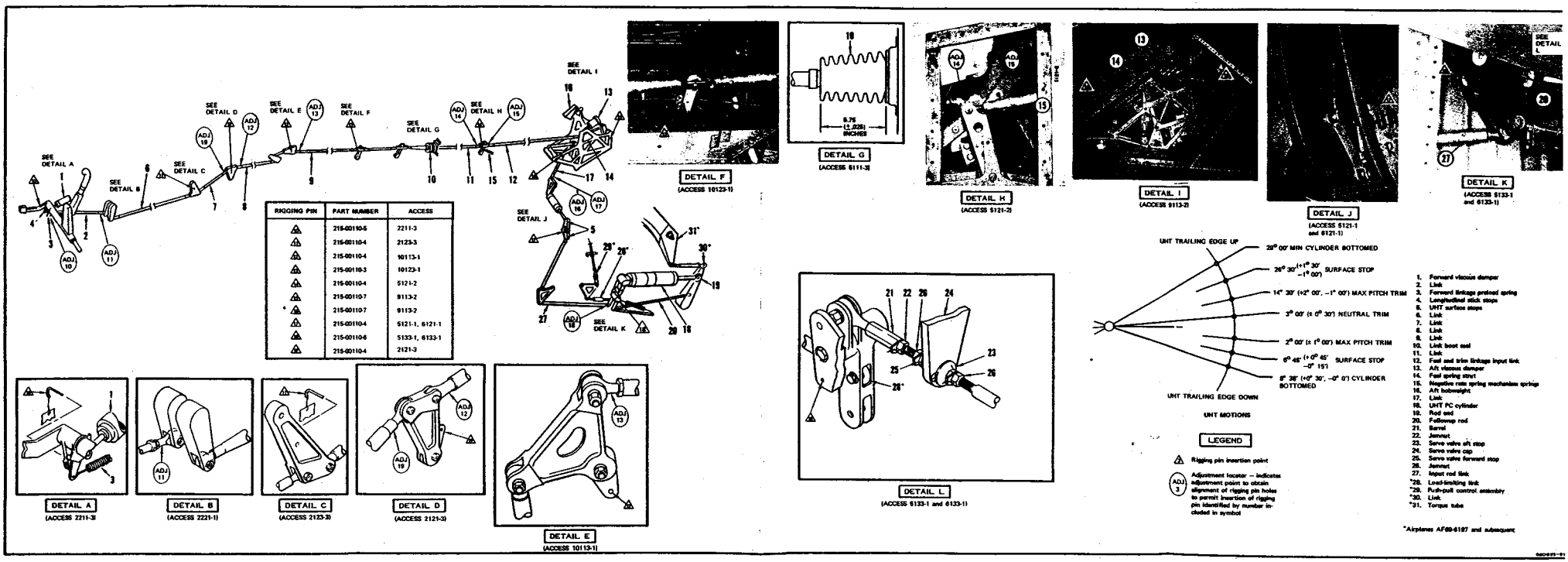
6-11. Forward and aft viscous damper cylinders resist rapid control stick movement, providing a feel force proportional to rate of stick movement. They also damp oscillations caused by the bobweights. As the control stick is moved forward or aft, the torque tube is rotated, stroking the forward viscous damper cylinder piston rod. The aft viscous damper cylinder is stroked by the pushrod system.

6-12. An aft cam mechanism, consisting of a cam, roller, and spring arrangement is connected into the control linkage upstream of the aft bobweight. The mechanism inserts a force into the control linkage which minimizes stick forces that result from unbalance at the preload springs. Unbalance occurs when these springs are displaced because one is lengthened, increasing its load, while the other is shortened.

6-13. A variable gain linkage progressively changes control surface response to stick movement, increasing it as the control stick is moved either direction away from neutral.

6-14. A dual rate feel spring strut simulates conventional feel forces at the control stick. The strut is mounted between an idler and a bellcrank of the feel and trim linkage package. Control stick movement displaces the strut through movement of the control linkage. The internal spring force in the strut opposes this change in length and must be overcome by the pilot, thus resulting in feel forces at the control stick. When the control stick is released, the spring force returns the stick to neutral.

6-15. The feel spring strut works in two stages. The first stage spring presents a relatively rapid increasing feel force for a small control stick deflection from neutral. The second stage action occurs as the control stick is moved to the point at which a force of approximately 7.3 pounds is reached at the grip. Beyond this point, relatively large stick



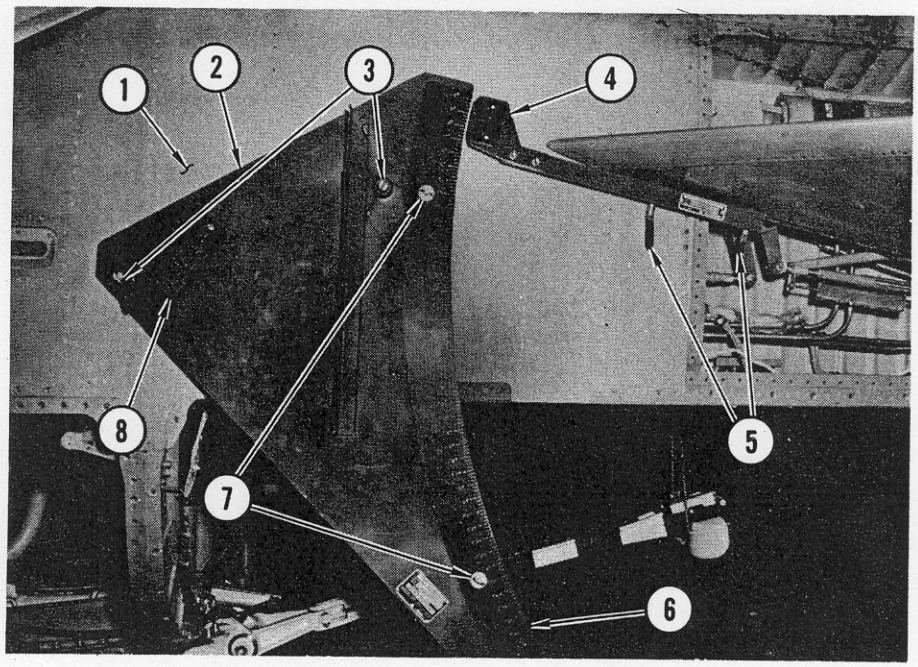
RIGGING PIN	PART NUMBER	ACCESS
1	215-00110-5	2211-3
2	215-00110-4	2123-3
3	215-00110-4	10113-1
4	215-00110-3	10123-1
5	215-00110-4	5121-2
6	215-00110-7	9113-2
7	215-00110-7	9113-2
8	215-00110-4	5121-1, 6121-1
9	215-00110-6	5133-1, 6133-1
10	215-00110-4	2121-3

1. Forward viscous damper
2. Link
3. Forward linkage preload spring
4. Longitudinal stick stops
5. UHT surface stops
6. Link
7. Link
8. Link
9. Link
10. Link boot seal
11. Link
12. Fwd and trim linkage input link
13. Aft viscous damper
14. Fwd spring strut
15. Negative rate spring mechanism springs
16. Aft bobweight
17. Link
18. UHT PC cylinder
19. Rod end
20. Followup rod
21. Barrel
22. Jamnut
23. Servo valve aft stop
24. Servo valve cap
25. Servo valve forward stop
26. Jamnut
27. Input rod link
*28. Load-limiting link
*29. Push-pull control assembly
*30. Link
*31. Torque tube

*Airplanes AF69-6197 and subsequent

DETAIL A (ACCESS 2211-3)
DETAIL B (ACCESS 2221-1)
DETAIL C (ACCESS 2123-3)
DETAIL D (ACCESS 2121-3)
DETAIL E (ACCESS 10113-1)
DETAIL F (ACCESS 10123-1)
DETAIL G (ACCESS 6111-3)
DETAIL H (ACCESS 5121-2)
DETAIL I (ACCESS 9113-2)
DETAIL J (ACCESS 5121-1 and 6121-1)
DETAIL K (ACCESS 5133-1 and 6133-1)
DETAIL L (ACCESS 5133-1 and 6133-1)

Figure 6-5. UHT Control System Rigging



1. Fuselage
2. Protractor base
3. Thumbscrew
4. Indicator
5. Thumbscrew
6. Protractor scale
7. Thumbscrew
8. Gage

08D061-12-68

Figure 6-4. UHT Protractor Installation

i. Remove rigging pin No. 10.

j. Reconnect link (2).

k. Screw piston rod of forward viscous damper cylinder (1) into rod end and secure with MS20995C32 lockwire. (See figure 6-7.)

l. Perform operational checkout (paragraph 6-30).

m. Close accesses 2211-3 and 2221-1.

6-37. RIGGING LONGITUDINAL STICK STOPS. (See figure 6-5.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external hydraulic power	Connect hydraulic power

TT08D092-12-68

a. Open accesses 2211-2 and 2211-3.

b. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

c. Check that pitch trim is in neutral.

d. Cut lockwire and back off longitudinal stick stops (4).

e. Move stick aft until UHT surface stops (5) engage. Use minimum force necessary to engage stops.

f. Adjust aft longitudinal stick stopbolt (4) until it contacts pad. Back bolt off one-half turn.

g. Secure bolt with MS20995C32 lockwire.

h. Move stick forward until UHT surface stops (5) engage.

i. Adjust forward longitudinal stick stopbolt (4) until it contacts pad. Back bolt off one-half turn.

j. Secure with MS20995C32 lockwire.

k. Perform operational checkout (paragraph 6-30).

l. Close accesses 2211-2 and 2211-3.

6-38. RIGGING LINKAGE FROM CONTROL STICK TO FEEL AND TRIM LINKAGE. (See figure 6-5.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
6-5	215-00110-3	Rigging pin No. 13	Rig linkage
6-5	215-00110-4	Rigging pins No. 11, 12, 14, and 19	Rig linkage
6-5	215-00110-5	Rigging pin No. 10	Rig linkage
6-5	215-00110-7	Rigging pin No. 15	Rig linkage
			TT08D093-08-69

a. Open accesses 10123-1, 5121-2, 2211-2, 2211-3, 2123-3, 5111-3, 9113-2, 2221-1, 2123-1, 2121-3, 10113-1, and 4113-11.

b. Insert rigging pin No. 10.

c. Adjust link (2) as required to insert rigging pin No. 11.

d. Adjust link (7) as required to insert rigging pin No. 19.

e. Adjust link (8) as required to insert rigging pin No. 12.

f. Adjust link (9) as required to insert rigging pin No. 13.

g. Adjust link boot seal (10) through access 5111-3 to length of 5.75 (±0.25) inches from most forward end of boot to rear plate of boot.

h. Adjust link (11) as required to insert rigging pin No. 14.

i. Adjust link (12) as required to insert rigging pin No. 15.

CAUTION

To avoid damage to the control system, restrain the control stick from bottoming in the forward direction when removing the rigging pins.

j. Remove rigging pins.

k. Perform operational checkout (paragraph 6-30).

l. Close accesses 2123-1, 2123-3, 10123-1, 5121-2, 2211-2, 2211-3, 5111-3, 9113-2, 2221-1, and 2121-3.

6-39. RIGGING AFT LINKAGE PRELOAD SPRINGS. (See figure 6-5.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external hydraulic power	Connect hydraulic power
	0013	Spring scale, 0 to 50 pounds	Measure force at control stick
6-5	215-00110-5	Rigging pin No. 10	Rig linkage
			TT08D094-11-73

a. Open accesses 2211-3, 5121-2, 9113-1, and 9113-2.

b. Install UHT protractors (paragraph 6-35).

c. Disconnect forward viscous damper cylinder (1) by unscrewing piston rod from rod end. Retract piston rod. Secure cylinder and rod end clear of linkage.

d. Disconnect aft viscous damper cylinder (13) and secure to access door flange. Check that cylinder is clear of linkage.

e. Disconnect feel spring strut (14) and secure clear of linkage.

f. Disconnect aft cam mechanism springs (15). Note spring attaching holes so springs can be attached to same holes later. Secure arm and other loose parts to prevent interference with linkage.

g. Check that aft linkage preload spring hanger is centered on threaded portion of end fitting.

h. Insert rigging pin No. 10.

i. Establish control stick centering position with rigging pin removed by measuring from point on instrument panel to top of control stick. Record measurement.

j. Remove all rigging pins.

k. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

l. Attach spring scale 3.32 (±0.25) inches below top of control stick.

m. Place stick approximately 2 inches forward of centering position determined in step i.

n. Pull stick aft with spring scale along line perpendicular to vertical axis of stick. Pull with minimum force required to keep stick moving. Note force as stick passes through centering position.

o. Repeat step n for forward stick movement, starting with stick approximately 2 inches aft of centering position Pull stick forward.

p. Shut down external hydraulic power.

q. Adjust aft linkage preload springs, by moving hanger on end fitting, if forces in steps n and o differ by more than 0.5 pound.

NOTE

Increased tension on springs will cause force in step n to decrease, and force in step o to increase. Rig negative rate spring mechanism (paragraph 6-40), if aft linkage springs require adjustment.

r. Screw forward viscous damper onto rod end until distance from center of rod end attaching hole to end of thread relief is 1.75 (±0.03) inches.

s. Connect aft viscous damper cylinder (13). Do not alter length.

t. Connect feel spring strut (14). Do not alter length.

u. Connect aft cam mechanism springs (15) in same holes from which springs were disconnected (refer to note preceding step r).

v. Perform operational checkout (paragraph 6-30).

w. Close accesses 2211-3, 5121-2, 9113-1, and 9113-2.

6-40. RIGGING AFT CAM MECHANISM SPRINGS. (See figure 6-5.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
6-5		Equipment for connecting external hydraulic power	Connect hydraulic power
	0013	Spring scale, 0 to 50 pounds	Measure force at control stick

TT08D095-05-69

a. Open accesses 2211-3, 5121-2, and 9113-2.

b. Disconnect forward viscous damper cylinder (1) at the control stick by unscrewing piston rod from rod end. Retract piston rod. Secure cylinder and rod end clear of linkage.

c. Disconnect aft viscous damper cylinder (13) and secure clear of linkage movement.

d. Disconnect feel spring strut (14) and secure clear of linkage.

e. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

f. Attach spring scale 3.32 (±0.25) inches below top of control stick.

g. Move stick from a position approximately 1 inch forward of stick neutral position to full aft position. Note maximum force required to slowly cycle stick forward and aft within this range.

NOTE

Decrease spring tension to correct a tendency of the stick to move away from center. Increase tension to correct tendency of stick to move toward center.

h. Adjust aft cam mechanism springs (15) by hooking in various holes in support until lowest force required to cycle stick is obtained.

i. Remove spring scale from stick.

j. Connect aft viscous damper cylinder (13) and feel spring strut (14).

k. Screw forward viscous damper cylinder (1) on rod end until distance from center of rod end attaching hole to end of thread relief is 1.75 (±0.03) inches.

l. Connect forward viscous damper cylinder.

m. Perform operational checkout (paragraph 6-30).

n. Close accesses 2211-3, 5121-2, and 9113-2.

6-41. RIGGING AFT BOBWEIGHT. (See figure 6-11.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external hydraulic power	Connect hydraulic power

TT08D096-12-68

a. Open access 9113-1.

b. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

c. Move control stick until bobweight is at top of its arc.

WARNING

The bobweight material is depleted uranium and is safe to handle in a solid form. The alloy is, however, toxic if breathed or ingested into the body in powdered form. Do not sand, file, or machine the bobweight. Wash hands thoroughly after handling bobweight.

d. Center bobweight laterally in shield by loosening attaching bolts on arm so indexing plate between bobweight and springs can be moved laterally. Clearance between bobweight and shield shall be 0.06-inch minimum. Tighten bolts.

e. Move bobweight to bottom of its arc.

f. Adjust shield by loosening attaching bolts to obtain 0.01-inch clearance between shields and tension cables while maintaining 0.06-inch clearance between shield and bobweight.

g. Tighten bolts.

h. Cycle control stick. Check for smooth operation of stick and absence of binding and interference at bobweight and shields.

i. Perform operational checkout (paragraph 6-30).

j. Close access 9113-1.

6-42. RIGGING AFT LINKAGE. (See figure 6-5.)

Tools Required

Figure & Index No.	Part Number	Nomenclature	Use and Application
		Equipment required for connecting external electrical power	Connect electrical power
	215-00110-7	Rigging pin No. 15	Rig linkage
	215-00110-7	Rigging pin No. 16	Rig linkage
	215-00110-4	Rigging pin No. 17	Rig linkage
			TT08D134-05-69

a. Open accesses 9113-2, 5121-1, and 6121-1.

b. Connect external electrical power (T.O. 1A-7D-2-1).

c. Verify trim neutral position of pitch trim actuator.

CAUTION

To prevent damage to linkage, do not attempt to move UHT surfaces, either with control stick or manually, with rigging pins installed.

d. Insert rigging pin No. 15.

e. Adjust left link (17) so rigging pins No. 16 and 17 can be inserted. Repeat adjustment for right link.

f. Remove rigging pins.

g. Perform operational checkout (paragraph 6-30).

h. Close accesses 9113-2, 5121-1, and 6121-1.

6-43. RIGGING UHT PC PACKAGE. (See figure 6-5.)

Tools Required

Figure & Index No.	Part Number	Nomenclature	Use and Application
		Equipment required for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
	GGG-W-686	Torque wrench, 0 to 250 pound-feet	Tighten rod end jamnut
6-5	215-00110-4	Rigging pin No. 17 (2)	Rig linkage
6-5	215-00110-6	Rigging pins No. 18 (2)	Rig linkage
6-5	215-00110-7	Rigging pin No. 16	Rig linkage
	GGG-W-686	Torque wrench, 10 to 150 pound-inches	Tighten jamnuts
	7225379-10 (Oklahoma City ALC)	Block assembly, rigging	Support UHT
			TT08D097-10-77

WARNING

Observe UHT maintenance and rigging precautions (paragraph 6-28).

NOTE

Rig both UHT PC packages simultaneously using this procedure.

To remove screws in access panels 5133-1 and 6133-1, the UHT must be manually moved to the full nosedown position by applying up force against the trailing edge while the control stick is moved aft.

a. Open accesses 2211-3, 5121-1, 5132-1, 5133-1, 9113-2, 6121-1, 6132-1, and 6133-1 to rig left and right UHT PC packages.

b. Install UHT protractors (paragraph 6-35).

WARNING

To avoid injury to personnel or damage to equipment, ensure that hydraulic power is disconnected before disturbing linkage.

c. Back off longitudinal stick stops (4).

d. Back off UHT surface stops (5).

e. On airplanes AF69-6197 and subsequent, disconnect links (30) from UHT horns and load-limiting links (28) from UHT input linkages.

f. Connect external electrical power (T.O. 1A-7D-2-1).

g. Operate pitch trim actuator to neutral position (paragraph 7-23).

NOTE

To bottom piston, move control stick to position that would provide desired piston movement if hydraulic power were connected. Then apply up or down force against UHT surface trailing edge as required.

h. Manually bottom UHT PC cylinder piston in extended position. The UHT surface should be 8°38' (+0°30', -0°0') leading edge up. If so, proceed to step n. If not, perform steps i through m..

i. Support UHT with piston bottomed in extended position.

CAUTION

Allowing PC cylinder to remain unsupported while disconnecting from UHT horn could damage PC package linkage.

j. Support PC cylinder and remove cotter pin, nut, bolt, retainers, and pin connecting piston rod end (19) to UHT horn.

CAUTION

Do not turn piston rod during piston rod adjustment. Distortion of piston seals and possible internal leakage could result.

Before tightening rod end jamnut, ensure that tab of lockwasher is seated in notch in butt of rod end. Otherwise, rod end can loosen and allow piston rod to rotate during operation.

NOTE

One-half turn of piston rod end is equivalent to approximately 0°26' UHT deflection.

k. Adjust piston rod end (19) to obtain UHT deflection of 8°38' (+0°30', -0°0') leading edge up.

l. Connect piston rod end to UHT horn with pin, retainers, bolt, nut, and new cotter pin. Remove cylinder support.

m. Tighten jamnut on rod end (19) to 2,500 (±250) pound-inches torque and secure with MS20995C32 lockwire.

n. Manually bottom UHT PC cylinder piston in retracted position. UHT surface should be 29°00' (minimum) leading edge down. Replace cylinder if surface is not at 29°00' minimum.

o. Manually move UHT surface to approximate neutral position.

WARNING

To avoid injury to personnel or damage to equipment, ensure that hydraulic power is disconnected before disconnecting linkage.

p. Check followup rod (20) for presence of sabotage paint at adjusting nut. If paint has been disturbed or is not present, proceed with step q. If paint is intact, proceed to step r.

q. Remove followup rod. Adjust rod to 29.51 (±0.02) inches as measured between center of holes in lug and rod ends, and tighten rod end jamnut. Install followup rod in package.

r. Manually position UHT leading edge to 3°00' (±0°30') down (neutral) and support surfaces in this position using rigging block assembly. Check that UHT surfaces are synchronized within 0°12' of each other.

CAUTION

To prevent damage to linkage, do not move UHT manually or with control stick while rigging pins are installed.

s. Insert rigging pin No. 16 and both rigging pins No. 17 and 18. If either rigging pin No. 18 cannot be inserted without moving linkage, disconnect input rod link (27) and insert pin No. 18 in scissors linkage.

t. Adjust input rod link (27) to proper length and reconnect. Tighten rod end jamnut.

u. Remove all rigging pins and remove supports from UHT surfaces.

WARNING

To prevent injury to personnel or damage to equipment, ensure that personnel and equipment are clear of UHT surfaces and linkage before connecting external hydraulic power supply.

CAUTION

Ensure that all linkage is connected, except linkage disconnected in step e, and rigging pins are removed.

NOTE

Each UHT actuator utilizes a dual servo valve arrangement which synchronizes the actuator hydraulic neutral position. This hydraulic neutral position must be maintained when operating the actuator with both PC systems or by a single PC system. Servo valve adjustments are made at depot maintenance level only.

v. Perform synchronization check of left and right UHT actuator servo valves as follows:

1. Disconnect hydraulic power from PC No. 2 and PC No. 3 systems. Apply 3,000 psig hydraulic pressure to PC No. 1 system.

2. Record exact protractor reading for both left and right UHT surfaces.

3. Shut down and disconnect hydraulic power from PC No. 1 system.

4. Connect and apply 3,000 psig hydraulic pressure to PC No. 2 and PC No. 3 systems.

5. Record exact protractor reading for both left and right UHT surfaces.

6. Compare protractor readings recorded in substeps 2 and 5 for left UHT surface. If recorded readings differ by more than 0^{o} 30', replace left UHT actuator.

7. Compare protractor readings recorded in substeps 2 and 5 for right UHT surface. If recorded readings differ by more than $0^{o}30'$, replace right UHT actuator.

8. Check that difference between left and right UHT positions recorded in substeps 2 and 5 does not exceed $0^{o}30'$. If difference is greater than $0^{o}30'$, repeat steps r through u to bring surfaces within allowable tolerance. If unable to bring surfaces within tolerance, replace UHT actuator which has greatest differential in surface position readings when comparing single PC system readings with readings obtained with all PC systems operating.

9. Shut down hydraulic power to PC No. 2 and PC No. 3 systems.

w. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1) and apply 300 to 500 psi hydraulic pressure.

WARNING

To prevent injury to personnel, ensure that personnel are clear of UHT surfaces when inserting rigging pins.

x. Insert rigging pin No. 16.

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y. Check that UHT surfaces are positioned at 3°00' (±0°30') leading edge down and are within 0°12' of each other, record angle at both UHT surfaces accurately, and proceed to step z. If surfaces are not positioned correctly, perform UHT surface sychronization (paragraph 6-46).

z. Shut down hydraulic power and remove rigging pin No. 16.

aa. Manually position and support UHT surfaces, using rigging block assembly, to angles previously recorded in step y.

NOTE

Proper spacing of stops will allow ±1/8 inch servo valve travel.

ab. Insert rigging pin No. 18 and, if servo valve stops are not secured with MS20995C32 lockwire or are improperly spaced, proceed with next step. If stops are secured and correctly spaced proceed to step ae.

ac. Adjust aft stop (23) and forward stop (25) by advancing stops toward servo valve cap (24) until simultaneous contact is made and stops are only finger-tight.

ad. Place an index mark on both stops and the cap. Back off both stops precisely 3 complete turns which will allow 1/8 inch servo valve travel in each direction. Tighten jamnuts to 72.5 (±12.5) pound-inches torque and secure with MS20995C32 lockwire.

ae. Remove rigging pin No. 18.

af. Remove UHT surface supports installed in step aa.

WARNING

To prevent injury to personnel or damage to equipment, ensure that personnel and equipment are clear of UHT surfaces and linkages before applying hydraulic power, bottoming cylinders, and adjusting stopbolts.

CAUTION

Use care when moving control linkage to avoid high speed bottoming and consequent damage to PC cylinders.

ag. Apply 300 to 500 psi external hydraulic pressure to systems.

ah. Move control stick forward to slowly position UHT surfaces to maximum leading edge up. Adjust both UHT upper surface stops (5) until UHT surfaces are 6°45' (+0°45', -0°15') leading edge up with control linkage against stops.

ai. Move control stick aft to slowly position UHT surfaces to maximum leading edge down. Adjust both UHT lower surface stops (5) until UHT surfaces are 26°30' (+1°30', -1°00') leading edge down with control linkage against stops.

aj. Rig longitudinal stick stops (paragraph 6-37).

ak. On airplanes AF69-6197 and subsequent, reconnect links (28 and 30, figure 6-5).

al. On airplanes AF69-6197 and subsequent, if links (28 and 30) are a drop-in fit proceed to step am. If links (28 and 30) are not a drop-in fit, rig UHT backup controls (paragraph 6-44).

am. Perform operational checkout (paragraph 6-30).

an. Rig aileron-rudder interconnect variable resistor guide assembly (paragraph 6-45).

ao. Close accesses 2211-3, 5121-1, 5132-1, 5133-1, 9113-2, 6121-1, 6132-1, and 6133-1.

6-44. RIGGING UHT BACKUP CONTROLS. (Airplanes AF69-6197 and Subsequent.) (See figure 6-6.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment required for connecting external hydraulic power	Connect hydraulic power to UHT controls
	413-900-020	Torque wrench, 100 to 750 pound-inches	Tighten link jamnut
	L-5	Spring scale, 0 to 5 pounds	Check push-pull control assembly
	GGG-W-686	Torque wrench, 10 to 150 pound-inches	Tighten fuselage bracket jamnut
			TT08D142-09-71

NOTE

UHT PC packages must be rigged before rigging backup controls.

a. Remove engine (T.O. 1A-7D-2-5) or perform the following:

1. Open access 5131-1.

2. Remove tailcone (T.O. 1A-7D-2-1).

3. Remove engine removal door (T.O. 1A-7D-2-1).

4. Remove right tail floodlight assembly (T.O. 1A-7D-2-11).

b. Install UHT protractors (paragraph 6-35).

NOTE

If rigging is to be accomplished due to a push-pull control assembly replacement only, steps c through m need not be performed.

c. Disconnect left link (1) from torque tube (2) (paragraph 6-101).

NOTE

Right link (1) may be adjustable or nonadjustable. Nonadjustable link can be identified by a rivet installed through the inspection hole in the rod end of link.

d. If right link is adjustable, disconnect link (1) from torque tube (2) (paragraph 6-101). Leave nonadjustable right link in place.

e. Cut lockwire and loosen jamnuts (3) at fuselage bracket on both sides.

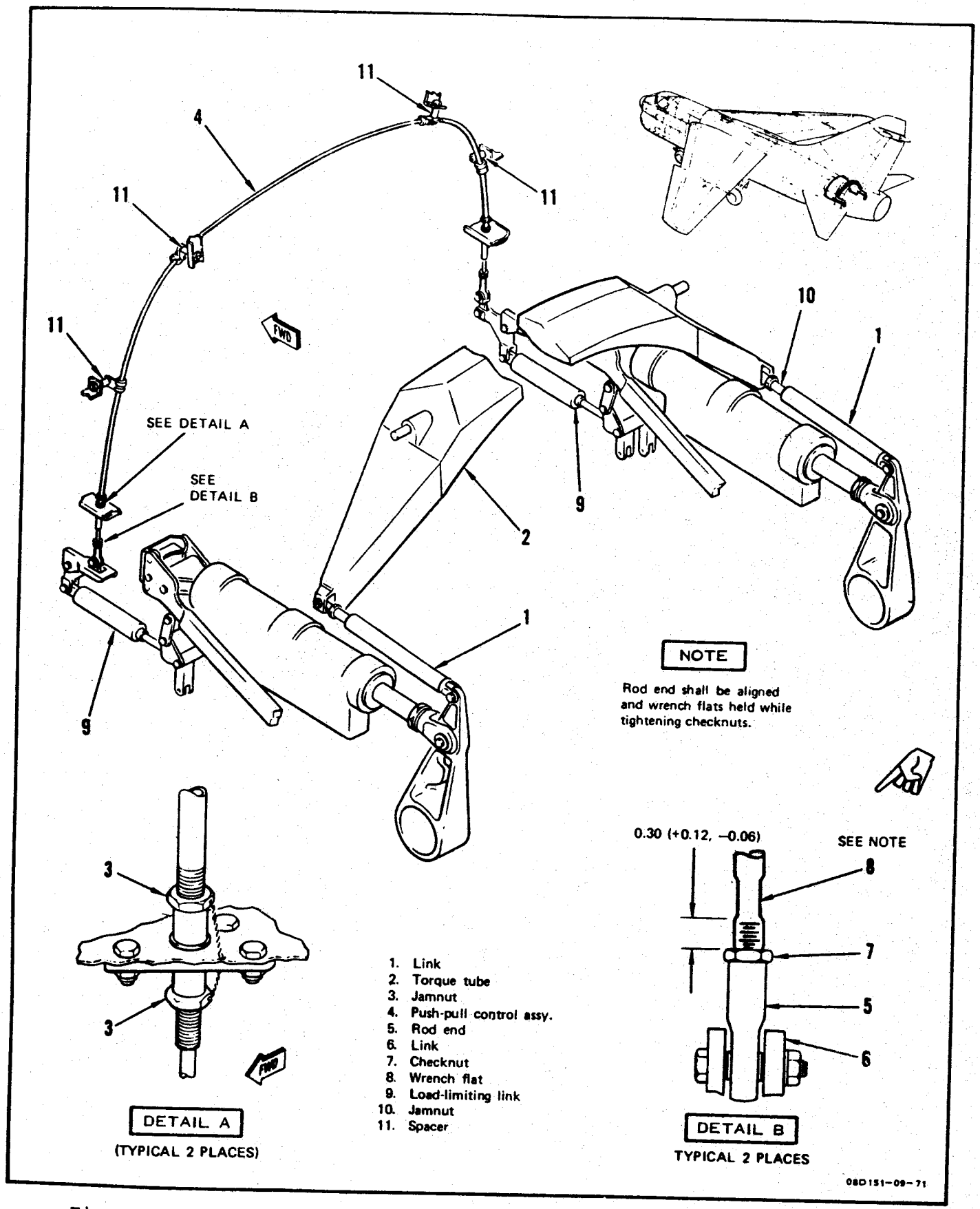


Figure 6-6. UHT Backup Controls Rigging (Airplanes AF69-6197 and Subsequent)

CAUTION

To prevent damage to push-pull control assembly (controlex), observe controlex handling precautions (T.O. 1A-7D-2-1) during rigging.

f. Remove clamps from push-pull control assembly (4).

g. Disconnect push-pull control assembly rod ends (5) from bellcranks (6) on both sides.

NOTE

Nonadjustable right link is preset to length of 16.30 (±0.02) inches.

h. If adjustable, adjust right link (1) to a length of 16.30 (±0.02) inches measured between center of mounting holes. Tighten link jamnut (10) to 650 (±50) pound-inches torque.

i. If required, connect right link to torque tube (paragraph 6-101).

j. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1) and apply 500 psi.

NOTE

Ensure UHT surfaces are positioned within 0°12' of each other before performing step k.

k. Adjust left link (1) as required to connect to torque tube. Tighten link jamnut (10) to 650 (±50) pound-inches torque.

l. Connect left link to torque tube (paragraph 6-101).

m. Shut down, but do not disconnect hydraulic power.

n. Manually stroke sliding part of push-pull assembly through several full cycles. Motion must be free and smooth with a minimum travel of 2.88 inches.

o. Adjust both push-pull control assembly rod ends (5) to a length of 0.30 (+0.12, -0.06) inch measured between top of checknut (7) and bottom of wrench flat (8). Tighten checknuts (7) to 35 (±5) pound-inches torque.

p. Connect push-pull control assembly rod ends to bellcrank links. Do not install cotter pins.

q. Tighten upper jamnuts (3) until one of the bolts connecting either end of push-pull control assembly slides freely in bellcrank and rod end. The control assembly should have approximately the same number of threads exposed on each side.

r. Tighten lower jamnuts to 35 (±5) pound-inches torque. Do not install lockwire.

s. Apply 500 psi hydraulic pressure to all PC systems.

t. Slowly move UHT surfaces from one extreme position to the other. Ensure that surfaces move from 6°45' (+0°45', -0°15') leading edge up to 26°30' (+1°30', -1°00') leading edge down without deflecting load-limiting links (9).

NOTE

Load limiting links are prerigged and should not require adjustment.

u. If load limiting links deflect, readjust jamnuts (3) or rod ends (5) as required, then repeat step t.

v. Check that threads cover inspection hole in rod end.

w. Secure jamnuts (3) with MS20995C32 lockwire.

x. Move control stick forward to slowly position UHT surfaces to maximum leading edge up. Adjust both UHT upper surface stops (5, figure 6-5) until UHT surfaces are 6°45' (+0°45', -0°15') leading edge up with control linkage against stops.

y. Move control stick aft to slowly position UHT surfaces to maximum leading edge down. Adjust both UHT lower surface stops (5) until UHT surfaces are 26°30' (+1°30', -1°00') leading edge down with control linkage against stops.

z. Shut down external hydraulic power.

aa. Install cable clamps, ensuring that clamps do not crush or squeeze push-pull control assembly.

ab. Disconnect push-pull control assembly rod end (5, figure 6-6) at both sides.

NOTE

The following step provides a check for proper installation and rigging of a new cable. When checking force during troubleshooting (table 6-2), 4.0 pounds maximum is allowed.

ac. Using a spring scale, check that force required to move sliding part of push-pull control assembly through full travel in both directions does not exceed 1.0 pound. If force exceeds 1.0 pound, adjust cable clamp spacers (11) and screw lengths as required to obtain no more than 1.0 pound.

ad. Connect both push-pull control assembly rod ends (5). Tighten nuts to 35 (±5) pound-inches torque and install new cotter pins.

ae. Perform operational checkout (paragraph 6-30).

af. Remove UHT protractors.

ag. Install engine (T.O. 1A-7D-2-5) or perform the following:

1. Install right tail floodlight assembly (T.O. 1A-7D-2-11).

2. Install engine removal door (T.O. 1A-7D-2-1).

3. Install tailcone (T.O. 1A-7D-2-1).

4. Close access 5131-1.

6-45. RIGGING AILERON-RUDDER INTERCONNECT VARIABLE RESISTOR GUIDE ASSEMBLY. (Refer to T.O. 1A-7D-2-9.)

6-46. SYNCHRONIZING UHT SURFACES. (See figure 6-5.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
6-5	215-00110-4	Rigging pin No. 17	Rig linkage
6-5	215-00110-7	Rigging pin No. 16	Rig linkage

TT08D098-03-71

a. Open access 9113-2.

b. Install UHT protractors (paragraph 6-35).

c. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1) and apply 500 psi.

d. Connect external electrical power (T.O. 1A-7D-2-1).

CAUTION

Do not operate control system with rigging pin inserted.

e. Position pitch trim actuator to neutral (3° (±0° 30') leading edge down).

f. Insert rigging pin No. 16.

g. If positions of UHT surfaces differ by more than 12', as determined by the protractor, or positions are not both at 3° (±0°30') leading edge down, perform steps h through m.

h. Shut down, but do not disconnect external hydraulic power.

i. Open accesses 5133-1 and 6133-1.

WARNING

To prevent injury to personnel, make sure that hydraulic power has been disconnected before adjusting control linkage.

NOTE

One flat rotation of the servo barrel nut will change UHT surface position 0° 32'.

j. Adjust servo valve input rod by rotating barrel (21), and repeating steps c through h after each adjustment. After final adjustment, tighten barrel jamnut (22) and secure barrel (21) and jamnut (22) with MS20995C32 lockwire. Recheck that surfaces are synchronized within 0° 12'.

k. Remove rigging pin No. 16.

l. Apply full 3,000 psi hydraulic pressure to all PC systems.

m. Trim UHT and check for synchronization within 0°12' of UHT surfaces at full trim, 10°, 8°, 6°, 4°, 3°, and 2° leading edge down, and at 2° leading edge up. If synchronization is not within 0°12' at required positions, adjust aft linkage as follows:

1. Open accesses 5121-1 and 6121-1.

2. Insert rigging pin No. 16.

NOTE

If both rigging pins No. 17 cannot be inserted when rigging pin No. 16 is installed, an undersize 1/8-inch diameter pin of suitable length may be used.

3. Adjust left or right link (17), or both, as required to synchronize surfaces within 0° 12' and allow insertion of rigging pins No. 17. After each adjustment, remove rigging pins No. 16 and 17 and repeat steps l and m. If correct synchronization is obtained, shut down hydraulic power, tighten link jamnuts, and remove rigging pins. If correct synchronization is not obtained, shut down hydraulic power, tighten link jamnuts, remove rigging pins, and rig UHT PC package (paragraph 6-43).

n. Perform operational checkout (paragraph 6-30).

o. Close accesses 5121-1, 5133-1, 6121-1, 6133-1, and 9113-2.

6-47. SERVICING.

6-48. For servicing of forward and aft UHT system viscous dampers, refer to T.O. 1A-7D-2-1.

6-49. BLEEDING UHT PC CYLINDER.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external hydraulic	Connect hydraulic power
	413-900-020	Torque wrench, 100 to 750 pound-inches	Tighten bleed plugs

TT08D099-12-69

NOTE

Open accesses 5121-1 and 5133-1 to bleed left UHT PC cylinder. To bleed right UHT PC cylinder, open accesses 6121-1 and 6133-1.

a. Disconnect control rod from UHT surface stops bellcrank.

b. Cut lockwire securing UHT PC cylinder bleed plugs.

c. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1) and apply 400 (±100) psi.

d. Loosen extend bleed plugs.

CAUTION

Stroke control rod slowly to prevent rapid actuation of the servo valve, which is spring loaded to extend the cylinder piston.

e. Stroke control rod to retract piston. Close bleed plugs.

f. Loosen retract bleed plugs.

g. Stroke control rod to extend piston. Close bleed plugs.

h. Repeat steps d through g until air-free fluid flows from bleed plugs.

i. Perform hydraulic system air check (T.O. 1A-7D-2-1).

j. Tighten bleed plugs to 135 (±15) pound-inches torque.

k. Secure bleed plugs with MS20995C32 lockwire.

l. Connect control rod to bellcrank with bolt, washers, nut, and new cotter pin.

m. Close accesses 5121-1 and 5133-1 or 6121-1 and 6133-1.

6-50. FORWARD BOBWEIGHT REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external hydraulic power	Connect hydraulic power

TT08D122-12-68

6-51. Remove and install forward bobweight through access 2211-3, observing the following.

WARNING

The bobweight material is depleted uranium and is safe to handle in a solid form. The alloy is, however, toxic if breathed or ingested into the body in powdered form. Do not sand, file, or machine the bobweight. Wash hands thoroughly after handling bobweight.

a. After installation, secure attaching bolts with MS20995C32 lockwire.

b. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

c. Verify proper operation of bobweight by cycling control stick forward and aft and checking for smooth operation without binding or interference.

d. Disconnect external hydraulic power (T.O. 1A-7D-2-1).

e. Close access 2211-3.

6-52. FORWARD VISCOUS DAMPER CYLINDER REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external hydraulic power	Connect hydraulic power

TT08D170-02-75

6-53. REMOVAL. (See figure 6-7.)

a. Open accesses 2221-1 and 2211-3.

b. Disconnect hydraulic filler tube (1) from viscous damper cylinder (2).

c. Cut lockwire, loosen jamnut (3), and disconnect forward end of damper by unscrewing piston rod (4) from rod end (5). Remove washer (6).

d. To facilitate access to nut (8), proceed as follows:

1. On airplanes AF69-6197 and subsequent, remove TACAN, ILS, and IMS control panels from right console.

2. On airplanes AF67-14582 through AF69-6188 and AF69-6190 through AF69-6196, remove ILS, VHF, and speech security control panels from right console.

e. Disconnect aft end of damper from structure by removing cotter pin (7), nut (8), washer (9), and bolt (10).

f. Remove viscous damper cylinder.

6-54. INSTALLATION. (See figure 6-7.)

a. Connect aft end of damper to structure with bolt (10), washer (9), nut (8), and new cotter pin (7).

b. Place washer (6) on piston rod (4).

c. Connect forward end of damper by screwing piston rod (4) into rod end (5) until dimension between rivet and shoulder on piston rod is 1.75 (±0.03) inches. Secure jamnut (3) with MS20995C32 lockwire.

d. Connect hydraulic filler tube (1) to viscous damper (2).

e. Check damper for proper servicing (T.O. 1A-7D-2-1).

f. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

g. Move control stick forward smoothly and rapidly approximately 3 inches then release stick. Stick shall return steadily to neutral. Repeat, except move stick in aft direction. Then move stick full travel inward and aft, observing stick stops to establish limits. No binding or sponginess shall be evident at any time.

h. Disconnect external hydraulic power (T.O. 1A-7D-2-1).

i. Reinstall control panels in right console.

j. Close accesses 2221-1 and 2211-3.

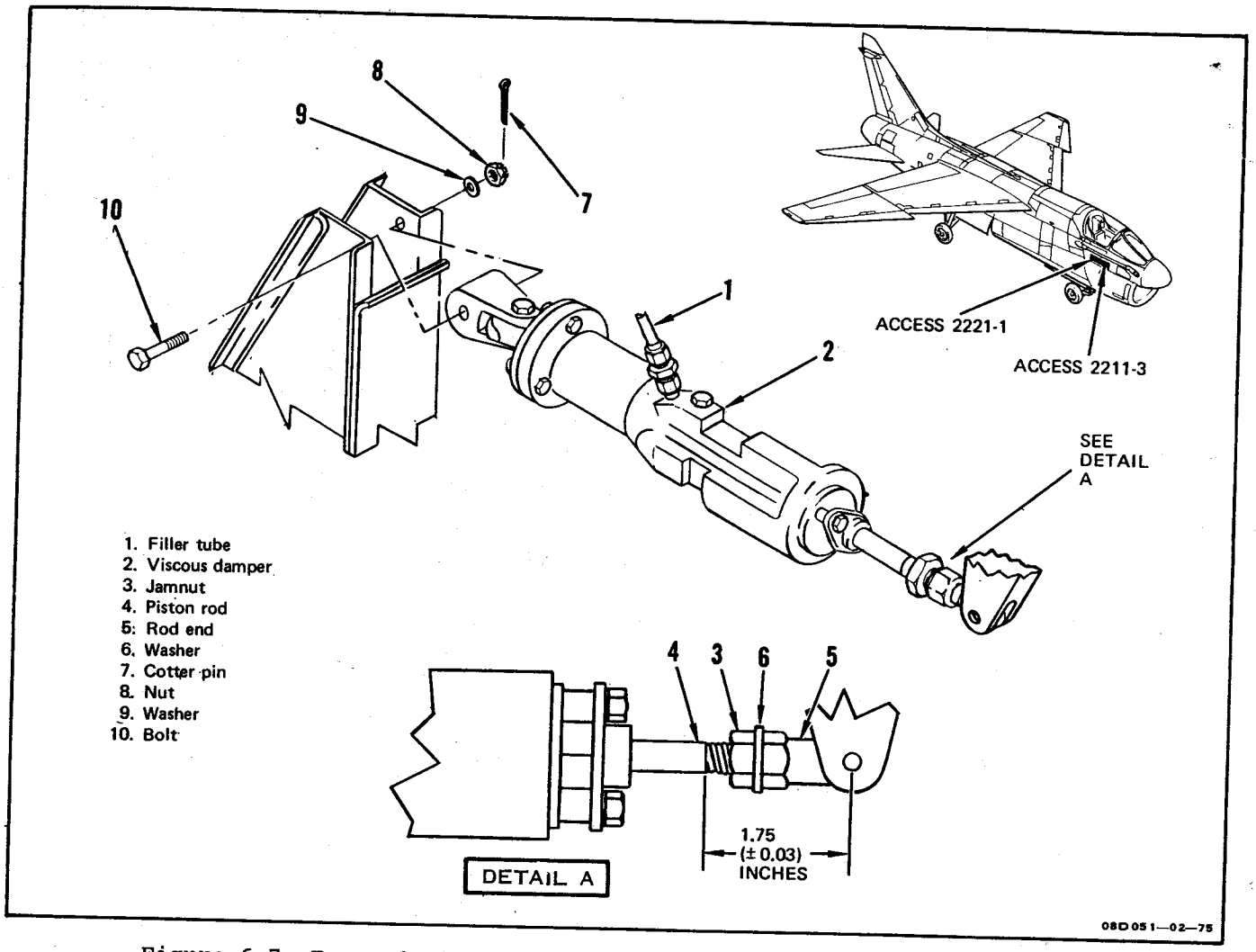


Figure 6-7. Forward Viscous Damper Cylinder Removal and Installation

6-55. FORWARD VISCOUS DAMPER CYLINDER ROD END ATTACHING RIVET REMOVAL AND INSTALLATION.

6-56. REMOVAL.

NOTE

During stick removal, do not remove stick grip and sensor, since stick removal is being accomplished only to gain access to the rivet.

a. Remove control stick (paragraph 1-18).

NOTE

The bobweight arm assembly is disassembled from the control stick during stick removal.

b. Remove bobweight arm assembly from airplane.

c. Remove rivet and viscous damper cylinder rod end from bobweight arm assembly.

6-57. INSTALLATION.

CAUTION

The rod end attaching rivet is designed to shear if the damper binds. Replace rivet only with one of correct part number.

a. Rivet rod end assembly to bobweight arm assembly with MS20470AD3 rivet.

b. Install control stick (paragraph 1-18).

6-58. AFT CAM MECHANISM REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	GGG-W-686	Torque wrench, 10 to 150 pound-inches	Tighten support assembly nut
6-5	215-00110-3	Rigging pin No. 13	Rig linkage
6-5	215-00110-7	Rigging pin No. 16	Rig linkage
			TT08D123-07-70

6-59. REMOVAL. (See figure 6-8.)

a. Open accesses 5121-2, 9113-2, and 10123-1.

b. Manually move UHT to approximate neutral position and insert rigging pins No. 13 and 16.

NOTE

See figure 6-5 for rigging pin locations.

c. Remove two springs (1) from arm assembly (2) and support assembly (3).

d. Remove cotter pin (4), nut (5), counterbored washer (6), washer (7), and self-retaining bolt (8) (paragraph 2-95) connecting link (9) to bellcrank (10).

e. Remove cotter pin (11), nut (12), counterbored washer (13), washer (14), and self-retaining bolt (15) (paragraph 2-95) connecting link (16) to bellcrank (10).

f. Remove cotter pin (17), nut (18), two washers (19), and bolt (20) securing bellcrank (10) to support assembly.

g. Remove six bolts (21) and six washers (22) securing support assembly to structure. Remove support assembly and two washers (23).

h. Remove vinyl tape from support assembly and airplane structure.

6-60. INSTALLATION. (See figure 6-8.)

a. Install No. 473 (Minnesota Mining and Manufacturing Company) pressure-sensitive vinyl tape for dissimilar metals on contact areas between support assembly (3) and airplane structure.

b. Position support assembly (3) on structure with washers (23) under two forward bosses of support assembly. Secure with six washers (22) and six bolts (21). Tighten bolts to 23 (±3) pound-inches torque.

c. Install bellcrank (10) on support assembly with bolt (20), two washers (19), and nut (18). Tighten nut finger-tight. Using wrench, tighten nut to next cotter pin slot and install new cotter pin (17).

d. Connect link (16) to bellcrank (10) with self-retaining bolt (15) (paragraph 2-95), washer (14), counterbored washer (13), nut (12), and new cotter pin (11).

e. Connect link (9) to bellcrank (10) with self-retaining bolt (8) (paragraph 2-95), washer (7), counterbored washer (6), nut (5), and new cotter pin (4).

f. Connect two springs (1) between arm assembly (2) and center holes of support assembly (3).

g. Remove rigging pins No. 13 and No. 16.

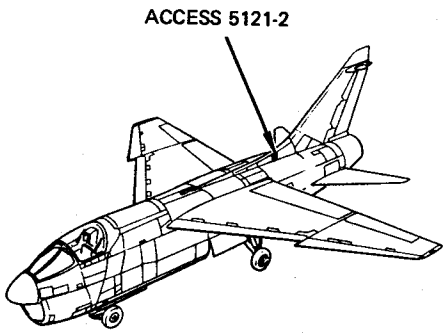
h. Rig aft cam mechanism (paragraph 6-40).

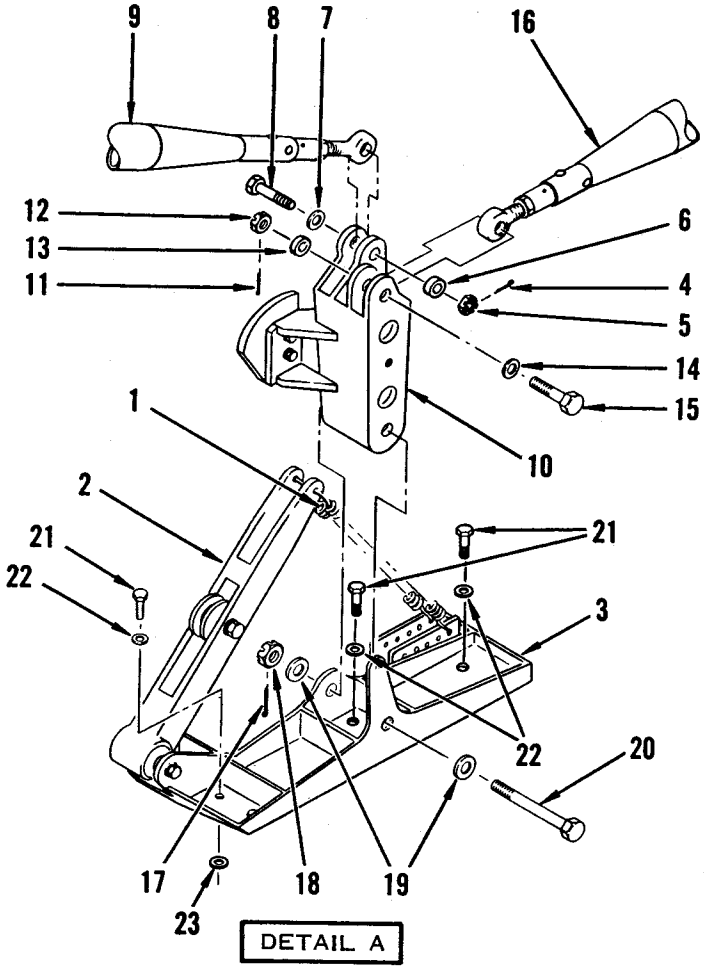
i. Close accesses 10123-1, 5121-2 and 9113-2.

6-61. AFT CAM MECHANISM CAM REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment required for connecting external hydraulic power	Connect hydraulic power
			TT08D151-10-70





1. Spring
2. Arm assembly
3. Support assembly
4. Cotter pin
5. Nut
6. Counterbored washer
7. Washer
8. Self-retaining bolt
9. Link
10. Bellcrank
11. Cotter pin
12. Nut
13. Counterbored washer
14. Washer
15. Self-retaining bolt
16. Link
17. Cotter pin
18. Nut
19. Washer
20. Bolt
21. Bolt
22. Washer
23. Washer

08D057-10-70

Figure 6-8. Aft Cam Mechanism Removal and Installation

6-62. REMOVAL. (See figure 6-9.)

a. Open access 5121-2.

NOTE

Before manually moving UHT surface with hydraulic power disconnected, position control stick in direction that would result in desired surface movement.

b. Manually move UHT to approximate neutral position.

c. Disconnect two springs (1) from arm assembly (2) and structure holes. Record location of structure holes so that springs maybe installed in same holes.

d. Remove cotter pins (3), nuts (4), washers (5), and bolts (6), securing cam (7) to bellcrank (8).

e. Remove vinyl tape from bellcrank.

6-63. INSTALLATION. (See figure 6-9.)

a. Install No. 473 (Minnesota Mining and Manufacturing Company) pressure-sensitive vinyl tape for dissimilar metals on contact areas between bellcrank (8) and cam (7).

b. Install cam (7) on bellcrank (8) with two bolts (6), four washers (5), two nuts (4), and two new cotter pins (3).

c. Connect two springs (1) to arm assembly (2) and structure holes from which they were removed.

d. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1) and move control stick through full travel. No binding or interference shall exist. If so, perform operational checkout (paragraph 6-30).

e. Disconnect external hydraulic power (T.O. 1A-7D-2-1).

f. Close access 5121-2.

6-64. AFT CAM MECHANISM BEARING REMOVAL AND INSTALLATION.

6-65. REMOVAL. (See figure 6-10.)

a. Open access 5121-2.

NOTE

Before manually moving UHT surface with hydraulic power disconnected, position control stick in direction that would result in desired surface movement.

b. Manually move UHT to approximate neutral position.

c. Disconnect two springs (1) from arm assembly (2) and holes in structure. Record location of structure holes for installation of springs in same hole.

d. Remove cotter pin (3), nut (4), four washers (5), and bolt (6) securing bearing (7) to arm assembly (2).

6-66. INSTALLATION. (See figure 6-10.)

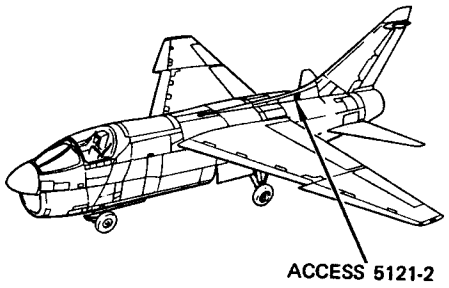
a. Install bearing (7) on arm assembly (2) with bolt (6), four washers (5), nut (4), and new cotter pin (3). Apply MIL-G-23827 grease to bolt before installation.

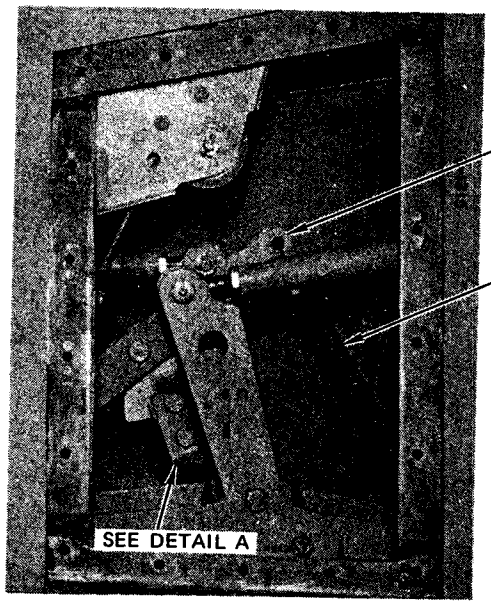
b. Connect two springs (1) to arm assembly (2) and same holes in structure from which they were removed.

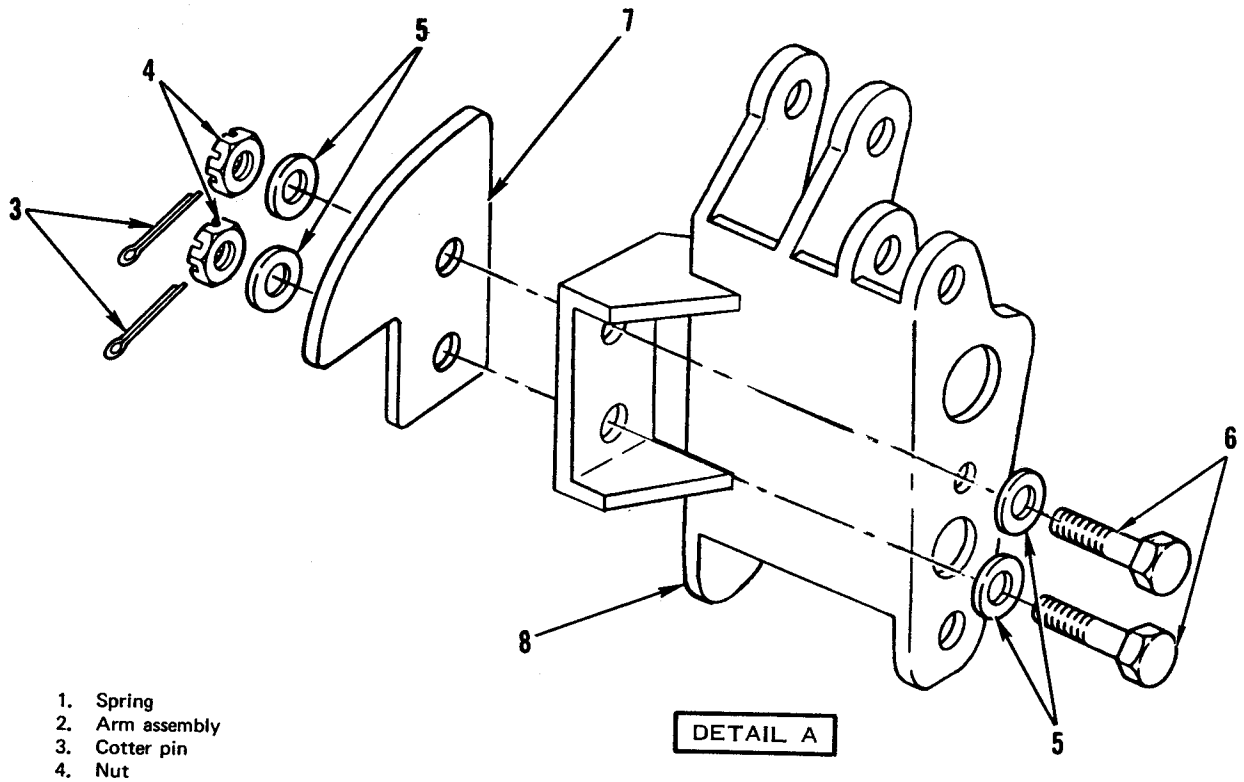
c. Perform operational checkout (paragraph 6-30) only if rigging was upset; otherwise, connect hydraulic power to all PC systems (T.O. 1A-7D-2-1) and move stick through full travel. No binding or interference shall exist.

d. Disconnect external hydraulic power (T.O. 1A-7D-2-1).

e. Close access 5121-2.







1. Spring
2. Arm assembly
3. Cotter pin
4. Nut
5. Washer
6. Bolt
7. Cam
8. Bellcrank

08D058-11-68

Figure 6-9. Aft Cam Mechanism Cam Removal and Installation

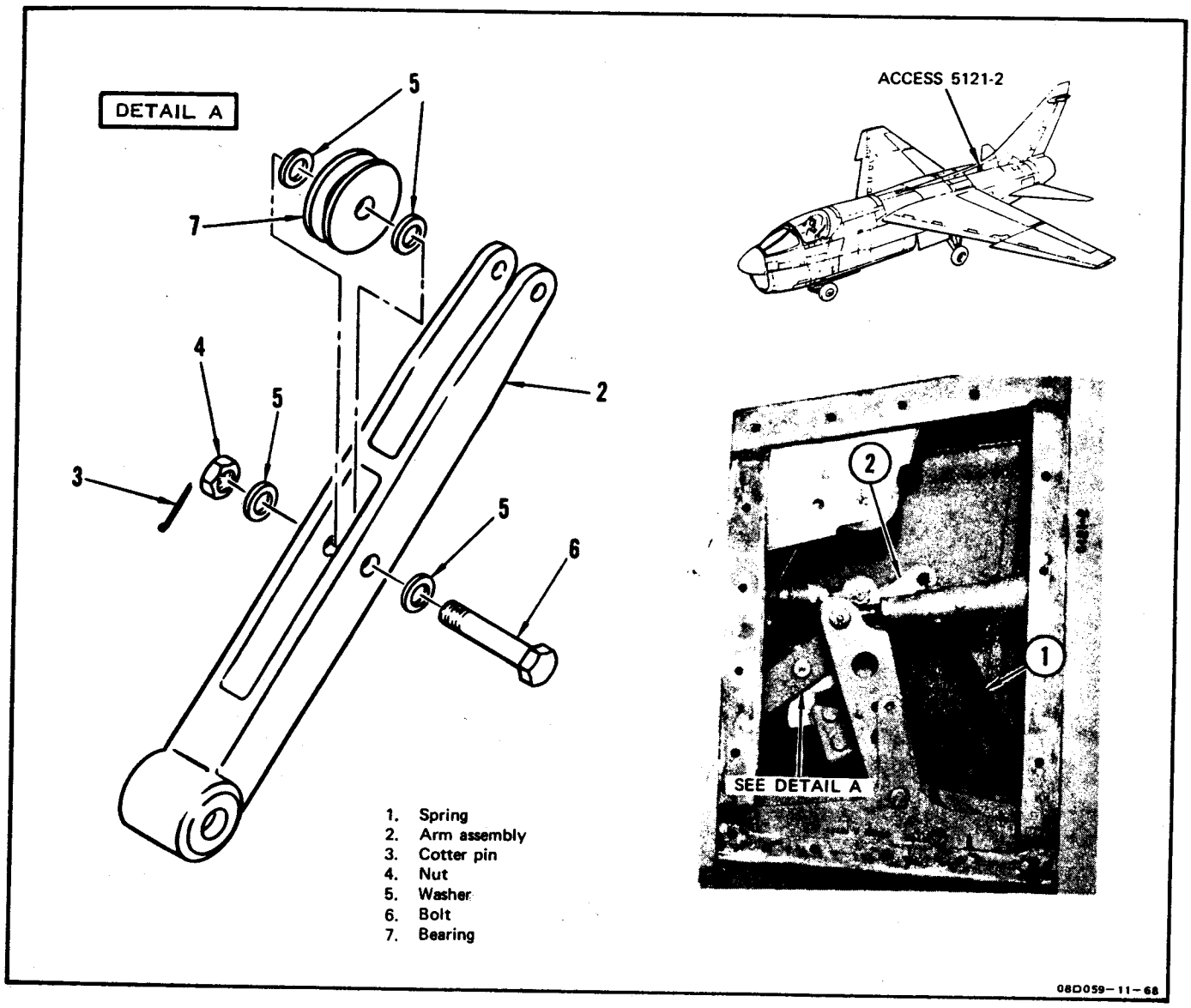


Figure 6-10. Aft Cam Mechanism Bearing Removal and Installation

6-67. AFT BOBWEIGHT ASSEMBLY REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external hydraulic power	Connect hydraulic power
	GGG-W-686	Torque wrench, 0 to 150 pound-inches	Tighten nut
			TT08D124-11-72

6-68. REMOVAL. (See figure 6-11.)

a. Open accesses 9113-1 and 9113-2.

b. Deleted.

c. Remove cotter pin (1), nut (2), bolt (3), three washers (4), and two washers (5) attaching UHT aft linkage preload spring fitting (6) to arm.

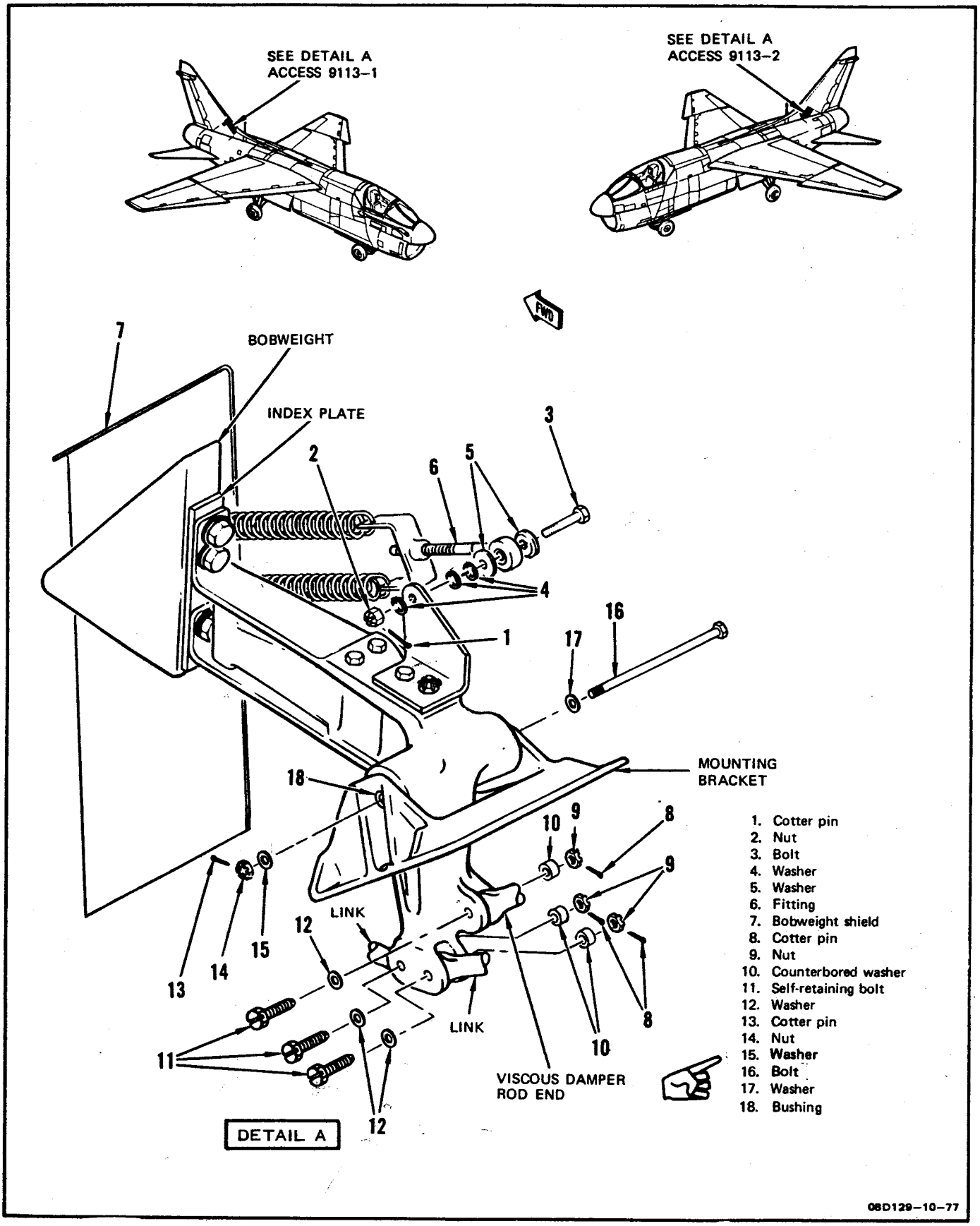


Figure 6-11. Aft Bobweight Assembly Removal and Installation

d. Secure springs and fittings clear of bobweight shields (7).

WARNING

The bobweight material is depleted uranium and is safe to handle in a solid form. The alloy is, however, toxic if breathed or ingested into the body in powdered form. Do not sand, file, or machine the bobweight. Wash hands thoroughly after handling bobweight.

e. Remove bobweight shields (7).

f. Remove cotter pins (8), nuts (9), counterbored washers (10), self-retaining bolts (11) (paragraph 2-95), and washers (12) securing aft viscous damper rod end and links to arm.

g. Remove cotter pin (13), nut (14), washer (15), bolt (16), and washer (17) attaching bobweight to mounting bracket and remove bobweight.

h. If looseness exists between arm and leaf springs, retorque attaching bolts to 20 - 22 inch-pounds and advance to the next cotter pin hole.

6-69. INSTALLATION. (See figure 6-11.)

a. Inspect right and left bushings (18) and bolt (16) for wear in accordance with tolerances given in T.O. 1A-7D-3. If worn beyond limits or if bushings are loose in mounting bracket, repair in accordance with T.O. 1A-7D-3.

b. Position bobweight on mounting bracket and install bolt (16), washers (17 and 15), and nut (14). Torque nut (14) to 85 pound-inches and install new cotter pin (13).

c. Connect links and aft viscous damper rod end to arm with self-retaining bolts (11) (paragraph 2-95), washers (12), counterbored washers (10), nuts (9), and new cotter pins (8).

d. Install bobweight shields (7).

e. Connect UHT aft linkage preload spring fitting (6) to arm with bolt (3), washers (5 and 4), nut (2), and new cotter pin (1).

f. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

g. Cycle control stick. Check for minimum clearance of 0.06 inch between bobweight and shield and 0.01 inch between shields and cables.

h. Cycle control stick. Check for smooth operation of stick and absence of binding or interference at points that were disconnected.

i. Disconnect external hydraulic power.

j. Close accesses 9113-1 and 9113-2.

6-70. AFT BOBWEIGHT REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external hydraulic power	Connect hydraulic power

TT08D125-12-68

6-71. REMOVAL.

a. Open access 9113-1.

b. Disconnect UHT aft linkage preload springs.

NOTE

Do not remove bobweight shield lower mounting bracket from airframe.

c. Remove six bolts securing outboard side of bobweight shield and remove shield.

WARNING

The bobweight material is depleted uranium and is safe to handle in a solid form. The alloy is, however, toxic if breathed or ingested into the body in powdered form. Do not sand, file, or machine the bobweight. Wash hands thoroughly after handling bobweight.

d. Cut lockwire and remove three bolts attaching bobweight to mounting springs.

e. Remove bobweight blocks and index plate.

6-72. INSTALLATION.

WARNING

Alodine is moderately toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate.

Epoxy primer is highly toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate.

a. Insulate dissimilar metal faying surfaces with two coats of MIL-C-5541 (Alodine 1200s) conversion coat with epoxy primer applied in accordance with T.O. 1-1-2, paragraph 6-10.d., NOTE.

b. Secure bobweight, index plate, and blocks to leaf springs with three bolts. Tighten bolts finger-tight.

c. Install shield and check that minimum clearance between shield and adjacent cables is 0.01 inch. Adjust shield, if necessary, by repositioning lower mounting bracket.

d. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

e. Move bobweight through full arc.

f. Adjust bobweight laterally to obtain 0.06 inch minimum clearance between bobweight and shield.

NOTE

Ensure serrations of index block and leaf springs are properly mated before tightening bolts.

g. Tighten mounting bolts and secure with MS20995C32 lockwire.

h. Shut down but do not disconnect hydraulic power.

i. Connect UHT aft linkage preload springs.

j. Apply external hydraulic power.

k. Cycle control stick. Check for smooth operation of stick and absence of binding and interference at points that were disconnected or adjusted.

l. Disconnect external hydraulic power (T.O. 1A-7D-2-1).

m. Close access 9113-1.

6-73. AFT VISCOUS DAMPER CYLINDER REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external hydraulic power	Connect hydraulic power

TT08D126-12-68

6-74. REMOVAL. (See figure 6-12.)

a. Open access 9113-2.

b. Disconnect rod end of damper from bobweight arm by removing cotter pin (1), nut (2), counterbored washer (3), washer (4), and self-retaining bolt (5). (paragraph 2-95).

c. Disconnect aft end of damper from mounting bracket by removing cotter pins (6), nuts (7), washers (8), bolts (9), and washers (10).

d. Remove damper.

6-75. INSTALLATION. (See figure 6-12.)

a. Verify that distance between center of piston rod end hole and edge of thread relief is 1.83 (±0.03) inches and jamnut is secured with MS20995C32 lockwire. (See figure 6-12, detail A.)

b. Connect aft end of damper to mounting bracket with washers (10), bolts (9), washers (8), nuts (7), and new cotter pins (6).

c. Connect rod end of damper to bobweight arm with self-retaining bolt (5) (paragraph 2-95), washer (4), counterbored washer (3), nut (2), and new cotter pin (1).

d. Check damper for proper servicing (T.O. 1A-7D-2-1). Ensure filler cap is retained with lockwire.

e. Install left UHT protractor (paragraph 6-35).

f. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

g. Check proper operation of damper by moving stick forward smoothly and rapidly approximately 3 inches. Release stick. Stick shall return at a steady rate to neutral. Repeat procedure except move stick in aft direction.

h. Move stick full travel forward and aft and UHT angle shall be 6°45' (+0°45', -0°15') leading edge up and 26°30' (+1°30', -1°00') leading edge down. No binding or sponginess shall be evident at any time.

i. Disconnect external hydraulic power (T.O. 1A-7D-2-1).

j. Remove left protractor.

k. Close access 9113-2.

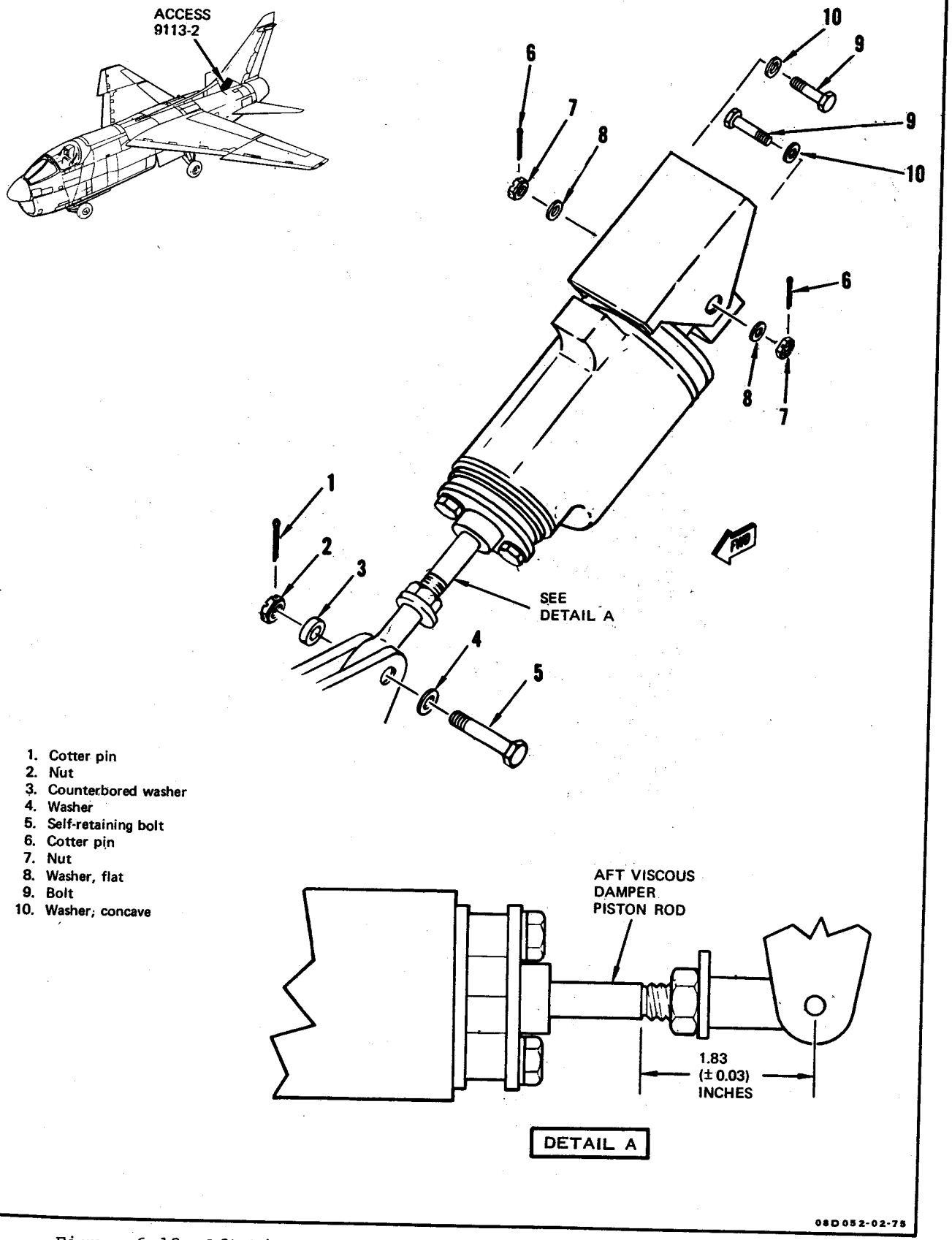


Figure 6-12. Aft Viscous Damper Cylinder Removal and Installation

6-76. FEEL SPRING STRUT REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
	215-00110-7	Rigging pin No. 15	Rig linkage
			TT08D127-05-69

6-77. REMOVAL. (See figure 6-13.)

a. Open access 9113-2.

b. Disconnect preload spring (1) from aft attaching point.

c. Remove cotter pin (2), nut (3), counterbored washer (4), washer (5), and self-retaining bolt (6) (paragraph 2-95) attaching rod end (7) of strut to bellcrank (8).

d. Remove cotter pin, nut, washers, and bolt attaching rod end of pitch trim actuator (9) to arm (10).

e. Remove cotter pin, nut, washers, and bolt attaching arm (10) to support lugs.

f. Remove feel spring strut (11) and arm.

g. Remove cotter pin (12), nut (13), counterbored washer (14), washer (15), and self-retaining bolt (16) attaching strut to arm.

6-78. INSTALLATION. (See figure 6-13.)

a. Adjust rod end until length between the rod end centerlines is approximately 13 inches. Secure jamnut with MS20995C32 lockwire.

b. Manually position UHT surfaces until rigging pin No. 15 can be inserted.

c. Install strut (11) on arm (10) with self-retaining bolt (16) (paragraph 2-95), washer (15), counterbored washer (14), nut (13), and new cotter pin (12).

d. Position feel spring strut (11) in airplane and connect arm (10) to support lugs with bolt, washers, nut, and new cotter pin.

e. Connect external electrical power (T.O. 1A-7D-2-1) and position pitch trim actuator so neutral position scribe mark on shaft is lined up with end of support cover within 0.01 inch.

f. Connect rod end of pitch trim actuator (9) to arm (10).

g. Connect preload spring (1) to aft attaching point.

h. Attempt to install self-retaining bolt (6) and washer (5) in rod end (7) of feel strut and bellcrank (8).

CAUTION

Do not scratch or damage the ground shaft surface of feel strut. The nut on opposite end of strut may be used to prevent shaft rotation while tightening rod end jamnut. Limit jamnut torque to 40 pound-inches maximum.

i. Readjust rod end of feel strut as necessary to permit installation of bolt (6) and washer (5). This adjustment shall permit bolt to be freely inserted without deflecting spring in feel strut.

j. Install counterbored washer (4), nut (3), and new cotter pin (2) on self-retaining bolt (6) (paragraph 2-95) attaching rod end (7) of strut to bellcrank (8).

k. Remove rigging pin No. 15.

l. Connect external electrical power (T.O. 1A-7D-2-1).

m. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

n. Cycle control stick with and without trim. Check for smooth control operation and absence of binding and interference.

o. Disconnect external hydraulic and electrical power (T.O. 1A-7D-2-1).

p. Close access 9113-2.

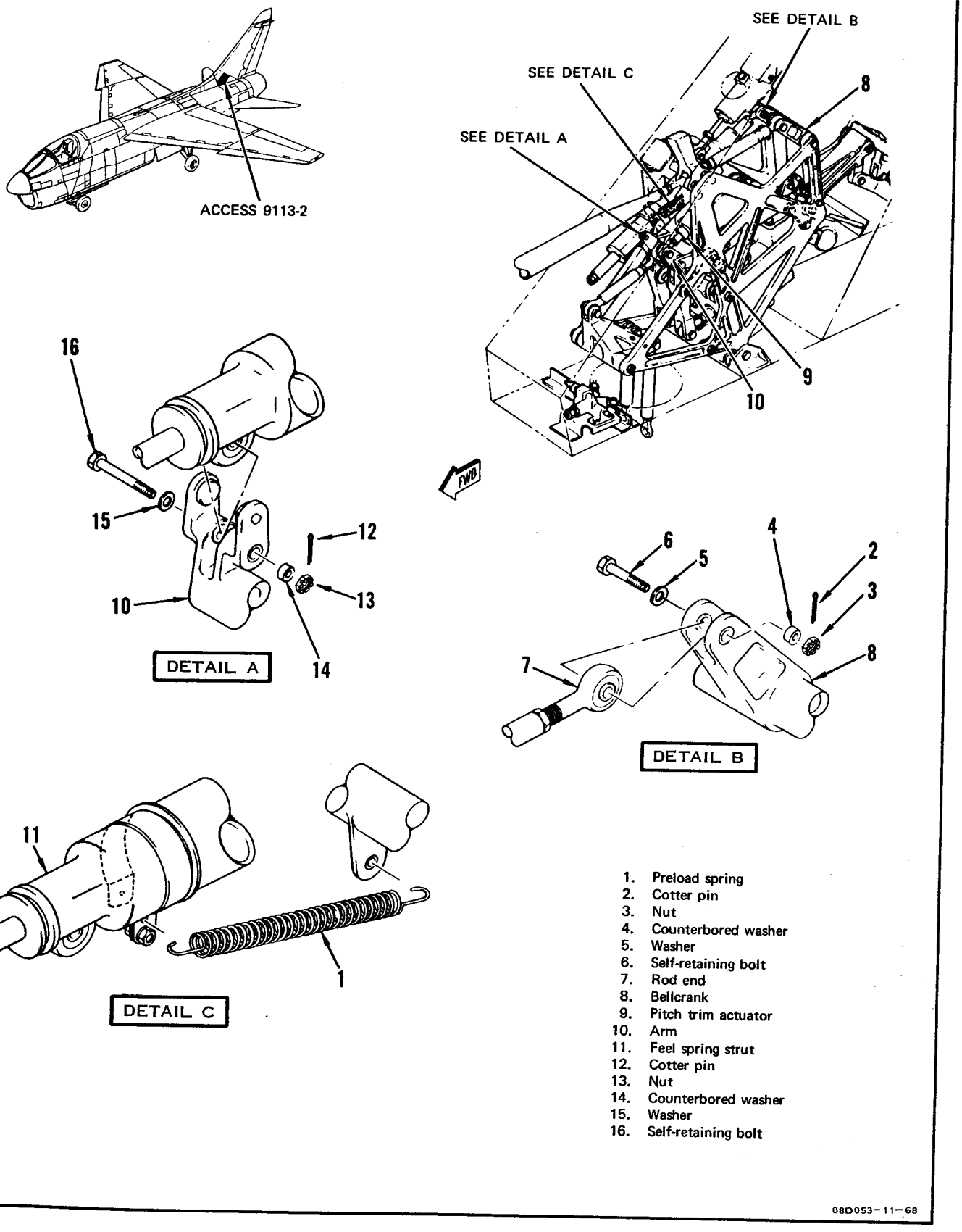


Figure 6-13. Feel Spring Strut Removal and Installation

6-79. FEEL AND TRIM LINKAGE PACKAGE REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
6-5	215-00110-4	Rigging pins No. 14 and 17	Rig linkage
6-5	215-00110-7	Rigging pin No. 15	Rig linkage

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6-80. REMOVAL. (See figure 6-14.)

a. Dump reservoir accumulator hydraulic pressure (T.O. 1A-7D-2-1).

b. Open accesses 9113-2 and 9113-1.

c. Disconnect hydraulic line clamps from hydraulic harness to facilitate removal of package.

d. Disconnect electrical leads and remove clamps.

e. Disconnect output rods (1) from bellcrank (2) by removing cotter pins (3), nuts (4), counterbored washers (5), washers (6), and self-retaining bolts (7) (paragraph 2-95).

f. Cut lockwire and remove bolts (15) and washers (16) attaching support at upper end to bracket (17).

g. Disconnect hydraulic lines from pitch stabilization actuator and remove lines to provide clearance for package removal.

h. Disconnect link (8) from bobweight arm by removing cotter pin (9), nuts (10), counterbored washer (11), self retaining bolt (12), (paragraph 2-95), and washer (13).

i. Remove cotter pins (9), nuts (10), washers (11), and bolts (12) attaching aft end of support (13) to bracket (14).

j. Remove three bolts securing bracket to airframe and remove bracket.

k. Disconnect power control pressure and return hydraulic lines from vertical fin spar fittings so that package can be removed.

l. Support feel and trim linkage assembly (18) and remove nuts (19), washers (20), and bolts (21) attaching support at lower end to mounting lugs (22).

m. Move control stick to position bobweight clear of linkage. Remove feel and trim linkage.

6-81. INSTALLATION. (See figure 6-14.)

a. Place feel and trim linkage in mounting position.

b. Install bolts (21), washers (20) (one under head, two under nut for outboard bolt; two under head, one under nut for inboard bolt), and nuts (19) to attach support at lower end to mounting lugs (22).

c. Install bolts (15) and washers (16) to attach support at upper end to brackets (17). Secure outboard bolts with MS20995C32 lockwire.

d. Install bolts (12), washers (11), (one under bolthead, two under nut), nuts (10), and new cotter pins (9) to attach aft end of support (13) to bracket (14).

e. Connect link (8) to bobweight arm with self-retaining bolt (12), (paragraph 2-95), washer (13), counterbored washer (11), nuts (10) and new cotter pin (9). (Reference Detail E, figure 6-14).

f. Connect hydraulic lines to pitch stabilization actuator.

g. Reinstall all removed hydraulic line clamps.

h. Connect and clamp electrical wiring.

i. Install bracket (14) on airframe with three bolts.

j. Perform pitch trim actuator adjustment check (paragraph 7-23). Leave electrical power connected and rigging pin No. 15 installed.

k. Open accesses 5121-1 and 5121-2.

l. Insert rigging pin No. 14 in rigging hole. Adjust the No. 15 adjusting link (figure 6-5, detail H) as required to permit rigging pin to be inserted.

NOTE

See figure 6-5 for rigging pin locations.

m. Manually position UHT and insert rigging pin No. 17.

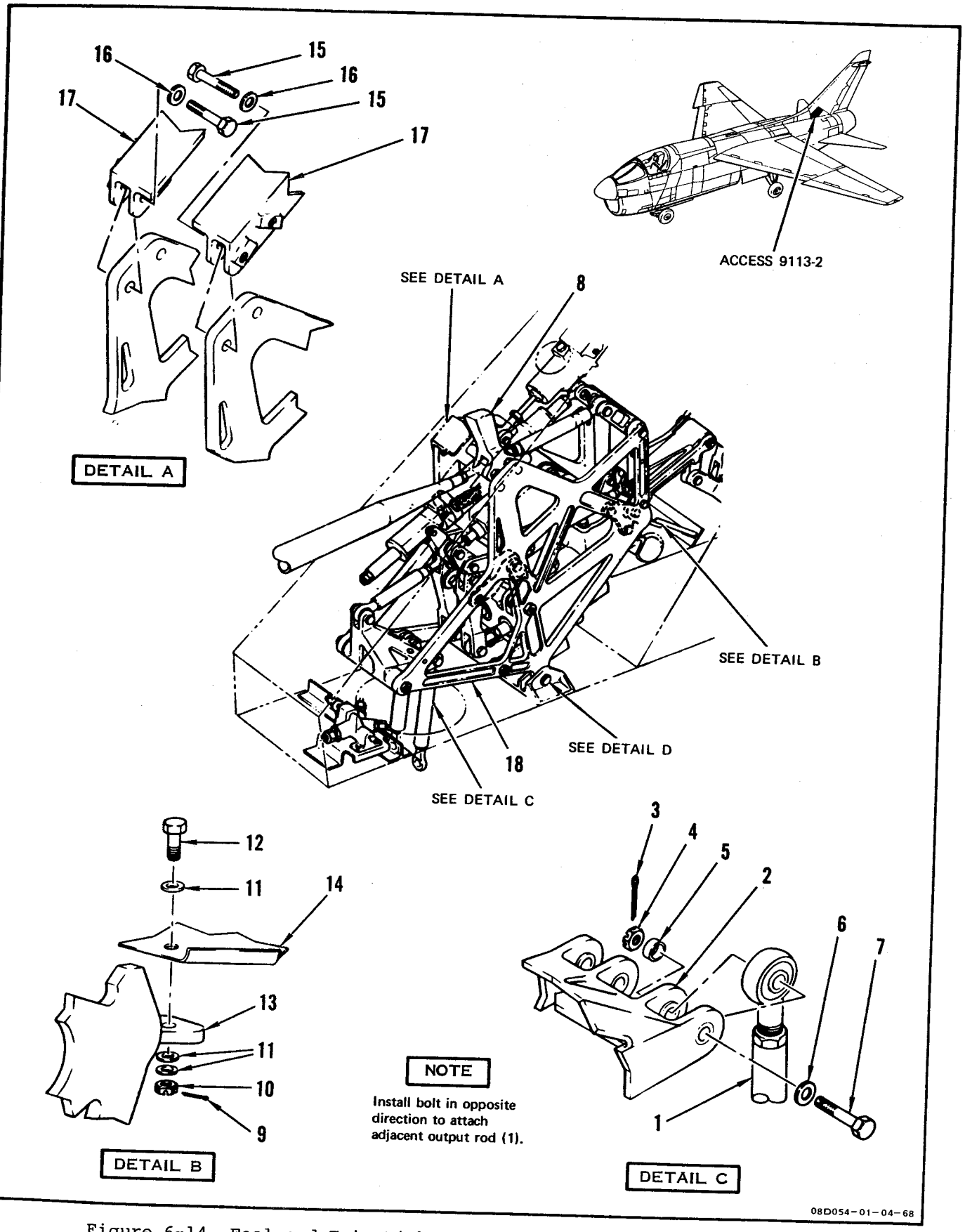

Figure 6-14. Feel and Trim Linkage Package Removal and Installation (Sheet 1)

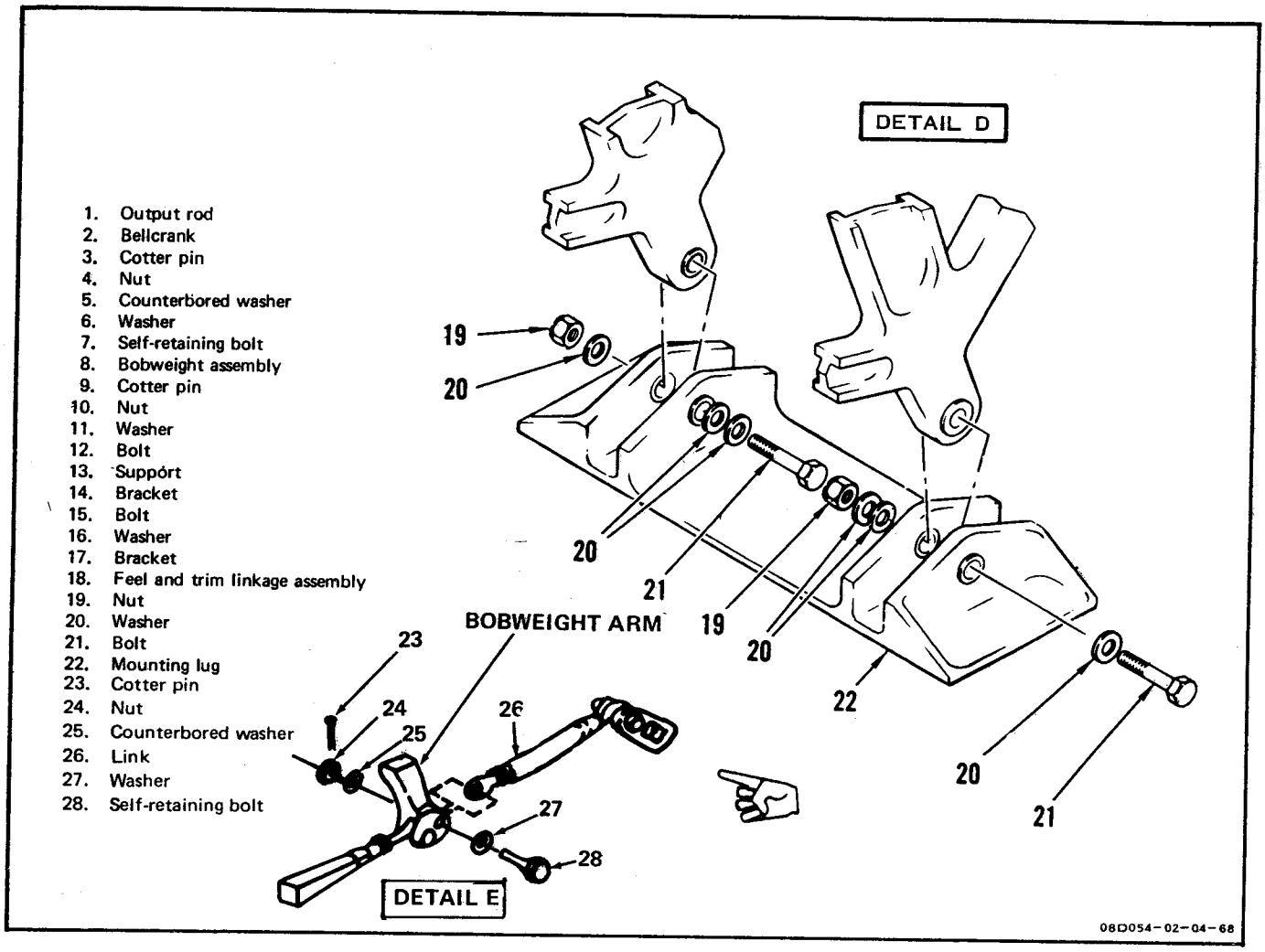

Figure 6-14. Feel and Trim Linkage Package Removal and Installation (Sheet 2)

n. Adjust and connect output rods (1) to bellcrank (2) with self-retaining bolts (7) (paragraph 2-95), washers (6) counterbored washers (5), nuts (4), and new cotter pins (3).

o. Remove rigging pins.

p. Bleed AFCS pitch actuator (paragraph 6-94). Leave hydraulic power connected.

q. Install UHT protractors (paragraph 6-35).

r. Apply hydraulic pressure to all PC systems.

s. Place pitch trim control in neutral. Check that UHT is 3° (±0°30') leading edge down and surfaces are within 0°12' of each other.

t. Cycle controls three to five times. There shall be no binding.

u. Place pitch trim control in full nose up. Check that UHT is 14°30' (±2°0') leading edge down and surfaces are within 0°12' of each other. Check that pitch trim indicator indicates UHT position within 1°30'

v. Cycle controls three to five times. There shall be no binding.

w. Place stabilization engage switch in STAB and AFCS engage switch in CONT AUG.

x. Apply pitch up, then pitch down force. Check that pitch indicator deflects clockwise, then counterclockwise.

y. Place switches in OFF.

z. Disconnect external hydraulic and electrical power (T.O. 1A-7D-2-1).

aa. Remove protractors.

ab. Close accesses 9113-2, 5121-1, and 5121-2.

6-82. FUNK SPRING STRUT REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external hydraulic power	Connect hydraulic power
6-5	215-00110-4	Rigging pin No. 14	Rig linkage
6-5	215-00110-4	Rigging pins No. 17 (2)	Rig linkage

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6-83. REMOVAL. (See figure 6-15.)

a. Open accesses 5121-1, 5121-2, and 6121-1.

NOTE

Before manually moving UHT surface with hydraulic power disconnected, position control stick in direction that would result in desired movement.

a-1. Manually move UHT to approximate neutral position.

b. Remove cotter pin (1), nut (2), counterbored washer (3), self-retaining bolt (4) (paragraph 2-95), and washer (5) securing funk spring strut rod end to outboard bellcrank.

c. Remove cotter pin (6), nut (7), counterbored washer (8), self-retaining bolt (9) (paragraph 2-95), and washer (10) securing funk spring strut lug end to inboard bellcrank.

d. Remove funk spring strut (11).

6-84. INSTALLATION. (See figure 6-15.)

a. Deleted.

NOTE

See figure 6-5 for rigging pin locations. If rigging pins cannot be inserted, perform pitch trim actuator adjustment check (paragraph 7-23).

b. Insert rigging pin No. 14 and both No. 17 pins.

c. Place funk spring strut (11) lug end to inboard bellcrank and install self-retaining bolt (9) (paragraph 2-95), washer (10), counterbored washer (8), nut (7), and new cotter pin (6).

d. In the event that rod end adjustment is required to align rod end and outboard bellcrank attaching holes, use the following steps:

1. Remove adjustable rod end bearing and existing nut, Part No. AN316-5, discarding the cotter pin which secures the rod end.

2. Replace with the following items in order: One drilled jam nut, Part No. NAS1423-5, one washer, Part No. CV15-608500-1, and the existing rod end bearing.

NOTE

The hex end of the rod end bearing must be drilled in a manner similar to the jam nut, Part No. NAS1423, to allow safety wiring of the assembly after adjustmen.

3. After adjustment of the strut rod end to align rod end and outboard bellcrank, the jam nut, washer and rod end can be safety wired together as a unit with lockwire, Part No. MS20995C32.

e. Install self-retaining bolt (4) (paragraph 2-95), washer (5), counterbored washer (3), nut (2), and new cotter pin (1) securing funk spring strut rod end to outboard bellcrank.

f. Remove rigging pins No. 14 and 17.

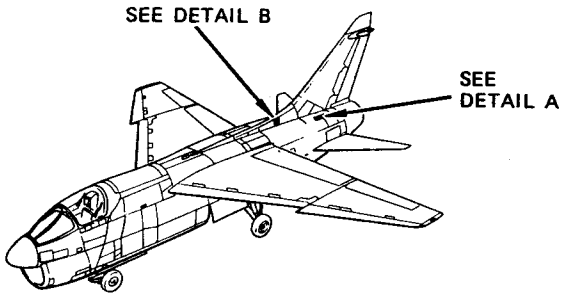
g. Install UHT protractor (paragraph 6-35).

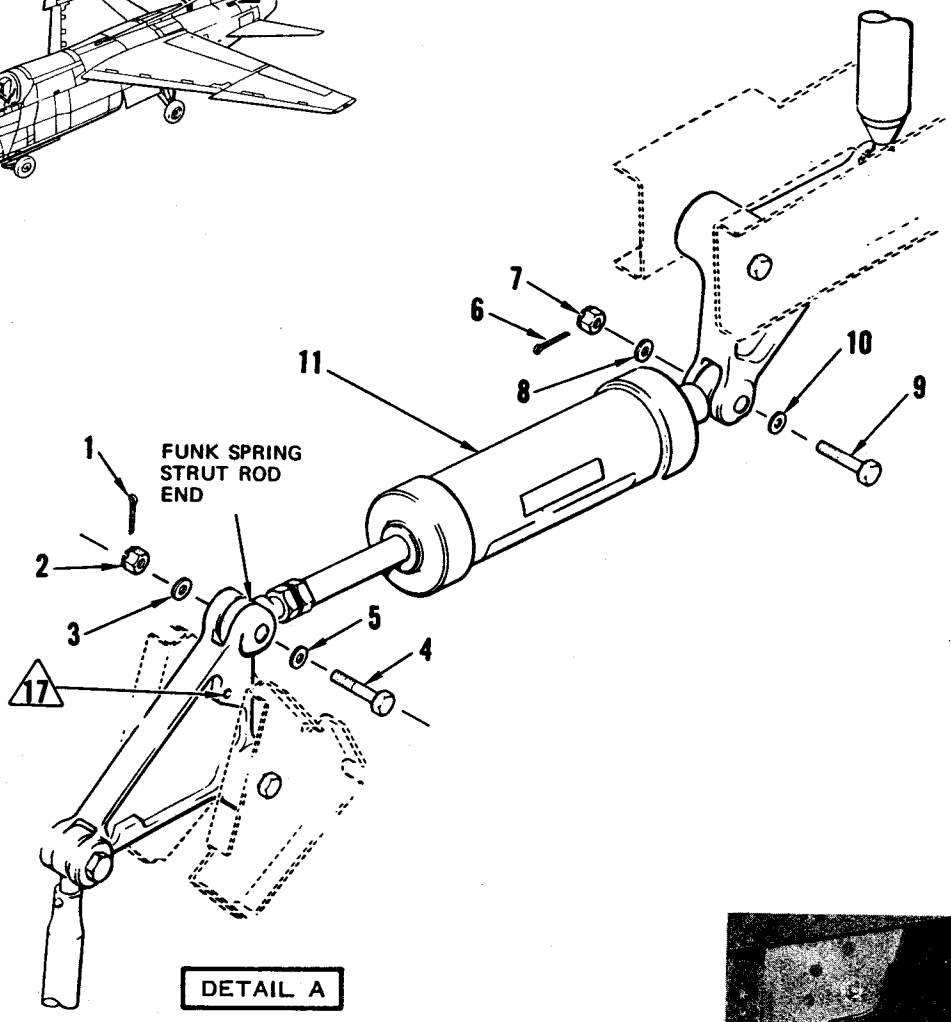
h. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

i. With control stick and pitch trim at neutral, verify that UHT is in neutral (leading edge down to 3°00' (±0°30')) and that left and right surface angles are within 0°12' of each other.

j. Cycle stick fully forward and aft; then release stick. Verify that UHT returns to neutral.

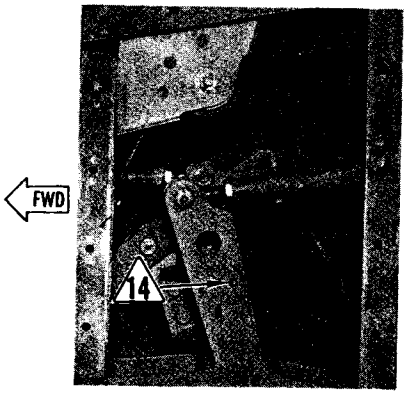
k. Cycle stick forward and aft. Check for smooth operation with no binding, interference, or abrupt changes in control stick and UHT movement.





DETAIL A

(ACCESS 5121-1 OR 6121-1)



DETAIL B

(ACCESS 5121-2)

1. Cotter pin
2. Nut
3. Counterbored washer
4. Bolt
5. Washer
6. Cotter pin
7. Nut
8. Counterbored washer
9. Self-retaining bolt
10. Washer
11. Funk spring strut

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Figure 6-15. Funk Spring Strut Removal and Installation

l. Disconnect external hydraulic power (T.O. 1A-7D-2-1).

m. Remove UHT protractor.

n. Close accesses 5121-1, 5121-2, and 6121-1.

6-85. UHT PC PACKAGE REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	MIL-G-3859	Grease gun	Grease UHT fittings
	CV15-206205-1, -2, -3	Grease gun adapter	Adapt grease gun
	GGG-W-686	Torque wrench, 10 to 150 pound-inches	Tighten taper pin nuts
	DF600	Torque wrench, 0 to 600 pound-feet	Tighten mounting bracket bolts
6-16A	Local fabrication	UHT actuator pin removal/ installation tool	Remove/install actuator-to-horn pin

TT08D130-09-76

NOTE

With exception of the UHT cylinder and the variable resistor guide assembly, do not replace component parts of the UHT PC package. The package should be replaced as a unit to control linkage slop and prevent UHT flutter.

6-86. REMOVAL. (See figure 6-16.)

NOTE

Open accesses 5132-1, 5231-1, and 5133-1 to remove left UHT PC package. To remove right UHT PC package, open accesses 6132-1, 6231-1, and 6133-1.

a. Dump reservoir accumulator hydraulic pressure (T.O. 1A-7D-2-1).

b. Remove cotter pin (1), nut (2), counterbored washer (3), washer (4), and self-retaining bolt (5) (paragraph 2-95) connecting input control rod (6) to package arm (7).

c. On airplanes AF69-6197 and subsequent, remove cotter pin (7A), nut (7B), counterbored washer (7C), washer (7D), and self-retaining bolt (7E) (paragraph 2-95) connecting load-limiting link (7F).

d. Remove cotter pin (8), nut (9), washers (10, 11, and 12), and bolt (13) connecting variable resistor guide assembly (14) and followup rod (15) to package arm (16).

e. Support guide assembly. Remove cotter pin (17), nut (18), washer (19), and bolt (20) connecting assembly to trunnion (21). Lower guide assembly to bottom of compartment.

f. Remove outboard and inboard springs (22).

g. Remove cotter pin (23), nut (24), washers (25), and bolt (26) connecting followup rod to UHT horn (27). Remove rod.

h. Pad bulkhead hole around UHT PC cylinder rod end and support cylinder to prevent damage to piston rod.

i. Remove cotter pin (29), nut (30), bolt (31), and retainers (32).

i-1. Support UHT. Using removal/installation tool (figure 6-16A), remove pin (33) connecting rod end (34) to UHT horn.

j. Disconnect four hydraulic lines (28) from cylinder (35).

k. Loosen two internally wrenched bolts (36) at aft mounting bracket (37) two turns to release tension on taper pins (40 and 41). Catch shims which may be installed between mounting bracket and bulkhead.

l. Remove nuts (38), washers (39), taper pins (40 and 41), and bushings (42) from beam assemblies in following sequence with a C-clamp or extractor nut. Do not drive taper pins out.

1. Forward end of inboard beam (43).

2. Forward end of outboard beam (44).

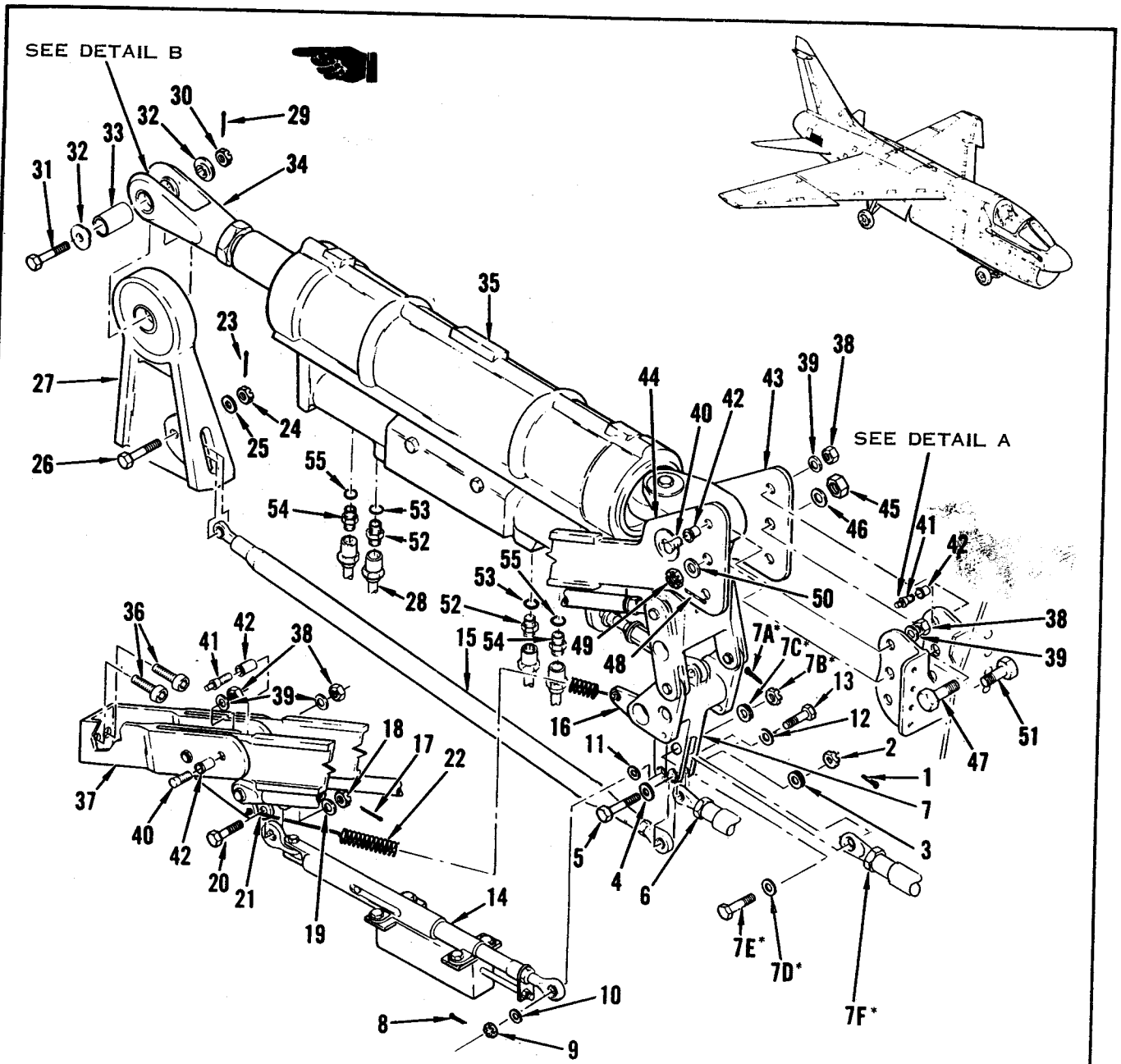
3. Aft end of inboard beam.

4. Aft end of outboard beam.

m. Support package.

n. Remove nut (45), washer (46), and bolt (47).

o. Remove cotter pin (48), nut (49), washer (50), and bolt (51).



1. Cotter pin
2. Nut
3. Counterbored washer
4. Washer
5. Self-retaining bolt
6. Input control rod
7. Package arm
*7A. Cotter pin
*7B. Nut
*7C. Counterbored washer
*7D. Washer
*7E. Self-retaining bolt
*7F. Load-limiting link
8. Cotter pin
9. Nut
10. Washer
11. Washer
12. Washer
13. Bolt
14. Aileron-rudder interconnect variable resistor guide assembly
15. Followup rod
16. Package arm
17. Cotter pin
18. Nut
19. Washer
20. Bolt
21. Trunnion
22. Spring
23. Cotter pin
24. Nut
25. Washer
26. Bolt
27. UHT horn
28. Hydraulic line
29. Cotter pin
30. Nut
31. Bolt
32. Retainer
33. Pin
34. Cylinder rod end
35. Cylinder
36. Bolt
37. Aft mounting bracket
38. Nut
39. Washer
40. Taper pin
41. Taper pin
42. Bushing
43. Inboard beam
44. Outboard beam
45. Nut
46. Washer
47. Bolt
48. Cotter pin
49. Nut
50. Washer
51. Bolt
52. Union
53. Packing
54. Check valve
55. Packing

*Airplanes AF69-6197 and subsequent

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Figure 6-16. UHT PC Package Removal and Installation (Sheet 1)

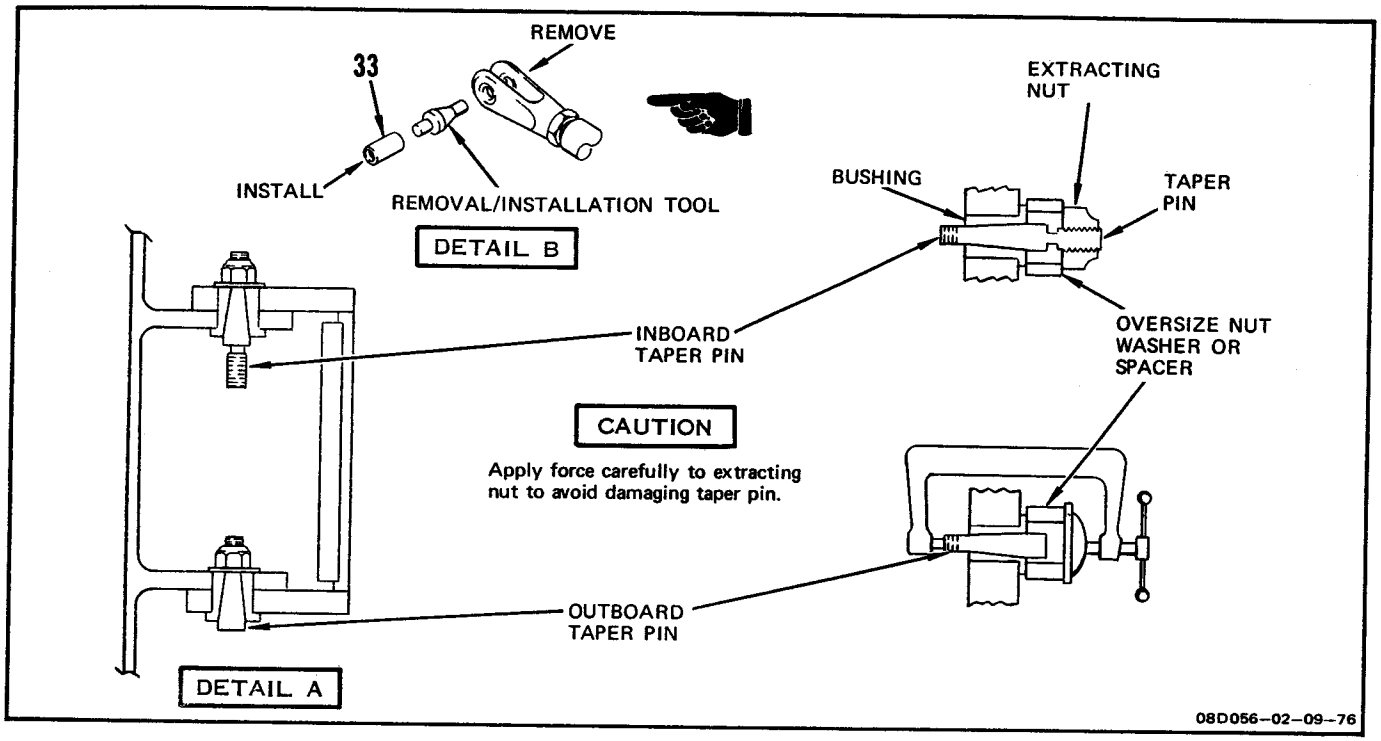

Figure 6-16. UHT PC Package Removal and Installation (Sheet 2)

p. Lower forward end of package clear of hydraulic lines.

q. Move package forward clear of horn, then move inboard.

r. Move forward end of package up, outboard, and forward to remove package.

s. Connect followup rod to package arm with bolt (bolthead inboard), washers (thin washer under bolthead), and nut. Do not install cotter pin.

t. Remove two unions (52) and packings (53) from package.

u. Remove two check valves (54) and packings (55) from package.

v. Plug open ports of UHT cylinder.

6-87. INSTALLATION. (See figure 6-16.)

a. Drain preservative fluid and fill cylinder with hydraulic fluid.

b. Install unions (52) with new packings (53) in cylinder.

CAUTION

Install check valves in cylinder pressure ports with free flow arrow pointed into cylinder (direction of arrow stamped on valve body) to obtain proper operation of cylinder.

c. Install check valves (54) with new packings (55) in cylinder.

d. For left package, disconnect followup rod and variable resistor guide assembly from replacement package by removing attaching bolts, washers, and nuts.

e. If replacement of variable resistor guide assembly is not required, transfer guide assembly from replacement package to defective package removed from airplane.

f. Ensure that padding is installed around edges of bulkhead hole for cylinder rod end passage.

g. Place package into mounting position.

h. Install bushings (42) for taper pins (40 and 41) in package beams. Check that collars are positioned in beams and bracket mounting holes with collars outboard. Install the longer bushings in aft holes.

i. Install bolt (47) with bolthead outboard, washer (46), and nut (45) to attach forward inboard beam (43) to mounting bracket.

j. Install bolt (51) with bolthead inboard, washer (50), nut (49), and new cotter pin (48) to attach forward outboard beam to mounting bracket.

k. Install double-end taper pins in inboard beam (43) and bracket mounting holes.

l. Install single-end taper pins in outboard beam (44) and bracket mounting holes.

m. Install washer (39) and nut (38) on each taper pin. Tighten nuts to 60 to 80 pound-inches torque.

NOTE

Install shims as necessary between bulkhead and bracket to eliminate structural deflection when bolts are tightened.

n. Tighten internally wrenched bolts (36) to 200 (±8) pound-feet torque at aft mounting bracket (37).

n-1. Support UHT. Using removal/installation tool (figure 6-16A), install pin (33).

o. Install bolt (31) with head outboard, retainers (32), and nut (30). Do not install cotter pin.

p. Connect hydraulic lines (28) to cylinder (35).

q. Connect followup rod (15) at nonadjustable end to horn with bolt (26), washers (25), nut (24), and new cotter pin (23).

r. Connect aft end of variable resistor guide assembly (14) to package trunnion (21) with bolt (20, washers (19), nut (18), and new cotter pin (17).

s. Install outboard and inboard springs (22).

t. Connect forward end of followup rod and variable resistor guide assembly to package arm (16) with bolt (13) (head inboard), washers, (10, 11, and 12) (thin washer under bolthead, thick washer between arm and guide assembly rod end, and dimpled washer under nut), and nut (9). Install new cotter pin (8).

u. Connect input control rod (6) to package arm (7) with self-retaining bolt (5) (paragraph 2-95) (head outboard), washer (4), counterbored washer (3), nut (2), and new cotter pin (1).

v. Lubricate UHT horn bearing at fitting with MIL-G-81322 grease.

w. Lubricate UHT PC package bearings with MIL-G-23827 grease.

x. Bleed UHT cylinder (paragraph 6-49). Shut down but do not disconnect external hydraulic power.

y. Bleed rudder PC cylinder (paragraph 5-36).

z. Rig UHT PC package (paragraph 6-43).

6-88. UHT PC CYLINDER REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	GGG-W-686	Torque wrench, 10 to 150 pound-inches	Tighten UHT PC cylinder beam nuts
	MIL-G-3859	Grease gun	Grease UHT horn fittings
	CV15-206205-1, -2, -3	Grease gun adapter	Adapt grease gun
6-16A	Local fabrication	UHT actuator pin removal/ installation tool	Remove/install actuator-to-horn pin

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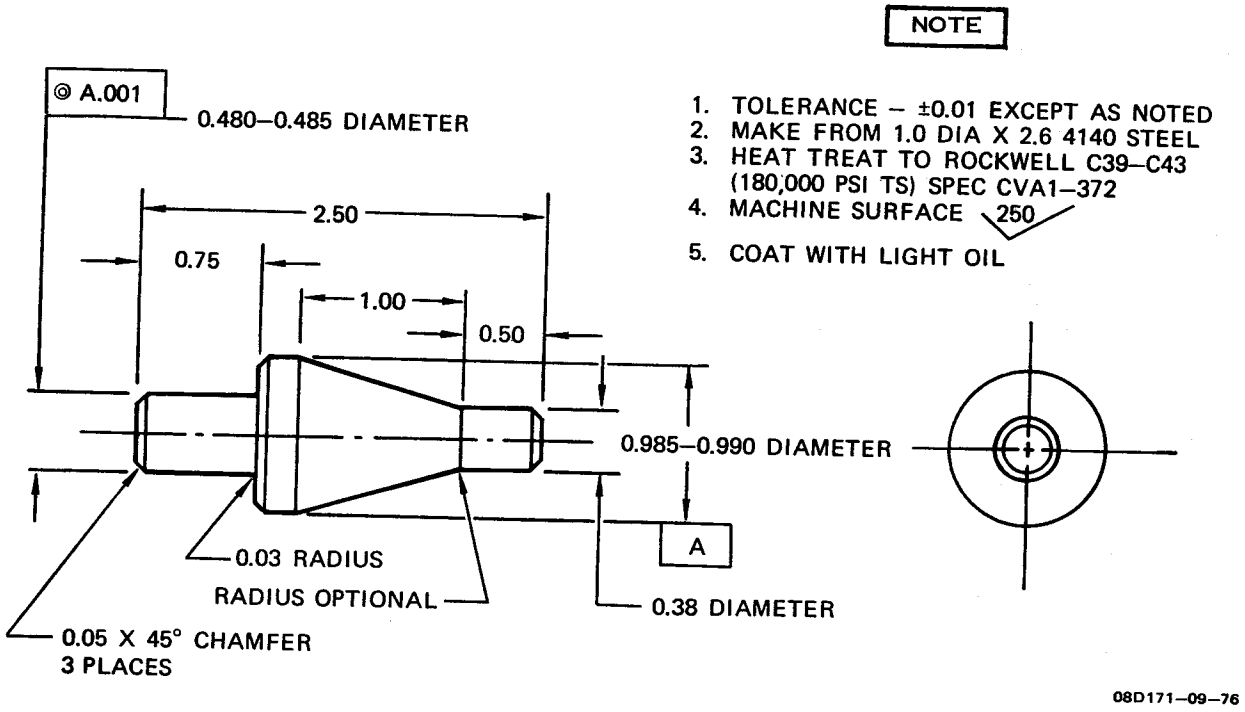


Figure 6-16A. UHT Actuator Pin Removal/Installation Tool

NOTE

With exception of the UHT cylinder and the variable resistor guide assembly, do not replace component parts of the UHT PC package. The package should be replaced as a unit to control linkage slop and prevent UHT flutter.

6-89. REMOVAL. (See figure 6-17.)

a. Dump reservoir accumulator hydraulic pressure (T.O. 1A-7D-2-1).

WARNING

To prevent possible injury to personnel or airplane damage, do not attempt to block or restrain UHT while hydraulic power is applied. Before maintenance, ensure three minutes has been allowed for pressure bleed down after shut down of hydraulic power.

NOTE

For removal of access screws and access 5133-1 or 6133-1, the UHT must be manually moved to the full nose down position by applying down force against the leading edge while the control stick is moved aft.

b. To remove left UHT cylinder, open accesses 5132-1 and 5133-1. To remove right UHT cylinder, open accesses 6132-1 and 6133-1.

c. Remove cotter pin (1), nut (2), washers (3), and bolt (4) from outboard beam (5). Do not remove bushing (6).

NOTE

See figure 6-16 for removal of taper pins.

d. Remove nuts (7), washers (8), taper pins (9), and bushings (10) from forward end of outboard beam.

e. Disconnect followup rod (11) and variable resistor guide assembly (12) (left side only) by removing cotter pin (13), nut (14), washers (15), and bolt (16). Support forward end of guide assembly while removing bolt and then lower to bottom of access.

f. Disconnect input rod (17) by removing self-retaining bolt (18) (paragraph 2-95).

CAUTION

Installation of link (18, figure 6-18) can result in damage to link during cylinder bleeding.

g. On airplanes AF69-6197 and subsequent, remove self-retaining bolt (19) (paragraph 2-95) and disengage load limiting link (20) from package input arm. Disconnect link (18, figure 6-18) and do not reconnect until required by installation (paragraph 6-90, step u).

h. Disconnect each end of inboard and outboard tubes (21, figure 6-17) by removing cotter pins (22), nuts (23), washers (24), and bolts (25).

i. Remove two springs (26).

CAUTION

To avoid damage, do not support PC cylinder by any portion of servo valve of cylinder linkage.

j. Provide support for UHT PC cylinder and remove nuts (27), washers (28), taper pins (29), and bushings (30) from aft end of outboard beam.

CAUTION

To avoid damage to variable resistor guide assembly and wiring, use care when placing beam and guide assembly in bottom of access.

k. Remove cotter pin (31), nut (32), washers (33), and bolt (34) at forward end of outboard beam. Disengage beam and outboard tube from mountings, remove tube, and lower beam and attached guide assembly to bottom of access.

l. Disconnect four hydraulic lines (35).

m. Remove cotter pin (36), nut (37), bolt (39), and retainers (38).

m-1. Support UHT. Using removal/installation tool (figure 6-16A), remove pin (40) connecting rod end to UHT horn.

n. Remove cylinder (41), attached linkage, and inboard tube (21) from airplane.

o. Remove cotter pin (42), nut (43), washers (44), bolt (45), and bushing (46) from trunnion.

p. Disconnect servo valve input linkage by cutting lockwire securing barrel nut (47) and unscrewing barrel nut from rod end while moving linkage clear of cylinder lug end.

q. Remove cylinder from linkage.

r. Remove two check valves (48) and two unions (49) from cylinder. Discard packings (50).

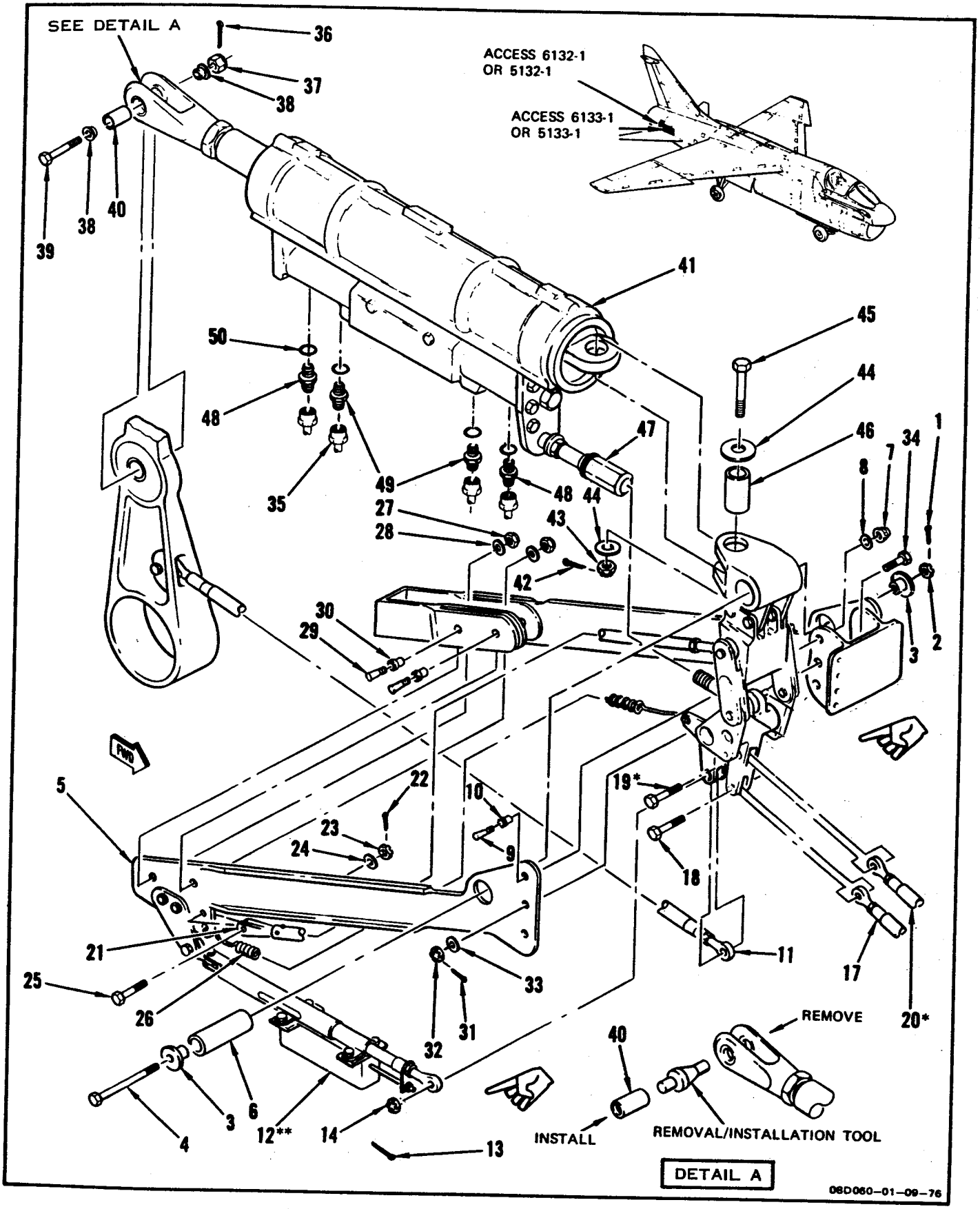
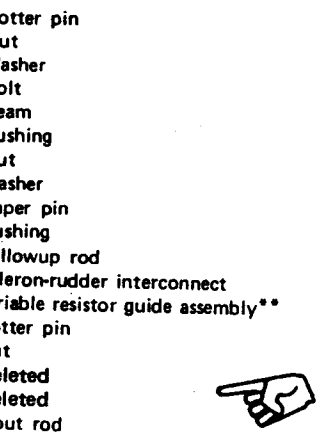


Figure 6-17. UHT PC Cylinder Removal and Installation (Sheet 1)



1. Cotter pin
2. Nut
3. Washer
4. Bolt
5. Beam
6. Bushing
7. Nut
8. Washer
9. Taper pin
10. Bushing
11. Followup rod
12. Aileron-rudder interconnect variable resistor guide assembly**
13. Cotter pin
14. Nut
15. Deleted
16. Deleted
17. Input rod
18. Self-retaining bolt
19. Self-retaining bolt*
20. Load limiting link*
21. Tube
22. Cotter pin
23. Nut
24. Washer
25. Bolt
26. Spring
27. Nut
28. Washer
29. Taper pin
30. Bushing
31. Cotter pin
33. Nut
33. Washer
34. Bolt
35. Hydraulic line
36. Cotter pin
37. Nut
38. Retainer
39. Bolt
40. Pin
41. Cylinder
42. Cotter pin
43. Nut
44. Washer
45. Bolt
46. Bushing
47. Barrel nut
48. Check valve
49. Union
50. Packing

*Airplanes AF69–6197 and subsequent.
**Left side only.

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Figure 6-17. UHT PC Cylinder Removal and Installation (Sheet 2)

6-90. INSTALLATION. (See figure 6-17).

a. Drain preservative fluid and fill cylinder with hydraulic fluid.

CAUTION

To avoid damage to components, do not lift or handle UHT PC package or cylinder and servo valve by any portion of linkage.

b. Using new packings (50), install two check valves (48) at cylinder pressure ports (flow arrows pointing toward cylinder) and two unions (49) at return ports.

c. Cut lockwire and remove barrel nut (47) and rod end from replacement cylinder assembly.

NOTE

To ensure that each end of the barrel nut has adequate grip on the linkage, start both ends of nut onto linkage at approximately the same time.

d. Connect servo valve input linkage to cylinder assembly by aligning linkage with cylinder lug end and screwing barrel nut (47) onto valve input rod. Do not secure with lockwire at this time.

e. Connect cylinder to trunnion with bushing (46), bolt (45), washers (44), nut (43), and new cotter pin (42).

f. Install cylinder (41) and linkage assembly in airplane. While supporting assembly approximately in mounting position, engage clevis end of inboard tube (21) with inboard beam and engage rod end with linkage. Secure tube at each end with bolt (25), washer (24), nut (23), and new cotter pin (22).

f-1. Support UHT. Using removal/installation tool (figure 6-16A), install pin (40).

g. Install bolt (39) with head outboard, retainers (38), nut (37), and new cotter pin (36).

h. Secure hydraulic lines (35) to cylinder.

i. Engage rod end of outboard tube (21) with linkage. Place outboard beam (5) in mounting position and simultaneously engage clevis end of tube with tube attaching point at aft end of beam. Secure tube at each end with bolt (25), washers (24), nut (23), and new cotter pin (22).

NOTE

Install longer bushings at aft holes.

j. Secure aft end of beam with bushings (30) (collars outboard), taper pins (29), washers (28), and nuts (27). Tighten nuts to 70 (±10) pound-inches torque.

k. Secure forward end of beam with bolt (34), washers (33), nut (32), and new cotter pin (31).

l. Install bushings (10) (collars outboard), taper pins (9), washers (8), nuts (7). Tighten nuts to 70 (±10) pound-inches torque.

m. Secure trunnion to beam with bushing (6), bolt (4), washers (3), nut (2), and new cotter pin (1).

n. Install two springs (26).

o. On airplanes AF69-6197 and subsequent, connect load limiting link (20) with self-retaining bolt (19) (paragraph 2-95).

p. Connect input rod (17) with self-retaining bolt (18) (paragraph 2-95).

q. Connect followup rod (11) and variable resistor guide assembly (12) (left side) with bolt (19), nut (14), and new cotter pin (13).

r. Secure barrel nut (47) with MS20995C20 lockwire.

s. Lubricate inner and outer bearings and upper bearing of horn (2) with MIL-G-81322 grease.

t. Bleed UHT cylinder (paragraph 6-49).

u. Rig UHT package (paragraph 6-43).

v. Close accesses 5132-1 and 5133-1 or 6132-1 and 6133-1.

6-91. UNIT HORIZONTAL TAIL ASSEMBLY REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	MIL-G-3859	Grease gun	Grease UHT fittings
	DF600	Torque wrench, 0 to 600 pound-feet	Tighten UHT bearing housing bolts
	CV15-206205-1, -2, -3	Grease gun adapter	Adapt grease gun
6-16A	Local fabrication	UHT actuator pin removal/installation tool	Remove/install actuator-to-horn pin

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6-92. REMOVAL. (See figure 6-18.)

a. Remove tail cone access A105133-1-1 (T.O. 1A-7D-2-1).

b. Open accesses 5132-1, 5133-1, and 5231-1 to remove left UHT. To remove right UHT, open accesses 6132-1, 6133-1, and 6231-1.

c. Disconnect bonding jumpers from UHT housing.

d. Disconnect forward end of followup rod and aileron-rudder interconnect guide assembly from package arm by removing cotter pin, nut, washers, and bolt.

e. Disconnect followup rod (1) from UHT horn (2) by removing cotter pin (3), nut (4), washers (5), and bolt (6).

f. Manually rotate and support UHT in full leading edge down position.

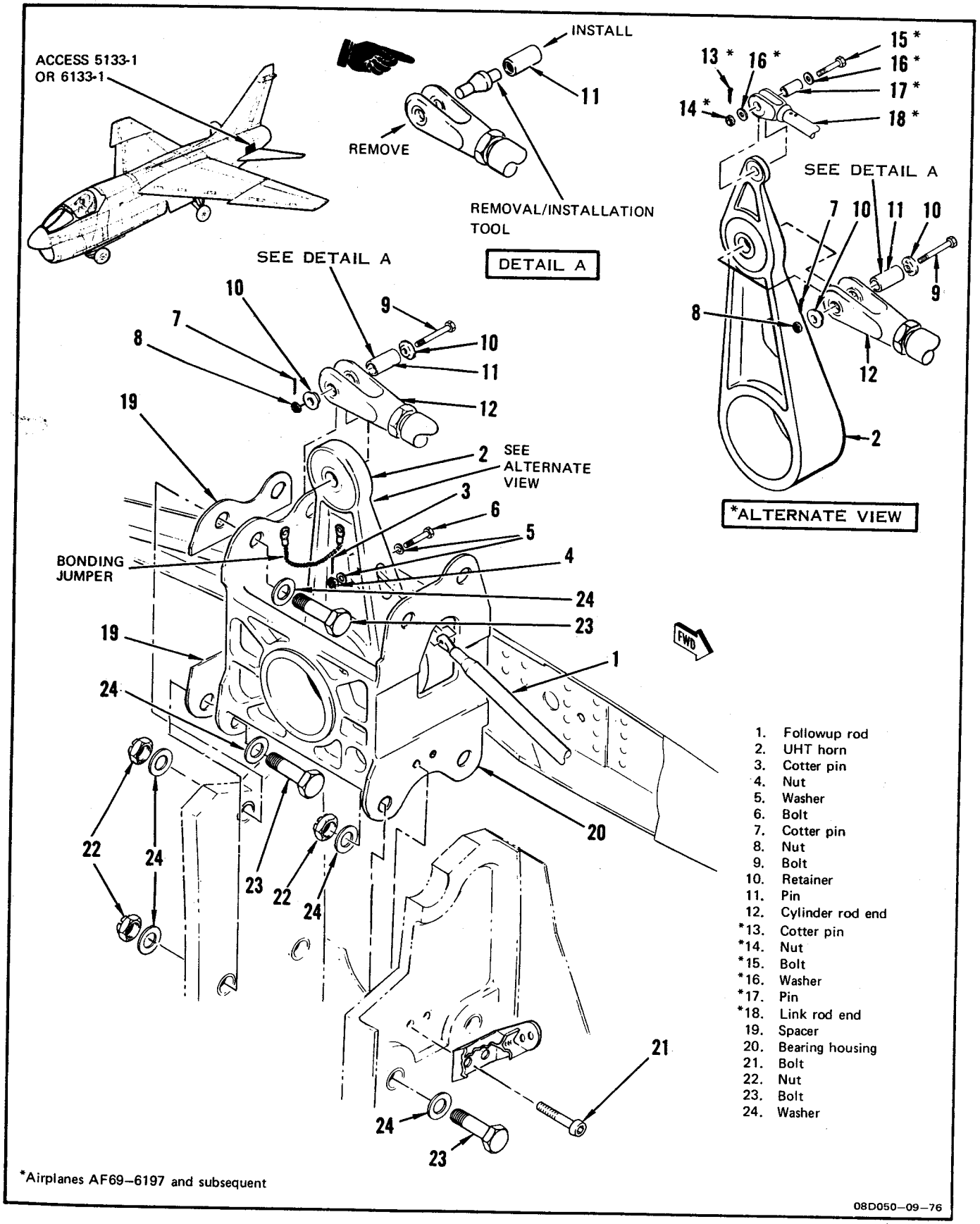

Figure 6-18. UHT Assembly Removal and Installation

g. Pad hole in bulkhead through which piston rod protrudes and support cylinder to prevent damage to piston rod.

h. Remove cotter pin (7), nut (8), bolt (9), and retainers (10).

CAUTION

To prevent serious damage to bulkhead at station 653.6, manually support UHT while disconnecting cylinder rod end (12) from UHT horn. Then carefully allow UHT to travel to the extent of its unrestricted position.

h-1. Support UHT. Using removal/installation tool (figure 6-16A), remove pin (11) connecting cylinder rod end (12) to UHT horn.

i. On airplanes AF69-6197 and subsequent, remove cotter pin (13), nut (14), bolt (15), washers (16), and pin (17), attaching link rod end (18) to UHT horn and secure link clear of horn.

j. Rotate and support UHT near neutral position.

k. Note location of spacers (19) between UHT bearing housing (20) and bulkhead at eight attaching points.

l. Remove two internal wrenching bolts (21).

m. Remove attaching nuts (22), bolts (23), washers (24), and spacers. Remove UHT.

6-93. INSTALLATION. (See figure 6-18.)

WARNING

Alodine is moderately toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate.

Epoxy primer is highly toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate.

a. Apply two coats of MIL-C-5541 (Alodine 1200s) conversion coat with epoxy primer applied in accordance with T.O. 1-1-2, paragraph 6-10.d., NOTE to mating surfaces of bearing housing and bulkhead (T.O. 1A-7D-23).

b. Lubricate inner and outer bearings with MIL-G-81322 grease.

c. Lift UHT to mounting position.

d. Place spacers (19) between bulkheads and bearing housing (20) and install attaching bolts (23), washers (24), and nuts (22). Tighten nuts to 120 (±12) pound-feet torque.

e. Install two internal wrenching bolts (21). Tighten bolts to 200 (±8) pound-feet torque.

f. Trim UHT to match fuselage contour. Minimum allowable clearance between surfaces is 0.19 inch.

g. Rotate and support UHT in full leading edge down position.

g-1. Support UHT. Using removal/installation tool (figure 6-16A), install pin (11).

h. Install bolt (9) with head outboard, retainers (10), and nut (8).

i. Connect followup rod (1) at nonadjustable end to UHT horn (2) with bolt (6), washers (5), nut (4), and new cotter pin (3).

j. Rotate and support UHT in position to align forward end of followup rod attaching holes with package arm.

k. Connect forward end of followup rod and variable resistor guide assembly to package arm with bolt (head inboard), washers (thin washer under bolthead, thick washer between arm and guide assembly rod end, and dimpled washer under nut), and nut. Insert new cotter pin.

l. Connect bonding jumpers to bearing housing.

m. Rig UHT PC package (paragraph 6-43).

n. Install new cotter pin (7).

o. Install tail cone access A105133-1-1.

p. Close accesses 5132-1, 5133-1, and 5231-1, or 6132-1, 6133-1, and 6231-1.

6-94. BLEEDING AFCS PITCH ACTUATOR.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
	AN/ASM-245A	AFCS flight line test set	Connect to pitch actuator for bleeding
	GGG-W-686	Torque wrench, 0 to 15 pound-inches	Tighten bleed fittings
			TT08D133-03-76

a. Open access 9113-2.

NOTE

The AFCS pitch actuator can be bled with the pitch control amplifier installed or removed. If bleeding is preferred with the amplifier installed, proceed to step c.

b. Remove pitch control amplifier (T.O. 1A-7D-2-9).

c. Connect AFCS flight line test set using test cable W1 or W3 as follows:

1. If pitch control amplifier is installed, connect test set to front of amplifier using test cable W1.

2. If pitch control amplifier is removed, connect test set to rack mounted pitch control amplifier receptacle using test cable W3.

d. Connect external electrical power (T.O. 1A-7D-2-1).

e. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1) with test stand set for closed system operation. Do not apply hydraulic pressure.

f. Rotate TEST SIG control on test set to zero.

g. Cut lockwire on all four bleed fittings and connect bleed tubes to bleed fittings on channel 1 side of actuator.

h. Submerge ends of bleed tubes in container of clean hydraulic fluid.

i. Place AFCS yaw stabilization engage switch in STBY for power to test set.

j. Place TEST CHANNEL switch in position 1 and HYDRO switch in BYPASS. Place AFCS SERVO switch in SERVO and hold.

k. Increase hydraulic pressure to unlock actuator and decrease pressure to approximately 500 psi.

l. Slowly rotate TEST SIG control clockwise. When actuator starts extension, open bleed fitting on rod end side of actuator. Continue clockwise rotation of TEST SIG control until actuator bottoms, and close bleed fitting.

m. Slowly rotate TEST SIG control counterclockwise. When actuator starts to retract, open bleed valve on lug side of actuator. Continue counterclockwise rotation of TEST SIG control until actuator bottoms and close bleed fittings.

n. Repeat steps l and m until air-free fluid flows from both bleed valves.

o. Rotate TEST SIG control to zero.

p. Release AFCS/SERVO switch.

q. Connect bleed tubes to bleed fittings on channel 2 side of actuator with ends submerged in hydraulic fluid.

r. Place TEST CHANNEL switch in position 2. Place AFCS/SERVO switch in SERVO and hold. Perform steps l through p for the other pair of bleed plugs.

s. Remove bleed tubes.

t. Tighten bleed fittings to 10 (±5) pound-inches torque. Check for minimum gap of 0.010 inch between bleed fitting and retainer. If gap is less than 0.010 inch, replace bleed fitting.

u. Secure bleed fittings with MS20995C32 lockwire.

v. Disconnect test set from airplane.

w. Perform hydraulic system air check (T.O. 1A-7D-2-1).

x. Install pitch control amplifier (T.O. 1A-7D-2-9), if removed.

y. Perform pitch AFCS operational checkout (T.O. 1A-7D-2-9).

z. Install associated wire bundles and clamps (figure 6-1, sheet 1) and close access 9113-2.

6-95. UHT BACKUP CONTROLS LOAD-LIMITING LINK REMOVAL AND INSTALLATION. (Airplanes AF69-6197 and Subsequent.)

6-96. REMOVAL. (See figure 6-19.)

NOTE

Open access 5133-1 to remove left load-limiting link or 6133-1 to remove right link.

a. Remove accesses 5222-3 and 5133-1 or 6133-1.

b. Remove self-retaining bolt (1) (paragraph 2-95) from UHT linkage.

c. Remove cotter pin (2), nut (3), washers (4), and bolt (5).

d. Move link (6) forward and out through engine bay.

6-97. INSTALLATION. (See figure 6-19.)

a. Position link (6), adjustable end aft, through hole from engine bay to UHT package compartment.

b. Connect link to UHT linkage with self-retaining bolt (1) (paragraph 2-95).

c. Connect forward end of link to bellcrank with bolt (5), washers (4), nut (3), and new cotter pin (2).

d. Perform operational checkout (paragraph 6-30).

e. Close accesses 5222-3 and 5133-1 or 6133-1.

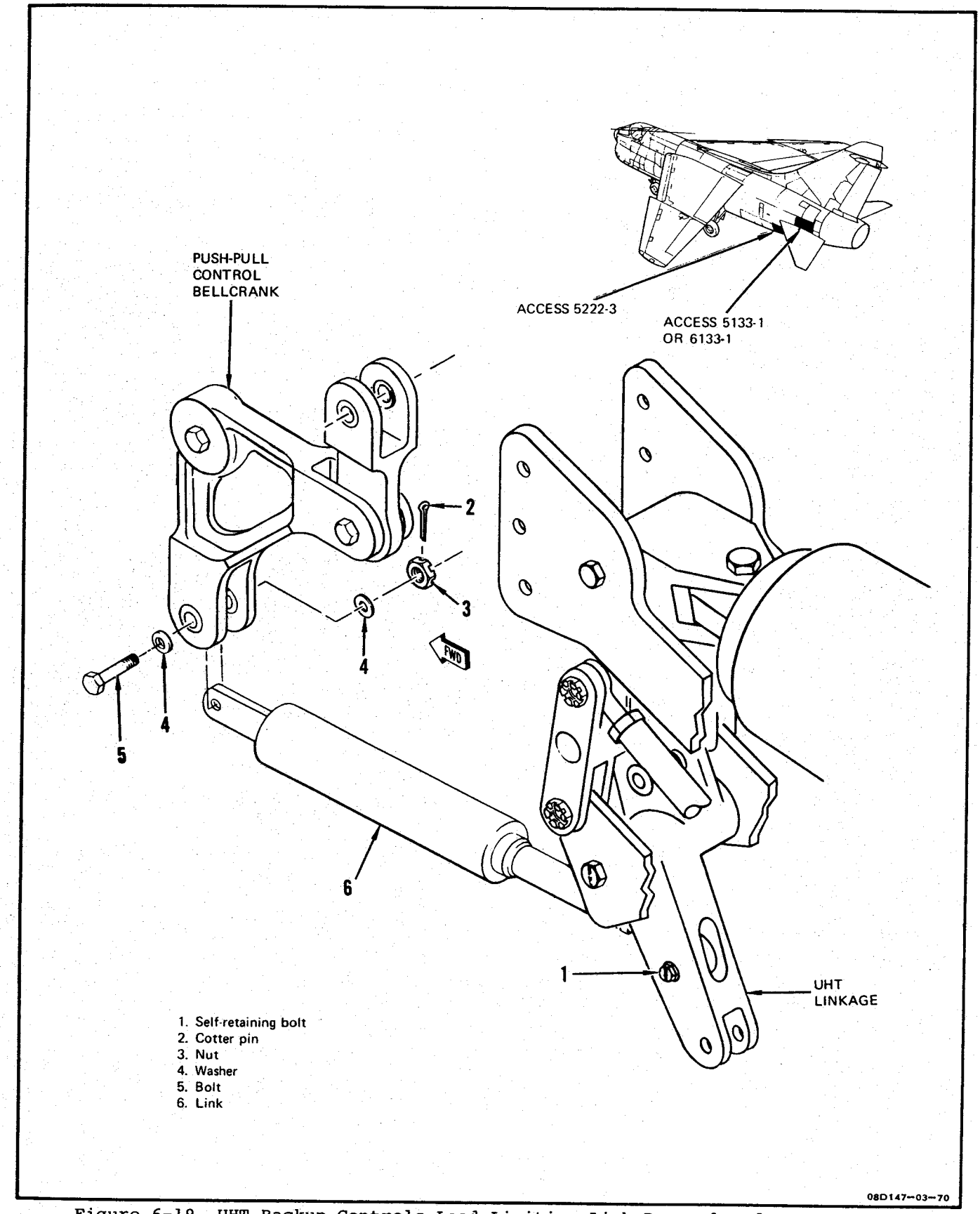

Figure 6-19. UHT Backup Controls Load-Limiting Link Removal and Installation (Airplanes AF69-6197 and Subsequent)

6-98. UHT BACKUP CONTROLS PUSH-PULL CONTROL ASSEMBLY REMOVAL AND INSTALLATION. (Airplanes AF69-6197 and Subsequent.)

CAUTION

To prevent damage to push-pull control assembly (controlex), observe controlex handling precautions given in T.O. 1A-7D-2-1.

6-99. REMOVAL. (See figure 6-20.)

a. Remove engine (T.O. 1A-7D-2-5) or perform the following:

1. Open access 5131-1.

2. Remove tailcone (T.O. 1A-7D-2-1).

3. Remove engine removal door (T.O. 1A-7D-2-1).

4. Remove right tail floodlight assembly (T.O. 1A-7D-2-11).

NOTE

The following procedures must be performed on both ends of the push-pull control assembly.

b. Remove cotter pins (1), nuts (2), washers (3), and bolts (4) from bellcranks.

c. Loosen nuts (5). Remove rod ends (6) and nuts (5).

d. Cut lockwire and remove nuts (7), spacers (8), and washers (9) from bottom of fuselage brackets.

e. Disconnect clamps (10) by removing nuts (11), washers (12), and screws (13).

f. Remove push-pull control assembly (14) from bracket and remove washers (15), spacers (16), and nuts (17).

6-100. INSTALLATION. (See figure 6-20.)

a. Install nut (17), spacer (16), and washer (15) on each end of push-pull control assembly (14).

b. Insert push-pull control assembly through brackets.

c. Install washers (9), spacers (8), nuts (7).

d. Install nuts (5) and rod ends (6). Do not tighten.

NOTE

Remaining items will be installed during rigging.

e. Rig backup controls (paragraph 6-44).

6-101. UHT BACKUP CONTROLS TORQUE TUBE LINK REMOVAL AND INSTALLATION. (Airplanes AF69-6197 and Subsequent.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	MIL-H-4034	Torque wrench, 10 to 150 pound-inches	Tighten link nuts
6-5	215-00110-6	Rigging pins No. 18 (2)	Rig linkage
	7225379-10	Block assembly, rigging	Support UHT
			TT08D140-02-75

6-102. REMOVAL. (See figure 6-21.)

a. Open access 5132-1 to remove left link or access 6132-1 to remove right link.

b. Remove tail cone (T.O. 1A-7D-2-1).

c. Remove tailpipe (T.O. 1A-7D-2-5).

d. Remove cotter pin (1), nut (2), washers (3), bolt (4), and spacer (5) from UHT horn.

e. Remove cotter pin (6), nut (7), washer (8), bolt (9), and spacer (10) from torque tube.

f. Remove link (11).

6-102A. REPLACEMENT OF UHT BACKUP CONTROL TORQUE TUBE LINK BOLT AND ROD ASSEMBLY. (See figure 6-21.)

a. Remove rod end and jamnut (12) from link (11).

b. If link is nonadjustable, remove lock rivet (15).

c. Remove lockring (13); then unscrew bolt and rod assembly (14) from link (11).

d. Coat threads of new bolt and rod assembly with wet epoxy primer prior to installation.

e. Install bolt and rod assembly (14) into link (11) and tighten to a torque of 650 (±50 inch-pounds).

f. Using existing lockring hole in link (11), drill to a depth of 0.31 (±0.03) inches using a 0.078 (5/54) drill bit, then install lockring.

g. Install rod end and nut (12) and adjust length from center of rod hole to center of lug hole to 15.30 inches.

h. If link is fixed, adjust to 16.30 inches and install new lockrivet in existing hole and tighten jam nut to a torque of 550 (±50 inch-pounds).

i. Install link assembly (11)(in accordance with paragraph 6-103).

6-103. INSTALLATION. (See figure 6-21.)

CAUTION

To prevent recurring breakage of replacement link, do not install link until after UHT servo valve stops and synchronization of surfaces are checked (step a).

a. Check servo valve stops and surface synchronization as follows:

1. Open accesses 5133-1 and 6133-1.

2. Install UHT protractors (paragraph 6-35).

3. Disconnect opposite link (11) from torque tube (both links disconnected from torque tube).

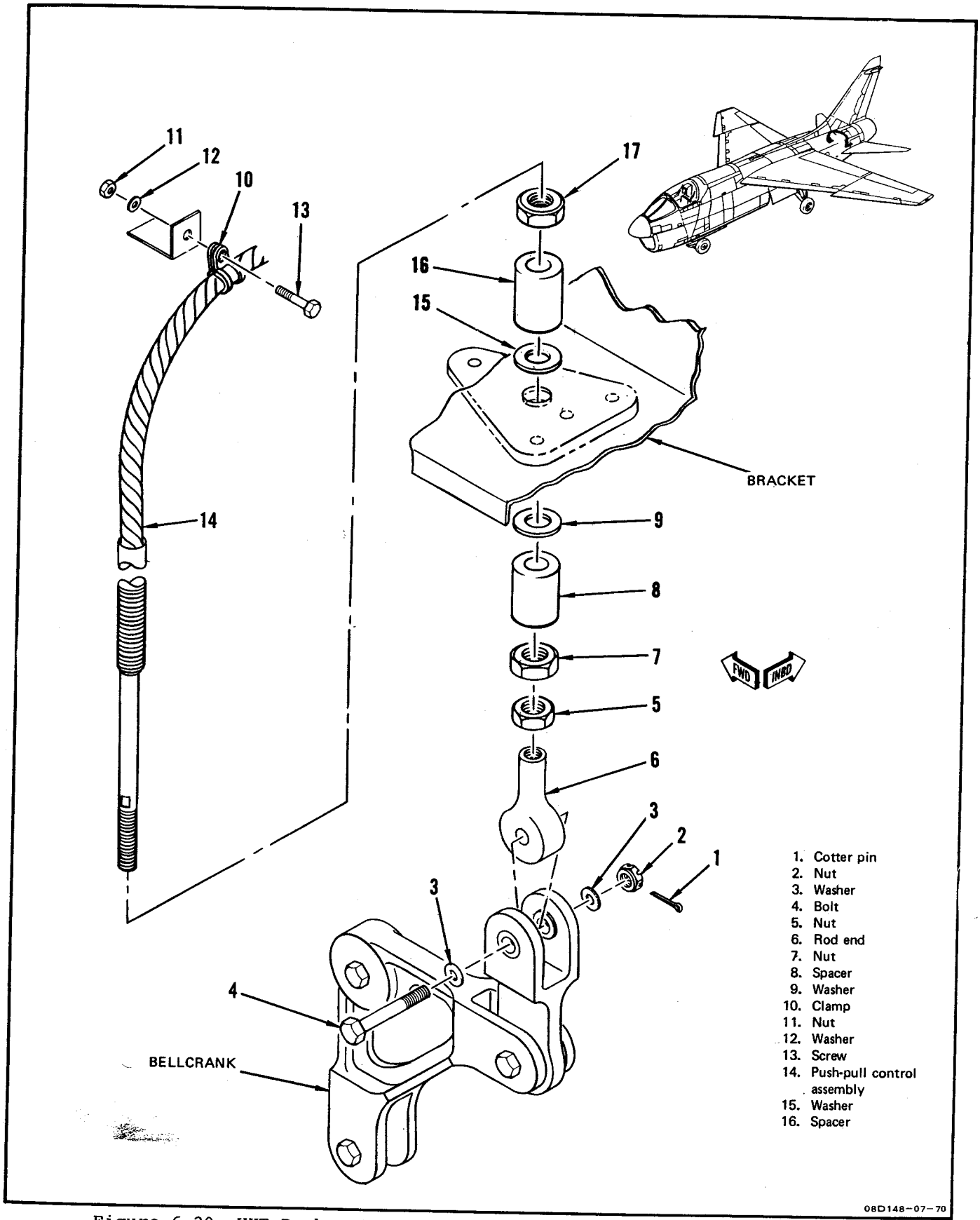

Figure 6-20. UHT Backup Controls Push-Pull Control Assembly Removal and Installation (Airplanes AF69-6197 and Subsequent)

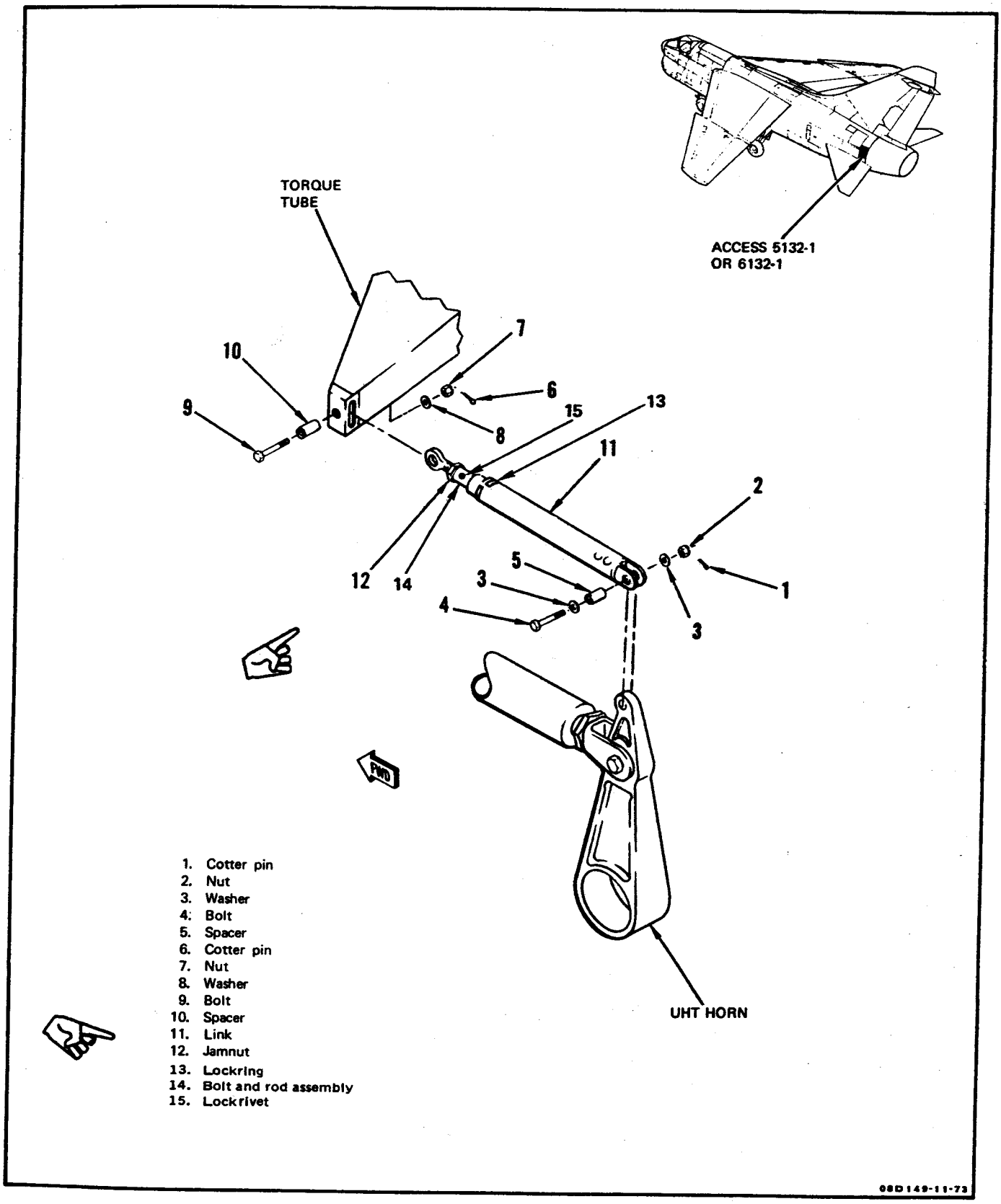

Figure 6-21. UHT Backup Controls Torque Tube Link Removal and Installation (Airplanes AF69-6197 and Subsequent)

4. Disconnect load-limiting links (28, figure 6-5) from UHT input linkage.

5. Synchronize UHT surface (paragraph 6-46) except do not perform operational checkout.

6. Manually position UHT leading edge to 3°00' (±0°30') down (neutral) and support surfaces in this position using rigging block assembly. Check that UHT surfaces are synchronized within 0°12' of each other.

7. Insert two rigging pins No. 18. Check for 1/8-inch clearance between each stop (23 and 25) and servo valve cap (24). If dimension is as specified, proceed to step 10; if not, proceed to step 8.

8. Cut lockwire and adjust forward and aft stops toward servo valve cap until simultaneous contact is made and stops are only finger-tight.

9. Place an index mark on both stops and cap. Back off each stop precisely 3 complete turns which will allow 1/8-inch servo valve travel in each direction. Tighten jamnuts to 72.5 (±12.5) pound-inches torque and secure with MS20995C32 lockwire.

10. Remove rigging pins No. 18.

11. Remove rigging block assembly.

12. Connect load limiting links (28).

b. Connect replacement link (11, figure 6-21) to UHT horn with spacer (5), bolt (4), washers (3), nut (2), and new cotter pin (1). Do not connect to torque tube at this time.

NOTE

Right link may be adjustable or nonadjustable. Nonadjustable link can be identified by a rivet installed through the jamnut end of link.

c. If right link is nonadjustable, connect link to torque tube with spacer (10), bolt (9), washer (8), nut (7), and new cotter pin (6).

NOTE

Link installation will be completed during rigging.

d. Rig UHT backup controls (paragraph 6-44).

e. Install tailpipe (T.O. 1A-7D-2-5).

f. Install tail cone (T.O. 1A-7D-2-1).

g. Close accesses 5133-1 and 6133-1.

6-104. UHT BACKUP CONTROLS TORQUE TUBE REMOVAL AND INSTALLATION. (Airplanes AF69-6197 and Subsequent.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	413-900-020	Torque wrench, 100 to 750 pound-inches	Tighten bolt

TT08D141-04-70

6-105. REMOVAL. (See figure 6-22.)

a. Open accesses 5131-2 and 6131-1.

a-1. Remove tail cone (T.O. 1A-7D-2-1).

b. Remove engine tailpipe (T.O. 1A-7D-2-5).

c. Disconnect links from torque tube by removing cotter pins (1), nuts (2), washers (3), bolts (4), and spacers (5).

d. Cut lockwire and remove bolts (6).

e. Loosen taper pins (7) by installing two washers (6A) and 3/4-16NF nuts (6B) on pins and turning nuts until taper pins are loose.

f. Support torque tube (8), withdraw both taper pins, and remove torque tube.

6-106. INSTALLATION. (See figure 6-22.)

a. Position torque tube (8) in airplane.

b. Lubricate taper pins ~~(7) with~~ MIL-L-7870 oil.

NOTE

Check that antirotation pin in torque tube is intact and not damaged before installing taper pin.

b-1. Slowly insert each taper pin (7) with slot up. Before fully inserting taper pin, ensure that slot engages antirotation pin in torque tube by attempting to rotate taper pin.

c. Install bolts (6). Tighten bolts to 300 (±15) pound-inches torque and secure with MS20995C32 lockwire.

d. Connect links with spacers (5), bolts (4), washers (3), nuts (2), and new cotter pin (1).

e. Perform operational checkout (paragraph 6-30).

f. Install engine tailpipe (T.O. 1A-7D-2-5).

g. Install tail cone (T.O. 1A-7D-2-1).

h. Close accesses 5131-2 and 6131-1.

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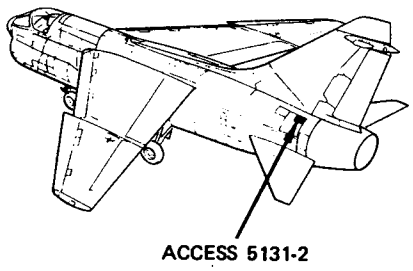
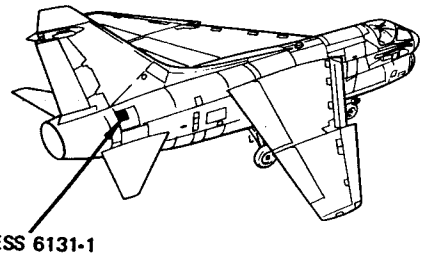
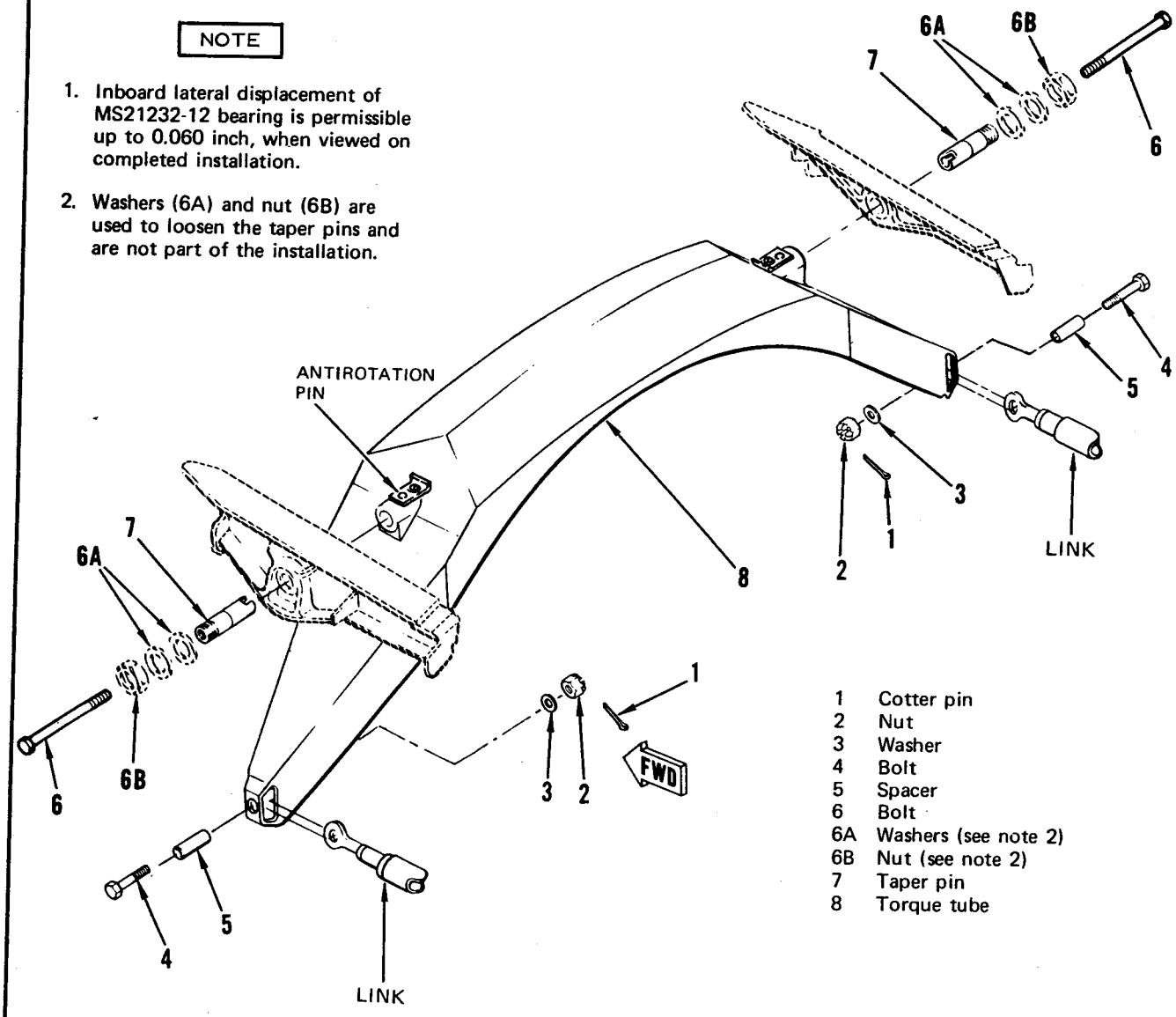




NOTE

1. Inboard lateral displacement of MS21232-12 bearing is permissible up to 0.060 inch, when viewed on completed installation.
2. Washers (6A) and nut (6B) are used to loosen the taper pins and are not part of the installation.



1 Cotter pin
2 Nut
3 Washer
4 Bolt
5 Spacer
6 Bolt
6A Washers (see note 2)
6B Nut (see note 2)
7 Taper pin
8 Torque tube

MAJOR CHANGE

08D150-09-76

Figure 6-22. UHT Backup Controls Torque Tube Removal and Installation (Airplanes AF69-6197 and Subsequent)

Section VII
PITCH TRIM SYSTEM

7-1. DESCRIPTION.

7-2. The pitch trim system is a flight control system used to position UHT control surfaces in the desired trim attitude. The control stick assumes a new neutral position in response to trim inputs. The system consists of a linear electromechanical pitch trim actuator, a combination pitch and roll trim amplifier package, a four-position roll and pitch trim button on the stick grip, and a pitch trim disengage switch. The trim actuator is located in the feel and trim linkage package, and normally acts as a fixed length link in the UHT control system (paragraph 6-1). Manual trim control is provided by up or down movement of the trim button. A maximum trim of 14°30' (+2°, -1°) trailing edge up and 2° (±1°) trailing edge down can be obtained. Automatic pitch trim control is provided when the automatic flight control system is in the attitude hold and/or altitude hold mode of operation. Automatic pitch trim maintains the proper UHT trim to keep the AFCS pitch actuator operating about its neutral point. For information on the automatic flight control system, refer to T.O. 1A-7D-2-9.

7-3. Pitch trim indication is provided by the pitch trim indicator. For information on the trim indication system, refer to paragraph 8-1.

7-4. For system controls and indicators, see figure 3-1. For system arrangement, see figure 7-1. For UHT control system schematic, see figure 6-2.

7-5. OPERATION. (See figures 7-1 and 7-2 or 7-3.)

7-6. With the pitch trim disengage switch in OFF, the trim actuator motor control field and brake coil are grounded. The trim system is disengaged and the actuator cannot be actuated. When the pitch trim disengage switch is in ON, a power circuit from the trim amplifier to the actuator motor control field and brake is completed, engaging the pitch trim system.

7-7. Pushing the roll and pitch trim button up completes a power circuit to apply 28 volts dc to the trim amplifier. The dc voltage is routed through deenergized contacts of an automatic pitch trim control relay and the pitch trim disengage switch and is applied to the trim actuator brake coil, causing the brake to release. In addition, the dc voltage input to the amplifier energizes a noseup control relay. This completes a power circuit from the phase A-C side of a coupling transformer, through deenergized contacts of a nosedown control relay, energized contacts of the noseup control relay, and deenergized contacts of the automatic pitch trim control relay to a noise filter. The noise filter prevents motor noise from the trim actuator from entering the dc voltage circuits within the trim amplifier. The filter output is applied to the trim actuator control field through deenergized contacts of the automatic pitch trim control relay and the pitch trim disengage switch. The pitch trim disengage switch also completes a ground circuit, through deenergized contacts of the automatic pitch trim control relay, to the other side of the control field. The trim actuator motor fixed phase voltage is obtained directly from the 115-volt, phase B, emergency ac bus. With phase A-C voltage applied to the control field, the control field voltage leads the fixed phase voltage and the actuator extends. Extension of the trim actuator supplies a nosedown input into the UHT control system linkage.

7-8. When the trim button is pushed down, a circuit similar to that for nosedown is completed. In this case, the nosedown control relay complete a power circuit from the coupling transformer (phase C-A) to the trim actuator motor control field. With phase C-A voltage applied to the control field, the control field voltage lags the fixed phase voltage, which causes the trim actuator to retract. Retraction of the trim actuator supplies a noseup input to the UHT control system linkage.

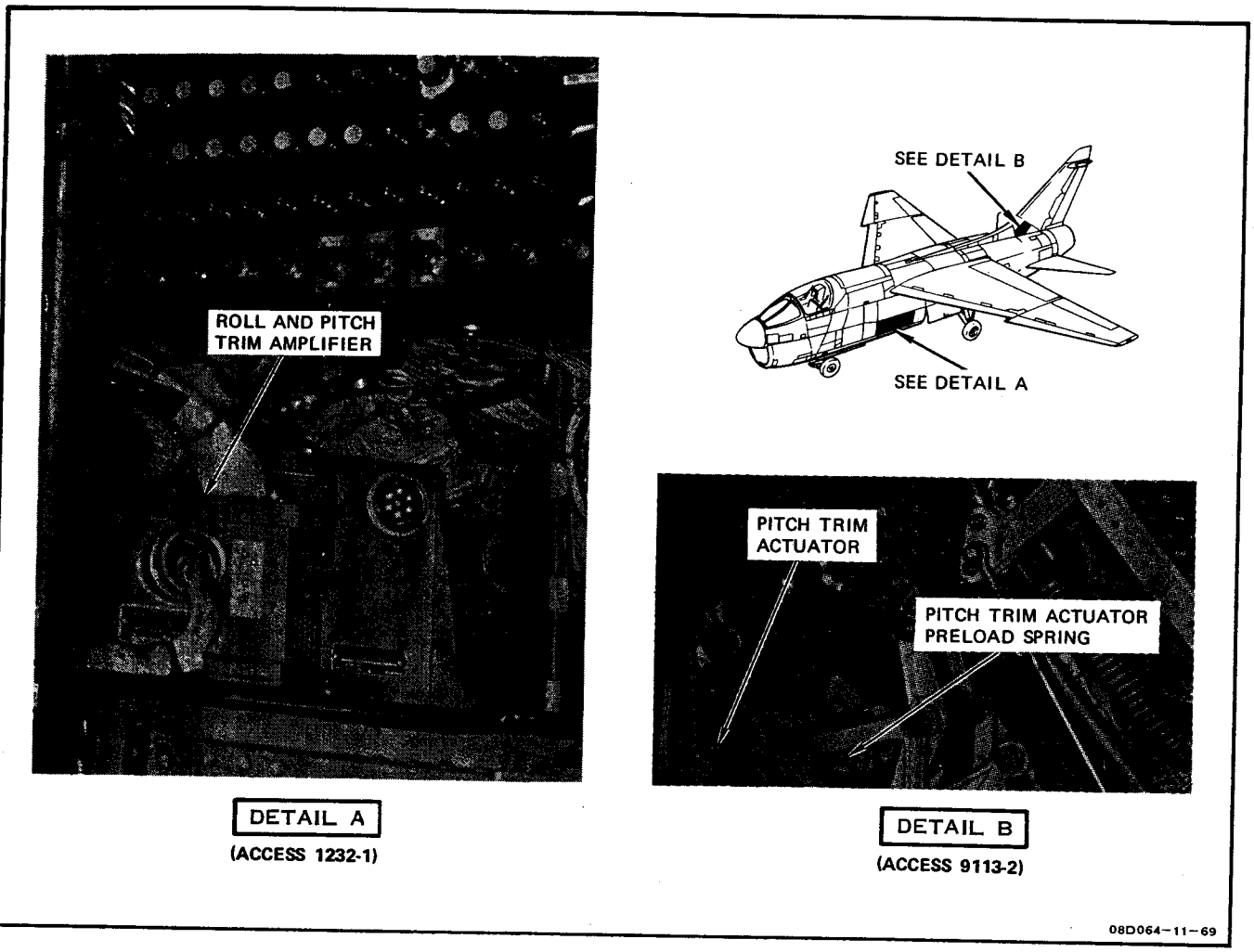


Figure 7-1. Pitch Trim System Arrangement

7-9. When the desired amount of trim (noseup or -down) is obtained, the trim button is released, allowing it to return to the center position. This interrupts the dc voltage circuit to the trim amplifier, causing the applicable pitch control relay to deenergize. Deenergized contacts of the relay interrupt the power circuit from the coupling transformer to the trim actuator motor control field. In addition, without a dc voltage input to the trim amplifier, the trim actuator brake coil power circuit is interrupted, causing the brake to engage. With the brake engaged and no control field power, the trim actuator will maintain the existing UHT trim position until the trim button is again actuated.

7-10. In case of pitch trim actuator runaway, the actuator may be stopped by moving the pitch trim disengage switch to OFF. With the switch in this position, the actuator motor control field and brake coil are grounded. There are no emergency provisions for returning the trim actuator to neutral. The actuator will remain in the position existing at the time pitch trim disengage was selected.

7-11. Automatic pitch trim is operative when the pitch trim disengage switch is in ON, the stabilization switch is in STAB, and the AFCS engage switch is in ATTD (or in CONT AUG with the longitudinal mode engage switch in ALT).

7-12. COMPONENTS.

7-13. For a list of system components, their locations (accesses), and functions, refer to table 7-1.

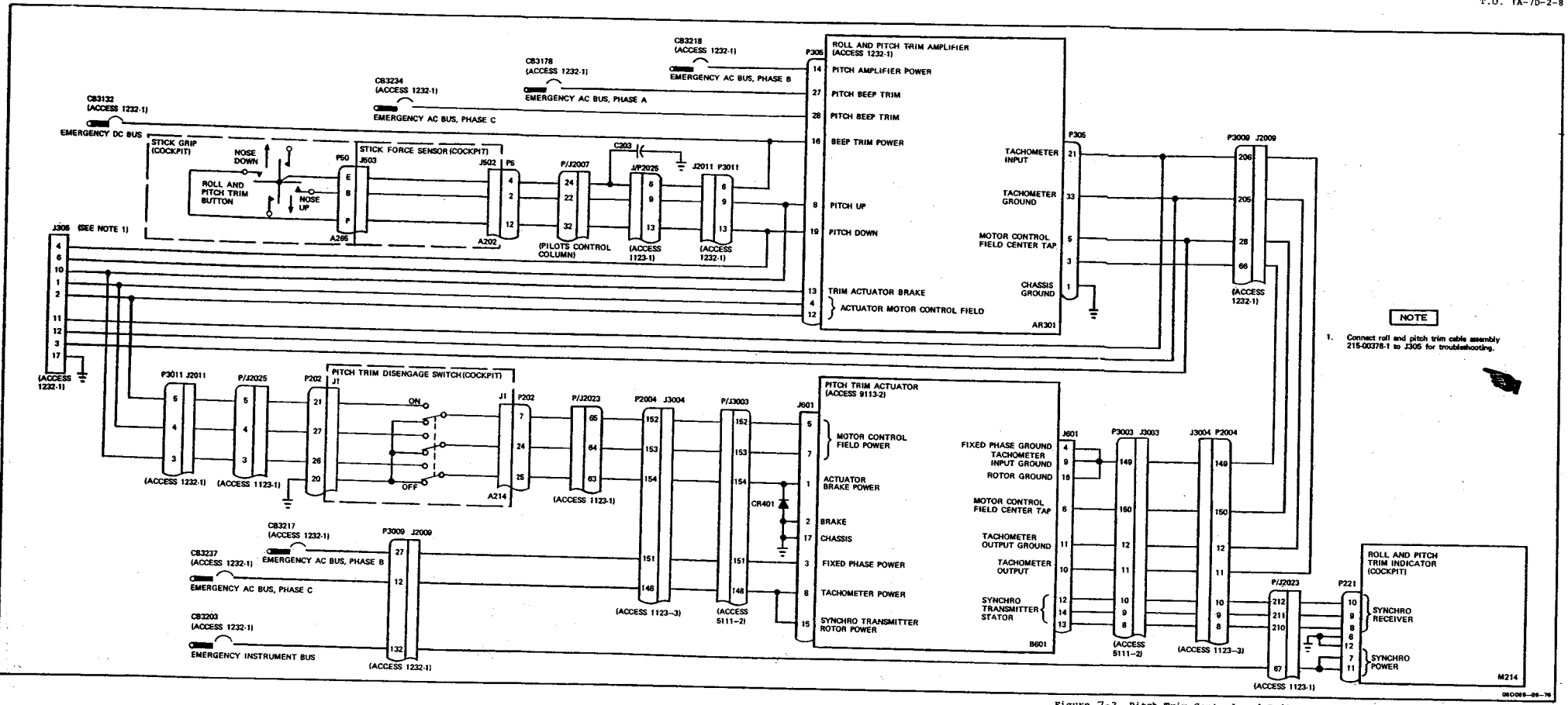


Figure 7-2. Pitch Trim Control and Indicating System Electrical Troubleshooting Schematic Diagram (Airplanes Through AF69-6196)

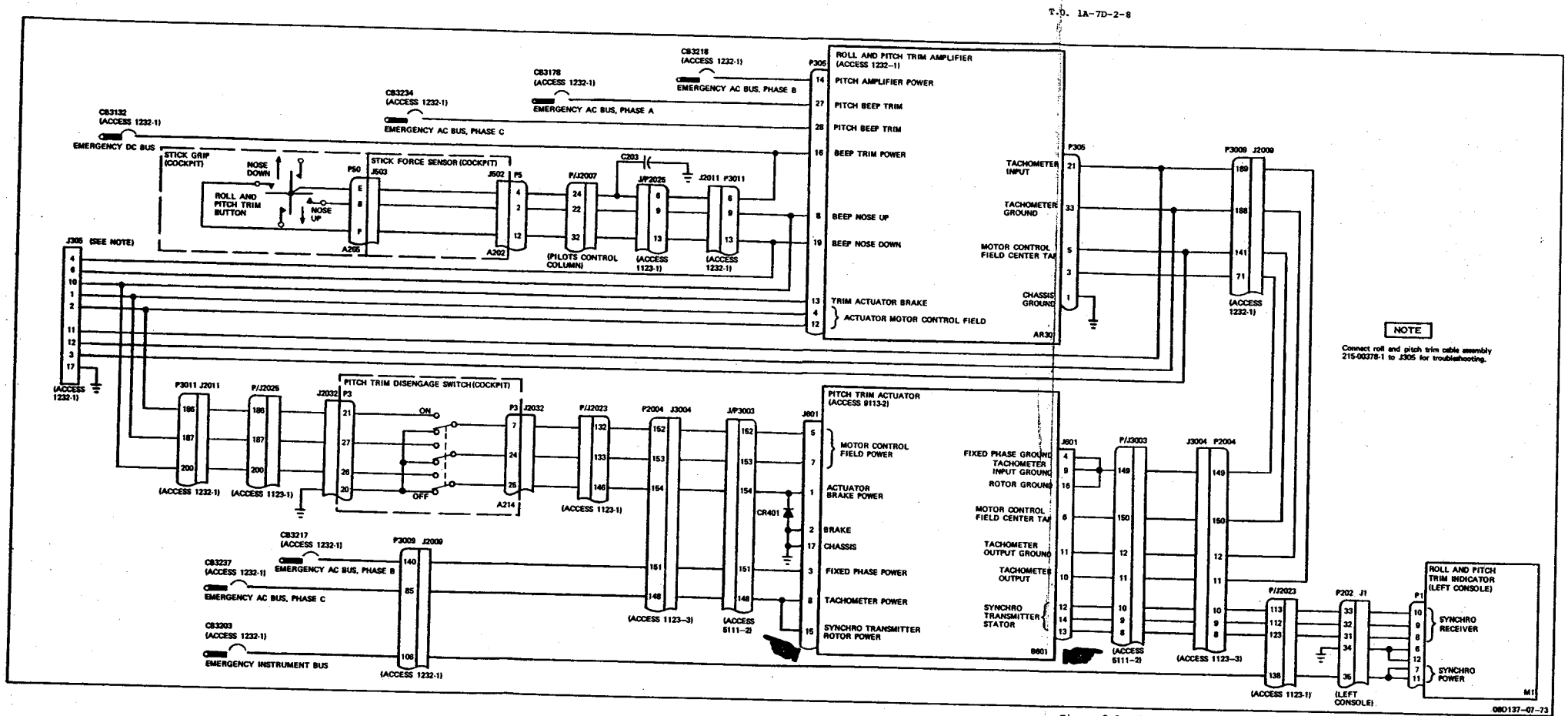


Figure 7-3. Pitch Trim Control and Indicating System Electrical Troubleshooting Schematic Diagram (Airplanes AF69-6197 and Subsequent)

Table 7-1. Pitch Trim System Components

Component	Access	Function
Actuator, pitch trim	9113-2	Positions UHT control surfaces in response to trim signals.
Amplifier, pitch and roll trim	1232-1	Controls electrical circuits to pitch trim actuator.
Button, roll and pitch trim	Stick grip	Supplies pitch trim signals to pitch and roll trim amplifier.
Capacitor (C203)	Cockpit	Eliminates radio frequency interference during beep trim operation.
Circuit breaker CB3132	1232-1	Applies 28-volt dc power from emergency bus to trim button and to beep trim circuits of roll and pitch trim amplifier.
Circuit breaker CB3178	1232-1	Applies 115-volt ac, phase A power from emergency bus to pitch beep trim circuit in roll and pitch trim amplifier.
Circuit breaker CB3217	1232-1	Applies 115-volt ac, phase B power from emergency bus to pitch motor fixed field in pitch trim actuator.
Circuit breaker CB3218	1232-1	Applies 115-volt ac, phase B power from emergency bus to pitch amplifier section of roll and pitch trim amplifier.
Circuit breaker CB3234	1232-1	Applies 115-volt ac, phase C power from emergency bus to pitch beep trim circuit of roll and pitch trim amplifier.
Diode assembly (CR401)	9113-2	Eliminates radio frequency interference during beep trim operation.
Spring, pitch trim actuator preload	9113-2	Preloads pitch trim actuator and connecting linkage to reduce free play.
Switch, pitch trim disengage	Left console	Controls electrical circuits to pitch trim actuator.

7-14. OPERATIONAL CHECKOUT.

Test Equipment Required

Figure & Index No.	*Name*	*AN Type Designation*	*Use and Application*
	Equipment for connecting external electrical power		Connect electrical power
	Equipment for connecting external hydraulic power		Connect hydraulic power
	Stopwatch	GG-S-764A	Time the movement of UHT surfaces

TT08D040-12-68

NOTE

A number, or numbers, enclosed in braces at the end of a step in the following test is a reference to a corresponding number in trouble-shooting table 7-2.

a. Install UHT protractors (paragraph 6-35).

b. Connect external electrical power (T.O. 1A-7D-2-1).

c. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

d. Place pitch trim disengage switch in ON.

da. Place IMS control mode switch on right console in GRID.

db. Check that AN/ASN-90(V) interial measurement set (IMS) is on by observing that attitude director indicator (ADI) sphere on instrument panel aligns to airplane attitude and OFF flag is not in view after 2 minutes.

e. Push up on roll and pitch trim button and hold until maximum nosedown trim is obtained. UHT shall move to 2° (±1°) leading edge up. {1, 2, and 3}

f. Check that pitch trim indicator indicates within 1°30' of UHT position. {4}

g. Push down on trim button and release before maximum trim is obtained. Check that UHT movement does not exceed 1° after releasing trim button. {5}

h. Push down on trim button and hold until maximum noseup trim is obtained. UHT shall move to 14°30' (+2°, -1°) leading edge down. {6}

i. Check that pitch trim indicator indicates within 1°30' of UHT position. {7}

j. Push up on trim button to position UHT 2° (±1°) leading edge up.

k. Push down on trim button to position UHT 14°30' (+2°, -1°) leading edge down and record time required for UHT to move from 2° (±1°) leading edge up position to 14°30' (+2°, -1°) leading edge down position.

l. Repeat steps j and k twice.

m. Compute average time. Average shall be 6.7 (+2.0, -0.7) seconds. {8}

n. Perform AFCS auto-trim test as follows:

1. Push up on trim button to obtain maximum UHT leading edge up position.

2. Place AFCS test selector switch on left console in RATE.

3. Place AFCS yaw stabilization switch in STAB and place AFCS engage switch in ATTD. Pitch trim indicator must remain steady. {9}

4. Press and hold AFCS test pushbutton switch on left console for approximately 5 seconds. Pitch trim indicator must move 6° (±3°) in up direction. {9}

5. Place AFCS test selector switch in OFF.

6. Place AFCS engage switch in OFF.

7. Actuate roll and pitch trim switch to obtain 3° pitch up indication on roll and pitch trim indicator.

8. Place AFCS engage switch in ATTD. Pitch trim indicator must indicate less than 1° drift rate for approximately 30 seconds. {9}

9. Place pitch trim disengage switch in OFF.

10. Place the IMS control mode switch in the OFF position.

11. Place AFCS yaw stabilization switch in OFF. Check that AFCS engage switch returns to OFF.

o. Disconnect external hydraulic power.

p. Disconnect external electrical power.

q. Remove protractors.

7-15. TROUBLESHOOTING. (See figure 7-2 or 7-3.)

Test Equipment Required

Figure & Index No.	*Name*	*AN Type Designation*	*Use and Application*
	Equipment for connecting external electrical power		Connect electrical power
	Multimeter	AN/PSM-6	Check voltage
	Cable assembly, roll and pitch trim	215-00378-1	Provide test jacks for system troubleshooting
			TT08D041-02-75

7-16. Refer to table 7-2 for troubleshooting information. Malfunctions are listed numerically and are related to a corresponding number, or numbers, following a step in the operaticnal checkout.

Table 7-2. Pitch Trim System Troubleshooting

Probable Cause	Isolation Procedure	Remedy
	NOTE Before proceeding with troubleshooting, connect external electrical power and hydraulic power (T.O. 1A-7D-2-1). Open access 1232-1 and connect roll and pitch trim cable assembly (215-00378-1) to test connector J305 to provide test jacks. Place pitch trim disengage switch in ON.	
1. UHT does not move when pitch and roll trim button is pushed up. (Nose down trim.)		
Defective pitch trim actuator.	Push trim button up. Check for 28 volts dc between J10 and J19 of test cable.	If voltage is not indicated, check for defective pitch and roll trim amplifier.
	If voltage is indicated, check for 36 volts ac between J1 and J19 of test cable.	If voltage is not indicated, check for defective pitch and roll trim amplifier.
	If voltage is indicated, open access 9113-2 and disconnect connector J601. Check for 115 volts ac between pins 2 and 3 of connector J601.	If voltage is not indicated, check for defective wiring.

Table 7-2. Pitch Trim System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
	If voltage is indicated, check for continuity between pin 1 of connector J601 and J10 of test cable. Check for continuity between pin 7 of connector J601 and J1 of test cable.	If continuity is not indicated, check for defective pitch trim disengage switch.
	Check for continuity between pins 1 and 2, 3 and 4, 5 and 6, and 5 and 7 of pitch actuator receptacle. Connect connector J601.	If continuity is not indicated, replace defective pitch trim actuator.
Defective pitch and roll trim amplifier.	Push trim button up. Check for 28 volts dc between J4 and J19 of test cable.	If voltage is not indicated, check for defective pitch and roll trim switch.
	If voltage is indicated, disconnect connector P305 from pitch and roll trim amplifier. Check for 115 volts ac between pins 27 and 1 and pins 28 and 1 of connector P305.	If voltage is indicated, replace defective pitch and roll trim amplifier. If voltage is not indicated, check for defective wiring.
Defective pitch and roll trim switch.	Remove grip from control stick. Check for 28 volts dc between pins E of connector J503 and ground.	If voltage is not indicated, check for defective wiring.
	If voltage is indicated, push trim button up and and check fcr continuity between pins E and P of connector P50.	If continuity is not indicated, replace defective stick grip assembly.
Defective wiring.	Check wiring for continuity.	Repair or replace defective wiring.
Defective pitch trim disengage switch.	Remove pilots generator control panel from left console. Check for continuity between pins 25 and 26 and 24 and 27 of connector J1* (or P3#).	If continuity is not indicated, replace defective pitch trim disengage switch.
Defective linkage.	Check linkage for defects.	Repair or replace defective linkage.

Table 7-2. Pitch Trim System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
2. UHT movement is reversed to pitch and roll trim button movement.		
Defective pitch and roll trim amplifier.	Push trim button up. Check for 28 volts dc between J4 and J19 of test cable.	If voltage is not indicated, check for defective wiring.
	If voltage is indicated, install serviceable pitch and roll trim amplifier.	If pitch trim operates correctly, replace removed pitch and roll trim amplifier.
		If pitch trim does not operate correctly, check for defective pitch trim actuator.
Pitch trim actuator.	None.	Replace defective pitch trim actuator.
Defective wiring.	Check wiring for continuity.	Repair or replace defective wiring.
3. UHT trim movement is not within limits.		
Defective pitch trim actuator.	Check pitch trim actuator adjustment.	Replace pitch trim actuator.
4. Pitch trim indicator indicates nosedown trim incorrectly.		
Defective pitch and roll trim indicator.	Refer to paragraph 8-11.	
Defective pitch trim actuator.	Refer to paragraph 8-11.	
5. UHT movement exceeds 1° after releasing trim button.		
Defective pitch trim actuator.	None.	Replace pitch trim actuator.
6. UHT does not move when roll and pitch trim button is pushed down. (Noseup trim.)		
Defective pitch trim actuator.	Push trim button down. Check for 28 volts dc between J10 and J19 of test cable.	If voltage is not indicated, check for defective pitch and roll trim amplifier.

Table 7-2. Pitch Trim System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
	If voltage is indicated, check for 36 volts ac between J1 and J19 of test cable.	If voltage is indicated, replace defective pitch trim actuator. If voltage is not indicated, check for defective pitch and roll trim amplifier.
Defective pitch and roll trim amplifier.	Push trim button down and check for 28 volts dc between J6 and J19 of test cable.	If voltage is indicated, replace defective pitch and roll trim amplifier. If voltage is not indicated, check for defective pitch and roll trim switch.
Defective pitch and roll trim switch.	Remove grip from control stick. Push trim button down and check for continuity between pins E and B of connector P50.	If continuity is not indicated, replace defective stick grip assembly.
Defective wiring.	Check wiring for continuity.	Repair or replace defective wiring.
7. Pitch trim indicator indicates noseup trim incorrectly.		
Defective pitch and roll trim indicator	Refer to paragraph 8-11.	
Defective pitch trim actuator.	Refer to paragraph 8-11.	
8. UHT trim movement too fast or too slow.		
Defective pitch trim actuator.	None.	Replace defective pitch trim actuator.
9. Pitch trim indications incorrect during AFCS auto-trim test.		
Defective AFCS system.	Perform complete AFCS pitch axis checkout.	Repair as necessary.

*Airplanes through AF69-6196
#Airplanes AF69-6197 and subsequent

7-17. PITCH TRIM DISENGAGE SWITCH REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for jacking airplane	Jack airplane

TT08D085-10-69

7-18. REMOVAL.

a. Jack airplane (T.O. 1A-7D-2-1).

b. Connect external electrical power (T.O. 1A-7D-2-1).

c. Press emergency downlock release switch.

d. Place landing gear handle in WHLS UP.

e. Shut down external electrical power.

f. Remove edge-lighted panel assembly from control panel.

g. Remove screws securing control panel. Lift panel and disconnect electrical connectors.

h. Disconnect wires from pitch trim disengage switch.

i. Remove nut and washer securing switch to control panel and remove switch.

7-19. INSTALLATION.

a. Position pitch trim disengage switch on control panel and secure with washer and nut.

b. Connect control panel wires to switch.

c. Connect console electrical harness connectors to control panel.

d. Position control panel on console and secure with screws.

e. Install edge-lighted panel assembly.

WARNING

Landing gear must be cycled before lowering airplane and removing jacks to ensure gear is in down and locked position.

f. Cycle gear and lower airplane in accordance with jacking procedures (T.O. 1A-7D-2-1).

g. Perform pitch trim system operational checkout (paragraph 7-14).

7-20. PITCH TRIM ACTUATOR REMOVAL AND INSTALLATION.

7-21. REMOVAL. (See figure 7-4.)

a. Open access 9113-2.

b. Disconnect electrical connector and unclamp wiring.

c. Disconnect rod end of actuator (1) from arm (2) by removing cotter pin (3), nut (4), washers (5), and bolt (6).

d. Disconnect actuator from support lug (7) by removing cotter pin (8), nut (9), washers (10), and bolt (11).

e. Manipulate actuator to clear linkage and remove actuator.

7-22. INSTALLATION. (See figure 7-4.)

NOTE

Ensure that actuator measures 7.5 inches between mounting holes when shaft scribe mark aligns with housing.

a. Position actuator (1) in airplane with hole in actuator lug end aligned

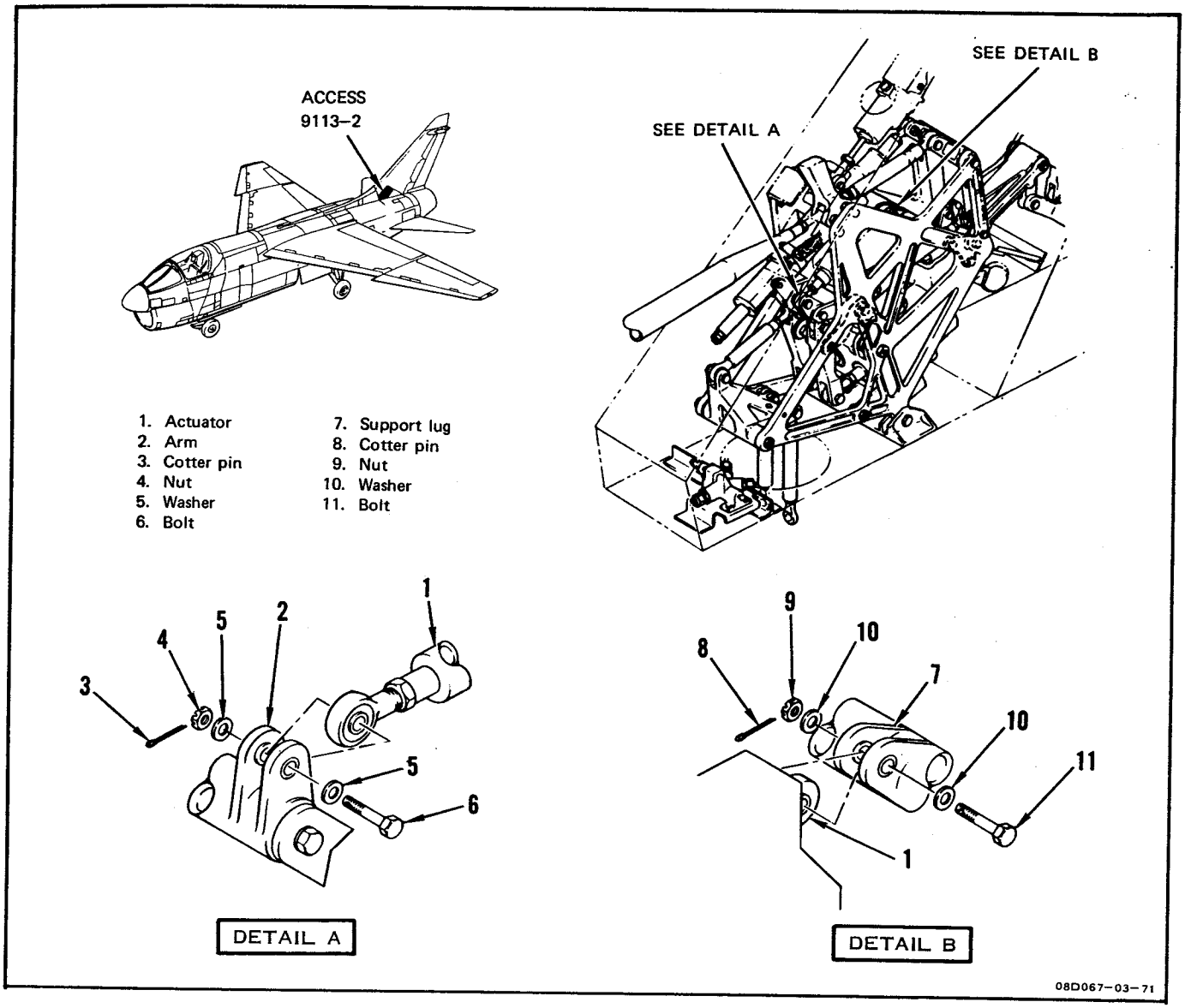


Figure 7-4. Pitch Trim Actuator Removal and Installation

with hole in support lug (7). Secure actuator to support lug with washers (10), bolt (11), nut (9), and new cotter pin (8).

b. Align hole in rod end of actuator with hole in arm (2). If holes will not align, loosen jamnut and adjust rod end as required for proper alignment. Tighten jamnut and secure rod end to arm with washers (5), bolt (6), and nut (4).

c. Connect electrical connector and clamp wiring.

d. Check actuator rigging (paragraph 7-23).

e. Install new cotter pin (3).

f. Perform pitch trim system operational checkout (paragraph 7-14).

g. Close access 9113-2.

7-23. PITCH TRIM ACTUATOR RIGGING CHECK.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
6-5	215-00110-7	Rigging pin No. 15	Rig linkage
			TT08D042-02-75

a. Open access 9113-2.

b. Connect external electrical power (T.O. 1A-7D-2-1).

c. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

d. Place pitch trim disengage switch in ON.

NOTE

See figure 6-5 for rigging pin locations.

e. Actuate pitch trim actuator to position where rigging pin No. 15 can be inserted.

f. Check that scribe mark on actuator shaft is aligned with housing end within ±0.01 inch. If scribe mark is not within ±0.01 inch, adjust actuator rod end as follows:

1. Remove cotter pin, nut, washers, and bolt connecting rod end to arm.

2. Actuate trim button until scribe mark aligns with housing end within ±0.01 inch.

3. Loosen jamnut and adjust rod end until holes in rod end and arm are aligned.

4. Tighten rod end jamnut and connect rod end to arm with bolt, washers, nut, and new cotter pin.

g. Remove rigging pin No. 15.

h. Disconnect external electrical power and hydraulic power (T.O. 1A-7D-2-1).

i. Close access 9113-2.

7-24. PITCH TRIM ACTUATOR TACHOMETER GENERATOR CHECKOUT. (See figure 7-2 or 7-3.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment required for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
	403B	AC voltmeter	Measure voltage
	215-00378-1	Cable assembly, roll and pitch trim	Provide test jacks for voltage check
			TT08D157-02-75

NOTE

The following procedure is used only when pitch trim actuator tachometer generator checkout is required due to abnormal pitch trim indications during AFCS troubleshooting (T.O. 1A-7D-2-9).

a. Open access 1233-1.

b. Connect roll and pitch trim cable assembly to test connector J305.

c. Place pitch trim disengage switch in ON.

d. Connect external electrical power (T.O. 1A-7D-2-1).

e. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

f. Push pitch trim button to run trim actuator full up or full down. Push trim button in the opposite direction and measure voltage between J11 and J12 of test cable while actuator is running at full speed.

1. If 3.0 to 6.0 volts ac is indicated, tachometer generator output is correct. Shut down electrical power. Replace roll and pitch trim amplifier (paragraph 3-23).

2. If 3.0 to 6.0 volts ac is not indicated, tachometer generator output is incorrect. Shut down electrical power. Replace pitch trim actuator (paragraph 7-20).

g. Perform roll trim system operational checkout (paragraph 3-12).

h. Perform pitch trim system operational checkout (paragraph 7-14).

i. Place pitch trim disengage switch in OFF.

j. Disconnect external electrical and hydraulic power (T.O. 1A-7D-2-1).

k. Disconnect pitch and roll trim cable assembly from test connector.

l. Close access 1233-1.

7-25. ROLL/PITCH TRIM AMPLIFIER REMOVAL AND INSTALLATION. (Refer to paragraph 3-23.)

Section VIII

CONTROL SURFACE POSITION INDICATING SYSTEM

8-1. DESCRIPTION.

8-2. The roll and pitch trim indicator receives electrical signals proportional to the displacement of the roll and pitch trim actuators, to provide continuous indication of aileron and UHT trim positions. The control surface position indicating system consists of a roll trim synchro transmitter, a pitch trim synchro transmitter, and a dual pointer roll and pitch trim indicator.

8-3. For system indicators, see figure 3-1.

8-4. OPERATION. (See figure 8-1.)

8-5. The roll trim actuator synchro transmitter rotor is powered by the 115-volt, phase C, emergency ac bus and the trim indicator synchro receiver is powered by the 26-volt ac emergency instrument bus. The synchro transmitter is an integral part of the trim actuator which allows the transmitter rotor to be positioned by actuator displacement. With the roll trim actuator at trim neutral position, the corresponding signal voltages in the synchro receiver stator will be at a null. With the stator input at a null, the roll trim indicator pointer will indicate 0° roll trim. When the trim actuator strokes, the synchro transmitter rotor is repositioned, causing a voltage to be induced in the transmitter stator. This voltage causes an unbalance between the transmitter stator and the synchro receiver stator. Since the transmitter rotor is not free to turn, the receiver rotor moves until the stator signal voltages are balanced. As the receiver rotor moves, the roll trim pointer moves to indicate roll trim corresponding to trim actuator displacement from neutral.

8-6. The pitch trim indicating circuit operation is identical to that for roll trim. When the corresponding synchro receiver stator input signal is at null, the pitch trim indicator pointer will indicate 3° pitch-up trim.

8-7. COMPONENTS.

8-8. For a list of system components, their locations (accesses), and functions, refer to table 8-1.

8-9. OPERATIONAL CHECKOUT - ROLL TRIM INDICATING SYSTEM.

Test Equipment Required

Figure & Index No.	*Name*	*AN Type Designation*	*Use and Application*
	Equipment for connecting external electrical power		Connect electrical power
	Equipment for connecting external hydraulic power		Connect hydraulic power
	Multimeter, AC-DC	AN/PSM-6	Measure voltage

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NOTE

A number, or numbers, enclosed in braces at the end of a step in the following test is a reference to a corresponding number in trouble-shooting table 8-2.

a. Install aileron protractors (paragraph 2-98).

b. Connect external electrical power (T.O. 1A-7D-2-1).

c. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

d. Place roll trim disengage switch in ON.

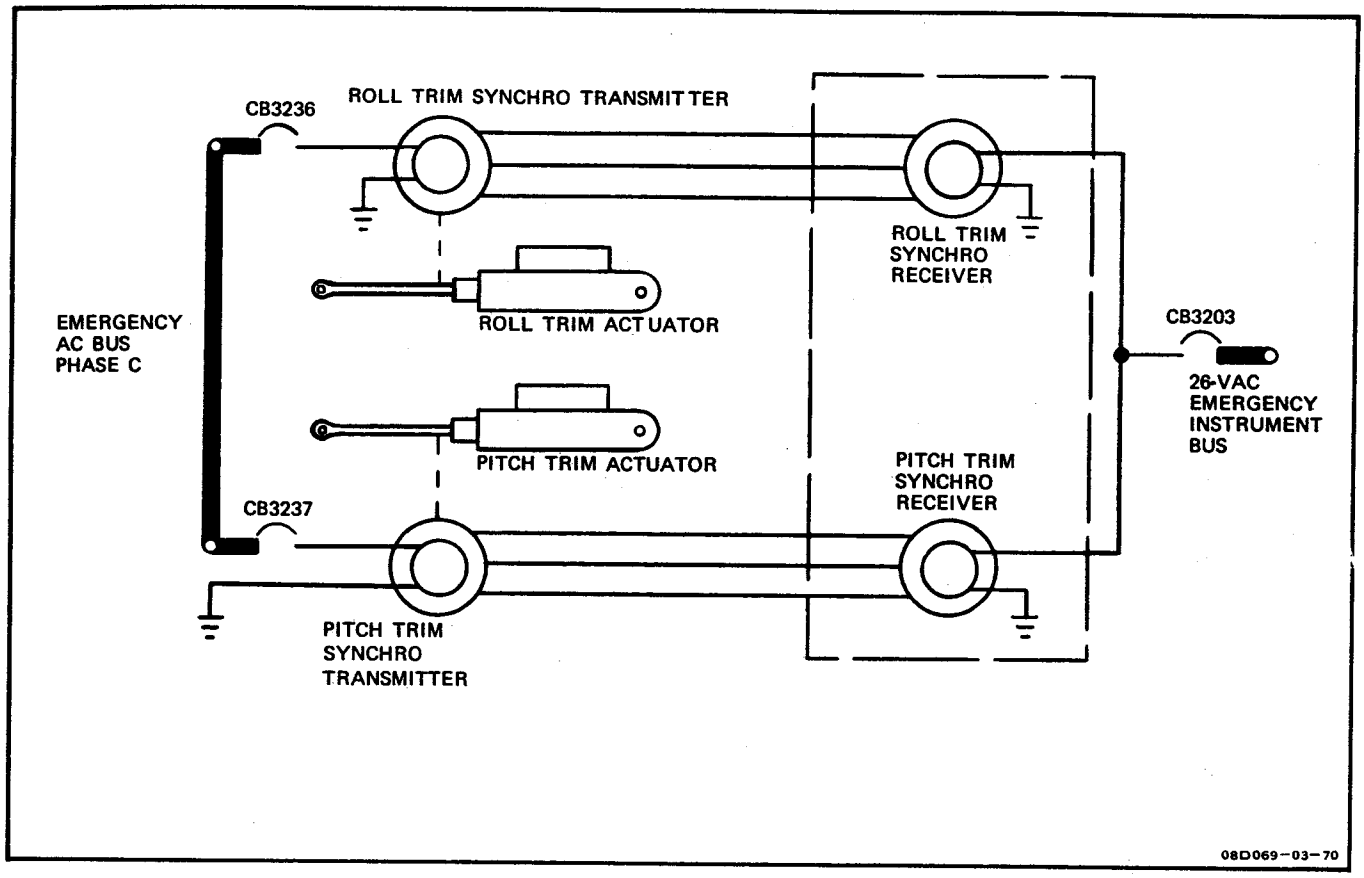


Figure 8-1. Control Surface Position Indicating System Schematic Diagram

e. Push roll and pitch trim button fully right. Left aileron shall be 13° (±1°) down. Roll trim indicator shall indicate within 1°30' of left aileron position. {1 and 2}

f. Push roll and pitch trim button fully left. Right aileron shall be 13° (±1°) down. Roll trim indicator shall indicate within 1°30' of right aileron position. {1 and 2}

g. Place roll trim disengage switch in OFF.

h. Disconnect external hydraulic and electrical power.

i. Remove protractors.

8-10. OPERATIONAL CHECKOUT - PITCH TRIM INDICATING SYSTEM.

Test Equipment Required

Figure & Index No.	*Name*	*AN Type Designation*	*Use and Application*
	Equipment for connecting external electrical power		Connect electrical power
	Equipment for connecting external hydraulic power		Connect hydraulic power
	Multimeter, AC-DC	AN/PSM-6	Measure voltage
			TT08D044-05-69

Table 8-1. Control Surface Position Indicating System Components

Component	Access	Function
Circuit breaker CB3203	1232-1	Applies 26-volt ac power from emergency instrument bus to roll and pitch trim indicator synchros.
Circuit breaker CB3236	1232-1	Applies 115-volt ac, phase C power from emergency bus to roll trim actuator synchro transmitter rotor (for position indication) and to actuator motor fixed phase.
Circuit breaker CB3237	1232-1	Applies 115-volt ac, phase C power from emergency bus to pitch trim actuator synchro transmitter rotor (for position indication) and to actuator tachometer generator.
Indicator, roll and pitch trim	Left console	Indicates aileron and UHT trim.
Transmitter, pitch trim synchro	9113-2	Provides input signals to the pitch trim indicator synchro receiver.
Transmitter, roll trim synchro	5111-1	Provides input signals to the roll trim indicator synchro receiver.

NOTE

A number, or numbers, enclosed in braces at the end of a step in the following test is a reference to a corresponding number in troubleshooting table 8-2.

a. Install UHT protractor (paragraph 6-35).

b. Connect external electrical power (T.O. 1A-7D-2-1).

c. Connect external hydraulic power to all PC systems (T.O. 1A-7D-2-1).

d. Place pitch trim disengage switch in ON.

e. Push roll and pitch trim button to position UHT 3° (±0°30') leading edge down (neutral). Pitch trim indicator shall indicate within 1°30' of UHT position. {3 and 4}

f. Push up on trim button. UHT position shall be 2° (±1°) leading edge up. Pitch trim indicator shall indicate within 1.5° of UHT position. {3 and 4}

g. Push down on trim button. UHT position shall be 14°30' (+2°, -1°) leading edge down. Pitch trim indicator shall indicate within 1.5°0' of UHT position. {3 and 4}

h. Disconnect external hydraulic and electrical power (T.O. 1A-7D-2-1).

i. Remove protractor.

8-11. TROUBLESHOOTING. (See figures 3-3 and 7-2 or 3-4 and 7-3.)

8-12. Refer to table 8-2 for troubleshooting information. Malfunctions in the table are listed numerically and are related to a corresponding number, or numbers, following a step in the operational checkout.

Table 8-2. Control Surface Position Indicating System Troubleshooting

Probable Cause	Isolation Procedure	Remedy
1. Roll trim indicator indicates incorrectly.		
Pitch and roll trim indicator defective.	Remove pitch and roll trim indicator from left console. Disconnect connector from indicator and connect serviceable unit. Perform roll trim system operational checkout.	If indicator indicates correctly, replace removed pitch and roll trim indicator. If indicator indicates incorrectly check for defective actuator.
Roll trim actuator defective.	None.	Replace defective roll trim actuator.
2. Roll trim indicator inoperative.		
Pitch and roll trim indicator defective.	Remove pitch and roll trim indicator from left console. Disconnect connector from indicator. Check for 26 volts ac between pins 6 and 7 and between pins 11 and 12. If voltage is indicated, connect serviceable indicator. Perform roll trim system operational checkout. If voltage is not indicated, check for defective wiring.	If indicator indicates correctly, replace removed pitch and roll trim indicator. If indicator is inoperative check for defective actuator.
Roll trim actuator defective.	Open access 6111-1 and disconnect connector P332 from roll trim actuator. Check for 115 volts ac between pins 11 and 12 of connector P332. If voltage is indicated, check for continuity between pins 11 and 12 and between pins 8, 9, and 10 of actuator connector.	If continuity is not indicated, replace defective roll trim actuator. If voltage is not indicated, check for defective wiring.
Defective wiring.	Check wiring for continuity.	Repair or replace defective wiring.
3. Pitch trim indicator indicates incorrectly.		
Pitch and roll trim indicator defective.	Remove pitch and roll trim indicator from left console. Disconnect connector from indicator and connect serviceable unit. Perform pitch trim system operational checkout.	If indicator indicates correctly, replace removed pitch and roll trim indicator. If indicator indicates incorrectly, check for defective actuator.
Pitch trim actuator defective.	None.	Replace defective pitch trim actuator.

Table 8-2. Control Surface Position Indicating System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
4. Pitch trim indicator inoperative.		
Pitch and roll indicator defective.	Remove pitch and roll trim indicator from left console. Disconnect connector from indicator and check for 26 volts ac between pins 11 and 12 and between pins 6 and 7 of connector. If voltage is indicated, install serviceable unit and perform pitch trim indicating system operational checkout. If voltage is not indicated check for defective wiring.	If indicator operates properly, replace removed pitch and roll trim indicator. If indicator is inoperative, check for defective pitch trim actuator.
Pitch trim actuator defective.	Open access 9113-2 and disconnect connector J601. Check for 115 volts between pins 15 and 16 of connector J601. If voltage is indicated, check for continuity between pins 12, 13, and 14 of actuator connector.	If continuity is not indicated, replace defective pitch trim actuator. If voltage is not indicated, check for defective wiring.
Wiring defective.	Check wiring for continuity.	Repair or replace defective wiring.

8-13. ROLL AND PITCH TRIM INDICATOR REMOVAL AND INSTALLATION.

8-14. REMOVAL.

a. Loosen mounting screw and disconnect electrical connector from indicator.

b. Remove indicator from left console.

8-15. INSTALLATION.

a. Connect electrical connector to indicator and install indicator on left console.

b. Tighten mounting screw.

c. Perform roll and pitch trim operational checkout (paragraph 8-9 and 8-10).

Section IX

FLAP SYSTEM

9-1. DESCRIPTION.

9-2. The flap system provides the components necessary for increased airplane stability and lift during takeoff and landing. On airplanes AF69-6197 and subsequent, the pilot may select an automatic maneuvering flap (AMF) system which automatically provides flap operation to increase stall resistance within a certain performance envelope of speed and attitude.

9-3. The flap system consists of full span, two position, center wing and outer wing leading edge flaps, slotted, variable position, center wing trailing edge flaps, cockpit controls, normal flap hydraulic system, emergency flap extension accumulator package, and on airplanes AF69-6197 and subsequent, the AMF system.

9-4. Normal flap operating pressure is provided by the utility hydraulic system which is supplied from the PC No. 2 hydraulic system through the isolation valve. A control handle in the cockpit mechanically actuates the isolation and the selector valve to control hydraulic pressure to the leading edge flaps and the trailing edge flap valve package. Switches actuated by the flap control handle cause a solenoid-actuated selector valve in the trailing edge flap valve package to route hydraulic pressure to the trailing edge flaps.

9-4A. On airplanes AF69-6197 and subsequent, an AMF extend shutoff valve, extend valve, and a retract valve bypass PC No. 2 hydraulic pressure around the isolation valve and normal flap selector valve for maneuvering flap operation. These valves and the trailing edge flap selector valve are controlled by an electronic control unit which monitors airplane speed and attitude and commands flap extension or retraction according to the requirements of a predetermined performance envelope. An AMF control switch on the pilot's left console provides selection of the AMF system when the flap handle is in ISO UTIL. An AMF advisory light on the right console comes on to inform the pilot that the AMF system is not in operation. The pilot can retract the maneuvering flaps by depressing and holding the AMF retract switch on the stick grip.

9-5. The normal flap operating system consists of a mechanical control, selector valve, variable trailing edge flap valve package, 12 actuating cylinders (two for each flap), and various restrictors to control flap movement rate. On airplanes AF69-6197 and subsequent, an AMF control switch, electronic control unit, extend shutoff valve, extend valve, retract valve, thermal relief valve, two overspeed switches, and a trailing edge flap position potentiometer are added to provide operation in the AMF mode.

9-6. Emergency flap operating pressure is provided for flap extension by accumulator package which is precharged with nitrogen on the pneumatic side and charged to normal hydraulic system operating pressure on the oil side. This provides a stored hydraulic energy service adequate for one flap extension. There are no provisions for emergency flap retraction.

9-7. The emergency flap system consists primarily of an electrical control circuit, emergency flap selector valve, emergency bypass valve for the leading edge flaps, emergency bypass valve for the trailing edge flaps, shuttle valve for the leading edge flaps, shuttle valve for the trailing edge flaps, and the emergency accumulator package. On airplanes AF69-6197 and subsequent when the emergency flap switch is placed in EMERG DN, the AMF system is disabled to prevent interference with the emergency flap system.

9-8. The emergency accumulator package consists of an accumulator, a solenoid-operated emergency pressure dump valve, a solenoid-operated precharge shutoff valve, and a thermal relief valve.

9-9. Cockpit indication of leading edge flap positions is provided by an indicator which indicates UP and DN for these respective positions and shows a barberpole when flaps are in transition or electrical power is off. Cockpit indication of trailing edge flap positions is provided by an indicator marked in degrees.

9-10. Leading edge flaps are two positions only, either up or extended 26°. Trailing edge flaps are variable and may be extended to any position between 0° and 40°. A wheels/flaps warning light flashes any time landing gear and flap positions do not agree. On airplanes AF69-6197 and subsequent when the flaps are extended by the AMF system, the leading edge flaps extend to 26° and the trailing edge flaps to 15°. An AMF fail light and the wheels/flaps warning light come on if the maneuvering flaps are extended and the airplane exceeds 325 KIAS (or 0.7 IMN) for 3.5 seconds or more. For information on the wheels/flaps warning system, refer to T.O. 1A-7D-2-7.

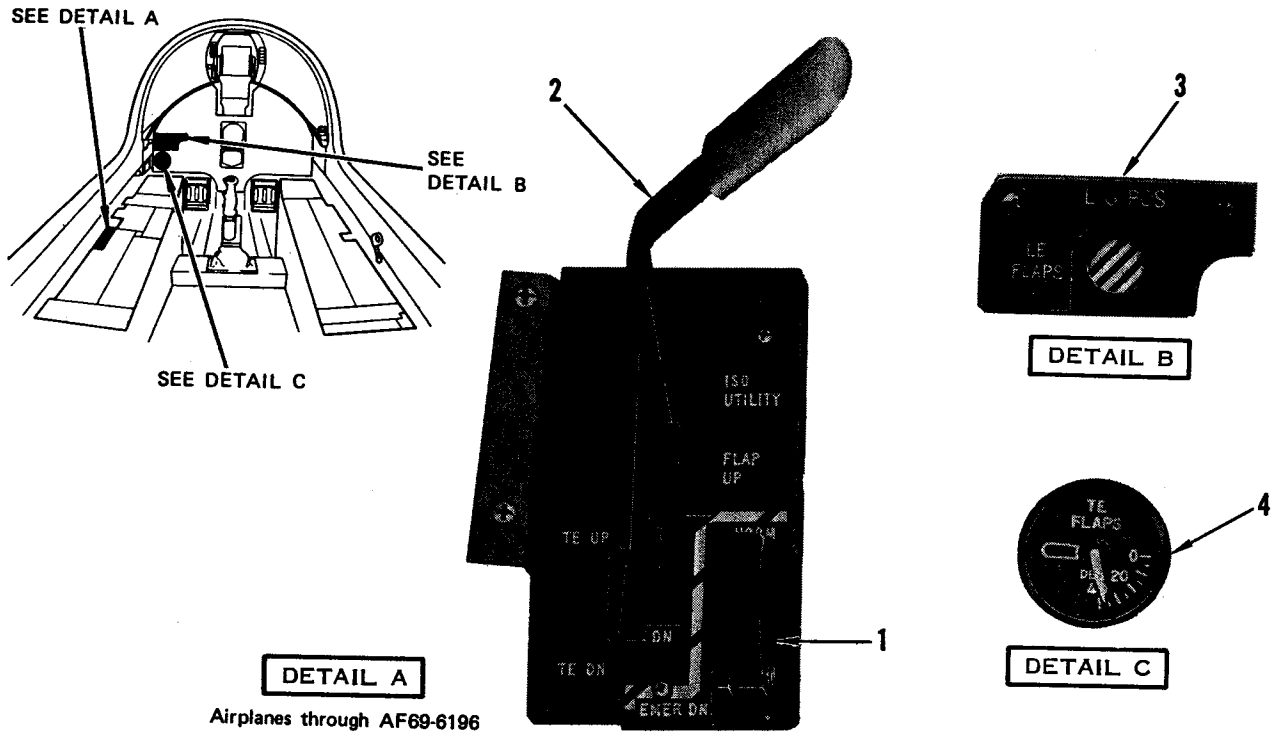
9-11. For system controls and indicators, see figure 9-1. For system arrangement, see figure 9-2.

9-12. OPERATION.

9-13. NORMAL FLAP OPERATION. (See figures 9-3 or 9-3A; 9-4, 9-5, and 9-6.) With the flap handle in ISO UTILITY, the selector valve is in the flap up position and the isolation valve is closed, blocking flow of hydraulic fluid to the flap system. The flap up and down lines are connected to system return and the flaps are locked up by internal locks in each flap actuating cylinder.

9-14. Moving the control handle to UP mechanically actuates the isolation valve, through a cable-pushrod system, to open the valve and pressurize the flap up lines. The flap selector valve rotates through an overtravel position which allows the valve to remain in the flap up position.

9-15. Moving the flap handle to DN mechanically actuates the flap selector valve to the flap down position. The isolation valve rotates through an overtravel position and remains in the



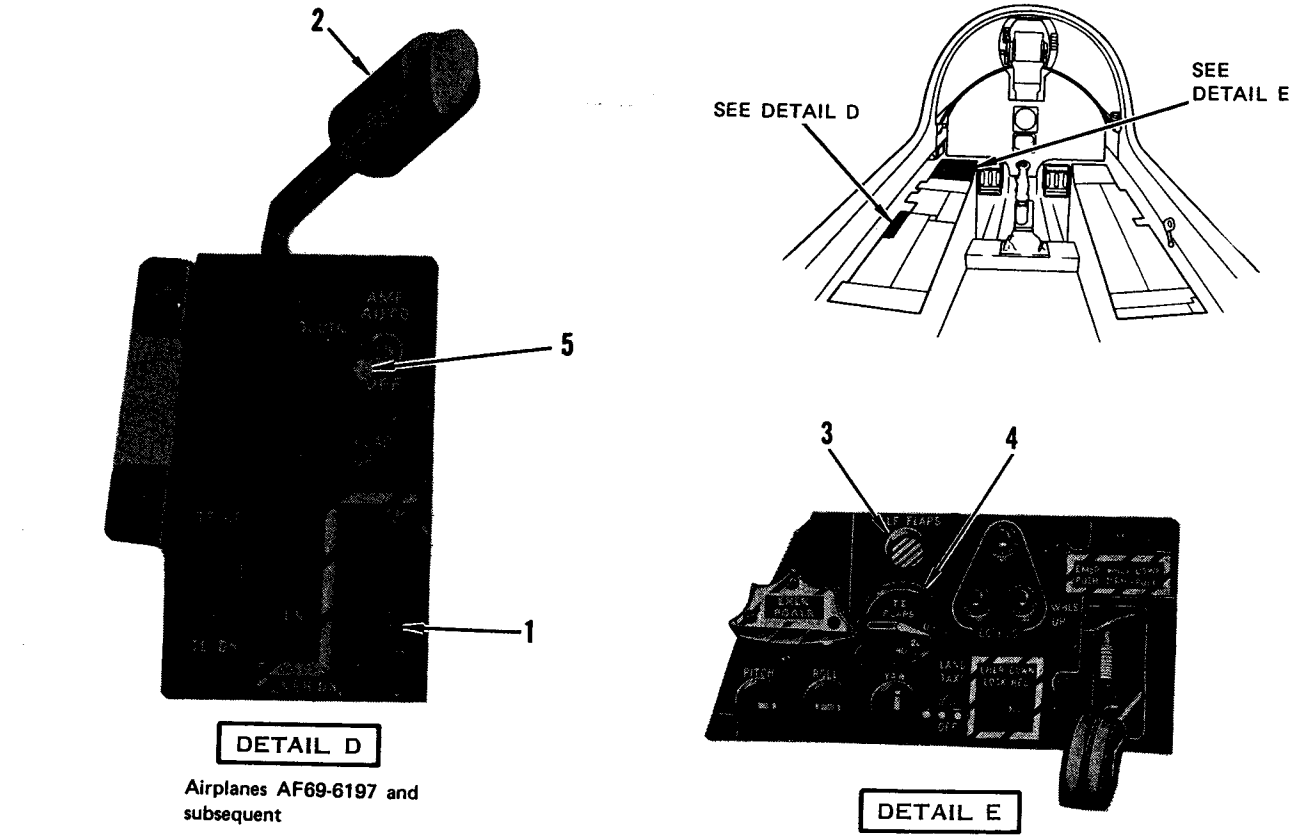


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Figure 9-1. Flap System Controls and Indicators (Sheet 1)

INDEX NO.	CONTROL/INDICATOR	FUNCTION
1	Emergency flap switch (EMERG DN)	NORM – disconnects electrical power to emergency flap selector valve to keep valve closed.
		EMERG DN – extends flaps by accumulator pressure and *disables AMF system.
2	Flap control assembly	ISO UTILITY (*ISO UTIL) – blocks PC 2 hydraulic pressure from normal flap system.
		UP – retracts leading and trailing edge flaps.
		DN – extends leading and trailing edge flaps.
		TE UP – retracts trailing edge flaps only.
		TE DN – extends trailing edge flaps only.
3	Leading edge flap indicator (LE FLAPS)	UP – indicates leading edge flaps are up.
		DN – indicates leading edge flaps are down.
		BARBERPOLE – indicates leading edge flaps are not up or down.
4	Trailing edge flap indicator (TE FLAPS)	Indicates trailing edge flap position.
5	AMF switch (AMF)*	OFF – AMF system inoperative.
		AUTO – places AMF system in operation when flap handle is in ISO UTIL and air refueling or emergency flap system is not in operation.

*Airplanes AF69-6197 and subsequent

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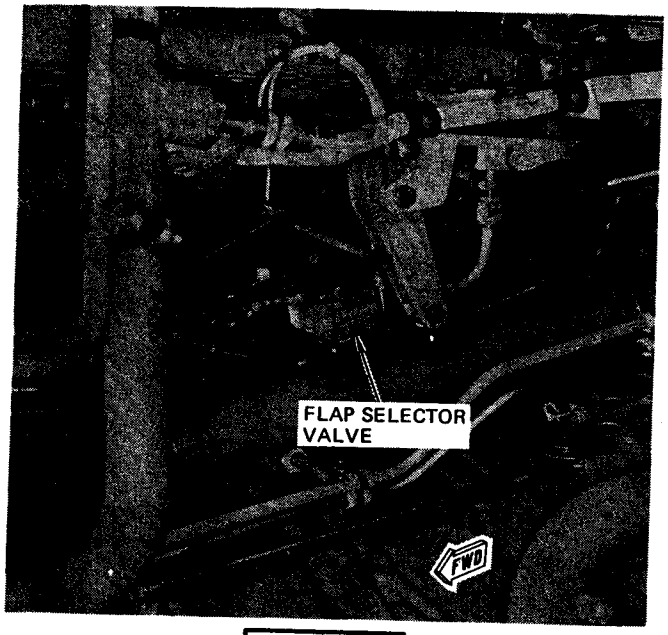
Figure 9-1. Flap System Controls and Indicators (Sheet 2)

open position. Hydraulic pressure is directed through the selector valve and shuttle valve to the eight leading edge flap actuating cylinder, releasing the internal locks and fully extending the leading edge flaps. Two-way restrictors in the flap up lines control flap extension rate by restricting flow of return fluid from the cylinders. An additional two-way restrictor is in the flap down line for the leading edge flaps. The hydraulic return circuit is completed through the deactuated emergency bypass valve and flap selector valve to system return. When the cylinders reach a fully extended position, internal locks at the retract end of the cylinders engage to mechanically lock the flaps in the fully extended position.

9-16. With placement of the flap handle in DN, the trailing edge flaps and the leading edge flaps extend simultaneously. With the flap handle in DN, the flap handle isolation switch closes and connects power from the primary dc bus, through circuit breaker CB3114, through the flap handle isolation switch, through the flap handle down switch, and through contacts of variable trailing edge flap relay K8 to energize the down solenoid of the variable trailing edge flap selector valve, opening the valve.

9-17. Hydraulic pressure is directed from the flap selector valve and through a check valve to the variable trailing edge flap valve package. Hydraulic pressure in the valve package flows through the variable trailing edge flap selector valve, through the shuttle valve, through the flow equalizer valve, and through the lock valves to the four trailing edge flap actuating cylinders to fully extend the trailing edge flaps. Two-way restrictors in the flap up lines control flap extension rate by restricting flow of return fluid from the cylinders. When the cylinders reach a fully extended position, internal locks at the retract end of the cylinders engage to mechanically lock the flaps in the fully extended position.

9-18. The flow equalizer valve synchronizes trailing edge flap extension or retraction by dividing flow equally, within 4%, through the left and right lock valves. In each lock valve, pressure simultaneously opens an extend poppet and actuates a spool which opens a retract poppet. Actuation of the extend poppet allows pressure to be directed to



DETAIL A
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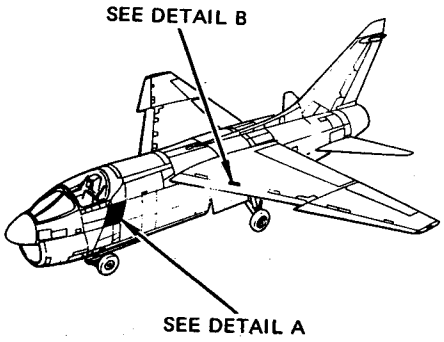

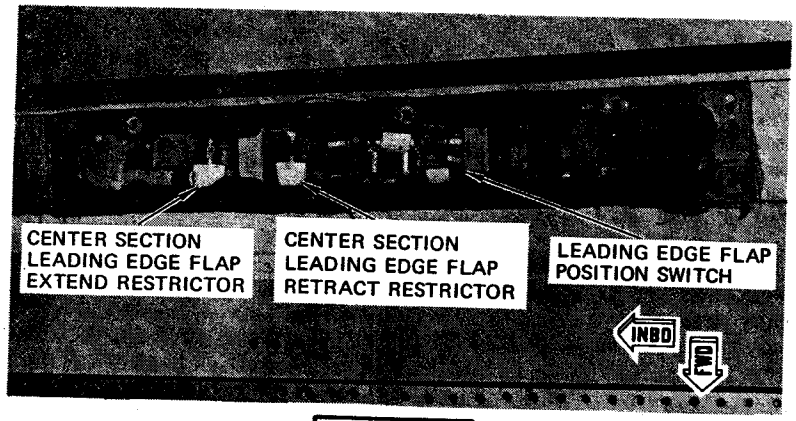

DETAIL B
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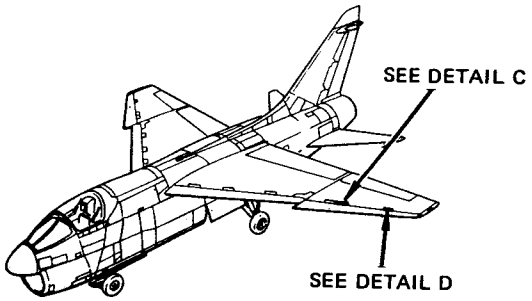
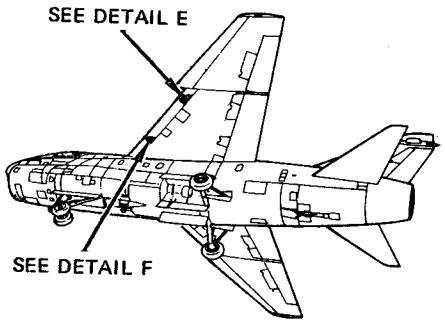
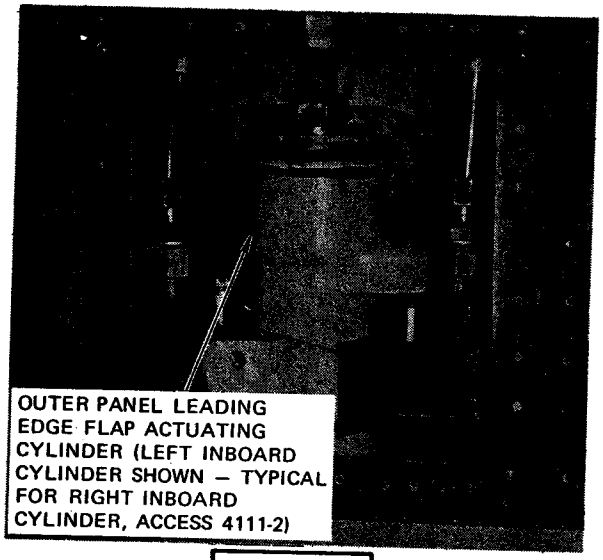
Figure 9-2. Flap System Arrangement (Sheet 1)

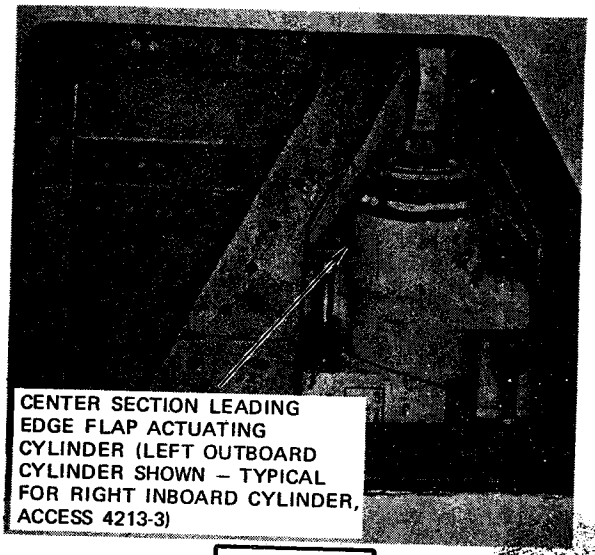






OUTER PANEL LEADING EDGE FLAP ACTUATING CYLINDER (LEFT INBOARD CYLINDER SHOWN – TYPICAL FOR RIGHT INBOARD CYLINDER, ACCESS 4111-2)

DETAIL C
(ACCESS 3112-2)



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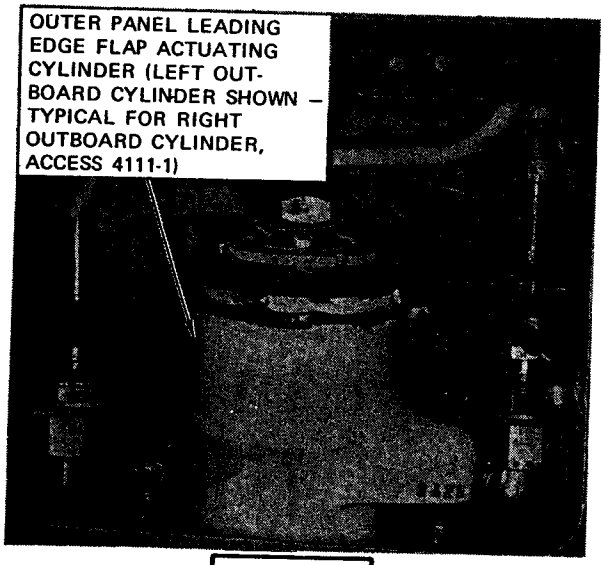
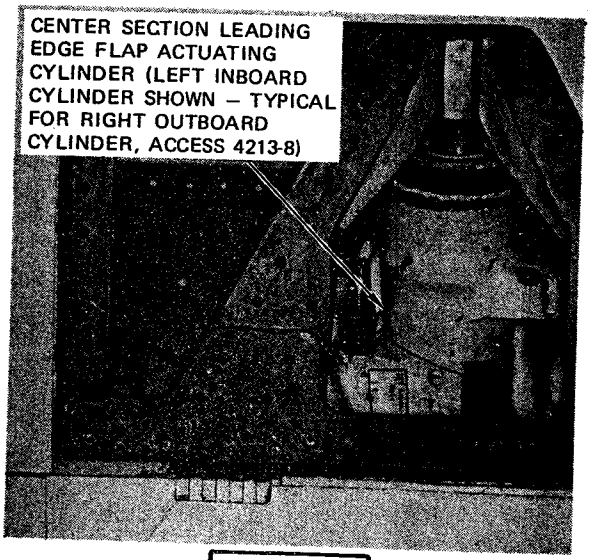
DETAIL E
(ACCESS 3213-3)



OUTER PANEL LEADING EDGE FLAP ACTUATING CYLINDER (LEFT OUTBOARD CYLINDER SHOWN – TYPICAL FOR RIGHT OUTBOARD CYLINDER, ACCESS 4111-1)

DETAIL D
(ACCESS 3112-1)



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DETAIL F
(ACCESS 3213-8)

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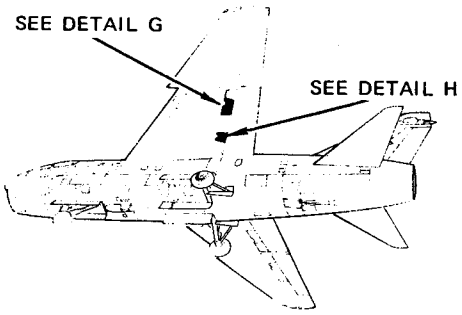
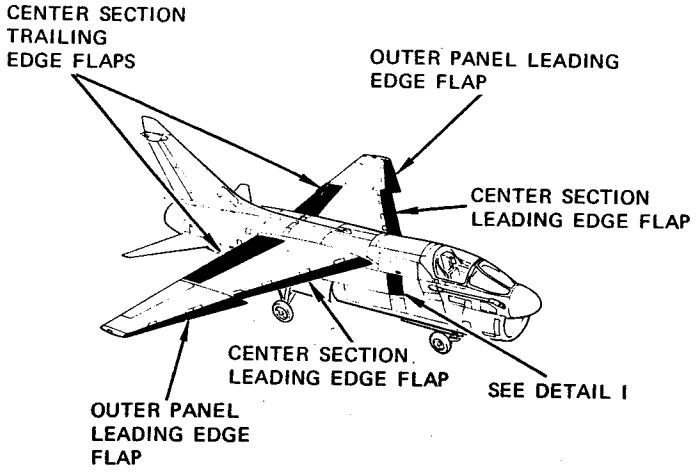
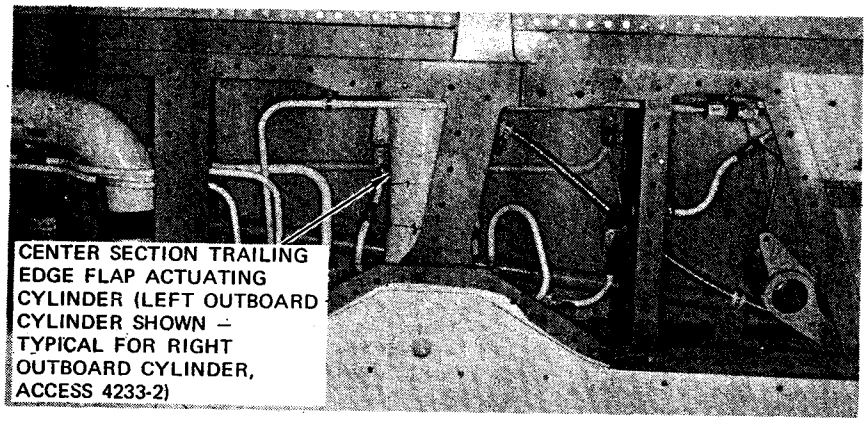
Figure 9-2. Flap System Arrangement (Sheet 2)







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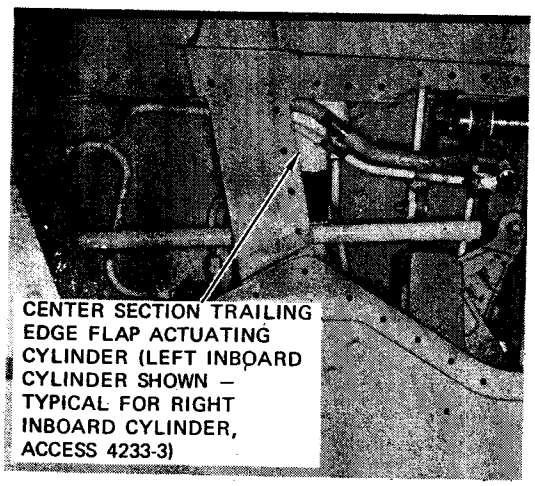

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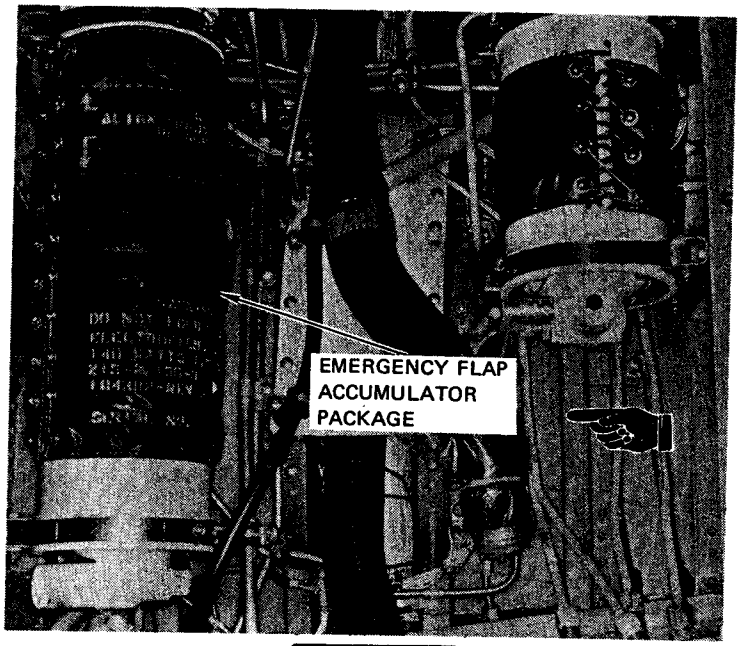

DETAIL I
ACCESS 2123-3

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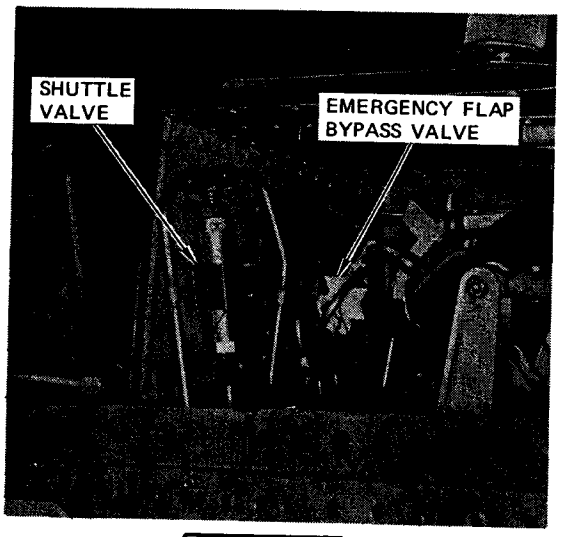
Figure 9-2. Flap System Arrangement (Sheet 3)



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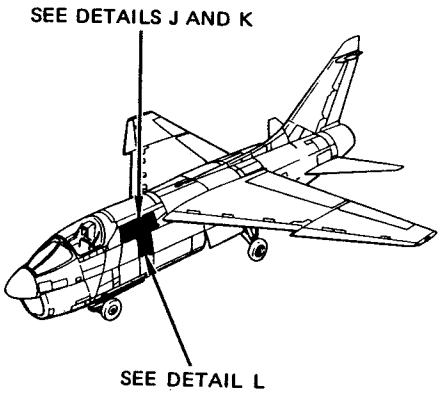

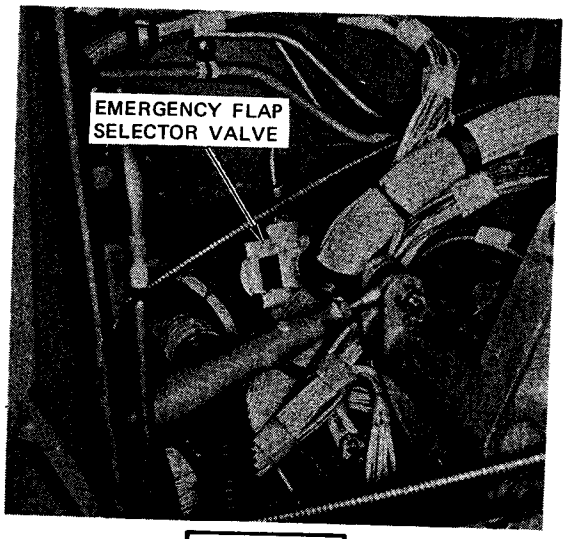

DETAIL K
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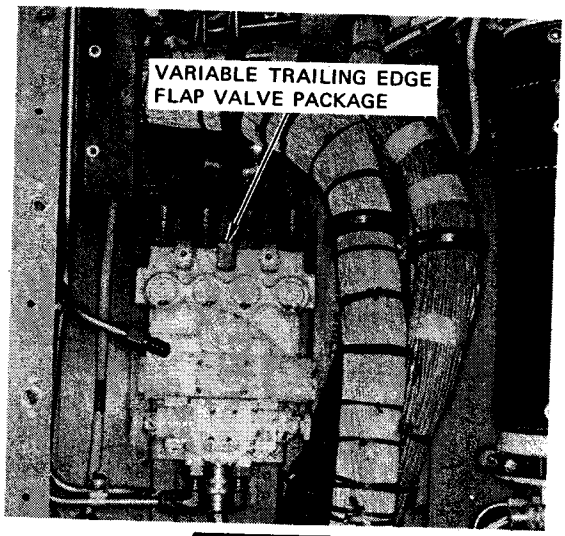

DETAIL L
(ACCESS 1123-3)

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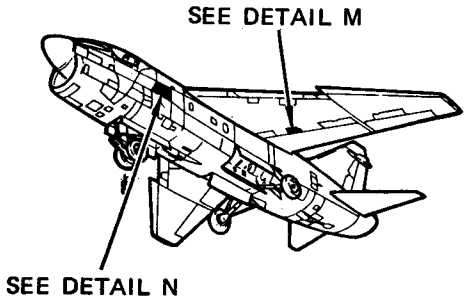
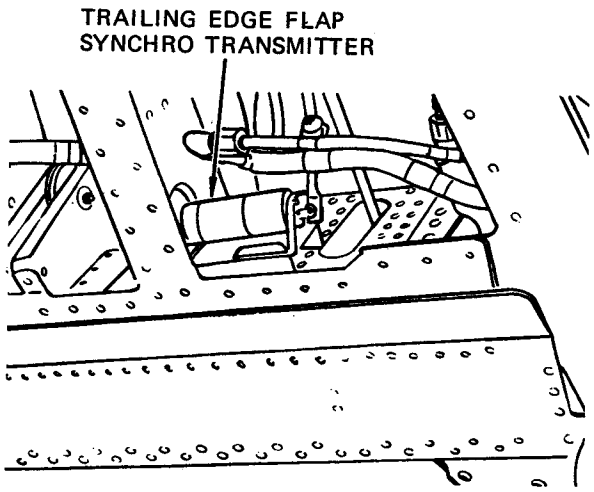
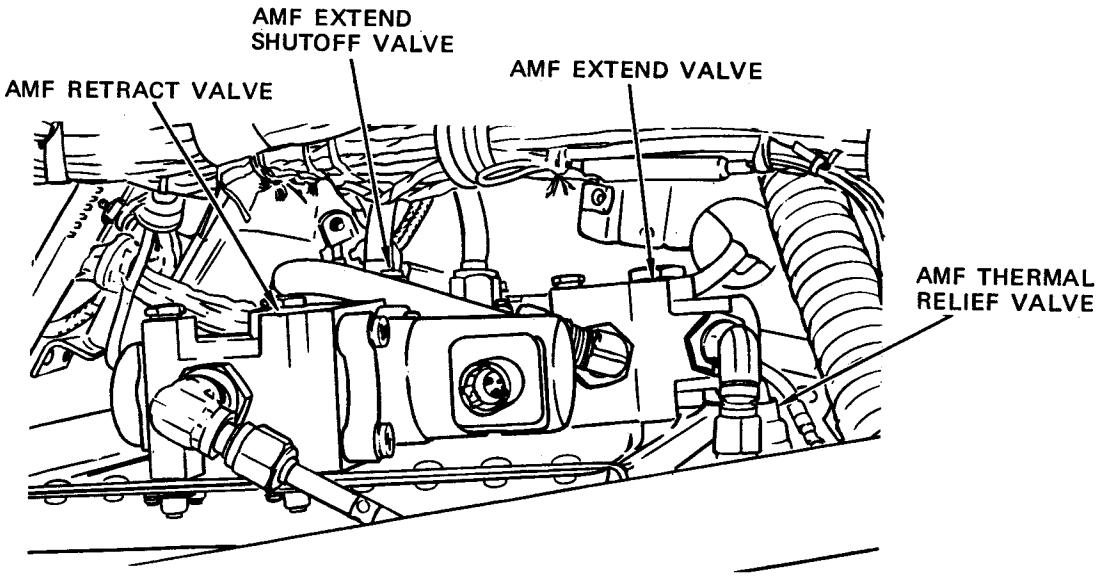
Figure 9-2. Flap System Arrangement (Sheet 4)





DETAIL M
(ACCESS 3233–3)



DETAIL N
(ACCESS 1123–4)

NOTE

Detail N only on airplanes AF69-6197 and subsequent.

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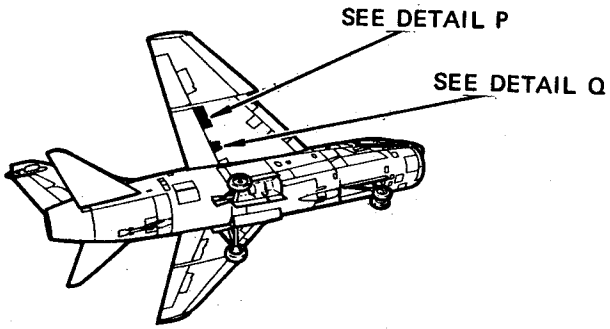
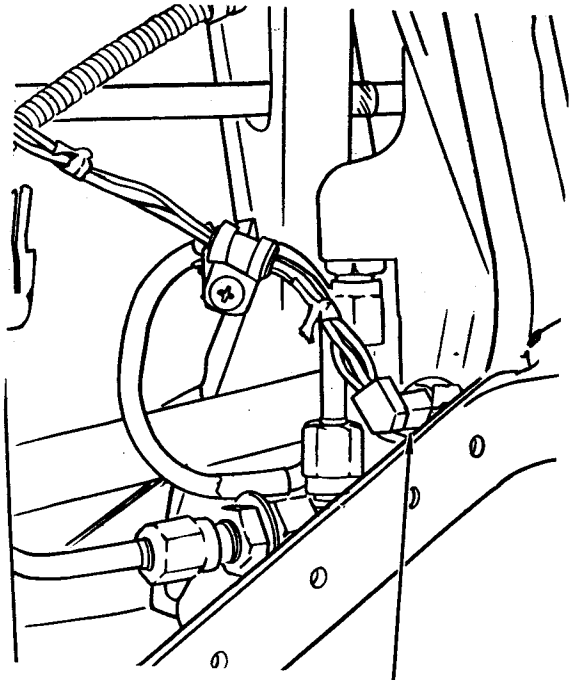
Figure 9-2. Flap System Arrangement (Sheet 5)



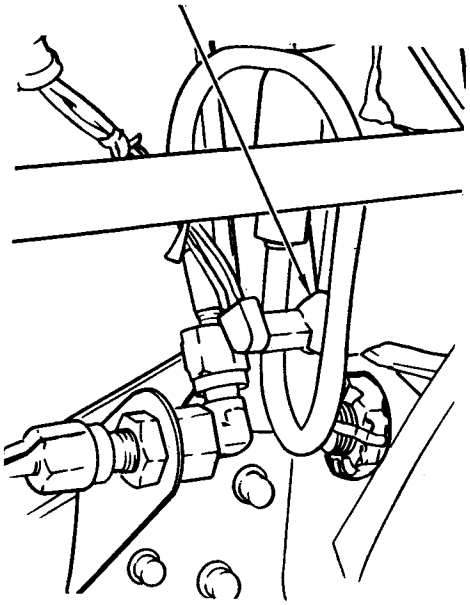


TRAILING EDGE FLAP ACTUATING CYLINDER UPLOCK SWITCH (RIGHT OUTBOARD SHOWN – TYPICAL FOR LEFT OUTBOARD SWITCH, ACCESS 3233–2)

DETAIL P

(ACCESS 4233–2)

TRAILING EDGE FLAP ACTUATING CYLINDER UPLOCK SWITCH (RIGHT INBOARD SHOWN – TYPICAL FOR LEFT INBOARD SWITCH, ACCESS 3233–3)



DETAIL Q

(ACCESS 4233–3)

NOTE

Details P and Q only on airplanes AF69-6197 and subsequent.

08D101–06–02–81

Figure 9-2. Flap System Arrangement (Sheet 6)

the down lines of the trailing edge flap cylinders. Actuation of the retract poppet opens the circuit for return flow from the up lines to the emergency bypass valve of the variable trailing edge flap valve package, through the package selector valve, and through a check valve to system return.

9-19. Placing the flap handle in UP mechanically actuates the flap selector valve to the flap up position. Hydraulic pressure is directed through the selector valve and the deactuated emergency bypass valve to the eight leading edge flap actuating cylinders, releasing the internal locks and fully retracting the flaps. Two-way restrictors in the flap down lines control flap retraction rate by restricting flow of return fluid from the cylinders. The hydraulic return circuit is completed through the shuttle valve, a restrictor, and the selector valve to system return. When the cylinders reach the fully retracted position, internal locks at the extend end of the cylinders engage to mechanically lock the flaps in the retracted position.

9-20. With placement of the flap handle in UP, the trailing edge flaps and leading edge flaps simultaneously begin retracting. With the flap handle in UP, the flap handle isolation switch remains closed and connects power through the flap handle down switch and diode CR15 to energize the up solenoid of the variable trailing edge flap selector valve and also to energize K8Y coil of variable trailing edge flap relay K8, thus closing the relay contacts. Hydraulic pressure is directed from the flap selector valve, through the deactuated emergency bypass valve, through a check valve, through the variable trailing edge flap selector valve, through the emergency bypass valve of the variable trailing edge flap selector valve, through the emergency bypass valve of the variable trailing edge flap valve package, and through the lock valves to the four trailing edge

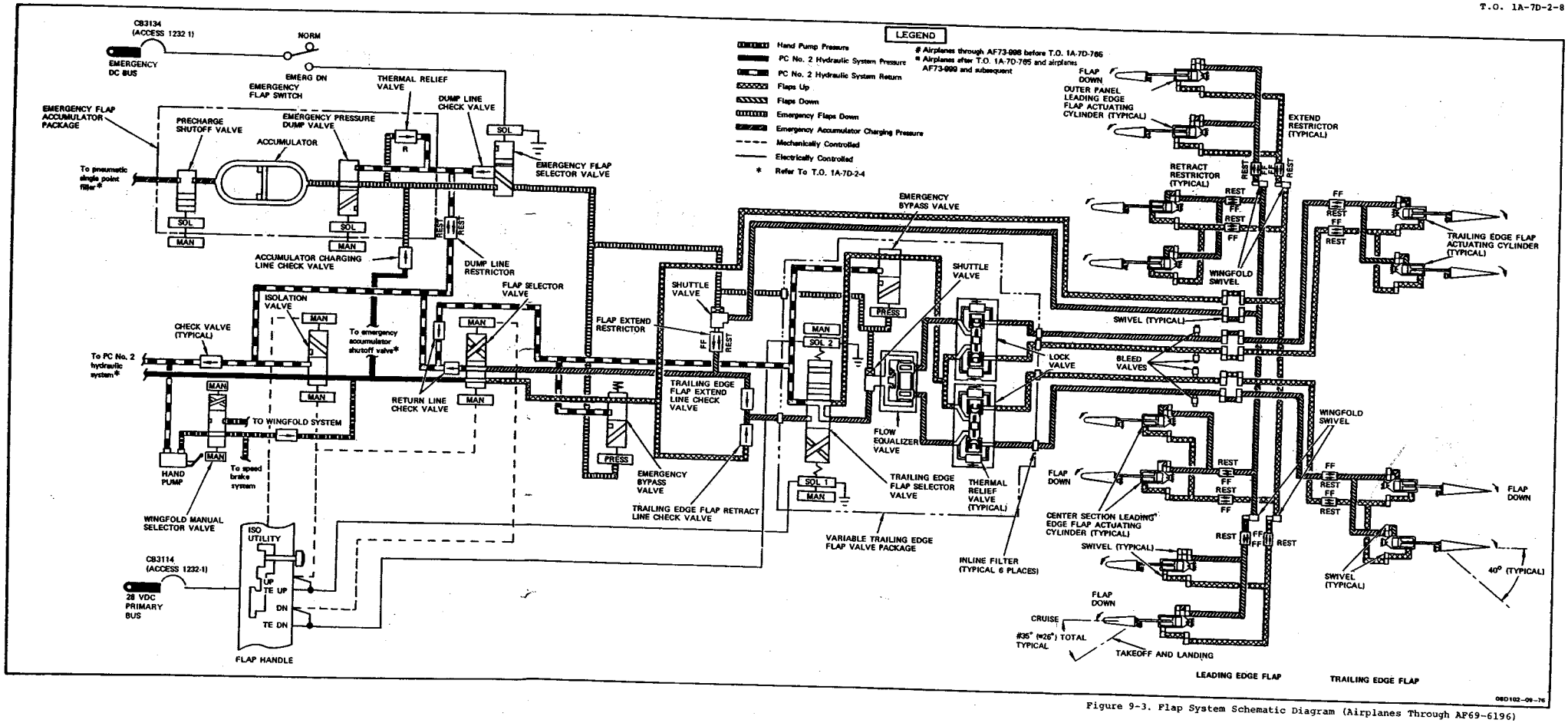


Figure 9-3. Flap System Schematic Diagram (Airplanes Through AF69-6196)

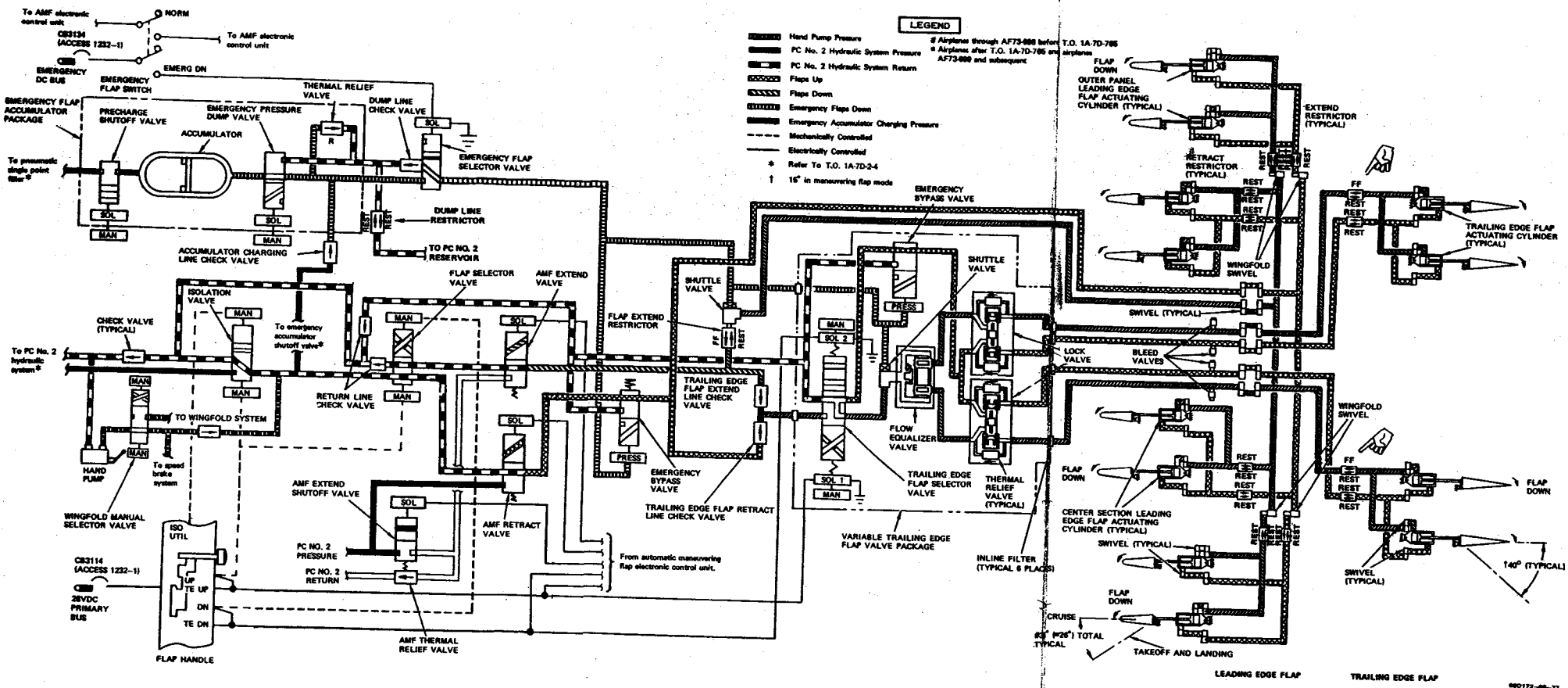
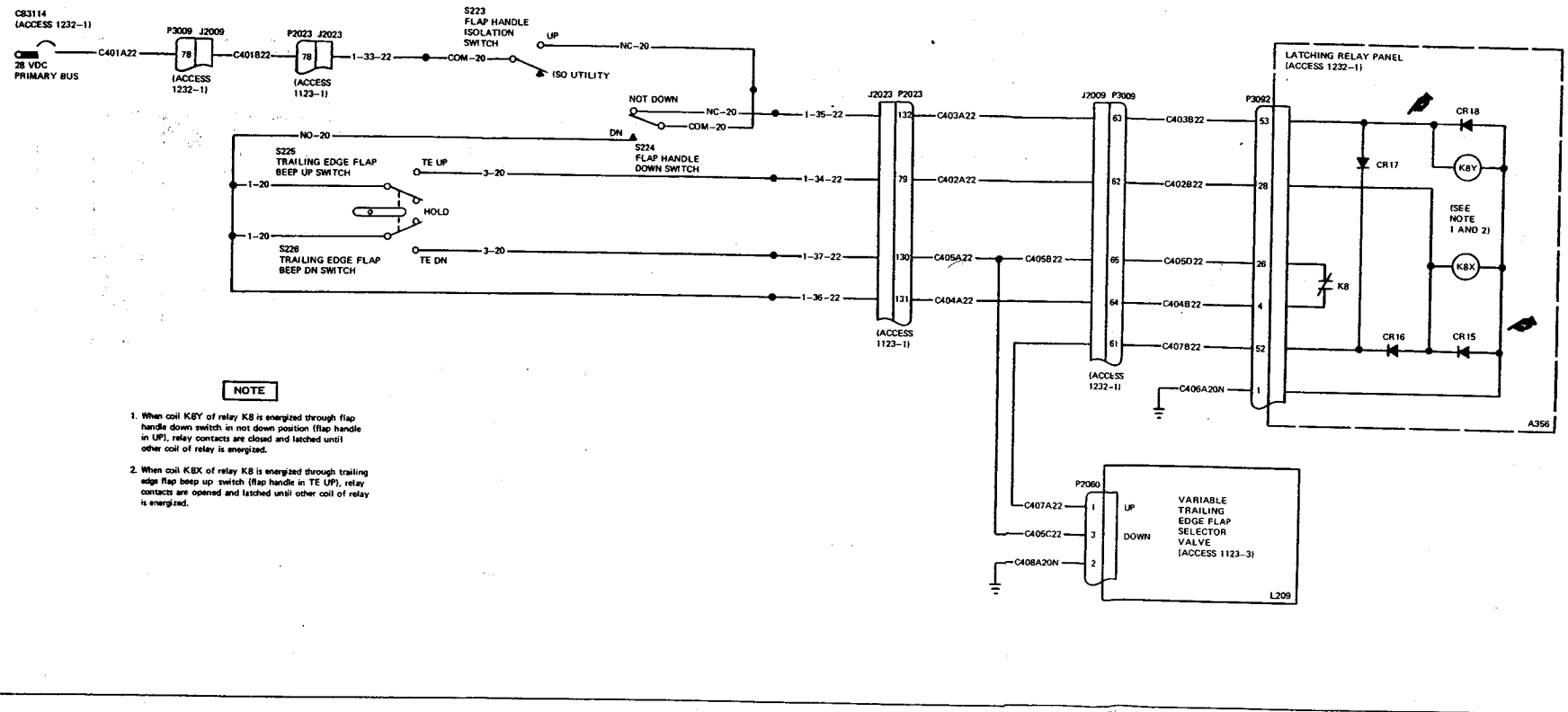


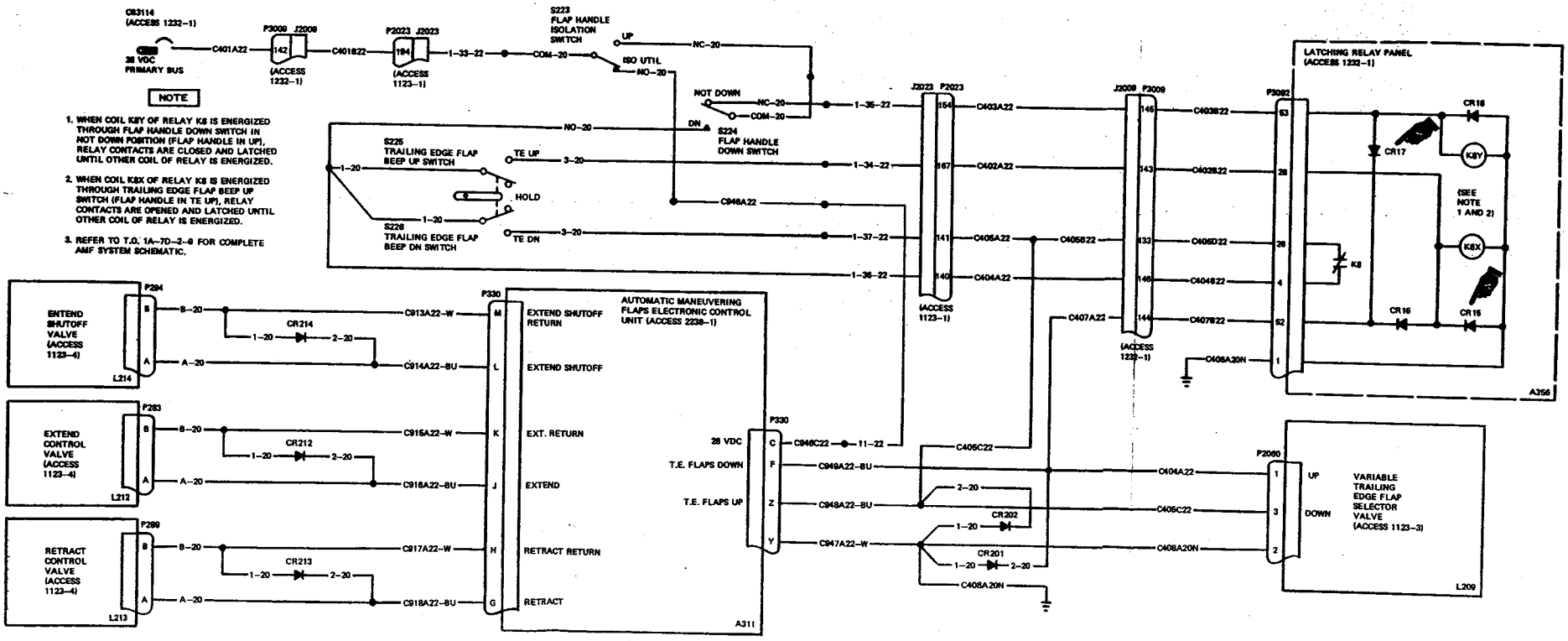
Figure 9-3A. Flap System Schematic Diagram (Airplanes AF69-6197 and Subsequent)



NOTE

1. When coil K8Y of relay K8 is energized through flap handle down switch in not down position (flap handle in UP), relay contacts are closed and latched until other coil of relay is energized.
2. When coil K8X of relay K8 is energized through trailing edge flap beep up switch (flap handle in TE UP), relay contacts are opened and latched until other coil of relay is energized.

Figure 9-4. Trailing Edge Flap System Electrical Troubleshooting Schematic Diagram (Airplanes Through AF69-6196)



NOTE

1. WHEN COIL K8Y OF RELAY K8 IS ENERGIZED THROUGH FLAP HANDLE DOWN SWITCH IN NOT DOWN POSITION (FLAP HANDLE IN UP), RELAY CONTACTS ARE CLOSED AND LATCHED UNTIL OTHER COIL OF RELAY IS ENERGIZED.
2. WHEN COIL K8X OF RELAY K8 IS ENERGIZED THROUGH TRAILING EDGE FLAP BEEP UP SWITCH (FLAP HANDLE IN TE UP), RELAY CONTACTS ARE OPENED AND LATCHED UNTIL OTHER COIL OF RELAY IS ENERGIZED.
3. REFER TO T.O. 1A-7D-2-8 FOR COMPLETE AMF SYSTEM SCHEMATIC.

Figure 9-5. Trailing Edge Flap System Electrical Troubleshooting Schematic Diagram (Airplanes AF69-6197 and Subsequent)

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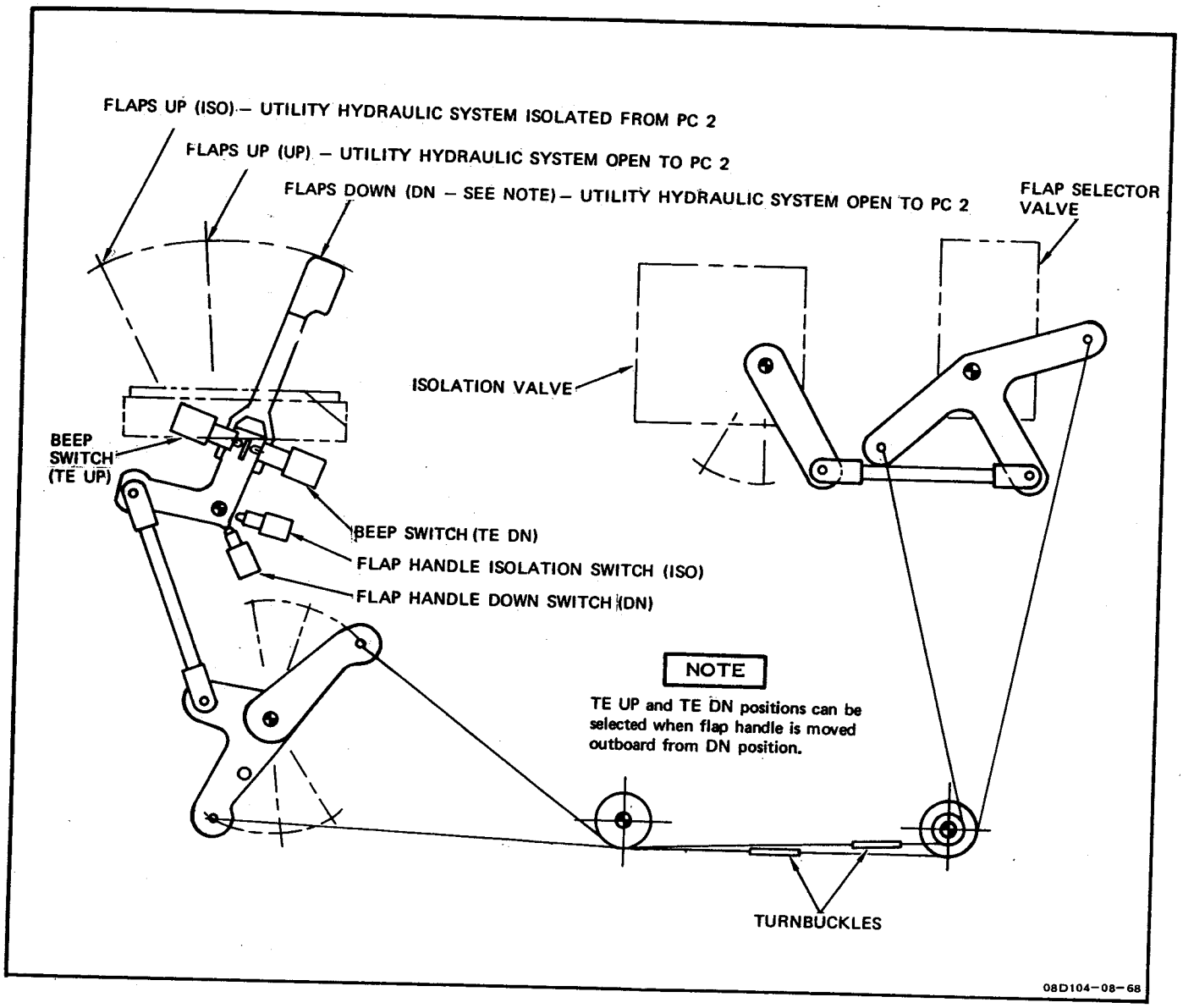

Figure 9-6. Flap Control System Schematic Diagram

flap actuating cylinders to fully retract the trailing edge flaps. One-way restrictors in the flap down lines control flap retraction rate by restricting flow of return fluid from the cylinders. When the cylinders reach a fully retracted position, internal locks at the extend end of the cylinders engage to mechanically lock the flaps in the fully retracted position. Return flow from the cylinders is through the lock valves, the flow equalizer valve, shuttle valve of the variable trailing edge flap valve package, variable trailing edge flap selector valve, and through a check valve to system return. Functions of the flow equalizer valve and lock valves are the same as for trailing edge flap extension, opposite in direction.

9-21. The trailing edge flaps can be extended or retracted to any position between fully retracted (0°) and fully extended (40°) during normal operation. System hydraulic operation is the same as during full retraction or extension.

9-22. The flap handle is spring loaded and, when released from DN, moves into a detent between TE UP and TE DN.

Intermediate trailing edge flap positions from 0° to 40° are selected by beeping the flap handle forward to TE UP for trailing edge flap up movement and aft to TE DN for trailing edge flap down movement. Leading edge flaps remain down.

9-23. The trailing edge flaps can be stopped during extension by moving the flap handle from DN and momentarily beeping to TE UP, and allowing the handle to return to DN. This energizes K8X coil of variable trailing edge flap relay K8 through the trailing edge flap up beep switch to open the relay contacts and interrupt power to the down solenoid of the flap package selector valve. The deenergized valve prevents hydraulic pressure from being applied to the cylinders, stopping flap extension. The locking valves trap fluid in the cylinder lines to provide a liquid lock for the flaps. Extension of the trailing edge flaps can be resumed by placing the flap handle in TE DN. This connects power through the trailing edge flap down beep switch to the down solenoid of the flap package selector valve. The energized valve permits application of hydraulic pressure to the cylinders.

9-24. Partial retraction of the trailing edge flaps may be accomplished by placing the flap handle in TE UP and then releasing the handle to DN when the flaps are at the desired position. With the handle in TE UP, power is connected through the trailing edge flap up beep switch through diode CR16 to energize the up solenoid of the flap package selector valve. The energized valve permits application of hydraulic pressure to the cylinders.

9-25. Deleted.

9-26. To increase aerodynamic smoothness of the lower wing surface during cruise flight, with flaps retracted, slot doors are mechanically actuated to the closed position to fair in the gap between the wing center section and trailing edge flaps. The slot doors are attached to the trailing edge flaps by leaf hinges and to the wing center section by adjustable links which provide slot door adjustment. Extension or retraction of the flaps results in the links moving the slot doors about their hinge points. This opens the slot doors during flap extension and closes the doors during flap retraction.

9-26A. AUTOMATIC MANEUVERING FLAP (AMF) OPERATION. (Airplanes AF69-6197 and Subsequent.) The automatic maneuvering flap (AMF) system is ready for operation when the flap handle is in ISO UTIL and the AMF switch is in AUTO. This combination of handle position and switch setting prepares the electronic control unit for response to inputs from the angle-of-attack potentiometer, airspeed overspeed switch, or Mach/airspeed overspeed switch for control of the maneuvering flaps.

9-26B. When the flap handle is in ISO UTIL, the isolation valve is positioned to block pressure from the normal flap system, the flap selector valve is in the up position, and the flap handle isolation switch is actuated to route 28 volts dc to the AMF electronic control unit. Placing the AMF switch in AUTO completes a circuit to place the AMF system in operation.

9-26C. When the angle of attack increases to 12.75° (14.5 units on the pilot's angle-of-attack indicator) and airplane speed is below 325 KIAS (0.7 IMN), the electronic control unit generates flap extend signals. These signals direct 28 volts dc to energize and open the extend shutoff valve, the extend valve, and the extend side of the trailing edge flap selector valve. The open extend shutoff valve routes PC No. 2 hydraulic pressure through the open extend valve to the leading edge flap extend lines and through the extend side of the trailing edge flap selector valve into the trailing edge flap extend lines. The leading edge flaps extend to the full-down position, and the trailing edge flaps extend to 15°. With the trailing edge flaps 15° (±0.5°) from up, the electronic control unit responds to an input from the trailing edge flap potentiometer and deenergizes the extend solenoid of the variable trailing edge flap selector valve. The valve closes to stop trailing edge flap extension, and the flaps are locked in place by the lock valves in the variable trailing edge flap valve package.

9-26D. Hydraulic fluid return flow from the leading edge flaps during extension is through the emergency bypass valve, the retract maneuvering valve, flap selector valve, and isolation valve. Return hydraulic flow from the trailing edge flaps is the same as during normal flap operation.

9-26E. Flap retraction is automatic when input signals monitored by the electronic control unit indicate that the airplane has departed from the performance envelope. Retraction is initiated if an input signal indicates that either the angle of attack is decreasing through

7.50° (11 units on pilot's angle-of-attack indicator) or airplane speed has increased to 325 KIAS (0.7 IMN).

9-26F. Retract signals generated by the electronic control unit deenergize the extend flap valve, extend shutoff valve, and the extend side of the trailing edge flap selector valve and, simultaneously, energize the retract valve and the retract side of the trailing edge flap selector valve. The deenergized valves close and the energized valves open to redirect hydraulic flow. The retract valve directs PC No. 2 hydraulic pressure into the retract lines of the leading edge flaps and through the trailing edge flap valve package to the retract lines of the trailing edge flaps and the flaps retract.

9-26G. With weight off the gear and the air refueling receptacle release handle pushed down, the maneuvering flaps can be retracted by depressing and holding the AMF retract switch. Closing the switch applies a signal to the electronic control unit which responds by generating retract signals for the leading and trailing edge flaps. The flaps will extend when the switch is released if airplane performance still demands flaps. The flaps will also retract automatically if an internal failure occurs in the electronic control unit.

9-26H. Hydraulic return flow during retraction of the trailing edge flaps is the same as during normal operation. Return flow from the leading edge flaps is through deenergized extend flap valve, normal flap selector valve, normal flap selector valve (up position), and into the PC No. 2 return system.

9-26J. The automatic maneuvering flap fail light and the wheels/flaps warning light come on to indicate that the airplane is exceeding 325 KIAS (0.7 IMN) with the flaps not up and locked. A 3.5-second delay occurs between the time the condition is sensed by the electronic control unit and when the lights come on. The delay prevents the lights from coming on during normal AMF operation when no malfunction is present. The fail light will also come on, without a time delay, when an electronic control unit malfunction occurs.

9-27. EMERGENCY FLAP OPERATION. (See figure 9-3 or 9-3A.) Placing the emergency flap switch in EMERG DN applies 28 volts from the emergency dc bus to open the emergency flap selector valve. On airplanes AF69-6197 and subsequent, placing the emergency flap switch in EMERG DN also disables the AMF system. Emergency flap accumulator hydraulic pressure discharges through flap selector valve into the emergency flap down line, actuating two shuttle valves and two emergency bypass valves with one of each located in the variable trailing edge flap valve package. The shuttle valves block the normal system pressure line and direct emergency pressure to the flap actuating cylinders to extend the flaps. Flow downstream of the shuttle valves is the same as during normal flap operation. The emergency bypass valves complete a direct return circuit to PC No. 2 hydraulic system.

9-28. During normal system operation, the accumulator precharge valve is closed trapping the nitrogen precharge in the accumulator. The emergency pressure dump valve is positioned to connect the accumulator oil side to the closed emergency flap selector valve. With PC No. 2 hydraulic system operating and the utility emergency manual shutoff valve handle in OPEN, full hydraulic system pressure is maintained on the accumulator. Placing the valve handle in CLOSE isolates the emergency circuit from PC No. 2 system, and the accumulator retains full system pressure. System pressure is trapped in the accumulator by a check valve in the emergency flap accumulator package pressure inlet line and by the closed emergency flap selector valve.

9-29. For additional information on the accumulator precharge system, refer to T.O. 1A-7D-2-4.

9-30. FLAP POSITION INDICATING CIRCUIT OPERATION. (See figures 9-7 and 9-9 or 9-8 and 9-10.) The leading edge flap position indicating circuit is powered by the 28-volt emergency dc bus. When the leading edge flaps are down, a ground circuit for the leading edge flap position indicator is completed through the down position of the leading edge flap position switch. The indicator is energized to show DN. When the leading edge flaps are up and locked, a ground circuit for the indicator is completed through the up-and-locked position of the leading edge flap uplock switches. The indicator is energized to show UP. When the flaps are in transition, both the position and uplock switches are open, interrupting the ground circuits to the indicator. In this condition, the

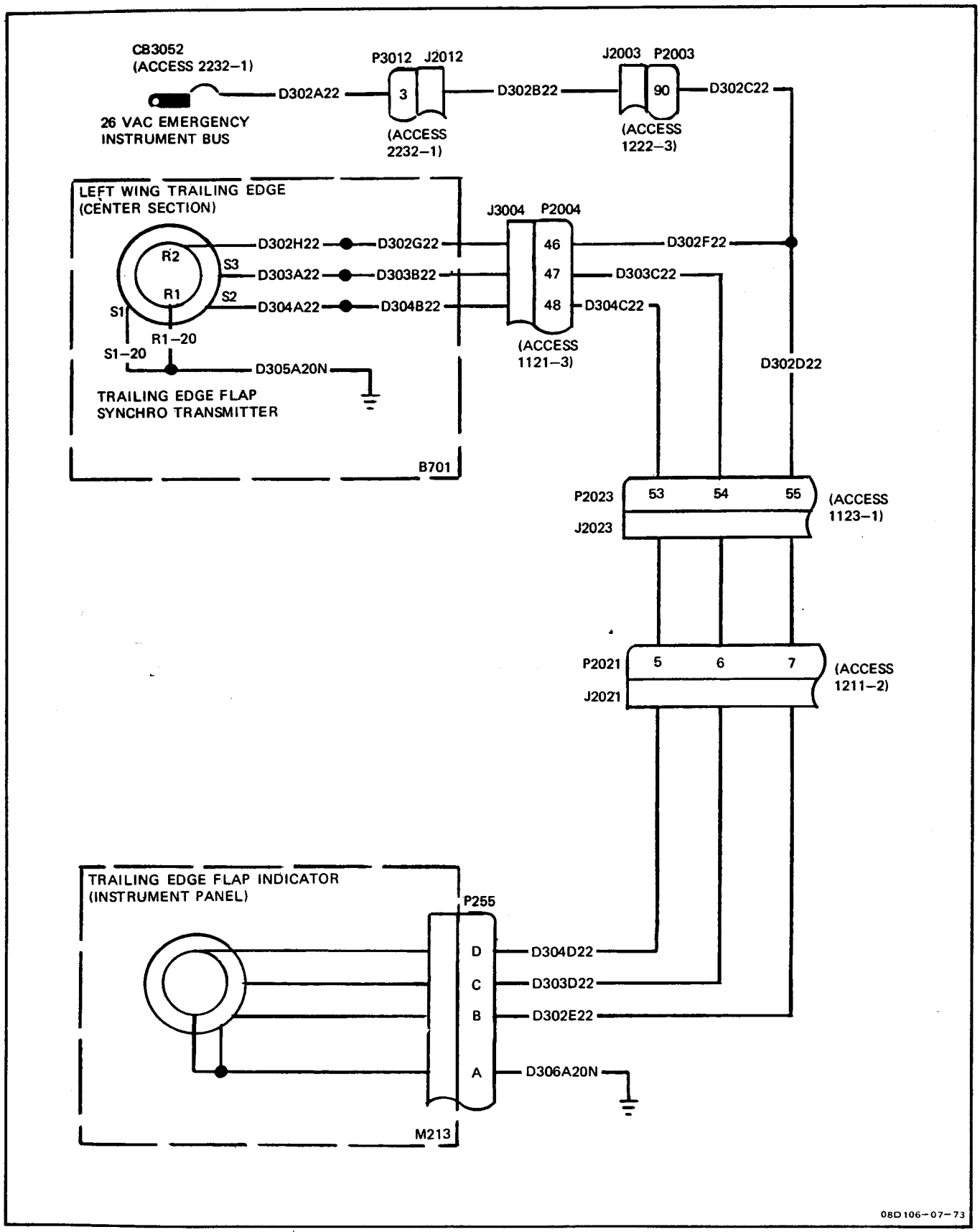

Figure 9-7. Trailing Edge Flap Position Indicating System Electrical Troubleshooting Schematic Diagram (Airplanes Through AF69-6196)

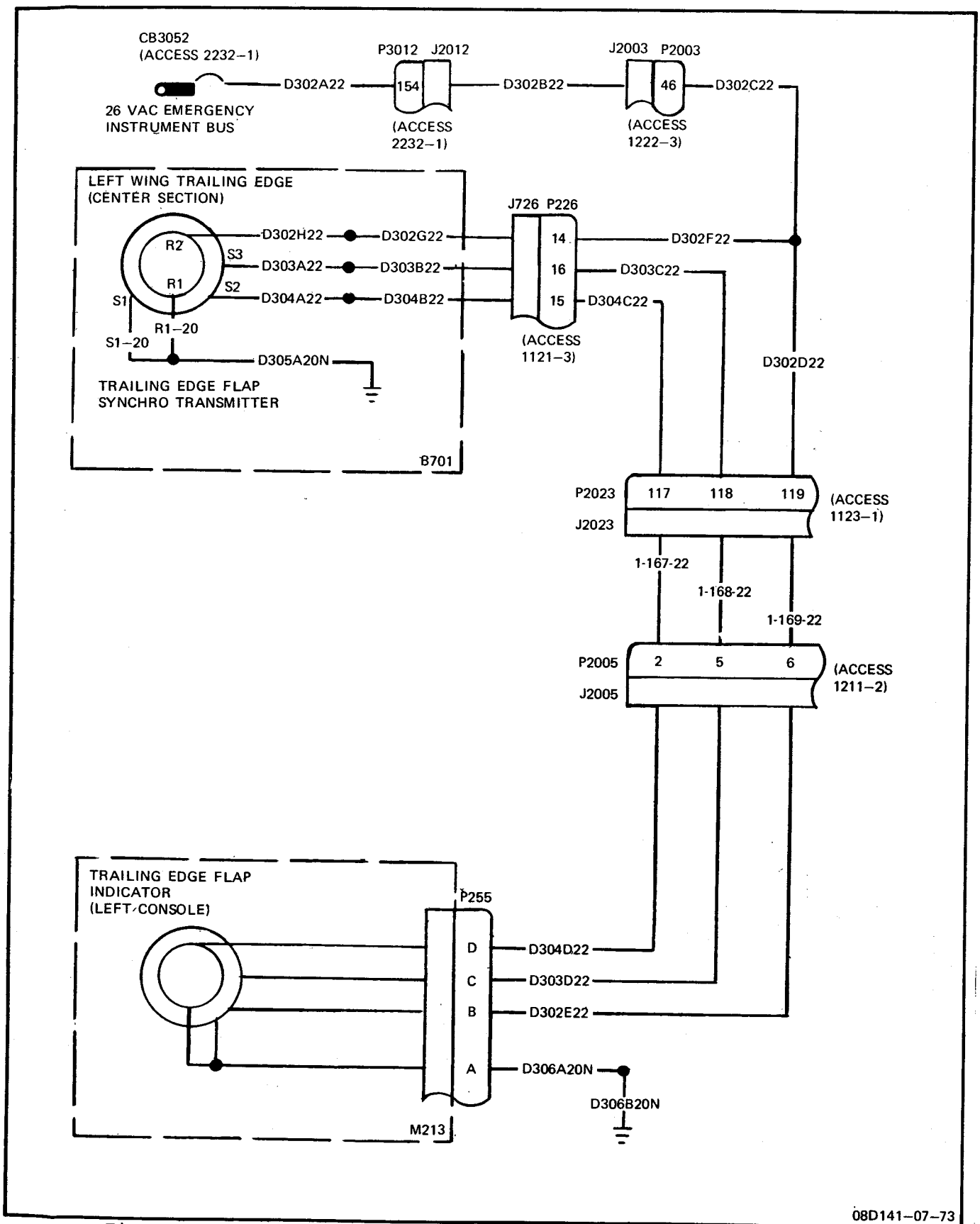

Figure 9-8. Trailing Edge Flap Position Indicating System Electrical Troubleshooting Schematic Diagram (Airplanes AF69-6197 and Subsequent)

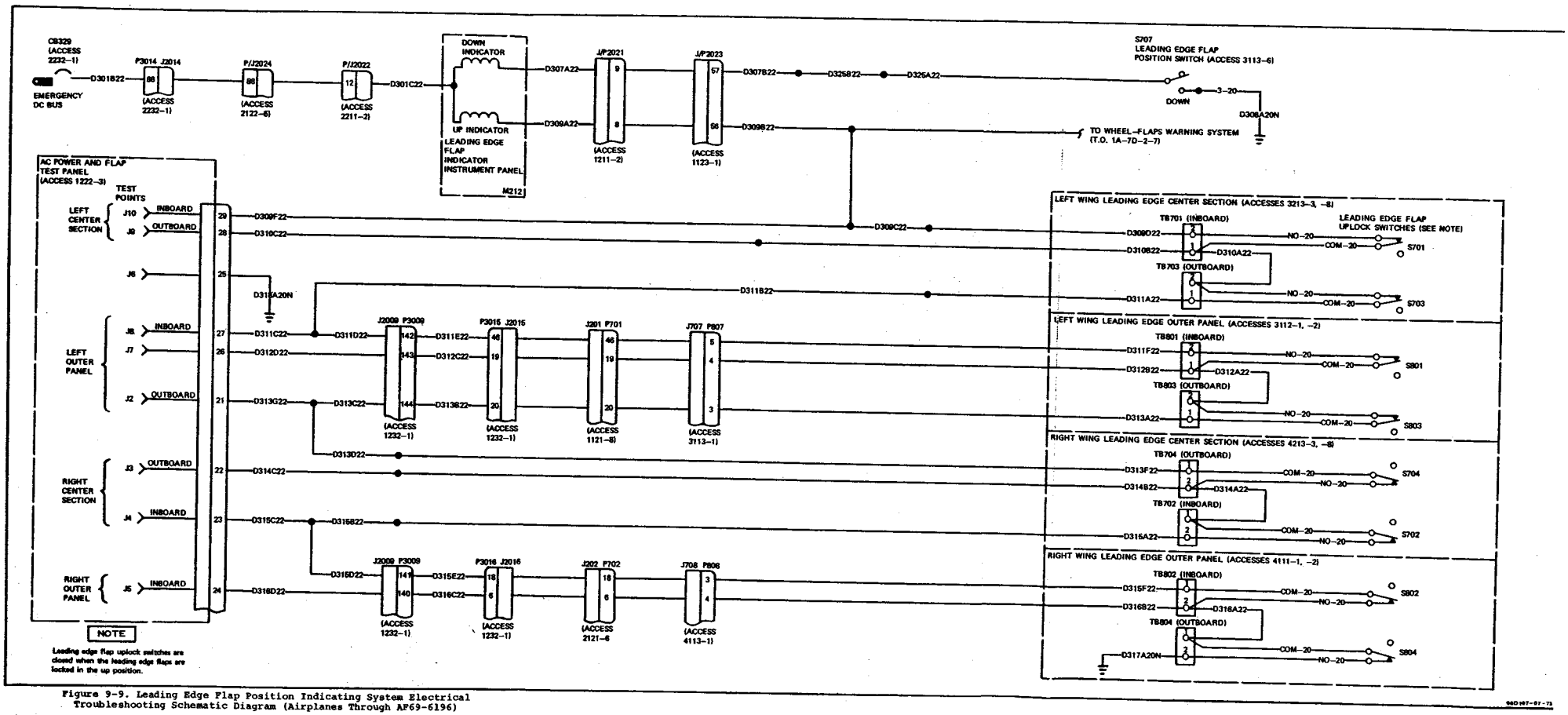

Figure 9-9. Leading Edge Flap Position Indicating System Electrical Troubleshooting Schematic Diagram (Airplanes Through AF69-6196)

indicator is deenergized and shows a barberpole. The indicator will also show a barberpole when electrical power is not applied.

9-31. The trailing edge flap position indicating circuit is a synchro system consisting of the trailing edge flap synchro transmitter and the trailing edge flap position indicator. Circuit operating voltage is 26 volts ac from the emergency instrument bus through circuit breaker CB3052. The synchro transmitter is mounted inside the left wing, forward of the trailing edge flap, with the transmitter shaft linked to the flap. Flap movement rotates the transmitter shaft, transmitting an electrical signal to the synchro receiver of the trailing edge flap position indicator. The synchro receiver shaft turns in the same direction and the same amount as the transmitter shaft. The flap position indicator pointer, attached to the synchro receiver shaft, indicates the position of the trailing edge flaps in degrees.

9-32. COMPONENTS.

9-33. For a list of system components, their locations (accesses), and functions, refer to table 9-1.

Table 9-1. Flap System Components

Component	Access	Function
	Electrical	
Circuit breaker CB3114	1232-1	Applies 28-volt dc power to trailing edge flap system.
		Applies 28 volts dc power to AMF electronic control unit.#
Circuit breaker CB329	2232-1	Applies 28-volt emergency dc bus power to leading edge flap position indicating system.
Circuit breaker CB3052	2232-1	Applies 26-volt ac emergency instrument bus power to trailing edge flap position indicating system.
Circuit breaker CB3134* or CB3168#	1232-1	Applies 28-volt dc power to emergency flap system.
Circuit breaker CB3170	2232-1	Applies 115-volt ac power to flap accumulator heater blanket.
Diodes (CR15, CR16, CR17, CR18)	1232-1	Voltage blocking.
Indicator, leading edge flap	Instrument panel	Indicates leading edge flap position.
Indicator, trailing edge flap	Instrument panel	Indicates trailing edge flap position.
Relay, variable trailing edge flap (K8)	1232-1	Completes power circuit to variable trailing edge flap valve package.
Switch, AMF#	Left console	Controls operation of automatic maneuvering flap system.
Switch, emergency flap	Left console	Controls operation of emergency flap selector valve.*
		Controls operation of emergency flap selector valve and disables AMF system when emergency flaps are selected.#

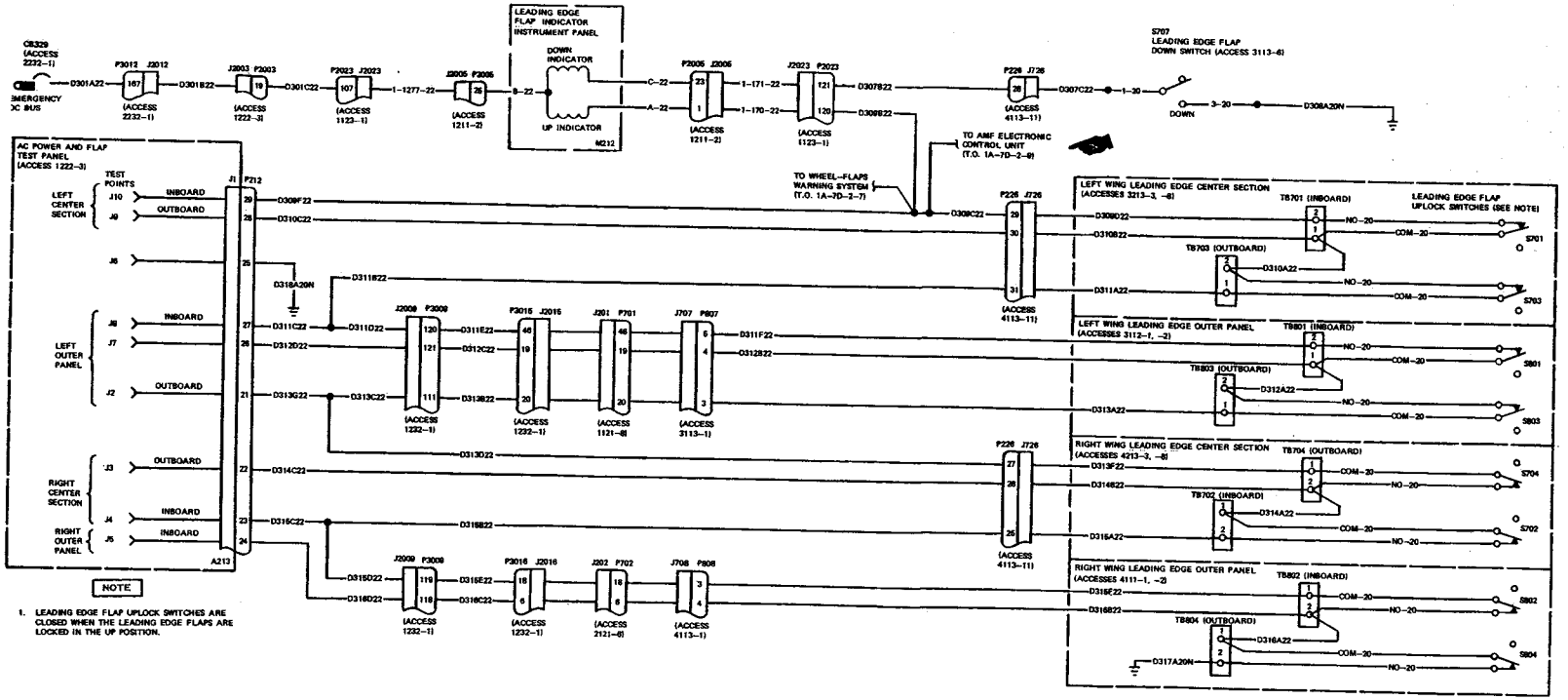

Figure 9-10. Leading Edge Flap Position Indicating System Electrical Troubleshooting Schematic Diagram (Airplanes AF69-6197 and Subsequent)

Table 9-1. Flap System Components (Continued)

Component	Access	Function
Switch, flap handle down	1123-1	When flap handle is not in DN, closes circuit to the variable trailing edge flap selector valve and to one coil of variable trailing edge flap relay (K1).
		When flap handle is in DN, closes circuit to trailing edge flap beep switches and to the variable trailing edge flap selector valve.
Switch, flap handle isolation	1123-1	When flap handle is in ISO UTILITY, opens circuit to prevent normal operation of trailing edge flaps.*
		When flap handle is in ISO UTIL, opens circuit to prevent normal operation of flaps and connects 28 volts dc to electronic control unit for flap operation in AMF mode.#
		When handle is not in ISO UTILITY, closes circuit to flap handle down switch to permit normal operation of trailing edge flaps.
Switch, leading edge flap position	3113-6	Completes ground circuit for leading edge flap indicator down coil.
Switch, left center section leading edge flap uplock (2)	3213-3, 3213-8	Completes portion of ground circuit for leading edge flap indicator up coil.*
		Completes portion of ground circuit for leading edge flap indicator up coil and for AMF system electronic control unit.#
Switch, left outer panel leading edge flap uplock (2)	3112-1, 3112-2	Same as left center section leading edge flap uplock switch.
Switch, right center section leading edge flap uplock (2)	4213-3, 4213-8	Same as left center section leading edge flap uplock switch.
Switch, right outer panel leading edge flap uplock (2)	4111-1, 4111-2	Same as left center section leading edge flap uplock switch.
Switch, trailing edge flap down beep	1221-1	When flap handle is in TE DN, closes circuit to the variable trailing edge flap selector valve to extend trailing edge flap.
Switch, trailing edge flap left inboard uplock#	4233-3	Completes portion of ground circuit for AMF system electronic control unit.
Switch, trailing edge flap left outboard uplock#	4233-2	Same as trailing edge flap left inboard uplock switch.

Table 9-1. Flap System Components (Continued)

Component	Access	Function
Switch, trailing edge flap right inboard uplock#	3233-3	Same as trailing edge flap left inboard uplock switch.
Switch, trailing edge flap right outboard uplock#	3233-2	Same as trailing edge flap left inboard uplock switch.
Switch, trailing edge flap up beep	1221-1	When flap handle is in TE UP, closes circuit to variable trailing edge flap selector valve to retract trailing edge flaps.
Transmitter, trailing edge flap synchro	3233-3	Transmits electrical signal, as a function of left trailing edge flap movement, to synchro receiver of trailing edge flap indicator.
	Hydraulic	
Cylinder, center section leading edge flap actuating (4)	3213-3, 3213-8, 4213-3, 4213-8	Extends and retracts center section leading edge flaps.
Cylinder, center section trailing edge flap actuating (4)	3233-2, 3233-3, 4233-2, 4233-3	Extends and retracts trailing edge flaps.
Cylinder, outer panel leading edge flap actuating (4)	3112-1, 3112-2 4111-1, 4111-2	Extends and retracts outer panel leading edge flaps.
Filter, inline (6)	1123-3	Installed in each part of variable flap valve to protect valve from system contamination
Swivel joints	Wingfold	Transfers hydraulic pressure to outer panel for operation of ailerons and leading edge flaps.
Package, emergency flaps accumulator	2123-3	
Accumulator		Provides flap emergency extension pressure.
Valve, emergency pressure dump		Dumps accumulator oil pressure into PC No. 2 hydraulic return circuit. Manually controlled by emergency accumulator test switch.
Valve, precharge shutoff		Controls nitrogen precharge circuit. Manually controlled by emergency accumulator test switch.
Valve, thermal relief		Prevents accumulator overpressurization due to fluid thermal expansion. Full flow pressure, 3,850 psi; reseat pressure, 3,390 psi.

Table 9-1. Flap System Components (Continued)

Component	Access	Function
Package, variable trailing edge flap valve	1123-3	Provides variable positioning capability for trailing edge flaps.
Valve, emergency bypass		Provides return circuit for trailing edge flaps during emergency flap operation.
Valve, flow equalizer		Synchronizes travel of left and right trailing edge flaps.
Valve, lock (2)		Locks trailing edge flaps in any selected position.
Valve, shuttle		Blocks off normal pressure line and directs emergency pressure to extend trailing edge flaps.
Valve, thermal relief		Prevents overpressurization of lines between lock valve and trailing edge flap actuating cylinders resulting from fluid thermal expansion.
Valve, trailing edge flap selector		Controls application of hydraulic pressure for trailing edge flap operation. Electrically controlled by actuation of switches through flap handle movement.* Electrically controlled by actuation of switches through flap handle movement or by AMF electronic control unit.#
Restrictor, dump line	1121-5	Prevents pressure surge in PC No. 2 hydraulic system return circuit when accumulator is dumped.
Restrictor, flap extend	1121-5	Retards extension rate, during normal operation, of all leading edge flaps.
Restrictor, center section leading edge flap retract (left/right)	3113-6, 4113-6	Controls center section leading edge flap retraction rate.
Restrictor, center section leading edge flap extend (left/right)	3113-6, 4113-6	Controls center section leading edge flap extension rate.
Restrictor, outer panel leading edge flap retract (left/right)	3112-3, 4111-3	Controls outer panel leading edge flap retraction rate.
Restrictor, outer panel leading edge flap extend (left/right)	3112-3, 4111-3	Controls outer panel leading edge flap extension rate.
Restrictor, trailing edge flap retract (left/right)	Spoiler cavity	Controls trailing edge flap retraction rate.

Table 9-1. Flap System Components (Continued)

Component	Access	Function
Restrictor, trailing edge flap extend (left/right)	Spoiler cavity	Controls trailing edge flap extension rate.
Valve, accumulator charging line check	2123-3	Traps hydraulic pressure in accumulator if normal hydraulic system failure occurs.
Valve, AMF extend#	1123-4	Directs PC No. 2 hydraulic pressure from extend shutoff valve into extend lines of leading edge flaps and to trailing edge flap valve package when commanded by AMF electronic control unit.
Valve, AMF extend shutoff#	1123-4	Supplies PC No. 2 hydraulic pressure to AMF extend valve when commanded by AMF electronic control unit.
Valve, AMF retract#	1123-4	Supplies PC No. 2 hydraulic pressure to leading edge flap retract lines and to trailing edge flap valve package when commanded by electronic control unit.
Valve, AMF thermal relief#	2123-6	Prevents excessive hydraulic pressure buildup between extend valve and extend shutoff valve.
Valve, bleed (4)	1121-6, 2121-6	Provides for bleeding trapped air from trailing edge flap lines.
Valve, dump line check	1121-5	Prevents application of hydraulic pressure to emergency flaps down line when accumulator is dumped.
Valve, emergency flap bypass	1121-3	Provides return circuit for leading edge flaps during emergency flap operation.
Valve, emergency flap selector	1123-3	Controls application of hydraulic pressure to emergency flap down line. Cockpit-controlled by emergency flap switch.
Valve, flap selector	1123-1	Controls application of hydraulic pressure for leading edge flap operation and application of hydraulic pressure to the trailing edge flap selector valve. Mechanically controlled by the flap handle.
Valve, return line check	1123-1	Prevents application of hydraulic pressure to normal flap down line when accumulator is dumped.
Valve, shuttle	1121-3	Blocks off normal pressure line and directs emergency pressure to extend leading edge flaps.

Table 9-1. Flap System Components (Continued)

Component	Access	Function
Valve, trailing edge flap extend line check	1121-4	Prevents flow into flap extend line during trailing edge flap retraction.
Valve, trailing edge flap retract line check	1121-4	Prevents flow into flap retract line during trailing edge flap extension.
	Mechanical	
Control assembly, flap	Left console	Manually actuated to control normal flap operation.
Flaps, center section leading edge (2)	Left and right center wing	Provides increased airplane stability during takeoff and landing.*
		Provides increased airplane stability during takeoff and landing and, at pilot's discretion, increased maneuvering capability within certain speed and attitude parameters.#
Flaps, center section trailing edge (2)	Left and right center wing	Same as center section leading edge flaps.
Flaps, outer panel leading edge (2)	Left and right outer wing	Same as center section leading edge flaps.

*Airplanes through AF69-6196
#Airplanes AF69-6197 and subsequent

9-34. OPERATIONAL CHECKOUT.

9-35. NORMAL OPERATIONAL CHECKOUT.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
	GG-S-764	Stopwatch	Time flap movement

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NOTE

A number, or numbers, enclosed in braces at the end of a step in the following checkout is a reference to a corresponding number in troubleshooting table 9-2.

a. Install variable trailing edge flap protractors (paragraph 9-41).

a-1. On airplanes AF69-6197 and subsequent, check that AMF switch is in OFF.

b. Connect external electrical power (T.O. 1A-7D-2-1).

c. Connect external hydraulic power to PC No. 2 hydraulic system (T.O. 1A-7D-2-1).

CAUTION

To prevent damage to internal locks of the flap actuating cylinders, which could lead to flap system failure and cause contamination of the PC No. 2 hydraulic system, do not use the hand pump to unlock the flaps from either the fully retracted or fully extended position. Unlock the cylinders using only an external power source delivering at least 1,400 psi hydraulic pressure with a minimum flow rate of 2 gpm.

To prevent interference with flap and possible damage, ensure cooling hole cover (215-00266-4) is removed before operating flaps.

d. Place flap handle in DN and visually check for synchronization of leading edge flaps as they extend. All flaps shall extend to locked position 8.8 (±1.5) seconds (airplanes through AF69-6196) or 5.6 (±1.0) seconds (airplanes AF69-6197 and subsequent) from time first surface moves until last surface stops. Check that leading edge flap position indicator indicates DN and trailing edge flap position indicator indicates 40° (±1°). {1, 2, 3, 4, 5, and 6}

NOTE

When operating the trailing edge flaps, squealing of the variable trailing edge flap valve package is allowable and not cause for rejection.

e. Place flap handle in UP and visually check for synchronization of leading edge flaps as they retract. All flaps must retract to locked position 12.0 (±1.5) seconds (airplanes through AF69-6196) or 12.8 (±1.5) seconds (airplanes AF69-6197 and subsequent) from time first surface moves until time last surface stops. Check that leading edge flap position indicator indicates UP and trailing edge flap position indicator indicates 0°. {1, 2, 3, 7, 8, and 9}

f. Place flap handle in ISO UTILITY. Flaps shall not move and indicators shall remain unchanged. {7 and 8}

NOTE

Apply 25-pound load continuously downward on surface of both trailing edge flaps while performing synchronization checks of steps g through k.

g. Place flap handle in DN, beeping handle momentarily in TE UP and quickly releasing to DN when trailing edge flap position indicator indicates 10°. Check trailing edge flaps for synchronization within 2° as indicated on protractor. {3 and 10}

h. Beep handle to TE DN, quickly releasing to DN when indicator indicates 20°. Check trailing edge flaps for synchronization within 2° as indicated on protractor. {3 and11}

i. Repeat step h with trailing edge flaps at 30°; then extend trailing edge flaps completely. {3 and 11}

j. With flaps fully extended, determine which protractor indicates the greatest number of degrees. Adjust opposite protractor until both readings are equal.

k. Retract trailing edge flaps by beeping flap handle in TE UP, checking for synchronization of flap surfaces within 2.4° at 30°, 20°, and 10°. {3 and 12}

l. Remove load.

m. Place flap handle in UP and check that all flaps retract. {1 and 9}

m-1. On airplanes AF69-6197 and subsequent, perform automatic maneuvering flap check as follows:

1. Check that angle-of-attack vane is at approximately 6 units.

CAUTION

Ensure that ground locks are installed on main and nose gear actuators.

2. Place flap handle in ISO UTIL.

3. Place AMF switch in AUTO.

4. Manually move angle-of-attack vane toward 16 units, and note that leading and trailing edge flaps start extending as vane reaches 14.75 (±0.25) units (as indicated on cockpit angle-of-attack indicator). Ensure that trailing edge flaps stop at 15°(±1°) and leading edge flaps extend fully. {21, 22, and 23}

5. Move angle-of-attack vane toward 0 units, and note that as vane

reaches approximately 10.5 (±0.5) units, leading and trailing edge flaps start retracting and continue to fully retracted position. (24)

n. Perform flap package leakage test as follows:

1. Cycle flaps a minimum of two times, ending with flaps in DN position.

2. Beep handle to TE UP, quickly releasing to DN when trailing edge flap position indicators indicate 20°. Note exact position of each flap.

3. Shut down hydraulic and electrical power.

4. Check each flap for a maximum creepage of 30' of angle in 5 minutes. {25}

5. Apply electrical and hydraulic power.

6. Place flap handle in UP. All flaps shall retract.

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o. Disconnect external electrical and hydraulic power (T.O. 1A-7D-2-1).

p. Remove variable trailing edge flap protractors.

9-36. EMERGENCY OPERATIONAL CHECKOUT.

Test Equipment Required

Figure & Index No.	*Name*	*AN Type Designation*	*Use and Application*
	Equipment for connecting external electrical power		Connect electrical power
	Equipment for connecting external hydraulic power		Connect hydraulic power
	Stopwatch	GG-S-764	Time flap movement

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NOTE

A number, or numbers, enclosed in braces at the end of a step in the following test is a reference to a corresponding number in trouble-shooting table 9-2.

a. Check that all emergency accumulators are properly precharged (T.O. 1A-7D-2-1).

b. Connect external electrical power (T.O. 1A-7D-2-1). {13}

c. Connect external hydraulic power to PC No. 2 hydraulic system (T.O. 1A-7D-2-1).

d. Place emergency accumulator shutoff valve handle in OPEN for 1 minute.

e. Place emergency shutoff valve handle in CLOSE.

CAUTION

To prevent interference with flap and possible damage, ensure engine cooling hole cover (215-00266-4) is removed before operating flaps.

f. Retract flaps, if extended.

g. Check that emergency accumulators are charged. Record pressures.

h. Shut down external hydraulic power but do not disconnect.

i. Place flap handle in ISO UTILITY.

NOTE

Check synchronization of trailing edge flaps by noting time required to extend each trailing edge flap. If difference in time exceeds 10% of total time required to extend both flaps, synchronization is unsatisfactory.

When operating the trailing edge flaps, squealing of the variable trailing edge flap valve package is allowable and not cause for rejection.

j. Place emergency flap switch in EMERG DN. Flaps shall extend to full down and locked position within 16 seconds from time first surface moves until last surface stops. {2, 3, 13, 14, and 15}

k. Check that leading edge flap position indicator indicates DN and trailing edge flap position indicator indicates 40° (±1°). {4 and 5}

l. Check that all emergency accumulators, other than flap, have the same pressure as recorded in step g. {16}

m. Place emergency flap switch in NORM.

n. Check that trailing edge flaps locked in down position as follows:

1. Remove lockwire from left and right trailing edge flap extend and retract line bleed valves.

2. Connect bleed hoses to bleed valves. Submerge open ends of hoses in container of clean hydraulic fluid.

WARNING

To prevent injury from fluid under pressure, ensure that emergency flap switch is in NORM before opening bleed valves to relieve trapped pressure.

3. Open bleed valves. Wait until flow stops.

4. Manually attempt to move flaps upward. No in or out movement of actuating cylinder piston should occur, indicating proper operation of cylinder locking fingers. {17}

5. Close bleed valves.

6. Disconnect bleed hoses from bleed valves.

7. Secure bleed valves with MS20995C32 lockwire.

o. Place flap handle in DN. Apply external test stand power. Place handle in UP and retract flaps. {18}

p. Cycle flaps several times and shut down hydraulic power.

q. Check PC No. 2 hydraulic system reservoir for proper fluid level (T.O. 1A-7D-2-1).

r. Close emergency accumulator heater blanket circuit breaker. Allow 5 minutes for accumulator heating blanket to warm up; then, check that blanket is heating. {19}

s. Disconnect external electrical and hydraulic power (T.O. 1A-7D-2-1).

9-37. TROUBLESHOOTING.

Test Equipment Required

Figure & Index No.	*Name*	*AN Type Designation*	*Use and Application*
	Equipment for connecting external electrical power		Connect electrical power
	Equipment for connecting external hydraulic power		Connect hydraulic power
	Multimeter	AN/PSM-6	Check voltage

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9-38. Refer to table 9-2 for troubleshooting information and to figures 9-7, 9-9, and 9-11 or 9-8, 9-10, and 9-12 for electrical schematic to aid in troubleshooting. Malfunctions in the table are listed numerically and are related to a corresponding number, or numbers, following a step in the operational checkout.

9-39. If trouble symptoms are known, troubleshooting may be accomplished without reference to the operational checkout; however, the following steps shall be performed:

a. Install variable trailing edge flap protractor (paragraph 9-41).

b. Connect external electrical power (T.O. 1A-7D-2-1).

c. Connect external hydraulic power to PC No. 2 hydraulic system (T.O. 1A-7D-2-1).

d. Perform flap system troubleshooting.

e. Disconnect external hydraulic power.

f. Disconnect external electrical power.

g. Remove variable trailing edge flap protractors.

Table 9-2. Flap System Troubleshooting

Probable Cause	Isolation Procedure	Remedy
1. Flaps will not extend or retract.		
Controls out of adjustment or defective.	Visually check that control system is actuating isolation valve and selector valve.	If isolation valve and selector valve do not actuate, rig control system or replace defective controls.
Isolation valve defective, or selector valve defective.	Remove hydraulic pressure and loosen outlet line on isolation valve. Apply minimum hydraulic pressure and check for fluid flow.	If fluid does not flow, replace isolation valve. If fluid flows, replace selector valve.

Table 9-2. Flap System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
Automatic maneuvering flap (AMF) system malfunction.#	Disconnect electrical connectors from AMF extend and retract valves and attempt to operate flaps.	If flaps operate, troubleshoot AMF system (T.O. 1A-7D-2-9). If flaps do not operate, check for defective AMF extend valve.
AMF extend valve defective.#	With hydraulic power shut down, place flap handle in UP, disconnect outlet line from extend valve, and apply minimum hydraulic pressure. Place flap handle in DN and check for hydraulic fluid flow from extend valve outlet port.	If fluid does not flow, replace AMF extend valve (paragraph 9-122).
2. Flaps extend or retract too rapidly or too slowly.		
Restrictor installed incorrectly.	Check that restrictors are installed for correct flow direction.	Install restrictor correctly.
Defective flap up or down line restrictors.	None	Replace restrictors.
Flap actuating cylinder defective.	Check flap actuating cylinders for evidence of leakage or binding.	Replace cylinder.
Substantial leak in hydraulic system.	Check flap system hydraulic lines and system components.	Tighten leaking hydraulic line fitting. Replace defective fitting O-rings or replace defective component.
AMF retract valve defective (leading edge flaps extend slowly).#	Retract flaps and shut down hydraulic power. Disconnect hydraulic line between flap selector and AMF retract valves. Apply minimum hydraulic pressure and place flap handle in DN. Check for hydraulic fluid flow from port of retract valve.	If fluid does not flow, replace AMF retract valve (paragraph 9-128).

Table 9-2. Flap System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
3. Trailing edge flap extension or retraction is not synchronized.		
Air trapped in lines.	Perform air check.	Bleed flap system.
Reversed or defective flap up or down line restrictors.	None	Check installation or replace all four up and down line restrictors.
Variable flap valve inline filter(s) clogged.	Remove fitting(s) from valve and check filter(s) for contamination.	Clean or replace filter(s).
Excessive hydraulic pressure required to release internal locks in actuating cylinder.	Visually observe flaps for start of movement from fully retracted or fully extended position, as applicable. All flaps should begin movement at approximately the same time.	Replace actuating cylinder.
Binding in flap hinges.	Visually check flap for evidence of binding or warping.	Correct binding or replace flap.
Variable trailing edge flap valve package defective.	Observe flap extension and retraction.	Replace variable trailing edge flap valve package.
Internal leak in actuating cylinder.	Operate flaps and stop at approximately 20 degrees. Flaps should remain stopped.	If both flaps slowly move down, replace variable trailing edge valve package. If one flap only slowly moves down, replace internally leaking actuating cylinder.
4. Leading edge flap indicator does not indicate DN with leading edge flaps extended.		
Circuit breaker open or defective.	Check circuit breakers CB329.	Close or replace CB329.

Table 9-2. Flap System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
Leading edge flap position indicator defective or open wiring.	Disconnect P2021*. Connect ground to pin 9 of J2021 and check that indicator indicates DN. Disconnect P2005#. Connect ground to pin 34 of J2005 and check that indicator indicates DN.	Replace indicator, or repair or replace associated wiring.
Leading edge flap position switch out of adjustment or defective.	Check position switch (paragraph 9-105).	Rig or replace position switch, or repair or replace associated wiring.
5. Trailing edge flap position indicator does not indicate 40° (±1°) with flaps extended.		
Circuit breaker open or defective.	Check circuit breaker CB3052.	Close or replace CB3052.
Synchro transmitter out of adjustment.	None	Adjust synchro transmitter.
Indicator defective.	Substitute a serviceable indicator for existing indicator. Indication shall be 40° (±1°).	If indication is 40° (±1°), replace defective indicator.
Transmitter defective or wiring open.	Same as above.	If indication is not 40° (±1°), replace transmitter, or repair or replace associated wiring.
6. Trailing edge flaps do not extend with flap handle in DN.		
Variable trailing edge flap valve package defective.	Actuate manual override button on solenoid No. 2 on variable trailing edge flap valve package. Flaps shall extend. If flaps extend, disconnect connector P2060. Multimeter shall indicate 28 volts dc between pins 2 and 3 of connector.	If flaps do not extend, replace variable trailing edge flap valve package. If flaps extend and 28 volts dc is indicated between pins 2 and 3 of P2060, check resistance between pins 2 and 3 of valve package. If resistance is not approximately 34 ohms, replace valve package. If resistance is correct, proceed with next probable cause.

Table 9-2. Flap System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
Flap handle isolation switch or flap handle down switch out of adjustment or defective, or wiring open.	Disconnect connector P3092 and hold flap handle in DN. Multimeter shall indicate 28 volts dc between pins 1 and 4 of P3092.	Rig or replace flap handle isolation switch or flap handle down switch, or repair or replace associated wiring.
Trailing edge flap up beep switch out of adjustment or defective, or wiring open.	Check for 0 volt dc at pin 28 of P3092.	If voltage is indicated, rig or replace trailing edge flap up beep switch, or repair or replace associated wiring.
Defective latching relay assembly or wiring open.	Connect connector P3092. Place flap handle in DN and hold. Multimeter shall indicate 28 volts dc between pins 2 and 3 of P2060.	Replace relay subassembly A356 (T.O. 1A-7D-2-10), or repair or replace wiring to pin 2 or pin 3 of P2060.
Check valve installed incorrectly.	Check direction of flow arrow on check valve in flaps down line, upstream of variable trailing edge flap valve package.	Reverse direction of installation of check valve.

7. Trailing edge flap position indicator does not indicate 0° with trailing edge flaps retracted.

Same as item 5 except for 0°.

8. Leading edge flap position indicator does not indicate UP with leading edge flaps retracted.

Indicator defective or open wiring.	With flaps retracted, flap handle in ISO UTILITY, and external hydraulic power applied to PC No. 2 hydraulic system, 28 volts dc shall be present at test point J10.	If voltage is not indicated, replace leading edge flap indicator or repair or replace wiring.
Leading edge flap uplock switch out of adjustment or defective.	28 volts dc shall be indicated at test points J9, J8, J7, J2, J3, J4 and J5 and terminal 2 of terminal board TB804. If voltage is not indicated, open circuit breaker CB329. Continuity shall exist between terminals 1 and 2 of terminal board having ground side connected to point where no voltage was indicated.	Rig or replace associated leading edge flap uplock switch, or repair or replace associated wiring.

Table 9-2. Flap System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
Open ground wire.	With circuit breaker CB329 open, continuity to ground shall exist at terminal 2 of TB804.	Repair or replace associated wiring.
9. Trailing edge flaps do not retract with flap handle in UP. Leading edge flaps operate satisfactorily.		
Variable trailing edge flap valve package.	Actuate manual override button on solenoid No. 1 on variable trailing edge flap valve package. Flaps shall retract. If flaps retract, disconnect connector P2060. Multimeter shall indicate 28 volts dc between pins 1 and 2 of P2060.	If flaps do not retract, replace variable trailing edge flap valve package. If flaps retract and 28 volts dc is indicated between pins 1 and 2 of P2060, check resistance between pins 1 and 2 of valve package. If resistance is not approximately 34 ohms, replace valve package. If resistance is correct, proceed with next probable cause.
Flap handle down switch or flap handle isolation switch out of adjustment or defective, or wiring open.	Disconnect P3092 and hold flap handle in UP. Multimeter shall indicate 28 volts dc between pins 1 and 53 of P3092.	Rig or replace flap handle down switch or flap handle isolation switch or repair or replace associated wiring.
Defective latching relay assembly or wiring open.	Connect P3092 and hold flap handle in UP. Multimeter shall indicate 28 volts dc between pins 1 and 2 of P2060.	Replace relay subassembly A356 (T.O. 1A-7D-2-10), or repair or replace wiring to pins 1 and 2 of P2060.
10. Variable trailing edge flaps do not stop during extension, when flap handle is moved from DN momentarily into TE UP.		
Trailing edge flap beep up switch defective or out of adjustment, or wiring open.	Disconnect connector P3092 and hold flap handle in TE UP. Multimeter shall indicate 28 volts dc between pins 1 and 28 of P3092.	Rig or replace trailing edge flap beep up switch, or repair or replace associated wiring.
Defective latching relay assembly.	Connect P3092 and disconnect connector P2060. Hold flap handle in TE UP. Multimeter shall indicate no voltage between 2 and 3 of P2060.	Replace relay subassembly A356 (T.O. 1A-7D-2-10).
Variable trailing edge flap valve package.	With flap handle in TE UP, multimeter shall indicate 28 volts dc between pins 1 and 2 of P2060.	If voltage is indicated, replace variable trailing edge flap valve package.

Table 9-2. Flap System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
11. Trailing edge flaps do not extend when flap handle is beeped in TE DN.		
Flap handle down switch or isolation switch out of adjustment or wiring open.	Disconnect connector P2023. Multimeter shall indicate 28 volts dc between pin 131* (140#) of J2023 and ground.	Rig or replace flap handle down switch or flap handle isolation switch, or repair or replace associated wiring.
Trailing edge flap down beep switch out of adjustment or wiring open.	Hold flap handle in TE DN. Multimeter shall indicate 28 volts dc between pin 130* (141#) of J2023 and ground.	Rig or replace trailing edge flap down beep switch, or repair or replace associated wiring.
Variable trailing edge flap valve package.	Connect P2023. Disconnect connector P2060. Multimeter shall indicate 28 volts dc between pins 2 and 3 of P2060.	If 28 volts dc is indicated, replace variable trailing edge flap valve package.
12. Trailing edge flaps do not retract when flap handle is beeped in TE UP.		
Flap handle down switch or flap handle isolation switch out of adjustment or defective or open wiring.	Disconnect connector P2023. Multimeter shall indicate 28 volts dc between pin 131* (140#) of J2023 and ground.	Rig or replace flap handle down switch, or repair or replace associated wiring.
Trailing edge flap up beep switch out of adjustment or defective or wiring open.	Hold flap handle in TE UP. Multimeter shall indicate 28 volts dc between pin 79* (167#) of J2023 and ground.	Rig or replace trailing edge flap up beep switch or repair or replace associated wiring.
Trailing edge flap up beep switch out of adjustment or defective.	Hold flap handle in TE UP. Multimeter shall indicate no voltage at pin 130* (141#) of J2023.	Rig or replace trailing edge flap down beep switch.
Defective latching relay assembly or wiring open.	Connect P2023 and disconnect connector P2060. Hold flap handle in TE UP. Multimeter shall indicate no voltage between pins 2 and 3 of P2060.	Replace relay subassembly A356 (T.O. 1A-7D-2-10), or repair or replace associated wiring.
Variable trailing edge flap valve package or open wiring.	Multimeter shall indicate 28 volts dc between pins 1 and 2 of P2060.	If voltage is indicated, replace variable trailing edge flap valve package. If no voltage is indicated, repair or replace associated wiring.

Table 9-2. Flap System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
13. Flaps do not extend when emergency flap switch is placed in EMER DN.		
Circuit breaker open or wiring open.	Check that circuit breaker CB3134* (CB3168#) is closed.	Close circuit breaker, or repair or replace associated wiring.
Emergency flap switch or emergency flap selector valve defective, or open wiring.	Ensure that accumulator is properly serviced. Disconnect P230 and place emergency flap switch in EMERG DN. Multimeter shall indicate 28 volts dc between pins 1 and 2 of P230.	If 28 volts dc is not indicated, replace emergency flap switch, or repair or replace wiring between connector and switch or connector and ground. If 28 volts dc is indicated, replace emergency flap selector valve.
14. Leading edge flaps do not extend during emergency operation. Trailing edge flaps extend.		
	WARNING Reduce emergency flap accumulator pressure to 200 psi maximum before loosening line fittings. Loosen line fittings gradually.	
Shuttle valve in leading edge flaps down line or emergency pressure-operated bypass valve defective.	Loosen leading edge flap down line downstream of shuttle valve. Fluid shall flow.	If fluid does not flow, replace shuttle valve. If fluid flows, replace emergency pressure-operated bypass valve.
15. Trailing edge flaps do not extend during emergency operation. Leading edge flaps extend.		
Variable trailing edge flap valve package defective.	Emergency operation of flaps.	Replace variable trailing edge flap valve package.
16. An emergency accumulator, other than flap, has reduced pressure after flap operation.		
Accumulator charging line check valve leaking.	None	Replace check valve.

Table 9-2. Flap System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
17. Flap(s) will not lock in down position when extended by emergency accumulator.		
Flap actuating cylinder defective, or defective accumulator precharge system.	Place emergency flap switch in NORM and apply 3,000 psi hydraulic pressure. Retract flaps, if extended, then extend flaps. Shut down hydraulic power and open bleed valves. Attempt to move flaps upward.	If either flap moves upward, replace both actuating cylinders. If flaps will not move, perform accumulator precharge system operational checkout (T.O. 1A-7D-2-4).
18. Trailing edge flaps cannot be retracted after emergency operation. Leading edge flaps retract.		
Variable trailing edge flap valve package defective.	Flap retraction.	Replace variable trailing edge flap valve package.
19. Emergency flap accumulator heating blanket will not heat.		
Defective heater blanket.	Check for 115 volts ac at wire splices of blanket.	If voltage is present, replace blanket.
20. With wheels and flaps extended, early asymmetrical stall is reported.		
Leading edge flap seal	None	Remove LE flaps on the side of aircraft that stalled and check condition of flap seal (paragraphs 9-88 and 9-93).
Incorrect gap between wing leading edge fairing and leading edge flap.	Check gap (figure 9-17 or 9-18). Rerig if near or above upper limit. Gap near lower limit is desirable.	Rig leading edge flap (paragraph 9-43 or 9-44).
21. Flaps do not extend when angle-of-attack vane is moved to 14.75 (±0.25) units with flap handle in ISO UTIL and AMF switch in AUTO.#		
AMF system electrical malfunction.	Disconnect P294 from extend shutoff valve and P283 from extend valve. Check for 28 volts dc on pin A of both connectors.	If voltage is not present at both connectors, troubleshoot AMF system (T.O. 1A-7D-2-9). If voltage is present, check for defective extend shutoff or extend valve.

Table 9-2. Flap System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
AMF extend shutoff valve or extend valve defective.	Connect electrical connectors. Apply minimum hydraulic pressure. Loosen hydraulic supply line at extend valve inlet port and check for hydraulic pressure.	If hydraulic pressure is not present, replace extend shutoff valve (paragraph 9-125). If hydraulic pressure is present, replace extend valve (paragraph 9-122).
22. Only leading edge flaps extend when angle-of-attack vane is moved to 14.75 (±0.25) units with flap handle in ISO UTIL and AMF switch in AUTO.#		
AMF system electrical malfunction.	Disconnect P2060 from variable trailing edge flap selector valve and check for 28 volts dc on pin 3 of connector.	If voltage is not present, troubleshoot AMF system (T.O. 1A-7D-2-9). If voltage is present, replace valve (paragraph 9-71).
23. Trailing edge flaps do not stop at 15° (±1°).		
Troubleshoot AMF system (T.O. 1A-7D-2-9).		
24. Flaps do not retract when angle-of-attack vane is moved toward 0 units.#		
AMF system electrical malfunction or defective retract valve.	Disconnect P289 from retract valve. Check for 28 volts dc on pin A of connector.	If voltage is not present, troubleshoot AMF system (T.O. 1A-7D-2-9). If voltage is present replace retract valve (paragraph 9-128).
25. Flap creepage exceeds 0° 30' in 5 minutes.		
Variable trailing edge flap valve package defective.	None	Replace variable trailing edge flap valve package.

*Airplanes through AF69-6196
#Airplanes AF69-6197 and subsequent

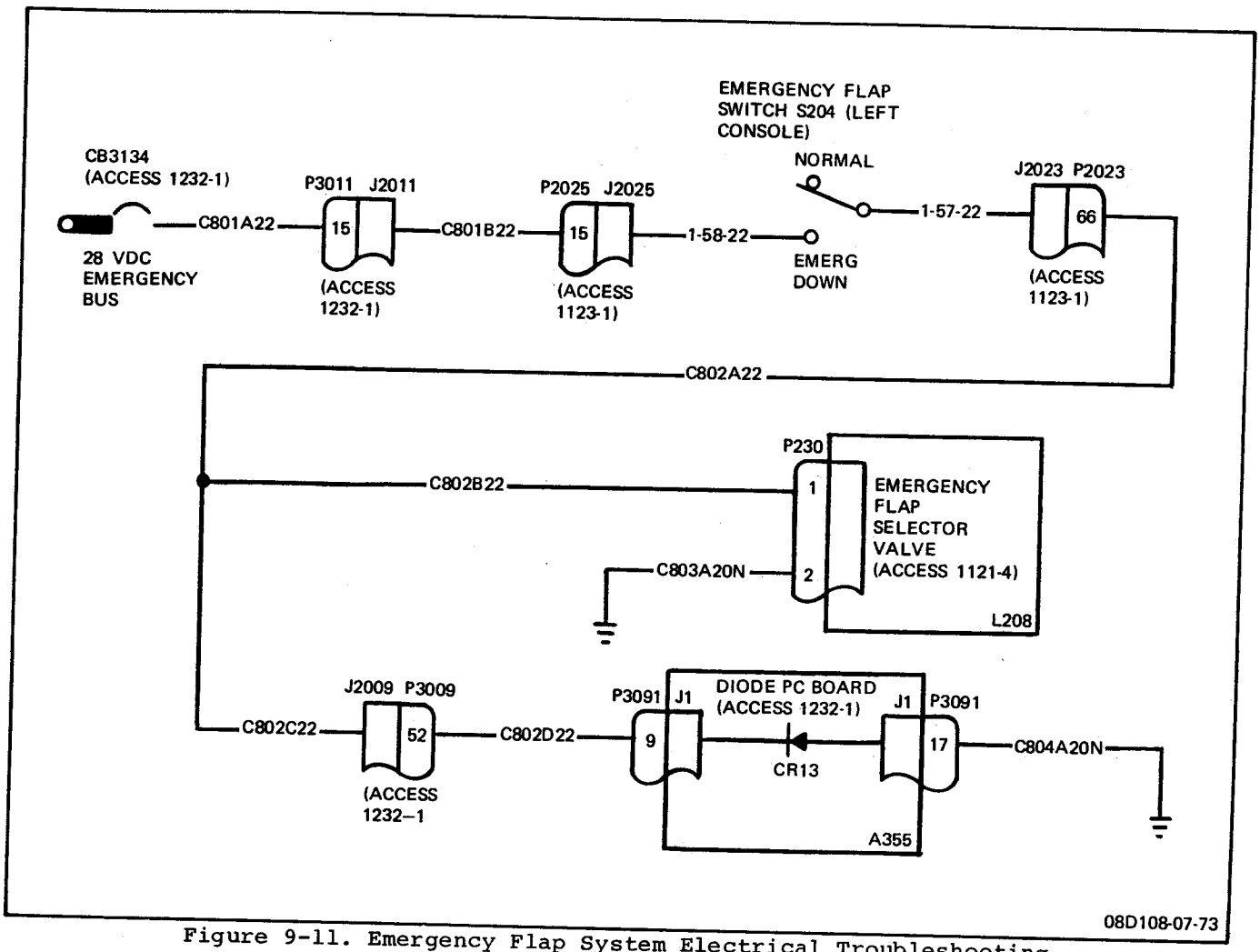

Figure 9-11. Emergency Flap System Electrical Troubleshooting Schematic Diagram (Airplanes Through AF69-6196)

9-40. TRAILING EDGE FLAP RESTRICTOR TESTING.

Test Equipment Required

Figure & Index No.	*Name*	*AN Type Designation*	*Use and Application*
	Hydraulic power supply, 0 to 5,000 psi		Supply hydraulic power for test
	Pressure gage, 0 to 3,000 psi		Indicate pressure applied to restrictor
	Stopwatch	GG-S-764	Time flow test
	Graduated cylinder, 2,000 cc	MS35943-11	Collect and measure fluid
			TT08D174-11-75

a. Install restrictor in test setup as shown in figure 9-13. Connect pressure gage within 6 inches of restrictor.

NOTE

Ensure restricted flow is toward graduated cylinder.

b. Apply 1,500 (±25) psig hydraulic pressure as indicated on pressure gage.

c. Allow flow through restrictor for exactly 1 minute and shut off hydraulic pressure.

d. Measure fluid collected in graduated cylinder. On airplanes through AF69-6196, fluid collected after flowing through extend or retract line restrictor should measure 870 to 930 cc. On airplanes AF69-6197 and subsequent, fluid collected after flowing through extend line restrictor should measure 1,020 to 1,250 cc. Retract line restrictors fluid flow must be measured in both directions. With flow being measured in the direction marked To Actuator on body of restrictor, fluid collected should measure 985 to 1,212 cc. With flow being measured in the opposite direction, fluid collected should measure 1,400 to 1,705 cc.

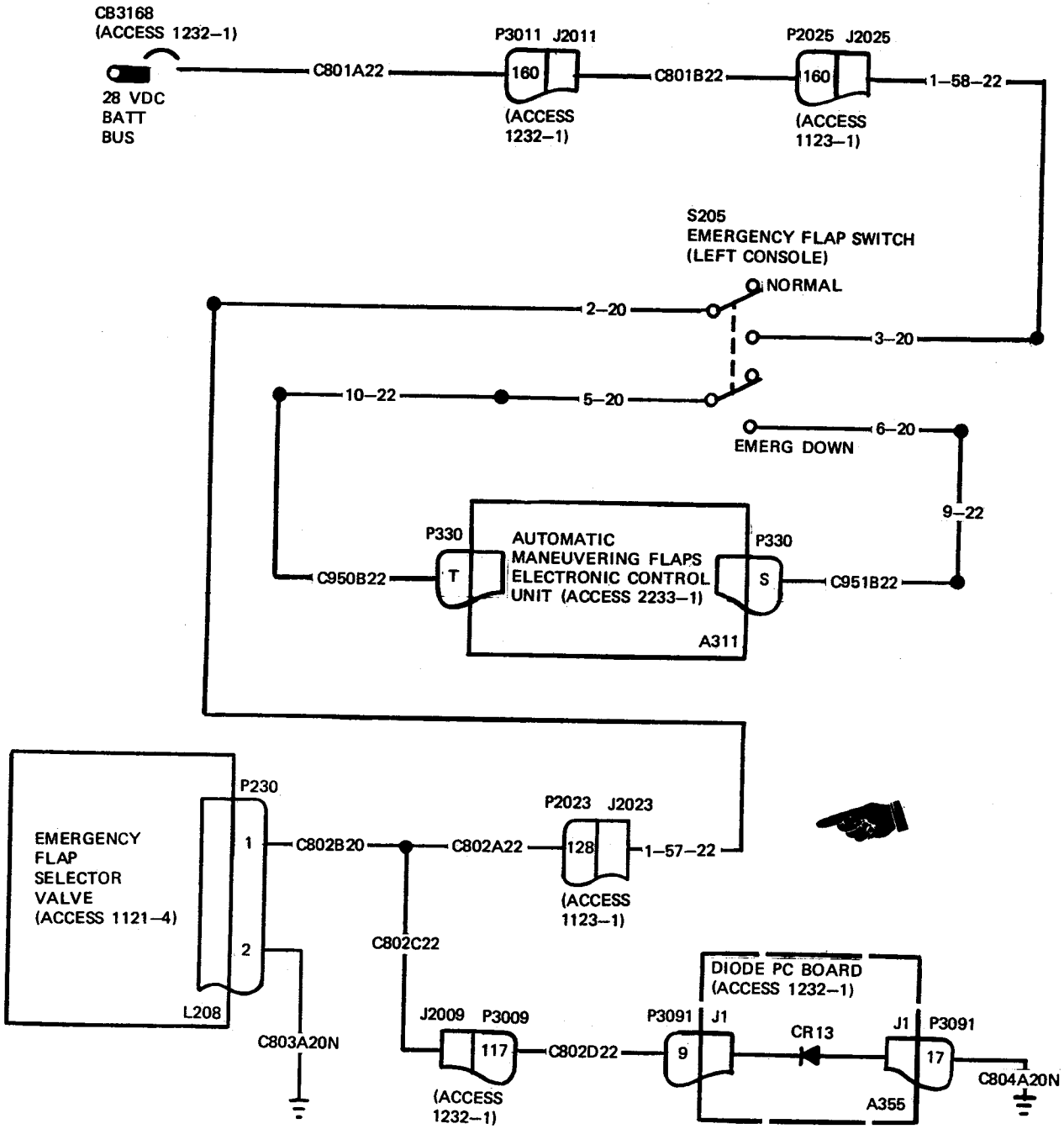

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Figure 9-12. Emergency Flap System Electrical Troubleshooting Schematic Diagram (Airplanes AF69-6197 and Subsequent)

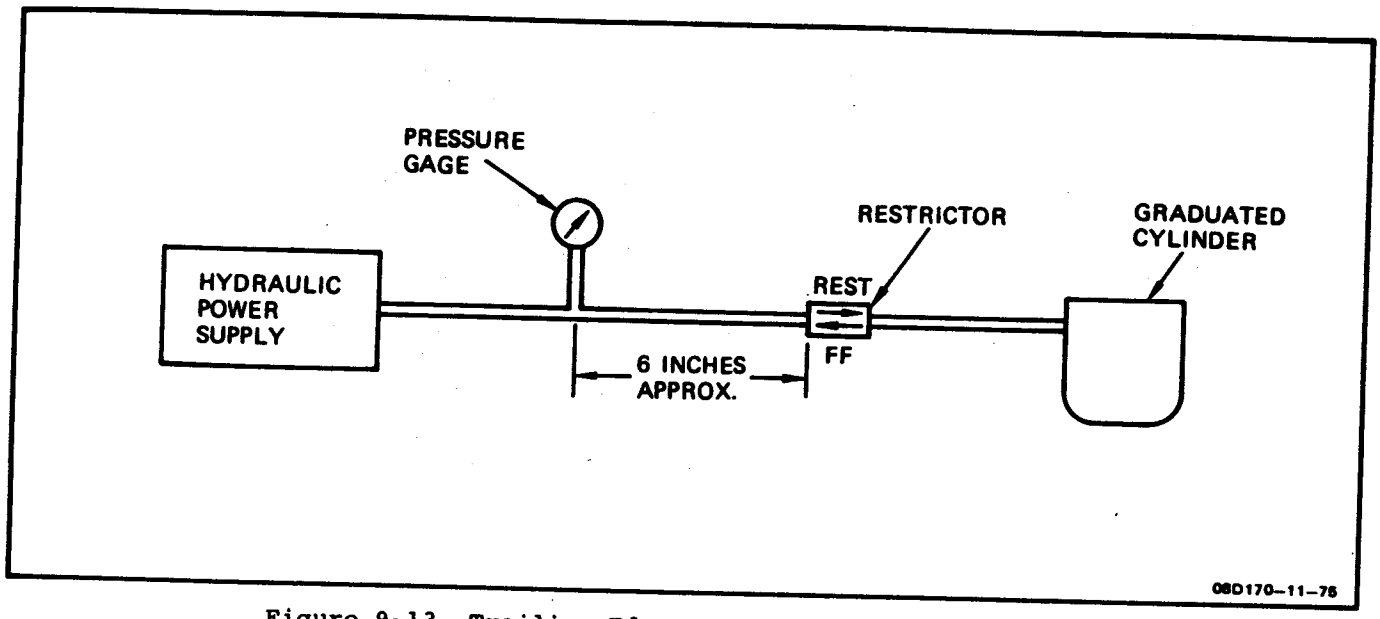


Figure 9-13. Trailing Edge Flap Restrictor Test Setup

e. Repeat flow test (steps b, c, and d) three times.

f. If amount of fluid collected in cylinder after each test is not correct, restrictor must be replaced.

g. Remove restrictor from test setup.

9-41. VARIABLE TRAILING EDGE FLAP PROTRACTOR INSTALLATION. (See figure 9-14.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment required for connecting external hydraulic power	Connect hydraulic power
9-14	215-00287-1	Left variable trailing edge flap protractor	Check flap deflection
9-14	215-00287-2	Right variable trailing edge flap protractor	Check flap deflection
			TT08057-03-76

NOTE

The variable trailing edge flap protractors are to be installed with the trailing edge flaps fully retracted.

a. Remove left or right fuselage screws (CVC241-4-10 or CVC128-416 R10) for mounting respective protractor.

b. Install protractor (2) on left aft fuselage with two thumbscrews (3) and two contour screws (5).

c. Adjust protractor scale (4) to align zero on scale with trailing edge flap edge (1).

d. Connect external hydraulic power to PC No. 2 hydraulic system (T.O. 1A-7D-2-1). Unlock flaps and shut down hydraulic power.

CAUTION

To prevent damage to internal locks of flap actuating cylinders, do not use hand pump to unlock flaps from either retracted or extended position. Unlock cylinders using external hydraulic power source delivering at least 1,450 (±50) psi with a minimum flow of 2 gpm.

After flap cylinders are unlocked, use hand pump to operate trailing edge flaps through full range of travel, observing that sufficient clearance exists between trailing edge flap and protractor scale. Improper protractor installation may result in damage to trailing edge flap.

e. Adjust gap between flap edge (1) and protractor scale (4).

f. Recheck protractor zero alignment after gap adjustment.

g. Replace fuselage screws when protractor is removed.

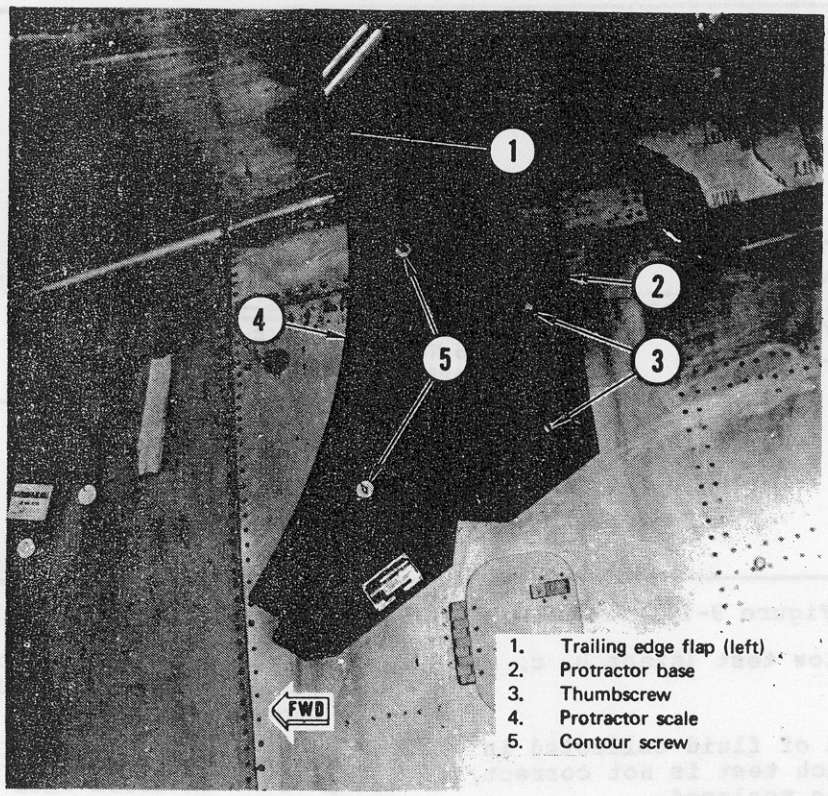


Figure 9-14. Variable Trailing Edge Flap Protractor Installation

9-42. RIGGING FLAP MANUAL CONTROL LINKAGE. (See figure 9-15.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	T60-1001-C8-00	Cable tensiometer	Check cable tension
9-9	215-00110-3	Rigging pin No. 70	Rig linkage
9-9	215-00110-5	Rigging pin No. 71	Rig linkage TT08D058-07-70

CAUTION

External hydraulic and electrical power must be disconnected from system during rigging.

a. Open accessed 1221-1 and 1123-1

b. Place flap handle in DN detent.

c. Disconnect link (1) at lever (2).

d. Disconnect link (3) at lever (4).

e. Insert rigging pin No. 70.

f. Check that index mark on lever (4) is aligned with index mark on valve shaft.

g. Remove locking clips and adjust turnbuckles (5 and 6) until rigging pin No. 71 can be easily inserted and cable tension is 30 (±3) pounds.

h. Secure turnbuckles with locking clips.

i. Hold flap handle as far aft as possible in DN detent and adjust line (1) to shortest length, which still permits reconnection of link to lever (2). Secure link with bolt, nut, and new cotter pin.

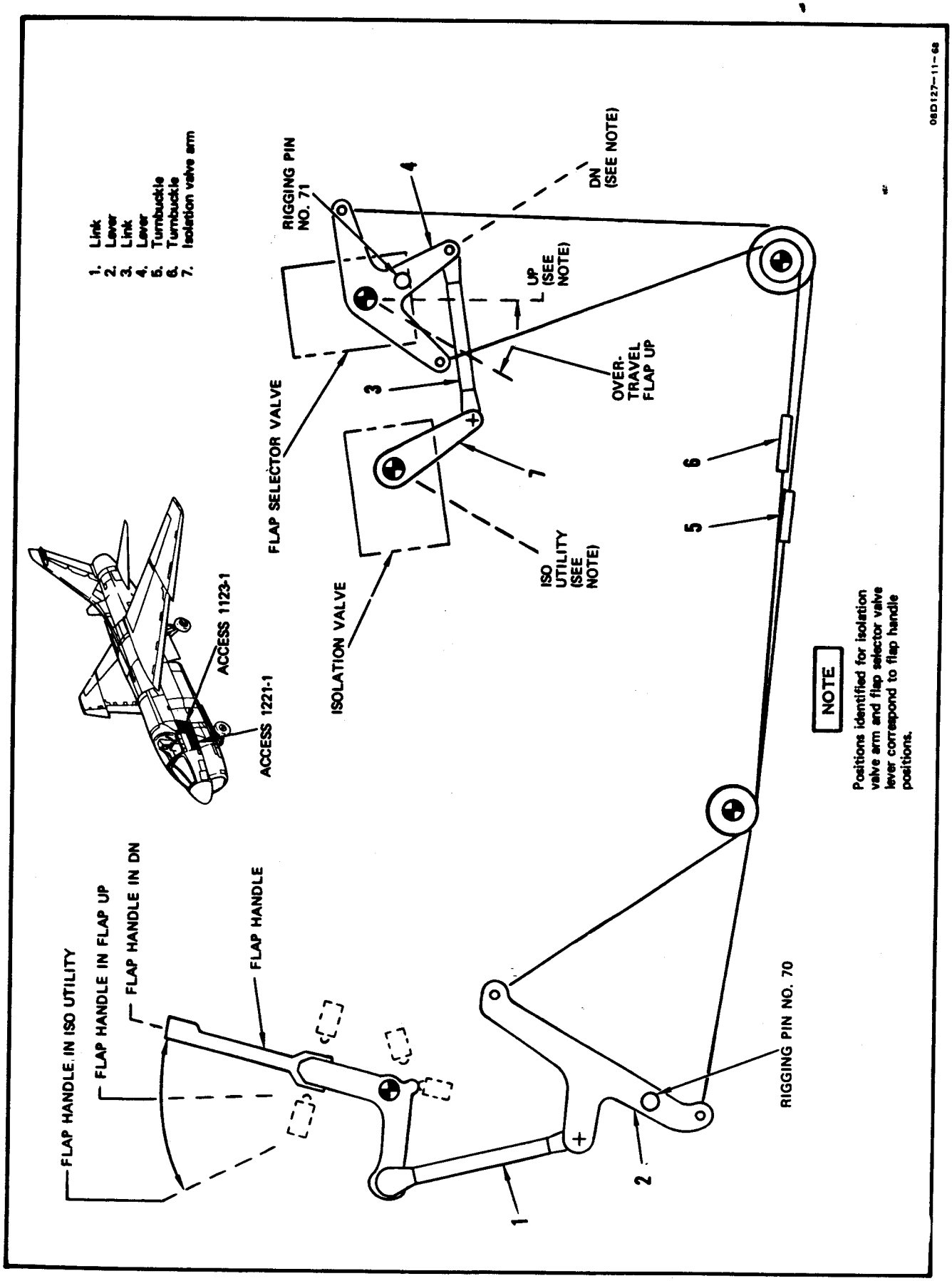


Figure 9-15. Rigging Flap Manual Control Linkage

j. Remove rigging pins No. 70 and 71.

k. Place flap handle in ISO UTILITY.

l. Rotate isolation valve arm (7) clockwise against stop.

m. Adjust link (3) so isolation valve arm (7) is held clockwise against stop; then check inspection holes in link.

NOTE

Inspection hole in adjustable end of link (3) must be covered. Inspection hole in fixed end of link must show a minimum of one-half thread.

n. If isolation valve cannot be rigged as specified, reposition isolation valve arm (7) on valve shaft and repeat step m.

o. Secure link to lever (4) with bolt, nut, and new cotter pin.

p. Place flap handle in TE DN. Check that rigging pin No. 71 can be inserted freely. Readjust link (3), if necessary; then recheck inspection holes in link.

q. Remove rigging pin.

r. Move flap handle through full travel in both directions. There shall be no binding or interference in control system.

s. Check that both beep switches can be actuated with control handle in DN detent.

t. Perform normal operational checkout (paragraph 9-35).

u. Close accesses 1221-1 and 1123-1.

9-43. RIGGING CENTER SECTION LEADING EDGE FLAP.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
	215-00135-20 and -21	Center section leading edge flap templates	Check flap clearance
	413-900-020	Torque wrench, 100 to 750 pound-inches	Tighten flap attach bolts
	GGG-W-686	Torque wrench, 0 to 250 pound-feet	Tighten cylinder rod end bolts

TT08D059-04-70

a. Connect external hydraulic power to PC No. 2 hydraulic system (T.O. 1A-7D-2-1).

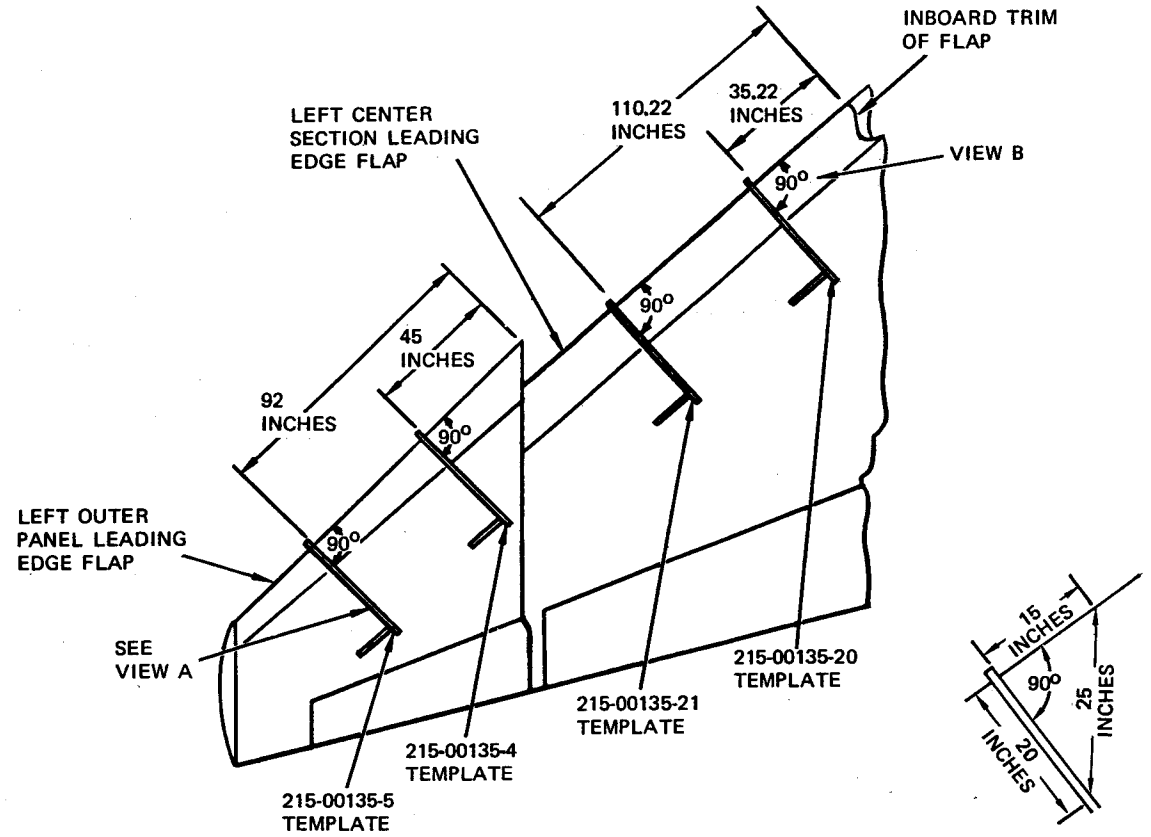
b. Connect external electrical power (T.O. 1A-7D-2-1).

CAUTION

To prevent interference with flap and possible damage, ensure engine cooling hole cover, Part No. 215-00266-4, is removed before operating flaps. When flap handle is selected to ISO utility, the trailing and leading edge flaps will go to the up position with application of electrical power.

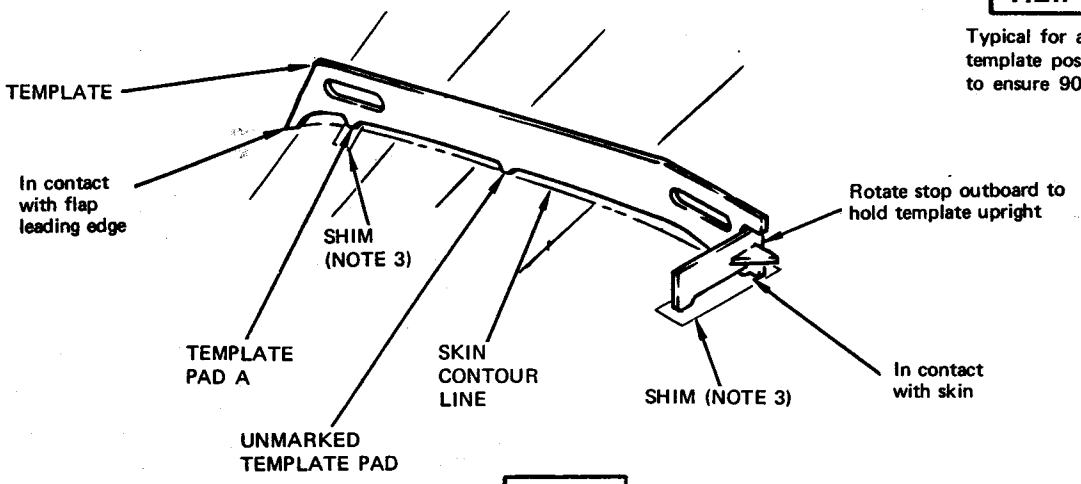
c. With flap retracted, place center section leading edge flap templates into position (figure 9-16).

d. Check that gap between template pad A and flap surface does not exceed 0.02 inch. There shall be no gap between wing contour and unmarked template pad. Remove template and proceed to next step if gap exceeds 0.02 inch. If gap does not exceed 0.02 inch, proceed to step m.



VIEW B

Typical for all template positions to ensure 90° angle



VIEW A

TYPICAL FOR ALL TEMPLATES

NOTE

1. No attachments are required for templates.
2. Templates are placed in position as shown. Same templates are used for left and right sides of wing.
3. On outer panels that have been repaired because of skin cracks, use 0.070 inch shims under –4 template and 0.060 inch shims under –5 template.

08D109-11-75

Figure 9-16. Leading Edge Flap Template Installation

e. Open accesses 3213-3 and 3213-8 to rig left flap. Open accesses 4213-3 and 4213-8 to rig right flap. Support flap and disconnect both cylinders from flap by removing attaching bolt at rod end.

f. Swing flap open to allow cylinder rod end to clear structure. Then swing flap upward and support flap in retracted position.

g. Cut lockwire, loosen jamnut, and rotate rod end to new trial length. Tighten jamnut to 60 (±5) pound-feet torque. Check for minimum thread engagement of rod end. Dimension from center of rod end attaching hole to inner face of lockwire tab shall not exceed 2.19 inches.

h. Lower flaps from supported position.

i. Extend pistons and connect cylinders to flap with attaching bolt and washer. Tighten bolt to 230 (±70) pound-inches torque.

j. Retract flap and repeat steps c and d. When gap is satisfactory, secure rod end jamnut and attaching bolt with MS20995C32 lockwire.

k. Perform normal operational checkout (paragraph 9-35) except do not disconnect external electrical and hydraulic power.

l. Close accesses 3213-3 and 3213-8 or 4213-3 and 4213-8.

m. Extend flaps and check that gap between flap wiper blade and leading edge fairing is in accordance with figure 9-18. If gap and overlap dimensions are not within tolerance, shut down hydraulic power and adjust dimensions as follows:

WARNING

MEK is flammable and moderately toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate.

Acetone is flammable and moderately toxic to eyes, skin, and respiratory tract. Consult Bioenvironmental Engineer for process control.

1. Sand surface lightly with 240 grit or finer sandpaper to remove glaze or contamination. Using a soft cloth, wipe surface clean with TT-M-261 methyl ethyl ketone or O-A-51 acetone.

2. Apply MIL-C-9084 Type I, III or VIII A glass fabric impregnated with resin (Epocast 50A/hardener 946 for 15 to 20 minute working life/hardener 9449 for 25 to 40 minute working life/hardener 9816 for 40 to 70 minute working life). Allow to cure at room temperature for 24 hours. Cure time can be shortened to 2 hours by localized heating to 150° F.

3. Sand reworked area of fairing to blend smoothly with rest of surface.

n. Disconnect external hydraulic and electrical power.

9-44. RIGGING OUTER PANEL LEADING EDGE FLAP.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	215-00135-4,-5	Outer panel leading edge flap templates	Rig leading edge flaps
	GGG-W-686	Torque wrench, 0 to 250 pound-feet	Tighten cylinder rod end bolts
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
			TT08D060-04-70

a. Connect external hydraulic power to PC No. 2 hydraulic system (T.O. 1A-7D-2-1).

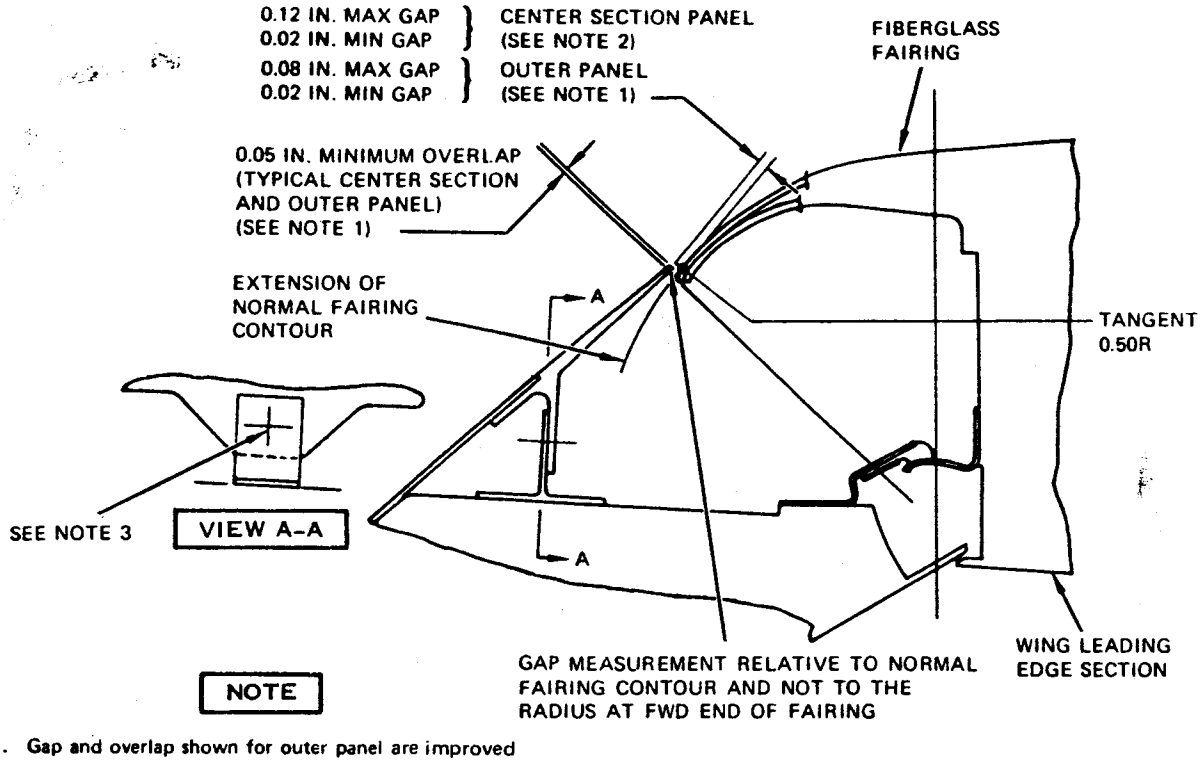
b. Connect external electrical power (T.O. 1A-7D-2-1).

CAUTION

To prevent interference with flap and possible damage, ensure engine cooling hole cover, Part No. 215-00266-4, is removed before operating flaps. When flap handle is selected to ISO utility, the trailing and leading edge flaps will go to the up position with application of electrical power.

c. With flap retracted, place outer panel leading edge flap templates into position (figure 9-16).

d. Check that gap between template pad A and flap surface does not exceed 0.02 inch. There shall be no gap between wing contour and unmarked template pad. Remove template and proceed to next step if gap exceeds 0.02 inch. If gap does not exceed 0.02 inch, proceed to step aa.



NOTE

1. Gap and overlap shown for outer panel are improved dimensions. On airplanes through AF70-1005, outer panel gap was 0.04 to 0.12 inch and overlap was 0.005 inch. These dimensions are satisfactory for outer panel and need not be changed. However, if flap is being replaced or reworked, the improved dimensions should be used. (paragraph 9-44)
2. For gap dimension check and rework of center section panel see paragraph 9-43.
3. For alternate method of adjusting gap on center section and inboard half of outer panel, See figure 9-18A.
4. For inspection of outer panel flap hinge line seal see paragraph 9-91.

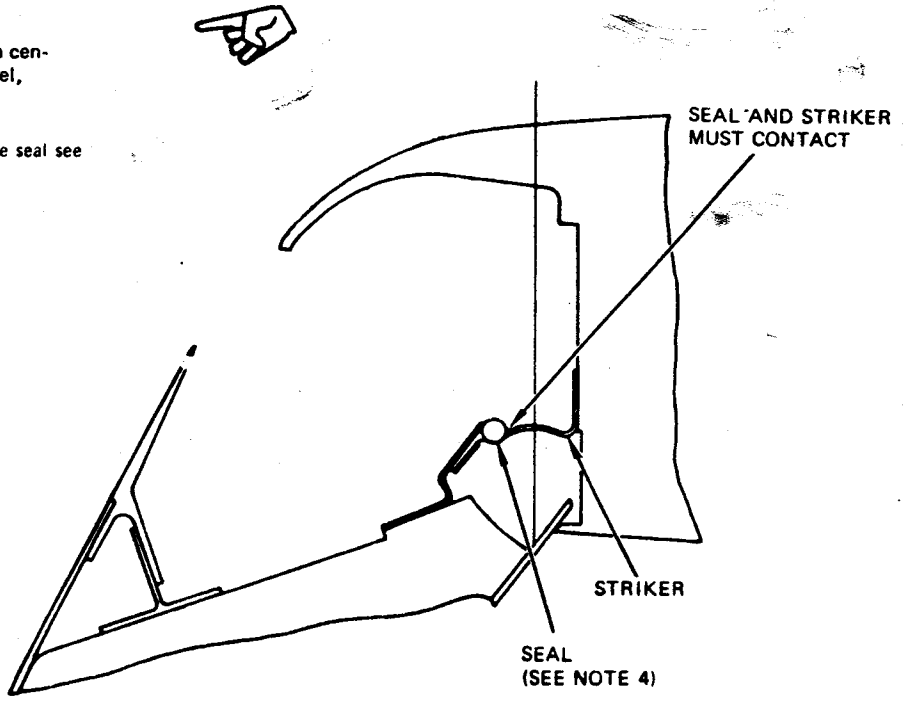


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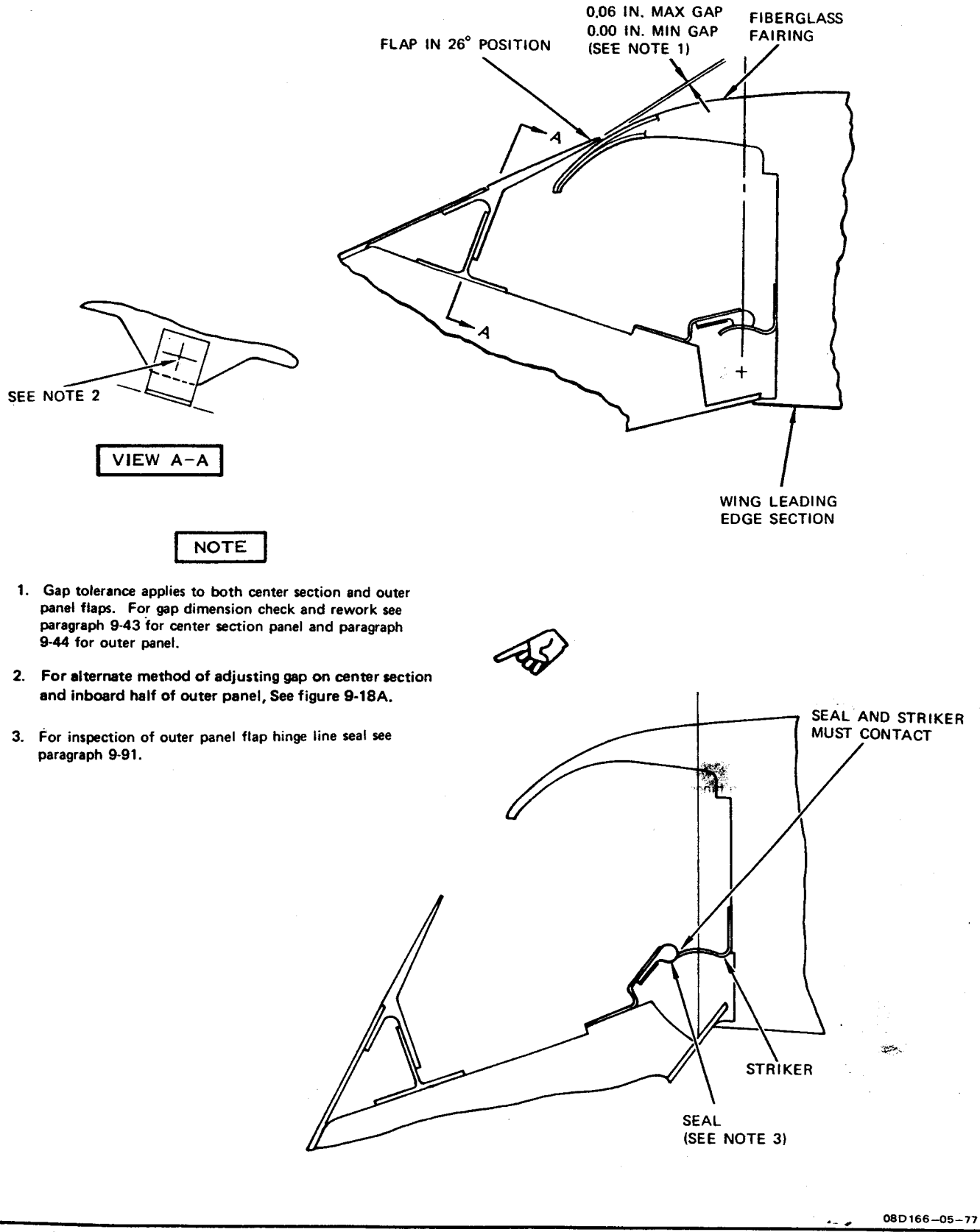
Figure 9-17. Leading Edge Flap Overlap/Gap Dimension and Outer Panel Hinge Line Seal Inspection



NOTE

1. Gap tolerance applies to both center section and outer panel flaps. For gap dimension check and rework see paragraph 9-43 for center section panel and paragraph 9-44 for outer panel.
2. For alternate method of adjusting gap on center section and inboard half of outer panel, See figure 9-18A.
3. For inspection of outer panel flap hinge line seal see paragraph 9-91.

Figure 9-18. Leading Edge Flap Gap Dimension and Outer Panel Hinge Line Seal Inspection

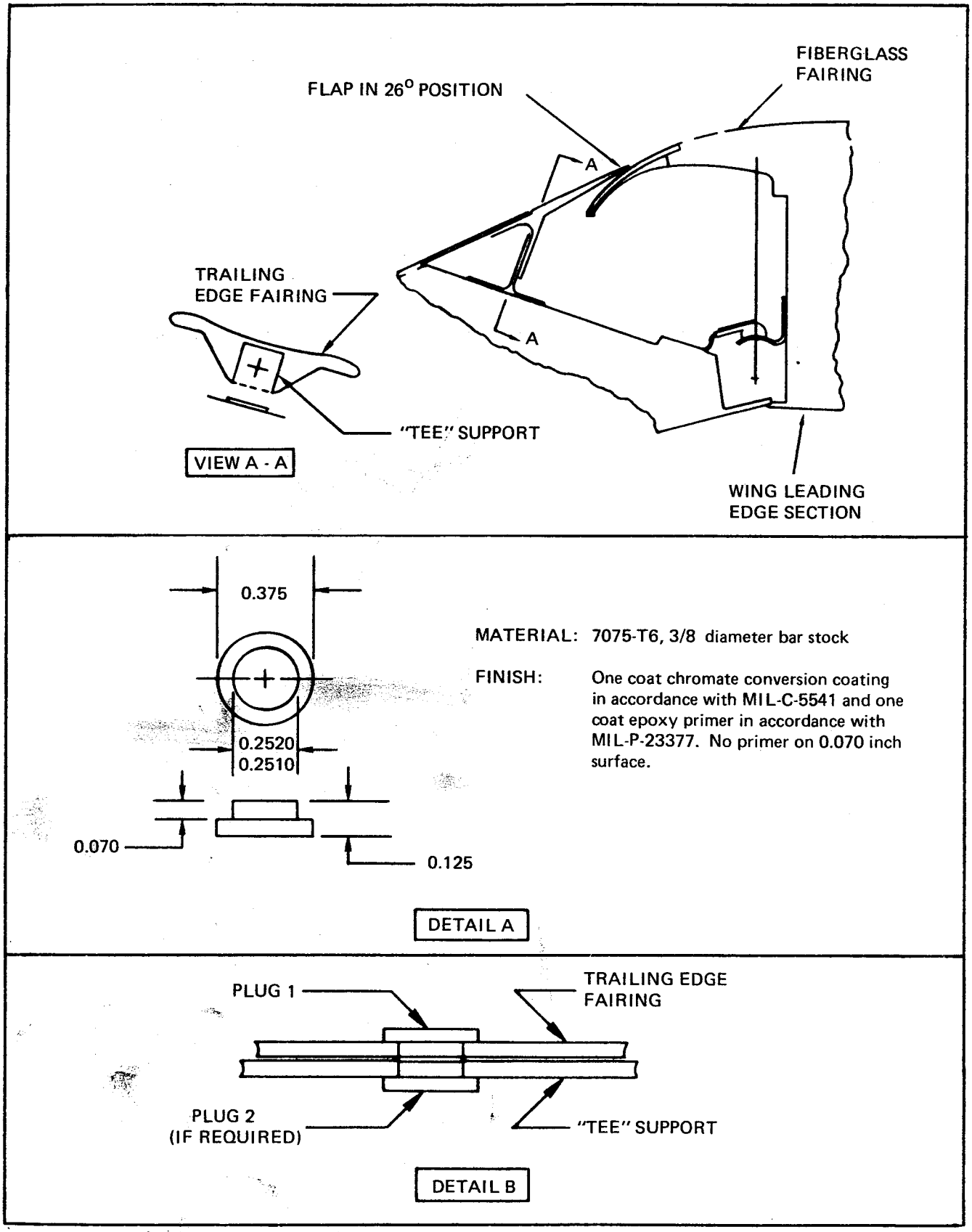


Figure 9-18A. Alternate Method of Adjusting Leading Edge Flap Gap (Sheet 1)

The gap between the leading edge flap trailing edge fairing and the wing center section fiberglass fairing on the wing center section leading edge flaps and the outboard half of the wing outer panel leading edge flaps may be adjusted as follows:

A. If the original rivets (MS20600MP4-2) are installed in the trailing edge fairing and "TEE" Support (See View A - A):

1. Gap may be reduced by removing existing rivet, reposition wiper to obtain proper gap and drilling larger hole to clean up offset holes in clip and wiper. Rivets up to a maximum diameter of 0.25 inch (MS20600MPS-2) may be used during this rework.

2. Gap may be increased by removing existing rivet, repositioning wiper to obtain proper gap and drilling larger hole to clean up offset holes in clip and wiper. Rivets up to a maximum diameter of 0.156 inch (MS20600MPS-2) may be used during this rework.

B. If the original rivets (MS20600MP4-2) in the trailing edge fairing and "TEE" Support (See View A - A) have been replaced with oversized rivets:

1. Remove oversized rivets in trailing edge fairing and "TEE" Support.

2. Drill holes in trailing edge fairing and "TEE" Support to 0.2500 ± 0.0005 inch.

3. Fabricate required number of repair plugs in accordance with Detail A.

4. Grind small end of plugs if required to match material thickness (See Detail B).

5. Install plugs in each location drilled to 0.2500 inch securing in place with MMM-A-134 Type I adhesive or equivalent (See Detail B).

CAUTION

Do not apply adhesive on small end of plug.

6. Position trailing edge fairing to obtain proper gap and secure in place with a MS20600MP4-2 rivet installed through the plugs.

Figure 9-18A. Alternate Method of Adjusting Leading Edge Flap Gap (Sheet 2)

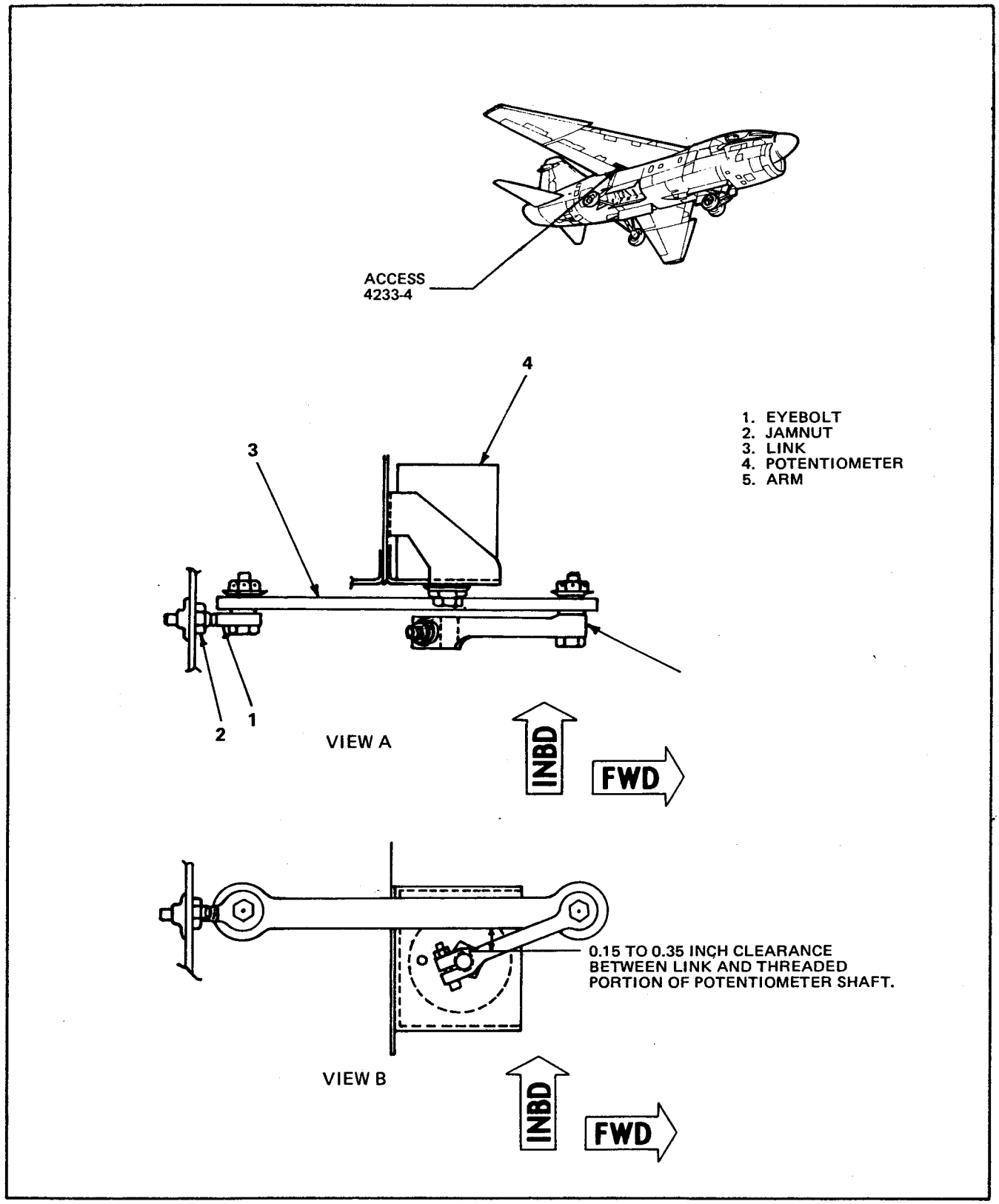


Figure 9-18B. Trailing Edge Flap 15° Potentiometer Linkage Adjustment

e. Open accesses 3112-1 and 3112-2 to remove left flap. Open accesses 4111-1 and 4111-2 to remove right flap.

CAUTION

To prevent damage to internal locks of flap actuating cylinders, do not use hand pump to unlock flaps from either retracted or extended position. Unlock cylinders using external hydraulic power source delivering at least 1,450 (±50) psi with a minimum flow of 2 gpm.

f. Extend flaps to best position for rod end attaching bolt access. Shut down hydraulic power.

g. Disconnect bonding jumper and protective strap at inboard cylinder.

h. Support flap and remove bolt attaching rod end to flap at both cylinders. Swing flap open on hinges.

i. Remove wing position light fairing attaching screws, unclamp wiring, and secure light assembly to wing surface with tape.

j. Open accesses 3212-4 through 3212-9 for access to left hinge pins. Open accesses 4211-4 through 4211-9 for access to right hinge pins.

k. Support flap and remove hinge pins, washers, and flaps.

l. Cut lockwire, loosen jamnut, and rotate rod end to new trial length of 1 (+0.06, -0.0) inch from jamnut face to end of thread on rod end. Tighten jamnut to 60 (±5) pound-feet torque.

m. Check for minimum thread engagement of rod end. Dimension from center of rod end attaching hole to inner face of lockwire tab shall not exceed 2.69 inches.

n. Lubricate hinge pins with MIL-L-7870 lubricating oil.

o. Attach flap at hinges with hinge pins and washers.

p. Install outboard cylinder rod end attaching bolt (bolthead outboard) partially in flap lug with bolt end clear of rod end slot. Install attaching bolt for inboard cylinder in similar manner with bolthead inboard.

q. Manually rotate flap upward to align rod end and flap lug holes. Push outboard bolt through rod end attaching hole. Install washer and nut finger-tight.

NOTE

If outboard bolt cannot be readily installed because of limited access, use following method: Insert a tube, bent as required, through the tunnel leading from tip of flap (position light opening) to bolthead. Push bolt through rod end hole with tube.

r. Clamp wiring and install wing position light and fairing assembly with attaching screws after bolt installation.

s. Check for 0.03 (±0.02) inch gap between light fairing assembly and outboard wing section.

t. Push inboard cylinder bolt through rod end attaching hole. Install washer and nut finger-tight.

u. Retract flap with hand pump and repeat steps c and d. When gap is satisfactory, secure jamnut with MS20995C32 lockwire.

v. Connect bonding jumper and protective strap at inboard cylinder.

w. Close accesses 3212-4 through 3212-9 or 4211-4 through 4211-9.

x. Install cotter pins in rod end attaching bolts.

y. Perform normal operational checkout (paragraph 9-35), but do not disconnect external electrical and hydraulic power.

z. Close accesses 3112-1 and 3112-2 or 4111-1 and 4111-2.

aa. Extend flaps and check that gap between flap wiper blade and leading edge fairing is in accordance with figure 9-18. If gap

or overlap dimensions are not within tolerance, shut down hydraulic power and adjust dimensions as follows:

WARNING

MEK is flammable and moderately toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate.

Acetone is flammable and moderately toxic to eyes, skin, and respiratory tract. Consult Bioenvironmental Engineer for process control.

1. Sand surface lightly with 240 grit or finer sandpaper to remove glaze or contamination. Using a soft cloth, wipe surface clean with TT-M-261 methyl ethyl ketone or O-A-51 acetone.

2. Apply MIL-C-9084 Type I, III or VIII A glass fabric impregnated with resin (Epocast 50A/hardener 946 for 15 to 20 minute working life/hardener 9449 for 25 to 40 minute working life/hardener 9816 for 40 to 70 minute working life). Allow to cure at room temperature for 24 hours. Cure time can be shortened to 2 hours by localized heating to 150° F.

3. Sand reworked area of fairing to blend smoothly with rest of surface.

ab. After making adjustments, retract flaps with external hydraulic power and check that all flaps lock in fully retracted position.

ac. Disconnect external hydraulic power.

ad. Disconnect external electrical power.

9-45. RIGGING TRAILING EDGE FLAP.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
	GGG-W-686	Torque wrench, 5 to 50 pound-inches	Tighten transmitter link

Tools Required (Continued)

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	E10385	Hydraulic servicing stand	Extend flap cylinder
	GGG-W-686	Torque wrench, 0 to 250 pound-feet	Tighten cylinder rod end jamnut
			TT08D061-04-70

a. Connect external hydraulic power to PC No. 2 hydraulic system (T.O. 1A-7D-2-1).

b. Connect external electrical power (T.O. 1A-7D-2-1).

CAUTION

To prevent interference with flap and possible damage, ensure engine cooling hole cover (215-00266-4) is removed before operating flaps.

c. Retract flaps.

d. Check that maximum spanwise step between trailing edge of flap and fuselage stub fairing does not exceed 0.06 inch. Perform steps e through p if step exceeds 0.06 inch.

e. Extend flap. Shut down hydraulic power.

f. Open accesses 4133-7 and 4133-10 to rig right flap. Open accesses 3133-10 and 3133-7 to rig left flap.

g. Disconnect slot door linkage at wing trailing edge by removing attaching pins

h. Remove bolt attaching outboard cylinder rod end to flap.

i. Open access 3233-2 to rig left flap. Open access 4233-2 to rig right flap.

j. Unclamp and remove hydraulic lines connected from swivel fittings to outboard cylinder.

k. Cap swivel fittings with pressure caps.

l. Remove plate covering rod end passage hole at outboard cylinder.

m. Cut lockwire and loosen rod end jamnut of outboard actuating cylinder.

CAUTION

To prevent damage to internal locks of flap actuating cylinders, do not use hand pump to unlock flaps from either retracted or extended position. Unlock cylinders using external hydraulic power source delivering at least 1,450 (±50) psi with a minimum flow of 2 gpm.

n. Connect hydraulic servicing stand to outboard cylinder and retract piston. Screw rod end into piston.

o. Retract flap.

p. Check for 0.06-inch maximum step requirement of step d. If step does not exceed 0.06 inch, extend flap with hand pump and proceed to step ad. If step exceeds 0.06 inch, extend flap and adjust inboard cylinder rod end as described in steps q through ac.

q. Cut lockwire and loosen rod end jamnut.

r. If rigging left flap, remove cotter pin, nut, washers, and bolt connecting trailing edge flap synchro transmitter link to eyebolt on leading edge of trailing edge flap.

s. On airplanes through AF69-6196, disconnect AFCS gain control switch link from right flap; or on airplanes AF69-6197 and subsequent, disconnect trailing edge flap position potentiometer link from eyebolt on flap.

t. Disconnect bonding jumpers from wing by removing attaching screws.

u. Deleted.

v. Support flap and remove rod end attaching bolt. Rotate flap open and support flap.

w. Adjust rod end. Tighten jamnut to 60 (±5) pound-feet torque. Check for minimum thread engagement of rod end. Dimension from center of rod end attaching hole to inner face of lockwire tab shall not exceed 2.69 inches.

x. Reconnect rod end to flap lug with bolt, washers, and nut tightened finger-tight.

y. Retract flap.

z. Check for maximum step allowed (step d). Repeat adjustment procedure until maximum step requirement is met.

aa. Extend flap.

ab. Secure jamnut with MS20995C32 lockwire.

ac. Install cotter pin at rod end attaching bolt.

ad. Extend outboard cylinder piston with servicing stand. Measure from center of rod end to flap attaching lug holes. Retract piston and unscrew rod end to measurement obtained. Tighten jamnut to 60 (±5) pound-feet torque. Check for minimum thread engagement of rod end. Dimension from center of rod end attaching hole to inner face of lockwire tab shall not exceed 2.69 inches.

ae. Secure jamnut with MS20995C32 lockwire.

af. Extend piston and connect rod end to flap lug with bolt, washers, and nut tightened finger-tight. Install new cotter pin.

ag. Disconnect servicing stand.

ah. Remove pressure caps from swivel fittings and connect outboard cylinder hydraulic lines and clamp lines.

ai. Retract flap.

aj. Check that 0.06-inch maximum spanwise between trailing edge of flap and fuselage stub fairing has not been disturbed by outboard cylinder.

ak. Extend flap.

al. Install plate covering rod end passage hole at outboard cylinder.

am. On left flap only, connect trailing edge flap synchro transmitter link to eyebolt on flap with bolt, washers, and nut. Tighten nut to 14 (±1) pound-inches torque and install new cotter pin.

an. On airplanes through AF69-6196, connect AFCS gain control switch to right flap.

ao. On airplanes AF69-6197 and subsequent, connect trailing edge flap 15° potentiometer linkage as follows:

1. With trailing edge flaps full-up and link temporarily connected to eyebolt, check that link will clear threaded portion of potentiometer shaft by 0.15 to 0.35 inch (figure 9-18A). If necessary, loosen jamnut and adjust eyebolt until clearance is correct. Tighten jamnut.

NOTE

Ensure link assembly is connected to inboard side of eyebolt.

2. Connect link to eyebolt with bolt, washers and nut (figure 9-18A, view A). Tighten nut to 12 to 15 pound-inches. Install new cotter pin.

3. Extend and retract flaps and check that linkage operates freely through full range of flap movement with no binding or chafing. Adjust arm on potentiometer shaft, if required.

4. If eyebolt or arm assembly was adjusted, perform trailing edge 15° potentiometer adjustment (T.O. 1A-7D-2-9).

ap. Connect bonding jumpers to wing with attaching screws.

aq. Bleed flap system (paragraph 9-50).

ar. Rig flap slot doors (paragraph 9-46).

as. Close accesses 3233-2, 3133-7, and 3133-10 or 4233-2, 4133-7, and 4133-10.

9-46. RIGGING FLAP SLOT DOORS. (See figure 9-19.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment required for connecting external electrical power	Connect electrical power
		Equipment required for connecting external hydraulic power	Connect hydraulic power
			TT08D062-04-70

CAUTION

Observe the following precautions to prevent structural damage: (1) allow only the single link being rigged to be attached to the slot door during rigging; (2) unrigged slot doors (that are not being rigged) must be disconnected from the wing trailing edge; (3) trailing edge flaps must not be extended beyond approximately 30° (2/3 down) with unrigged slot door attached to wing trailing edge; and (4) stop flap retraction if unrigged slot door closes before flap reaches retracted position.

NOTE

After the first flight following re-installation of a flap, recheck the slot door rigging in accordance with paragraph 9-47 to assure proper preload in slot door links after flap leading edge structure seats.

Refer to paragraph 9-47 for rigging check procedures.

a. Connect external electrical power (T.O. 1A-7D-2-1).

b. Connect external hydraulic power to PC No. 2 hydraulic system (T.O. 1A-7D-2-1).

CAUTION

To prevent interference with flap and possible damage, ensure engine cooling hole cover (215-00266-4) is removed before operating flaps.

c. Extend trailing edge flaps to approximately 30°.

NOTE

Slot doors may be rigged one at a time or in groups.

d. Remove all links, except the most inboard, from the slot door(s) being rigged. Tag links to assure reinstallation in same position from which removed.

e. Disconnect the inboard link at the wing trailing edge. Adjust the link to obtain a dimension of approximately 0.80 inch from the end of the link body to the center of the hole in the rod end.

f. Connect rod end of inboard link to wing trailing edge spar with attaching pin. Do not install washer and cotter pin until all links of door are rigged.

NOTE

A steel scale may be used, as an alternate to the 0.10 inch shim, to measure the clearance between the trailing edge spar and slot door (figure 9-19). A measured clearance from 0.03 to 0.10 inch is correct. A 1/2 turn adjustment of the rod end will move the forward edge of the slot door approximately 0.06 inch.

g. Insert a 0.10 inch thick shim against lower surface of trailing edge spar beneath point where link is attached.

NOTE

During clearance check, door slack must be held toward the open position.

h. Retract flap slowly to clean position and observe that slot door does not contact shim. If slot door contacts shim before flap reaches clean condition, shorten link until door does not contact shim with flaps retracted.

i. Extend trailing edge flap to approximately 30°.

j. Disconnect link from wing trailing edge spar and lengthen by unscrewing rod end 1/2 turn. Reconnect link to wing trailing edge spar with pin only.

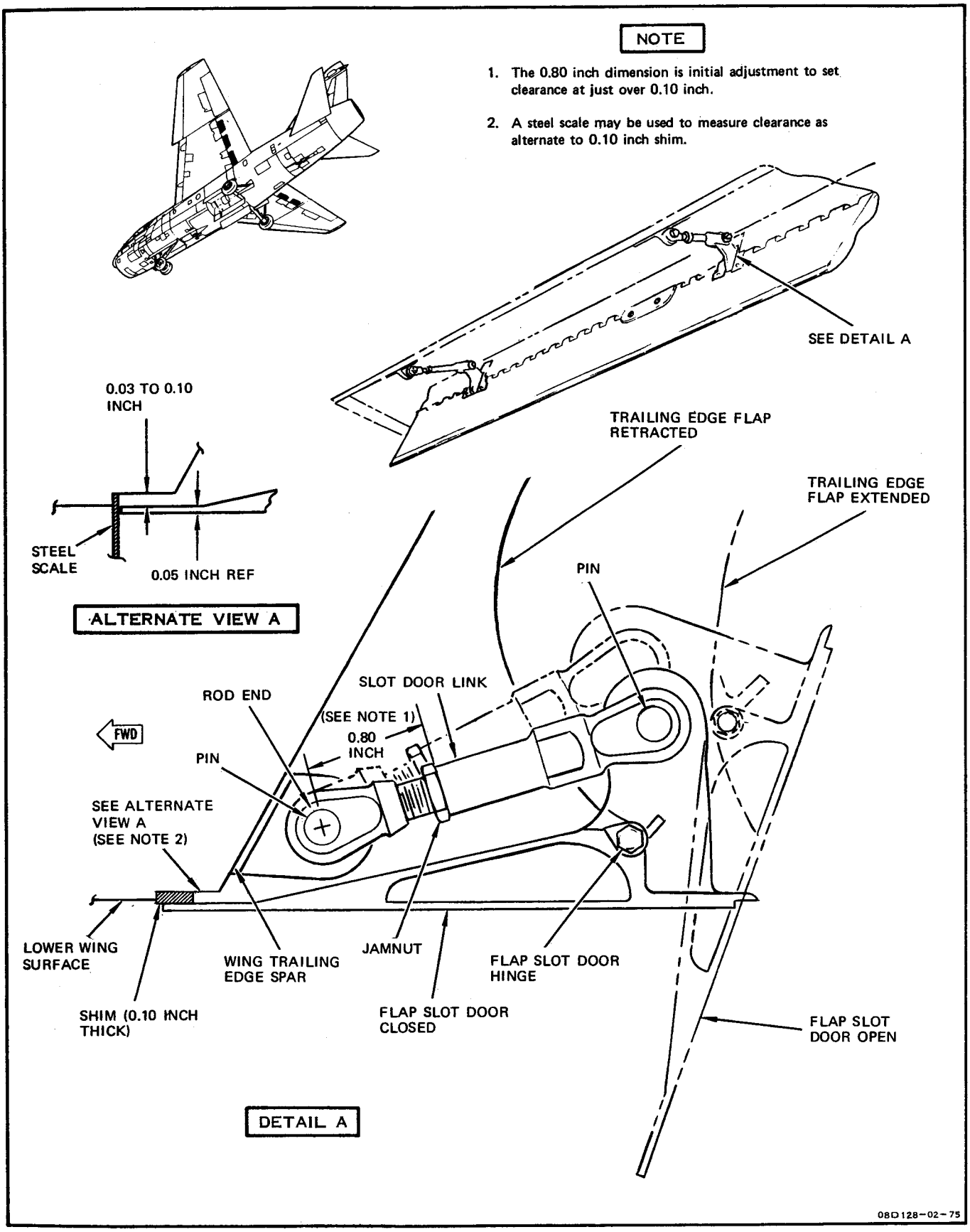


Figure 9-19. Rigging Flap Slot Doors

k. Retract trailing edge flap and check that the door contacts shim with flap in clean condition. Repeat step j as necessary until door contacts shim with flap in clean condition.

l. Extend flap to approximately 30° and remove shim from wing trailing edge spar.

m. Preload slot door link by disconnecting link from trailing edge spar and lengthen by unscrewing rod end as follows:

1. For inboard door - 3 turns (six 1/2 turns).

2. For center door - 2 1/2 turns (five 1/2 turns).

3. For outboard door - 2 turns (four 1/2 turns).

n. Reconnect link to wing and extend trailing edge flaps to full down position. Check that slot door is free to move through a small angle due to play in the link. If binding or interference between the slot door and flap leading edge is indicated, investigate and correct before proceeding.

o. Disconnect, tag, and remove rigged link without disturbing adjusted length.

p. Move outboard on slot door to next link and repeat steps e through n.

q. Install all rigged links between slot door being rigged and wing trailing edge spar. It may be necessary to slightly deflect (or twist) the slot door to install the rigged links because of manufacturing tolerance. If so, check for acceptable slot door deflection (or twist) limits as follows:

1. For inboard and outboard slot doors, disconnect outboard link and adjust length to permit connection to the wing spar without deflecting (or twisting) the slot door. Record number of 1/2 turns of adjustment required and return link to the rigged length established in step m. If number of 1/2 turns recorded is four or less, connect link (after readjustment to rigged length) by deflecting (or twisting) slot door as necessary. If more than four turns are recorded, slot door cannot be rigged to specifications.

2. For center slot door, disconnect inboard and outboard links and adjust length to permit connection to the wing spar without deflecting (or twisting) the slot door. Record number of 1/2 turns of adjustment required and return links to the rigged length established in step m. If number of 1/2 turns recorded is four or less, connect the links (after readjustment to rigged length) by deflecting (or twisting) slot door as necessary. If more than four turns are recorded, slot door cannot be rigged to specifications.

r. Secure links with pins, washers, and new cotter pins.

s. Repeat rigging procedure for remaining doors to be rigged.

t. Check that all rod end jamnuts are tight and all washers and cotter pins are installed.

u. Retract flaps.

v. Disconnect external electrical and hydraulic power (T.O. 1A-7D-2-1).

9-47. SLOT DOOR RIGGING CHECK.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment required for connecting external electrical power	Connect electrical power.
		Equipment required for connecting external hydraulic power	Connect hydraulic power.
			TT08D167-02-75

a. Connect external electrical power (T.O. 1A-7D-2-1).

b. Connect external hydraulic power to PC No. 2 hydraulic system (T.O. 1A-7D-2-1).

CAUTION

To prevent interference with flap and possible damage, ensure engine cooling hole cover (215-00266-4) is removed before operating flaps.

c. Extend trailing edge flaps to approximately 30° and shut down hydraulic power.

d. Mark location of all links on lower surface of slot door at link attachment point.

e. Remove cotter pins and washers from each slot door link.

f. Disconnect slot door links from wing trailing edge by removing pins. Remove preload by shortening links 3 turns (six 1/2 turns) for inboard doors, 2 1/2 turns (five 1/2 turns) for the center doors, and 2 turns (four 1/2 turns) for the outboard doors. Tighten jamnut.

NOTE

Tag link or tape link to lower surface of flap aft of installed position to prevent mixing of links.

g. Remove all links except inboard link on each door.

h. With only the inboard link connected (pins only), apply hydraulic power and raise flaps to full up.

NOTE

During clearance check, door slack must be held toward open position.

i. Using a steel scale, measure and record clearance between the wing trailing edge spar and the slot door at link position (figure 9-19). Clearance should be 0.030 to 0.100 inch. If required, adjust link to obtain proper clearance as follows:

1. Lower flaps to 30° and shut down hydraulic power.

2. To decrease clearance, link must be lengthened. To increase clearance, shorten link. An adjustment of 1/2 turn will move forward edge of slot door approximately 0.060 inch. Tighten jamnut after adjustment.

3. Apply hydraulic power, raise flaps, and recheck clearance. Repeat adjustment as necessary.

j. Lower flaps to 30°. Remove inboard link from each door and install outboard link (with pins only).

k. Raise flaps. Measure, record, and adjust clearance in accordance with step i.

l. Lower flaps to 30°. Remove outboard link from center slot door and install center link (with pins only).

m. Raise flaps. Measure, record, and adjust clearance in accordance with step i.

n. Lower flaps to 30° and shut down hydraulic power.

o. Connect all slot door links to slot door with pin, washer, and new cotter pin.

p. Add preload to links as follows:

1. For inboard slot door, lengthen each link by unscrewing rod end 3 turns (six 1/2 turns).

2. For center slot door, lengthen each link by unscrewing rod end 2 1/2 turns (five 1/2 turns).

3. For outboard slot door, lengthen each link by unscrewing rod end 2 turns (four 1/2 turns).

4. Tighten jamnut.

q. Connect each link to wing trailing edge with pin, and check for acceptable slot door deflection (twist) limits in accordance with paragraph 9-46.

r. Connect links to wing trailing edge with pins, washers, and new cotter pins.

s. Retract flaps.

t. Disconnect external hydraulic and electrical power (T.O.1A-7D-2-1).

9-48. SERVICING.

9-49. For servicing of the emergency flap accumulator, refer to T.O. 1A-7D-2-1.

9-50. NORMAL FLAP SYSTEM BLEEDING.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
	GGG-W-686	Torque wrench, 5 to 50 pound-inches	Tighten bleed plugs
			TT08D063-04-70

9-51. TRAILING EDGE FLAP BLEEDING.

a. Open accesses 1121-6 and 2121-6.

b. Remove lockwire from left and right trailing edge flap extend and retract line bleed valves.

c. Attach bleed hoses to bleed valves.

d. Submerge end of bleed hose in container of clean hydraulic fluid.

e. Connect external electrical power (T.O. 1A-7D-2-1).

f. Connect external hydraulic power to PC No. 2 hydraulic system and apply 1,450 (±50) psi (T.O. 1A-7D-2-1).

g. Open trailing edge flap retract line bleed valves.

CAUTION

To prevent interference with flap and possible damage, ensure engine cooling hole cover (215-00266-4) is removed before operating flaps.

g-1. On airplanes AF69-6197 and subsequent, perform the following:

1. Check that AMF switch is in OFF.

2. Check that angle-of-attack vane is at approximately 6 units.

CAUTION

Ensure that ground locks are installed on main and nose gear actuators.

3. Place flap handle in ISO UTIL.

4. Place AMF switch in AUTO.

5. Manually move angle-of-attack vane toward 16 units until flaps extend.

6. Close retract line bleed valves.

7. Open flap extend line bleed valves.

8. Move angle-of-attack vane toward 6 units until flaps retract.

9. Close extend line bleed valves.

10. Repeat substeps 5 through 9 until air-free fluid flows.

11. Place flap handle in UP.

12. Place AMF switch in OFF.

h. Extend flaps.

i. Close retract line bleed valves.

j. Open flap extend line bleed valves.

k. Retract flaps.

l. Close extend line bleed valves.

m. Repeat steps g through l until air-free fluid flows.

n. Remove bleed hose from bleed valves.

o. Tighten bleed valves to 10 (±5) pound-inches torque. Check for a minimum gap of 0.010 inch between bleed valves and retainer. If gap is less than 0.010 inch, bleed valves must be replaced.

p. Secure bleed valves with MS20995C32 lockwire.

q. Shut down external electrical and hydraulic power.

r. Close accesses 1121-6 and 2121-6.

NOTE

If leading edge flaps are to be bled, omit step s and proceed to paragraph 9-52.

s. Perform hydraulic system air check (T.O. 1A-7D-2-1).

9-52. LEADING EDGE FLAP BLEEDING.

a. Open accesses 3112-1, 3112-2, 4111-1, and 4111-2 for outer panel flap bleeding. Open accesses 3213-3, 3213-8, 4213-3, and 4213-8 for center section flap bleeding.

b. Connect external hydraulic power to PC No. 2 hydraulic system and apply 400 (±100) psi (T.O. 1A-7D-2-1).

NOTE

If flaps are extended, start bleeding at extend line (step e).

c. Loosen retract line fitting on each flap cylinder and allow flow until fluid is free of air.

d. Increase pressure to 1,450 (±50) psi, place flap handle in DN, and allow flaps to extend. Tighten the retract line fittings.

e. Reduce pressure to 400 (±100) psi and loosen extend line fitting on each flap cylinder. Allow flow until fluid is clear of air.

f. Increase pressure to 1,450 (±50) psi, place flap handle in UP, and allow flaps to retract. Tighten the extend line fittings.

g. Repeat steps b through f until air-free fluid flows from fittings.

h. Shut down hydraulic power.

i. Perform hydraulic system air check (T.O. 1A-7D-2-1).

j. Close accesses 3112-1, 3112-2, 3213-3, 3213-8, 4111-1, 4111-2, 4213-3, and 4213-8.

9-53. EMERGENCY FLAP SYSTEM BLEEDING.

a. Open accesses 1121-3 and 1123-3.

b. Check that emergency accumulator shutoff valve is closed.

c. Connect external electrical power (T.O. 1A-7D-2-1).

d. Connect external hydraulic power to PC No. 2 hydraulic system and apply 1,450 (±50) psi (T.O. 1A-7D-2-1).

e. Lower flaps and shut down hydraulic power.

f. Check that emergency flap accumulator hydraulic pressure is dumped and accumulator is properly precharged (T.O. 1A-7D-2-1).

g. Open emergency accumulator shutoff valve.

h. Apply 400 (±100) psi hydraulic pressure and place emergency flap switch in EMERG DN.

i. Loosen emergency hydraulic line fittings at the shuttle valve, at the pressure port of the bypass valve, and at the emergency port of the variable flap valve. When air-free fluid flows, tighten fitting.

j. Place emergency flap switch in NORM.

k. Increase pressure to 1,450 (±50) psi and retract flaps.

l. Shut down external electrical and hydraulic power.

m. Close accesses 1121-3 and 1123-3.

n. Perform hydraulic system air check (T.O. 1A-7D-2-1).

9-54. FLAP CONTROL ASSEMBLY REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
9-15	215-00110-3	Rigging pin No. 70	Rig linkage TT08D064-03-76

9-55. REMOVAL. (See figure 9-20.)

a. Open access 1221-1.

b. Remove edge-lighted panel attaching screws (1) and remove panel.

c. Unscrew nut securing panel lighting connector, lift connector from panel, and disconnect wire by removing screw.

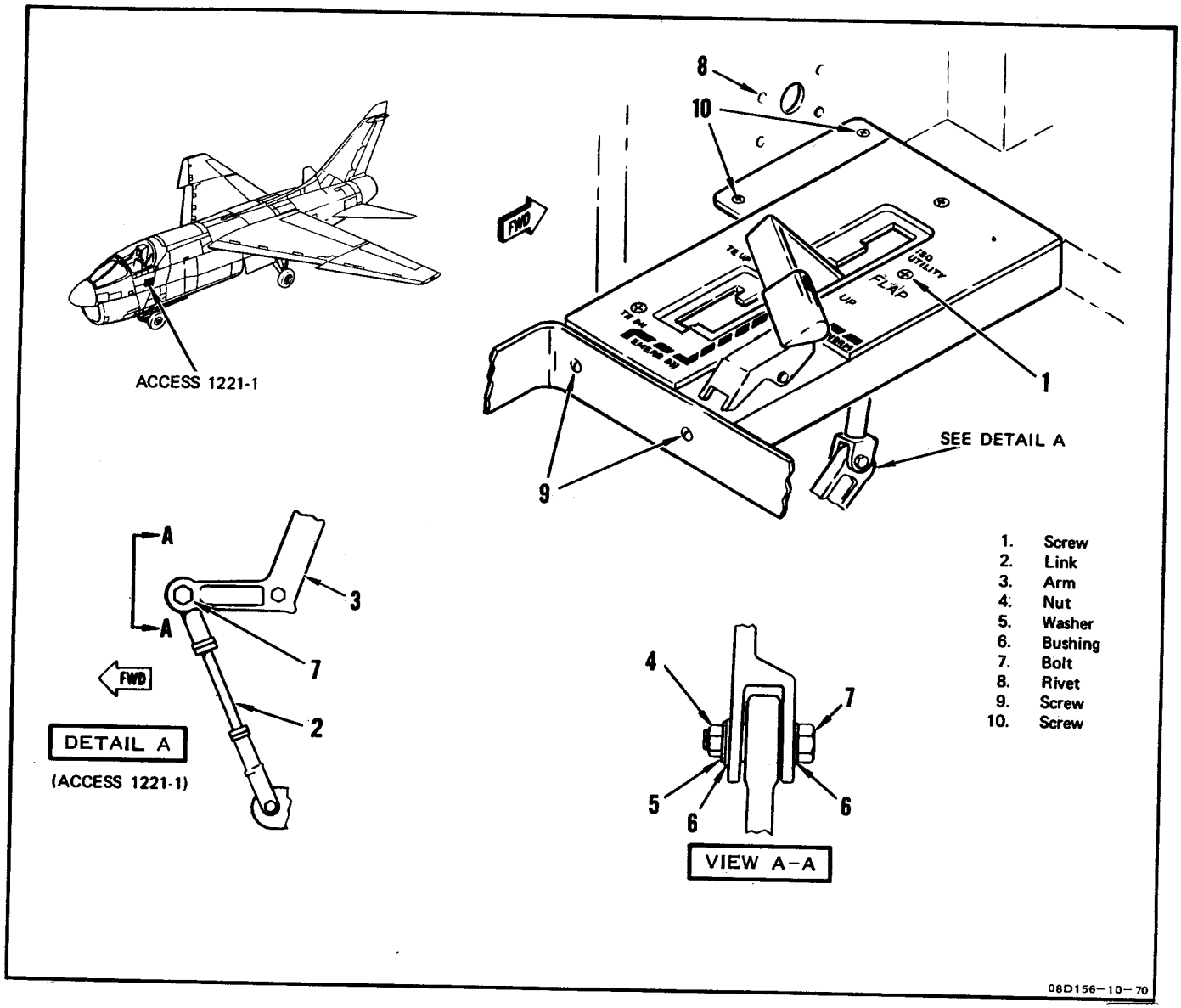


Figure 9-20. Flap Control Assembly Removal and Installation

d. Disconnect control link (2) from control assembly arm (3) by removing cotter pin, nut (4), washer (5), bushings (6), and bolt (7).

e. Disconnect cockpit air regulator line from static port No. 4. Remove union and discard packing.

f. Drill out four rivets (8) securing static port and remove static port.

g. Loosen and lift adjacent panels to gain access to four hidden screws (9) (two forward and two aft) securing control assembly to console.

h. Remove nut securing emergency flap switch and push through control assembly.

h-1. On airplanes AF69-6197 and subsequent, remove nut, lockwasher, and key washer securing AMF switch and push switch through control assembly.

i. Disconnect clamps and remove sleeve securing switch wire bundle.

j. Remove control assembly attaching screws (10). Lift control assembly from console.

k. Remove four switches from control assembly.

9-56. INSTALLATION. (See figure 9-20.)

a. Install trailing edge flap up and trailing edge flap down beep switches in housing with two nuts.

b. Install flap handle down and flap handle isolation switches with nuts.

c. Adjust switches as shown in figure 9-21. Secure with MS20995C32 lockwire.

d. Install control assembly to console.

e. Install screws (9 and 10).

f. Install emergency flap switch with nut and washer.

f-1. On airplanes AF69-6197 and subsequent, install AMF switch with key washer, lockwasher, and nut.

g. Connect wire to lighting panel connector with screw and washer and push connector into mounting hole of control assembly. Secure connector with lockwasher and nut.

h. Install lighting panel with screws (1).

CAUTION

To ensure proper operation of static system, ensure sealant does not clog port orifice.

WARNING

Sealant, MIL-S-8802 is flammable and moderately toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate.

i. Apply faying surface seal to static port No. 4 using MIL-S-8802 heat-resistant sealant (T.O. 1A-7D-23).

j. Secure static port to airframe with four rivets (8).

k. Using new packing, install union and connect cockpit air pressure regulator line to static port.

l. Secure panels adjacent to control assembly.

m. Place flap handle in DN.

n. Insert rigging pin No. 70 through lever and structure rigging holes.

o. Hold flap handle full aft in TE DN position and connect link (2) with bushings (6) and bolt (7). Link must be at shortest length that will allow insertion of bolt. If necessary, adjust link so bushings are as near as possible to bottom of slot in arm with bolt inserted. Secure bolt with washer (5), nut (4), and new cotter pin.

p. Remove rigging pin No. 70.

q. Install clamps securing switch wire bundle below control assembly.

r. Perform normal and emergency operational checkouts (paragraphs 9-35 and 9-36). Leave external electrical power connected.

s. Perform applicable portion of interior lighting system checkout to verify that edge-lighting is functioning properly for flap control panel (T.O. 1A-7D-2-11).

t. Close access 1221-1.

9-57. FLAP HANDLE ISOLATION SWITCH REPLACEMENT.

a. Open access 1221-1.

b. Cut lockwire and remove nut attaching switch to bracket.

c. Cut switch wires at convenient length and remove switch.

d. Splice switch wires to airplane wires.

e. Install switch in bracket with nut and lockwasher.

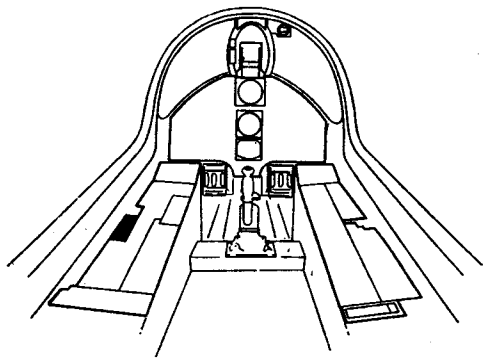
f. Rig switch (paragraph 9-58).

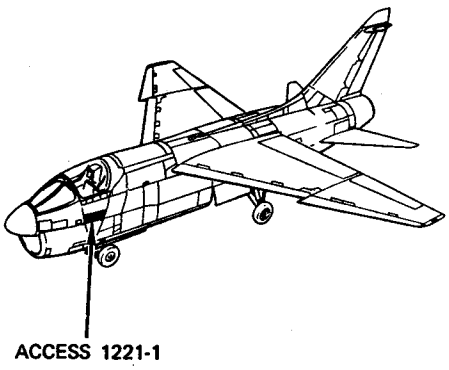
9-58. RIGGING FLAP HANDLE ISOLATION SWITCH. (See figure 9-21.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
	AN/PSM-6	Multimeter	Check voltage

TT08D065-12-68





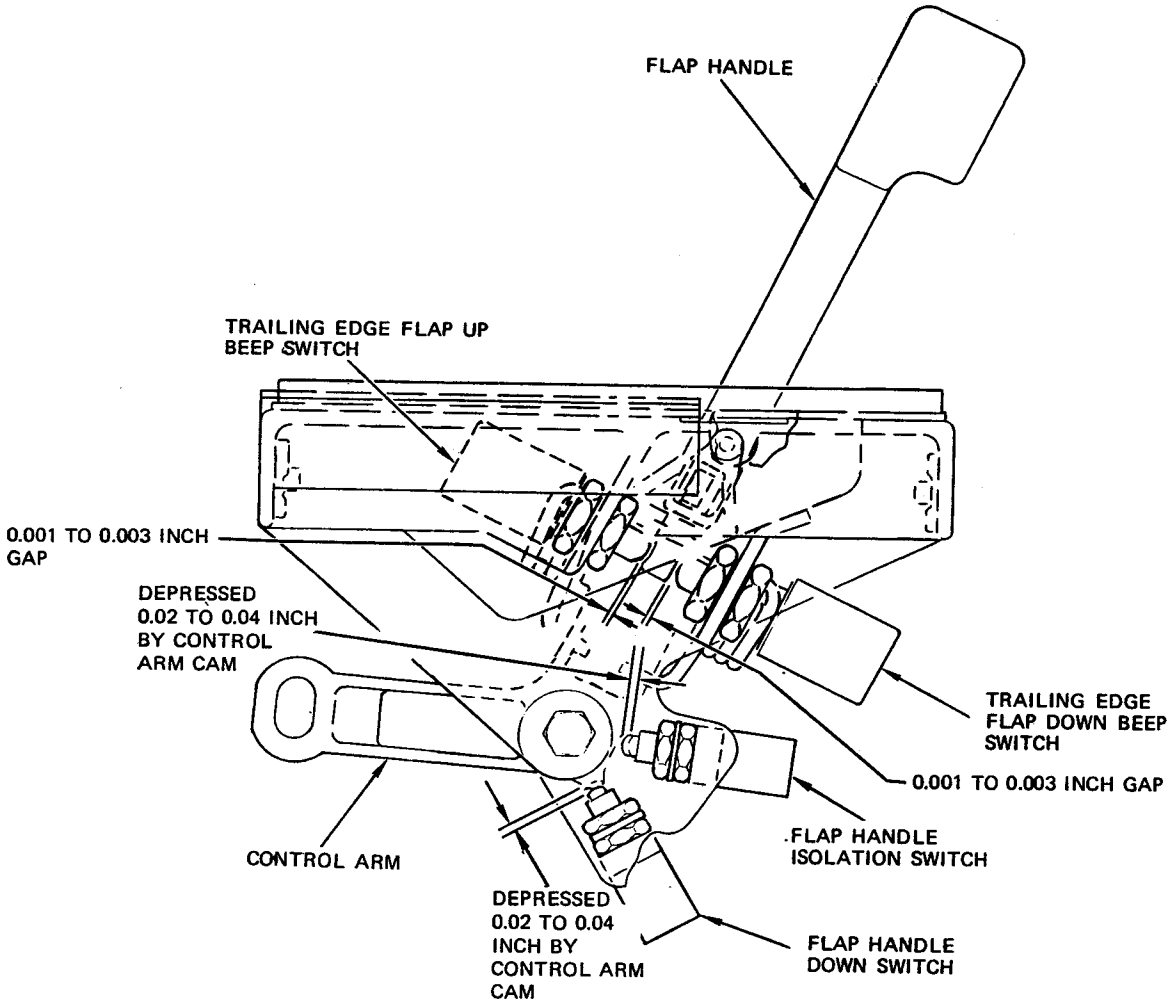


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Figure 9-21. Rigging Flap Handle Switches and Trailing Edge Flap Beep Switches

a. Open accesses 1221-1 and 2121-6.

b. Adjust flap handle isolation switch so control arm actuates switch 0.02 to 0.04 inch with flap handle in ISO UTILITY. Tighten locknuts.

c. Disconnect electrical connector P2060 from variable trailing edge flap selector valve.

d. Connect external electrical power (T.O. 1A-7D-2-1).

e. With flap handle in ISO UTILITY, check for no voltage at pin 1 of connector P2060.

f. Place flap handle in UP.

g. Check for 28 volts dc at pin 1 of connector P2060.

g-1. On airplanes AF69-6197 and subsequent, place flap handle in ISO UTIL, disconnect P330 from AMF electronic control unit, and check for 28 volts dc at pin C of connector. Place flap handle in UP.

h. Shut down external electrical power.

i. Connect connector P2060 to variable trailing edge flap selector valve.

j. Connect external hydraulic power to PC No. 2 hydraulic system (T.O. 1A-7D-2-1).

k. Apply external electrical power.

CAUTION

To prevent interference with flap and possible damage, ensure engine cooling hole cover (215-00266-4) is removed before operating flaps.

l. Place flap handle in DN. Flaps shall extend.

m. Place flap handle in UP. Flaps shall retract.

n. Disconnect external electrical and hydraulic power (T.O. 1A-7D-2-1).

o. Secure switch with MS20995C32 lockwire.

p. Close accesses 1221-1 and 2121-6.

9-59. FLAP HANDLE DOWN SWITCH REPLACEMENT.

a. Open access 1221-1.

b. Cut lockwire and remove nut attaching switch to control assembly.

c. Cut wires at location suitable for splicing, identify wires, and remove switch.

d. When installing switch, splice identified wires to airplane wiring.

e. Install switch in control assembly with nut.

f. Rig switch (paragraph 9-60).

9-60. RIGGING FLAP HANDLE DOWN SWITCH. (See figure 9-21.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
			TT08D066-12-68

a. Open access 1221-1.

b. Adjust flap handle down switch so control arm actuates switch 0.02 to 0.04 inch with flap handle in TE UP or TE DN position. Tighten locknuts.

c. Connect external electrical power (T.O. 1A-7D-2-1).

d. Connect external hydraulic power to PC No. 2 hydraulic system (T.O. 1A-7D-2-1).

CAUTION

To prevent interference with flap and possible damage, ensure engine cooling hole cover (215-00266-4) is removed before operating flaps.

e. Extend flaps by placing flap handle in DN, beeping handle momentarily in TE UP and quickly releasing to DN when trailing edge flaps extend approximately 20°. Trailing edge flaps shall halt and remain in this position.

f. Hold flap handle in TE DN. Trailing edge flaps shall extend.

g. Retract flaps by placing flap handle in UP.

h. Disconnect external electrical and hydraulic power (T.O. 1A-7D-2-1).

i. Secure switch nut with MS20995C32 lockwire.

j. Close access 1221-1.

9-61. TRAILING EDGE FLAP UP BEEP SWITCH REPLACEMENT.

a. Remove flap control assembly (paragraph 9-54).

b. Cut lockwire and remove nut securing switch to control assembly.

c. Cut wires at location suitable for splicing, identify wires, and remove switch.

d. When installing switch, splice identified wires to airplane wiring.

e. Install switch in control assembly with jamnut.

f. Rig trailing edge flap up beep switch (paragraph 9-62).

9-62. RIGGING TRAILING EDGE FLAP UP BEEP SWITCH. (See figure 9-21.)

a. Remove flap control assembly (paragraph 9-54).

b. Place flap handle in DN. Adjust trailing edge flap up beep switch so gap between handle and switch plunger is 0.001 to 0.003 inch. Tighten switch locknuts.

c. Secure switch with MS20995C32 lockwire.

d. Install flap control assembly (paragraph 9-54).

9-63. TRAILING EDGE FLAP DOWN BEEP SWITCH REPLACEMENT.

a. Remove flap control assembly (paragraph 9-54).

b. Cut lockwire and remove nut securing switch to control assembly.

c. Cut wires at location suitable for splicing, identify wires, and remove switch.

d. When installing switch, splice identified wires to airplane wiring.

e. Install switch in control assembly with jamnut.

f. Rig trailing edge flap down beep switch (paragraph 9-64).

9-64. RIGGING TRAILING EDGE FLAP DOWN BEEP SWITCH. (See figure 9-21.)

a. Remove flap control assembly (paragraph 9-54).

b. Place flap handle in DN. Adjust trailing edge flap down beep switch so gap between handle and switch plunger is 0.001 to 0.003 inch. Tighten switch locknuts.

c. Secure switch with MS20995C32 lockwire.

d. Install flap control assembly (paragraph 9-54).

9-65. FLAP MANUAL CONTROL CABLE REMOVAL AND INSTALLATION.

9-66. REMOVAL. (See figure 9-22.)

a. Open accesses 1221-1 and 1123-1.

b. Remove turnbuckle clips (1) and disconnect both turnbuckles (2).

c. Remove cable guard (3) located below cable pulleys.

d. Remove cotter pins (4), nuts (5), and bolts (6) securing cables to bellcrank and remove cables (7).

9-67. INSTALLATION. (See figure 9-22.)

a. Connect upper cable (7) to bellcrank with bolt (61) (head outboard) nut (5) and new cotter pin (4).

CAUTION

To prevent interference with bolt securing throttle controlex, bolthead of lower cable bolt (6) must be inboard.

b. Connect lower cable (7) to bellcrank with bolt (6) (head inboard), nut (5), and new cotter pin (4).

c. Route both cables under pulleys and install cable guard (3).

d. Connect cables to turnbuckles (2) (upper cable connects to cable leading to aft end of selector valve arm) and tighten hand-tight.

e. Rig control system (paragraph 9-42).

9-68. FLAP SELECTOR VALVE REMOVAL AND INSTALLATION.

9-69. REMOVAL.

a. Open access 1123-1.

b. Relieve cable tension at turnbuckle.

c. Disconnect isolation valve interconnecting rod.

d. Remove arm from valve shaft by removing nut.

e. Disconnect hydraulic lines from valve.

f. Note position of rigging pin hole tab for use during installation.

g. Remove mounting bolts and valve.

h. Remove fittings from valve.

9-70. INSTALLATION.

NOTE

Before installing valve, align index mark on actuating arm with tooth on valve shaft and note position.

a. Install fittings and new packings in valve.

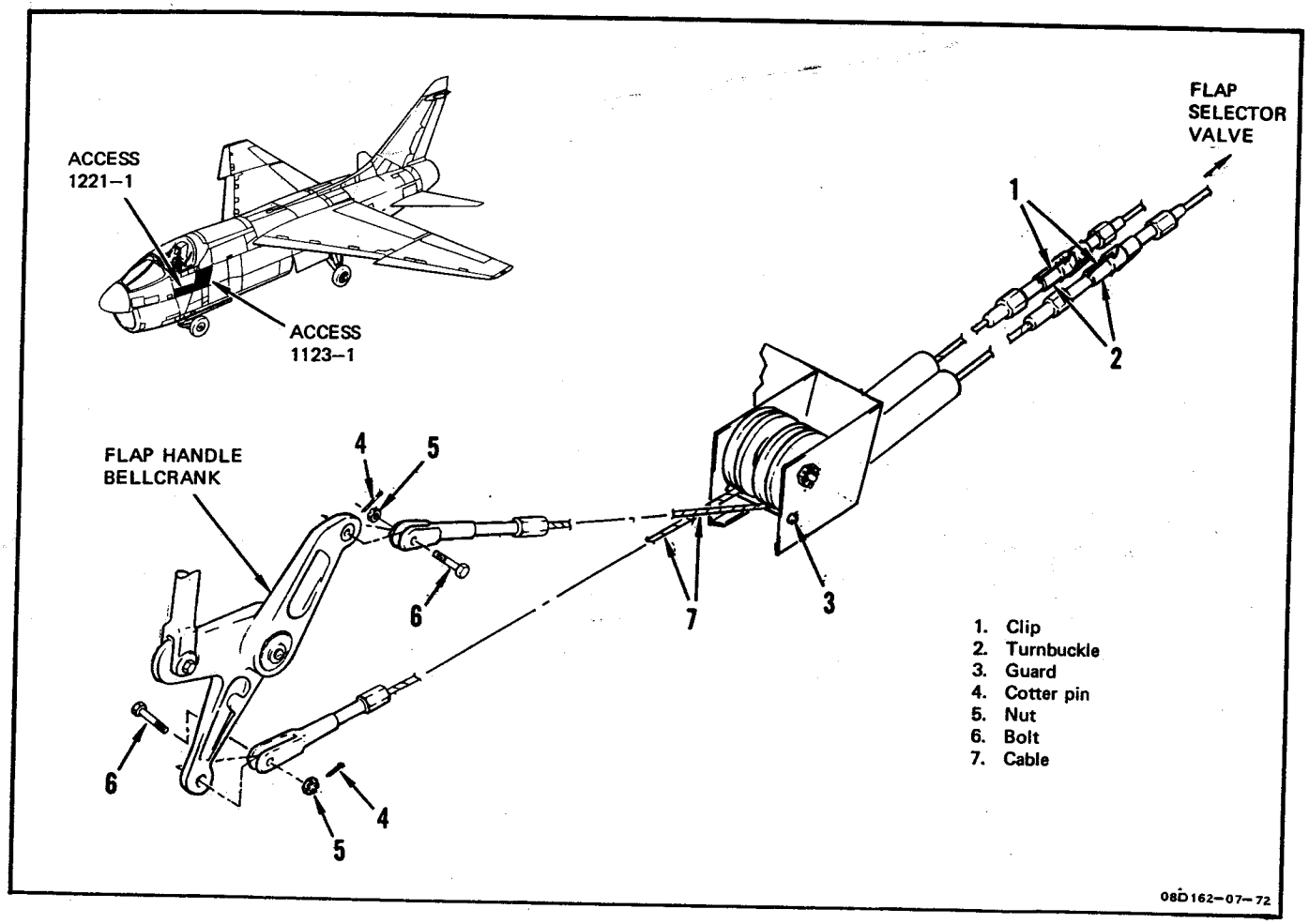

Figure 9-22. Flap Manual Control Cable Removal and Installation

b. Position rigging pin hole tab over two outer mounting holes of valve with rigging hole outboard and closest to aft mounting hole.

c. Install mounting bolts.

d. Connect hydraulic lines to valve.

e. Align index mark on actuating arm with index tooth on valve shaft. Install arm on shaft with nut.

f. Bleed flap system (paragraph 9-50).

NOTE

Inspect for leakage at valve and line connections during operational checkout.

g. Rig flap manual control linkage (paragraph 9-42).

h. Close access 1123-1.

9-71. VARIABLE TRAILING EDGE FLAP VALVE PACKAGE REMOVAL AND INSTALLATION.

9-72. REMOVAL.

a. Dump emergency flap accumulator (T.O. 1A-7D-2-1).

b. Open access 1123-3.

c. Place flap handle in ISO UTILITY.

d. Disconnect electrical connector from valve.

e. Disconnect hydraulic lines from valve.

f. Remove four bolts and washers securing valve. Remove valve.

g. Remove line fittings from valve.

9-73. INSTALLATION.

NOTE

Valve fittings contain an integral filter.

a. Clean all filter fittings ultrasonically or with forced air and P-D-680 cleaning solvent.

b. Inspect filter for looseness, and indication of deterioration, if any indication of deterioration is found, replace filter fitting.

c. Install fittings in valve using new packings.

d. Install valve with four mounting bolts and washers.

e. Connect hydraulic lines to valve.

f. Connect electrical connector to valve.

g. Bleed trailing edge and emergency flaps (paragraphs 9-51 and 9-53).

h. Perform flap system normal and emergency operational checkouts (paragraph 9-35 and 9-36).

i. Inspect for leakage at lines and fittings, which were disconnected, and at valve.

j. Close access 1123-3.

9-74. CENTER SECTION LEADING EDGE FLAP ACTUATING CYLINDER REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment required for connecting external hydraulic power	Connect hydraulic power
	413-900-020	Torque wrench, 100 to 750 pound-inches	Tighten cylinder bolt
	GGG-W-686	Torque wrench, 0 to 250 pound-feet	Tighten cylinder rod end jamnut
			TT08D069-02-75

NOTE

The procedure is typical for removal and installation of the four center section leading edge flap actuating cylinders.

9-75. REMOVAL.

a. Connect external hydraulic power to PC No. 2 hydraulic system (T.O. 1A-7D-2-1).

CAUTION

To prevent damage to internal locks of flap actuating cylinders, do not use hand pump to unlock flaps from either retracted or extended position. Unlock cylinders using external hydraulic power source delivering at least 1,450 (±50) psi with a minimum flow of 2 gpm.

To prevent interference with flap and possible damage, ensure engine cooling hole cover (215-00266-4) is removed before operating flaps.

b. Place flap handle in DN, allow flap cylinders to unlock, and shut down hydraulic power to stop flaps in midtravel.

c. Open accesses 3213-3, 3113-4, 3213-8, and 3113-9 to remove left cylinders. To remove right cylinders, open accesses 4213-8, 4113-4, 4213-3, and 4113-9.

d. Support flap, cut lockwire, and disconnect both cylinder rod ends from flap by removing bolts and washers. Swing flap down.

e. Disconnect hydraulic lines from cylinder.

f. Disconnect switch wires from terminal board and unclamp wires.

g. Cut lockwire and remove lug end bolt and washer.

h. For inboard cylinder remove nuts, washers, and bolts securing rod end support and remove support.

i. Remove cylinder and attached switch through bottom access.

j. Remove hydraulic fittings from cylinder. Note number of exposed threads on rod end.

9-76. INSTALLATION.

CAUTION

Ensure correct cylinder is installed. Airplanes through AF73-998 before T.O. 1A-7D-765 require cylinder for 35° flap extension. Airplanes after T.O. 1A-7D-765 and airplanes AF73-999 and subsequent require cylinder for 26° extension. If cylinders are interchanged, damage to airplane could occur.

a. Adjust rod end so that same number of threads are exposed as noted during removal.

b. Tighten jamnut to 60 (±5) pound-feet torque.

c. Secure jamnut with MS20995C32 lockwire.

d. Install hydraulic fittings in cylinder. Use new packings.

e. Drain preservative fluid and fill cylinder with hydraulic fluid.

f. Install cylinder and attached switch with lug end attaching bolt and washer.

g. Tighten bolt to 166 (±8) pound-inches torque.

h. Secure bolt with MS20995C32 lockwire.

i. Connect hydraulic lines to cylinder.

j. Connect switch wires to terminal board and install wire clamp.

k. Apply external hydraulic power and retract flap cylinder pistons to locked position.

l. For inboard cylinder, install rod end support with bolts, washers, and nuts.

m. With cylinder rod ends disconnected, swing flap upward and support flap in retracted position.

n. Push cylinder rod ends into position and connect to flap with bolts and washers.

o. Rig center section leading edge flap (paragraph 9-43). Leave external hydraulic power connected.

p. Place center section leading edge flap contour templates in position (figure 9-16) and check that gap between template and wing surface is within limits.

q. Tighten rod end bolts to 230 (±70) pound-inches torque.

r. Secure bolts with MS20995C32 lockwire.

s. Bleed leading edge flaps (paragraph 9-52).

t. Perform normal operational checkout (paragraph 9-35).

u. Close accesses 3213-3, 3113-4, 3213-8, and 3113-9 or 4213-8, 4113-4, 4213-3, and 4113-9.

9-77. OUTER PANEL LEADING EDGE FLAP ACTUATING CYLINDER REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external hydraulic power	Connect hydraulic power
	413-900-020	Torque wrench, 100 to 750 pound-inches	Tighten cylinder bolt
	GGG-W-686	Torque wrench, 0 to 250 pound-feet	Tighten cylinder rod end jamnut

TT08D070-02-75

9-78. REMOVAL.

NOTE

This procedure is typical for removal and installation of the four outer panel leading edge flap actuating cylinders.

a. Open accesses 3112-1 and 3112-2 to remove left cylinder or 4111-1 and 4111-2 to remove right cylinder.

b. Open following accesses for lug end attaching bolt of cylinder being removed:

Left outboard cylinder - 3112-4
Left inboard cylinder - 3112-5
Right outboard cylinder - 4111-4
Right inboard cylinder - 4111-5

c. Connect external hydraulic power to PC No. 2 hydraulic system (T.O. 1A-7D-2-1). Unlock flaps and shut down hydraulic power.

CAUTION

To prevent damage to internal locks of flap actuating cylinders, do not use hand pump to unlock flaps from either retracted or extended position. Unlock cylinders using external hydraulic power source delivering at least 1,450(±50) psi with a minimum flow of 2 gpm.

To prevent interference with flap and possible damage, ensure engine cooling hole cover (215-00266-4) is removed before operating flaps.

d. Extend flaps with hand pump to best position for rod end attaching bolt access.

e. Disconnect bonding jumper and tube protective strap at inboard cylinder.

f. Remove cotter pin, nut, washer, and bolt attaching rod end to flap at both cylinders and swing flap open.

g. Note number of exposed threads on rod end of cylinder being replaced. Cut lockwire, loosen jamnut, and screw rod end fully into piston.

h. Retract cylinder pistons with hand pump.

i. Disconnect switch wires from terminal board and unclamp wires.

j. Disconnect hydraulic lines to cylinder at bracket fitting.

k. Remove lug end attaching bolt and cylinder.

l. Remove hydraulic swivels, packings, and lines from cylinder.

9-79. INSTALLATION.

CAUTION

Ensure correct cylinder is installed. Airplanes through AF73-998 before T.O. 1A-7D-765 require cylinder for 35° flap extension. Airplanes after T.O. 1A-7D-765 and airplanes AF73-999 and subsequent require cylinder for 26° extension. If cylinders are interchanged, damage to airplane could occur.

a. Loosen rod end jamnut and screw rod end completely into piston.

b. Drain preservative fluid and fill cylinder with hydraulic fluid.

c. Install hydraulic swivels in cylinder and connect lines. Use new packings. Tighten swivel bolts to 120 (±10) pound-inches torque.

d. Attach cylinder at lug end to structure with bolt.

e. Tighten bolt to 330 (±15) pound-inches torque.

f. Adjust rod end with same number of threads exposed as noted during removal.

g. Tighten jamnut to 60 (±5) pound-feet torque.

h. Secure jamnut with MS20995C32 lockwire.

i. Connect hydraulic lines.

j. Connect switch wires to terminal board and clamp wires.

k. Install outboard cylinder rod end attaching bolt (bolthead outboard) partially in flap lug with bolt end clear of rod end slot. Install attaching bolt for inboard cylinder in similar manner, with bolthead inboard.

l. Apply hydraulic power. Extend pistons partially to position that will allow best access for final bolt installation. Shut down hydraulic power.

m. Manually rotate flap upward to align rod end and flap lug holes. Push outboard bolt through rod end attaching hole.

n. If outboard bolt cannot be readily installed, perform steps o and p. If bolt can be installed, continue procedure with step q.

o. Remove wing position light fairing attaching screws, unclamp wiring, and secure light assembly to wing with tape. (This will expose a tunnel which will permit insertion of a bent tube to be used to push bolt through rod end attaching hole.)

p. Clamp wiring and install wing position light and fairing assembly with screws after bolt installation.

q. Install washer and nut on rod end bolt. Tighten nut finger-tight. Install cotter pin.

r. Push inboard cylinder bolt through rod end attaching hole.

s. Install washer and nut on rod end bolt. Tighten nut finger-tight. Install cotter pin.

t. Connect bonding jumper and tube protective strap.

u. Bleed leading edge flaps (paragraph 9-52).

v. Check flap rigging (paragraph 9-44). If rigging check is satisfactory, perform normal operational checkout (paragraph 9-35).

w. Check that lines and fittings which were disconnected are not leaking.

x. Close accesses 3112-1 and 3112-2 or 4111-1 and 4111-2. Close accesses 3112-4, 3112-5, 4111-4, or 4111-5 as applicable.

9-80. TRAILING EDGE FLAP ACTUATING CYLINDER REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external hydraulic power	Connect hydraulic power
		Equipment for connecting external electrical power	Connect electrical power
	AN/PSM-6	Multimeter	Check continuity across uplock switch at test panel
	GGG-W-686	Torque wrench, 0 to 250 pound-feet	Tighten jamnut
	GGG-W-686	Torque wrench, 10 to 150 pound-inches	Tighten piston rod end
	E10385	Hydraulic servicing stand	Extend and retract piston
	T60-1001-C8-00	Cable tensiometer	Check tension of 6° rudder stop cable

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NOTE

This procedure is typical for all trailing edge flap actuating cylinders.

9-81. REMOVAL.

a. Open access 3233-2 or 3233-3 to remove left cylinders. Open access 4233-2 or 4233-3 to remove right cylinders. On airplanes AF69-6197 and subsequent if removing outboard cylinder, also open inboard access (3233-3 or 4233-3) for access to uplock switch wiring splice.

a-1. Perform trailing edge flap removal procedure (paragraph 9-96) except swing flap down and leave hinge bolts installed. Shut down but do not disconnect external hydraulic and electrical power.

b. Remove plate covering rod end passage hole by removing screws around edges. Remove angle.

CAUTION

To prevent damage to internal locks of flap actuating cylinders, do not use hand pump to unlock flaps from either retracted or extended position. Unlock cylinders using external hydraulic power source delivering at least 1,450 (±50) psi with a minimum flow of 2 gpm.

c. Apply hydraulic power and retract flap cylinder pistons.

d. Shut down hydraulic power.

e. Remove hydraulic lines connected to cylinder.

f. For inboard flap cylinders, remove flap retract line connected between two forward brackets.

g. Remove swivel fitting inboard of attaching bolt.

h. For outboard flap cylinders, remove swivel fitting and bracket inboard of lug end attaching bolt.

i. On airplanes AF69-6197 and subsequent, disconnect cylinder uplock switch wiring at splice (access 3233-3 or 4233-3).

j. Note number of exposed threads on piston rod end.

k. Cut lockwire, loosen jamnut, and unscrew rod end.

l. Remove cotter pin, washers, and bolt at lug end and remove cylinder.

m. Remove fittings from cylinder. Cap or plug ports.

9-82. INSTALLATION.

a. Adjust piston rod end to same number of threads exposed as noted during removal.

b. Install fittings and new packings in cylinder.

c. Drain preservative fluid and fill cylinder with hydraulic fluid.

d. Retract piston with hydraulic servicing stand.

e. Disconnect hydraulic servicing stand.

NOTE

Where installation of right hand outboard cylinder and switch cannot be accomplished due to insufficient clearance, trim rib assembly (figure 9-23A).

f. Install cylinder at lug end with attaching bolt and washers, and tighten nut finger-tight (bolthead inboard).

g. Install cotter pin.

h. Install swivel fittings and bracket.

i. Connect hydraulic lines to cylinder.

j. For inboard cylinders, connect flap retract line at forward bracket fitting and clamp line.

k. Apply external hydraulic power. Place flap handle in DN. When all cylinders unlock, shut down hydraulic power.

l. Align cylinder rod end with boltholes in flap using handpump. Install bolts, washers, and nuts (inboard bolthead outboard and outboard bolthead inboard). At inboard cylinder install thin washer under bolthead and thick washer under nut. Tighten nuts finger-tight.

m. Retract flaps using hand pump.

n. Check that maximum spanwise step between trailing edge of flap and fuselage stub fairing does not exceed 0.06 inch. Rig flap (paragraph 9-45) if step exceeds 0.06 inch. If step check is satisfactory, extend flap and continue with following steps.

o. Tighten rod end jamnut to 60 (±5) pound-feet torque.

p. Secure jamnut with MS20995C32 lockwire.

q. Install new cotter pin through rod end attaching bolt.

r. Bleed trailing edge flaps (paragraph 9-51).

s. Deleted.

t. For left trailing edge flap, connect synchro transmitter link to flap eyebolt with bolt, washers, and nut. Tighten nut to 14 (±1) pound-inches torque and install new cotter pin.

u. Reconnect bonding jumpers.

v. Connect uplock switch wiring at splice. Slip 3-inch section of 1/2-inch black shrink-fit tubing over splice and shrink in place. Secure splice with clamp.

w. Perform normal operational checkout (paragraph 9-35). Leave external hydraulic power connected.

x. With flaps extended, install plate assembly at rod end passage hole.

y. Check that lines and fittings which were disconnected are not leaking.

z. Retract flaps.

aa. Disconnect external hydraulic and electrical power (T.O. 1A-7D-2-1).

ab. Close accesses 3233-2, 3233-3, 4232-3, and 4233-3.

9-83. LEADING EDGE FLAP ACTUATOR MICROSWITCH OPERATIONAL CHECK.

Tools Required

Figure & Index No.	Part Number	Nomenclature	Use and Application
	AN/PSM-6	Multimeter	Check continuity open and common leads.
	E1036	Hydraulic servicing stand.	Pressure to check and operate actuators.

Check the operation of each of the eight (8) LE flap actuator microswitches (to verify de-actuation) as follows:

CAUTION

To prevent damage to internal locks of flap actuating cylinders, do not use hand pump to unlock flaps from either retracted or extended position. Unlock cylinders using external hydraulic power source delivering at least 1,450 (±50) psi with a minimum flow of 2 gpm.

To prevent interference with flap and possible damage, ensure engine cooling hole cover (215-00266-4) is removed before operating flaps.

a. With PC-2 hydraulic pressure supplied (closed system with normal back pressure), electrical power off, and flaps up, connect VOM across a switch at test jacks in lox compartment. Verify continuity.

b. Place flap handle in down and verify that switch actuates (to open) by loss of continuity on VOM.

c. Select flaps up and verify continuity is reestablished.

d. Move meter leads to jacks across next switch. Check for continuity flaps up, loss of continuity with flaps in transition, or down, and continuity restored flaps up.

e. Repeat steps a through d for the remaining six (6) switches.

f. Remove VOM leads, apply electrical power, and check cockpit indication (LE flaps) for correct indication (i.e., up indication with flaps up and down indication with flaps down).

g. Place flap handle in ISO UTILITY. Flaps shall not move and indicators shall remain unchanged.

9-84. Deleted.

9-85. EMERGENCY BYPASS VALVE REMOVAL AND INSTALLATION.

9-86. REMOVAL.

WARNING

To prevent injury from high pressure, check that emergency flap accumulator is dumped before disconnecting lines.

a. Dump emergency flap accumulator (T.O. 1A-7D-2-1).

b. Open access 1121-3.

c. Disconnect hydraulic lines from valve.

d. Remove mounting bolts and washers.

e. Remove emergency bypass valve.

f. Remove fittings from valve.

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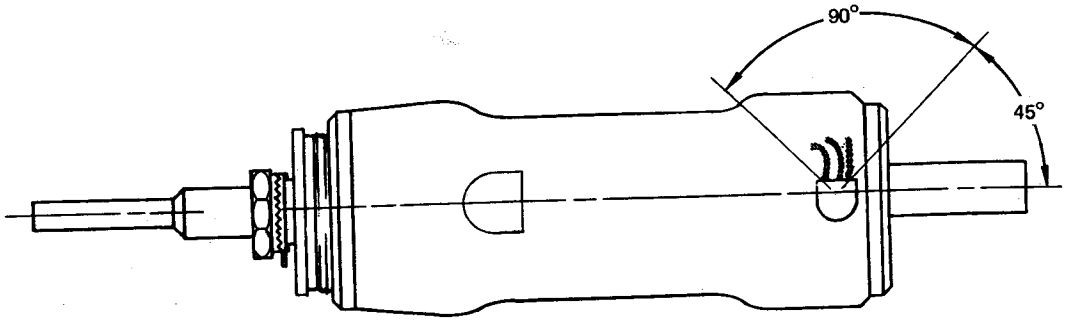
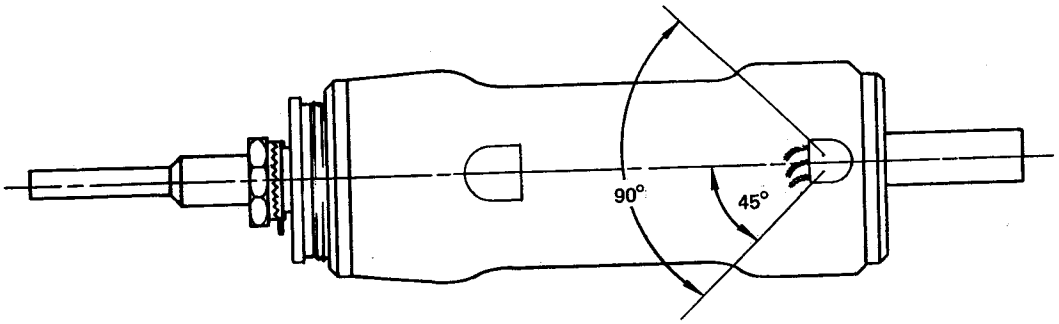


LEADING EDGE FLAP CENTER SECTION CYLINDER



LEADING EDGE FLAP OUTER PANEL CYLINDER AND
*TRAILING EDGE FLAP CYLINDERS

*Airplanes AF69-6197 and subsequent

08D110-02-81

Figure 9-23. Flap Uplock Switch Wire Position

9-87. INSTALLATION.

a. Install fittings and new packings in valve.

b. Install valve with mounting bolts and washers.

c. Connect hydraulic lines to valve.

d. Bleed normal and emergency flap systems (paragraphs 9-50 and 9-53).

e. Perform flap system emergency operational checkout (paragraph 9-36).

f. Inspect for leakage at lines and fittings which were disconnected and at valve.

g. Close access 1121-3.

9-88. CENTER SECTION LEADING EDGE FLAP REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment required for connecting external electrical power	Connect electrical power
		Equipment required for connecting external hydraulic power	Connect hydraulic power
	413-900-020	Torque wrench, 100 to 750 pound-inches	Tighten attaching bolts
9-24	(Local fabrication)	Leading edge flap seal alignment tool set	Check alignment of flap seal
			TT08D074-03-76

9-89. REMOVAL.

a. Open accesses 3113-6, 3213-3, and 3213-8 to remove left flap. To remove right flap, open accesses 4113-6, 4213-3 and 4213-8.

b. If removing the left flap, disconnect leading edge flap position switch arm from flap by removing cotter pin, attaching pin, and washers.

c. Disconnect bonding jumper and protective strap from wing section by removing nut, bolt, and washers.

d. Connect external hydraulic power to PC No. 2 hydraulic system (T.O. 1A-7D-2-1).

CAUTION

To prevent interference with flap and possible damage, ensure engine cooling hole cover (215-00266-4) is removed before operating flaps.

e. Extend flaps and shut down hydraulic power.

f. Open accesses 3213-12 through 3213-20 to remove left flap. Open accesses 4213-12 through 4213-20 to remove right flap.

g. Support flap. Cut lockwire and remove bolts and washers attaching cylinders to flap.

h. Remove hinge pins, washers, and flap.

9-90. INSTALLATION.

WARNING

Flap seal adjustment is critical to safe aircraft operation. Be careful during seal adjustment and flap installation to avoid seal damage.

a. Using leading edge flap seal alignment tool set (figure 9-24), check fit and alignment of leading edge flap seal along full length of seal (figure 9-25)

b. Correct any bends or adjust fit of seal by tapping metal seal strip with nonmetallic block and mallet.

c. Using leading edge flap seal alignment tool set, check fit and alignment of leading edge flap seal striker along full length of striker (figure 9-25).

d. Correct any bends or adjust fit of seal striker by tapping striker with nonmetallic block and mallet.

e. Lubricate flap hinge pins with MIL-L-7870 lubricating oil.

CAUTION

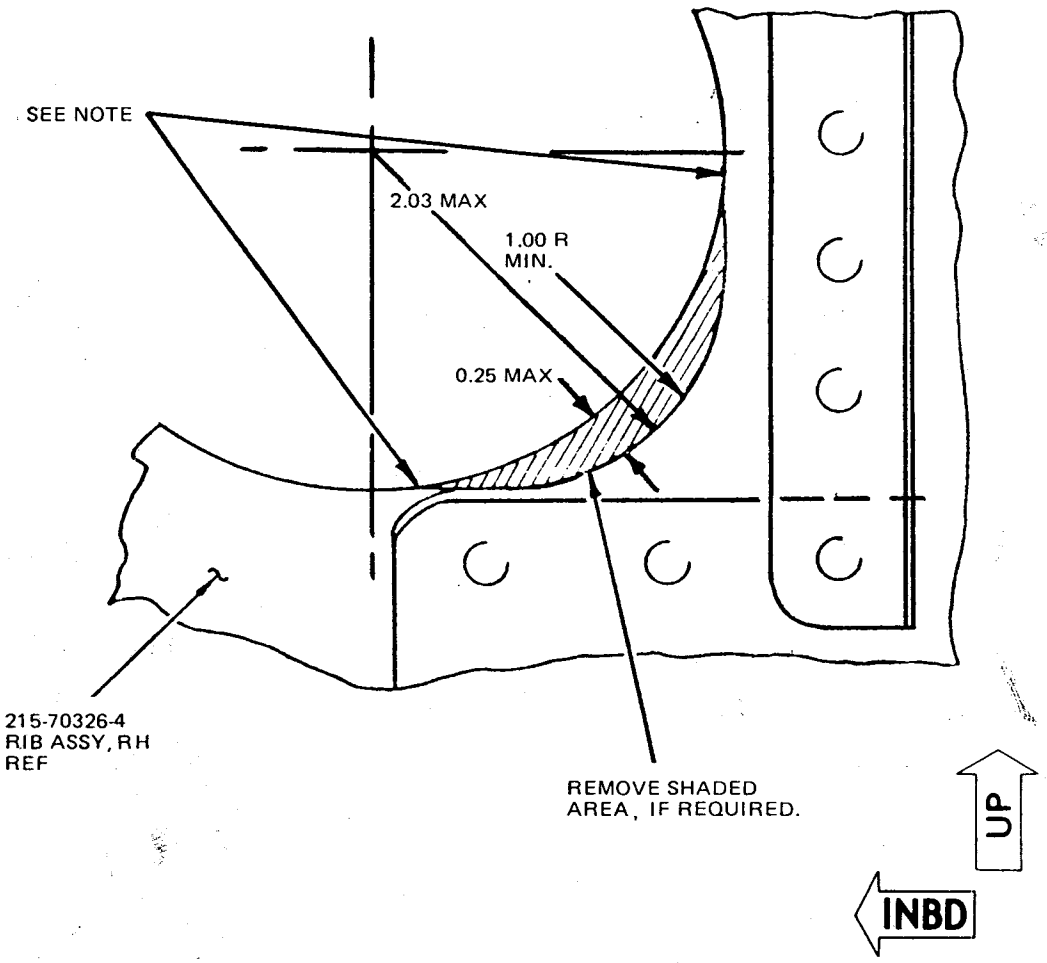
To prevent damage to hinges, do not use excessive force or drift pins to align hinges or to install hinge pins.

f. Align flap and wing hinges, support flap, and install hinge pins and washers in the proper hinge lugs according to length.

g. Apply external hydraulic power and retract flap cylinder pistons.

h. Spread wings if folded (T.O. 1A-7D-2-1).

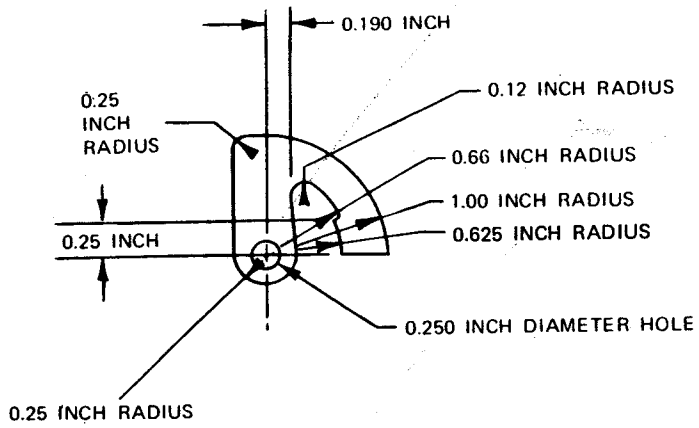
i. Rotate flap upward to retracted position.



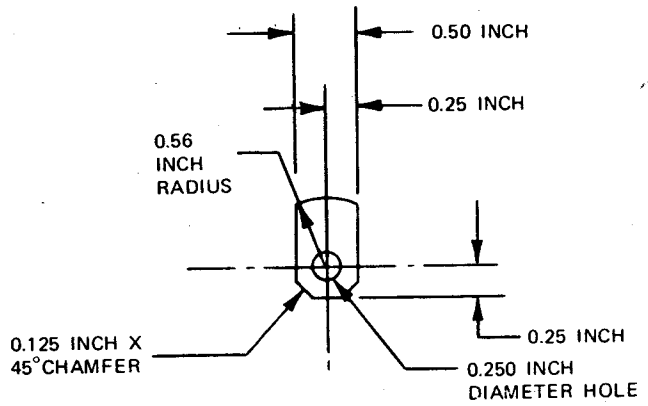
NOTE

1. BLEND TO EXISTING HOLE. MAXIMUM MISMATCH 0.02.
2. ALL DIMENSIONS ARE IN INCHES.

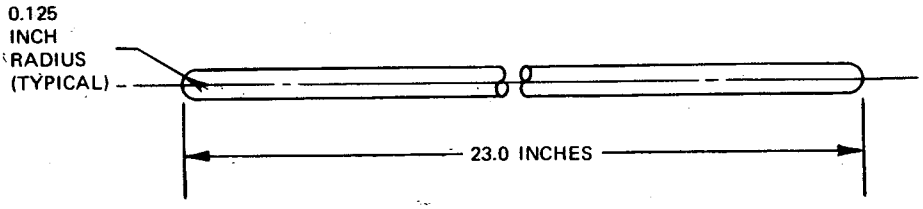
Figure 9-23A. Rib Assembly, Right Hand Outboard Rework



FLAP SEAL STRIKER ALIGNMENT TOOL –
0.125 INCH GAGE 6061–T6 ALUMINUM OR EQUIVALENT



FLAP SEAL ALIGNMENT TOOL –
0.50 INCH 6061–T6 ALUMINUM OR 1020 STEEL SQUARE BAR OR EQUIVALENT



PIVOT ROD – 0.250 INCH DIAMETER 1020 STEEL ROD OR EQUIVALENT

08D158–01–72

Figure 9-24. Leading Edge Flap Seal Alignment Tool Set

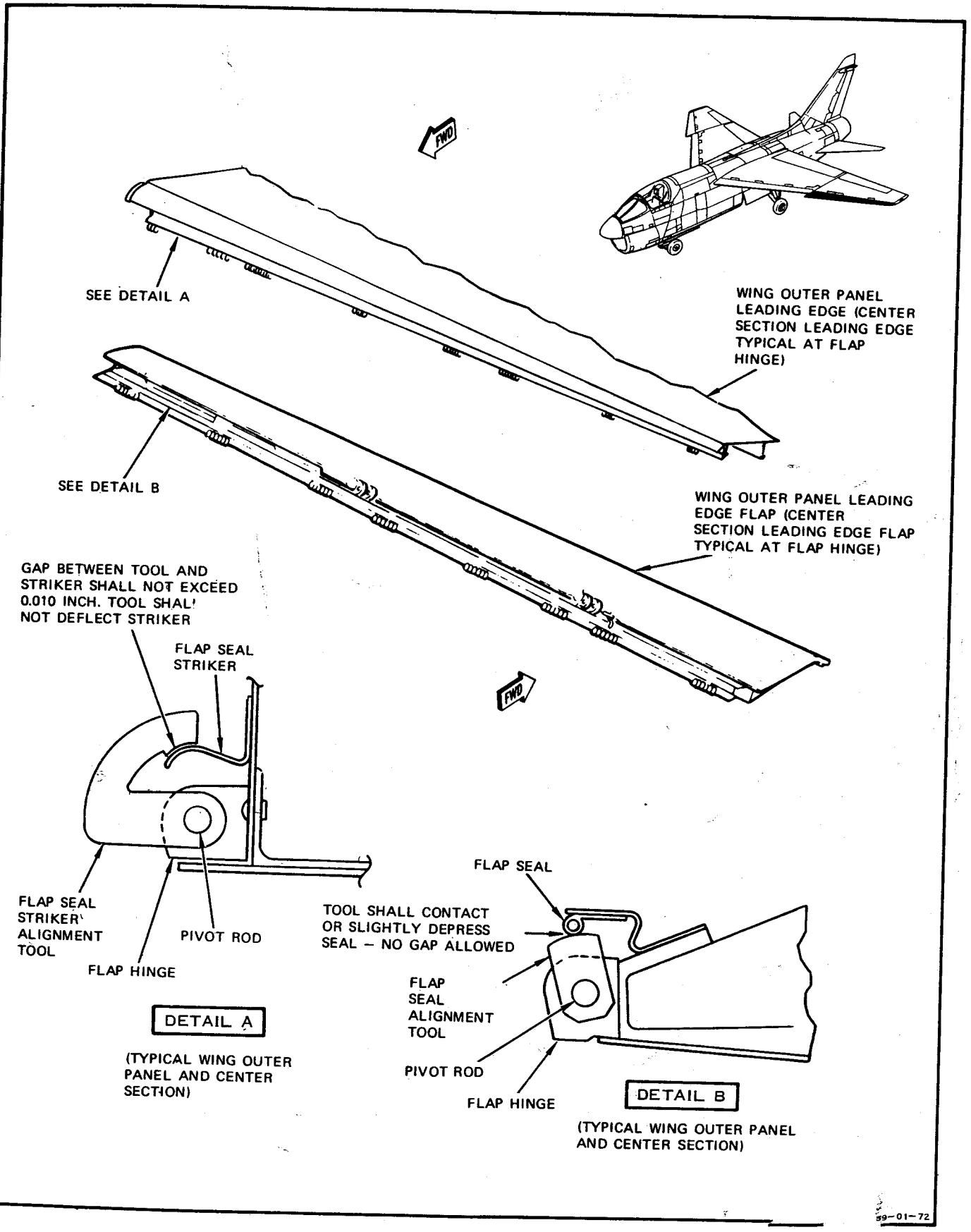


Figure 9-25. Leading Edge Flap Seal Alignment

j. Check for a minimum clearance of 0.06 inch between mating edges of flap and wing at lower surface. Check that no binding exists between flap and outer panel and between flap and fuselage. Trim as necessary.

k. Place flap handle in DN. When cylinders unlock, shut down hydraluic power.

l. Align cylinder rod ends with bolt holes in flap using hand pump.

m. Connect cylinders to flap with attaching bolts and washers. Tighten bolts to 230 (±70) pound-inches torque.

n. Apply hydraulic power and retract flaps.

o. Connect bonding jumper and strap to wing with washers, bolt, and nut.

p. If installing the left flap, connect leading edge flap position switch arm to flap with pin, washers, and new cotter pin.

q. Rig flap (paragraph 9-43).

r. Secure rod end attaching bolt with MS20995C32 lockwire.

s. For left flap only, check rigging of leading edge flap position switch (paragraph 9-105).

t. Perform normal operational checkout (paragraph 9-35).

u. Close accesses 3113-6, 3213-3, and 3213-8 or 4113-6, 4213-3, and 4213-8.

v. Close accesses 3213-12 through 3213-20 or 4213-12 through 4213-20.

9-91. OUTER PANEL FLAP HINGE LINE SEAL INSPECTION. (See figure 9-17 or 9-18.)

9-92. Perform outer panel flap hinge line seal inspection as follows:

a. When outboard pylon is installed, the wing outer panel must be folded in order for flap to clear pylon leading edge.

b. To gain access to the outer panel flap hinge line seal for inspection, disconnect the flap actuators in accordance with paragraph 9-93.

c. Allow flap to swing down as far as possible.

d. Visually inspect seal with flashlight and inspection mirror. The seal must be in contact with edge of striker (figure 9-17 or 9-18).

e. If seal and striker are in contact for full length, no further inspection of seal is required.

f. Reconnect flap actuators in accordance with paragraph 9-95.

g. Should gaps exists between the seal and striker, proceed with full flap removal, seal adjustment and flap reinstallation in accordance with paragraphs 9-94 and 9-95.

9-93. OUTER PANEL LEADING EDGE FLAP REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment required for connecting external hydraulic power	Connect hydraulic power
9-24	(Local fabrication)	Leading edge flap seal alignment tool set	Check alignment of flap seal

TT08D075-03-76

9-94. REMOVAL.

a. Open accesses 3112-1 and 3112-2 to remove left flap. Open accesses 4111-1 and 4111-2 to remove right flap.

b. Connect external hydraulic power to PC No. 2 hydraulic system (T.O. 1A-7D-2-1). Unlock flaps and shut down hydraulic power.

CAUTION

To prevent damage to internal locks of flap actuating cylinders, do not use hand pump to unlock flaps from either retracted or extended position. Unlock cylinders using external hydraulic power source delivering at least 1,450 (±50) psi with a minimum flow of 2 gpm.

To prevent interference with flap and possible damage, ensure engine cooling hole cover (215-00266-4) is removed before operating flaps.

c. Extend flaps with hand pump to best position for rod end attaching bolt access.

d. Disconnect bonding jumper and protective strap at inboard cylinder by removing nut, bolt, and washers.

e. Support flap and disconnect both cylinder rod ends by removing cotter pin, nut, washer, and bolt. Swing flap open.

f. Remove wing position light fairing attaching screws, unclamp wiring, and secure light assembly to wing.

NOTE

Two screws at leading edge tip and three screws retaining light assembly do not have to be removed to remove fairing.

g. Open accesses 3212-4 through 3212-9 to remove left flap or 4211-4 through 4211-9 to remove right flap.

h. Support flap. Remove hinge pins, washers, and flap.

9-95. INSTALLATION.

WARNING

Flap seal adjustment is critical to safe aircraft operation. Be careful during seal adjustment and flap installation to avoid seal damage.

a. Using leading edge flap seal alignment tool set (figure 9-24), check fit and alignment of leading edge flap seal along full length of seal (figure 9-25).

b. Correct any bends or adjust fit of seal by tapping metal seal strip with nonmetallic block and mallet.

c. Using leading edge flap seal alignment tool set, check fit and alignment of leading edge flap seal striker along full length of striker (figure 9-25).

d. Correct any bends or adjust fit of seal striker by tapping striker with nonmetallic block and mallet.

e. Lubricate hinge pins with MIL-L-7870 lubricating oil.

f. Align flap and wing hinge holes and install hinge pins and washers.

g. Swing flap upward to retracted position and check that approximate gap of 0.06 inch exists along hinge line. Trim as necessary.

h. Install outboard cylinder rod end attaching bolt (bolthead outboard) partially in flap lug with bolt end clear of rod and slot. Install attaching bolt for inboard cylinder in similar manner, with bolthead inboard.

i. Manually rotate flap upward to align rod end and flap lug holes.

j. Push outboard bolt through rod end attaching hole. Install washer and nut. Tighten nut finger-tight.

NOTE

If outboard bolt cannot be pushed through rod end attaching hole readily because of limited access, use following method: insert a tube, bent as required, through the tunnel leading from tip of flap (position light opening) to bolthead. Push bolt through rod end hole with tube.

k. Push inboard cylinder bolt through rod end attaching hole. Install washer and nut. Tighten nut finger-tight.

l. Connect bonding jumper and protective strap with bolt, washer, and nut.

m. Apply hydraulic power and retract flap to locked position.

n. Rig flap (paragraph 9-44).

o. Install new cotter pins at rod end attaching bolts.

p. With flap retracted, check that the minimum gap along hinge line is 0.06 inch. Trim as necessary.

q. Clamp wiring and install wing position light assembly and fairing with screws.

r. Check for 0.01-inch minimum to 0.05-inch maximum gap between light fairing assembly and outboard section. Trim as necessary.

s. Perform normal operational checkout (paragraph 9-35).

t. Close accesses 3112-1 and 3112-2 or 4111-1 and 4111-2.

u. Close accesses 3212-4 through 3212-9 or 4211-4 through 4211-9.

9-96. TRAILING EDGE FLAP REMOVAL AND INSTALLATION.

Test Equipment Required

Figure & Index No.	*Name*	*AN Type Designation*	*Use and Application*
	Equipment for connecting external electrical power		Connect electrical power
	Equipment for connecting external hydraulic power		Connect hydraulic power
	Torque wrench, 5 to 50 pound-inches	GGG-W-686	Tighten transmitter link bolt
	Cable tensiometer	T60-1001-C8-00	Check 6° rudder stops cable tension

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9-97. REMOVAL.

NOTE

On airplanes before T.O. 1A-7D-524, if removing left flap, open accesses 5111-1 and 5111-4 and relieve 6° rudder stop cable tension by loosening turnbuckle.

a. Connect external electrical power (T.O. 1A-7D-2-1).

b. Connect external hydraulic power to PC No. 2 hydraulic system (T.O. 1A-7D-2-1).

CAUTION

To prevent interference with flap and possible damage, ensure engine cooling hole cover (215-00266-4) is removed before operating flaps.

c. Extend flaps and shut down hydraulic power.

d. Open accesses 3133-7 and 3133-10 to remove left flap or 4133-7 and 4133-10 to remove right flap.

e. If removing left flap, remove cotter pin, nut, washers, and bolt connecting trailing edge flap synchro transmitter link to eyebolt on leading edge of flap.

f. On airplanes through AF69-6196 if removing right flap, disconnect AFCS gain control switch link from flap; or on airplanes AF69-6197 and subsequent, disconnect trailing edge flap position potentiometer link from eyebolt on flap.

g. Disconnect bonding jumpers from each end of flap by removing screws and washers.

h. Disconnect slot door linkage at wing trailing edge by removing cotter pins, washers, and pins.

i. Deleted.

j. Support flap and remove cotter pin, nut, bolt, and washers attaching flap to cylinder rod end at both cylinders.

k. Open accesses 3233-6, 3233-8, 3233-9, and 3233-11 to remove left flap or 4233-6, 4233-8, 4233-9 and 4233-11 to remove right flap.

l. Remove screws securing flap hinge pin bolt access support clips and remove clips.

m. Support flap. Remove cotter pins, nuts, bolts, and washers securing flap to wing fittings. Remove flap.

n. Remove access plates for slot door hinge pins.

o. Remove hinge pins and slot doors.

9-98. INSTALLATION.

a. Lubricate slot door hinge pins with MIL-L-7870.

b. Attach flap slot doors to flap with hinge pins.

c. Rotate slot door to closed position.

d. Check that gap along mating edges of slot door and flap is 0.06 to 0.12 inch. Trim slot door as necessary.

e. Install access plates for slot door hinge pins.

f. Support flap and connect flap to wing at hinge lugs with bolts (outboard bolthead facing inboard, inboard bolthead facing outboard), washers, and nuts. Tighten nuts finger-tight. Back nuts off as necessary to align cotter pin holes and install new cotter pins.

g. Install flap hinge pin bolt access support clips and secure with screws.

h. Apply hydraulic power and retract flap cylinder pistons. Shut down hydraulic power.

CAUTION

To prevent damage during flap retraction, ensure that trailing edge synchro transmitter connecting link for left flap, AFCS gain control switch link (right flap), and 6° rudder stop cable fitting are clear of flap retraction area.

i. Raise flap manually and secure in retracted position to check clearance.

j. With flap in retracted position, rotate slot doors to closed position and mark for trimming to obtain following clearances. Trim as necessary.

0.19 to 0.31 inch along mating edges of flap, slot doors, and fuselage.

0.06 to 0.12 inch along mating edges of wing and slot door.

0.07 to 0.16 inch along mating edges of flap, slot doors, and fuel overboard dump fitting.

k. Swing flap open.

l. Apply hydraulic power and extend cylinder pistons.

m. Install bolt, washers,and nut attaching each cylinder to flap (inboard bolthead outboard and outboard bolthead inboard). Tighten nuts finger-tight.

n. Retract flaps.

o. Check that maximum spanwise step between trailing edge of flap and wing stub fairing does not exceed 0.06 inch. Install new cotter pins at rod end attaching bolts if step is within tolerance and continue with following steps. Rig flap (paragraph 9-45) if step exceeds 0.06 inch.

NOTE

Ensure synchro link assembly is connected to the outboard side of eyebolt.

p. When installing left flap, connect trailing edge flap synchro transmitter link to flap eyebolt with bolt, washers, and nut. Tighten nut to 14 (±1) pound-inches torque and install new cotter pin.

q. Adjust flap synchro transmitter (paragraph 9-109).

r. On airplanes through AF69-6196, connect AFCS gain control switch to right flap.

s. On airplanes AF69-6197 and subsequent, connect trailing edge flap 15° potentiometer linkage as follows:

1. With trailing edge flaps fully up and link temporarily connected to eyebolt, check that link will clear threaded portion of potentiometer shaft by 0.15 to 0.35 inch (figure 9-18A). If necessary, loosen jamnut and adjust eyebolt until clearance is correct. Tighten jamnut.

NOTE

Ensure potentiometer link is connected to inboard side of eyebolt.

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2. Connect link to eyebolt with bolt, washers and nut (figure 9-18A, view A). Tighten nut to 12 to 15 pound-inches. Install new cotter pin.

3. Extend and retract flaps and check that linkage operates freely through full range of flap movement with no binding or chaffing. Adjust arm on potentiometer shaft, if required.

4. If eyebolt or arm assembly was adjusted, perform trailing edge 15° potentiometer adjustment (T.O. 1A-7D-2-9).

t. Extend flaps.

u. Check for proper gap between trailing edge air deflector and leading edge of fully extended trailing edge flap (figure 9-26). If necessary, adjust gap to dimensions shown by bending deflectors with trailing edge flap deflector adjustment tool, Part No. 8035577.

v. Rig flap slot door (paragraph 9-46).

w. Connect bonding jumpers to each end of flap with washers and screws.

x. Close accesses 3133-7 and 3133-10 or 4133-7 and 4133-10.

y. Close accesses 3233-6, 3233-8, 3233-9, and 3233-11 or 4233-6, 4233-8, 4233-9, and 4233-11.

9-99. FLAP SLOT DOOR REMOVAL AND INSTALLATION.

Test Equipment Required

Figure & Index No.	*Name*	*AN Type Designation*	*Use and Application*
	Equipment for connecting external electrical power		Connect electrical power
	Equipment required for connecting external hydraulic power		Connect hydraulic power TT08D077-04-70

9-100. REMOVAL.

a. Connect external electrical power (T.O. 1A-7D-2-1).

b. Connect external hydraulic power to PC No. 2 hydraulic system (T.O. 1A-7D-2-1).

CAUTION

To prevent interference with flap and possible damage, ensure engine cooling hole cover (215-00266-4) is removed before operating flaps.

c. Extend flaps and shut down hydraulic power.

NOTE

Tag links for reinstallation in same positions from which removed.

d. Remove cotter pins, washers, and pins attaching door links to slot doors and wing. Remove links.

e. Remove access plates for hinge pins.

f. Remove hinge pins and slot door.

9-101. INSTALLATION.

NOTE

The flap slot door hinge will have adequate strength at airspeeds up to the maximum permissible (T.O. 1A-7D-1) if every second hinge lug is in good condition.

a. Inspect flap slot door hinge lugs. Replace slot door if two or more adjacent lugs are cracked or broken.

a-1. Lubricate hinge pins using MIL-L-7870 lubricating oil.

b. Engage slot door with trailing flap and install hinge pins. If new hinge pin is being installed, allow to protrude approximately 3/16 inch beyond hinge at access plate opening and squeeze end to partially flatten.

c. Apply hydraulic power and retract flaps.

d. Shut down but do not disconnect hydraulic power.

e. Rotate slot door to closed position and check gaps as follows:

1. Check that gap between forward edge of slot door and trailing edge of wing skin is 0.09 (±0.03) inch.

2. Check that gap between aft edge of slot door skin and forward edge of trailing edge flap skin is 0.09 (±0.03) inch.

3. Check that gap between edge of slot door skin and adjacent flap hinge fitting is 0.10 (±0.06) inch.

4. Check that skin gap of 0.12 (+0.04, -0.05) inch exists at outboard edge of outboard slot door.

5. Check that skin gap of 0.25 (±0.06) inch exists at inboard edge of inboard slot door.

6. Trim slot door as necessary to obtain correct gap tolerances.

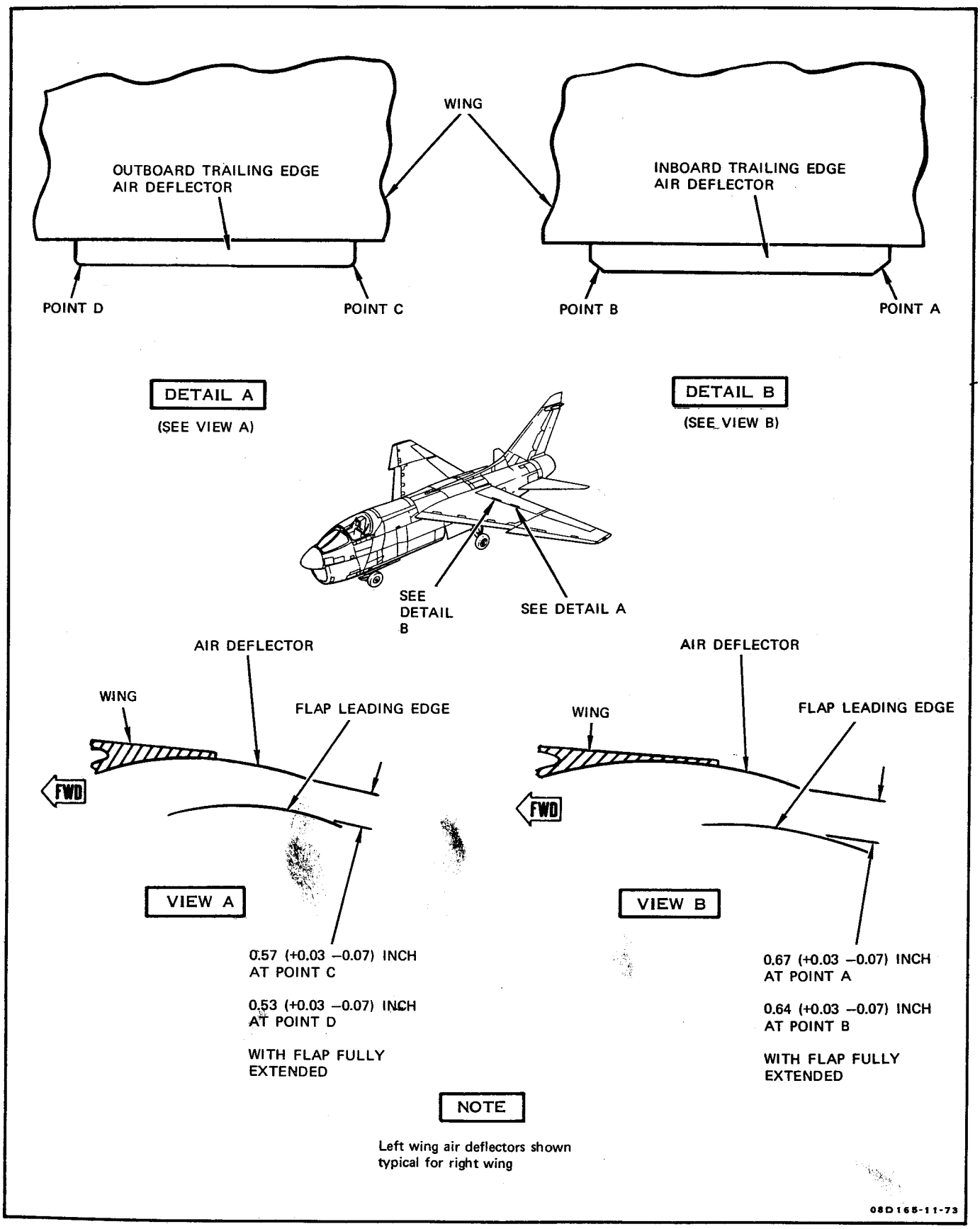


Figure 9-26. Trailing Edge Flap Air Deflector Clearance

NOTE

Install links in same positions as tagged during removal.

f. Attach only the inboard door link to slot door with pin. Remaining links, washers, and cotter pins will be installed and all links connected to wing trailing edge during slot door rigging.

g. Install hinge pin access plates and secure with screws.

h. Rig flap slot doors (paragraph 9-46).

9-102. LEADING EDGE FLAP DOWN POSITION SWITCH REMOVAL AND INSTALLATION. (See figure 9-27.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external hydraulic power	Connect hydraulic power TT08D145-02-75

9-103. REMOVAL.

a. Connect external hydraulic power to PC No. 2 hydraulic system (T.O. 1A-7D-2-1).

CAUTION

To prevent interference with flap and possible damage, ensure engine cooling hole cover (215-00266-4) is removed before operating flaps.

b. Extend flaps and shut down hydraulic power.

c. Open access 3113-6.

d. Remove cotter pin (1), clevis pin (2), and washers (3) securing arm to flap connecting bracket (4).

e. Remove position switch lever arm retaining nut (5) and washer (6). Slide arm (7) off of switch shaft (8).

f. Remove lower nut (9) and clevis (10) from end of clevis rod (11) noting exposed threads on rod. Remove upper nut (12). Retain clevis and nuts to install on new rod.

g. Cut lockwire and remove position switch retaining nut (13) and lockwasher (14).

h. Mark and cut wires at splice.

i. Remove position switch (15).

9-104. INSTALLATION.

a. Support new position switch (15) and splice wires.

b. Insert position switch shaft through bracket hole. Install lockwasher (14) and switch retaining nut (13). Tighten retaining nut and secure with MS20995C41 lockwire.

c. Install clevis (10) and nuts (12 and 9) on clevis rod (11) with same number of threads exposed as noted during removal. Secure nuts with MS20995C32 lockwire.

d. Adjust position switch (15) and lever arm (7) to operating position by rotating switch shaft (8) clockwise until resistance to movement is noted. Center shaft in area of resistance.

e. Slide lever arm (7) over switch shaft (8) engaging serrations and install washer (6) and nut (5). Tighten retaining nut.

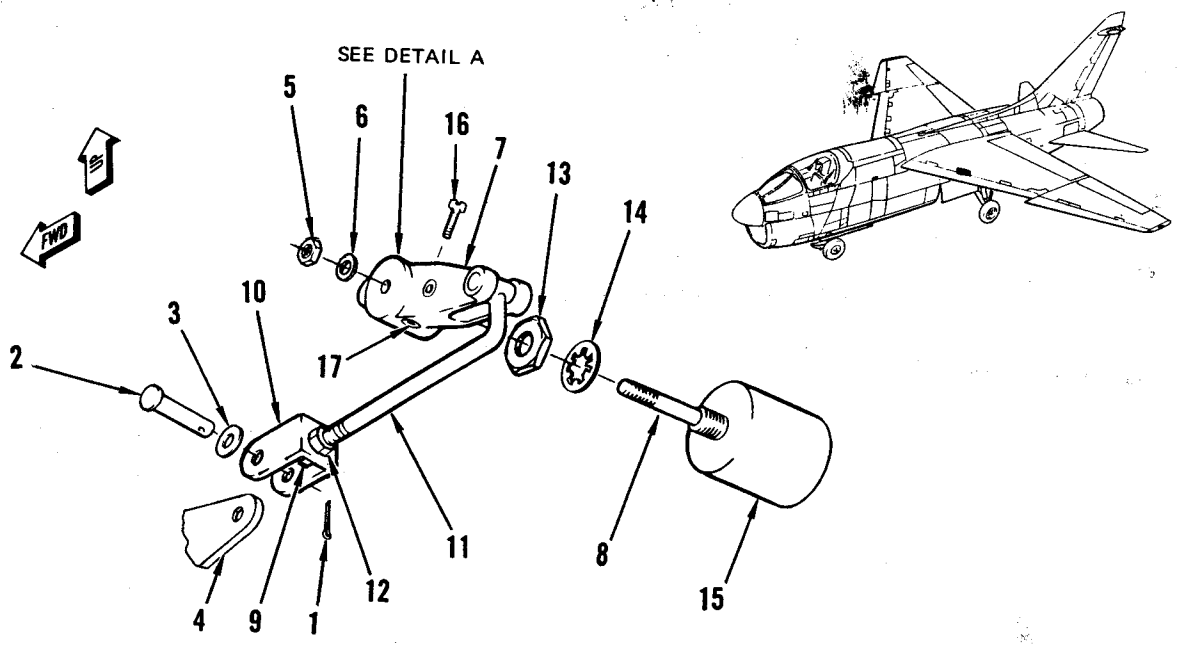
f. Align clevis (10) and flap position bracket (4). Install clevis pin (2), washers (3), and cotter pin (1) securing clevis to bracket.

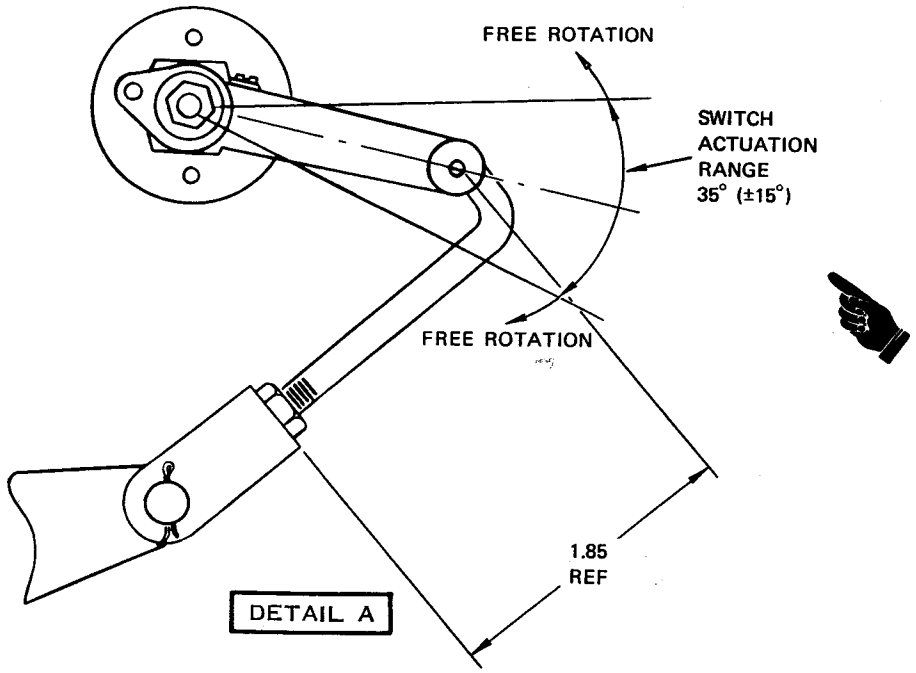
g. Rig position switch (paragraph 9-105).

9-105. RIGGING LEADING EDGE FLAP DOWN POSITION SWITCH.

Test Equipment Required

Figure & Index No.	*Name*	*AN Type Designation*	*Use and Application*
	Equipment for connecting external electrical power		Connect electrical power
	Equipment required forcconnecting external hydraulic power		Connect hydraulic power TT08D078-04-70





1. Cotter pin
2. Clevis pin
3. Washer (2)
4. Bracket
5. Nut
6. Washer
7. Arm
8. Switch shaft
9. Nut
10. Clevis
11. Clevis rod
12. Nut
13. Retaining nut
14. Lockwasher
15. Switch
16. Lockscrew
17. Worm gear

08D132-09-76

Figure 9-27. Leading Edge Flap Down Position Switch Removal and Installation

a. Connect external hydraulic power to PC No. 2 hydraulic system (T.O. 1A-7D-2-1).

b. Connect external electrical power (T.O. 1A-7D-2-1).

CAUTION

To prevent interference with flap and possible damage, ensure engine cooling hole cover (215-00266-4) is removed before operating flaps.

c. Extend flaps.

d. Open access 3113-6.

e. Remove nut (5, figure 9-27) and washer (6) attaching arm (7) to switch shaft (8). Slide arm off switch shaft.

f. Ensure that lockscrew (16) is secured with MS20995C20 lockwire.

NOTE

Switch actuation occurs in a range of 35° (±15°).

g. Using fingers, rotate switch shaft (8) counterclockwise until torque rise is felt. Continue rotation to position switch shaft at mid-travel of switch actuation range. Leading edge flap position indicator should indicate DN.

h. While retaining position of switch shaft, slide arm onto shaft, and secure with washer (6) and nut (5).

i. Place flap handle in UP, and retract flaps, ensuring that switch actuating linkage does not contact structure during retraction.

j. Check that leading edge flap position indicator indicates UP.

k. Disconnect external electrical and hydraulic power (T.O. 1A-7D-2-1).

l. Close access 3113-6.

9-106. TRAILING EDGE FLAP SYNCHRO TRANSMITTER REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	GGG-W-686	Torque wrench, 5 to 50 pound-inches	Tighten transmitter rod nut
			TT08D079-05-69

9-107. REMOVAL.

a. Open access 3233-3.

b. Loosen nut securing arm to trailing edge flap synchro transmitter shaft.

c. Remove cotter pin, nut, bolt, and two washers securing arm to flap connecting link and remove arm.

d. Remove moistureproof coating from transmitter electrical terminals. Tag wires for identification during installation, and remove screws securing wires to transmitter.

e. Cut lockwire and remove four screws and washers securing transmitter to bracket.

f. Remove transmitter.

9-108. INSTALLATION.

a. Ensure that any coating which might interfere with good electrical contact is removed from wiring and transmitter terminals. Secure wires to terminals with screws as tagged at removal.

b. Apply coating of ECCO VE moistureproofing compound (or equivalent) to terminals.

c. Secure transmitter to bracket with four screws and washers.

d. Secure screws with MS20995C32 lockwire.

e. Slide arm onto transmitter shaft and secure other end of arm to flap connecting link with bolt, two washers, and nut. Tighten nut to 14 (±1) pound-inches torque and install new cotter pin.

f. Adjust transmitter (paragraph 9-109).

9-109. ADJUSTING TRAILING EDGE FLAP SYNCHRO TRANSMITTER.

Test Equipment Required

Figure & Index No.	*Name*	*AN Type Designation*	*Use and Application*
	Equipment for connecting external electrical power		Connect electrical power
	Equipment for connecting external hydraulic power		Connect hydraulic power
	Torque wrench, 5 to 50 pound-inches	GGG-W-686	Tighten transmitter link nut
			TT08D080-04-70

a. Connect external electrical power (T.O. 1A-7D-2-1).

b. Connect external hydraulic power to PC No. 2 hydraulic system (T.O. 1A-7D-2-1).

c. Open access 3233-3.

CAUTION

To prevent interference with flap and possible damage, ensure engine cooling hole cover (215-00266-4) is removed before operating flaps.

d. If flaps are extended, retract.

e. Loosen trailing edge flap synchro transmitter shaft lockscrew and adjust shaft until trailing edge flap indicator indicates 0°. Tighten lockscrew.

f. Extend flaps and check that trailing edge flap indicator indicates 40° (±1°).

NOTE

If trailing edge flap indicator indicates 40° (±1°), proceed to step o. If trailing edge flap indicator does not indicate 40° (±1°), proceed to step g.

g. Disconnect synchro transmitter link from eyebolt on trailing edge flap.

NOTE

Install washers, as required, between bracket and support if minimum flap indication of 39° cannot be obtained.

h. Loosen eyebolt jamnut and adjust eyebolt (clockwise if trailing edge flap indicator indicates more than 40° (±1°) or counterclockwise if trailing edge flap indicator indicates less than 40° (±1°)) until trailing edge flap indicator indicates 40° (±1°).

i. Reconnect synchro transmitter link to eyebolt on trailing edge flap. Do not torque nut at this time.

j. Retract flaps and check that trailing edge flap indicator indicates 0°. Repeat step e if 0° is not indicated on trailing edge flap indicator.

k. Extend flaps and check that trailing edge flap indicator indicates 40° (±1°).

l. Repeat steps g through k until trailing edge flap indicator indicates 0° when flaps are retracted and 40° (±1°) when flaps are extended.

m. Tighten eyebolt jamnut and secure with MS20995C32 lockwire.

n. Tighten nut securing link to eyebolt 14 (±1) pound-inches torque and install new cotter pin.

o. Disconnect external electrical and hydraulic power.

p. Close access 3233-3.

9-110. TRAILING EDGE FLAP POSITION INDICATOR REMOVAL AND INSTALLATION.

Test Equipment Required

Figure & Index No.	*Name*	*AN Type Designation*	*Use and Application*
	Equipment for connecting external electrical power		Connect electrical power
	Equipment for connecting external hydraulic power		Connect hydraulic power
			TT08D081-12-68

9-111. REMOVAL.

a. Loosen indicator attaching screw adjacent to indicator.

b. Pull indicator out until electrical connector is exposed.

c. Disconnect electrical connector from indicator.

d. Remove indicator from airplane.

9-112. INSTALLATION.

a. Connect electrical connector to indicator.

b. Position indicator into mounting position.

c. Secure indicator in instrument panel by tightening attaching screw.

d. Connect external electrical power (T.O. 1A-7D-2-1).

e. Install left variable trailing edge flap protractor (paragraph 9-41).

f. Connect external hydraulic power to PC No. 2 hydraulic system (T.O. 1A-7D-2-1).

g. With flaps retracted, check that indicator indicates 0°.

h. Extend trailing edge flaps partially. Check that indicator indicates approximately same as left variable trailing edge flap protractor.

i. Extend trailing edge flaps fully. Check that indicator indicates approximately 40°.

j. Retract flaps.

k. Perform interior lighting system operational checkout of indicator (T.O. 1A-7D-2-11).

l. Disconnect external electrical and hydraulic power (T.O. 1A-7D-2-1).

m. Remove variable trailing edge flap protractor.

9-113. EMERGENCY FLAP SELECTOR VALVE REMOVAL AND INSTALLATION.

9-114. REMOVAL.

a. Open access 1123-3.

WARNING

To prevent injury from high pressure, check that emergency flap accumulator is dumped before disconnecting lines.

b. Dump emergency flap accumulator (T.O. 1A-7D-2-1).

c. Disconnect hydraulic lines from valve and cap lines.

d. Disconnect electrical connector from valve.

e. Remove two mounting bolts and washers and remove valve.

f. Remove fittings from valve and discard O-rings and retainers.

9-115. INSTALLATION.

a. Install fittings in valve using new O-rings and retainers.

b. Install valve with two mounting bolts and washers.

c. Connect electrical connector to valve.

d. Connect hydraulic lines to valve.

e. Bleed emergency flap system (paragraph 9-53).

f. Perform flap system emergency operational checkout (paragraph 9-36).

g. Inspect for leakage at lines and fittings which were disconnected or loosened and at valve.

h. Close access 1123-3.

9-116. EMERGENCY FLAP ACCUMULATOR PACKAGE REMOVAL AND INSTALLATION.

9-117. REMOVAL.

WARNING

To prevent injury from high pressure, depressurize accumulator before disconnecting lines.

a. Depressurize accumulator (T.O. 1A-7D-2-1).

b. Open access 2123-3.

c. Disconnect electrical connectors.

WARNING

To avoid injury to personnel, perform positive depressurization check of accumulator after pneumatic lines are disconnected by manually operating accumulator precharge shutoff valve. Ensure that personnel are not in line with discharge port when valve is operated.

d. Disconnect pneumatic line from accumulator. Depress manual button on accumulator precharge shutoff valve to ensure that accumulator is depressurized.

e. Disconnect hydraulic lines from accumulator.

f. Unlace heating blanket and remove from accumulator.

g. Loosen mounting clamps and remove accumulator.

h. Remove check valve and unions from actuator.

9-118. INSTALLATION.

a. Install check valve and unions with new packings in accumulator.

b. Drain preservative fluid and fill oil side of accumulator with hydraulic fluid.

c. Install accumulator by tightening mounting clamps.

d. Secure heater blanket to accumulator (paragraph 9-121).

e. Connect pneumatic and hydraulic lines to accumulator.

f. Connect electrical connectors.

g. Bleed emergency flap system (paragraph 9-53).

h. Perform flap system emergency operational checkout (paragraph 9-36).

i. Inspect for leakage at lines and fittings which were disconnected.

j. Disconnect external hydraulic and electrical power (T.O. 1A-7D-2-1).

k. Close accesses 1121-3 and 2123-3.

9-119. EMERGENCY FLAP ACCUMULATOR HEATING BLANKET REMOVAL AND INSTALLATION.

Test Equipment Required

Figure & Index No.	*Name*	*AN Type Designation*	*Use and Application*
	Equipment for connecting external electrical power		Connect electrical power
	AC voltmeter	403B	Measure voltage
			TT08D084-02-75

9-120. REMOVAL.

a. Open access 2123-3.

b. Remove insulating tape and unlace blanket.

c. Unclamp wiring to blanket, cut wires at convenient location for splicing, and remove blanket.

CAUTION

To prevent damage to blanket heating wires and thermostat, do not fold or roll blanket.

9-121. INSTALLATION.

a. Apply double layer of 1/2-inch wide MIL-I-15126, Type GFT, insulating tape over metal fasteners on interior surface of heater blanket.

b. Position heating blanket on emergency accumulator package and secure with 3/32-inch diameter MIL-C-43307 nylon cord lacing.

CAUTION

To prevent an electrical short and possible fire, the two grooves in the top half of the blanket shall be aligned with ridges on top half of the accumulator.

c. Splice blanket wires to airplane wires and clamp wiring.

d. Connect external electrical power (T.O. 1A-7D-2-1).

e. Check for ac voltage at all blanket hooks. If voltage is 3 volts ac or more, replace blanket .

f. Allow 5 minutes for blanket to warm up and check that blanket is heating.

g. Disconnect external electrical power.

h. Apply double layer of MIL-I-15126, Type GFT (1/2-inch wide), insulating tape over blanket hooks.

i. Close access 2123-3.

9-122. AMF EXTEND VALVE REMOVAL AND INSTALLATION. (Airplanes AF69-6197 and Subsequent.)

9-123. REMOVAL. (See figure 9-28.)

a. Open access 1123-4.

b. Disconnect hydraulic lines (1) from valve. Cap lines.

c. Disconnect electrical connector (2) from valve.

d. Remove bolts (3) and washers (4), and remove valve (5) from airplane.

e. Loosen jamnuts (6) and remove elbows (7), packings (8), and retainers (9) from valve. Discard packings and retainers. Plug valve ports.

f. Loosen jamnut (10) and remove elbow (11), packing (12), and retainer (13). Discard packing and retainer. Plug valve port.

9-124. INSTALLATION. (See figure 9-28.)

a. Install jamnut (10), new retainer (13), and new packing (12) on elbow (11). Install elbow in pressure inlet port. Do not tighten jamnut.

b. Install jamnuts (6), new retainers (9), and new packings (8) on elbows (7). Install elbows in valve. Do not tighten jamnuts.

c. Install valve (5) in airplane and secure with bolts (3) and washers (4).

d. Connect electrical connector (2) to valve.

e. Connect hydraulic lines (1) to valve and tighten jamnuts (6 and 10).

f. Bleed flap system (paragraph 9-50).

NOTE

Check for leakage at line connections during checkout.

g. Perform flap system normal operational checkout (paragraph 9-35).

h. Close access 1123-4.

9-125. AMF EXTEND SHUTOFF VALVE REMOVAL AND INSTALLATION. (Airplanes AF69-6197 and Subsequent.)

9-126. REMOVAL. (See figure 9-29.)

a. Open access 1123-4.

b. Disconnect hydraulic lines (1) from valve. Cap lines.

c. Disconnect electrical connector (2) from valve.

d. Remove bolts (3) and washers (4), and remove valve (5) from airplane.

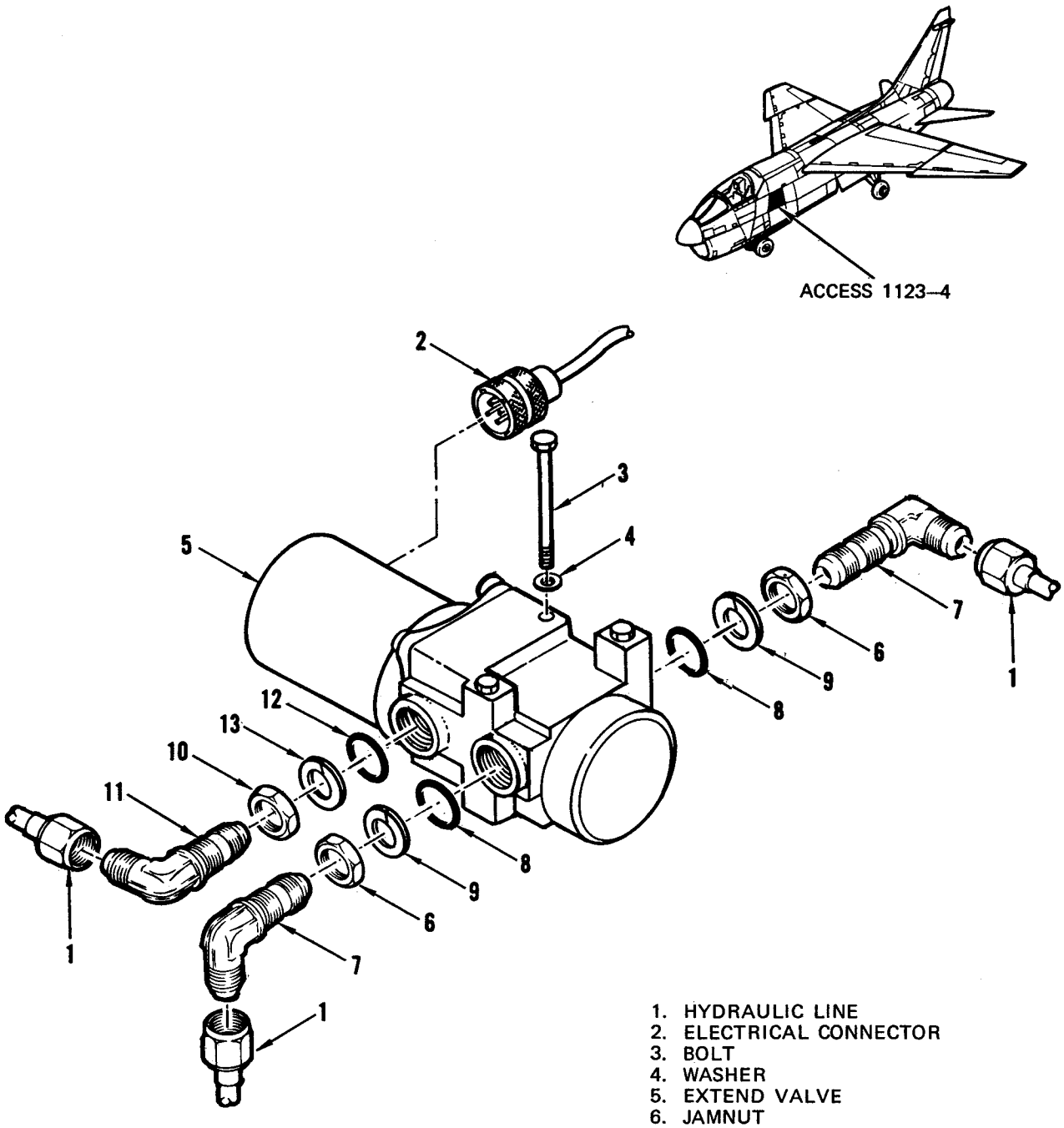


Figure 9-28. AMF Extend Valve Removal and Installation (Airplanes AF69-6197 and Subsequent)

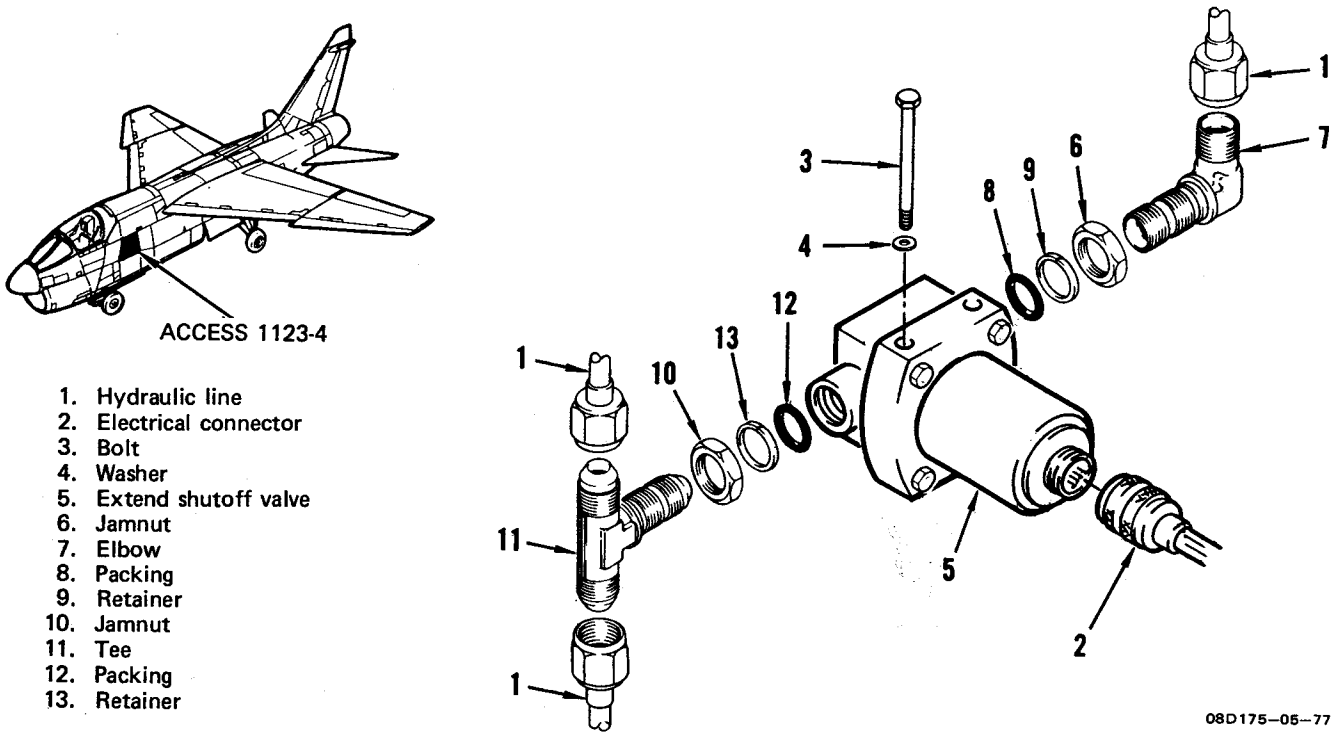


Figure 9-29. AMF Extend Shutoff Valve Removal and Installation (Airplanes AF69-6197 and Subsequent)

e. Loosen jamnut (6) and remove elbow (7), packing (8), and retainer (9) from valve.

f. Loosen jamnut (10) and remove tee (11), packing (12), and retainer (13) from valve.

g. Discard packings and retainers. Plug valve ports.

9-127. INSTALLATION. (See figure 9-29.)

a. Install jamnut (10), new retainer (13), and new packing (12) on tee (11). Install tee in outlet port of valve. Do not tighten jamnut.

b. Install jamnut (6), new retainer (9), and new packing (8) on elbow (7). Install elbow in inlet port of valve. Do not tighten jamnut.

c. Install valve (5) in airplane and secure with bolts (3) and washers (4).

d. Connect electrical connector (2) to valve.

e. Connect hydraulic lines (1) to valve and tighten jamnuts (6 and 10).

f. Bleed flap system (paragraph 9-50).

NOTE

Check for leakage at line connections during checkout.

g. Perform flap system normal operational checkout (paragraph 9-34).

h. Close access 1123-4.

9-128. AMF RETRACT VALVE REMOVAL AND INSTALLATION. (Airplanes AF69-6197 and Subsequent.)

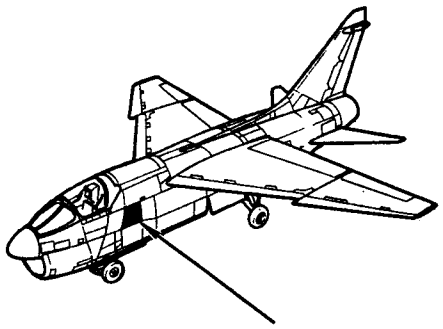
9-129. REMOVAL. (See figure 9-30.)

a. Open access 1123-4.

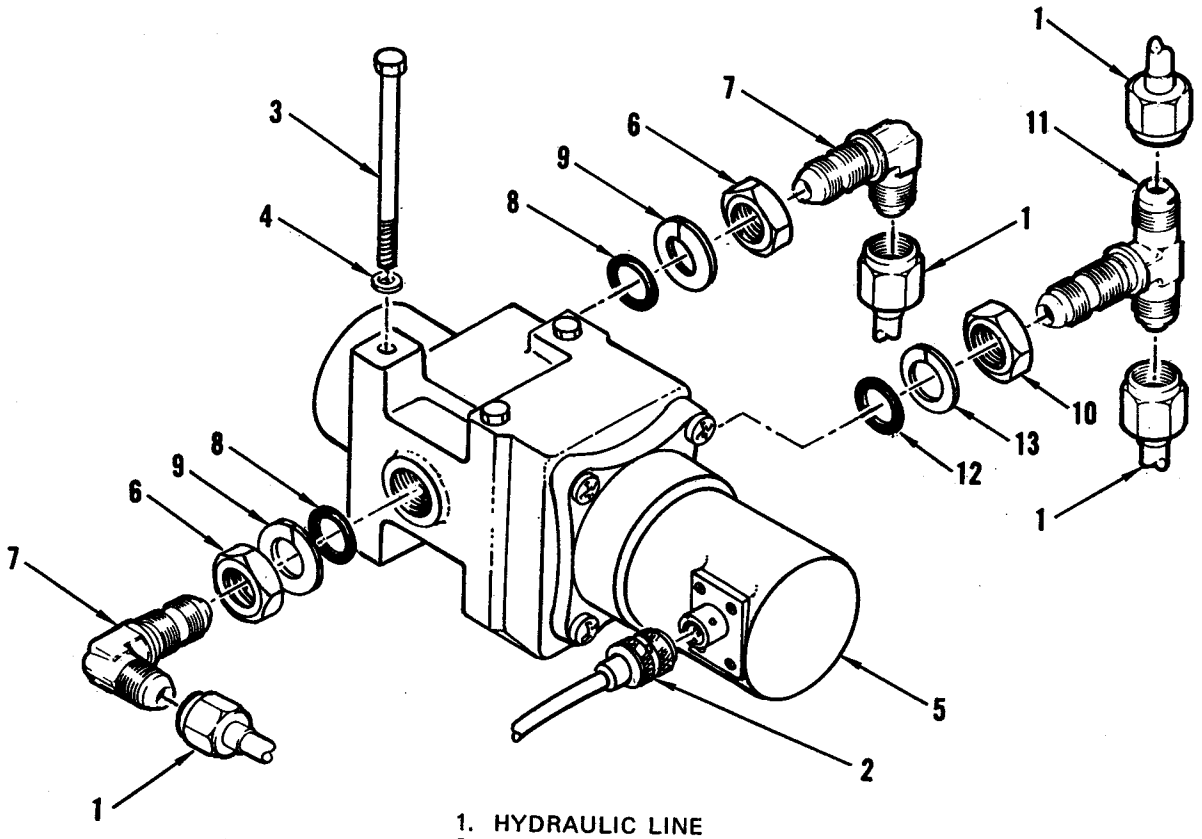
b. Disconnect hydraulic lines (1) from valve. Cap lines.

c. Disconnect electrical connector (2) from valve.

d. Remove bolts (3) and washers (4), and remove valve (5) from airplane.



ACCESS 1123–4



1. HYDRAULIC LINE
2. ELECTRICAL CONNECTOR
3. BOLT
4. WASHER
5. RETRACT VALVE
6. JAMNUT
7. ELBOW
8. PACKING
9. RETAINER
10. JAMNUT
11. TEE
12. PACKING
13. RETAINER

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Figure 9-30. AMF Retract Valve Removal and Installation (Airplanes AF69-6197 and Subsequent)

e. Loosen jamnuts (6) and remove elbows (7), packings (8), and retainers (9) from valve.

f. Loosen jamnut (10) and remove tee (11), packing (12), and retainer (13) from valve.

g. Discard packings and retainers. Plug valve ports.

9-130. INSTALLATION. (See figure 9-30.)

a. Install jamnut (10), new retainer (13), and new packing (12) on tee (11). Install tee in P2 port of valve. Do not tighten jamnut.

b. Install jamnuts (6), new retainers (9), and new packings (8) on elbows (7). Install elbows in valve. Do not tighten jamnuts.

c. Install valve (5) in airplane and secure with bolts (3) and washers (4).

d. Connect electrical connector (2) to valve.

e. Connect hydraulic lines (1) to valve and tighten jamnuts (6 and 10).

f. Bleed flap system (paragraph 9-50).

NOTE

Check for leakage at line connections during checkout.

g. Perform flap system normal operational checkout (paragraph 9-35).

h. Close access 1123-4.

9-131. AMF THERMAL RELIEF VALVE REMOVAL AND INSTALLATION. (Airplanes AF69-6197 and Subsequent.)

9-132. Remove and install the thermal relief valve in sequence shown in figure 9-31, observing the following:

a. Open access 2123-6.

b. Cap hydraulic lines and plug valve ports.

c. Install new packings (6 and 8) in replacement valve.

d. After installation, bleed flap system (paragraph 9-50).

e. Close access 2123-6.

9-133. TRAILING EDGE FLAP ACTUATING CYLINDER UPLOCK SWITCH REPLACEMENT. (Airplanes AF69-6197 and Subsequent.)

NOTE

This procedure is typical for all trailing edge flap actuating cylinder uplock switches.

a. Remove cylinder (paragraph 9-80).

b. Cut lockwire, loosen jamnut, and unscrew switch from cylinder.

c. Perform switch adjustment (paragraph 9-134).

d. Install cylinder (paragraph 9-80).

9-134. TRAILING EDGE FLAPS ACTUATING CYLINDER UPLOCK SWITCH ADJUSTMENT. (Airplanes AF69-6197 and Subsequent.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	AN/PSM-6	Multimeter	Check continuity
	E10385	Hydraulic servicing stand	Pressurize cylinder
	GGG-W-686	Torque wrench, 10 to 150 pound-inches	Tighten switch jamnut
			TTO8D176-05-77

NOTE

This procedure is typical for all trailing edge flap actuating cylinder uplock switches.

a. Remove cylinder (paragraph 9-80).

b. Cut lockwire, loosen jamnut, and unscrew switch from cylinder.

c. Remove switch actuating pin from bore of switch mounting hole.

d. Screw lug end of cylinder into cylinder body until actuating pin cannot be fully inserted.

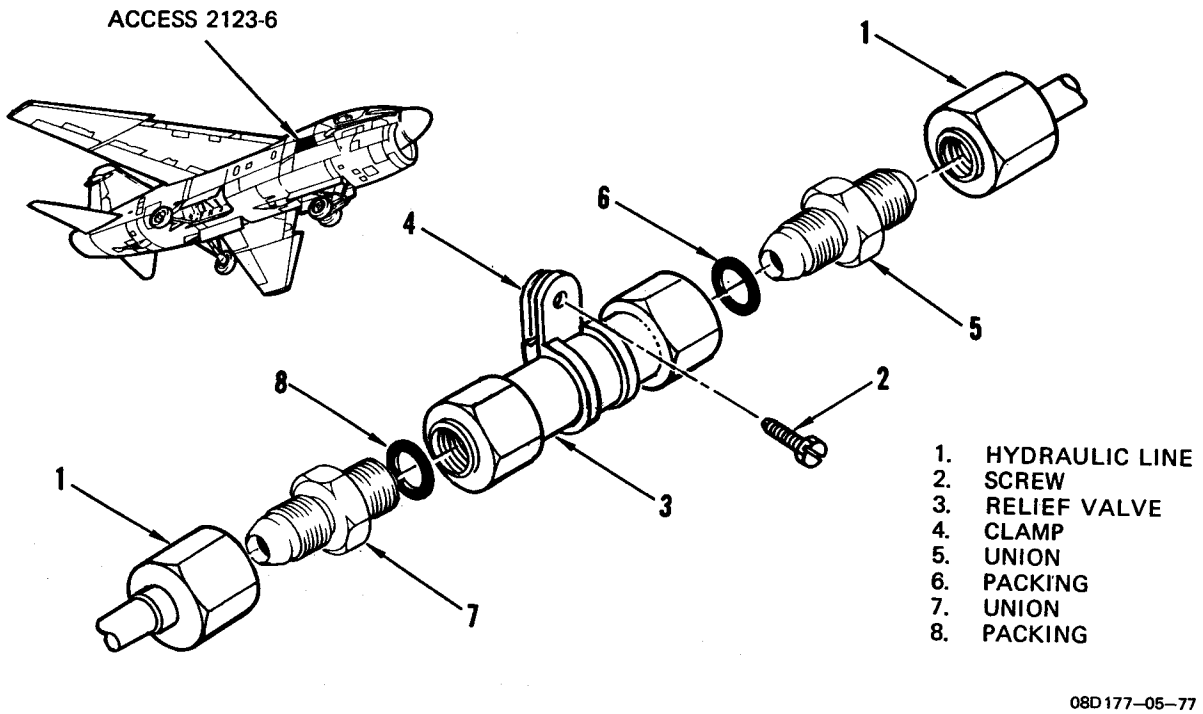


Figure 9-31. AMF Thermal Relief Valve Removal and Installation (Airplanes AF69-6197 and Subsequent)

e. Carefully screw lug end out to position where actuating pin can just be fully inserted. Screw lug end out an additional 1/2 turn, tighten locknut, and secure with MS20995C32 lockwire.

f. Connect cylinder to hydraulic servicing stand. Apply 600 psi hydraulic pressure and retract cylinder piston until internal locks are engaged.

g. Connect multimeter between common and normally open leads of switch.

h. Apply tension load to piston rod end sufficient to overcome seal friction, and take slop out of lock finger-cam engagement.

i. While maintaining tension load, screw switch into cylinder until multimeter indicates continuity (flaps up and locked position). Note position of switch wires with respect to longitudinal centerline of cylinder.

j. Using 600 psi hydraulic pressure, unlock and fully extend cylinder piston. Reduce hydraulic pressure to 0.

k. Screw switch further into cylinder until multimeter again indicates continuity (flaps down and locked position). Note position of switch wires with respect to longitudinal centerline of cylinder.

l. Screw switch out until wires are midway between previously noted switch wire positions. If wires are within 45° of either side of cylinder longitudinal centerline (figure 9-23), proceed to step o. If wires are not in specified area, proceed to step m.

m. Estimate fraction of turn switch must be tightened so wires will be in specified area when switch actuates closed. Remove switch and actuating pin. Grind enough material from pin head to permit required positioning of wires. Remove 0.00425 inch of material for 1/8 turn of switch, 0.0085 inch of material for 1/4 turn, or 0.017 inch of material for 1/2 turn. Do not reduce pin head thickness to less than 0.015 inch.

n. Install pin in cylinder and repeat steps f through m as necessary.

o. Tighten switch jamnut and secure with MS20995C20 lockwire.

p. Disconnect hydraulic servicing stand.

q. Install cylinder (paragraph 9-80).

Section X

SPEED BRAKE SYSTEM

10-1. DESCRIPTION.

10-2. The speed brake system is an electrically controlled, hydraulically operated system which provides the capability for inflight braking of the airplane to decrease airspeed. The amount of braking is proportional to the extent the brake surface is extended into the airstream. The brake can be extended and held in any position between fully closed and fully open. Maximum speed brake extension, with reference to the bottom of the fuselage, is approximately 60°.

10-3. The speed brake system consists of a speed brake surface, two extensions (chines) hinged on each side of the brake, an actuating cylinder, a solenoid-operated selector valve, an electrical control and indicating circuit, a relief valve, and various check valves.

10-4. The surface automatically retracts when the landing gear is extended or electrical power is lost. The surface cannot be extended, if closed, with the landing gear extended. If the brake is extended at high airspeeds, airloads will partially retract the surface.

10-5. An advisory light provides a cockpit indication when the speed brake is not closed. An indicator provides cockpit indication of speed brake position from 0° to 60°.

10-6. For system controls and indicators, see figure 10-1. For system arrangement, see figure 10-2.

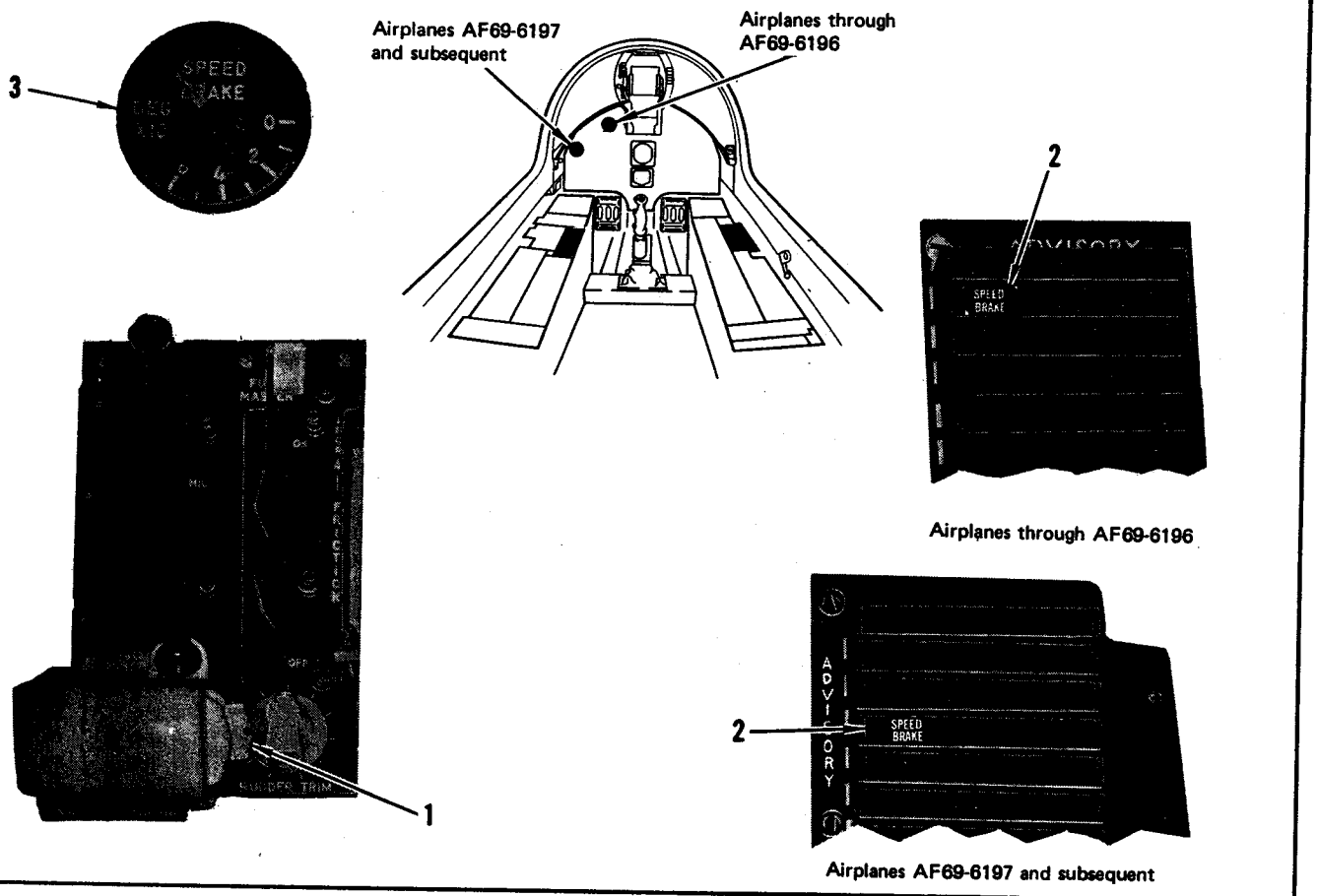
10-7. OPERATION. (See figure 10-3.)

10-8. MECHANICAL AND HYDRAULIC SYSTEM. Moving the speed brake selector switch to OPEN, with the landing gear handle in WHLS UP, completes an electrical circuit to energize both solenoids of the speed brake selector valve. With both solenoids energized, the selector valve directs PC No. 2 hydraulic system pressure to the speed brake actuating cylinder extend port. As the speed brake extends, two speed brake chines (hinged on each side of the speed brake and connected by linkage to structure) are mechanically actuated to enlarge the effective speed brake surface. The chines rotate approximately 105°. A two-way restrictor in the speed brake extend line controls extension rate by restricting flow of hydraulic fluid to the actuating cylinder.

10-9. Moving the speed brake selector switch to STOP completes an electrical circuit to actuate the speed brake selector valve to the hold position. In the hold position, the selector valve blocks all hydraulic fluid flow to the speed brake actuating cylinder. The speed brake remains in the position existing at the time STOP was selected. If excessive airloads are imposed on the speed brake, a relief valve interconnecting the system pressure return lines opens to allow the speed brake to partially close. The relief valve also prevents overpressurization of the speed brake retract line due to thermal expansion. A check valve connecting the cylinder retract port to system return provides a fluid path from system return to keep the cylinder retract side filled with hydraulic fluid.

10-10. Moving the speed brake selector switch to CLOSE interrupts the electrical circuit to the speed brake selector valve, deenergizing both solenoids. With both solenoids deenergized, the selector valve directs hydraulic pressure to the cylinder retract port. As the speed brake closes, the chines are retracted to provide fuselage contour alignment with the speed brake. Internal locks in the cylinder lock the cylinder in the retract position.

10-11. With engine operating, or with PC No. 2 hydraulic system pressure applied to airplane, the speed brake selector valve is normally positioned to maintain the speed brake in retracted position. As long as hydraulic power is



INDEX NO.	CONTROL/INDICATOR	FUNCTION
1	Speed brake selector switch (SP BK)	OPEN – extends speed brake. STOP – prevents speed brake movement. CLOSE – retracts speed brake.
2	Speed brake advisory light (SPEED BRAKE)	On – indicates brake is open.
3	Speed brake position indicator (SPEED BRAKE)	Indicates position of speed brake in 10-degree increments.

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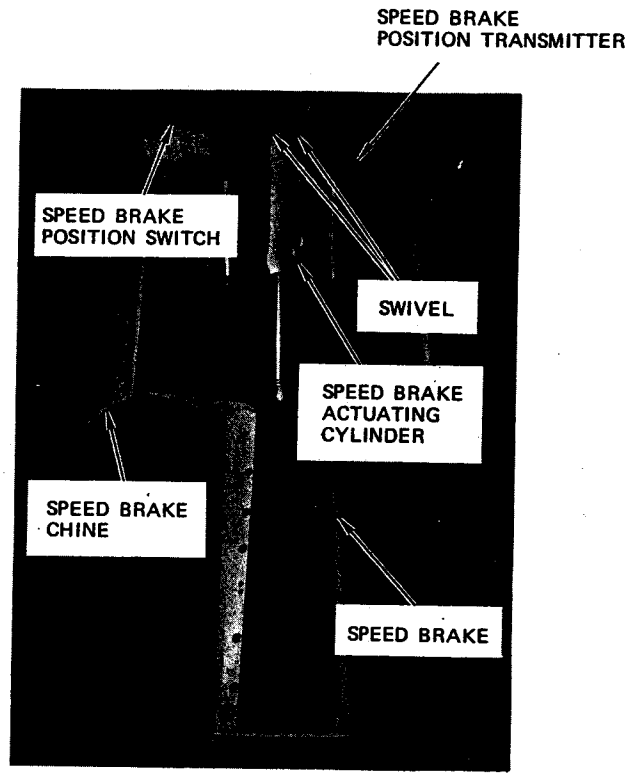
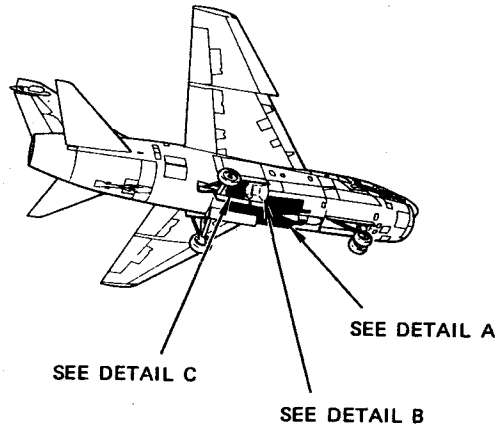
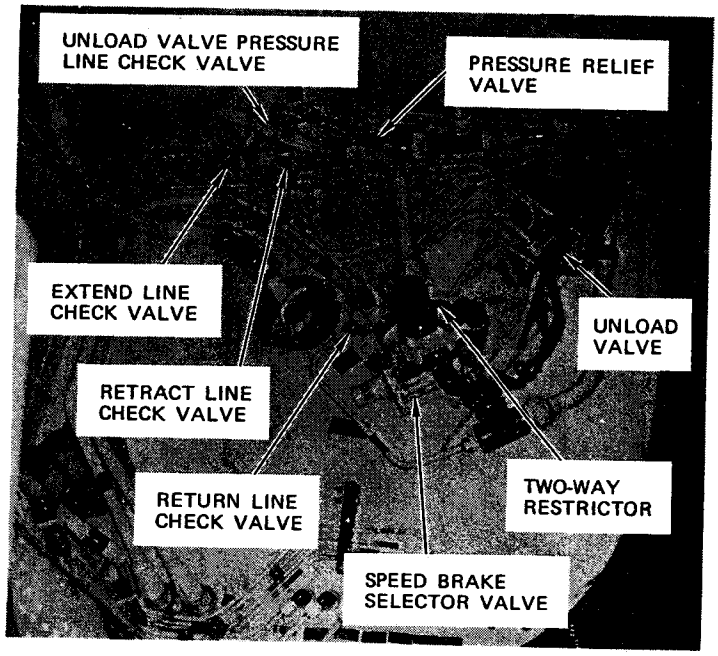
Figure 10-1. Speed Brake System Controls and Indicators



DETAIL A





DETAIL B

(RIGHT WHEEL WELL)

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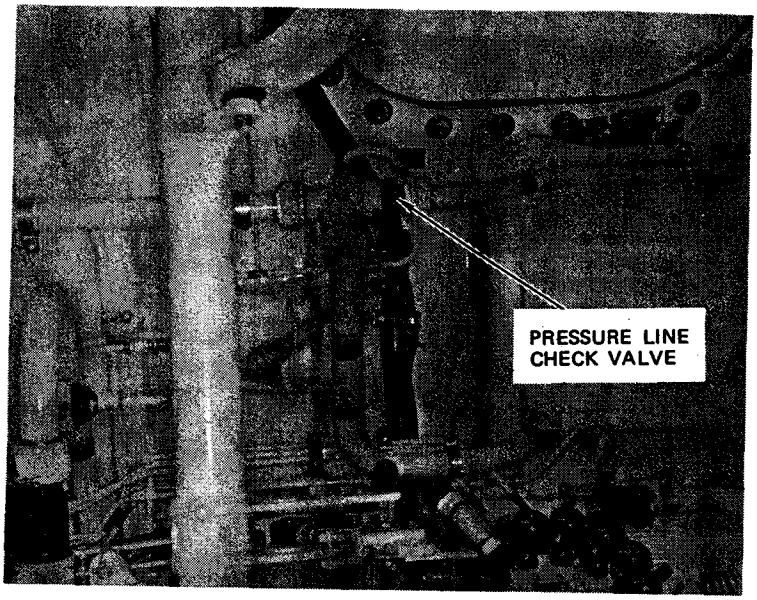
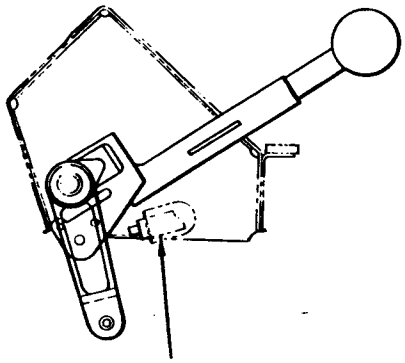
Figure 10-2. Speed Brake System Arrangement (Sheet 1)



DETAIL C

(RIGHT WHEEL WELL)



DETAIL D

(ACCESS 1211-2)

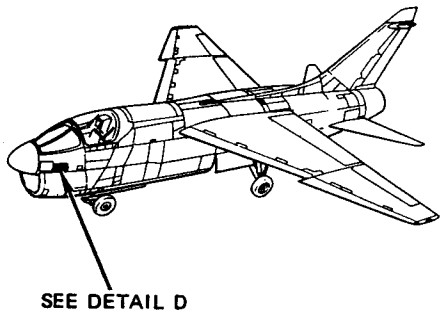


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Figure 10-2. Speed Brake System Arrangement (Sheet 2)

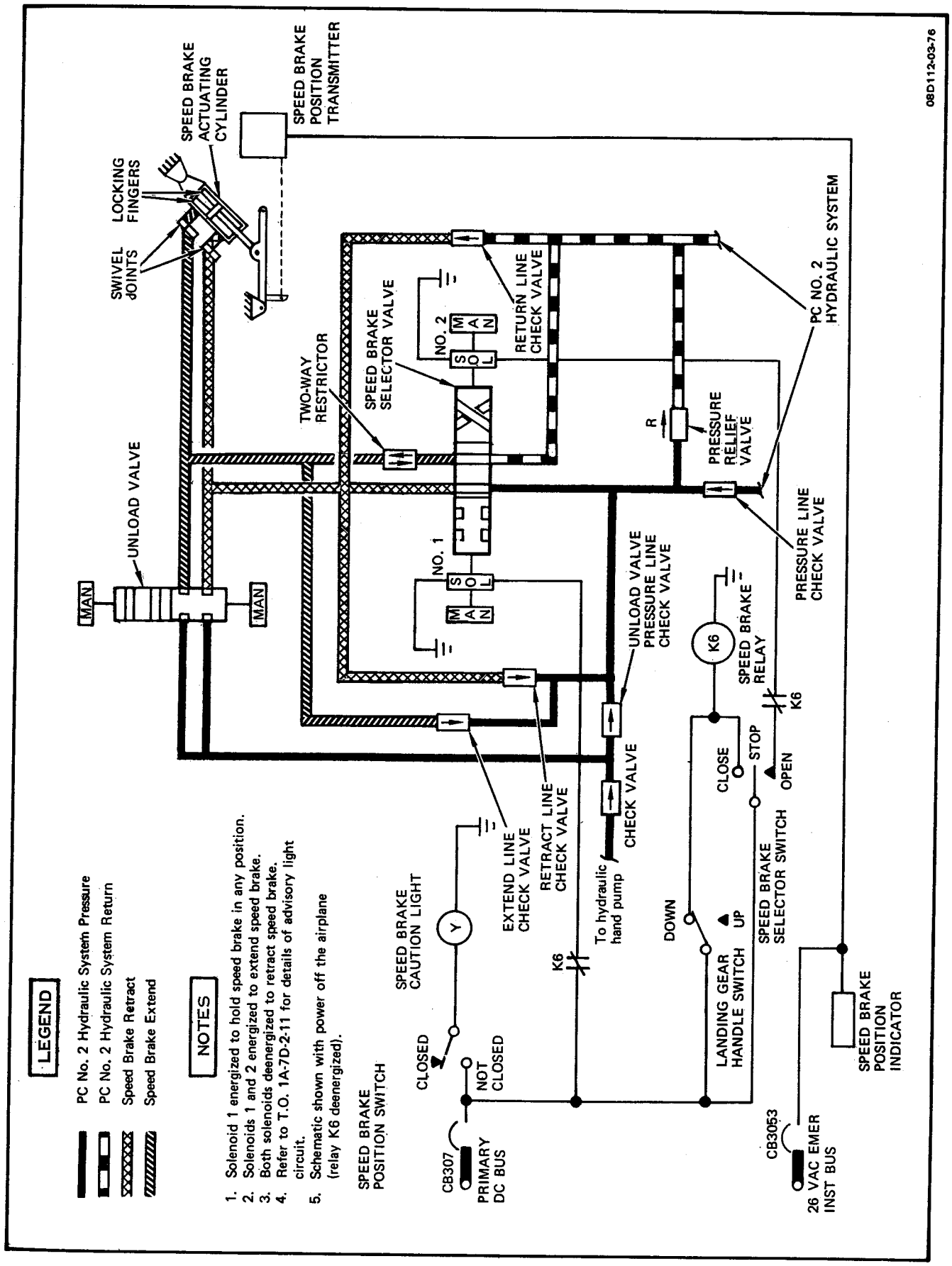

Figure 10-3. Speed Brake System Schematic Diagram

on airplane, the speed brake will remain flush with adjacent fuselage surface. When engine is shut down or hydraulic power removed, the speed brake may droop slightly due to the slack designed into the internal lock mechanism of the speed brake actuating cylinder.

10-12. The unload valve provides for speed brake extension during ground operation with hand pump power. Rotating the valve handle clockwise against the stop opens the valve. The valve is secured in the closed position with lockwire.

10-13. To extend the speed brake with the hand pump, the speed brake selector valve must be in the hold position. The unload valve must be in the closed position until pressure is built up by stroking the hand pump. When pumping effort indicates pressure buildup, opening the unload valve applies a differential pressure across the speed brake cylinder to unlock the piston. Continued pumping extends the speed brake.

10-14. ELECTRICAL CONTROL AND INDICATING SYSTEM. When the landing gear handle is placed in WHLS DOWN, the speed brake automatically retracts, if extended. With the handle in WHLS DOWN, 28 volts dc from the primary dc bus is applied through the landing gear handle switch to the speed brake relay, energizing the relay. Open contacts of the relay interrupt power to the speed brake selector valve hold solenoid (solenoid 1). The selector valve deenergizes, directing hydraulic pressure to the actuating cylinder retract port, retracting the speed brake. With the landing gear handle in WHLS DOWN, the speed brake cannot be extended.

10-15. When the landing gear handle is placed in WHLS UP, the up position of the landing gear handle switch interrupts power to the speed brake relay, deenergizing the relay. Normally closed contacts of the relay complete a power circuit to energize the hold solenoid of the speed brake selector valve. In the hold position, the selector valve blocks all hydraulic fluid flow to and from the speed brake actuating cylinder.

10-16. Moving and holding the speed brake selector switch in OPEN completes a power circuit through another set of normally closed relay contacts to energize the speed brake selector valve open solenoid (solenoid 2). With both solenoids energized, the selector valve completes a hydraulic circuit to extend the speed brake. If the selector switch is released, it will return to STOP, interrupting the power circuit to solenoid 2. The selector valve returns to the hold position, since solenoid 1 remains energized, and the speed brake stays in the position existing at the time STOP was selected.

10-17. Moving the speed brake selector switch to CLOSE completes a power circuit to energize the speed brake relay. Energized contacts of the relay interrupt power to the selector valve hold solenoid, and the valve actuates to complete a hydraulic circuit retracting the speed brake.

10-18. The speed brake advisory light comes on if the speed brake opens 1/2 inch or more at the aft end of the wide portion of the brake. The speed brake position switch, actuated by the speed brake, connects power to the light when the brake opens. The speed brake position indicator, through inputs from the speed brake position transmitter, provides cockpit indication of speed brake position from 0° to 60°.

10-19. COMPONENTS.

10-20. For a list of system components, their locations (accesses), and functions, refer to table 10-1.

10-21. OPERATIONAL CHECKOUT.

Test Equipment Required

Figure & Index No.	*Name*	*AN Type Designation*	*Use and Application*
	Equipment for connecting external electrical power		Connect electrical power
	Equipment for connecting external hydraulic power		Connect hydraulic power

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Table 10-1. Speed Brake System Components

Component	Access	Function
	Electrical	
Circuit breaker CB307 (left circuit breaker panel)	1232-1	Supplies 28-volts dc power to speed brake position switch and speed brake advisory light panel.
Circuit breaker CB3053 (left circuit breaker panel)	1232-1	Supplies 26-volts ac power to speed brake position transmitter and speed brake advisory light.
Indicator, speed brake position	Cockpit instrument panel	Indicates speed brake position.
Light, speed brake advisory	Right console	Indicates speed brake not closed.
Relay, speed brake (K6, left relay rack)	1232-1	Deenergized, provides power circuits for speed brake operation. Energized, closes speed brake.
Switch, landing gear handle	1211-2	Controls power circuit to speed brake relay.
Switch, speed brake position	Speed brake well	Connects power to speed brake advisory light when speed brake is not closed.
Switch, speed brake selector	Throttle grip	Controls application of electrical power to speed brake selector valve solenoids (with landing gear handle in WHLS UP).
Transmitter, speed brake position	Speed brake well	Transmits speed brake position indication to cockpit indicator.
	Hydraulic	
Cylinder, speed brake actuating	Speed brake well	Extends and retracts speed brake.
Restrictor, two-way	Right wheel well	Controls speed brake extension and retraction rate.
Swivel (2)	Speed brake well	Allows speed brake actuating cylinder and hydraulic lines to rotate as speed brake is extended and retracted.
Valve, extend line check	Right wheel well	Provides fluid path to relieve excess pressure in speed brake extend line.
Valve, pressure line check	Right wheel well	Traps fluid in speed brake retract line.
Valve, pressure relief	Right wheel well	Relieves excessive hydraulic pressure caused by thermal expansion or airloads on extended speed brake. Full flow pressure, 3,850 psi; reseat pressure, 3,390 psi.

Table 10-1. Speed Brake System Components (Continued)

Component	Access	Function
Valve, retract line check	Right wheel well	Provides fluid path to relieve excess pressure (in speed brake retract line) caused by thermal expansion.
Valve, return line check	Right wheel well	Keeps actuator filled with fluid when pressure relief valve is open.
Valve, speed brake selector	Right wheel well	Controls application of hydraulic pressure to actuator. Cockpit-controlled by speed brake selector switch.
Valve, unload	Right wheel well	Applies pressure to speed brake actuating cylinder to permit release of internal finger locks for ground operation of speed brake.
Valve, unload valve pressure line check	Right wheel well	Prevents PC No. 2 utility hydraulic system pressure from being applied to pressure line of unload valve.
	Mechanical	
Brake, speed		When extended, provides drag loads to decrease airplane speed.
Chine, speed brake (2)	Speed brake well	Increases effective speed brake surface when brake is extended.

10-22. CHECKOUT WITHOUT SPEED BRAKE CHECKOUT PIT.

NOTE

A number, or numbers, enclosed in braces at the end of a step in the following test is a reference to a corresponding number in trouble-shooting table 10-2.

If checkout pit is available, refer to paragraph 10-23 for checkout.

With no hydraulic power on airplane, it is normal for speed brake to droop slightly due to slack designed into the internal lock mechanism of the speed brake actuating cylinder. A speed brake which droops to the ground may have a damaged lock and the actuating cylinder should be replaced.

CAUTION

To prevent structural damage from interference, do not operate speed brake while access 1232-1 or 2232-1 is open. Prior to application of hydraulic power, accesses 1232-1 and 2232-1 must be closed.

a. Extend speed brake (paragraph 10-26).

b. Place board under edge of extended speed brake.

c. Disconnect actuating cylinder from speed brake at rod end.

d. Fasten cylinder securely to prevent piston interference with structure.

e. Check that speed brake selector switch is in STOP.

CAUTION

Ensure that cylinder is secured adequately to withstand actuation from power-operated test stand.

f. Connect external electrical power (T.O. 1A-7D-2-1).

WARNING

To prevent possible gear retraction, keep landing gear handle in WHLS DOWN during checkout procedure.

g. Actuate landing gear handle switch through hole in left console to simulate gear up.

h. Connect external hydraulic power to PC No. 2 hydraulic system (T.O. 1A-7D-2-1).

i. Check that speed brake advisory light is on and piston remains extended. {1, 2}

j. Place speed brake selector switch in CLOSE. Cylinder piston shall retract. {3}

k. Hold speed brake selector switch in OPEN. Cylinder piston shall fully extend. {4} Release switch. Piston shall remain extended. {2}

l. Place speed brake selector switch in CLOSE. When piston is partially retracted, place switch in STOP. Piston shall remain at partially retracted position. {2}

m. Release landing gear handle switch from simulated gear up position. Piston shall fully retract. {5}

n. Disconnect external hydraulic power.

o. Free cylinder from test rigging.

p. Extend piston using hand pump (paragraph 10-26).

q. Connect cylinder rod end to speed brake with pin, washers, bolt, and nut. Tighten nut finger-tight, then tighten to next cotter pin hole and install cotter pin.

r. Stroke hand pump to retract speed brake. Advisory light shall go off when speed brake is 1/2 to 1/4 inch from fully closed position at aft end of wide portion of brake.

s. Check that speed brake position indicator indicates speed brake is fully retracted. {6, 7}

t. Disconnect external electrical power.

u. Secure speed brake unload valve handle with MS20995C32 lockwire with handle rotated counterclockwise against stop.

10-23. CHECKOUT USING SPEED BRAKE CHECKOUT PIT.

WARNING

Pit must be clear of personnel, equipment, and debris.

CAUTION

To prevent structural damage from interference, do not operate speed brake while access 1232-1 or 2232-1 is open. Prior to application of hydraulic power, accesses 1232-1 and 2232-1 must be closed.

To prevent speed brake damage, checkout pit must be at least 10 feet long, 6.25 but no greater than 7.00 feet wide, and 6 feet deep.

NOTE

A number, or numbers, enclosed in braces at the end of a step in the following test is a reference to a corresponding number in troubleshooting table 10-2.

With no hydraulic power on airplane, it is normal for speed brake to droop slightly due to slack designed into the internal lock mechanism of the speed brake actuating cylinder. A speed brake which droops to the ground may have a damaged lock and the actuating cylinder should be replaced.

a. Tow airplane over speed brake checkout pit.

b. Align main landing gear jack points with rear edge of pit. Position center line of aircraft to within ±3 inches of pit center line.

c. Place a 2-inch board or other suitable support across pit at forward end of main gear wheel well. Partially extend speed brake with hand pump (paragraph 10-26) to ensure that end and sides of speed brake will clear checkout pit. Remove board or support.

d. Check that speed brake selector switch is in STOP.

e. Connect external electrical power (T.O. 1A-7D-2-1).

WARNING

To prevent possible gear retraction, keep landing gear handle in WHLS DOWN during checkout procedure.

f. Actuate landing gear handle switch through hole in console to simulate gear up.

g. Connect external hydraulic power to PC No. 2 hydraulic system (T.O. 1A-7D-2-1).

h. Check that speed brake advisory light is on and speed brake remains extended. {1, 2}

i. Place speed brake selector switch in CLOSE. Speed brake shall retract and advisory light shall go off. {3}

j. Hold speed brake selector switch in OPEN. Speed brake shall fully extend. {4} Release switch. Speed brake shall remain extended. {2}

k. Place speed brake selector switch in CLOSE. When speed brake is partially retracted, place switch in STOP. Speed brake shall remain at partially retracted position. {2}

l. Release landing gear handle switch from simulated gear up position. Speed brake shall fully retract. {5}

m. Shut down hydraulic power. Place board or other suitable support across pit. Using hand pump, partially open speed brake (paragraph 10-26). Retract speed brake to within 1/2 to 1/4 inch from fully closed position at aft end of wide portion of brake. Speed brake advisory light shall go off at this point. Remove board or support.

n. Check that speed brake position indicator indicates speed brake is fully retracted. {6, 7}

o. Disconnect external hydraulic power (T.O. 1A-7D-2-1).

p. Disconnect external electrical power (T.O. 1A-7D-2-1).

q. Secure speed brake unload valve handle with MS20995C32 lockwire with handle rotated counterclockwise against stop.

r. Remove airplane from checkout pit.

10-24. TROUBLESHOOTING.

Test Equipment Required

Figure & Index No.	*Name*	*AN Type Designation*	*Use and Application*
	Equipment for connecting external electrical power		Connect electrical power
	Multimeter	AN/PSM-6	Check voltage

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10-25. Refer to table 10-2 for troubleshooting information and to figure 10-4 or 10-5 for electrical schematic to aid in troubleshooting. Malfunctions in the table are listed numerically and are related to a corresponding number, or numbers, following a step in the operational checkout.

Table 10-2. Speed Brake System Troubleshooting

Probable Cause	Isolation Procedure	Remedy
1. Speed brake advisory light does not come on with speed brake extended.		
Circuit breaker open.	Open access 2232-1 and check CB307.	Close circuit breaker. If circuit breaker does not remain closed, check for defective wiring.
Lamp defective.	Actuate indicator lights test switch.	If speed brake advisory light does not come on, replace defective lamp.
Speed brake position switch defective.	With speed brake extended sufficiently to close speed brake position switch, check switch for continuity between switch terminals 1 and 2.	If continuity is not indicated, replace defective speed brake position switch. If continuity is indicated, check for defective wiring.
Wiring defective.	Check wiring for continuity.	Repair or replace defective wiring.
2. Speed brake (cylinder) retracts with speed brake control switch in STOP.		
Speed brake selector valve defective.	Remove connector P333 from speed brake selector valve. Check for 28 volts dc between pins 7 and 6 of connector P333.	If voltage is indicated, replace defective speed brake selector valve. If voltage is not indicated, check for defective speed brake relay.
Speed brake relay defective.	Open access 1232-1 and disconnect connector P301 from relay assembly. Check for 28 volts dc between pins 74 and 71 of P301. If voltage is indicated, check for continuity between pins 74 and 75 of relay assembly receptacle. If voltage is not indicated, check for defective wiring.	If continuity is not indicated, replace relay assembly.
Wiring defective.	Check wiring for continuity.	Repair or replace defective wiring.

Table 10-2. Speed Brake System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
3. Speed brake (cylinder) does not retract with speed brake control switch in CLOSE.		
Speed brake control switch defective.	Release landing gear handle switch and check that speed brake cylinder retracts.	If speed brake cylinder retracts, replace defective speed brake control switch. If cylinder does not retract, check for defective speed brake relay.
Speed brake relay defective.	Open access 1232-1 and disconnect connector P301 from relay rack. With speed brake control switch in close, check for 28 volts dc between pins 71 and 72 of connector P301. If voltage is indicated, check for continuity between pins 77 and 78 and between pins 74 and 75 of connector P301. If voltage is not indicated, check for defective wiring.	If continuity is indicated, replace relay assembly. If continuity is not indicated, check for defective speed brake selector valve.
Speed brake selector valve defective.	None.	Replace valve.
Wiring defective.	Check wiring for continuity.	Repair or replace defective wiring.
Return line check valve defective.	Loosen PWR CONT RET 2 line at check valve. Place speed brake selector switch in CLOSE and check that no fluid flows from check valve.	If fluid flow is noted, replace return line check valve.
4. Speed brake (cylinder) does not extend with speed brake selector switch in OPEN.		
Speed brake selector valve defective.	Remove connector P333 from speed brake selector valve. Place speed brake control switch in OPEN and check for 28 volts dc between pin 1 of connector P333 and ground.	If voltage is indicated, replace defective speed brake selector valve. If voltage is not indicated, check for defective speed brake relay.

Table 10-2. Speed Brake System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
Speed brake relay defective.	Open access 1232-1 and disconnect connector P301 from left relay rack. Place speed brake control switch in OPEN and check for 28 volts dc between pins 77 and 78 of connector P301. If voltage is indicated check for 28 volts between pins 71 and 72 of connector P301.	If voltage is indicated between pins 77 and 78 and is not indicated between pins 71 and 72, replace defective relay assembly. If voltage is not indicated between pins 77 and 78, check for defective speed brake control switch. If voltage is indicated between pins 71 and 72, check for defective landing gear handle switch.
Speed brake control switch defective.	Remove access 1221-1 and disconnect connector P237 from throttle quadrant. With speed brake switch in OPEN, check for continuity between pins 17 and 18 of throttle quadrant receptacle.	If continuity is not indicated, replace defective speed brake switch. If continuity is indicated, check for defective landing gear handle switch.
Landing gear handle switch defective.	Open access 1232-1 and disconnect connector P301 from relay rack. Place speed brake switch in STOP. Check for continuity between pins 72 and 74 of connector P301.	If continuity is indicated, replace defective landing gear handle switch. If continuity is not indicated, check for defective diode board.
Diode board defective.	Disconnect connector P3091 from relay assembly. Connect pin 71 of relay assembly receptacle to ground. Check for continuity between pin 75 of relay assembly receptacle and ground.	If continuity is indicated, replace diode board. If continuity is not indicated, check for defective wiring.
Wiring defective.	Check wiring for continuity.	Repair or replace defective wiring.
Relief valve defective.	Loosen PWR CONT RET 2 line at relief valve relief port. Apply hydraulic pressure and check that no fluid flows from relief port.	If fluid flow is noted, replace relief valve.

Table 10-2. Speed Brake System Troubleshooting (Continued)

Probable Cause	Isolation Procedure	Remedy
5. Speed brake (cylinder) does not retract when landing gear handle switch is released.		
Landing gear handle switch defective	Place speed brake control switch in CLOSE and check that speed brake cylinder retracts.	Replace defective landing gear handle switch.
6. Speed brake position indicator inoperative.		
Circuit breaker open.	Open access 2232-1 and check CB3053.	Close circuit breaker. If circuit breaker does not remain closed, check for defective wiring.
Speed brake position indicator defective.	Remove speed brake position indicator from instrument panel and disconnect connector P2086 from indicator. Check for 26 volts ac between pin B of connector P2086 and ground. If voltage is indicated, install serviceable indicator and perform speed brake operational checkout. If voltage is not indicated, check for continuity between pin B of connector P2086 and ground.	If speed brake position indicator operates correctly, replace removed indicator. If indicator does not operate correctly, check for defective speed brake transmitter. If continuity is not indicated, check for defective wiring.
Speed brake position transmitter defective.	None.	Replace defective speed brake position transmitter.
7. Speed brake position indicator does not indicate 0° with speed brake retracted.		
Speed brake position transmitter not properly adjusted.	None.	Adjust speed brake position transmitter.

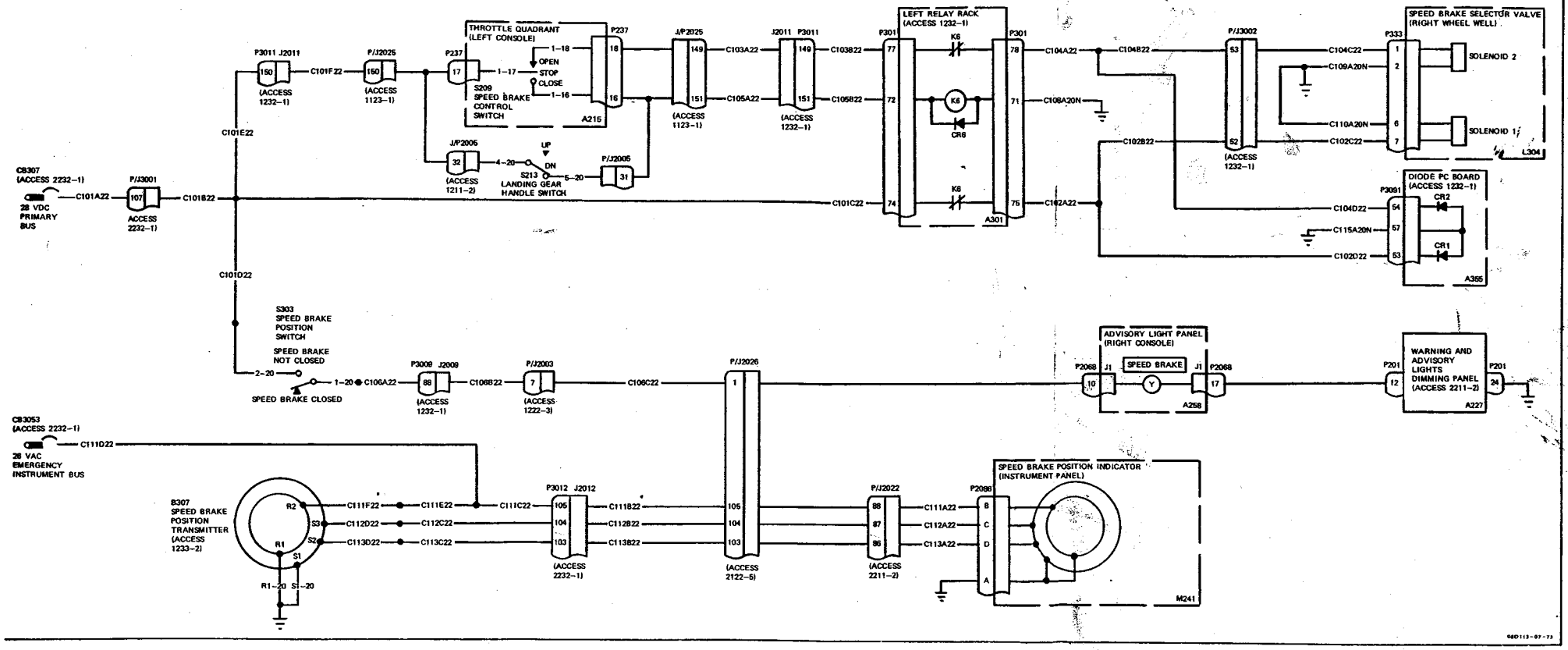

Figure 10-4. Speed Brake System Electrical Troubleshooting Schematic Diagram (Airplanes Through AF69-6196)

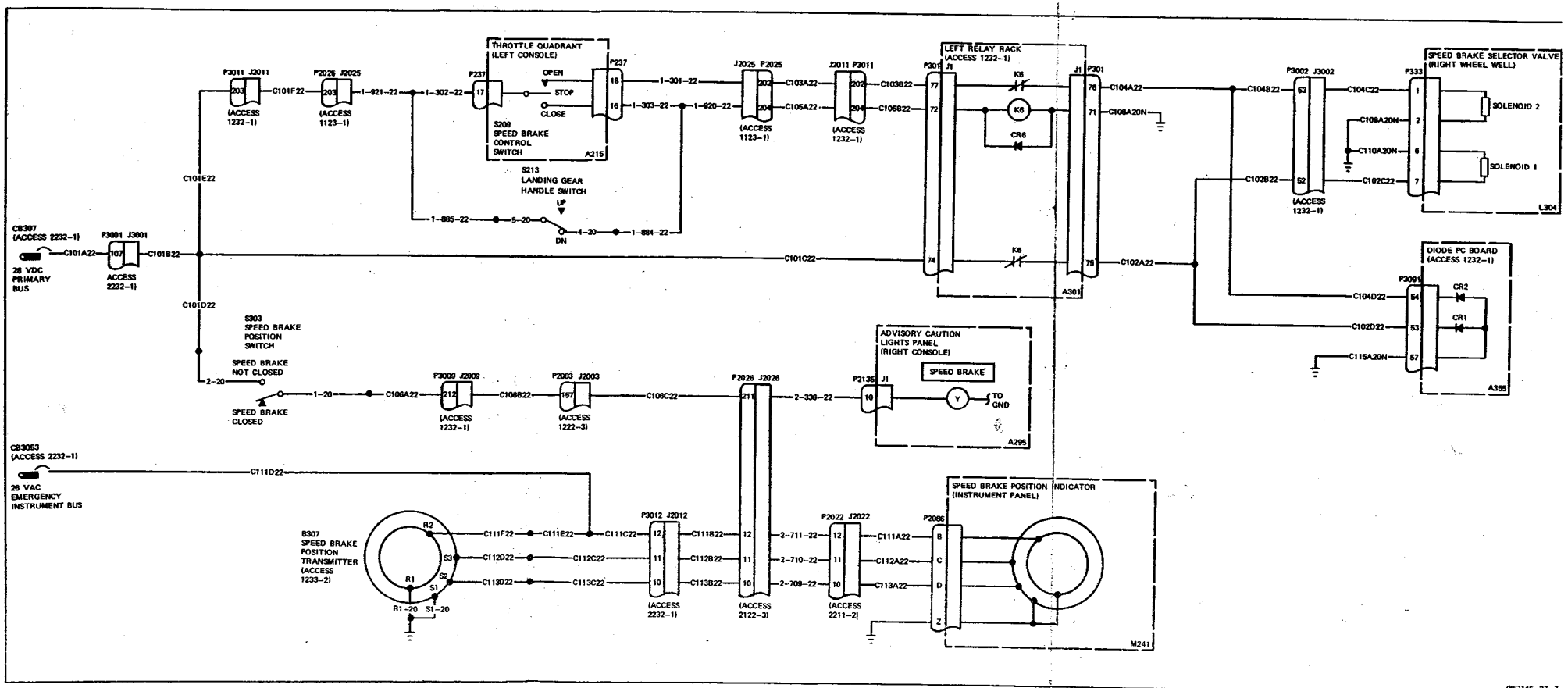

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Figure 10-5. Speed Brake System Electrical Troubleshooting Schematic Diagram (Airplanes AF69-6197 and Subsequent)

10-26. SPEED BRAKE EXTENSION AND RETRACTION - GROUND OPERATION.

10-27. Ground operation of the speed brake requires no external electrical or hydraulic power. Jacking the airplane is not required unless greater extension is needed than is available with airplane on the landing gear.

WARNING

To prevent injury to personnel or damage to the speed brake, ensure that airplane and external hydraulic pressure is shut down before performing maintenance in the speed brake well or before actuating the speed brake selector valve. Use only the hand pump to supply hydraulic pressure for ground operation of the speed brake.

CAUTION

To prevent structural damage from interference, do not operate speed brake while access 1232-1 or 2232-1 is open. To avoid damage to flap cylinder lock, ensure that flap handle is in the same position as the flaps before operating the hand pump.

To prevent internal damage to speed brake cylinder, open unload valve after depressing solenoid number 1 button and ensure that solenoid number 2 button on selector valve is not dpreseed.

10-28. EXTENSION.

a. Cut lockwire securing speed brake unload valve handle.

b. Stroke hand pump to build up 200 to 500 psi pressure. Pressure may be obtained by stroking hand pump at the rate of 1 stroke per second for 25 seconds.

c. Maintain pressure by stroking hand pump and press and hold solenoid number 1 button on speed brake selector valve.

d. Rotate speed brake unload valve handle 45° clockwise against stop and check that speed brake opens.

NOTE

Failure of speed brake to open indicates that valve was opened before sufficient pressure was obtained. If this occurs, close valve and repeat steps b, c, and d.

e. Extend speed brake to desired level by stroking hand pump. Place board under edge of speed brake if it is extended to ground level.

f. Release speed brake selector valve plunger and rotate unload valve handle counterclockwise against stop to close valve.

g. Secure unload valve handle with MS20995C32 lockwire.

10-29. RETRACTION.

a. Stroke hand pump until speed brake closes.

b. Check that speed brake unload valve handle is rotated counterclockwise against stop and handle is secured with MS20995C32 lockwire.

10-30. RIGGING. (See figure 10-6.)

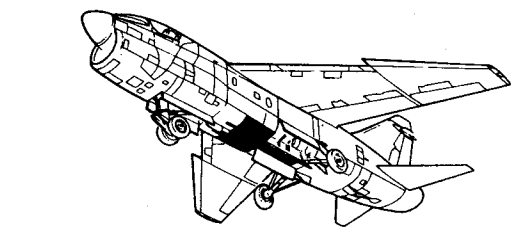
Tools Required

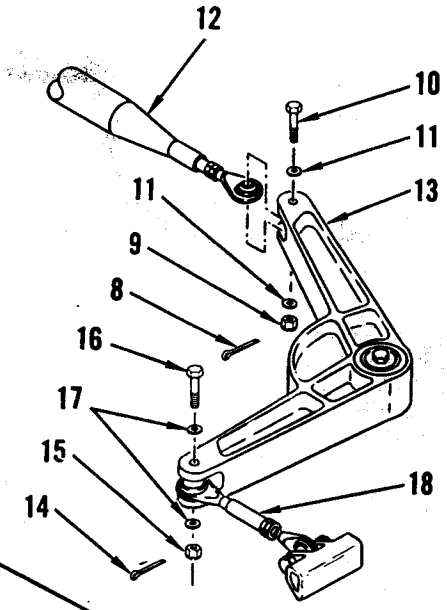
Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
10-6	215-00110-5	Rigging pin No. 25 (2)	Rig speed brake
			TT08D047-07-70

a. Extend speed brake (paragraph 10-26).

b. Remove cotter pin (8), nut (9), bolt (10), and washers (11) to disconnect chine upper rod (12) from bellcrank (13).

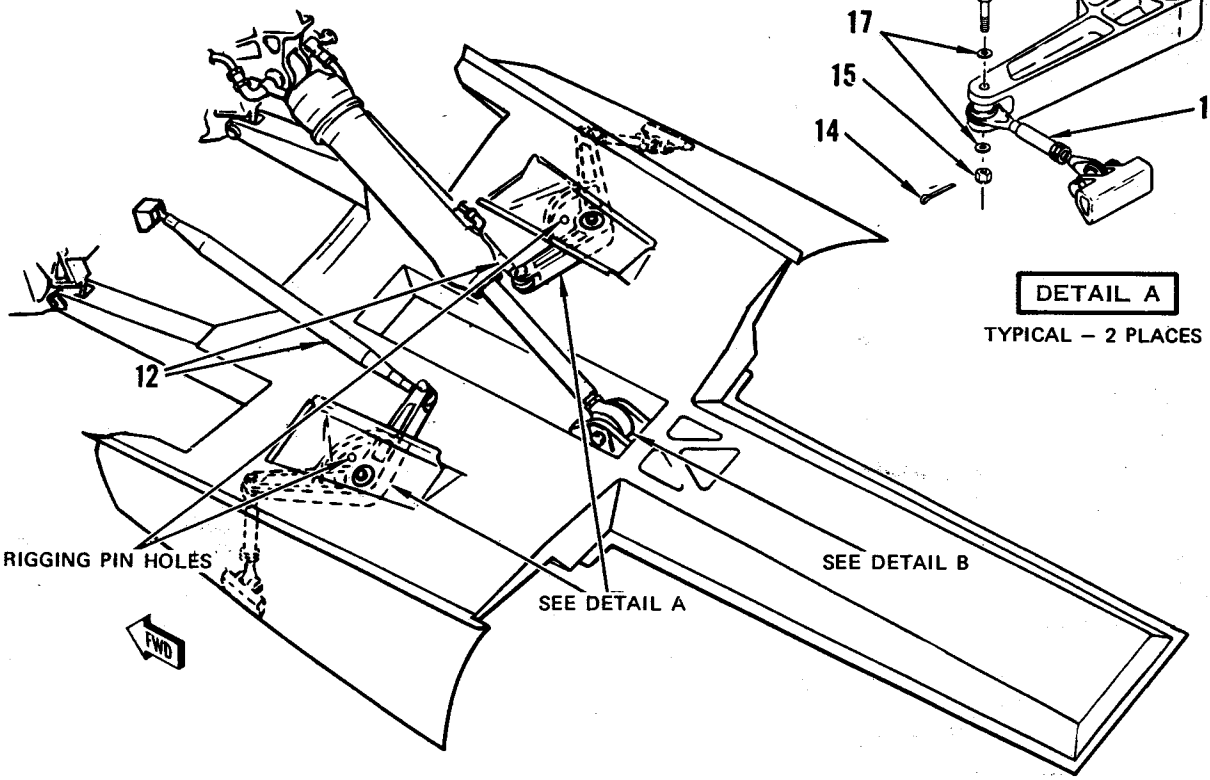
c. Manually close chine and check that rigging pin No. 25 can be inserted in forward rigging hole of chine bellcrank. If pin can be inserted, proceed to step g. If pin cannot be inserted, continue with step d.



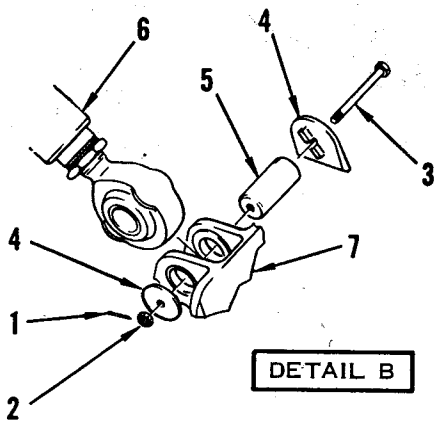


DETAIL A

TYPICAL – 2 PLACES



1. Cotter pin
2. Nut
3. Bolt
4. Washer
5. Pin
6. Actuating cylinder
7. Speed brake fitting
8. Cotter pin
9. Nut
10. Bolt
11. Washer
12. Chine upper rod
13. Bellcrank
14. Cotter pin
15. Nut
16. Bolt
17. Washer
18. Chine lower rod



DETAIL B

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Figure 10-6. Speed Brake Rigging

d. Remove cotter pin (14), nut (15), bolt (16), and washers (17) connecting chine lower rod (18) to bellcrank.

e. Adjust chine lower rod (18) until rigging pin can be inserted with chine door closed and bolt (16) inserted.

f. Remove rigging pin and bolt (16), and connect chine rod (18) to bellcrank (13) with washers (17), bolt (16), and nut (15). Tighten nut finger-tight; then tighten to next cotter pin hole and install new cotter pin (14).

g. Rotate bellcrank to open chine and insert rigging pin No. 25 in aft hole of bellcrank and chine.

h. Check for approximately 1/16-inch opening along chine hinge line. Clearance is necessary to allow 5° overtravel without interference at hinge. Reject brake assembly if clearance cannot be obtained.

i. Remove rigging pin.

j. Repeat steps b and c for opposite chine.

k. Close chines and insert rigging pin No. 25 to secure chines and prevent interference during cylinder rigging.

CAUTION

Secure upper chine rods in fuselage cavity to prevent structural damage during cylinder rigging.

NOTE

To actuate the cylinder during cylinder rigging, refer to paragraph 10-26.

l. If disconnected, connect actuating cylinder (6) to speed brake fitting (7) with pin (5), washers (4), bolt (3), and nut (2).

m. Retract speed brake and check that piston bottoms before brake closes. Stop pumping if brake closes and perform steps n through p. If piston bottoms before speed brake closes, proceed to step q.

n. Extend brake.

o. Disconnect cylinder from brake, adjust rod end by 1/2 turn to increase length, and reconnect cylinder to brake.

p. Retract brake to check that piston bottoms before brake closes. Repeat steps n and o until required result is obtained.

q. Extend brake.

r. Disconnect cylinder, reduce rod end length by 1/2 turn, and reconnect cylinder to brake.

s. Retract brake and check that brake is faired with fuselage contour with piston bottomed. Repeat steps q and r until required result is obtained.

t. Extend brake.

u. Secure rod end jamnut with MS20995C32 lockwire.

v. Tighten nut on rod end attaching bolt to align next cotter pin hole and install cotter pin (1).

w. Remove rigging pin No. 25.

x. Connect upper chine rod (12) to bellcrank (13) with bolt (10), washers (11), and nut (9). Tighten nut finger-tight.

y. Retract speed brake and observe chine closing action. If chine closes before speed brake closes, stop retraction and extend brake. Disconnect rods and adjust to decrease length. Adjust rods until chines are faired with speed brake contour with brake closed. If chines did not close when brake closed, adjust rods to increase length.

z. Tighten nuts on upper rods to align next cotter pin hole and install cotter pin (8).

aa. Ensure position transmitter is operating properly before retracting speed brake (paragraph 10-55).

ab. Retract speed brake (paragraph 10-26).

10-31. SPEED BRAKE SELECTOR VALVE REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
	GGG-W-686	Torque wrench 0 to 250 pound-feet	Torque valve fittings

10-32. REMOVAL. (See figure 10-7.)

a. Disconnect electrical connector (1).

b. Disconnect hydraulic lines (2).

c. Remove selector valve (3) from airplane by removing screws (4) and washers (5).

d. Loosen nuts (6) and remove manifold (7), fittings (8), and nuts.

e. Remove fitting (9).

f. Discard retainers (10) and packings (11).

10-33. INSTALLATION. (See figure 10-7.)

a. Assemble fittings (8) with nuts (6), new retainers (10), and new packings (11).

b. Install fittings into selector valve (3). Do not tighten nuts.

c. Install manifold (7) with nut (6), new retainer (10), and new packing (11). Do not tighten nut.

d. Install fitting (9) in selector valve with new packing (11).

e. Install selector valve in airplane with washers (5) and screws (4).

f. Connect hydraulic lines (2).

g. Tighten nuts (6) to 900 (±300) pound-inches torque.

h. Extend speed brake (paragraph 10-26).

i. Disconnect rod end at actuating cylinder from speed brake.

j. Loosen line fitting at retract end of cylinder. Press and hold solenoid number 1 button. Stroke hand pump. Release solenoid and tighten fitting when air-free fluid flows.

k. Loosen line fitting at extend end of cylinder. Stroke hand pump to retract piston. Tighten fitting when air-free fluid flows.

l. Connect electrical connector (1) to valve.

m. Connect external electrical power (T.O. 1A-7D-2-1).

WARNING

To prevent possible gear retraction, do not move landing gear handle.

n. Actuate landing gear handle switch to simulate gear up position.

o. Place speed brake selector switch in CLOSE, stroke hand pump, and check that cylinder retracts. Do not fully retract cylinder.

p. Hold selector switch in OPEN, stroke hand pump, and check that cylinder extends.

q. Release landing gear handle switch.

r. Connect rod end of actuating cylinder to speed brake and retract speed brake by stroking hand pump.

s. Perform hydraulic system air check (T.O. 1A-7D-2-1).

t. Disconnect external electrical power.

10-34. SPEED BRAKE ACTUATING CYLINDER REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
		Equipment for connecting external hydraulic power	Connect hydraulic power
			TT08D049-07-70

10-35. REMOVAL. (See figure 10-8.)

CAUTION

To prevent contamination and excessive loss of fluid, cap or plug all connections when disconnected.

a. Extend speed brake (paragraph 10-26).

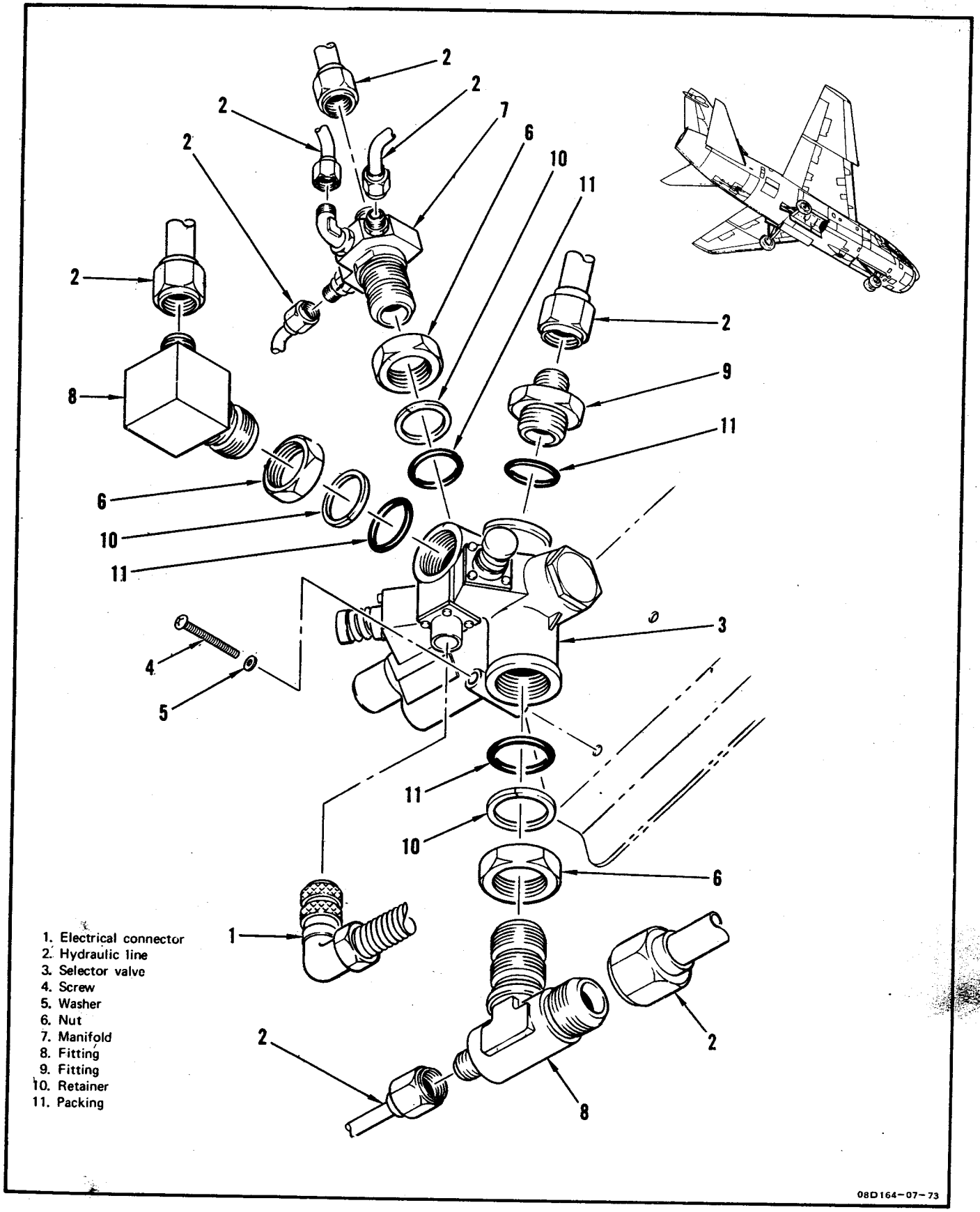


Figure 10-7. Speed Brake Selector Valve Removal and Installation

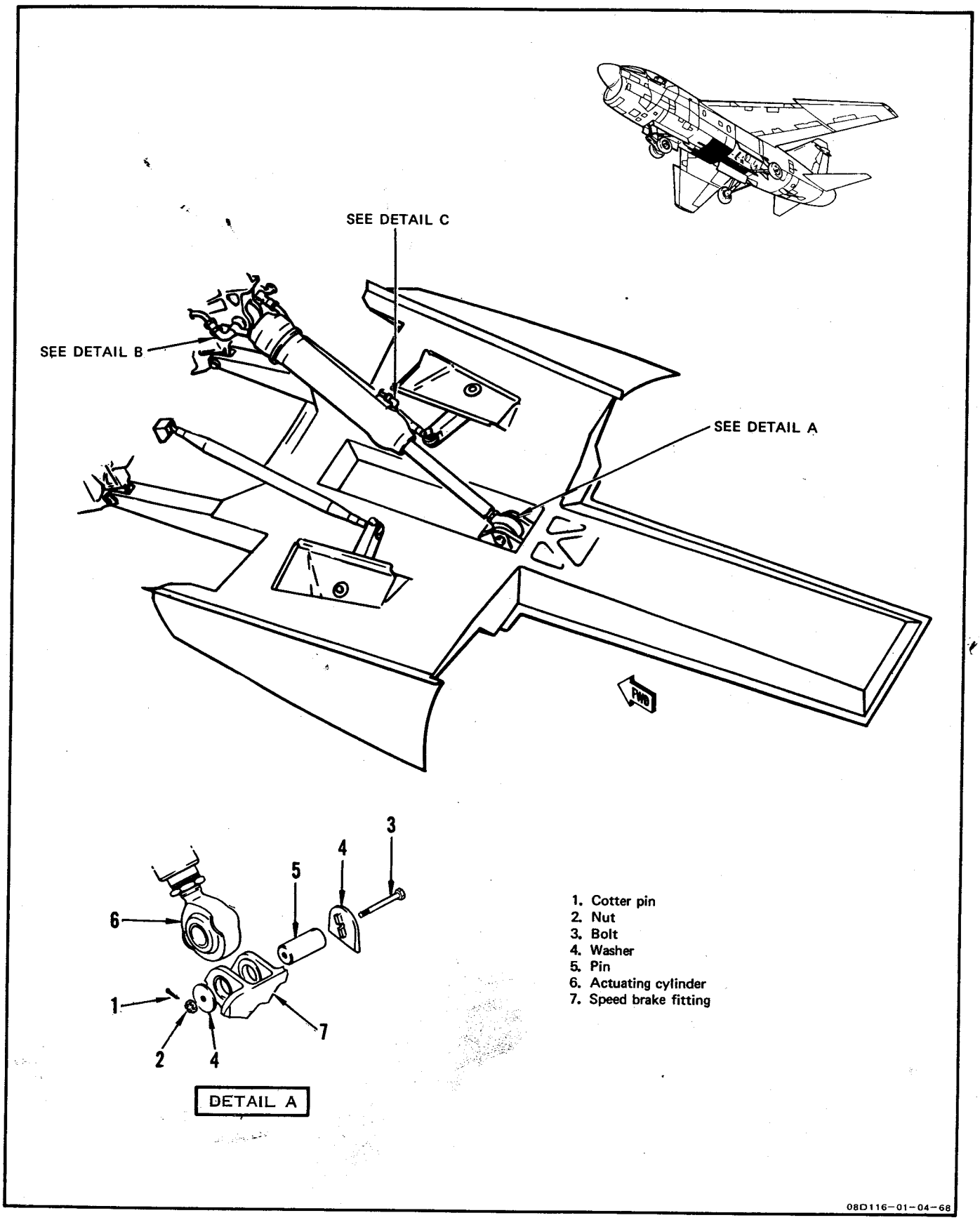
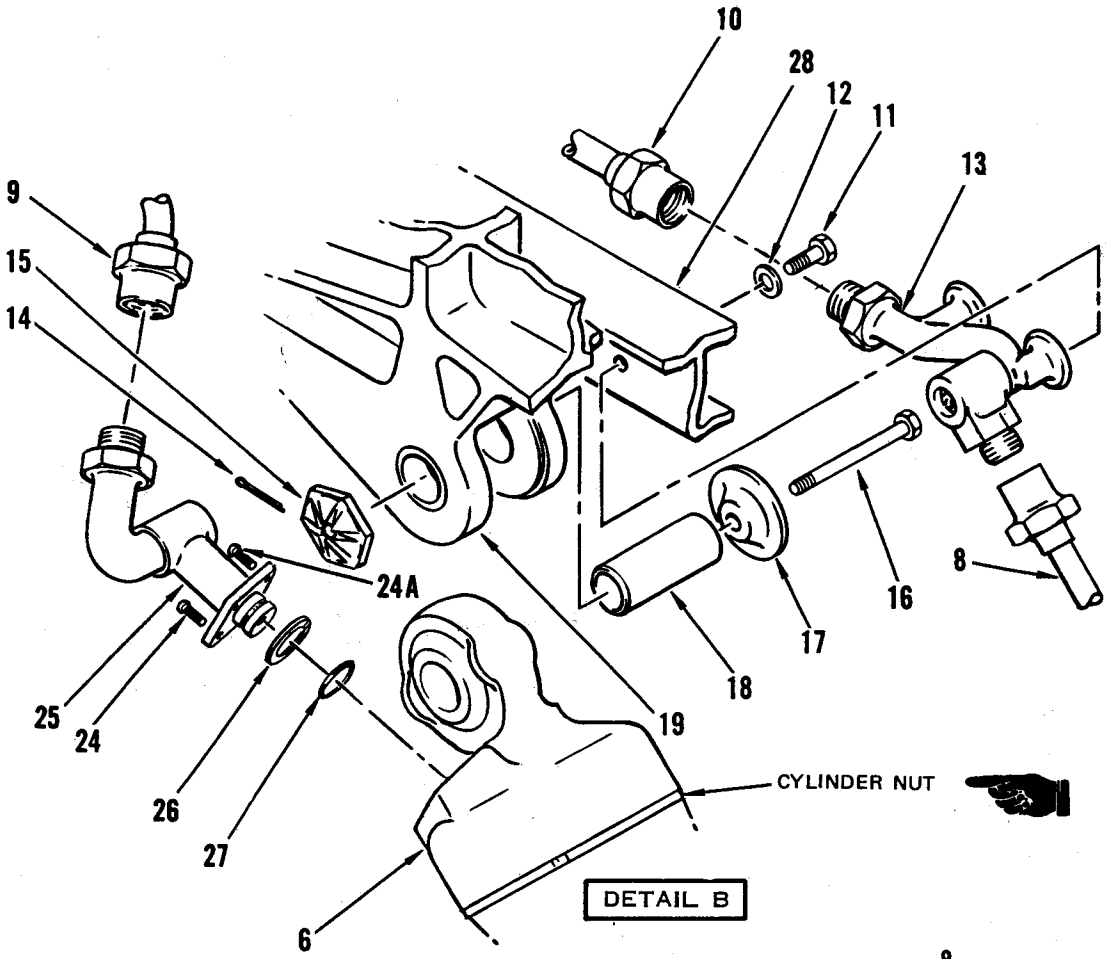
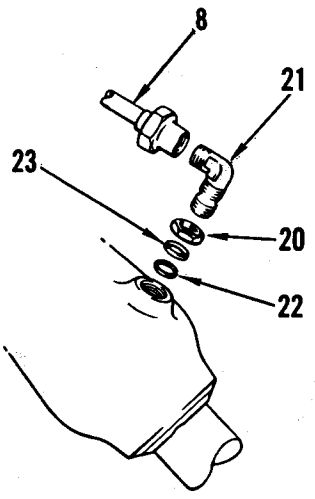


Figure 10-8. Speed Brake Actuating Cylinder Removal and Installation (Sheet 1)





8. Hydraulic line
9. Hydraulic line
10. Hydraulic line
11. Bolt
12. Washer
13. Swivel
14. Cotter pin
15. Nut
16. Bolt
17. Washer
18. Pin
19. Keel
20. Jamnut
21. Elbow
22. Packing
23. Retainer
24. Screw
24A. Screw
25. Swivel
26. Retainer
27. Packing
28. Beam

08D116-02-10-77

Figure 10-8. Speed Brake Actuating Cylinder Removal and Installation (Sheet 2)

NOTE

The following interference check is made before cylinder removal to facilitate the interference check made after installation of replacement cylinder.

b. Check for interference between:

1. Hydraulic line (8) and end cap of cylinder (6).

2. Hydraulic line (8) and speed brake beam (28).

3. Elbow (21) and speed brake beam (28).

4. Elbow (21) and elbow recess in speed brake well.

c. If interference is noted, repair damaged structure (T.O. 1A-7D-3) and/or replace defective hydraulic components as required.

CAUTION

To prevent potential damage to speed brake swivels, avoid excess lateral movement of free end of cylinder during removal.

d. Remove cotter pin (1), nut (2), bolt (3), washers (4), and pin (5) attaching cylinder (6) to speed brake fitting (7).

e. Retract cylinder piston using hand pump.

f. Remove hydraulic line (8).

g. Loosen B-nut on hydraulic line (9).

h. Disconnect hydraulic line (10), and remove bolts (11), washers (12), and swivel (13).

i. Support cylinder and disconnect hydraulic line (9). Remove cotter pin (14), nut (15), bolt (16), washer (17), and pin (18) attaching cylinder lug to keel (19). Remove cylinder.

j. With cylinder fully retracted, measure and record distance from center of hole in cylinder rod end to center of hole in cylinder lug for use during installation of replacement cylinder.

k. Loosen jamnut (20), and remove elbow (21), packing (22), retainer (23), and jamnut (20). Discard packing and retainer.

l. Cut lockwire and remove screws (24), swivel (25), retainer (26), and packing (27). Discard packing and retainer.

10-36. INSTALLATION. (See figure 10-8.)

a. Drain preservative fluid from replacement cylinder.

b. Retract cylinder piston and adjust rod end to approximate measurement recorded during cylinder removal. Back off rod end two additional turns to ensure that speed brake will not fully retract before piston bottoms during initial retraction.

c. Install swivel (25) with screws (24) using new packing (27) and new retainer (26). Secure three screws (24) with MS20995C32 lockwire. Secure cylinder nut to top right screw (24A) with MS20995C32 lockwire.

d. Fill cylinder extend and retract ports with hydraulic fluid. Cap swivel (25).

CAUTION

To prevent possible loss of PC No. 2 hydraulic system pressure and subsequent damage to hydraulic pump, use care when installing elbow (21). If elbow is not threaded into cylinder far enough, the B-nut attaching hydraulic line to elbow will strike speed brake well during speed brake retraction, leading to possible damage to hydraulic line. If elbow is threaded too far into cylinder or if it is necessary to back off the elbow a partial turn for alignment with hydraulic line, the packing may be damaged and fail under pressure.

e. Lubricate packing (22) with hydraulic fluid and install jamnut (20), retainer (23), and packing (22) on elbow (21). Adjust jamnut until top thread on elbow is covered. Thread elbow into cylinder until packing contacts cylinder. Do not tighten jamnut.

f. Remove caps or plugs from swivel (25) and hydraulic line (9). Attach lug end of cylinder to keel (19) with pin (18), washer (17), bolt (16), and nut (15). Secure nut with new cotter pin (14). Connect hydraulic line (9) to swivel (25), but do not tighten B-nut.

g. Unplug hydraulic line (10) and install swivel (13) to beam (28) with washers (12) and bolts (11).

h. Connect hydraulic line (10) to swivel (13) but do not tighten B-nut.

i. Using lockwire or equivalent, restrain cylinder in approximate position achieved before disconnecting from speed brake.

j. Manually raise cylinder and remove cap from elbow (21). Connect hydraulic line (8) to elbow (21) and swivel (13). Lower actuating cylinder until supported by restraint.

k. Tighten jamnut (20).

l. Tighten B-nuts on hydraulic lines (9 and 10).

m. Loosen hydraulic line B-nut at elbow (21). Stroke hand pump until air free fluid flows, then tighten B-nut.

n. Loosen B-nut on hydraulic line (10). Depress and hold solenoid No. 2 button and stroke hand pump. Continue stroking hand pump until air free fluid flows, then release solenoid button and tighten B-nut.

o. Loosen hydraulic line B-nut at elbow (21). Extend cylinder piston (paragraph 10-26). When piston fully extends, tighten B-nut.

p. Loosen hydraulic line B-nut at swivel (25).

q. Retract cylinder piston with hand pump. Tighten B-nut when air-free fluid flows.

r. Extend cylinder piston (paragraph 10-26) and align rod end of cylinder with speed brake fitting (7).

s. Attach rod end of cylinder to fitting (7) with pin (5), washers (4), bolt (3), and nut (2). Tighten nut finger-tight.

t. To check clearance of elbow (21) and hydraulic line (8) during speed brake retraction, apply a 0.1-inch minimum thick coat of putty to the following areas:

1. Along right edge of speed brake actuating cylinder well in fuselage, starting at point where elbow fitting passes edge of well during retraction and continuing forward along edge for approximately 12 inches.

2. In elbow recess in speed brake well.

3. To hydraulic line, starting approximately 2 inches aft of swivel.

CAUTION

To avoid possible damage to speed brake and adjacent structure, ensure that speed brake does not fair with fuselage before speed brake actuating cylinder piston is fully retracted.

u. Retract speed brake using hand pump. Extend speed brake and check putty for evidence of contact by elbow, elbow B-nut, or hydraulic line. If putty is not contacted, or if putty is contacted and remaining thickness indicates optimum clearance at all points, proceed to step v. If clearance does not exist at all points, recheck installation of elbow and hydraulic line. If optimum clearance cannot be obtained, replace cylinder.

v. Retract speed brake and check that speed brake is faired with fuselage contour. If speed brake is out of contour, adjust cylinder rod end in accordance with paragraph 10-30.

w. Fully retract speed brake and recheck clearance in accordance with step u. Remove putty.

x. Tighten cylinder rod end jamnut and secure with MS20995C32 lockwire.

y. Tighten nut (2) to next cotter pin hole, then secure nut with new cotter pin (1).

z. Perform hydraulic system air check (T.O. 1A-7D-2-1).

aa. Rotate speed brake unload valve handle counterclockwise against stop. Secure handle with MS20995C32 lockwire.

10-37. SPEED BRAKE REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power
10-6	215-00110-5	Rigging pins No. 25 (2)	Align chines
	215-00242-1	Speed brake hinge pin puller	Pull speed brake hinge pins
	215-00303-41	Multipurpose dolly	Support speed brake
	215-00307-15	Speed brake removal and installation adapter assembly	Adapt dolly for speed brake removal and installation
	MIL-G-22588	Grease gun	Lubricate fittings

TT08D050-07-70

10-38. REMOVAL. (See figure 10-9.)

a. Open accesses 1233-3 and 2233-3.

b. Extend speed brake (paragraph 10-26).

c. Place dolly with adapter under speed brake so leading edge of brake rests inside forward stops on adapter. Lock dolly wheels.

d. Actuate hand pump several times to ensure speed brake is supported by dolly.

e. Remove cotter pin (1), nut (2), bolt (3), and washers (4) connecting each chine upper rod (5) to bellcrank (6).

f. Secure rods in fuselage cavity.

g. Manually close chines and insert rigging pin No. 25.

CAUTION

To prevent potential damage to speed brake swivels, avoid excess lateral movement of free end of cylinder when disconnecting and connecting actuator in fuselage cavity.

h. Remove cotter pin (7), nut (8), bolt (9), washers (10), pin (11), and pin retainer (12) connecting actuating cylinder (13) to speed brake fitting (14).

i. Secure actuating cylinder in fuselage cavity.

NOTE

Balance speed brake on dolly until lowered and pinned in a horizontal position.

j. Remove screws securing two bonding jumpers (15) to fuselage at both locations.

k. On right hinge retainer (16), disconnect transmitter rod end (17) by removing cotter pin (18), nut (19), bolt (20), and washers (21).

l. Cut lockwire and remove hinge pin retainer bolt (22) and retainer (25) at left hinge.

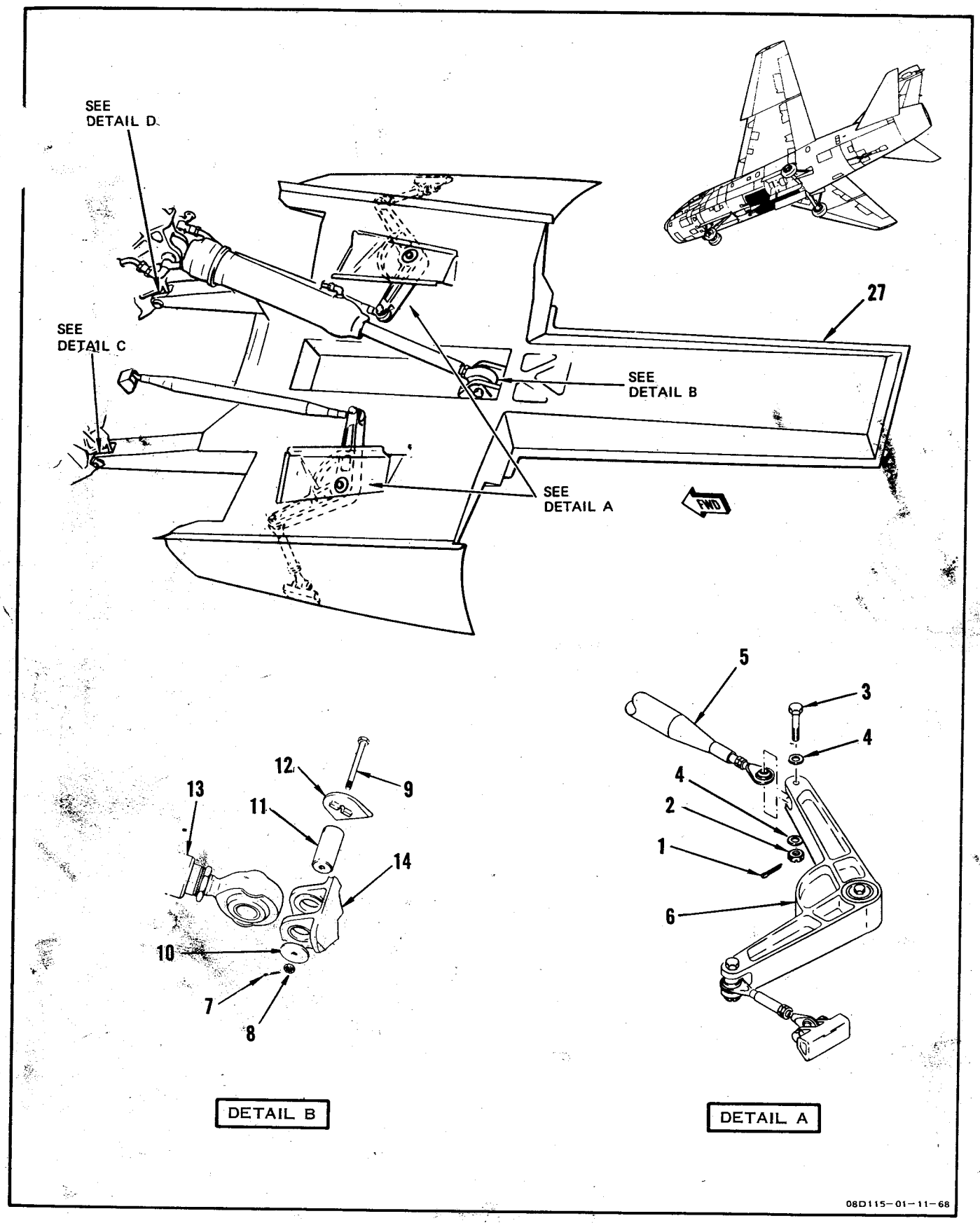
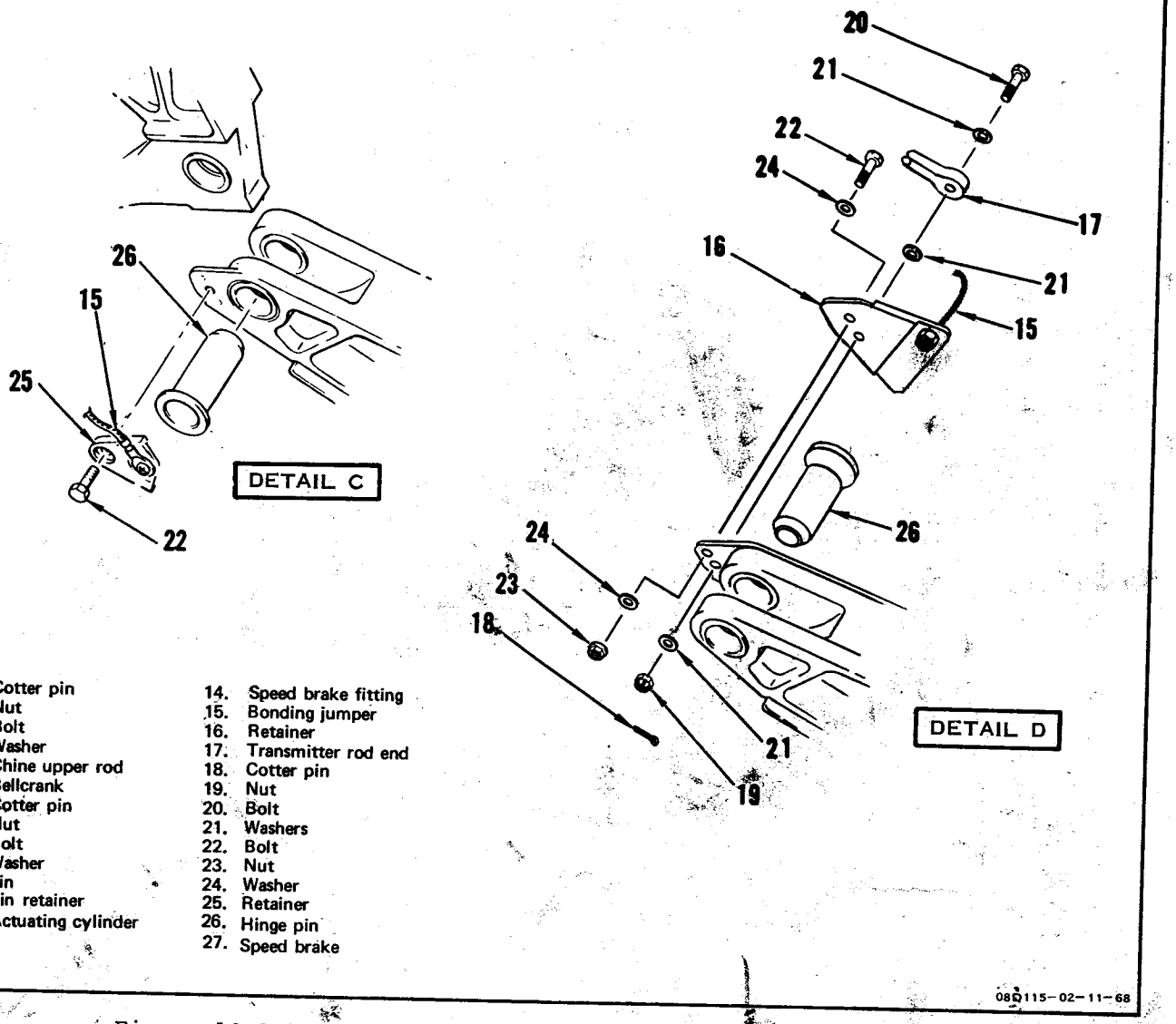


Figure 10-9. Speed Brake Removal and Installation (Sheet 1)



1. Cotter pin
2. Nut
3. Bolt
4. Washer
5. Chine upper rod
6. Bellcrank
7. Cotter pin
8. Nut
9. Bolt
10. Washer
11. Pin
12. Pin retainer
13. Actuating cylinder
14. Speed brake fitting
15. Bonding jumper
16. Retainer
17. Transmitter rod end
18. Cotter pin
19. Nut
20. Bolt
21. Washers
22. Bolt
23. Nut
24. Washer
25. Retainer
26. Hinge pin
27. Speed brake

Figure 10-9. Speed Brake Removal and Installation (Sheet 2)

m. To remove right hinge retainer, remove nut (23), washers (24), and bolt (22).

n. Remove hinge pin (26) from both hinges with hinge pin puller and remove speed brake (27).

o. Unlock dolly wheels.

p. Lower dolly, install adapter pin to secure speed brake, and roll dolly with speed brake away from airplane.

10-39. INSTALLATION. (See figure 10-9.)

a. Lubricate all bolts, bushings, and ball joints with MIL-G-81322 grease.

b. Lubricate chine hinges and pins with MIL-L-7870 oil.

c. Place speed brake on dolly and adapter. Roll dolly under speed brake fuselage cavity.

d. Remove adapter pin securing speed brake. Tilt speed brake (27) on dolly and raise dolly to align brake and fuselage hinges. Lock dolly wheels.

e. Install hinge pins (26).

f. Install hinge pin retainer (25) with bolt (22). Secure bolt with MS20995C32 lockwire on left hinge. On right hinge, secure retainer (16) with washers (24) and nut (23).

g. Connect transmitter rod end (17) to right hinge pin retainer with bolt (20), washers (21), nut (19), and new cotter pin (18).

h. Install screws attaching bonding jumpers (15) to fuselage.

i. Remove dolly from under airplane.

NOTE

During rigging, trim speed brake to obtain contour fit with fuselage.

j. Rig speed brake (paragraph 10-30).

k. Connect external electrical power (T.O. 1A-7D-2-1).

l. Check that speed brake advisory light is on.

CAUTION

To prevent structural damage from interference, do not operate speed brake while access 1232-1 or 2232-1 is open. To avoid damage to flap cylinder lock, ensure that flap handle is in the same position as the flaps before operating the hand pump.

m. Retract speed brake. Advisory light will go off when speed brake is 1/2 to 1/4 inch from fully closed position at aft end of wide portion of brake.

n. Disconnect external electrical power.

o. Close accesses 1233-3 and 2233-3.

p. Fabricate formed-in-place door seal along chine edges mating with brake surface and along aft edge of brake (T.O. 1A-7D-3).

10-40. SPEED BRAKE REPAIR. (See figure 10-10.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	GGG-W-686	Torque wrench, 10 to 150 pound-inches	Torque nuts and bolts

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10-41. DISASSEMBLY.

NOTE

Disassemble only to extent required for repair or replacement of defective parts.

a. Remove cotter pin (1), nut (2), washers (3), and bolt (4) securing link (5) to chine fitting (6).

b. Remove hinge pin stop, consisting of nut (7), washers (8), bonding jumper (9), and screw (10) from chine (11).

c. Withdraw hinge pin (12) securing chine to speed brake (13).

d. Remove cotter pin (14), nut (15), washers (16), and bolt (17) securing link (5) to arm (18).

e. Remove plug (19) from speed brake.

f. Remove cotter pin (20), nut (21), washer (22), bolt (23), pin (24), and bushing (25) securing arm (18) to speed brake.

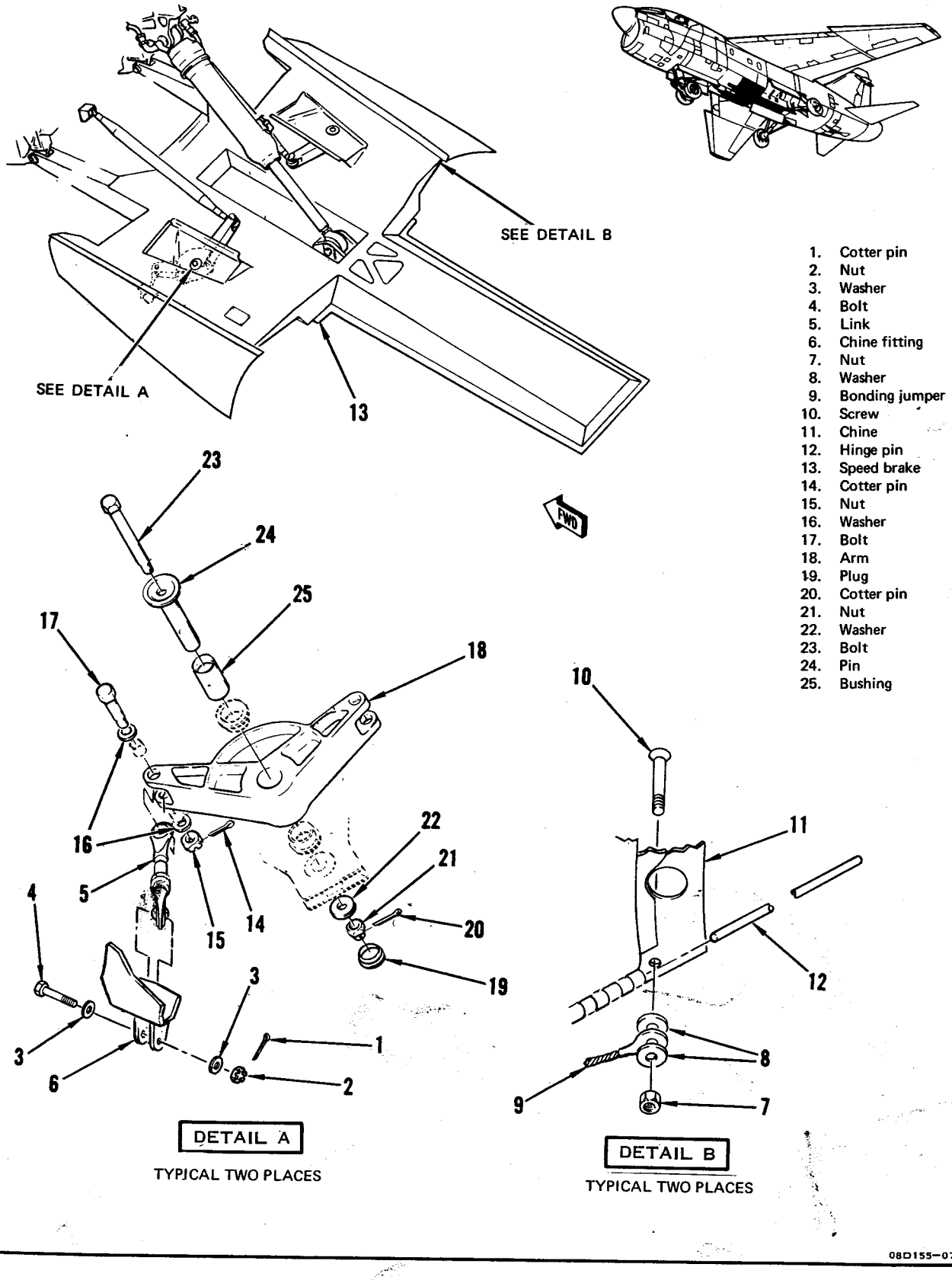


Figure 10-10. Speed Brake Repair

10-42. CLEANING AND INSPECTION.

WARNING

P-D-680 is combustible and moderately toxic to eyes, skin, and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate.

a. Clean parts with P-D-680 dry-cleaning solvent and dry with clean, soft cloth.

b. Inspect all parts for cracks, dents, nicks, distortion, corrosion (T.O. 1A-7D-23), excessive wear, and other damage.

10-43. REPAIR.

a. Perform any structural repair required (T.O. 1A-7D-3).

b. Clean minor corrosion from parts (T.O. 1A-7D-23). Replace excessively corroded parts.

c. Replace cracked, broken, distorted, or excessively worn parts.

10-44. REASSEMBLY.

a. Install arm (18) on speed brake (13) with bushing (25), pin (24) with grease fitting facing inboard, bolt (23), washer (22), and nut (21).

b. Tighten nut to 35 (±5) pound-inches torque.

c. Install new cotter pin (20).

d. Install plug (19) in speed brake.

e. Connect nonadjustable end of link (5) to arm (18) with bolt (17), washers (16), and nut (15).

f. Install new cotter pin (14).

g. Align chine (11) and speed brake (13) at hinge and install hinge pin (12).

h. Install screw (10), washers (8), bonding jumper (9), and nut (7) in chine.

i. Connect link (5) to chine fitting (6) with bolt (4), washers (3), and nut (2).

j. Install new cotter pin (1).

k. Lubricate bearings with MIL-G-23827 grease.

l. Stake forward hinge lug to retain hinge pin.

10-45. SPEED BRAKE POSITION SWITCH REMOVAL AND INSTALLATION.

10-46. REMOVAL.

a. Extend speed brake (paragraph 10-26).

b. Remove nut and washer securing speed brake position switch to support bracket.

c. Cut wires at convenient location for splicing and remove switch.

10-47. INSTALLATION.

a. Splice speed brake position switch wires to airplane wires.

b. Secure switch to support bracket with nut and washer.

c. Adjust switch (paragraph 10-48).

10-48. SPEED BRAKE POSITION SWITCH ADJUSTMENT. (See figure 10-11.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power

TT08D-051-07-70

a. Connect external electrical power (T.O. 1A-7D-2-1).

b. Extend speed brake (paragraph 10-26).

c. Adjust speed brake position switch so that plunger extends 0.40 inch below the switch support bracket.

d. Cycle brake with hand pump and adjust switch so speed brake advisory light first comes on when brake opens 1/4 to 1/2 inch (measured at aft end of wide portion of brake).

e. Secure switch with MS20995C32 lockwire.

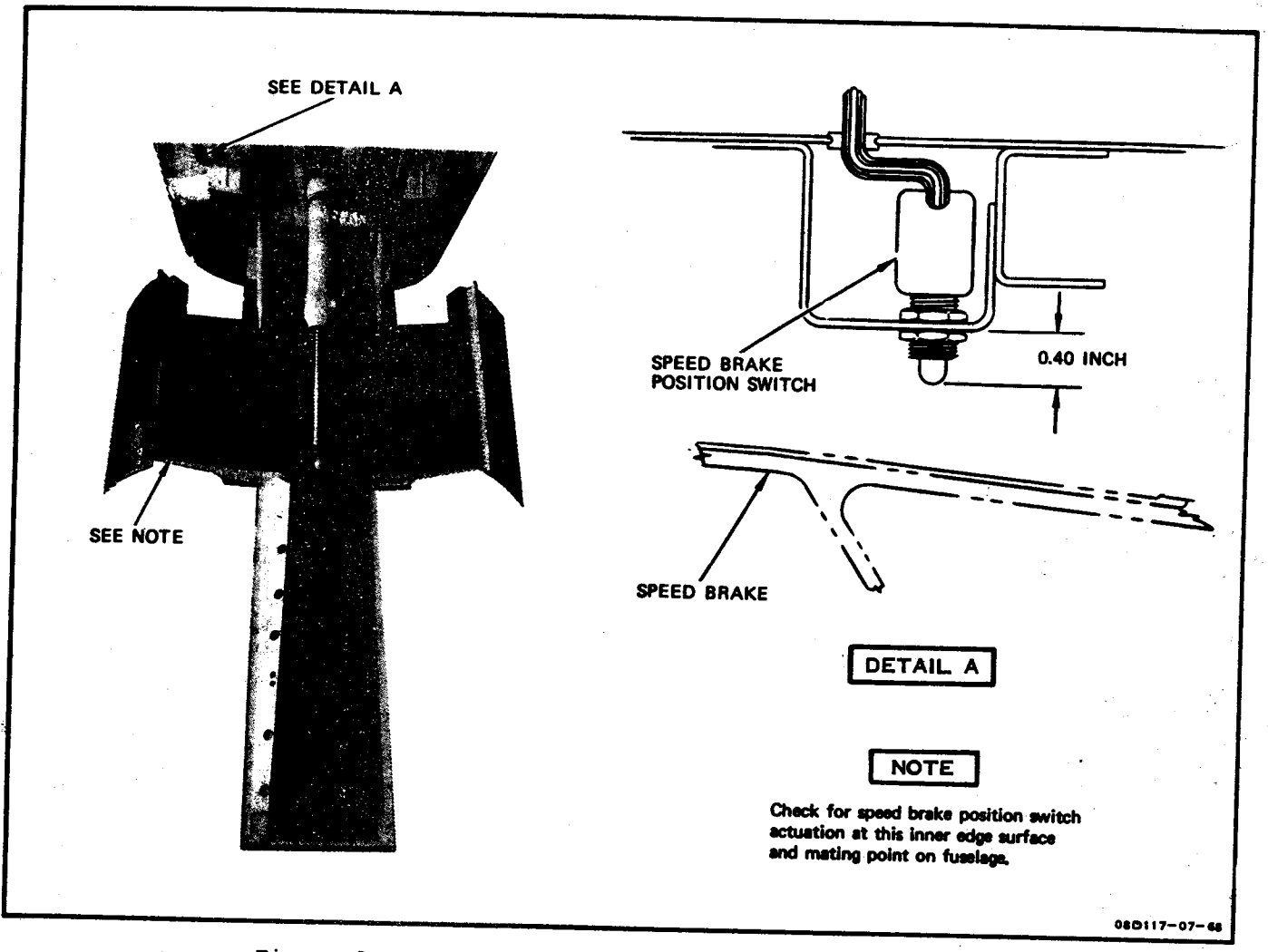


Figure 10-11. Speed Brake Position Switch Adjustment

f. Retract speed brake (paragraph 10-26).

g. Disconnect external electrical power.

10-49. SPEED BRAKE UNLOAD VALVE REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	GGG-W-686	Torque wrench, 10 to 150 pound-inches	Tighten brazed tube bushing end jamnut TT08D052-01-72

10-50. REMOVAL.

a. Cut lockwire securing valve handle to stop.

b. Cut lockwire, remove bolt and two washers securing handle to valve, and remove handle.

CAUTION

Ensure speed brake is locked in retracted position before disconnecting hydraulic lines to prevent extension of speed brake.

c. Disconnect hydraulic line from elbow.

CAUTION

Restrain brazed tube assembly bushings when loosening jamnuts to prevent damage to tube ends.

d. Disconnect three brazed tubes by loosening outer jamnuts, then backing out bushings. Discard gaskets.

e. Cut lockwire, remove four bolts and four washers securing valve to bracket and remove valve.

f. Back off jamnut and remove elbow from valve. Discard gasket and retainer.

10-51. INSTALLATION.

a. Install elbow in unload valve using new retainer and new gasket.

b. Install new gaskets on brazed tube bushings.

b-1. Position valve on mounting bracket with CYL 2 port facing outboard and aft.

c. Secure valve to bracket with four washers and four bolts. Secure bolts with MS20995C32 lockwire.

d. Screw bushings into valve until hex shoulders bottom on valve. Tighten bushings to 95 (±25) pound-inches torque.

e. Tighten jamnuts on brazed tubes to 95 (±25) pound-inches torque. Apply CVC3017 torque stripe over jamnut.

f. Connect hydraulic line to elbow and tighten jamnut.

g. Secure valve handle to valve with two washers and bolt. Secure bolt with MS20995C32 lockwire.

h. Rotate handle counterclockwise to closed position (handle against stop).

i. Extend speed brake (paragraph 10-26).

j. Disconnect actuating cylinder from speed brake.

k. Loosen line fitting at retract end of cylinder.

l. Extend piston with hand pump. Tighten fitting when air-free fluid flows.

m. Loosen line fitting at extend end of cylinder.

n. Retract piston with hand pump. Tighten fitting when air-free fluid flows.

o. Perform hydraulic system air check (T.O. 1A-7D-2-1).

p. Perform speed brake system operational checkout (paragraph 10-21).

q. Check that lines and fittings that were disconnected are not leaking.

10-52. SPEED BRAKE POSITION TRANSMITTER REMOVAL AND INSTALLATION.

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
	GGG-W-686	Torque wrench, 10 to 150 pound-inches	Tighten speed brake transmitter arm after installation TT08D053-05-69

10-53. REMOVAL.

WARNING

To prevent personnel injury, ensure that external hydraulic power is disconnected at all times while maintenance is being performed in speed brake well.

a. Open accesses 2233-1 and 1233-2.

b. Disconnect position transmitter actuating rod from position transmitter lever by removing cotter pin, nut, bolt, and washers.

c. Loosen position transmitter lever retaining lockscrew and slide lever off position transmitter shaft.

d. Cut and identify wires connected to transmitter at a convenient point for splicing.

e. Cut lockwire, and remove four position transmitter attaching bolts, nuts, and washers.

f. Remove position transmitter.

10-54. INSTALLATION.

a. Secure position transmitter to bracket with four bolts, nuts and washers.

b. Secure bolts with MS20995C32 lockwire.

c. Splice transmitter wires to harness wires.

d. Slide transmitter lever onto position transmitter shaft and secure other end of lever to position transmitter actuating rod with bolt, two washers, and nut. Tighten nut to 14 (±1) pound-inches torque and install new cotter pin.

e. Rig position transmitter (paragraph 10-55).

f. Close accesses 2233-1 and 1233-2.

10-55. RIGGING SPEED BRAKE POSITION TRANSMITTER. (See figure 10-12.)

Tools Required

Figure & Index No.	*Part Number*	*Nomenclature*	*Use and Application*
		Equipment for connecting external electrical power	Connect electrical power

TT08D132-07-70

CAUTION

To prevent structural damage from interference, do not operate speed brake while access 1232-1 or 2232-1 is open.

a. Open accesses 2233-3 and 1233-2.

WARNING

To prevent personnel injury, ensure that external hydraulic power is disconnected at all times while maintenance is being performed in speed brake well.

b. Check that position transmitter actuating rod (1) is adjusted to a length of 6.55 (±0.02) inches center to center of the rod ends. To adjust actuating rod (1) perform steps c through g. If actuating rod is adjusted correctly, proceed to step g.

c. Cut lockwire and loosen jamnuts (2 and 3) at forward and aft ends of actuating rod.

d. Remove cotter pins (4 and 5), nuts (6 and 7), and washers (8 and 9).

e. Remove bolt (13), washers (14), and actuating rod (1). Alternately adjust rod ends (10 and 11) until a length of 6.55 (±0.02) inches is obtained with an equal number of threads exposed on rod ends. Tighten jamnuts and secure with MS20995C32 lockwire.

f. Install actuating rod on bolt (12) and attach opposite end to bracket with washers (14) and bolt (13). Secure actuating rod with washers (8 and 9), nuts (6 and 7), and new cotter pins (4 and 5).

g. Loosen position transmitter shaft lever lockscrew (16).

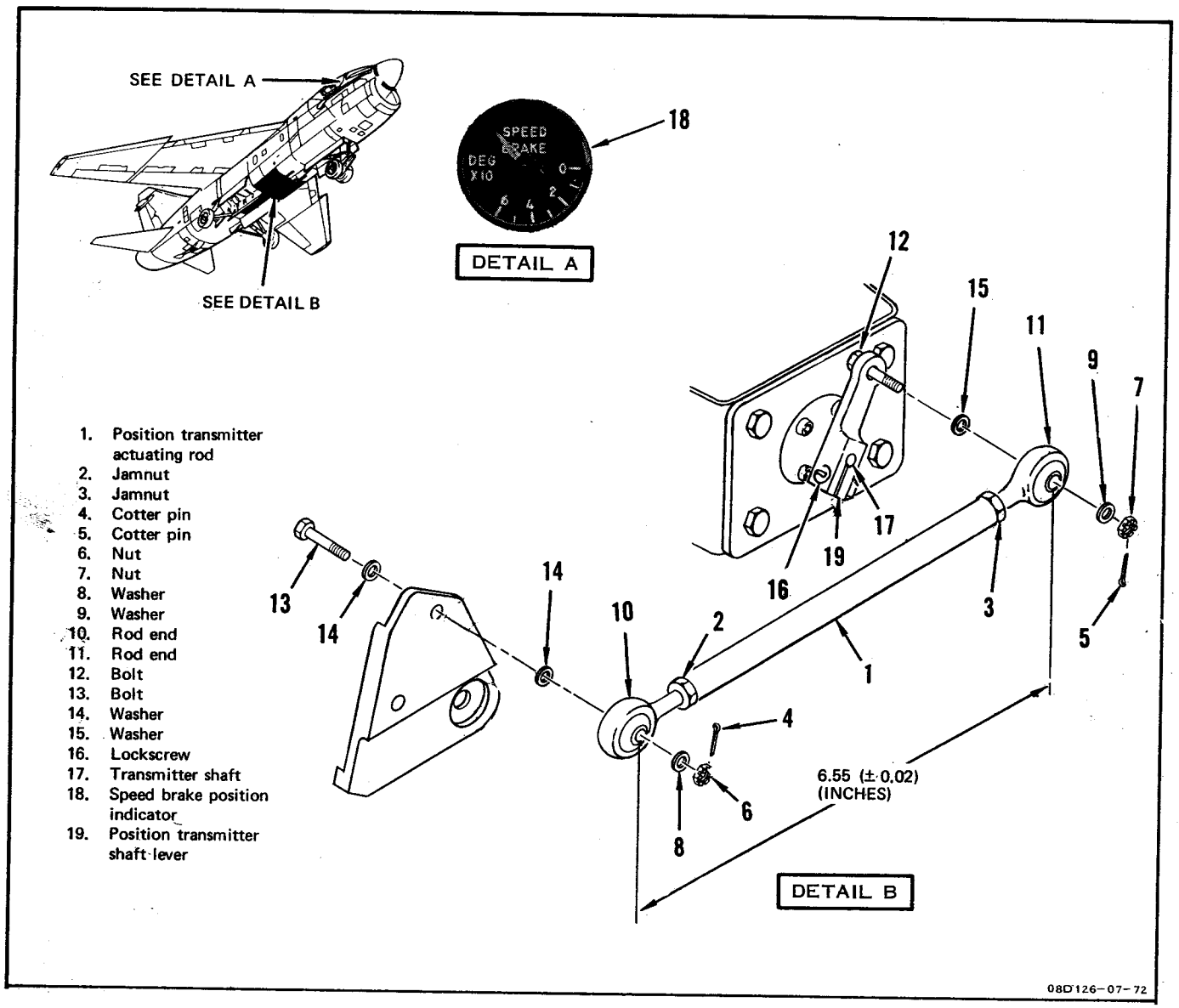
h. Connect external electrical power (T.O. 1A-7D-2-1).

i. Operate hand pump to fully close speed brake. Rotate position transmitter shaft (17) until cockpit speed brake position indicator (18) indicates 0°.

j. Check that position transmitter shaft lever (19) is flush with the end of shaft (17) and tighten lockscrew (16).

k. Disconnect external electrical power.

l. Close accesses 2233-3 and 1233-2.



1. Position transmitter actuating rod
2. Jamnut
3. Jamnut
4. Cotter pin
5. Cotter pin
6. Nut
7. Nut
8. Washer
9. Washer
10. Rod end
11. Rod end
12. Bolt
13. Bolt
14. Washer
15. Washer
16. Lockscrew
17. Transmitter shaft
18. Speed brake position indicator
19. Position transmitter shaft lever

Figure 10-12. Speed Brake Position Transmitter Rigging

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	General	Description	Operation	Components	Checkout	Troubleshooting	Rigging/Adjustment	Removal/Installation	Bleeding	Repair		
Cylinder, Flap Actuating Trailing Edge							9-80					
Cylinder, Rudder PC							5-69 *5-15					
Cylinder, Speed Brake							*10-8 10-34					
Cylinder, Spoiler/Deflector PC							4-26 *4-5	4-34	4-29 *4-6			
Cylinder, UHT PC								6-88 *6-17				
Cylinder, Viscous Damper Aft (UHT)	6-34						*6-12	6-73				
Cylinder, Viscous Damper (Aileron)								2-50				
Cylinder, Viscous Damper Forward (UHT)	6-34							6-52 *6-7				
Deflector							4-24 *4-4	4-39 *4-8				
Door, Flap Slot							9-46 9-47 *9-19	9-99				
Emergency Flap System Electrical Troubleshooting Schematic Diagram						*9-11 *9-12						
Extension Unit, Aileron								2-82				
Extension Unit, Roll Feel Isolation								2-62				
Extension Unit, Spoiler/Deflector								4-25				
Flap Actuating Cylinder Uplock Switch, Leading Edge	*9-23						9-84	9-83				
Flap Actuating Cylinder Uplock Switch, Trailing Edge							9-134	9-133				
Flap, Center Section Leading Edge							9-43 *9-17 *9-18	9-88				

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	General	Description	Operation	Components	Checkout	Troubleshooting	Rigging/Adjustment	Removal/Installation	Bleeding	Repair		
Link, Rudder, Flap Cable Stop								5-57				
Link, Spoiler/Defector Load-Limiting								2-73				
Linkage, Aft (UHT)							6-42					
Linkage, Aileron/Spoiler Mixing								2-70 *2-12				
Linkage, Aileron/Spoiler Mixing to Spoiler/Defector							2-42					
Linkage, Control Stick To Feel and Trim (UHT)							6-38					
Linkage, Control Stick to Feel Isolation Actuator and Roll AFCS (Aileron)							2-36					
Linkage, Flap Manual Control							9-42 *9-15					
Mechanism, Aft Cam								6-58 *6-8				
Package, Roll AFCS							2-39	2-67 *2-10				
Rigging Clean Condition Stops and Cables							5-33					
Rivet, Forward Viscous Damper Cylinder Rod End Attaching								6-55				
Roll and Pitch Trim System Controls and Indicators	*3-1											
Roll Trim Control and Indicating System Schematic Diagram	*3-3 *3-4											
Roll Trim System	*3-2	3-1	3-4	3-10 †3-1	3-12	3-13 †3-2	3-15 3-16					
Rudder Assembly								5-79 *5-18				
Rudder Clean Condition Stops Push-Pull Control Assembly								5-82 *5-19				
Rudder Control Cable, Aft								5-48A *5-11A				

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	General	Description	Operation	Components	Checkout	Troubleshooting	Rigging/Adjustment	Removal/Installation	Bleeding	Repair		
Trailing Edge Flap Troubleshooting Schematic Diagram						*9-5 *9-4						
Transmitter, Speed Brake Position							10-55 *10-12	10-52				
Transmitter, Trailing Edge Flap Synchro							9-109	9-106				
UHT Actuator Pin Removal/Installation Tool		*6-16A										
UHT Assembly								6-91 *6-18				
UHT Backup Controls Load-Limiting Link								6-95 *6-19				
UHT Backup Controls Push-Pull Control Assembly							6-44 *6-6	6-98 *6-20				
UHT Backup Controls Torque Tube								6-104 *6-22				
UHT Backup Controls Torque Tube Link					6-33			6-101 *6-21				
UHT Control System	6-28 *6-1	6-1	6-7	6-26 †6-1	6-30	6-31 †6-2	*6-5					
UHT Control System Schematic Diagram	*6-2											
UHT PC Cylinder							6-43		6-49			
UHT Throws					*6-3							
Valve, AMF Extend								9-122 *9-28				
Valve, AMF Extend Shutoff								9-125 *9-29				
Valve, AMF Retract								9-128 *9-30				
Valve, AMF Thermal Relief								9-131 *9-31				

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	General	Description	Operation	Components	Checkout	Troubleshooting	Rigging/Adjustment	Removal/Installation	Bleeding	Repair		
Valve, Emergency Bypass, Flap								9-85				
Valve, Emergency Flap Selector								9-113				
Valve, Flap Selector								9-68				
Valve, Rudder Servo								5-66 *5-14				
Valve, Speed Brake Selector								10-31 *10-7				
Valve, Speed Brake Unload								10-49				