CHAPTER 67 — FLIGHT CONTROLS

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FIGURES

FLIGHT CONTROLS

67-1. INTRODUCTION.

This chapter contains instructions for maintenance of the flight control systems. Mechanical linkage systems, actuated by conventional helicopter controls, are used to control flight attitude and direction. Systems include a cyclic control stick for fore, aft, and lateral control; a collective pitch control stick for vertical control; and antitorque pedals for directional control. A synchronized elevator is linked into cyclic fore-and-aft control system. Electrically operated force trims, connected to cyclic and antitorque controls, induce artificial control feel and stabilize the control stick and pedals to prevent movement from feedback forces.

67-2. TROUBLESHOOTING.

Refer to Chapter 29 for flight control troubleshooting.

FLIGHT CONTROL RIGGING

67-3. FLIGHT CONTROL RIGGING

The following paragraphs provide rigging instructions for the collective, cyclic, antitorque (tail rotor), and synchronized elevator controls.

67-4. GENERAL RIGGING INSTRUCTIONS

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-104	Corrosion Preventive Compound

NOTE

The following general procedures shall be followed when rigging any control system unless detailed instructions direct otherwise.

1. Perform all checks and rigging with hydraulic boost off and hydraulic systems properly bled (Chapter 29).

2. After adjustment, control tube shall be free to rotate several degrees about the longitudinal axis.

3. After adjustment, control tubes jam nuts shall be torqued 80 to 100 inch-pounds (9.04 to 11.29 Nm) unless otherwise specified.

4. Prior to beginning rigging, ensure all control tubes and links within that system are installed and all rigging points are disconnected.

5. Tolerance for rigging dimensions is ±0.03 inch (0.76 mm) except as noted.

6. Apply corrosion preventive compound (C-104) to threads of all adjustable rod end bearings and clevises.

7. Pilot cyclic or collective may be held either by hand or with friction adjustment when a rigging procedure requires either be maintained in a specific position.

8. All adjustable control tubes shall have a minimum of one complete thread exposed after final adjustment. Thread engagement shall be sufficient to cover inspection hole when so equipped.

67-5. COLLECTIVE CONTROLS

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-308	Adhesive
C-405	Lockwire

NOTE

Refer to paragraph 67-4 prior to beginning rigging.

1. Disconnect collective pitch controls at rigging points as follows:

a. Control tube (2, Figure 67-1) from collective levers (1).

b. Control tube (6) and spring (19), from actuator lever (18).

2. Place collective control stick full up against stop. Tighten friction adjustment to hold in position.

3. For helicopters S/N 30796 and subsequent, disconnect control tube (3, Figure 67-2) at forward end and position bellcrank (2) to dimension shown. Adjust control tube to fit and install on lever (10, Figure 67-1).

4. With collective controls positioned per step 2 (step 3 for helicopters S/N 30796 and subsequent), move actuator lever (18) enough to release hydraulic lock of cylinder and move (or bottom) hydraulic cylinder in up position.

1. Collective lever
2. Control tube
3. Universal
4. Support
5. Cylinder
6. Control tube
7. Support
8. Bellcrank
9. Control tube
10. Lever
11. Control tube
12. Clamp
13. Bearing housing
14. Control arm
15. Jackshaft tube
16. Boot
17. Pilot collective stick
18. Actuator lever
19. Spring
20. Support
21. Lock
22. Clevis
23. Nut

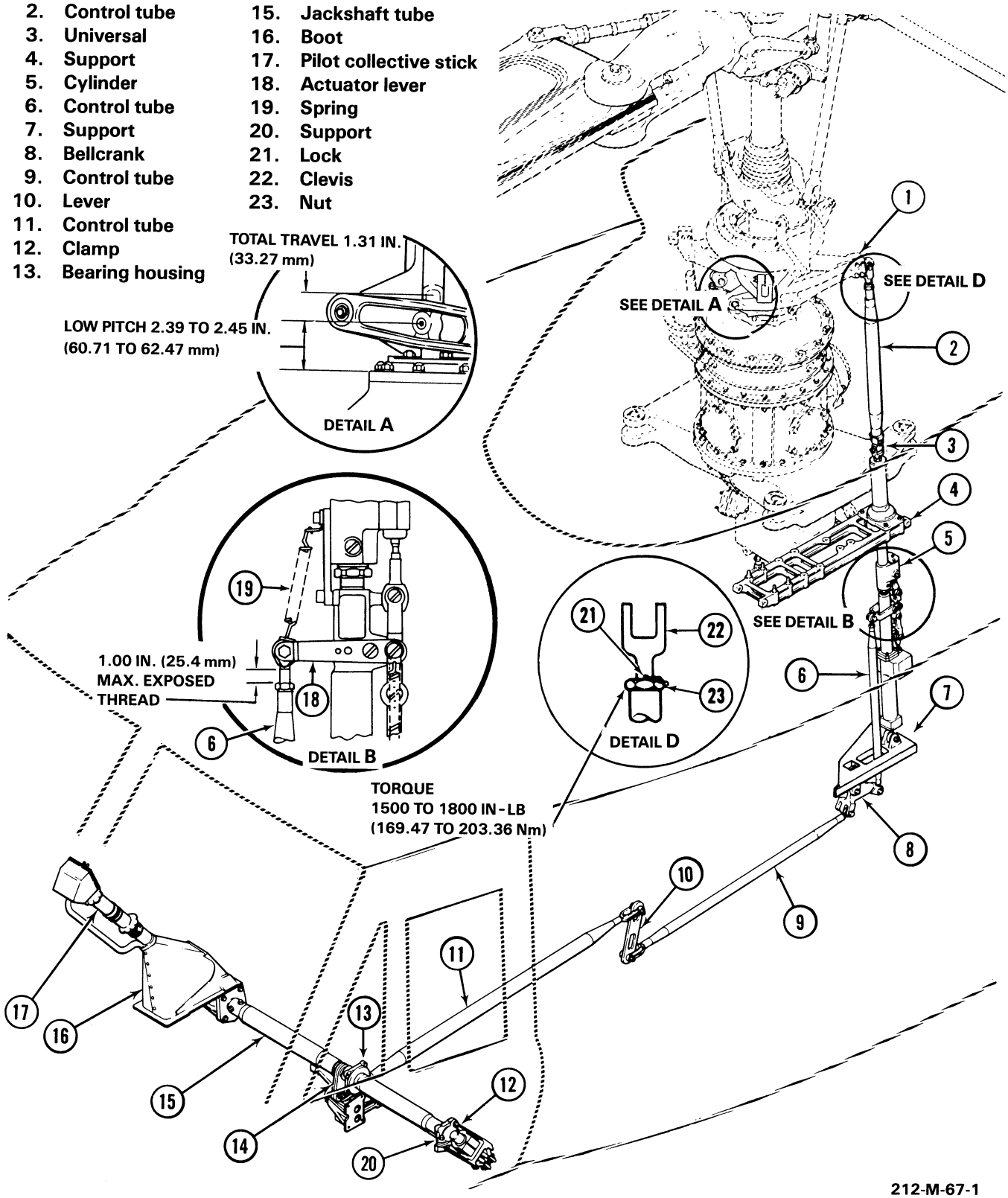

Figure 67-1. Collective controls

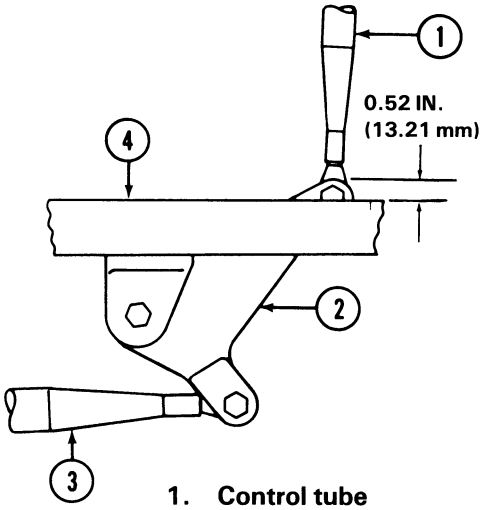

Figure 67-2. Collective bellcrank

Set valve actuator lever in position shown in detail B.

5. Adjust control tube (6) to correct length to attach to actuator lever (18), then shorten 3 to 5 turns at end fitting. Attach to lever with bolt, using clip under bolthead and washer under nut. Attach spring (19) before tightening nut. Install cotter pin.

NOTE

Maximum exposed thread dimension on control tube (6) is 1.0 in. (25.4 mm) (detail B).

CAUTION

COLLECTIVE CONTROL LINKAGE BELOW SERVO ACTUATOR SHALL NOT MOVE WHILE PERFORMING STEP 6 .

6. Place collective control stick full down against stop. Tighten friction adjustment to hold in position. Position collective lever (1) 2.39 to 2.45 in. (60.71 to 62.23 mm) from center of lever cam roller bolt to top surface of mast bearing plate (detail A). Center actuator lever (18) and adjust length of control tube (2) to fit. Connect control tube (2) to collective lever (1). Install washers on bolt, install bolt, washer, and nut. Torque nut, install cotter pin. Torque nut (23) on clevis (22) 1500 to 1800 in.lbs. (169.47 to 203.36 Nm). Apply lockwire (C-405) to lock (21, detail D). Apply adhesive (C-308) evenly around nut, lock, and threads on clevis.

NOTE

If rigging system with hydraulic system not completely bled of air, apply sufficient downward pressure on control tube (2) to hold actuator lever (18) at top of travel. Adjust clevis on control tube (2) to fit collective lever (1) then shorten one full turn of clevis and connect as described in step 6 .

7. Establish main rotor low blade angle of 8° (Chapter 62).

8. Check minimum friction adjustment on collective control stick (paragraph 67-22).

9. Inspect collective pitch control system for secure installation and unobstructed full travel.

67-6. CYCLIC CONTROLS (HELICOPTERS PRIOR TO S/N 30850).

MATERIALS REQUIRED

NUMBER	NOMENCLATURE
C-308	Adhesive
C-405	Lockwire

CAUTION

FOR RIGGING IFR EQUIPPED HELICOPTERS, REFER TO APPLICABLE SERVICE INSTRUCTIONS .

NOTE

Refer to paragraph 67-4 prior to beginning rigging.

1. Disconnect extension tubes (3 and 10, figure 67-3) and spring (2) from swashplate horns, and control tubes (9) from valve arm (30) of hydraulic cylinders (7 and 14).

NOTE

For rigging procedures if dual control kits is installed, refer to appropriate Service Instruction .

2. Hold pilot cyclic stick in extreme aft left corner position so upper arm of bellcrank (8) is in upper-most position. Bottom out piston at top of right side hydraulic cylinder (7) and position valve arm (30) to top of travel. Adjust control tube (9) to correct length to attach to valve arm (30). Shorten control tube by three turns and connect to input lever with bolt, washer, nut, and cotter pin.

3. Hold pilot cyclic stick in extreme aft right corner so upper arm of bellcrank (15) is in uppermost position. Bottom out piston at top of left hydraulic cylinder (14) and position valve arm (30) to top of travel. Adjust control tube (9) to correct length to attach to valve arm (30). Shorten control tube by three turns and connect to input lever with bolt, washer, nut and cotter pin.

4. Position pilot cyclic stick perpendicular to deck within $^1/_2$ degree.

NOTE

Alternate procedure for centering cyclic stick with copilot cyclic stick installed: Install T101330 cyclic stick fixture on copilot cyclic stick.

5. Set swashplate within dimensions of figure 67-4 .

NOTE

If rigging system with hydraulic cylinder not completely bled of air, bottom valve arm (30, figure 67-3) at top of travel. Adjust extension tubes (3 and 10) to fit swashplate; shorten one full turn and attach as described in step 6 .

6. Position valve arm (30) to center.

7. Adjust each extension tube (3 and 10) to correct length and attach to swashplate with bolt, washer, nut and cotter pin. Torque jamnuts on control tubes 1500 to 1800 in.lbs. (169.47 to 203.36 Nm) and secure with lockwire (C-405) (figure 67-1 , detail D).

8. Apply adhesive (C-308) around nut, lock, and threads on clevis.

9. Hold arm of lateral magnetic brake (20, figure 67-3) in center of travel. Adjust link of force gradient (21) to align on bellcrank (23). Install bolt, washers (under head), and nut;

secure with cotter pin. Tighten nut against link.

10. Loosen cyclic stick friction (or remove rigging fixture, if installed).

11. Check clearance between lateral force gradient and structure at extreme positions of brake arm. If required for clearance, brake arm may be moved one serration on shaft.

12. Hold cyclic stick against forward stop. Hold arm of fore-aft magnetic brake (17) full aft.

13. Adjust clevis of force gradient (18) to fit on cyclic lever of jackshaft (26) plus two turns, for approximately 0.30 inch (7.62 mm) cushion at forward cyclic stop. Install bolt and washer. Secure bolt head with lockwire (C-405).

14. Connect spring (2) to bracket on right forward horn of swashplate.

15. Check complete system for secure installation and unobstructed full travel.

NOTE

Adjust swashplate lateral pretilt, within dimension of Figure 67-4, for satisfactory flight.

67-7. CYCLIC CONTROLS (HELICOPTERS S/N 30850 AND SUBSEQUENT)

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
T101330	Cyclic Stick Fixture

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-308	Sealant
C-405	Lockwire

CAUTION

FOR RIGGING IFR EQUIPPED HELICOPTER, REFER TO APPLICABLE SERVICE INSTRUCTIONS.

NOTE

Refer to paragraph 67-4 prior to beginning rigging.

1. Disconnect extension tubes (3 and 10, Figure 67-3) and spring (2) from swashplate horns.

2. Disconnect control tubes (9) from valve arm (30) of hydraulic cylinders (7 and 14).

3. Retract all stop bolts (Views D and E) as far as possible and secure with lockwire (C-405).

4. Place pilot cyclic stick (25) in extreme aft left corner position, so upper arm of bellcrank (8), below right hydraulic cylinder (7), is in upper most position.

5. Bottom out piston at top of right hydraulic cylinder (7). Set valve arm (30) in position as shown in View A.

6. Adjust control tube (9) to fit, then shorten tube by three turns of rod end bearing and install on valve arm.

7. Place pilot cyclic stick (25) in extreme aft right corner position so upper arm of bellcrank (15), below the left hydraulic cylinder (14), is in uppermost position.

8. Bottom out piston at top of left hydraulic cylinder (14) and set valve arm (30) in position as shown in View A.

9. Adjust control tube (9) to fit then shorten tube by three turns of rod end bearing and install.

10. Position pilot cyclic control stick perpendicular to the deck within 1/2°.

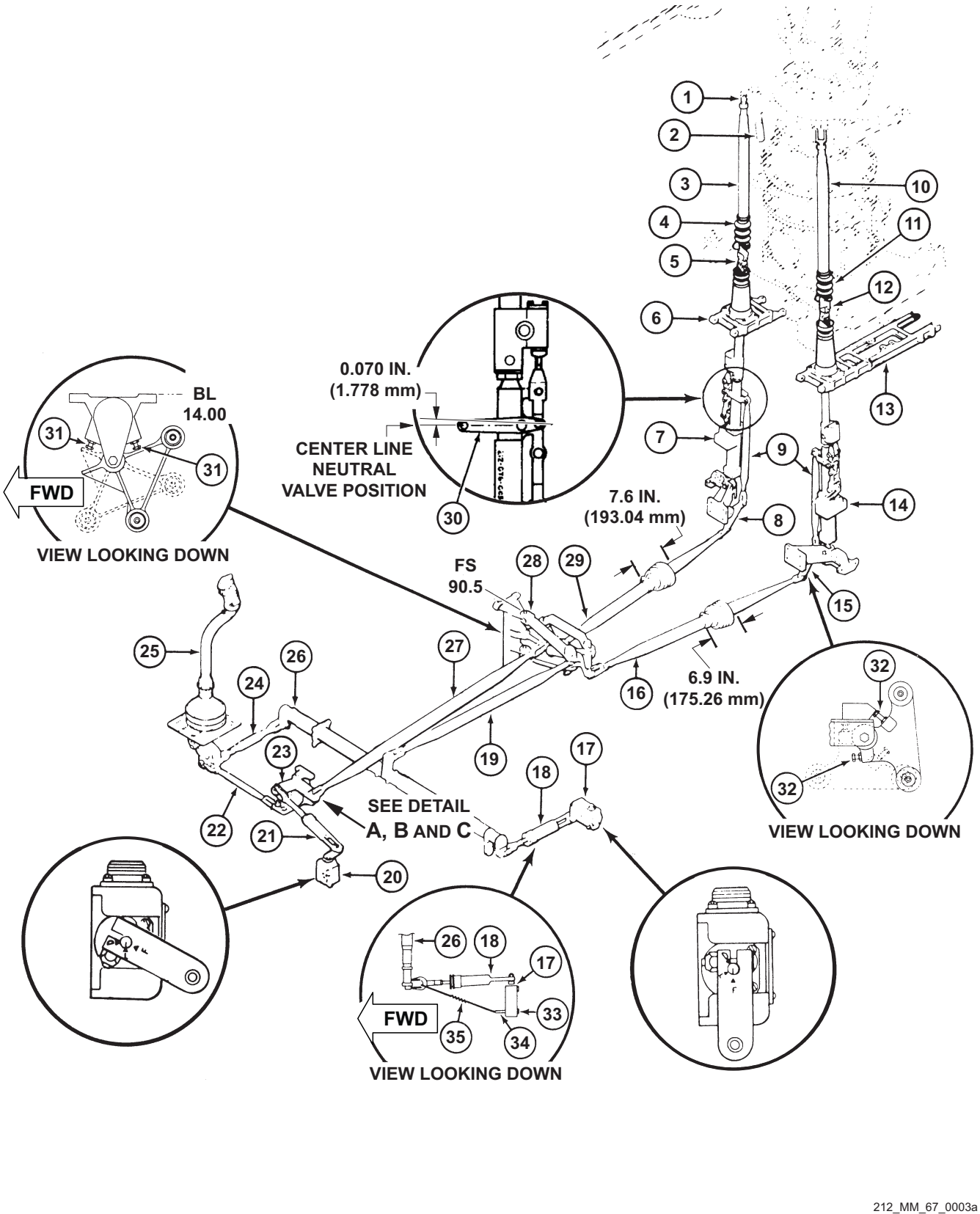

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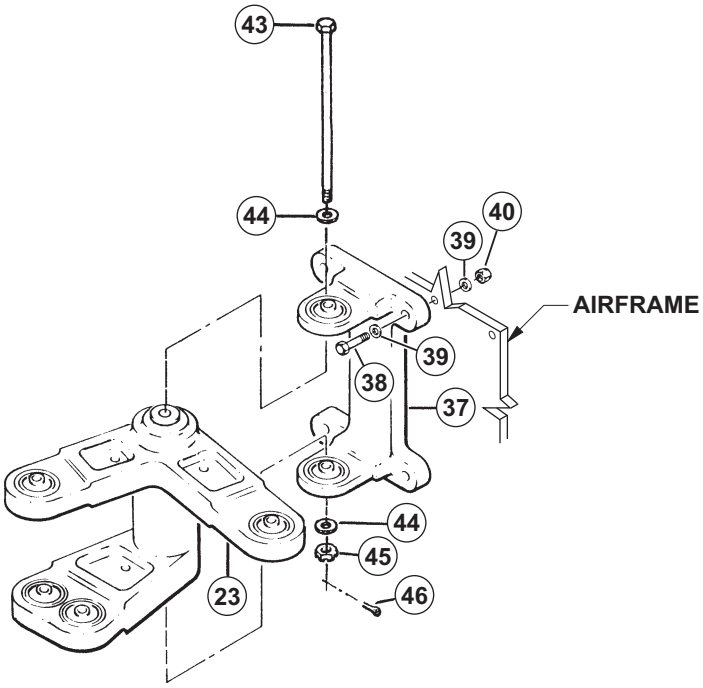
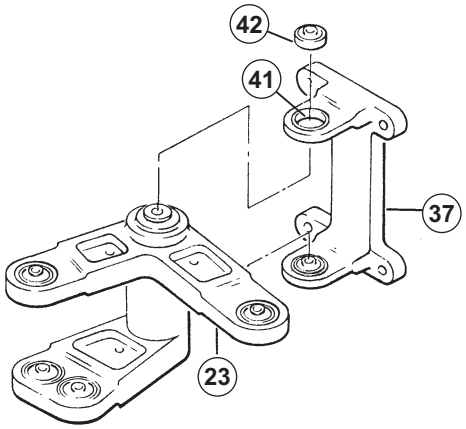
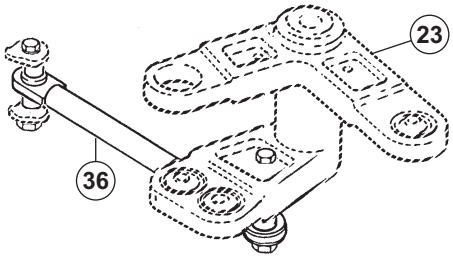
Figure 67-3. Cyclic Controls (Sheet 1 of 2)



DETAIL A



DETAIL B
BEARING INSTALLATION



DETAIL C
(SOME PARTS OMITTED FOR CLARITY)

1. Bolt
2. Spring
3. Extension tube
4. Boot
5. Universal
6. Cylinder support
7. Hydraulic cylinder
8. Bellcrank
9. Control tube (2)
10. Extension tube
11. Boot
12. Universal
13. Support
14. Hydraulic cylinder
15. Bellcrank
16. Control tube
17. Magnetic brake
18. Force gradient
19. Control tube
20. Magnetic brake
21. Force gradient
22. Control tube
23. Bellcrank
24. Control tube
25. Pilot cyclic stick
26. Cyclic jackshaft
27. Control tube
28. Mixing lever
29. Control tube
30. Valve arm
31. Stop bolt
32. Stop bolt
33. Bolt
34. Plate
35. SpringBellcrank
36. Transducer
37. Support assembly
38. Bolt
39. Washer
40. Nut
41. Sleeve
42. Bearing
43. Bolt
44. Washer
45. Nut
46. Cotter pin

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Figure 67-3. Cyclic Controls (Sheet 2 of 2)

NOTE

Alternate procedure for centering cyclic stick with copilot cyclic stick installed. Install cyclic stick fixture (T101330) on copilot cyclic stick.

11. Set swashplate as per dimensions of Figure 67-4.

12. Position valve arm (30, Figure 67-3) to center.

13. Adjust each extension tube to correct length and attach to swashplate with bolt, washer, nut, and cotter pin. Torque jam nuts on control tubes 1500 to 1800 inch-pounds (169.47 to 203.36 Nm) and secure with lockwire (C-405) (Figure 67-1, Detail D). Apply sealant (C-308) around nut, lock, and threads on clevis.

NOTE

If rigging system with hydraulic cylinder is not completely bled of air, bottom valve arm (30, Figure 67-3) at top of travel. Adjust extension tube (3 and 10) to fit swashplate; shorten one full turn and attach as described in step 13.

14. Install extension tubes (3 and 10) on swashplate horns with bolts and nuts. Secure with cotter pins.

NOTE

When rigging with fluid in bled hydraulic system, the hydraulic cylinder valve arms should be centered and no change in extension tubes (3 and 10) adjustment is required.

15. Position output arm of longitudinal and lateral magnetic brakes (17 and 20) at center of travel (Views B and C).

16. Place pilot cyclic stick (25) against extreme forward stop. Place output arm of longitudinal magnetic brake (17) against aft stop. Adjust force gradient (18) to fit. Extend clevis on force gradient two turns and install. For initial installation, install spring (35) in fourth hole in plate (34).

NOTE

With hydraulic boost on or at ground run-up, adjust spring tension to position pilot cyclic stick (25) (longitudinal cyclic only) perpendicular to deck within 2°.

17. Position pilot cyclic stick (25) perpendicular to deck within 0.5°. Set output arm of lateral magnetic brake (20) at center of travel (View C). Adjust force gradient (21) to fit and install with bolt and washer. Secure bolt head with lockwire (C-405).

NOTE

Check clearances between force gradient (21) and structure at extreme positions of magnetic brake arm. If required, re-index arm relative to shaft by one serration for clearance. Repeat step 17.

18. Connect spring (2) to bracket on right forward horn of swashplate.

19. Check complete system for secure installation and unobstructed full travel.

NOTE

Adjust swashplate lateral pretilt within dimension of Figure 67-4, for satisfactory flight.

67-8. ANTITORQUE CONTROLS (HELICOPTERS PRIOR TO S/N 31175)

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

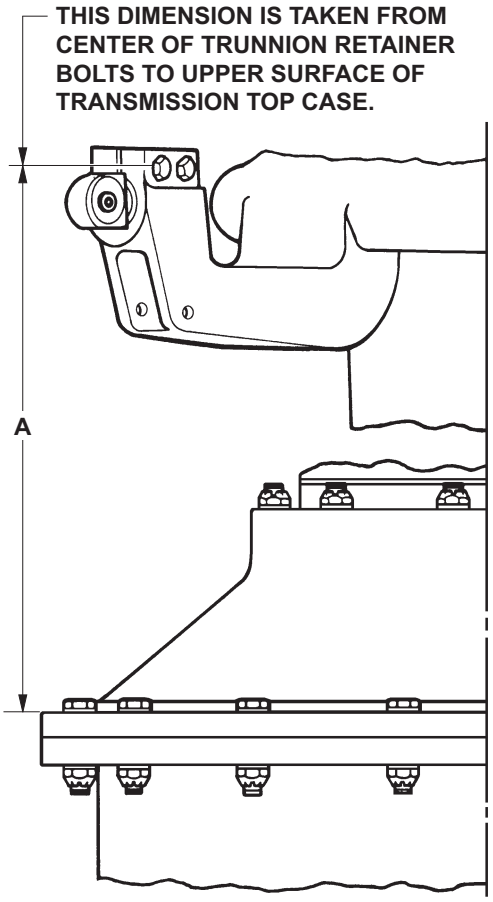
NUMBER	NOMENCLATURE
C-405	Lockwire

NOTE

Refer to paragraph 67-4 prior to beginning rigging.

1. Ensure linkage is complete, with the following adjustable links and control tubes disconnected:

a. Pitch change links (3, Figure 67-5) from tail rotor blades.



SWASHPLATE SETTING WITH RESPECT TO MAST		DIMENSION A	
FORE AND AFT	LATERAL	RIGHT HORN	LEFT HORN
1° DOWN AFT	2° DOWN LEFT	14.44 IN. (366.78 mm) 14.38 IN. (365.25 mm)	14.00 IN. (355.6 mm) 13.94 IN. (354.08 mm)
1° DOWN AFT	2° 1/2 DOWN LEFT	14.50 IN. (368.3 mm) 14.44 IN. (366.78 mm)	13.94 IN. (354.08 mm) 13.88 IN. (352.55 mm)

ADJUST 2° TO 2 1/2° DOWN LEFT AS REQUIRED FOR SATISFACTORY FLIGHT.

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Figure 67-4. Swashplate Pretilt Settings

b. Link (6) from lever on left side of tail rotor gearbox.

c. Control tube (12) from bellcrank (13) above hydraulic cylinder.

d. Force gradient (31) from pedal adjuster (28).

NOTE

For rigging copilot pedals if copilot dual control kit is installed, refer to appropriate Service Instruction.

2. Retract all adjustable stop bolts (Detail E) as far as possible.

NOTE

Adjustment of pitch change link length not required for fixed length pitch change links (Post TB 212-01-185).

3. Adjust both pitch change links (3) to initial length of 6.115 ±0.010 inch (155.32 ±0.254 mm) between centers of rod end bearings.

4. Connect each link to blade pitch horn with bolt and floating bushing. Torque bolt to 135 inch-pounds (15.26 Nm). Secure with lockwire (C-405).

CAUTION

DO NOT MEASURE BETWEEN CROSSHEAD AND WEAR INDICATOR, IF INSTALLED. MEASUREMENT SHALL BE TAKEN BETWEEN CROSSHEAD AND TRUNNION.

5. Position tail rotor blades to obtain dimensions of 4.032 ±0.010 inch (102.413 ±0.254 mm) between inboard face of crosshead and outboard face of hub trunnion (Detail C).

6. Holding specified position of rotor, adjust link (6) to obtain 0.40 inch (10.16 mm) minimum clearance (Detail D) with bellcrank (7) and connect link to lever (5) with bolt, washers, and nut. Torque nut 60 to 110 inch-pounds (6.78 to 12.43 Nm). Install cotter pin.

7. Check clevis on cylinder (15) for 1.22 inch (30.99 mm) dimension from end of piston rod to center of clevis bolt hole.

8. Hold left pedal full forward. Push down on hydraulic cylinder rod to bottom actuator valve.

9. Maintaining specified rotor position, adjust control tube (12) to fit on bellcrank (13), then shorten tube one-half turn and connect.

10. Place left pedal in full forward position. Push down on tail rotor servo control rod to center valve arm and remove control system looseness.

11. Flap tail rotor assembly to one extreme and check for clearance between blade and tail rotor yoke using a 0.010 inch (0.254 mm) feeler gauge (Figure 67-7). Perform clearance check on same blade with tail rotor flapped to opposite extreme. Accomplish clearance check on opposite blade in same manner.

12. If clearance is greater than 0.010 inch (0.254 mm), rigging has been performed correctly.

NOTE

Maximum exposed thread length on fixed control rod clevis is 1.00 inch (25.40 mm).

13. Rig and connect force trim as follows:

a. Hold pedals in neutral position.

b. Position arm of magnetic brake (32, Figure 67-5) at center of travel (Detail B).

c. Adjust tube of force gradient (31) and connect to bellcrank of pedal adjuster (28).

d. Check for clearance of force gradient and structure at extreme positions of brake arm. If required to obtain clearance, arm can be re-indexed on brake shaft by one serration.

14. Operate system through full travel to check for any binding or interference.

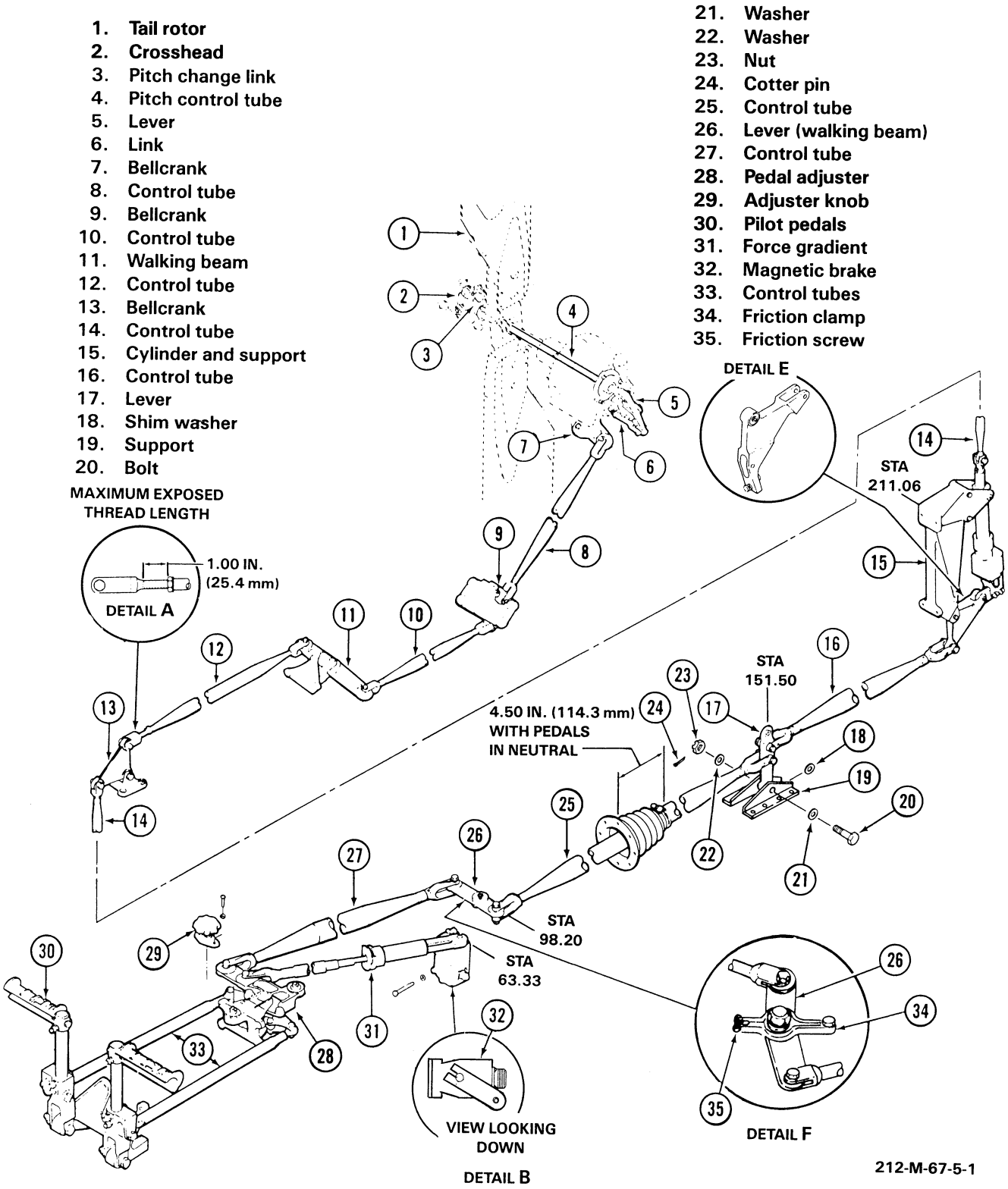

Figure 67-5. Antitorque Controls (Sheet 1 of 2)

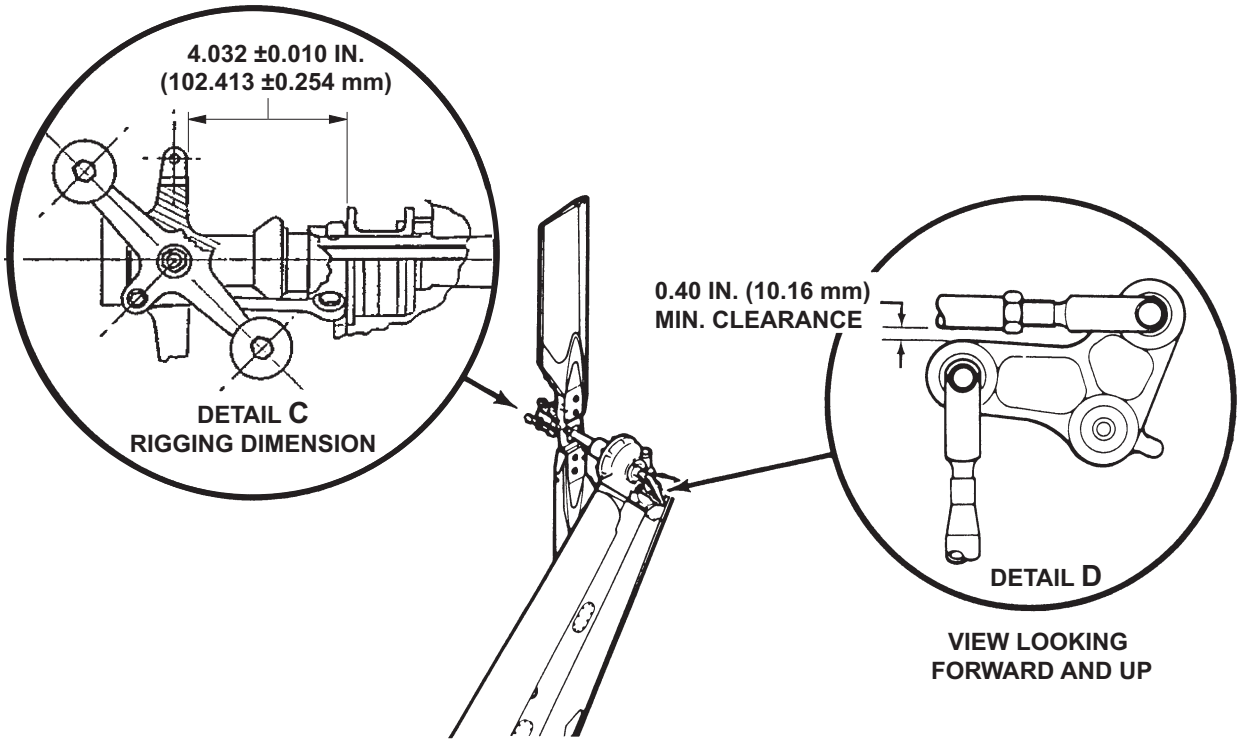

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Figure 67-5. Antitorque Controls (Sheet 2 of 2)

NOTE

Adjustment of pitch change link length not required for fixed length pitch change links (Post TB 212-01-185).

15. Check track of tail rotor in operation (Chapter 62). If required for track, adjust pitch change links by half-turn increments, alternately, in opposite directions.

16. Check complete system for security and safetying of parts. Check control system for clearance and freedom of operation.

67-9. ANTITORQUE CONTROLS (212-011-701 HUB AND BLADE) (HELICOPTERS S/N 31175 AND SUBSEQUENT)

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-405	Lockwire

NOTE

Refer to paragraph 67-4 prior to beginning rigging.

1. Check linkage is complete, except for the following adjustable links and control tubes disconnected:

a. Pitch change links (3, Figure 67-5) from tail rotor blades.

b. Link (6) from lever on left side of tail rotor gearbox.

c. Control tube (12) from bellcrank (13) above hydraulic cylinder.

d. Force gradient (31) from pedal adjuster (28).

NOTE

Refer to appropriate Service Instruction for rigging copilot pedals if dual controls are installed.

2. Retract all adjustable stop bolts (detail E) as far as possible.

NOTE

Adjustment of pitch change link length not required for fixed length pitch change links (Post TB 212-01-185).

3. Adjust both pitch change links (3) to initial length of 6.180 ±0.010 inches (156.972 ±0.254 mm) between centers of rod end bearings. Connect each link to blade pitch horn with bolt and floating bushing. Torque bolt 135 inch-pounds (15.26 Nm). Secure with lockwire (C-405).

4. Position tail rotor blades to obtain dimension of 4.334 ±0.010 inches (110.084 ±0.254 mm) between inboard face of crosshead and outboard face of trunnion journal (Figure 67-6, Detail A).

5. Holding specified position of rotor, adjust link (6, Figure 67-5) to obtain 0.58 inch (14.73 mm) minimum clearance with bellcrank (7) and connect link to lever (5) with bolt, washers, and nut (Figure 67-6, Detail B). Torque nut 60 to 110 inch-pounds (6.78 to 12.42 Nm). Install cotter pin.

6. Check clevis on cylinder (15, Figure 67-5) for 1.22 inch (30.99 mm) dimension from end of piston rod to center of clevis bolt hole.

7. Hold left pedal full forward. Push down on hydraulic cylinder rod to bottom actuator valve. Maintaining specified rotor position, adjust control tube (12) to fit on bellcrank (13), then shorten tube one-half turn and connect.

8. Place left anti-torque pedal in full forward position. Push down on tail rotor servo control rod to center valve arm and remove control system looseness.

9. Flap tail rotor assembly to one extreme and check for clearance between blade and tail rotor yoke using a 0.010 inch (0.254 mm) feeler gauge (Figure 67-7). Perform clearance check on same blade with tail rotor flapped to opposite extreme. Accomplish clearance check on opposite blade in same manner.

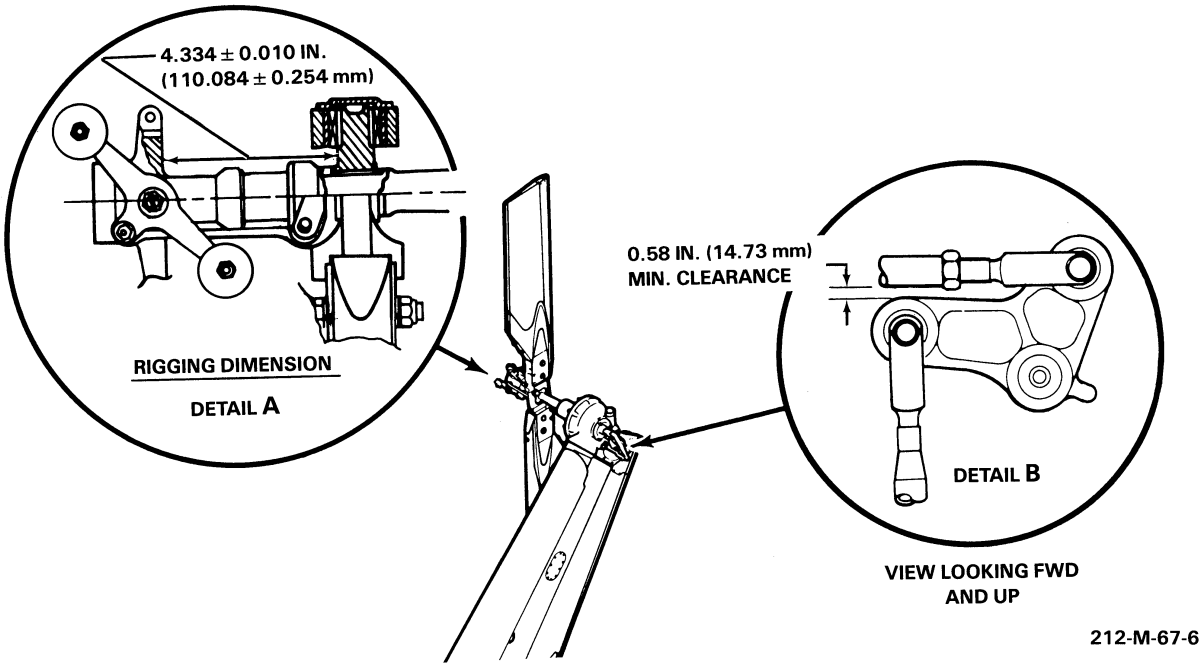

Figure 67-6. Antitorque Rigging (212-011-701 Hub and Blade) (Helicopters S/N 31175 and Subsequent)

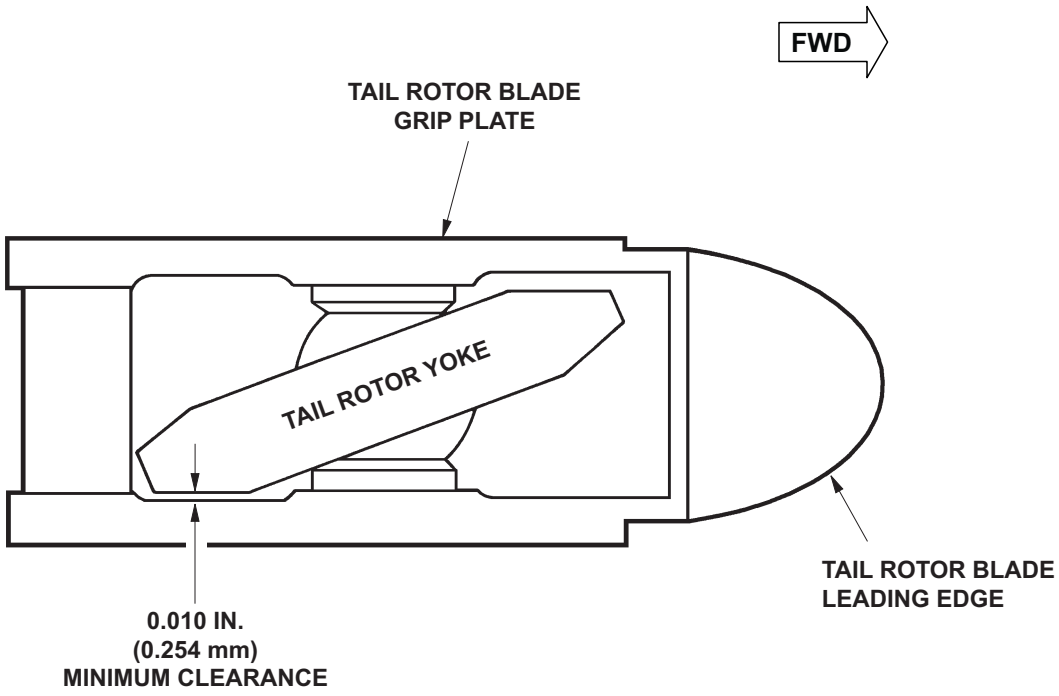

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Figure 67-7. Tail Rotor Blade to Yoke Clearance

10. If clearance is greater than 0.010 inch (0.254 mm), rigging has been performed correctly.

NOTE

Maximum exposed thread length on fixed control rod clevis is 1.0 inch (25.4 mm) (Figure 67-5, Detail A).

11. Rig and connect force trim as follows:

a. Hold pedals in neutral position.

b. Position arm of magnetic brake (32) at center of travel (Detail B).

c. Adjust tube of force gradient (31) and connect to bellcrank of pedal adjuster (28).

d. Check for clearance of force gradient and structure at extreme positions of brake arm. If required to obtain clearance, arm can be reindexed on brake shaft by one serration.

12. Operate system through full travel to check for any binding or interference.

NOTE

Adjustment of pitch change link length not required for fixed length pitch change links (Post TB 212-01-185).

13. Check track of tail rotor in operation (Chapter 62). If required for track, adjust pitch change links in half-turn increments, alternately, in opposite directions.

14. Check complete system for security and safetying. Check control system for clearance and freedom of operation.

67-10. SYNCHRONIZED ELEVATOR CONTROLS

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
T101330	Cyclic Stick Fixture

CAUTION

FOR RIGGING IFR EQUIPPED HELICOPTERS, REFER TO APPLICABLE SERVICE INSTRUCTIONS.

NOTE

Refer to paragraph 67-4 prior to beginning rigging.

The following shall be accomplished after installation of all bellcranks and nonadjustable control tubes (20, 13, 7, and 10, Figure 67-8) and with swashplate in position shown on Figure 67-4.

1. Rig synchronized elevator with hydraulic system off as follows:

a. Position cyclic stick in neutral.

NOTE

If dual control kit is installed, install cyclic stick fixture (T101330) on copilot cyclic stick.

b. Position cyclic hydraulic cylinder control valves to top of travel. Adjust and connect tube (19, Figure 67-8) to obtain dimension of 2.20 inches (55.88 mm) from top surface of idler (17) to centerline of lower bolts in idler support (View B).

CAUTION

ENSURE BOLTS ATTACHING CONTROL TUBES (16 AND 19) TO IDLER (17) ARE INSTALLED WITH BOLT HEADS INBOARD (VIEW B). BOLTS IN WRONG DIRECTION COULD INTERFERE WITH ENGINE POWER CONTROL LINKAGE.

NOTE

Do not allow cyclic controls below cylinder to move while bottoming valves.

c. Verify control tube (4) is disconnected from bellcrank (5).

d. Set right elevator (1) so upper surface passes through rigging rivet **P** (located on right side of tailboom, aft of elevator) for maximum nose down position (View A). Adjust control tube (4) to minimum length that will reach bellcrank (5) and connect. Tube will be in line with horn assembly arm and pivot at bellcrank (5) (View C).

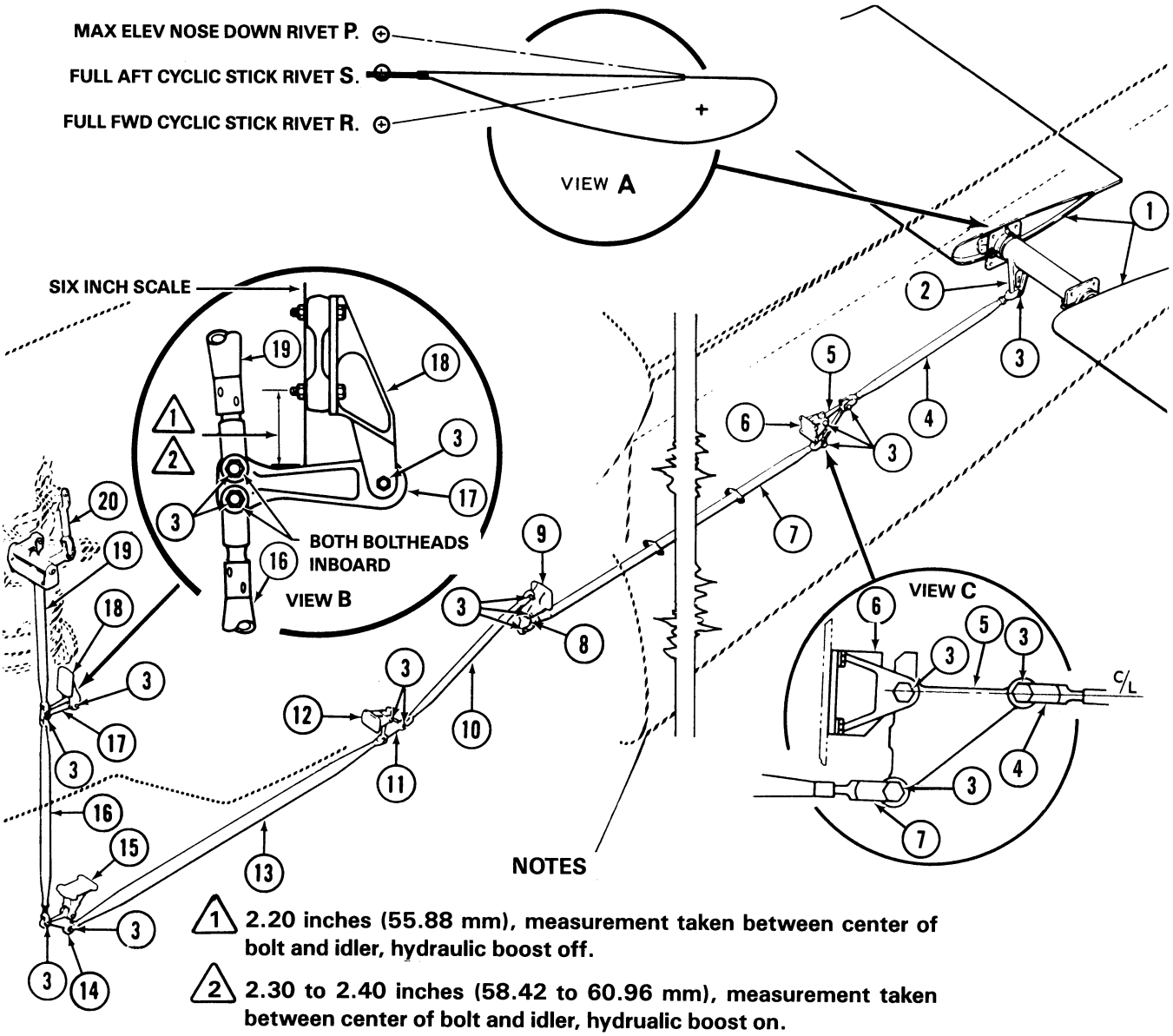
e. Loosen cyclic stick friction (or remove cyclic stick fixture (T101330) from copilot cyclic control stick, if installed). Hold pilot control stick full forward.

f. Set right elevator upper surface 0.50 to 0.75 inch (12.70 to 19.05 mm) below rivet **R** for full forward cyclic control stick position (View A). Aft arm of bellcrank (5) shall be above horizontal.

g. With valves in both cyclic control hydraulic cylinders positioned at top of travel, adjust control tube (16) to fit and connect.

h. Hold pilot cyclic control stick full aft. Check right elevator upper surface for alignment to rigging rivet **S** within ±0.40 inch (10.16 mm) as shown in View A, with valves centered or boost on.

i. Check system for freedom of operation and full travel.



NOTES

1. 2.20 inches (55.88 mm), measurement taken between center of bolt and idler, hydraulic boost off.
2. 2.30 to 2.40 inches (58.42 to 60.96 mm), measurement taken between center of bolt and idler, hydrualic boost on.

1. Elevators
2. Elevator horn
3. Bolt-washer-nut-cotter pin
4. Control tube
5. Bellcrank
6. Bulkhead support
7. Control tube
8. Walking beam
9. Bulkhead support
10. Control tube
11. Bellcrank
12. Bulkhead fitting
13. Control tube
14. Bellcrank
15. Bulkhead support
16. Control tube
17. Idler
18. Bulkhead support
19. Control tube
20. Control tube

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Figure 67-8. Synchronized elevator controls rigging

j. With hydraulic boost cart connected and operating, place pilot cyclic control stick full forward. Check alignment of right elevator upper surface to rigging rivet **R**. If necessary, readjust control tube (16) only to align trailing edge with rivet **R**.

2. Rig synchronized elevator with hydraulic system on as follows:

NOTE

All rigging to be accomplished with hydraulic boost on, boost cart connected and operating, or with hydraulic valve arm centered.

a. Disconnect elevator control tubes at rigging points.

b. Position pilot cyclic stick perpendicular (centered) to deck within 0.5°. Swashplate shall be positioned as shown in figure 67-4 .

CAUTION

DO NOT ALLOW CYCLIC CONTROLS BELOW HYDRAULIC SERVO ACTUATORS TO MOVE WHILE CENTERING SERVO ACTUATOR VALVE ARMS.

NOTE

Alternate procedure for centering cyclic stick with copilot cyclic stick installed: Install T101330 rigging fixture on copilot cyclic stick.

c. Position idler (17, figure 67-8 , view B) to 2.30 to 2.40 in. (58.42 to 60.96 mm) dimension as shown. Adjust control tube (19) to fit and install.

d. Set upper surface of right elevator to align with rivet **P**. Adjust control tube (4) to minimum length that will reach bellcrank (5) and install. Centerline of control tube (4) will pass through output connection and pivot of bellcrank (5).

e. Place pilot cyclic stick in extreme forward position against stick stop and center valves of cyclic hydraulic servo actuators. Set upper surface of right elevator to align with rivet **R**. Aft arm of bellcrank (5) shall be above centered position of step d . Adjust control tube (16) to fit and install.

f. With hydraulic power applied to system, recheck elevator rigging as follows:

(1) Place pilot cyclic stick in extreme forward position against stick stop. Readjust control tube (16), if necessary, to align right elevator upper surface on rivet **R**.

(2) Place pilot cyclic stick in extreme aft position against stick stop. Check right elevator upper surface on rivet **S** within ±0.40 in. (10.16 mm). If elevator does not check within the ±0.40 in. (10.16 mm) on rivet **S**, repeat steps b. through e .

67-10A. FLIGHT DATA RECORDER — DUAL ELEMENT CONTROL MOTION TRANSDUCER ADJUSTMENT.

MATERIALS REQUIRED

NUMBER	NOMENCLATURE
C-405	Lockwire

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
T103347	Cyclic stick fixture

NOTE

This procedure requires the use of a Simpson No. 260 multimeter or equivalent.

1. Locate control motion transducer connectors and rig as described below. Refer to figure 67-8A .

2. Measure the resistance, T, between pins D and F of transducer connector. Resistance, T, should measure 5000 ± 10% ohms.

a. Multiply resistance T, measured at each transducer by the following percents.

Collective Control	T × 11.3% =	_____
Longitudinal Cyclic Control	T × 50.0% =	_____
Lateral Cyclic Control	T × 49.7% =	_____
Antitorque Control	T × 12.0% =	_____

3. Measure resistance, R between pins E and F. Adjust transducer shaft until R, equals the value computed for each control in step 2.a.

4. Adjust collective control motion transducer. Place the pilots collective stick against the down stick stop. Loosen the jamnut on transducer so shaft can rotate easily. Adjust the transducer shaft until the resistance is within limits established above.

a. Turn shaft clockwise into rod end bearing to extend, counterclockwise to retract. Tighten the jamnut on the transducer shaft and verify that resistance is still within limits.

b. Connect connector and secure with lockwire (C-405).

5. Adjust longitudinal cyclic control motion transducer. Position the pilots cyclic stick perpendicular to the deck within 1/2 degree longitudinally and laterally. (As an alternate, the cyclic stick may be centered with fixture T1-03347). Loosen jamnut on transducer so shaft can rotate easily.

a. Adjust the transducer shaft until the resistance is within limits established in step 2.a.

b. Repeat steps 4.a . and b. to verify transducer is set within limits.

6. Adjust lateral cyclic control motion transducer. Position the pilot cyclic stick perpendicular to the deck within 1/2 degree longitudinally and laterally. Loosen jamnut on transducer so shaft can rotate easily.

a. Adjust transducer shaft until the resistance is within the limits established in step 2.a .

b. Repeat steps 4.a . and b. to verify transducer is set within limits.

7. Adjust antitorque control motion transducer. Position pilot left pedal against the forward stop. Loosen jamnut on transducer so shaft can rotate easily.

a. Adjust the transducer shaft until the resistance is within the limits established in step 2.a .

b. Repeat steps 4.a . and b. to verify transducer is set within limits.

67-10B. FLIGHT DATA RECORDER — DUAL ELEMENT CONTROL MOTION TRANSDUCER ADJUSTMENT.

MATERIALS REQUIRED

NUMBER	NOMENCLATURE
C-405	Lockwire

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
T103347	Cyclic stick fixture
412-274-001-101	Calibration tool

NOTE

When calibration tool "LO BAT" light comes on, replace batteries. (Use 9VDC alkaline batteries).

1. Locate control motion transducers, disconnect connectors. Refer to figure 67-8A .

2. Adjust collective control motion transducer. Place pilot collective stick against the down stick stop. Loosen jamnut on transducer so shaft can rotate easily. Switch calibration tool power switch to the "OFF" (O) position. Attach calibration tool connector to transducer connector. Turn selector knob to "CLTV" position. Move the calibration tool switch to the "ON" (1) position.

a. If a "RED" lamp comes on, the transducer shaft must be adjusted in the indicated direction. An "EXTEND" indication means extend the transducer shaft by screwing it into the threaded end of rod end bearing (clockwise). A "RETRAC" indication means retract the transducer shaft by unscrewing it from threaded end of rod end bearing (counterclockwise). Adjust the transducer shaft until the "GREEN", (IN RANGE), lamp comes on.

b. Tighten the jamnut on transducer shaft and verify that "GREEN" (IN RANGE) lamp is on and the "RED" lamps are off.

c. Move the calibration tool power switch to the "OFF" (0) position. Disconnect the calibration tool from transducer.

d. Connect the transducer to the connector on the bulkhead, and secure with lockwire (C-405).

3. Adjust longitudinal cyclic control motion transducer. Position pilot cyclic stick perpendicular to the deck within 1/2 degree longitudinally and laterally. (As an alternate the cyclic stick may be centered with fixture T103347). Loosen the jamnut on the transducer so shaft can rotate easily.

a. Switch calibration tool power switch to the "off" (0) position. Attach tool connector to transducer connector. Turn selector knob to the "F/A" position.

b. Repeat steps 2.a. thru d.

4. Adjust lateral cyclic control motion transducer. Position pilot cyclic stick perpendicular to the deck within 1/2 degree longitudinally and laterally. (As an alternate the cyclic stick may be centered with fixture T103347). Loosen the jamnut on the transducer so shaft can rotate easily.

a. Switch calibration tool power switch to the "off" (0) position. Attach tool connector to transducer connector. Turn selector knob to "LAT" position.

b. Repeat steps 2.a. thru d.

5. Adjust antitorque control motion transducer. Position pilot left pedal against forward stop. Loosen jamnut on the transducer shaft so the shaft can rotate easily.

a. Switch calibration tool power switch to the "off" (0) position. Turn selector knob to "YAW" position.

b. Repeat steps 2.a. thru d.

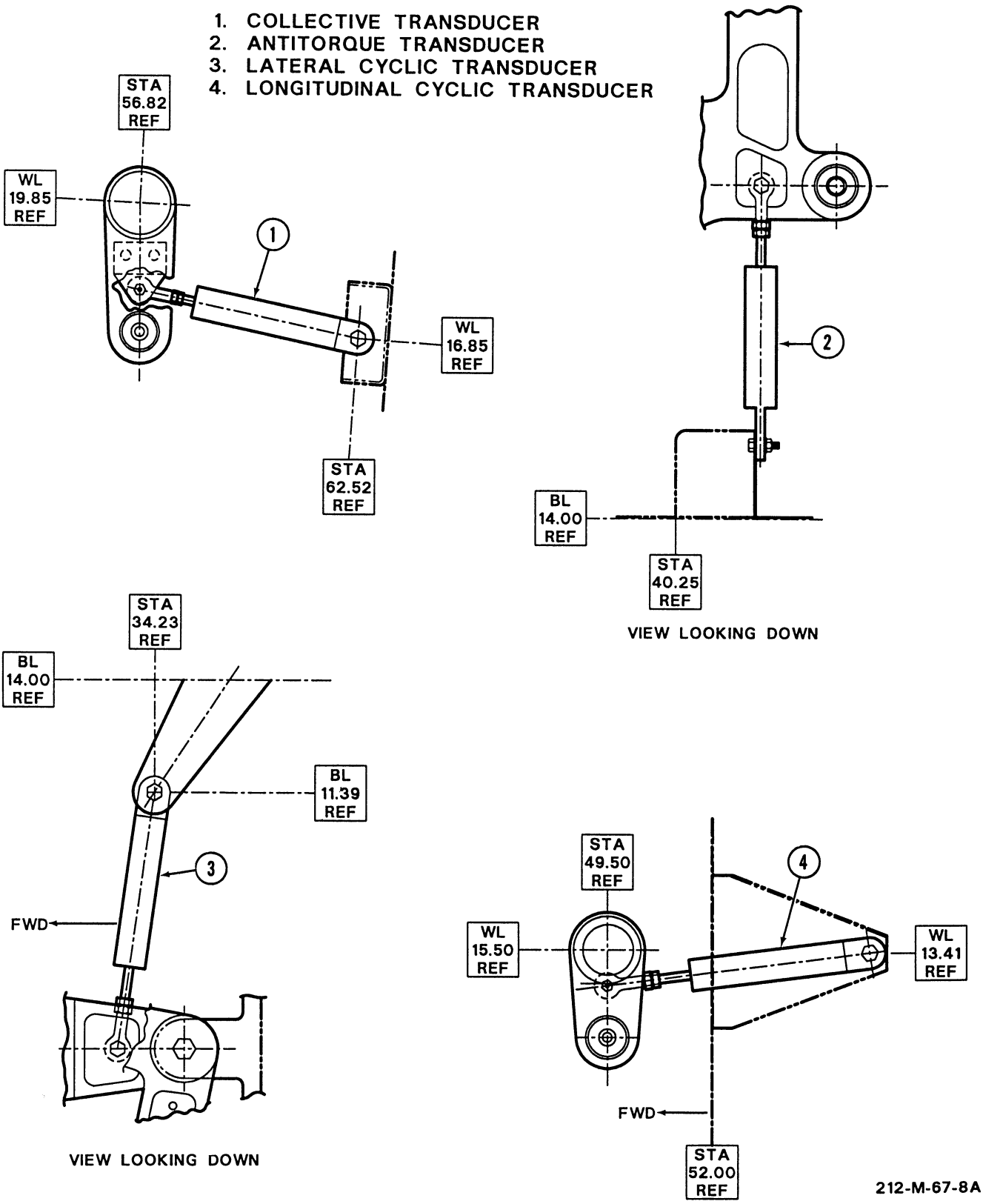

Figure 67-8A. Flight data recorder dual element control motion transducers

COLLECTIVE FLIGHT CONTROLS

67-11. COLLECTIVE CONTROLS .

The collective control system consists of a jackshaft assembly with pilot control stick, push-pull tubes and bellcranks, and a dual hydraulic power cylinder connected to a control lever below the swashplate. Movement of collective control stick is transmitted through linkage and power cylinder to main rotor pitch control mechanism, causing helicopter to ascend or descend or to remain at constant altitude. The hydraulic power cylinder incorporates a check valve system to provide irreversibility to reduce feedback forces to controls in event of hydraulic power failure.

67-12. COLLECTIVE CONTROL STICK AND JACKSHAFT.

Pilot collective pitch control stick extends up and forward through a flexible boot in floor at left side of seat, and is connected to a jackshaft mounted laterally under floor. A knurled collar on stick allows adjustment of friction drag. A spring-loaded down lock is provided on floor below stick. Twist-grip type power controls, with friction adjustments, are incorporated in control stick assembly. A switch box on top of collective stick contains control switches for engine starting, engine governor rpm, idle stop releases, landing light and searchlight.

67-13. Removal.

1. Remove boot from pilot collective stick.

2. Disconnect electrical cable connector. Disconnect power control system tubes from gear levers on lower end of collective stick.

3. Remove two bolts and tapered bushings attaching tube (6, figure 67-9) to elbow (4). Identify bolts and bushings for reinstallation in same location.

4. Remove two screws and two bolts attaching housing (5) to structural intercostal. Remove collective stick (3) and housing (5).

5. Disconnect pitch control tube (9) from arm (7) on jackshaft.

6. Remove two bolts and tapered bushings attaching tubes (6) and (10) to arm (7). Identify bolts and bushings for reinstallation in same location.

7. Remove tube (6) and arm (7).

8. Disconnect power control tubes from levers on elbow (12).

9. Disconnect electrical connection on copilot stick (if installed).

10. Remove two bolts and tapered bushings attaching tube (10) to elbow (12). Identify bolts and bushings for reinstallation in same location.

11. Remove four bolts attaching support (11) to intercostal structural member and lift elbow and support. Identify shims for reinstallation.

12. Remove bolts from support (8) and remove support and jackshaft tube (10).

67-14. Inspection.

1. Inspect all components of the collective control stick assembly for nicks, scratches, dents, broken or bent tubing, and frayed, worn or broken wiring.

2. Inspect tubes for nicks, dents, and scratches.

3. Inspect friction mechanism on left side of collective jackshaft for wear and general condition.

4. Check pilot collective stick friction for proper operation.

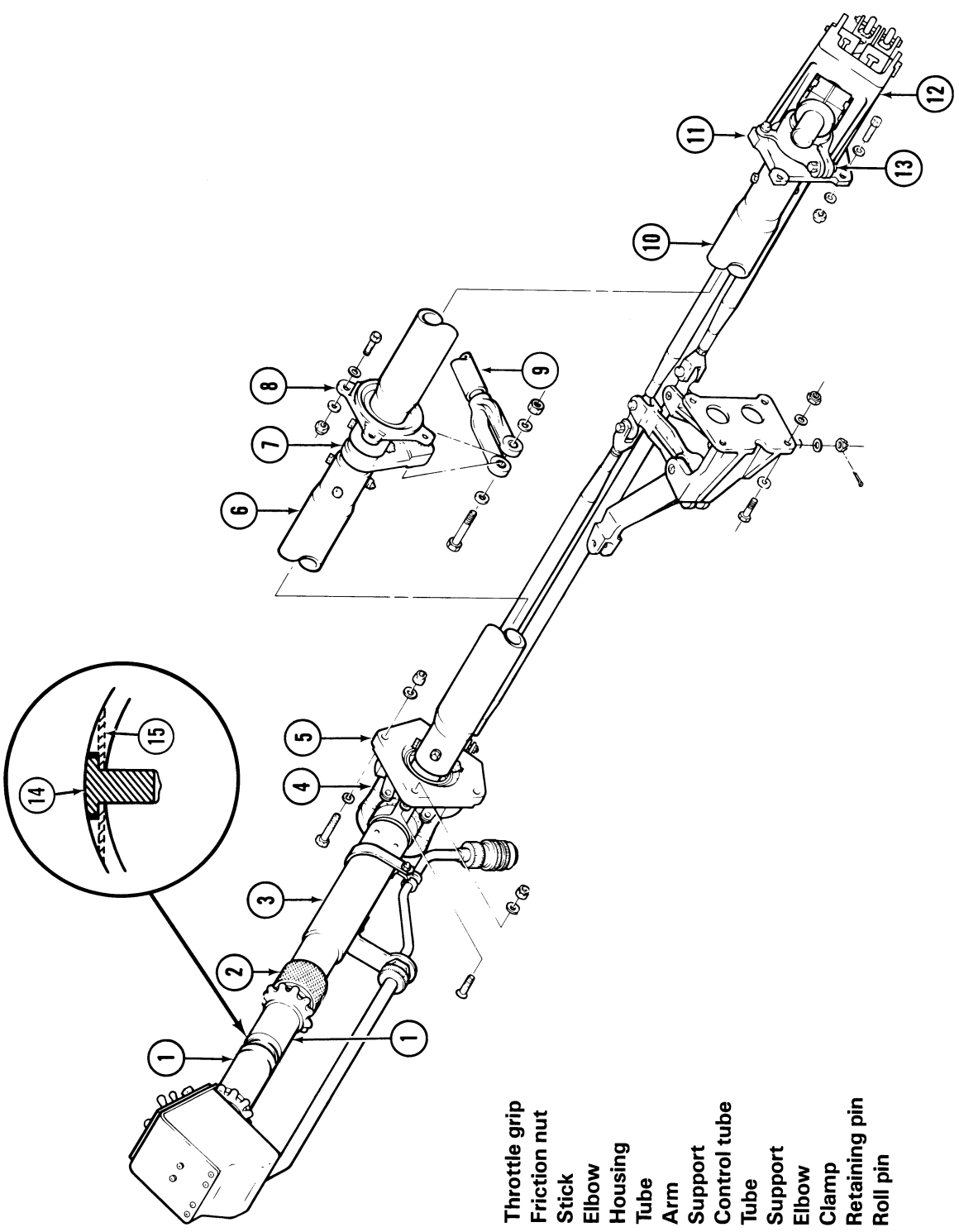

Figure 67-9. Collective stick and jackshaft

5. Inspect throttle controls grips retaining pins, both pilot and, if installed, copilot stick, for looseness. Also inspect throttle(s) for smoothness of operation.

67-15. Repair.

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specification and source.

NUMBER	NOMENCLATURE
C-204	Primer
C-309	Methyl-Ethyl-Ketone (MEK)
C-313	Adhesive
C-423	Abrasive Cloth or Paper

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
T27872-2	Reamer

1. Twist grip.

a. If engine control twist grips retaining pins, pilot and/or copilot, are found loose, proceed as follows:

(1) Use abrasive cloth or paper (C-423) and clean area surrounding pin. Wipe area with a clean, lint-free cloth dampened with MEK (C-309).

(2) Apply adhesive (C-313) over head of pins, using slight pressure to ensure sufficient bond. Allow adhesive to dry, then sand to smooth contour.

NOTE

Hole opposite pin is provided for disassembly purposes only. Do not apply adhesive to this area.

2. Repair of mechanical damage shall not exceed original damage depth and width of repair area at any section shall not exceed one third of tube circumference.

3. Repair of corrosion damage shall be twice depth of corrosion damage but not exceeding mechanical damage limits for depth or width.

4. Remove all mechanical and corrosion damage within limits with abrasive cloth or paper (C-423), to obtain a smooth scratch free surface. Apply primer (C-204) to repaired area.

5. Replace collective jackshaft as follows:

a. Assemble collective jackshaft (3, figure 67-10), arm (4) and collective jackshaft (7).

b. Clamp in a suitable holding fixture. Position collective jackshaft (3) with arm (4) and pilot stick (11) 131.30° apart and forward.

c. Hold dimensions as shown in figure 67-10.

d. Drill through collective jackshaft (3) and arm (4) with a No.F (0.257 in. (6.528 mm)) diameter drill.

e. Insert T27872-2 reamer so end of pilot projects through parts to be reamed.

f. Ream one side (smooth finish).

g. Install tapered bushing. Ream opposite hole using tapered bushing to support reamer pilot.

h. Disassemble and remove burrs and metal particles.

i. Install tapered bushing (13) and secure with bolt (10), washer and nut.

NOTE

After torquing bolt (10), the washer must be held off the surface of jackshaft tube within limits given in figure 67-10, detail A.

j. Repeat sub steps d. through h. for remaining holes.

k. Apply primer (C-204) to all bare metal.

l. Install collective jackshaft assembly (paragraph 67-16).

67-16. Collective Control Stick and Jackshaft — Installation

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-204	Epoxy Polyamide Primer
C-430	Barrier Tape

NOTE

If installing collective jackshaft, refer to paragraph 67-14, step 5.

1. Apply barrier tape (C-430) to mounting face of support (8, Figure 67-9) and install support and tube (10). Place support on left side of structure and install four bolts with plain aluminum alloy washers under heads, and heads against support. Install four nuts with anodized aluminum alloy washers against structure.

2. Apply barrier tape (C-430) to mounting face of support (11).

3. Apply barrier tape (C-430) between faying surfaces and install elbow (12) and support (11) to structure with four bolts with aluminum alloy washers under bolt heads and nuts. Long bolt goes through clamp at upper aft position. Use shims between support and structure as necessary to minimize deflection of flexible shafts.

4. Align tube (10) with elbow (12) and attach with tapered bushings of correct size and two bolts with steel washers under bolt heads and nuts.

5. Check throttle control gear sectors for proper mating and backlash with flex shaft gears (paragraph 67-23).

6. Attach power control tubes to gear sector levers.

7. Connect electrical connector below copilot stick (if installed).

8. Apply epoxy polyamide primer (C-204) to mating surfaces of arm (7) and tubes (6 and 10).

9. Align holes in arm (7) to tube (10) and attach with bushings of correct size and two bolts with steel washers under bolt heads and nuts.

10. Align holes in tube (6) with arm (7) and attach with tapered bushings of correct size and two bolts with steel washers under bolt heads and nuts.

11. Apply barrier tape (C-430) to mounting face of housing (5). Apply epoxy polyamide primer (C-204) to mating surfaces of tube (6) and elbow (4).

12. Position pilot collective stick in helicopter and attach to structure with two bolts and two screws. Install plain aluminum alloy washers on bolts next to collective stick housing (5). Install anodized aluminum alloy washers under nuts on two bolts and two screws.

13. Align holes in elbow (4) with holes in tube (6) and attach with tapered bushings of correct size and two bolts with steel washers under bolt heads and nuts.

14. Check throttle control gear sectors for proper mating and backlash with flex shaft gears (paragraph 67-23).

15. Attach power control tubes to gear sector levers.

16. Connect electrical connector at base of pilot collective stick and secure boot.

17. Adjust collective friction (paragraph 67-22).

18. Attach control tube (9) to arm (7). Install one washer under bolt head and one washer under nut. Install cotter pin.

19. Check collective rigging (paragraph 67-5).

20. Functionally check all controls on pilot collective stick.

21. Check for free operation of power controls. Check power control rigging (Chapter 76).

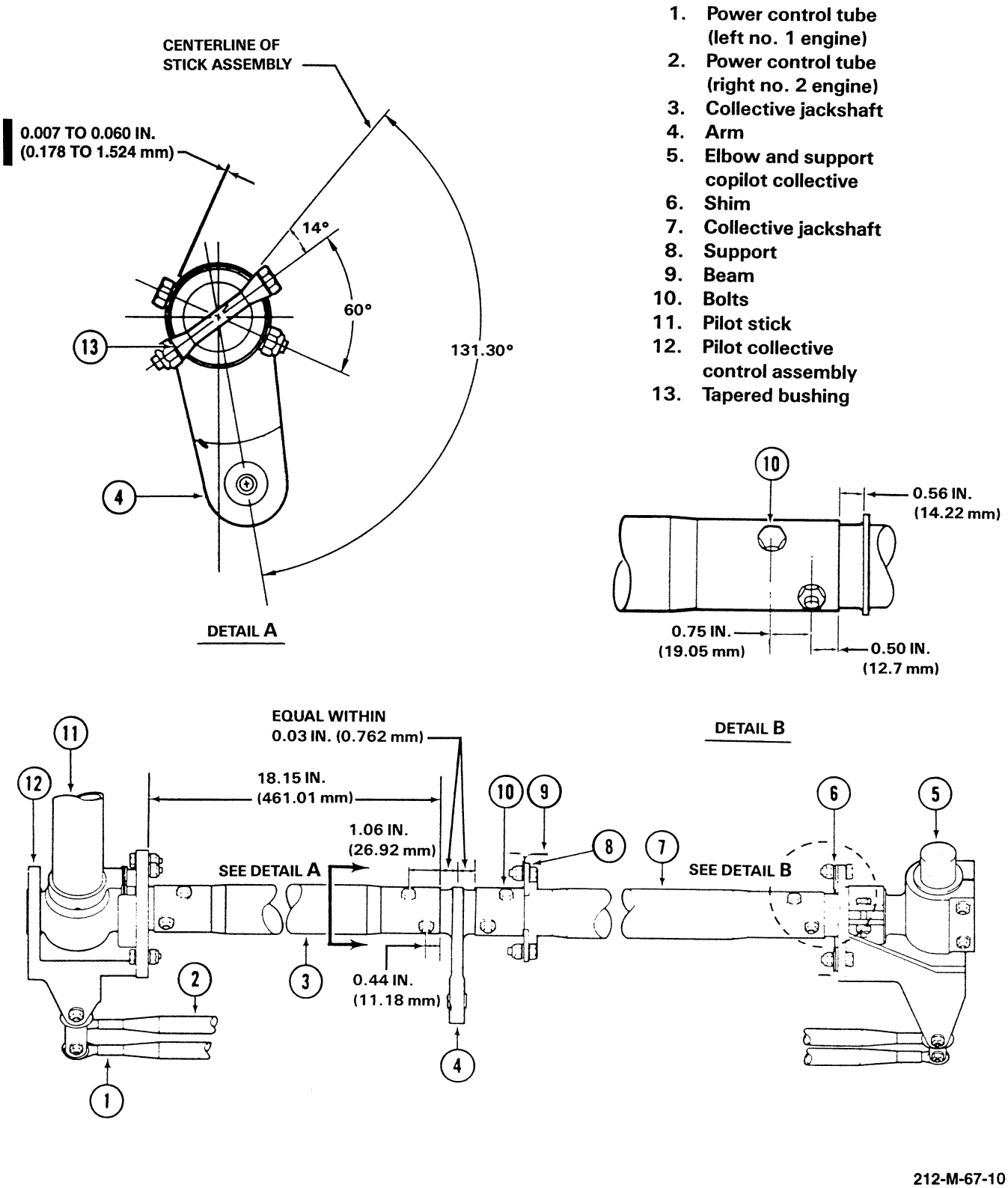

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Figure 67-10. Collective stick and jackshaft installation

67-17. COLLECTIVE FRICTION CLAMP.

67-18. Removal.

1. Remove left seat and access panel below seat.

2. Remove bolt (4, figure 67-11), washers (3 and 10), and nut (11) attaching clamp halves (5 and 8) to throttle support assembly.

3. Remove bolt (1), washers (2), and nut (9).

4. Remove bolt (6) and washers (7). Remove two halves of clamp assembly from support.

67-19. Inspection.

1. Inspect clamp assembly for cracks or deformation. No cracks are allowed. Any deformation which prevents proper operation is cause for rejection.

2. Inspect friction lining for obvious wear. Wear which prevents proper operation necessitates replacement of friction liner.

67-20. Repair.

MATERIALS REQUIRED

NUMBER	NOMENCLATURE
C-309	Methyl-Ethyl-Ketone (MEK)
C-363	Adhesive
C-407	Abrasive Pad
C-423	Abrasive Cloth or Paper
C-481	Fabric

1. Remove all old liner material and adhesive from clamp halves (5 and 8, figure 67- 11) using 180 grit abrasive cloth or paper (C-423) .

2. Rinse clamp halves in clean water and dry using clean cloths or a heat gun.

3. Cut fabric (C-481) to approximately 1.0 by 3.0 in. (25.4 to 76.2 mm) to match inside areas of clamp halves.

4. Lightly abrade dacron surface (pink side) of liner material with 180 grit abrasive cloth or paper (C-423).

NOTE

The dark (teflon) side of the liner material is the friction side.

5. Mix adhesive (C-363) according to manufacturers instructions.

NOTE

Pot life of adhesive is 30 minutes at 75°F (24°C).

6. Apply adhesive to inner surface of both clamp halves (5 and 8) and to dacron (pink) surface of liner material. Install liner material in clamp halves.

7. Install clamp halves (5 and 8) around cylindrical workaid 2.03 to 2.09 in. (51.56 to 53.05 mm) diameter and install bolt (6) and washer (7).

8. Install bolt (1), washer (2), and nut (9) through tongues of clamp halves (5 and 8) and tighten nut (9) to 1.0 in.lbs. (0.113 Nm) greater than nut tare torque.

9. Remove adhesive squeeze-out. Allow bonding adhesive to cure 24 hours at 75°F (24°C) or heat assembly to 175 to 190°F (80 to 88°C) for one hour.

10. After complete curing, remove clamp assembly from workaid and scuff friction surface of liner material with 180 grit abrasive cloth or paper (C-423) followed by an abrasive pad (C-407) until a uniform finish is attained.

11. Wash clamp assembly with mild soap and water followed by a rinse of MEK (C-309) to remove all grit and foreign material.

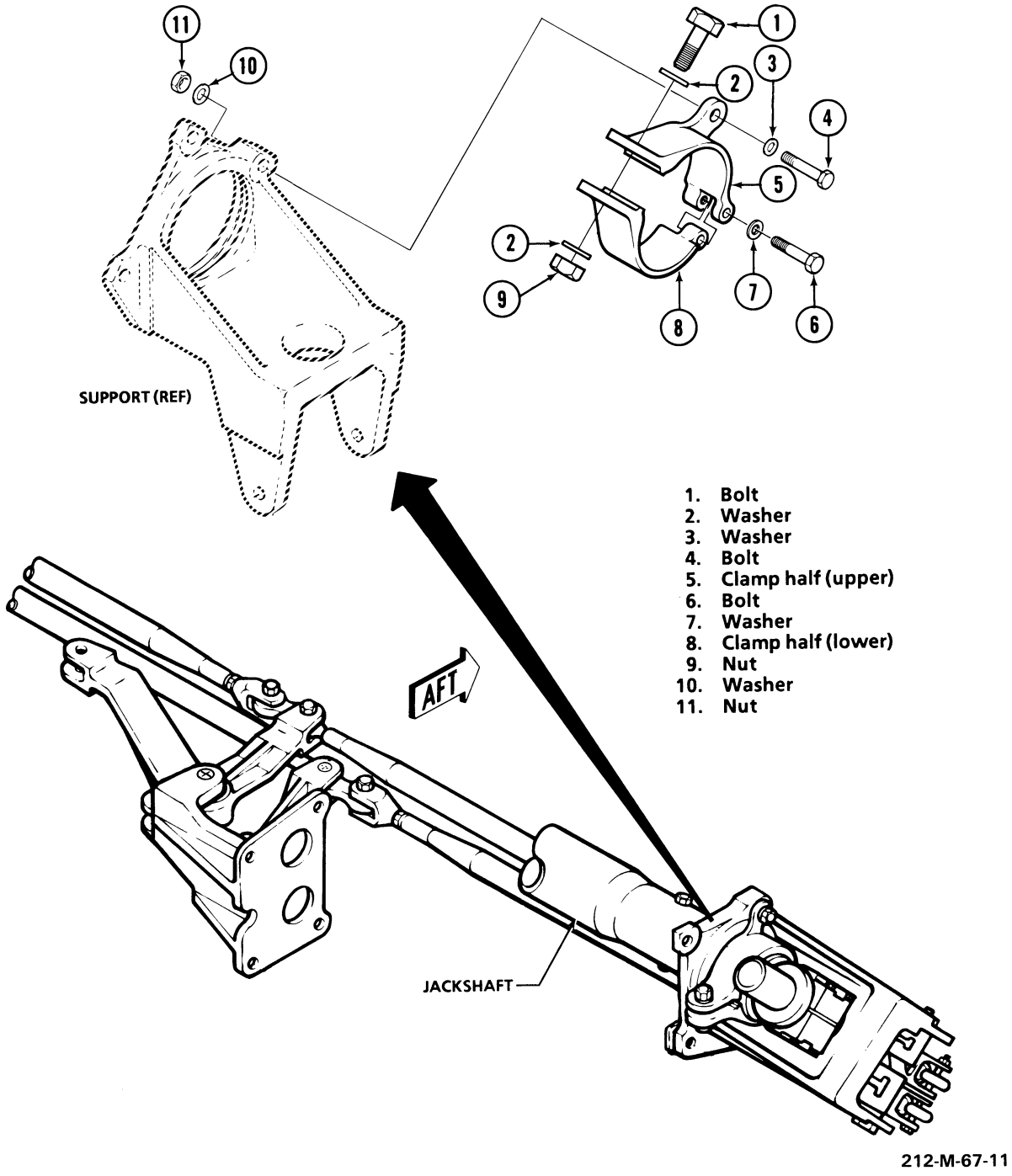


Figure 67-11. Friction clamp assembly

67-21. Installation.

1. Place clamp halves around elbow (figure 67- 11).

2. Install washer (7) and bolt (6).

3. Install bolt (1), washer (2) and nut (9). Tighten nut (9) only enough to hold clamp halves in contact with elbow.

4. Align hole in tang on upper clamp half with hole in support and install bolt (4), washers (3 and 10), and nut (11).

5. Adjust minimum collective friction (paragraph 67-22).

6. Install floor access panel and seat.

67-22. MINIMUM COLLECTIVE FRICTION ADJUSTMENT.

1. Loosen friction nut (2, figure 67-9) completely.

2. With hydraulic power on, apply a spring scale at middle within 0.5 in. (12.7 mm)) of upper throttle grip. Check for 8 to 10 lbs. (35.58 to 44.48 N) force required to move stick upward against sliding friction preload.

NOTE

If hydraulic power is not available, adjustment may be checked by disconnecting control tube (9) from arm (7). Scale should indicate 13 to 14 lbs. (57.82 to 62.27 N) sliding friction when stick is moved upward.

3. When adjustment is required, remove access plate from floor at left of copilot seat. Adjust bolt in clamp (13) on jackshaft elbow to obtain proper friction.

67-23. Throttle control gears adjustment.

MATERIALS REQUIRED

NUMBER	NOMENCLATURE
C-405	Lockwire

NOTE

If throttle controls do not operate smoothly, perform following checks and adjustments (figure 67-12).

1. Detach control stick boot and remove cover plates for access to throttle control gears at both ends of collective stick and jackshaft assembly.

2. At each end of jackshaft, verify marked tooth of each flex shaft gear is mated in tenth tooth space of gear sector. Also check at each end of travel each gear sector is at least one full tooth from rolling off mating gear.

3. Disconnect control tubes and check for 0.003 to 0.008 in. (0.076 to 0.203 mm) backlash of each gear sector with mating gear, measured at control tube attach point of sector arm in neutral position. With gear sector and flex shaft in neutral position, a pull force of 4.5 lbs. (20.01 N) is maximum allowable.

4. Determine type of spacer installed between throttle gear sectors. If spacer shown in view A is installed, adjust as outlined in step 5. If spacer shown in view B is installed, adjust as outlined in step 6.

5. Adjust gear sector backlash as follows (view A):

a. Remove nut, washers, and bolt securing gear sectors and spacer. Remove gear sectors, spacer and shims.

b. Install gear sectors, with shims between gear sectors and support. Place spacer between gear sectors and install bolt.

c. Measure gap between spacer and gear sector to determine thickness of shim required to provide a snug fit.

d. Install shim between spacer and gear sector and install and torque nut 50 to 70 in.lbs. (5.65 to 7.91 Nm).

e. Check backlash of each gear sector is 0.003 to 0.008 in. (0.076 to 0.203 mm). With gear sector and flex shaft in a neutral position, check gear sector will move when a maximum force of 4.5 lbs. (20.01 N) is applied at bolt hole with pull applied perpendicular to gear sector. Install cotter pin in nut.

6. Adjust gear sector backlash as follows (view B):

a. Remove bolt securing gear sector requiring adjustment.

b. Remove lockwire and turn nuts of spacer to decrease length of spacer.

c. Increase or decrease shim between gear sector and support until backlash is 0.003 to 0.008 in. (0.076 to 0.203 mm).

d. With gear sector and shim in position, turn nuts of spacer to increase length until spacer is a snug fit between gear sectors.

e. Install bolt through gear sector, restrain spacer, and torque 50 to 70 in.lbs. (5.65 to 7.90 Nm).

f. Check backlash of each gear sector is 0.003 to 0.008 in. (0.0762 to 0.203 mm). With gear sector and flex shaft in a neutral position, check gear sector will move when a maximum force of 4.5 lbs. (20.01 N) is applied at bolt hole with pull applied perpendicular to gear sector.

g. Secure nuts of spacer together and bolt to hole in support with lockwire (C-405).

NOTE

Adjust backlash at each gear sector independently. Torquing of retaining bolt of opposite sector gear can affect adjustment.

7. Reconnect throttle control tubes and verify throttles operate smoothly.

8. Install coverplates and control stick boot.

67-24. MISCELLANEOUS CONTROL COMPONENTS.

Linkage between collective control jackshaft and collective sleeve lever on swashplate support consists of push-pull tubes, bellcranks, support, and a dual hydraulic power cylinder.

NOTE

For maintenance practices on copilot collective controls, refer to appropriate Service Instruction .

67-25. Removal.

NOTE

Parts of control system can be removed separately as needed or completely in practical sequence. Take precautions against damage by accidental movement of linkage while disconnected.

1. Remove covers and access panels as required.

2. Remove nuts, washers and bolts attaching control tube (2, figure 67-1) to collective lever (1) and universal (3). Remove control tube (2).

3. Remove nuts, washers and bolts attaching control tube (6) to cylinder (5) and bellcrank (8). Remove control tube (6).

4. Remove nuts and washers attaching cylinder (5) to support (4). Remove nut, washers, and bolt attaching cylinder (5) to support (7). Remove cylinder (5).

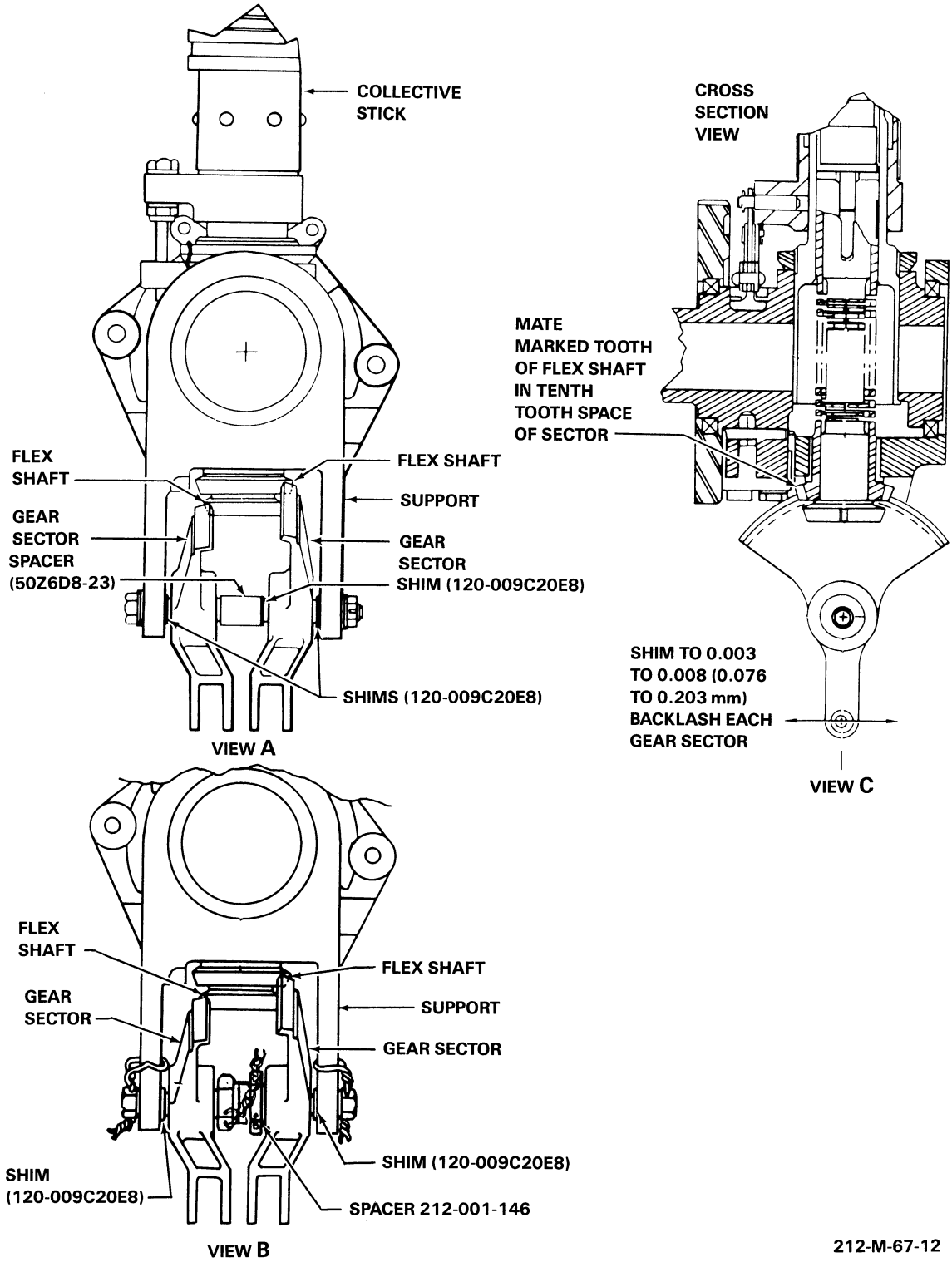


Figure 67-12. Throttle control gear sectors shimming and backlash

5. Remove nuts, washer, and bolts from each end of support (4) and lift beam. Remove support (4).

6. Remove nuts, washers, and bolts attaching control tube (9) to bellcrank (8) and lever (10). Remove control tube (9).

7. Remove nuts, washers and bolts attaching control tube (11) to lever (10) and control arm (14). Remove control tube (11).

67-26. Inspection and repair.

Inspect and repair collective pitch control linkage components (BHT- 212- CR&O).

67-27. Installation.

1. Install and align control tube (11, figure 67- 1) to lever (10) and control arm (14). Install bolts, washers and nuts. Tighten and install cotter pins.

2. Install and align control tube (9) to lever (10) and bellcrank (8); install bolts, washers and nuts. Tighten and install cotter pins.

3. Install and align control tube (6) to bellcrank (8) and cylinder (5). Install bolts, washers and nuts. Tighten and install cotter pins.

4. Install and position support assembly (4) on lift beam and attaching brackets. Install bolts, washers and nuts.

5. Install collective hydraulic cylinder (Chapter 29).

6. Install and align control tube (2) to collective lever (1) and universal (3). Install bolts, washers and nuts. Tighten and install cotter pin.

7. Rig collective pitch controls (paragraph 67- 5).

8. Install panels and covers.

CYCLIC FLIGHT CONTROLS

67-28. CYCLIC CONTROLS.

The cyclic control system consists of pilots cyclic control stick, push-pull tubes, bellcranks, mixing levers, two dual hydraulic power cylinders, and electrically operated force trim units. Movement of cyclic control stick is transmitted through linkage and hydraulic cylinders to the swashplate. Fore and aft control linkage is separate from lateral control linkage from control stick to mixing levers. Two dual hydraulic power cylinders are incorporated to reduce effort required for control and to reduce feedback forces from main rotor. Two force gradient units, with magnetic brakes, are incorporated for artificial control feel and stabilization of controls. The cyclic control stick is mounted through the floor in front of pilot seat. The cyclic stick has adjustable friction and is equipped with a trigger type intercom and communication switch, a cargo hook release switch, rescue hoist control switch, and a force trim switch.

67-29. CYCLIC CONTROL STICK.

The cyclic control stick is mounted through the floor in front of the pilot seat. The cyclic stick has adjustable friction and is equipped with a trigger type intercom and communication switch, a cargo hook release switch, rescue hoist control switch and a force trim switch.

67-30. Removal.

NOTE

Use this procedure to remove complete stick assembly, including support and lever.

1. Remove screws (2, figure 67-13) and washers to detach boot (3) from floor. Remove boot assembly. Remove access plate on lower skin.

2. Disconnect control stick cable plug (10) from receptacle on structure. Detach clamp (4) from structure.

3. Disconnect fore-aft and lateral control tube assemblies (5 and 7) from lever, below stick support, by removing bolts (6 and 8).

4. Remove four bolts (9) and washers from support. Remove cyclic stick (1) and support assembly.

67-31. Installation.

1. Position stick (figure 67-13) in place. Secure support to structure with four bolts (9) and washers.

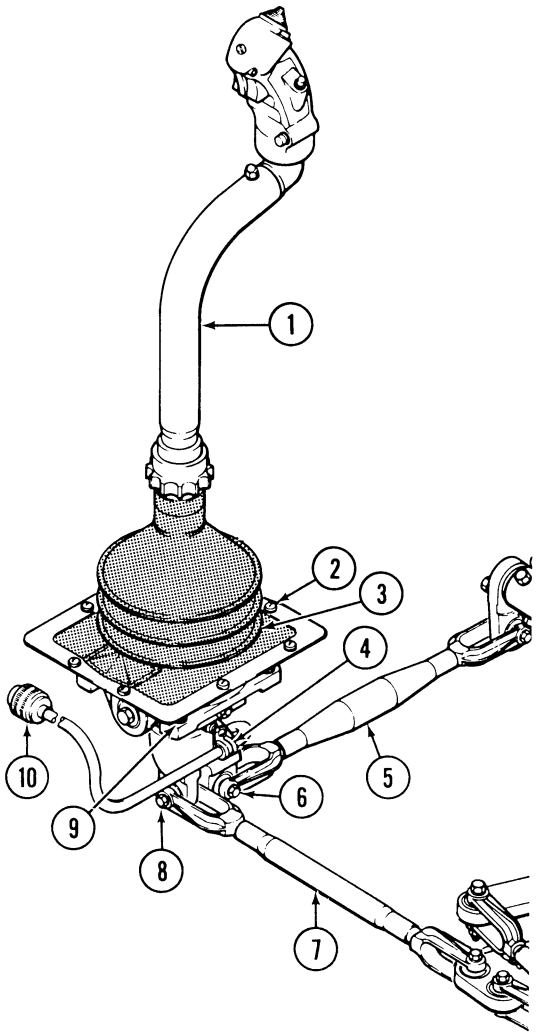
2. Attach fore-and-aft, and lateral control tube assemblies (5 and 7), to control stick lever with bolts (6 and 8), washers, nuts, and cotter pins.

3. Connect and lockwire control stick electrical cable plug (10) to receptacle on structure below floor. Check cable support clamp (4) allows enough slack in cable for full stick travel only.

4. Install boot assembly (3) with eight screws (2) with washers. Install access plate on lower skin.

67-32. FORCE TRIM.

A magnetic brake and force gradient installation is used in each of the two cyclic control systems for stick centering and force trim functions. The brake is secured to airframe structure, and has an arm on its rotary shaft. The arm can be braked and held at any point in its travel by use of a switch on cyclic stick. Brake and force gradient are alike in appearance for lateral and fore-and-aft systems, but are different in position of installation. Lateral force gradient is located behind F.S. 23 bulkhead inboard of left main beam. Fore-and-aft force gradient attaches to



1. Cyclic stick
2. Screw
3. Boot
4. Clamp
5. Tube assembly (fore-and-aft)
6. Bolt
7. Tube assembly (lateral)
8. Bolt
9. Bolt
10. Cable plug

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Figure 67-13. Cyclic control stick

left end of cyclic control jackshaft at F.S. 49.5 and extends aft to connect to magnetic brake.

67-33. Cyclic control force gradient.

The force gradient is a link equipped with an internal spring and connects arm of magnetic brake to a lever in fore-and-aft system and a bellcrank in lateral system.

67-34. Removal.

1. Remove access panels from cabin floor and from lower fuselage skin as necessary.

2. Disconnect link from bellcrank (23, figure 67-3) in lateral system by removing nut, washers, and bolt.

3. Disconnect clevis from lever on cyclic jackshaft (26) in fore-and-aft system by removing bolt.

4. Remove spring (35) if installed. Note rigging.

5. Remove nut to detach brake from force gradient (18 or 21).

6. If force gradient is to be replaced, remove link or clevis for use on replacement.

67-35. Installation.

MATERIALS REQUIRED

NUMBER	NOMENCLATURE
C-405	Lockwire

NOTE

All force gradients are similar in appearance but each installation requires a different part number because of different spring assembly.

1. Adjust spring preload on force gradient as follows:

a. Remove cap (3, figure 67-14).

b. Remove spring assembly (1) from housing (2).

c. Adjust nuts (6) to hold 2.5 to 3.0 lbs. (11.1 to 13.3 N) force against spring (1) on lateral force gradient. Tighten nuts together.

d. Adjust nuts (6) to hold 5.5 to 6.5 lbs. (24.5 to 29.0 N) force against spring assembly (1) on fore-and-aft force gradient. Tighten nuts together.

e. Insert spring assembly (1) into housing (2) and install cap (3) and tighten until all noticeable end play is eliminated. Secure with lockwire (C-405) as shown to prevent turning in either direction.

2. Install spring (35, figure 67-3) as required.

3. Adjust and connect force trim in accordance with cyclic controls rigging procedure (paragraph 67-6 or 67-7).

4. Install access panels on cabin floor and lower fuselage skin.

67-36. MAGNETIC BRAKE.

Two magnetic brakes are used with force gradient assemblies for stick centering and force trim in fore-and-aft and lateral cyclic control linkage. The brake assemblies are identical to each other except for position of arm on brake and position of mounting on structure.

67-37. Removal.

1. Remove access panels from cabin floor and from lower fuselage skin as necessary.

2. Disconnect force gradient from arm of magnetic brake.

3. Disconnect electrical plug from magnetic brake (17 or 20, figure 67-3). Note rigging of spring (35) in plate (34) if installed. Remove spring (35) and four bolts with washers. Lift magnetic brake from helicopter.

4. If force gradient is to be replaced, remove arm for use on replacement.

67-38. Installation.

MATERIALS REQUIRED

NUMBER	NOMENCLATURE
C-405	Lockwire

1. Install arm on magnetic brake as follows:

a. Align arm on magnetic brake (20, figure 67-3) so **L** is next to mark on shaft (view C). Tighten attaching bolt.

b. Align arm on magnetic brake (17) so **F** is next to mark on shaft (view B). Tighten attaching bolt.

c. Attach magnetic brake to structure by installing four bolts with washers and install spring (35) if required. Attach electrical plug to magnetic brake and secure with lockwire (C-405).

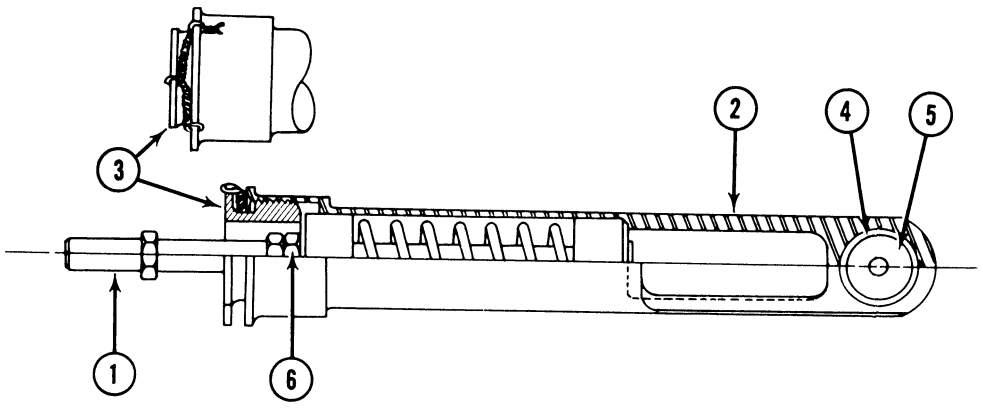
d. Attach magnetic brake (17 and 20) to force gradient (18 and 21) by installing nut and cotter pin.

e. Adjust and connect force trim in accordance with cyclic controls rigging procedure (paragraph 67-6 or 67-7).

NOTE

Check clearance between force gradient and structure at extreme positions of magnetic brake arm. Re-index arm relative to shaft by one serration, if required for clearance, then repeat step 11., paragraph 67-6 or step 11., paragraph 67-7.

f. Install access panels on cabin floor and lower fuselage skin.



1. Spring assembly
2. Housing
3. Cap
4. Sleeve
5. Bearing
6. Nuts

212-M-67-14

Figure 67-14. Force gradient

67-39. MISCELLANEOUS CONTROL COMPONENTS

Cyclic control components include push-pull tubes, bellcranks, jackshaft, mixing lever, and supports.

NOTE

For maintenance practices on cyclic controls dual control kit, refer to appropriate Service Instruction.

67-40. Miscellaneous Control Components — Removal

NOTE

Parts of control system can be removed separately as need occurs, or completely in any practical sequence. Take precautions against damage by accidental movement of linkage while disconnected.

1. Remove access covers on cabin floor, front of pylon island, and lower skin of fuselage, as required.

2. Disconnect the control tubes (22 and 24, Figure 67-3) from the pilot cyclic stick (25).

3. To remove the bellcrank assembly (23), proceed as follows:

a. Disconnect the control tubes (22 and 27), force gradient (21), and transducer (36).

b. Remove the cotter pin (46), bolt (43), washers (44), and nut (45) from the bellcrank assembly (23). Discard the cotter pin.

c. Remove the bellcrank assembly (23) from the support assembly (37).

4. To remove the support assembly (37), remove the bolts (38), washers (39), and nuts (40).

5. When removal of cyclic jackshaft (26) is required, remove bolts and tapered bushings to separate jackshaft tubes from each side of control lever. Remove each jackshaft by removing four bolts attaching bearing housing to beam, withdrawing assembly through access opening inside of cabin lower skin.

6. Disconnect control tubes from mixing lever (28) bellcranks (8 and 15).

7. Remove bellcranks from or with supports as required.

8. Remove either hydraulic cylinder (7 or 14).

9. Remove cylinder support (6) and support (13).

10. Remove cyclic mixing levers (Figure 67-15).

67-41. Miscellaneous Control Components — Inspection

1. Inspect cyclic control jackshaft components (BHT-212-CR&O).

2. Inspect bearings of cyclic control jackshaft components for secure installation and serviceability (BHT-ALL-SPM).

3. Inspect cyclic control bellcranks, mixing lever, supports, and control tubes (BHT-212-CR&O).

4. Check balance spring (2, Figure 67-3) for security, distortion, and excessive length. Spring should be approximately 9.41 inches (239.01 mm) long, with a spring rate of 20 pounds (89.0 N) per inch (25.4 mm).

5. On helicopters S/N 30850 and subsequent, check spring (35, Figure 67-3) for security, distortion, and excessive length. Spring should be approximately 7.6 inches (193.04 mm) long, with a spring rate of 2.3 pounds (10.2 N) per inch (25.4 mm).

6. The maximum allowable lateral movement on cyclic jackshaft (26) is 0.20 inch (5.08 mm) (Figure 67-16).

67-42. Miscellaneous Control Components — Repair

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-423	Abrasive Paper

NOTE

Check rigging and proper operation of system after removal and installation of any parts.

1. Polish out mechanical damage to cyclic control jackshaft components with 400 grit or finer abrasive paper (C-423) to obtain a smooth, scratch-free surface. Refinish component to original finish (BHT-ALL-SPM).

2. Remove corrosion from cyclic control jackshaft components (BHT-ALL-SPM) and refinish component to original finish.

3. Replace unserviceable bearings of cyclic control jackshaft components (BHT-ALL-SPM).

4. Repair cyclic control bellcranks, mixing lever, supports, and control tubes (BHT-212-CR&O).

67-43. Miscellaneous Control Components — Installation

NOTE

If a support assembly (37, Figure 67-3) is being replaced, the upper bearing (42) will not be installed or supplied with the new support.

This is to make sure the bearing inner race touches the bellcrank bushing after ring staking the sleeve. If the support assembly is replaced, do the following step.

1. Temporarily put the bellcrank assembly (23) into the support assembly (37) and put the new upper bearing (42) in position on the support assembly.

2. Ring stake the sleeve (41) to secure the upper bearing (42) in place (BHT-ALL-SPM, Chapter 9).

3. Install the support assembly (37) on the airframe with the bolts (38), washers (39), and nuts (40). Torque the nuts.

4. Install the bellcrank (23), bolt (43), washers (44), nut (45), and new cotter pin (46) on the support assembly (37).

5. Connect the control tubes (22 and 27), force gradient (21), and transducer (36) on the bellcrank assembly (23).

6. Connect the control tubes (22 and 24) on the pilot cyclic stick (25).

7. Install bellcranks (8 and 15) if removed. Assemble and install mixing lever assembly (Figure 67-15).

8. Install cyclic jackshaft (26, Figure 67-3), if removed.

9. Insert right and left tube assemblies, with bearings and supports in place, through access openings at sides of cabin lower skin. Slip ends of tubes on stub shafts of control arm. Align bolt holes with center arm pointing up and end arms down, and install bolts and tapered bushings.

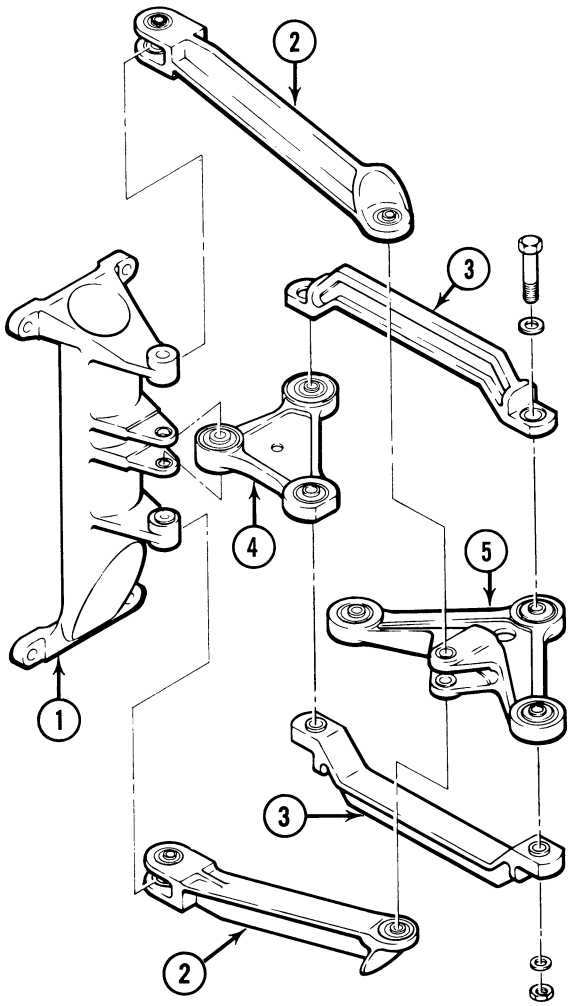
10. Secure right and left bearing supports to each beam by installing four bolts with nuts and washers. Check for free operation.

11. Install and attach all fixed-length control tubes. If adjustable control tubes are not correct length to be attached, leave one end free until controls are rigged.

12. Install supports (6) and support (13).

13. Install hydraulic cylinders (7 and 14).

14. Complete connection of linkage while rigging control system (paragraph 67-6 or paragraph 67-7).



1. Support
2. Matched Links
3. Matched Links
4. Bellcrank
5. Bellcrank

212-M-67-15

Figure 67-15. Cyclic control mixing lever assembly (typical)

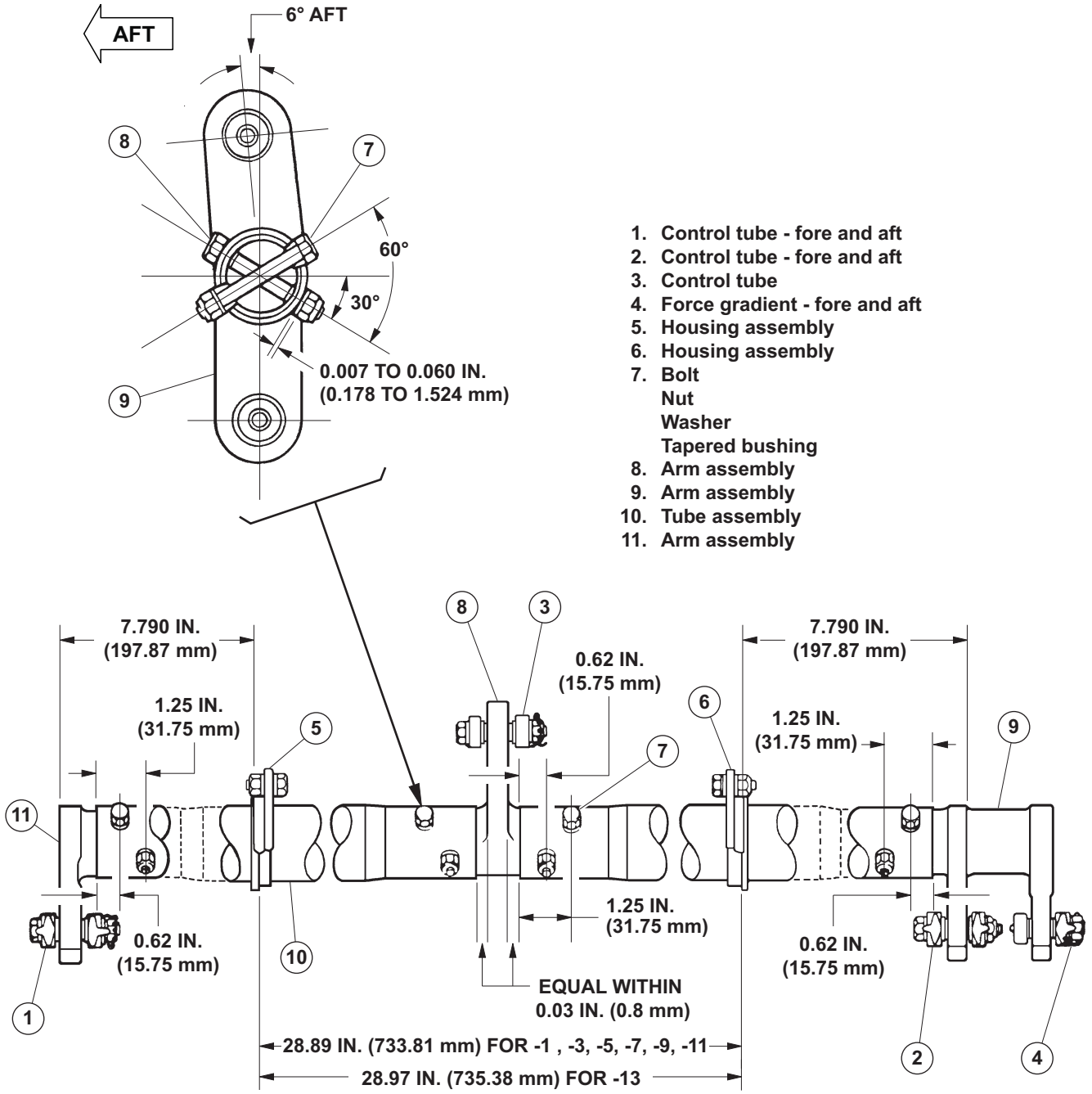


Figure 67-16. Cyclic Jackshaft

67-44. CYCLIC JACKSHAFT

67-45. Cyclic Jackshaft — Replacement

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
T-27872-11	Reamer

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-204	Epoxy Polyamide Primer

1. Remove access covers on cabin floor and lower skin of fuselage, as required.

2. Disconnect control tubes (1, 2, and 3, Figure 67-16) from jackshaft. Disconnect force gradient (4) from cyclic jackshaft.

3. Remove bolts and tapered bushings to separate jackshaft tubes from each side of control lever. Remove each jackshaft by removing four bolts attaching bearing housing to beam. Withdraw assembly through access opening of cabin lower skin.

4. Assemble arm assembly (9), arm assembly (8), and tube assembly (10).

5. Clamp jackshaft in a suitable holding fixture with arm assemblies (9 and 11) down 90° and arm assembly (8), up and aft 6°.

6. Hold dimensions as shown in Figure 67-16.

7. Drill through tube assembly and arm assembly with a No. F (0.257 inch (6.53 mm)) drill.

8. Insert reamer (T-27872-11) so end of pilot projects through parts to be reamed.

9. Ream one side (smooth finish).

10. Install tapered bushing. Ream opposite hole using tapered bushing to support reamer pilot.

11. Disassemble and remove burrs and metal particles.

12. Install tapered bushing and secure with bolt, washer, and nut (7).

NOTE

After torquing bolt (7), the washer must be held off the surface of jackshaft tube within limits given in Figure 67-16, Detail A.

13. Repeat step 7 through step 11 for remaining holes.

14. Apply epoxy polyamide primer (C-204) to all raw metal.

15. Insert right and left tube assemblies, with bearings and supports in place, through access openings at sides of cabin lower skin. Slip ends of tubes on stub shafts of control arm. Align bolt holes with center arm pointing up and end arms down, and install bolts and tapered bushings. Secure right and left housing assemblies (5 and 6) to each beam with four bolts, washers, and nuts. Check for free operation.

16. Connect control tubes (1, 2, and 3) to jackshaft.

17. Connect force gradient (4) to jackshaft. Check rigging (paragraph 67-6 or paragraph 67-7).

ANTITORQUE CONTROL

67-46. ANTITORQUE CONTROL SYSTEM.

67-47. ANTITORQUE CONTROLS (HELICOPTERS PRIOR TO S/N 31175).

The antitorque control system includes control pedals, pedal adjusters, a force gradient (centering spring) assembly with an electrically operated magnetic brake, a hydraulic power cylinder, and connecting linkage. Actuation of pedals causes a power-assisted pitch change of tail rotor blades to offset main rotor torque and control directional heading of helicopter. Refer to appropriate Service Instruction for maintenance practices on copilot dual controls kit.

67-48. ANTITORQUE CONTROLS (P/N 212-011-701 HUB AND BLADE) (HELICOPTERS S/N 31175 AND SUB.).

The antitorque control system includes control pedals, pedal adjuster, a force gradient (centering spring) assembly with an electrically operated magnetic brake, a hydraulic power cylinder, and connecting linkage. Actuation of pedals causes a power-assisted pitch change of the tail rotor blades to offset main rotor torque and control directional heading of helicopter. Refer to appropriate Service Instruction for maintenance practices on copilot dual controls kit.

67-49. Minimum friction adjustment.

NOTE

Helicopter S/N 30850 and subsequent require minimum friction adjustment.

1. Disconnect force gradient (31, figure 67-5) from pedal adjuster (28). Disconnect control tube (25) from walking beam (26).

2. Adjust friction screw (35) in friction clamp (34) until a force of 4.25 to 4.75 lbs. (18.9 to 21.1 Nm) is measured at pedals moving through neutral position.

3. Install force gradient (31) and control tube (25).

67-50. PEDALS AND ADJUSTER.

A set of control pedals, supported on forward bulkhead, is connected under cabin floor to adjuster assembly. Adjuster is a bellcrank assembly with a knob on the floor for manual adjustment of pedal position according to pilot need. Force gradient and control linkage to power cylinder are connected to a bellcrank on pilot adjuster.

67-51. Removal.

1. Remove pilot seat.

2. Remove flight control access doors.

3. Remove nuts, washers and bolts from control tube (33, figure 67-5). Remove control tube (33).

4. Remove four bolts attaching pedal support to bulkhead. Remove pedals and support.

5. Remove nut, washer and bolt from forward end of control tube (27) and force gradient (31).

6. Remove two bolts and washers. Remove adjuster knob (33).

7. Remove four nuts, washers and bolts attaching tail rotor control pedal adjuster (28) to bulkhead. Remove pedal adjuster (28).

67-52. Installation.

MATERIALS REQUIRED

NUMBER	NOMENCLATURE
C-200	Putty
C-201	Primer

1. Apply a coat of putty (C-200) to mounting surface of tail rotor control pedal adjuster, position on bulkhead, install bolts and washers. Torque nuts 50 to 70 in.lbs. (5.65 to 7.91 Nm).

2. Position adjuster knob (29, figure 67-5) in slots of tail rotor control pedal adjuster, install washers and bolts. Torque 20 to 25 in.lbs. (2.26 to 2.82 Nm).

3. Position forward end of control tube (27) and force gradient (31) on tail rotor control adjuster, install bolts, washers and nuts. Torque nuts 30 to 40 in.lbs. (3.39 to 4.52 Nm) and secure with cotter pins.

4. Apply a coat of primer (C-201) to mounting surface of pedal support, position on bulkhead with the word TOP up. Install four bolts and washers. Torque 30 to 40 in.lbs. (3.39 to 4.52 Nm).

5. Position control tubes (33) on pedals. Install bolts, washers and nuts. Torque nuts 30 to 40 in.lbs. (3.39 to 4.52 Nm) and secure with cotter pins.

6. Install flight control access doors.

7. Install pilot seat.

8. Perform rigging and operational check (paragraph 67-4).

67-53. FORCE TRIM.

A magnetic brake and force gradient installation is used for control centering and force trim. An arm on a rotary shaft can be braked and held at any point in arc of travel by use of a switch on cyclic stick. The force gradient is a link equipped with an internal spring, and connects brake arm to center hole in aft bellcrank on pilot pedal adjuster. Brake and force gradient are like units used in cyclic system but are different in position of installation. Brake is mounted on forward side of F.S. 63.33 bulkhead at approximately right B.L. 20 and force gradient extends forward.

67-54. FORCE GRADIENT.

67-55. Removal.

1. Remove pilot seat.

2. Remove access panels from cabin floor as necessary.

3. Disconnect forward end of force gradient (31, figure 67-5) from pedal adjuster (28).

4. Remove nut from stud on magnetic brake arm and remove force gradient.

67-56. Installation.

MATERIALS REQUIRED

NUMBER	NOMENCLATURE
C-405	Lockwire

CAUTION

ALL FORCE GRADIENTS ARE SIMILAR IN APPEARANCE, BUT EACH INSTALLATION REQUIRES A DIFFERENT PART NUMBER BECAUSE OF DIFFERENT SPRING ASSEMBLY.

1. Adjust spring preload on force gradient, if required, as follows:

a. Remove cap (3, figure 67-14).

b. Adjust nuts (6) to hold 2.5 to 3 lbs. (11.1 to 13.3 N) force against spring assembly (1). Tighten nuts together.

c. Insert spring assembly (1) into housing (2) and install cap (3) until all noticeable end play is eliminated. Secure cap with lockwire (C-405) as shown to prevent turning either direction.

2. Place aft end of force gradient over stud on magnetic brake arm. Secure with washer, nut and cotter pin.

3. Adjust length of force gradient (paragraph 67-6 or 7) and connect to pedal adjuster (28, figure 67-5). Install cotter pin.

4. Install cabin floor access panel.

5. Install pilot seat.

67-57. MAGNETIC BRAKE.

67-58. Removal.

1. Remove pilot seat.

2. Remove access panels from cabin floor, as necessary.

3. Remove aft end of force gradient from arm of magnetic brake.

4. Disconnect electrical plug from magnetic brake.

5. Remove four bolts with washers and lift assembly from helicopter.

6. Remove arm from magnetic brake.

67-59. Installation.

MATERIALS REQUIRED

NUMBER	NOMENCLATURE
C-405	Lockwire

1. Align arm on magnetic brake shaft so that the **D** is next to mark on shaft. Tighten arm attaching bolt.

2. Position magnetic brake in helicopter and secure magnetic brake to bulkhead with four bolts and washers.

3. Connect electrical plug to magnetic brake. Secure connector with lockwire (C-405)

4. Check rigging of magnetic brake and force gradient in accordance with paragraph 67- 6 or 67-7 and connect force gradient to magnetic brake. Install cotter pin.

5. Install cabin floor access panel.

6. Install pilot seat.

67-60. MISCELLANEOUS CONTROL COMPONENTS.

Control components between tail rotor control pedals and pitch change mechanism mounted on tail rotor gearbox includes control tubes, bellcranks, levers, a walking beam, a force gradient with magnetic brake and a hydraulic power cylinder.

67-61. Removal.

NOTE

Parts of control system can be removed separately as need arises, or completely in any practical sequence. Take precaution against damage by accidental movement of linkage while disconnected.

1. Remove access covers on cabin floor and lower skin of fuselage and tailboom as necessary.

NOTE

Remove tail rotor gearbox prior to removing control tube (8, figure 67-5).

2. Remove control tubes, bellcranks, levers and walking beam by removing attaching hardware.

67-62. Inspection and repair.

1. Inspect linkage parts for wear, elongated bolt holes, cracks, nicks, and damage. Inspect bearings for wear and roughness.

NOTE

Maximum allowable elongation to a bushing or clevis hole in the control system is 0.003 in. (0.076 mm).

2. Inspect control tubes for wear and damage (BHT- 212- CR&O).

67-63. Installation.

MATERIALS REQUIRED

NUMBER	NOMENCLATURE
C-101	Corrosion Preventive Compound

CAUTION

ENSURE CORROSION PREVENTIVE COMPOUND (C-101) IS NOT ALLOWED ON FAYING SURFACES OF FRICTION CLAMP (34, FIGURE 67-5) AND LEVER (26).

1. Apply corrosion preventive compound (C-101) to bolts shown in figure 67-17 prior to installing.

2. Install control tubes, bellcranks, levers, and walking beam by installing attaching hardware.

3. Install lever (17, figure 67-5) in support (19). If lever has side play in support (19), a maximum of two shim washers (18) may be used, one each side of lever (17). One shim washer (18) may be used on one side only.

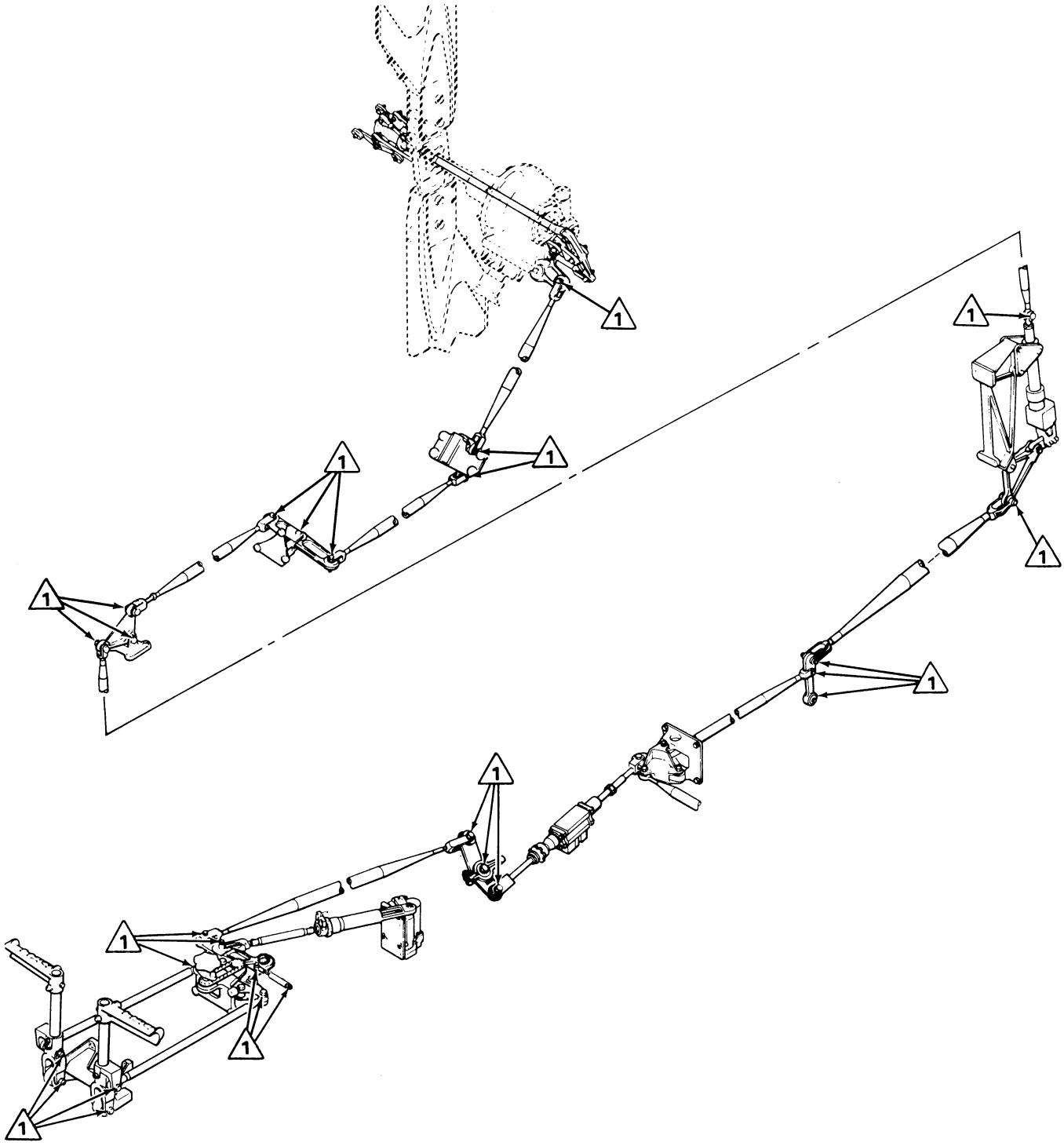
4. Place washer (21) on bolt (20). Install bolt (20) through support (19) and lever (17). Install washer (22) and nut (23). Install cotter pin (24).

5. When installing hydraulic power cylinder, install bolts with heads inboard.

6. Install boot on control tube (25) with aft edge of clamp positioned 4.5 in. (114.3 mm) aft of F.S. 123.0 bulkhead with pedals in neutral.

7. Install tail rotor gearbox, if removed.

8. Rig antitorque controls (paragraph 67-4).



NOTE

212-M-67-17

1 Bolts to be installed with corrosion preventive compound (C-101).

Figure 67-17. Antitorque control pivot bolts

SYNCHRONIZED ELEVATOR

67-64. SYNCHRONIZED ELEVATOR.

The synchronized elevator consists of two elevators, one on each side of tailboom (figure 67-18). Each elevator is a horizontal airfoil section built up on a spar tube which is inserted into a projecting end of a horn assembly and secured by two bolts. The horn assembly is installed horizontally through sides of the tailboom and is secured to the structure by supports which serve as bearings for rotational movement. A control arm on the horn provides attachment for linkage from the fore-and-aft cyclic control system at the swashplate.

67-65. MAINTENANCE.

67-66. Removal.

Remove either synchronized elevator assembly as follows:

1. Remove access door from bottom of tailboom below elevator.

2. Remove catter pin (15, figure 67-18), nut (14), washers (13), and bolt (12).

3. Remove special retaining bolt (2), with washer, to detach elevator fitting from lug (4) on horn assembly ((5).

4. Withdraw elevator straight outboard until spar tube (3) is pulled free from horn assembly (5).

5. If hor (5) is to be removed, proceed as follows:

a. Disconnect control tube assembly from arm (6) on horn assembly.

b. At each end of horn assembly (inside tailboom) remove two bolts with nuts, washers, and shims (8) which attach upper and lower retainers (7).

c. Remove bolts and washers attaching retainers (7) and shim sets (9) to tailboom support brackets (10). Remove retainers and shim sets.

CAUTION

HANDLE RETAINERS WITH CARE TO AVOID DAMAGING INNER SURFACES OF BUSHINGS. KEEP REMOVED PARTS IN SETS.

d. Remove horn assembly through access opening in bottom of tailboom.

67-67. Inspection and repair.

MATERIALS REQUIRED

NUMBER	NOMENCLATURE
C-300	Adhesive
C-305	Aliphatic Naphtha
C-306	Toluene

1. Inspect elevator for damage, dents, and cracks.

2. Check elevator radial movement as follows:

a. With elevators installed, mount a dial indicator on tailboom with stylus in contact with upper surface of elevator at spar station.

b. Lightly move elevator up and down and observe total reading on dial indicator. Maximum play of 0.010 in (0.254 mm) is permissable. If reading is not within allowable limits, accomplish following steps c. through e.

c. Check elevator for proper installation (paragraph 67-68).

d. Check drag on support assembly (paragraph 67-68).

e. Inspect elevator and support in accordance with following steps 3 . and 4 .

3. Inspect elevator for loose rivets, damage, dents, cracks, and worn spar tube (figure 67-19).

4. Inspect support retainer set (7, figure 67-18) for damage, wear, and looseness (BHT-212- CR&O).

5. Inspect horn (5) for damage, dents, cracks, and excessive wear (BHT- 212- CR&O).

NOTE

Inboard rib may be modified in accordance with T.B. 212- 83- 76 to reduce the possibility of cracking.

6. Inspect inboard rib for cracks. Small crack in web may be stop drilled if crack does not extend into radius of rib flange. If crack extends into rib flange, replace rib.

7. Replace tip cap (11, figure 67-18) if loose or missing as follows:

a. Clean elevator tip area with alphatic naphtha (C-305).

b. Inspect new cap assembly (11) to ensure freedom from oil, grease, dirt, or other contaminants. If necessary, clean cap with toluene (C-306).

c. Brush a thin coat of adhesive (C-300) (approximately 0.010 in. (0.254 mm) thick) on elevator tip (cleaned area) and inside of cap.

d. Allow approximately one hour drying time until adhesive attains an aggressive tack. Install cap on elevator tip.

e. Retain cap in place at least 15 seconds.

f. Allow a minimum of 24 hours drying time before releasing helicopter for flight.

8. For structural repair of elevator, refer to FAA Aircraft Inspection and Repair Manual A.C. 43.13-1A.

9. The following procedure is to be used when replacing elevator horn:

CAUTION

HORN MUST BE MACHINED IN ACCORDANCE WITH FIGURE 67-20 . FAILURE TO COMPLY WILL RESULT IN LOSS OF INTERCHANGEABILITY WITH FUTURE SPARE PARTS.

a. Drill 0.375 to 0.376 inch (9.53 to 9.55 mm) diameter hole through both walls of elevator horn. Hole to be 6.750 inches (171.45 mm) inboard of center of elevator attach bolt hole and through center of horn parallel to face of adjacent elevator attach lug (figure 67-20). Repeat procedure on opposite end of horn. Deburr holes.

b. Assemble synchronized elevators to horn and secure in place with bolt (2, figure 67- 18).

c. Push bushing, P/N 20-006-16-32-32 (or similar drill bushing) into one of four holes in elevator horn wall.

NOTE

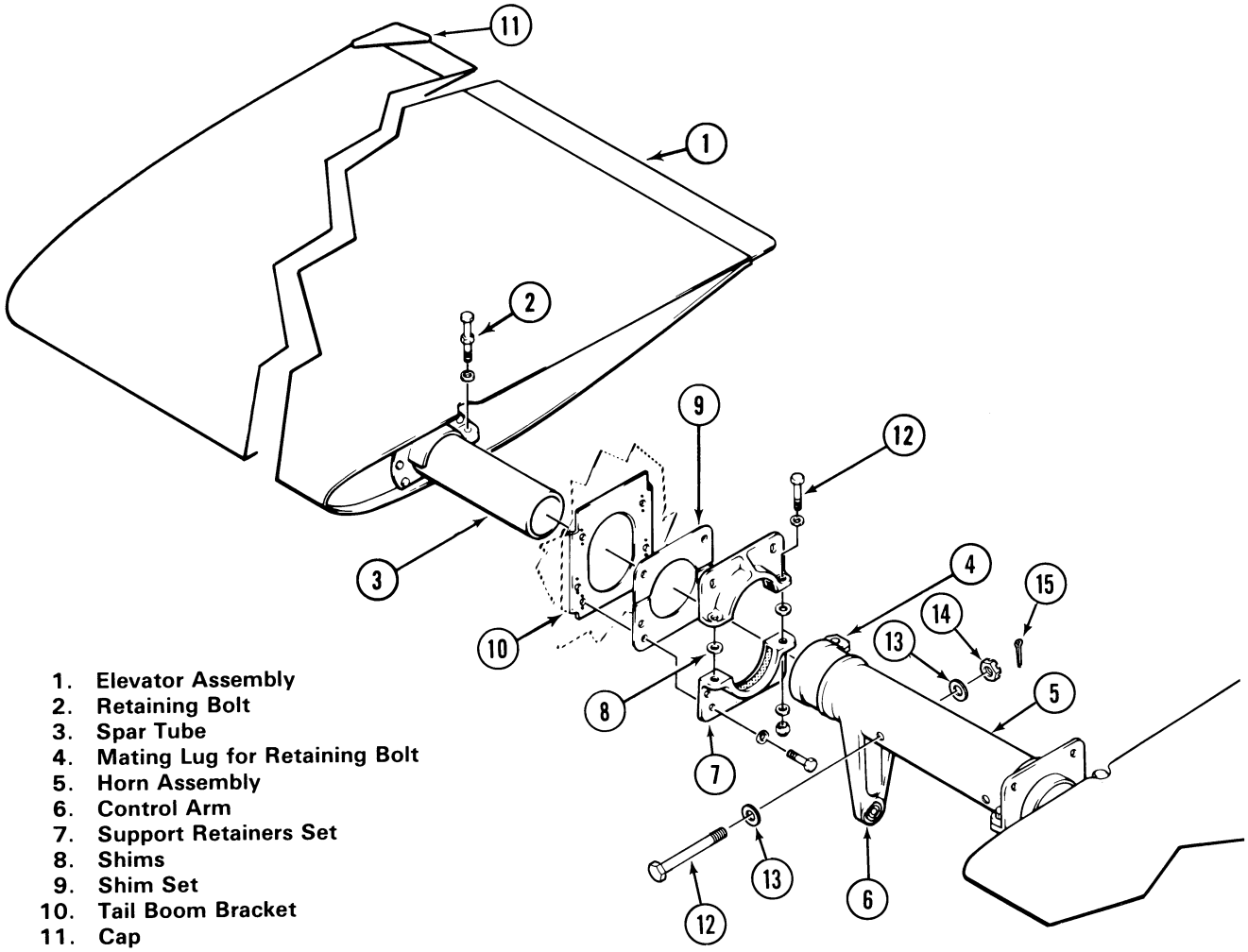
Bushing should be light push fit in horn. If fit is too tight, polish outside diameter of bushing down until light push fit is obtained.

d. Drill 0.246 to 0.250 inch (6.25 to 6.35 mm) diameter hole through spar wall using size “D” drill.

e. Repeat steps c . and d . for remaining three elevator horn hole locations.

f. Disassemble elevators from horn.

g. Drill holes in elevator spars 0.312 to 0.313 inch (7.92 to 7.95 mm) diameter. Deburr holes.



1. Elevator Assembly
2. Retaining Bolt
3. Spar Tube
4. Mating Lug for Retaining Bolt
5. Horn Assembly
6. Control Arm
7. Support Retainers Set
8. Shims
9. Shim Set
10. Tail Boom Bracket
11. Cap
12. Bolt
13. Washers
14. Nut
15. Cotter Pin

Figure 67-18. Synchronized elevator

h. Apply primer (C-204) to holes and allow to dry.

67-68. Installation.

MATERIALS REQUIRED

Refer to BHT- ALL- SPM for specification and source.

NUMBER	NOMENCLATURE
C-104	Corrosion Preventive Compound

1. Coat horn assembly (5, figure 67-18) with corrosion preventive compound (C-104).

2. Insert horn into tailboom through access door on bottom of tailboom below elevator. Position assembly with ends through tailboom brackets (10) and with control arm (6) at right of center pointing down.

3. Position shim sets (9) and retainers (7) on tailboom brackets (10) and install attaching washers and bolts. Peel shim sets as necessary to obtain 0.005 in. to 0.030 in. (0.127 to 0.762 mm) lateral play of horn assembly.

CAUTION

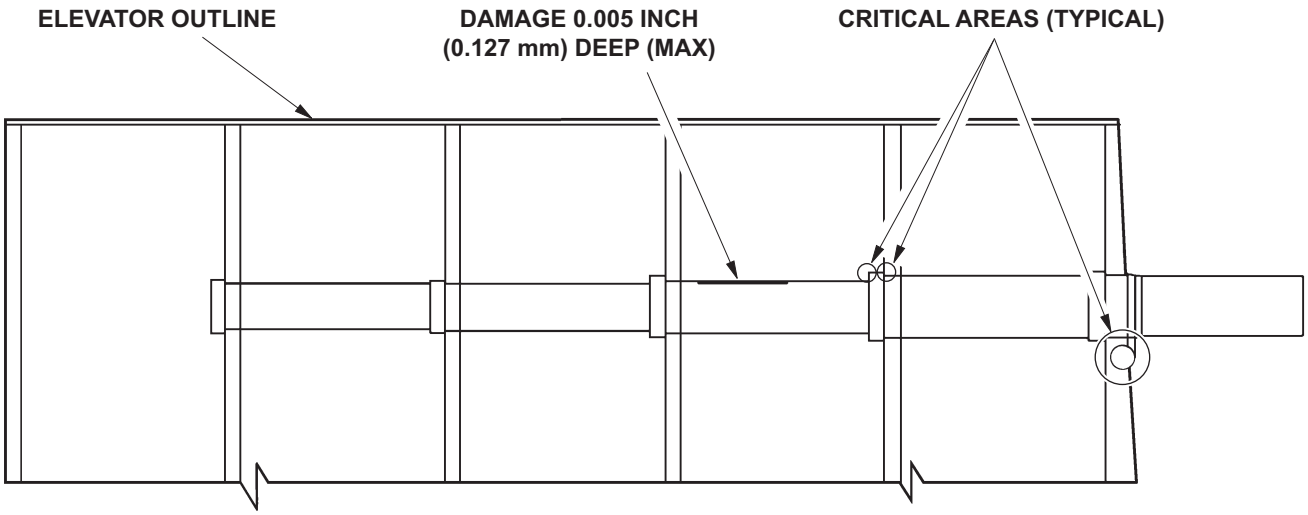
HANDLE RETAINERS CAREFULLY TO AVOID DAMAGING INNER SURFACES OF BUSHINGS.

4. Secure upper and lower retainers together with two bolts and nuts (with thin aluminum washers next to bolt heads and shims (8) between retainers).

5. Adjust preload on bearings as follows:

NOTE

Preload will be measured by using a standard spring scale applied to control arm (6) of horn assembly. Apply spring scale tension 90° to control arm to obtain a correct reading.



NOTES

1. The entire elevator spar tube is a critical fatigue area. The area where the elevator attaches to the horn and the radii adjacent to the rib lands are especially critical because these are the points where loads are transferred to the spar. If an elevator sustains damage, the elevator skin must be removed for inspection of the spar prior to repair of the internal damage.

   LIMITS - REPAIRABLE DAMAGE. Scratch and scoring damage is limited to 0.005 inch (0.127 mm) depth after clean-up with 400 grit or smoother abrasive paper to a polished smooth surface. Scratch and scoring damage is further limited as follows: 0.50 inch (12.7 mm) radially. 1.00 inch (25.4 mm) longitudinally. No dents which result in visible tube wall depressions are permitted. The allowable limit on pit corrosion is 10% of wall thickness. No corrosion is permitted after clean-up.

2. Apply two coats of epoxy polyamide primer (C-204) to spar in clean-up areas and a light coat of super koropon primer (C-202) or epoxy polyamide primer (C-204) to portion of spar which fits inside horn.

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Figure 67-19. Elevator Spar Damage

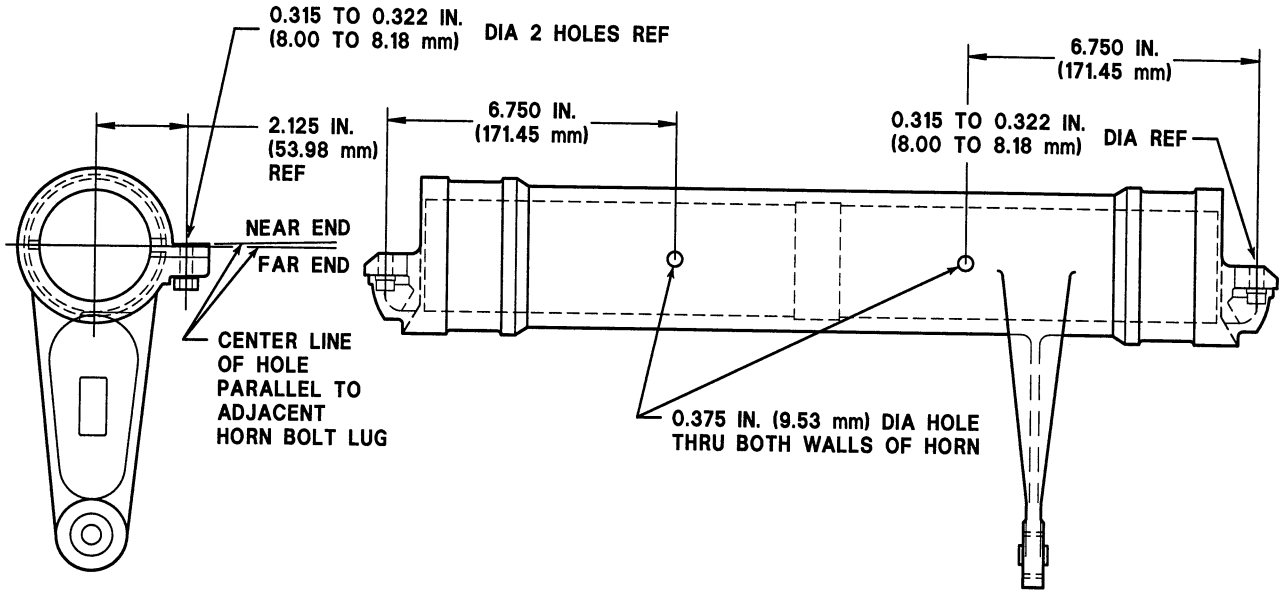

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Figure 67-20. Elevator horn hole location

a. With one support retainer set (7) loosely installed, peel or add to shims (8) on opposite set to obtain 13 to 16 pounds (57.827 to 71.172 N) preload with bolts torqued 50 to 70 inch-pounds (5.6 to 7.9 Nm).

b. Adjust opposite support retainer set (in the same manner) until an overall reading of 26 to 32 pounds (115.7 to 141.9 N) of drag is measured on horn assembly control arm (6).

6. Connect control tube to horn assembly.

7. Coat surfaces of elevator spar tube with corrosion preventive compound (C-104). Install each elevator assembly by inserting spar tube into end of horn assembly and installing special retaining bolt with washer. Torque bolt 100 to 140 inch-pounds (11.3 to 15.82 Nm).

8. Install bolt (12), washers (13), and nut (14). Tighten nut snugly but do not exceed 10 inch-pounds (1.13 Nm). Install cotter pin.

9. Check elevator system rigging.

10. Install access door on underside of tailboom.