

Section

67-10-00

Main Rotor Flight Controls (369D/E/FF – 500/600N)

MAIN ROTOR FLIGHT CONTROLS

DESCRIPTION AND OPERATION

1. Main Rotor Flight Controls

Main rotor flight controls consist of scissors, rotating swashplate, stationary swashplate, mixer controls (lateral bellcrank, longitudinal idler, collective pitch mixer bellcrank, longitudinal bellcrank, longitudinal control-mixer link, longitudinal link, and two mixer links) and five pitch control rods.

Movement of collective pitch cyclic control sticks is transferred to mixer controls through control rods routed up through the controls tunnel at the center of Sta. 78.50 bulkhead. Mixer controls transfer required combination of collective, longitudinal and lateral travel through swashplates to main rotor blades. The helicopter may be equipped with either right-hand or left-hand control configurations consisting of cyclic, collective and anti-torque controls. The main rotor hub and blades, swashplate and control linkage to the crew compartment controls are identical on either basic configuration.

NOTE: This section contains information for both L/H command and R/H command helicopters. Unless otherwise denoted, the information in this section pertains to both type helicopters.

A. Collective Mixer, Lateral and Longitudinal Mixer (Tunnel-Routed) Control Rods

Tunnel-routed control rods mechanically transfer displacement of flight controls to associated bellcranks and the idler at the front of main rotor mast base. All tunnel-routed control rods are removed, inspected, repaired and installed in same manner.

B. Controls Support Bracket and Bellcranks

The controls support bracket is below the pilot's seat cover, between right and left inboard sides of the seat structure. The bracket provides the hingeline for longitudinal and lateral idler bellcrank, tail rotor bellcrank, and the engine droop control bellcrank. It also

provides inboard support for the collective torque tube.

C. Collective Controls

Pilot's compartment collective controls consist of collective pitch stick, collective bungee, and the interconnecting shaft and linkage. All components, except the stick and tunnel-routed collective mixer control rod, are located within the pilot's seat structure. Dual control provisions are incorporated into the pilot's compartment collective controls installation.

D. Pilot's Collective Pitch Stick

The pilot's collective pitch stick consists primarily of a switch housing, throttle grip and friction mechanism, collective stick tube and friction mechanism and gas producer control shaft with right angle (pinion and bevel gear) drive. Collective pitch stick controls include: the N_1 throttle and idle stop release ring, N_2 governor trim switch, landing light switch, stick friction adjustment grip throttle friction nut and a starter-ignition switch.

E. Copilot's Collective Pitch Stick

The copilot's collective stick consists primarily of a switch housing, N_1 throttle grip, stick tube, and internal gas producer control shafts having right angle (pinion and bevel) gear drive. The gear drive linkage is essentially the same as in pilot's collective stick housing. Copilot's collective controls include an N_2 governor trim switch.

F. Collective Pitch Stick Friction

Pilot's collective pitch stick friction allows the pilot to vary amount of effort required to raise and lower the collective pitch stick as well as increasing stick resistance to position change resulting from sudden changes in main rotor collective forces. The grip is marked with arrows indicating direction of rotation for increasing or decreasing friction. Friction can be applied or released with one hand by rotating the friction adjustment grip.

CAUTION Collective stick friction mechanism is designed so that stick cannot be locked in maximum friction point. Safety of flight considerations require that pilot be able to instantly change any established collective pitch stick position, without changing friction adjustment in event of a power failure. There is no suitable check that pilot can make, with helicopter on the ground, to determine if maintenance adjustment of collective friction is correct. This is due to large force application necessary to override collective bungee and blades resting on droop stops. If stick friction is inadequate during flight, a maintenance check should be performed. Once friction adjustment is determined to be correct at low friction point, any further mechanical adjustment to alter (increase) friction at low point can cause stripping of mechanism when grip is fully rotated for maximum friction.

G. Collective Control Interconnecting Torque Tube

The collective interconnecting torque tube consists of the tube, bungee bracket, bungee fitting and a tube support bearing. The torque tube interconnects the pilot's collective pitch stick and the inboard collective stick socket assembly. The torque tube is supported at the left end by a bearing installed in seat structure, and at the right end by the controls support bracket.

H. Collective Bungee

The collective bungee installation consists of a male bearing assembly, female bearing assembly, spring and retainer. This unit attaches between the bungee over-center fitting and bungee bracket of collective interconnecting torque tube. The collective bungee helps maintain selected collective pitch stick position in flight by counteracting forces that are fed back in collective pitch stick(s) (blade pitching moments, rotor head strap pack torsion when collective pitch stick is raised or lowered from mid-position, and combined imbalance of forces in the controls system). Flight characteristics of the helicopter are such that collective forces are relatively low during most stick travel from low to high blade pitch. At a point near full pitch, stick forces reverse and become heavy. The purpose of the adjustable bungee and the overcenter

bracket attachment is to counteract these forces so that collective stick loads are relatively constant throughout full range of travel. There are two adjustments provided to establish or correct collective flight loads. The collective bungee spring corrects variation in collective load from low pitch (level flight) to high pitch (climb). Setting of overcenter bolt to raise or lower bungee fitting reduces or increases overall collective forces in both low pitch (level flight) and high pitch (climb).

I. Inboard Collective Stick Socket Assembly

Inboard collective stick socket assembly is a cast magnesium housing that contains gas producer linkage and provisions for attachment of dual collective controls. Internal gas producer drive gear linkage is essentially the same as that in the pilot's collective stick housing with the addition of a splined N₁ pinion gear for simplified installation or removal of a copilot's collective stick. The lower end of the collective mixer (tunnel-routed) control rod is attached to the socket housing and the exterior bellcrank, idler and link transfer movement of the pilot's collective stick throttle to the gas producer controls routed through the fuselage to the engine.

J. Cyclic Controls

The cyclic pitch control system is a fully mechanical control system. Any combination of lateral and longitudinal cyclic pitch stick movement is mixed by cyclic lateral and longitudinal control mixers and transferred to the main rotor swashplate, which applies the combined motion through pitch control rods to the main rotor blades. Forward and rearward movement of the cyclic pitch stick causes helicopter motion in a longitudinal direction, while side-to-side movement provides motion in a lateral direction. This action varies lift developed by main rotor blades and serves as primary control by horizontal flight. Pilot's compartment cyclic controls include the control stick, a lateral interconnecting rod, lateral cyclic bellcrank, longitudinal cyclic control interconnecting torque tube and lateral and longitudinal friction mechanism.

K. Pilot's Cyclic Control Stick

The pilot's cyclic control stick consists of a grip and a tube riveted in a socket. The cyclic grip contains a toggle switch for cyclic trim control

and a trigger switch for radio/interphone communication. A blank switch socket is provided at the left of the trim switch for optional equipment. Coiled, insulated and open-ended wiring is provided in the grip for connection to an optional switch.

L. Copilot's Cyclic Control Stick

The copilot's cyclic control stick is similar to the pilot's except electrical wiring exits above the stick socket. The copilot's cyclic stick is detachable and may be removed or installed by use of two quick-release pins.

M. Pilot's Compartment Lateral and Longitudinal Cyclic Control Linkage

Pilot's compartment lateral and longitudinal cyclic control linkage consists of two control rods and a bellcrank that interconnect lateral control movement, and the cyclic torque tube and one-way lock control system that interconnect longitudinal control movement of pilot's cyclic stick to tunnel-routed mixer control rods. R/H command configuration is identical to L/H command except for an additional lateral control rod that attaches lower end of copilot's cyclic control stick to lateral cyclic bellcrank.

N. One-Way Lock Control System

The one-way lock of the cyclic control system is located in longitudinal control linkage within the pilot's seat structure. The one-way lock control system is essentially a self-contained, closed-loop hydraulic unit - consisting of a check valve, relief valve and pushrod mechanism. The check valve is seated when longitudinal control force (feed-back) originated by main rotor tends to move the one-way lock (and cyclic stick) in an aft direction. Seating the check valve prevents unwanted aft movement of cyclic stick and shunts feed-back force to helicopter structure. Normally, only very slight aft movement of the cyclic stick is required to unseat the check valve. Should the check valve (or pushrod shaft that unseats the valve) gall and freeze in the valve-closed position, a force of approximately 30 pounds is necessary to open the relief valve and bypass the check valve. This force is then required for each subsequent aft movement of the cyclic stick. Conversely,

should the check valve spring fail, the one-way lock does not function to shunt longitudinal feedback forces to structure. The unit is mounted in two pivoting supports attached to seat structure, and has a transparent, vented reservoir with a capacity of approximately 0.67 fluid ounce (20 cc). The one-way lock control system is serviced through the filler with hydraulic oil (6, Table 203).

O. Cyclic Trim Actuators

Each of the two cyclic trim actuators consists of an actuator, housing support, trim tube and spring assembly. The actuator is essentially a motor-driven, variable length shaft that compresses a spring assembly, counteracting feedback forces from the main rotor and compensating for imbalance conditions such as those imposed by crosswinds or unevenly distributed cargo. Cyclic trim is controlled by the cyclic trim switch on top of cyclic stick grip. The cyclic trim switch has five positions: normally **OFF** at the center, and momentary **FORWARD, AFT, LEFT, and RIGHT**. When the trim switch is moved off center to any of the four trim positions, one of the trim motors operates to provide trim spring force in the desired direction. By momentarily activation of the switch, very small trim increments are obtained. Trim forces cannot be applied in two directions simultaneously; when both lateral and longitudinal trim corrections are required, it is necessary to apply first one, then the other. Travel of the cyclic pitch control stick is not limited by the cyclic trim mechanism; trim spring tension can be overridden at any time.

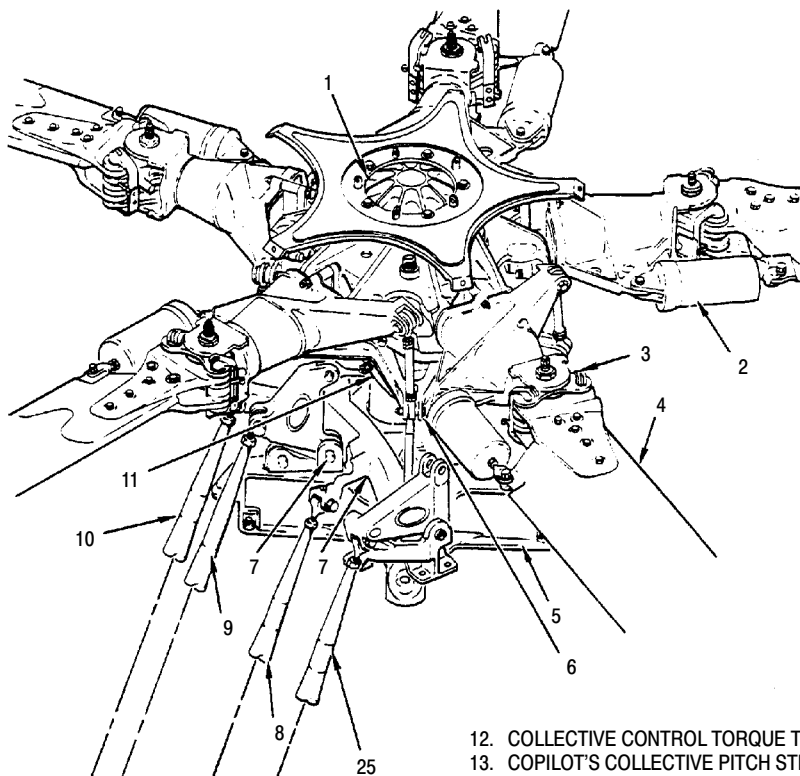
P. Roof-Mounted Control Rods (600N)

The roof-mounted control rods transmit cyclic and collective flight control input from the tunnel-routed control rods, via the forward roof-mounted bellcranks, to the link assemblies, via the aft roof-mounted bellcranks, at the mixer assembly.

Q. Roof-Mounted Bellcranks (600N)

The forward roof-mounted bellcrank transfer controls input from the tunnel-routed control rods to the roof-mounted control rods. The aft roof-mounted control rods transfer controls input from the roof-routed control rods to the link assemblies.

1. MAIN ROTOR DRIVE SHAFT
2. DAMPER
3. BLADE ATTACH PIN
4. MAIN ROTOR BLADE
5. ROTOR MAST SUPPORT
6. ROTATING SWASHPLATE
7. MAIN ROTOR CONTROLS (MIXER, IDLER BELLCRANKS AND LINKS)
8. LATERAL MIXER CONTROL ROD (CYCLIC)
9. LONGITUDINAL MIXER CONTROL ROD (CYCLIC)
10. COLLECTIVE MIXER CONTROL ROD
11. STATIONARY SWASHPLATE



12. COLLECTIVE CONTROL TORQUE TUBE
13. COPILOT'S COLLECTIVE PITCH STICK
14. DROOP CONTROL OVERRIDE LINK
15. COPILOT'S CYCLIC STICK
16. LATERAL CYCLIC FRICTION KNOB
17. CYCLIC LATERAL CONTROL ROD
18. LATERAL CYCLIC TRIM ACTUATOR
19. LONGITUDINAL CYCLIC TRIM ACTUATOR
20. LONGITUDINAL CYCLIC FRICTION KNOB
21. ONE-WAY LOCK
22. CYCLIC CONTROL TORQUE TUBE
23. GAS PRODUCER CONTROL ROD
24. COLLECTIVE CONTROL BUNGEE
25. ANTI-TORQUE CONTROL ROD (REF)
26. PILOT'S COLLECTIVE PITCH STICK
27. PILOT'S CYCLIC STICK

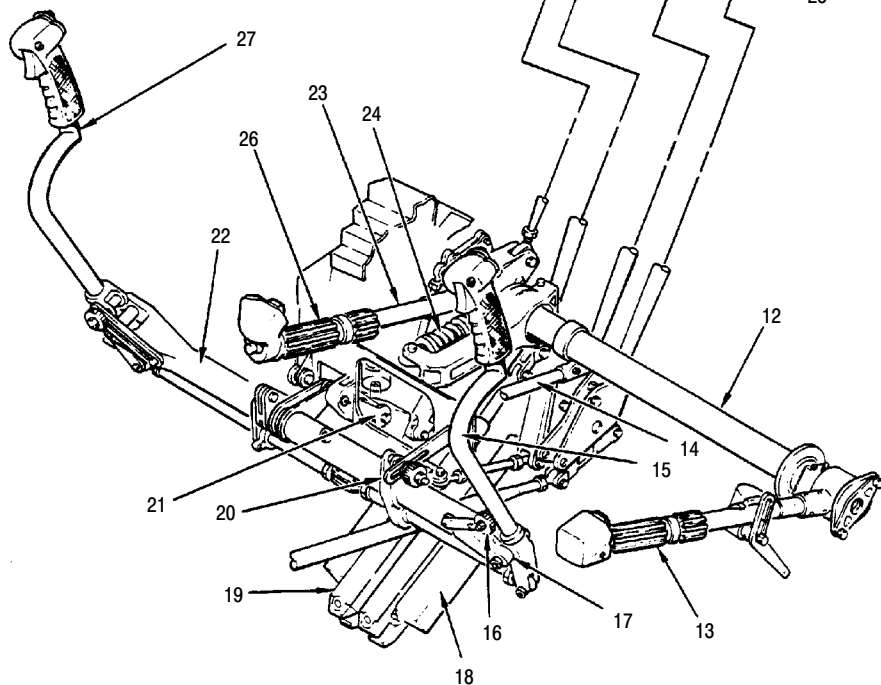
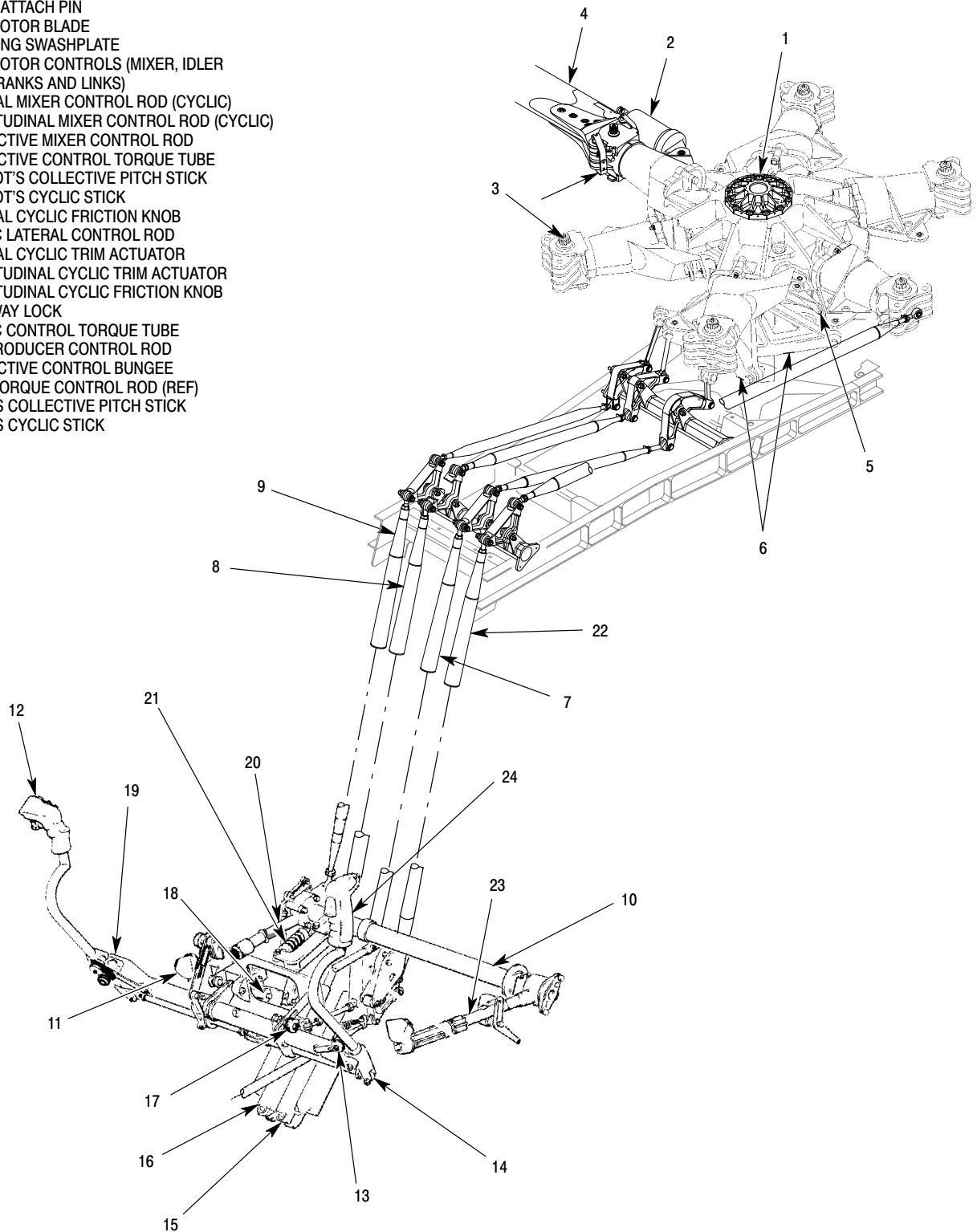


Figure 1. Main Rotor and Control System (369D/E/FF – 500N)

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1. MAIN ROTOR DRIVE SHAFT
2. DAMPER
3. BLADE ATTACH PIN
4. MAIN ROTOR BLADE
5. ROTATING SWASHPLATE
6. MAIN ROTOR CONTROLS (MIXER, IDLER BELLCRANKS AND LINKS)
7. LATERAL MIXER CONTROL ROD (CYCLIC)
8. LONGITUDINAL MIXER CONTROL ROD (CYCLIC)
9. COLLECTIVE MIXER CONTROL ROD
10. COLLECTIVE CONTROL TORQUE TUBE
11. COPILOT'S COLLECTIVE PITCH STICK
12. COPILOT'S CYCLIC STICK
13. LATERAL CYCLIC FRICTION KNOB
14. CYCLIC LATERAL CONTROL ROD
15. LATERAL CYCLIC TRIM ACTUATOR
16. LONGITUDINAL CYCLIC TRIM ACTUATOR
17. LONGITUDINAL CYCLIC FRICTION KNOB
18. ONE-WAY LOCK
19. CYCLIC CONTROL TORQUE TUBE
20. GAS PRODUCER CONTROL ROD
21. COLLECTIVE CONTROL BUNGEE
22. ANTI-TORQUE CONTROL ROD (REF)
23. PILOT'S COLLECTIVE PITCH STICK
24. PILOT'S CYCLIC STICK



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Figure 2. Main Rotor and Control System (600N)

MAIN ROTOR FLIGHT CONTROLS

REMOVAL/INSTALLATION

1. Tunnel-Routed Control Rod Replacement

(Ref. Figure 401)

A. Tunnel-Routed Control Rod Removal

Special Tools (Ref. Section 91-00-00)	
Item	Nomenclature
ST508	Collective bungee installation tool

WARNING

Before disconnecting collective pitch control rod, install collective bungee installation tool to prevent spring reaction due to droop stop load on control rod.

- (1). Install collective bungee installation tool (ST508) and remove collective bungee.
- (2). For access to lower rod ends, remove controls access door at base of canted bulkhead in cargo compartment.
- (3). Hand turn main rotor blades to align blue blade to right side of aircraft.
- (4). Disconnect upper end of control rod.
- (5). Remove double boot from control tunnel cover. All tubes will be removed through the double hole.

CAUTION

Use care during removal of control rods. Any surface damage caused by hasty removal may result in un-serviceable control rods.

- (6). Move blue blade pitch housing down as far as it will go. This will allow the tubes to go past the housing.
- (7). Remove bolts from bottom of 369A7009 and 7011 tubes.
- (8). Move cyclic controls so that the 7012 tube moves to its highest point. Place 7009 tube to the far right and lower out of way. Lower 7011 tube to the left side of center beam. This will allow 7011

tube to angle up through the double hole.

- (9). Remove bolt from bottom of 7012 tube and lower to belly of aircraft and angle up through the double hole.
- (10). Remove bolts from bottom of 7007 tube and lower to the belly of aircraft, then angle up through the double hole.
- (11). Move 7009 tube to the other side of center beam and angle up through the double hole.

B. Tunnel-Routed Control Rod Installation

To reinstall tunnel-routed control rods, reverse the sequence of Tunnel-Routed Control Rod Removal.

2. Roof-Mounted Control Rod Replacement (600N)

(Ref. Figure 402)

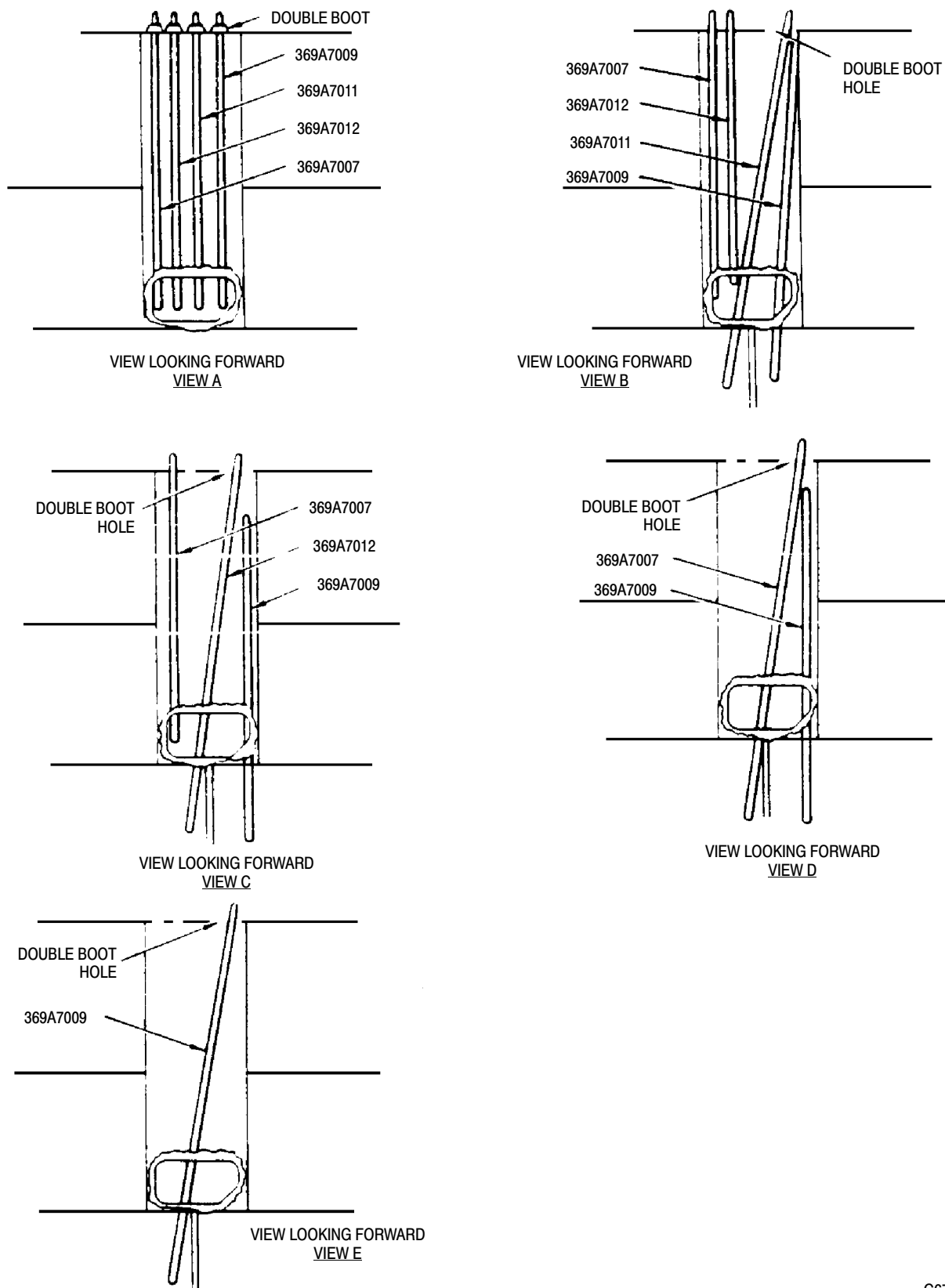
A. Roof-Mounted Control Rod Removal (600N)

Special Tools (Ref. Section 91-00-00)	
Item	Nomenclature
ST508	Collective bungee installation tool

- (1). Install collective bungee installation tool (ST508) and remove collective bungee.
- (2). For access to roof-mounted control rods, remove upper fuselage controls fairing.

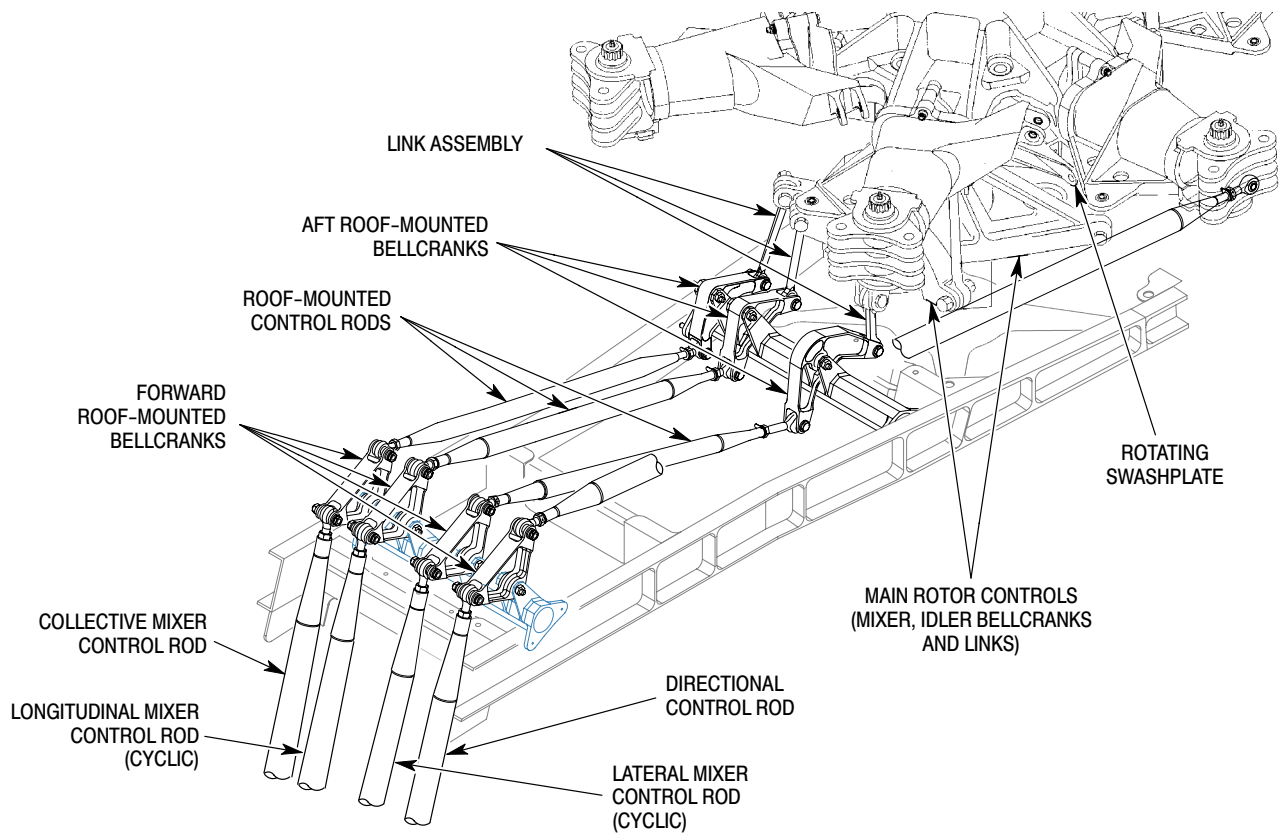
NOTE: If same rods are to be reinstalled, mark rods for proper positioning upon reinstallation. If new rods are installed, main rotor flight controls must be re-rigged.

- (3). Mark control rod for proper reinstallation.
- (4). Remove hardware from control rods and remove rods from aircraft.



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Figure 401. Tunnel-Routed Control Rod Installation



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Figure 402. Roof-Mounted Controls Installation

B. Roof-Mounted Control Rod Installation (600N)

- (1). Install control rods in bellcranks ensuring RH threaded rod end is forward.
- (2). Install hardware connecting control rods. Torque nuts to **30 - 40 inch-pounds (3.39 - 4.52 Nm)** and install cotter pin.
- (3). Remove collective bungee installation tool.
- (4). Reinstall upper fuselage controls fairing.
- (5). Perform flight controls rigging check.

3. Roof-Mounted Bellcrank Replacement (600N)

(Ref. Figure 402) Replacement of the roof-mounted bellcranks is the same procedure for the forward and aft bellcranks.

A. Roof-Mounted Bellcrank Removal (600N)

Special Tools (Ref. Section 91-00-00)	
Item	Nomenclature
ST508	Collective bungee installation tool

- (1). Install collective bungee installation tool (ST508) and remove collective bungee.
- (2). For access to roof-mounted control rods and bellcranks, remove upper fuselage controls fairing.

- (3). Remove hardware connecting rod from bellcrank.
- (4). Remove hardware from bellcrank pivot point and remove bellcrank.

B. Roof-Mounted Bellcrank Installation (600N)

NOTE: Ensure bellcranks are installed in proper position. If bellcranks are install in the wrong position, rigging will be impossible (Ref. Illustrated Parts Catalog).

- (1). Install bellcrank in mount with word FORWARD facing up and arrow pointing towards front of aircraft.
- (2). Install hardware connecting bellcrank to mount. Torque nuts to **30 - 40 inch-pounds (3.39 - 4.52 Nm)** and install cotter pin.
- (3). Reinstall disconnected control rods.
- (4). Remove collective bungee installation tool.
- (5). Reinstall upper fuselage controls fairing.

4. Link Assembly Replacement (600N)

(Ref. Figure 402)

A. Link Assembly Removal (600N)

Special Tools (Ref. Section 91-00-00)	
Item	Nomenclature
ST508	Collective bungee installation tool

- (1). Install collective bungee installation tool (ST508) and remove collective bungee.
- (2). Remove upper fuselage controls fairing.

NOTE: Upper link bolt has a bushing in the mixer bellcrank.

- (3). Remove hardware from link and remove link from aircraft.

B. Link Assembly Installation (600N)

- (1). Install link between lower bellcrank and mixer bellcrank with hardware previously removed.

- (2). Ensure bushing protrudes a minimum of 0.010 inch (0.254 mm) to a maximum of 0.060 inch (1.524 mm) beyond the surface of mixer.

- (3). Torque nuts to **30 - 40 inch-pounds (3.39 - 4.52 Nm)** and install cotter pin.

- (4). Remove collective bungee installation tool.

- (5). Reinstall upper fuselage controls fairing.

5. Controls Support Bracket and Bellcrank Replacement

(Ref. Figure 403)

A. Controls Support Bracket and Bellcrank Removal

Special Tools (Ref. Section 91-00-00)	
Item	Nomenclature
ST508	Collective bungee installation tool

- (1). Remove foot fairings and controls access door (Sta. 78.50) and pilot's seat cover.

WARNING

Before disconnecting collective pitch control rod, install collective bungee installation tool to prevent spring reaction due to droop stop load on control rod.

- (2). Install collective bungee installation tool (ST508) and remove collective bungee.
- (3). Disconnect tunnel-routed control rods.
- (4). Disconnect upper end of each cyclic trim actuator.
- (5). Disconnect floor-routed tail rotor control rod from tail rotor bellcrank.
- (6). Disconnect Sta. 70 lateral control rod from lateral idler bellcrank.
- (7). Disconnect one-way lock from longitudinal idler bellcrank.

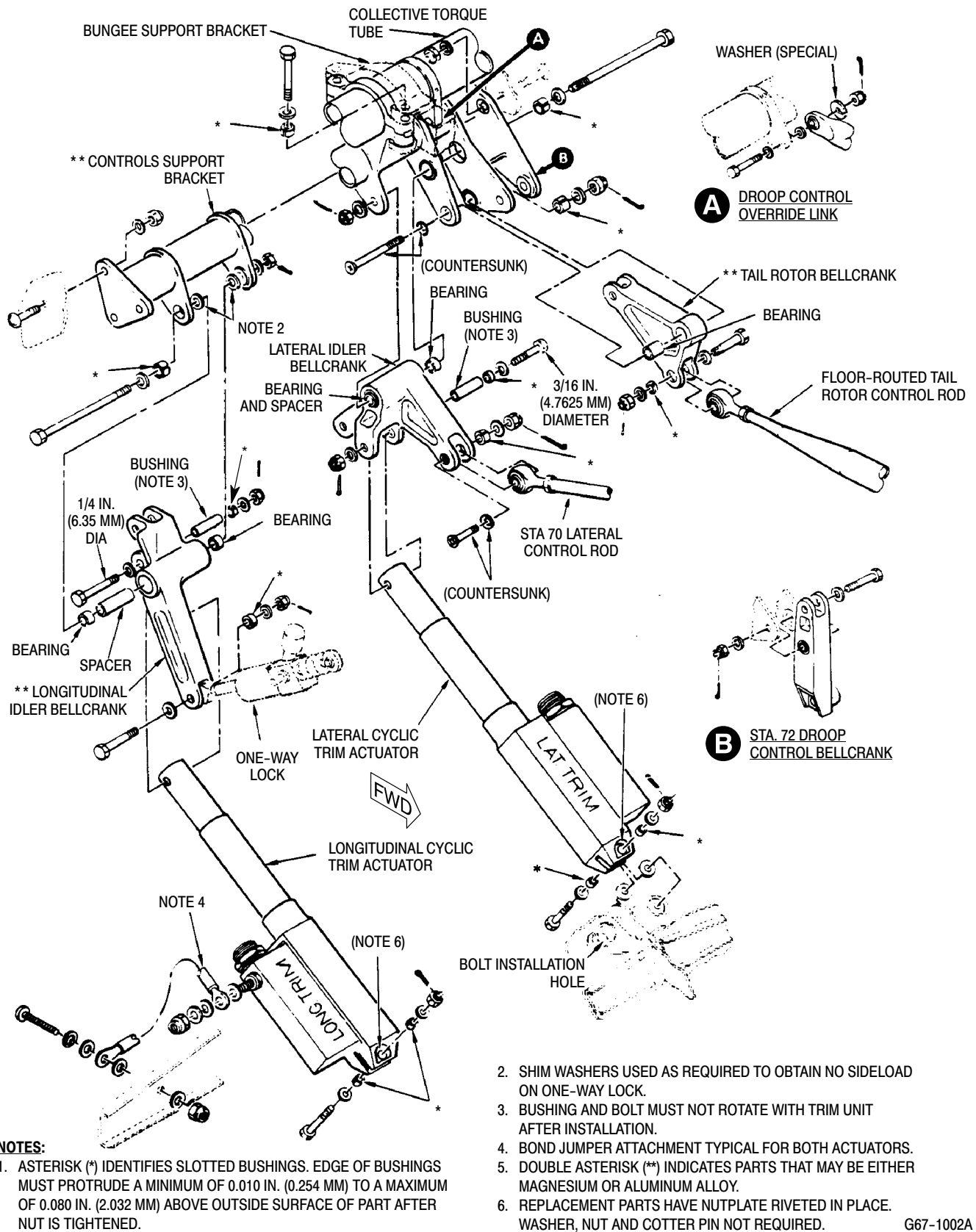


Figure 403. Controls Support Bracket, Idler Bellcranks and Cyclic Trim Actuators Installation

- (8). Remove pilot's collective pitch stick.
- (9). Provide support for collective torque tube. Remove bolts, washers and nuts securing bungee support bracket and collective torque tube to controls support bracket.
- (10). Disconnect aft end of droop control override link from collective torque tube bracket.
- (11). Remove Sta. 72 droop control bellcrank from support bracket.
- (12). Disconnect and remove support bracket from seat structure. Avoid striking any bellcranks and pushrods.

B. Controls Support Bracket and Bellcrank Installation

- (1). Carefully position assembled support bracket and bellcranks between seat structure bulkheads and secure with attaching hardware.
- (2). Position Sta. 72 droop control bellcrank in support bracket and install.

NOTE: Cap is matched to cradle of each control support bracket. Check that numbers on each part are identical before accomplishing step (3). below.

- (3). Check that two slotted bushings are in place in bungee support bracket. Position collective torque tube and bungee bracket on support bracket cradle and install cradle bolts, washers and nuts. Ensure index groove, in edge of cap that clamps torque tube to support bracket cradle, mates with matching index at bracket cradle parting surface.
- (4). Install pilot's collective pitch stick.
- (5). Connect aft end of droop control override link to collective torque tube droop control bracket.
- (6). Connect one-way lock to longitudinal idler bellcrank.

NOTE: For following steps, ensure that slotted bushing is in bellcrank ear.

- (7). Connect Sta. 70 lateral control rod to lateral idler bellcrank.

- (8). Connect floor-routed tail rotor control rod to tail rotor bellcrank.
- (9). Connect upper end of each cyclic trim actuator.

NOTE: Lateral actuator uses 3/16 inch (4.7625 mm) diameter bolt. The longitudinal actuator requires 1/4 inch (6.035 mm) diameter bolt.

- (10). Connect lower ends of tunnel-routed control rods.
- (11). Install collective bungee and remove collective bungee installation tool.

6. Pilot's Collective Pitch Stick Replacement (L/H Command)

(Ref. Figure 404)

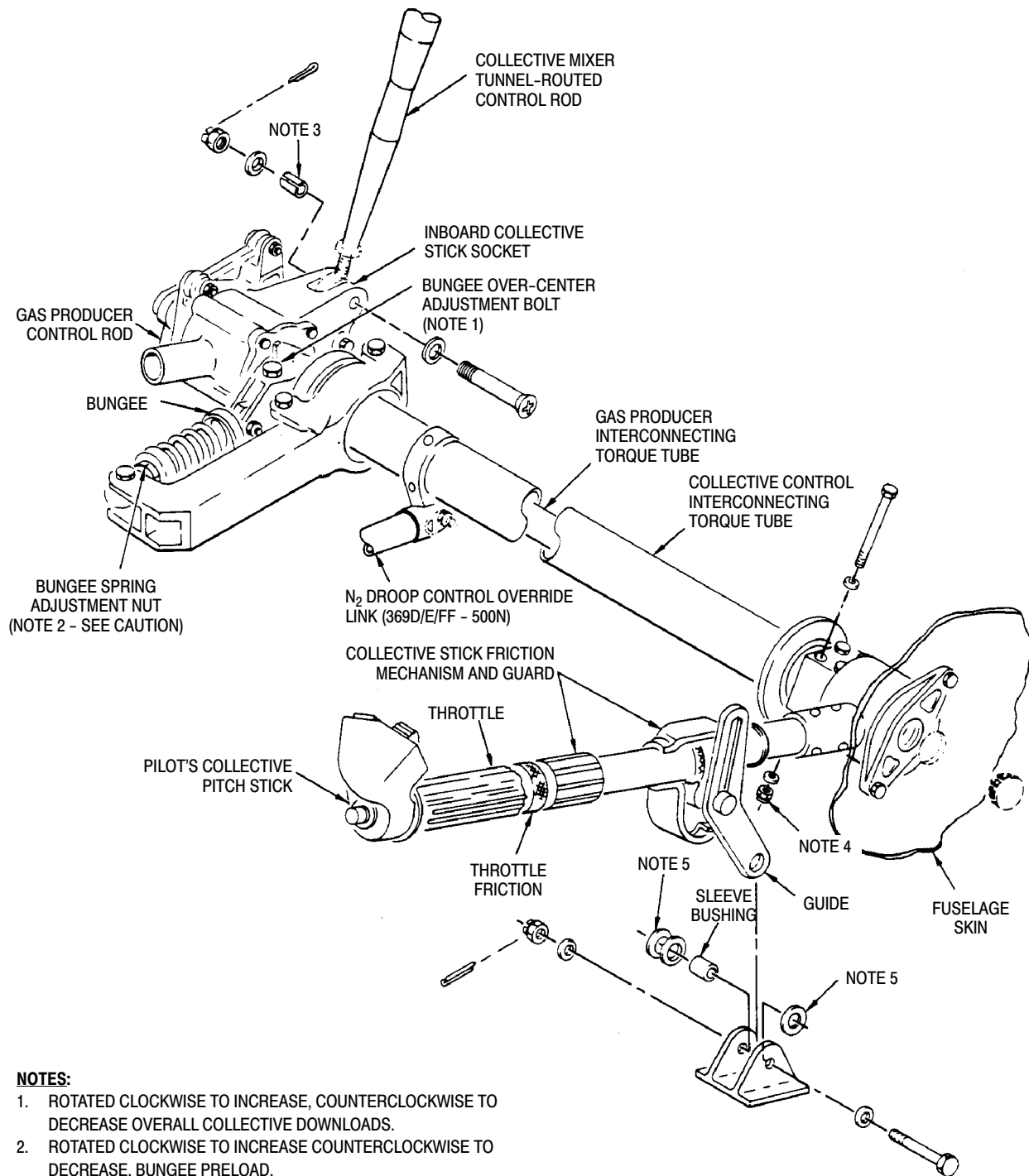
A. Pilot's Collective Pitch Stick Removal (L/H Command)

Special Tools (Ref. Section 91-00-00)	
Item	Nomenclature
ST508	Collective bungee installation tool

- (1). Remove outboard collective stick cover.
- (2). Disconnect pilot's collective stick electrical plug.
- (3). Remove attaching hardware that secures guide to seat structure bracket.

WARNING Before disconnecting collective stick, install collective bungee installation tool to prevent spring reaction due to droop stop load on controls.

- (4). Install collective bungee installation tool (ST508).
- (5). Remove collective bungee and inboard collective socket. Disconnect droop control override link (369D/E/FF - 500N only), slide bungee bracket to side, remove cradle cap and slide collective torque tube inboard.
- (6). Remove attaching hardware that connects stick housing to torque tube.



NOTES:

1. ROTATED CLOCKWISE TO INCREASE, COUNTERCLOCKWISE TO DECREASE OVERALL COLLECTIVE DOWNLOADS.
2. ROTATED CLOCKWISE TO INCREASE COUNTERCLOCKWISE TO DECREASE, BUNGEE PRELOAD.

CAUTION: DO NOT ADJUST BUNGEE SPRING TENSION WHILE BUNGEE INSTALLATION TOOL IS INSTALLED. USE OVER-CENTER ACTION OF STICK TO COMPRESS SPRING TO REMOVE TOOL.

3. BUSHINGS MUST PROTRUDE A MINIMUM OF 0.010 IN. (0.254 MM) TO A MAXIMUM OF 0.060 IN. (1.524 MM) AFTER BOLT IS TIGHTENED.
4. FOUR NUTS TORQUED EQUALLY AND BY SMALL INCREMENTS.
5. WASHERS ARRANGED TO ALIGN GUIDE WITH STICK; LOOSELY SPACED WITH THREE WASHERS.

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Figure 404. Dual Collective Controls (L/H Command)

- (7). Remove stick by sliding it outboard off torque tube.

B. Pilot's Collective Pitch Stick Installation (L/H Command)

Consumable Materials (Ref. Section 91-00-00)	
Item	Nomenclature
CM116	Grease, aircraft and instrument

- (1). Lubricate stick housing socket with grease (CM116).
- (2). Install stick by sliding housing on collective control interconnecting torque tube. Install bolts, washers and nuts. Tighten nuts equally and by small increments until correct torque is applied.
- (3). Connect electrical plug.
- (4). Install outboard collective stick cover. Raise and lower stick; verify that wiring does not foul.
- (5). Remove snap plug from exterior skin, rotate throttle and visually check for zero backlash between gas producer interconnect torque tube and hexagonal interior surfaces of drive gearshaft in stick housing. Eliminate any backlash by tightening pipe plug in end of torque tube; zero backlash is required at both ends of tube.
- (6). Check that inboard stick socket gears are at mid-travel when pilot's stick throttle grip is set to mid-travel. If not, adjust collective stick gas producer control linkage.

7. Pilot's Collective Pitch Stick Replacement (R/H Command)

(Ref. Figure 405)

A. Pilot's Collective Pitch Stick Removal (R/H Command)

Special Tools (Ref. Section 91-00-00)	
Item	Nomenclature
ST508	Collective bungee installation tool

- (1). Remove stick cover from seat structure.
- (2). Disconnect pilot's collective stick electrical plug.
- (3). Remove attaching hardware that secures guide to seat structure bracket.

WARNING

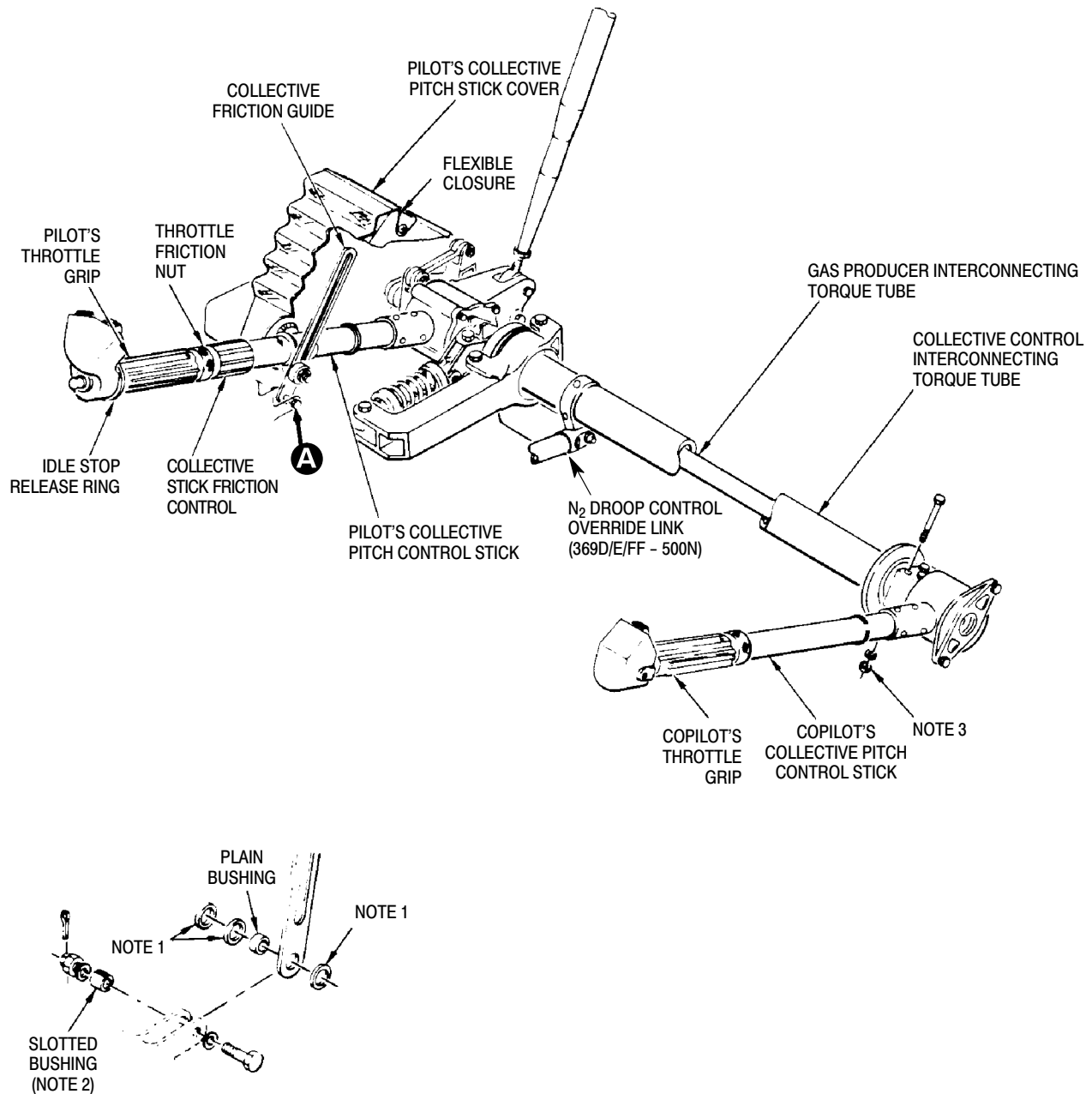
Before disconnecting collective stick, install collective bungee installation tool to prevent spring reaction due to droop stop load on controls.

- (4). Install collective bungee installation tool (ST508).
- (5). Remove collective bungee and inboard collective socket. Disconnect droop control override link (369D/E/FF - 500N only), slide bungee bracket to side, remove cradle cap and slide collective torque tube inboard.
- (6). Disconnect gas producer control rod.
- (7). Remove attaching hardware that connects stick housing to torque tube.

B. Pilot's Collective Pitch Stick Installation (R/H Command)

Consumable Materials (Ref. Section 91-00-00)	
Item	Nomenclature
CM116	Grease, aircraft and instrument

- (1). Lubricate surfaces that are in contact during rotation with grease (CM116).
- (2). Ensure that pilot's and copilot's throttle grips are in same relative positions. Slide pilot's stick housing on collective interconnecting torque tube, align matching holes and secure stick to torque tube. Connect gas producer control rod. Align and/or match bell-crank centerline, gearshaft assembly gear cutout and pilot's throttle.



A BUSHING INSTALLATION

NOTES:

1. ARRANGE WASHERS TO LINE UP GUIDE WITH STICK; SPACE LOOSELY WITH THREE WASHERS.
2. SLOTTED BUSHING MUST PROTRUDE A MINIMUM OF 0.010 INCH (0.254 MM) TO A MAXIMUM OF 0.060 INCH (1.524 MM) AFTER BOLT IS TIGHTENED.
3. FOUR NUTS TORQUED; EQUALLY AND BY SMALL INCREMENTS.
4. ALLOWABLE FREE PLAY IN CO-PILOT'S TWIST GRIP IS $\pm 5^\circ$.

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Figure 405. Dual Collective Controls (R/H Command)

- (3). Position friction guide in seat structure bracket with plain bushing, slotted bushing, and three washers loosely spaced between bracket ears so guide is in line (parallel) with stick. Install bolt, two washers, nut and new cotter pin.
- (4). Connect electrical plug.
- (5). Perform operational check of collective stick friction and adjust friction mechanism as necessary.
- (6). Install collective stick cover on seat structure. Check that wiring is not fouled when stick is raised and lowered.

8. Copilot's Collective Pitch Stick Replacement (L/H Command)

(Ref. Figure 406)

A. Copilot's Collective Pitch Stick Removal (L/H Command)

- (1). Remove collective stick cover from seat structure.
- (2). Disconnect electrical plug.

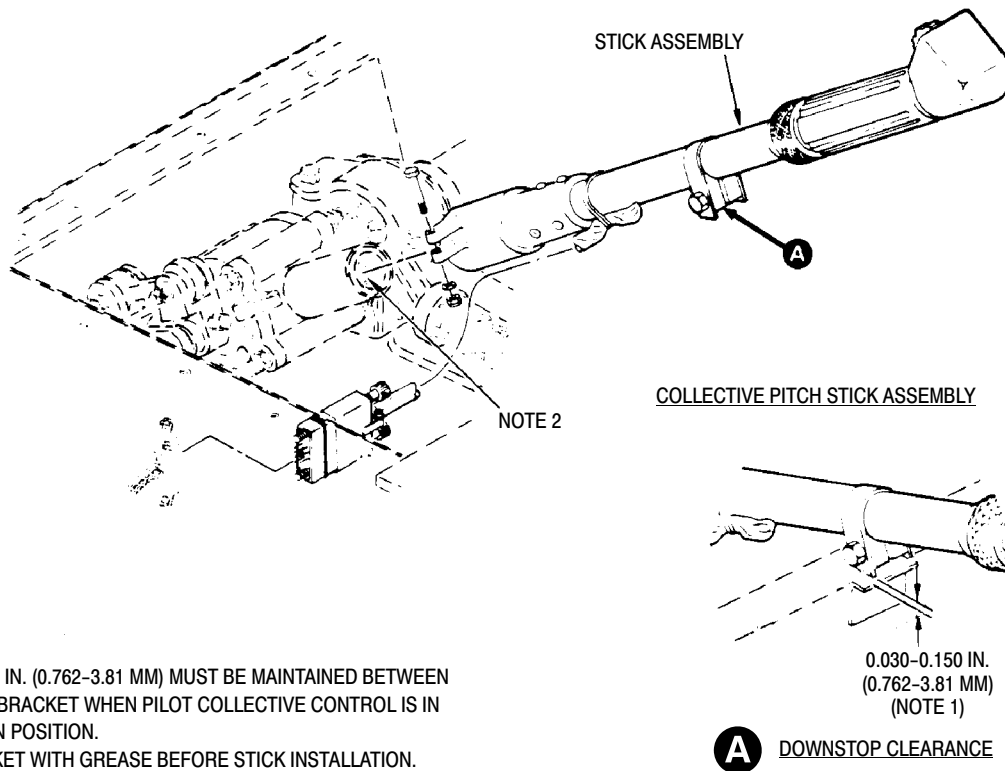
- (3). Remove hardware from stick tube socket adapter and remove pitch stick assembly by sliding it forward and off the inboard stick housing.

B. Copilot's Collective Pitch Stick Installation (L/H Command)

Consumable Materials (Ref. Section 91-00-00)

Item	Nomenclature
CM116	Grease, aircraft and instrument

- (1). Lubricate stick housing socket with grease (CM116).
- (2). Rotate pilot's or copilot's throttle grips so that the grip attach bolts are down.
- (3). Install copilot's stick socket adapter on the inboard housing socket extension and, while moving copilot's throttle back and forth slightly to get engagement of the socket pinion and adapter splines, slide the adapter into place.
- (4). Install attaching hardware to secure socket adapter.



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Figure 406. CoPilot's Collective Stick Assembly Installation (L/H Command)

- (5). Connect electrical plug.
- (6). Position downstop assembly. Check that 0.030–0.150 inch (0.762–3.302 mm) clearance exists between downstop and seat structure with collective pitch stick in full down position.
- (7). Install collective cover on seat structure. Check that wiring is not fouled when stick is raised and lowered.

9. Copilot's Collective Pitch Stick Replacement (R/H Command)

(Ref. Figure 404)

A. Copilot's Collective Pitch Stick Removal (R/H Command)

Remove copilot's collective stick according to instructions in **Pilot's Collective Pitch Stick Removal (L/H Command)** except disregard information on friction guide.

B. Copilot's Collective Pitch Stick Installation (R/H Command)

Consumable Materials (Ref. Section 91–00–00)	
Item	Nomenclature
CM116	Grease, aircraft and instrument

- (1). Lubricate stick housing socket with grease (CM116).
- (2). Slide stick housing on collective control interconnecting torque tube. Align matching holes and install bushings, bolts, washers and nuts. Tighten equally and by small increments until proper torque is applied.
- (3). Install outboard collective stick cover. Secure electrical plug and check that wiring will not foul when stick is raised and lowered.
- (4). Remove snap plug from exterior skin, rotate throttle and visually check for zero backlash between gas producer interconnect tube and hexagonal ID of drive gearshaft in stick housing. Eliminate any backlash by tightening pipe plug in end of torque tube; zero

backlash is required at both ends of tube.

NOTE: The R/H command configuration collective friction mechanism is the same as L/H command except no separate friction guard is provided, since the pilot's collective pitch cover also functions as a guard for the friction mechanism.

10. Collective Control Interconnecting Torque Tube Replacement

(Ref. Figure 407)

A. Collective Control Interconnecting Torque Tube Removal

Special Tools (Ref. Section 91–00–00)	
Item	Nomenclature
ST508	Collective bungee installation tool

WARNING

Before disconnecting collective pitch control rod, install collective bungee installation tool to prevent spring reaction due to droop stop load on control rod.

- (1). Install collective bungee installation tool (ST508) and remove collective bungee.
- (2). Remove inboard collective socket assembly.
- (3). Disconnect aft end of droop control override link (369D/E/FF – 500N only) from torque tube droop control bracket.
- (4). Remove hardware securing bungee support bracket reinforcement strap and torque tube to controls support bracket. Slide bungee bracket aside and remove controls bracket cradle cap and reinforcement strap.
- (5). Slide collective control torque tube sufficiently toward right side of seat structure to remove pilot's collective pitch stick housing from end of tube.
- (6). Remove hardware that connects stick housing to torque tube.
- (7). Remove stick by sliding it outboard and off torque tube.

- (8). Remove torque tube by sliding it approximately three inches toward right side of seat structure to disengage left end from support bearing inside left torque tube support. Provide support at seat structure lightening hole and care, fully withdraw torque tube from structure.
- (9). Remove gas producer interconnect torque tube by carefully sliding it out of collective torque tube.

B. Collective Control Interconnecting Torque Tube Installation

Consumable Materials (Ref. Section 91-00-00)

Item	Nomenclature
CM116	Grease, aircraft and instrument

- (1). Install gas producer interconnect torque tube by sliding it carefully into place in collective control interconnecting torque tube.
- (2). Insert torque tube into lightening hole in seat structure. Use care when inserting tube into place to prevent scraping on edge of hole. Insert tube only to a position that provides sufficient space between tube end and fuselage skin for installation of pilot's stick housing on end of tube.
- (3). Lubricate pilot's stick housing with grease (CM116).
- (4). Slide pilot's stick housing on collective control interconnecting torque tube.

NOTE: Stick housing must be placed on torque tube before installing torque tube attaching hardware.

- (5). Complete insertion of tube and position left end of tube in fixed bearing bore. Rotate torque tube slowly back and forth until right end bearing rests in cradle of controls support bracket.
- (6). Check that two slotted bushings are in place in upper lugs of bungee bracket.

Position torque tube, controls bracket cradle cap, reinforcement strap and bungee bracket on controls support bracket. Check that cap-to-cradle index grooves are matched. Install with hardware removed. Apply thin layer of grease (CM116) to sliding surfaces of bungee overcenter fitting.

- (7). Install droop control override link (369D/E/FF - 500N only) to torque tube droop control bracket.
- (8). Install inboard collective socket assembly.
- (9). Complete installation of pilot's collective stick.
- (10). Install collective bungee.

11. Collective Bungee Replacement

(Ref. Figure 407)

A. Collective Bungee and Over-Center Fitting – Removal

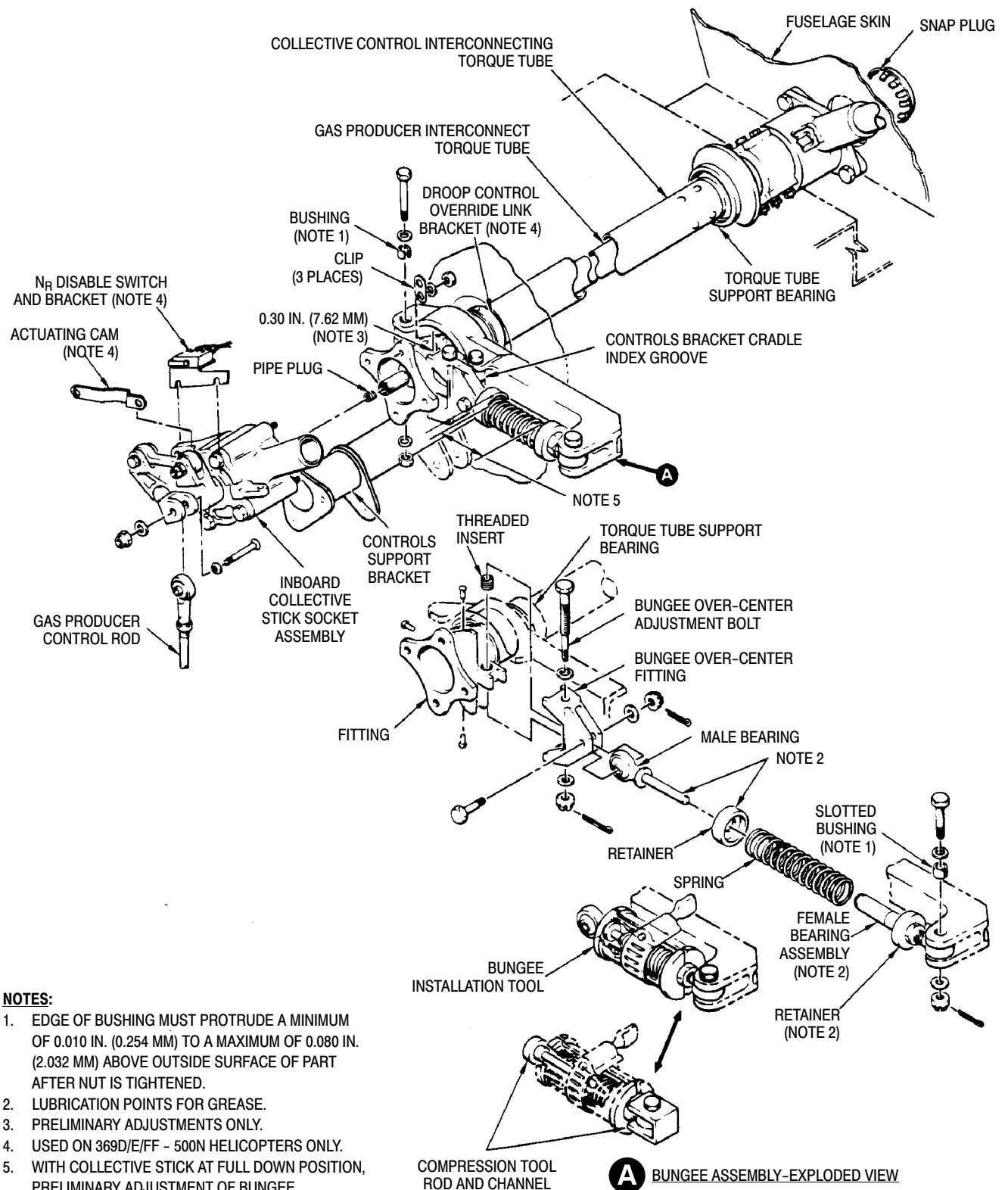
Special Tools (Ref. Section 91-00-00)

Item	Nomenclature
ST508	Collective bungee installation tool

WARNING

Before disconnecting collective pitch control rod, install collective bungee installation tool to prevent spring reaction due to droop stop load on control rod.

- (1). Remove pilot's seat cover from seat structure.
- (2). Raise collective stick and use torque tube over-center action to compress bungee spring until bungee installation tool (ST508) fits over spring retainers. Secure tool halves in place with clamp.
- (3). With stick in over-center position, remove cotter pin, nut, washer and bolt that secure male bearing to bungee over-center fitting.

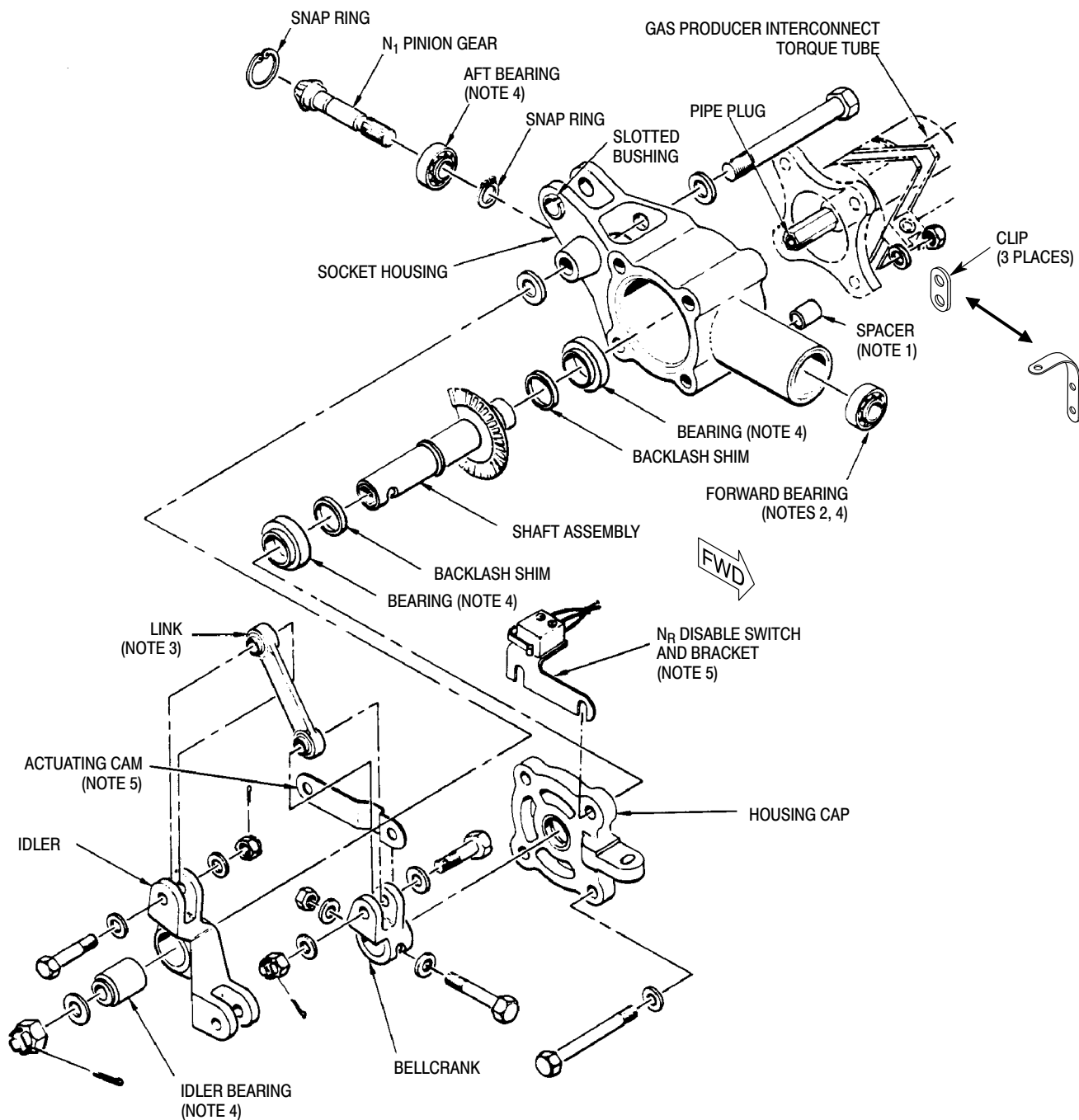


NOTES:

1. EDGE OF BUSHING MUST PROTRUDE A MINIMUM OF 0.010 IN. (0.254 MM) TO A MAXIMUM OF 0.080 IN. (2.032 MM) ABOVE OUTSIDE SURFACE OF PART AFTER NUT IS TIGHTENED.
2. LUBRICATION POINTS FOR GREASE.
3. PRELIMINARY ADJUSTMENTS ONLY.
4. USED ON 369D/E/FF - 500N HELICOPTERS ONLY.
5. WITH COLLECTIVE STICK AT FULL DOWN POSITION, PRELIMINARY ADJUSTMENT OF BUNGEE INSTALLATION IS:
369D/E/FF - 500N; 2.20 ± 0.05 IN. (5.588 ± 0.127 CM)
600N; 2.70 ± 0.05 IN. (6.86 ± 0.127 CM).

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Figure 407. Collective Torque Tube, Gas Producer Torque Tube and Collective Bungee

**NOTES:**

1. FOUR SPACERS USED ONLY ON REMOVED SOCKET ASSEMBLY TO KEEP ASSEMBLY INTACT.
2. N₁ PINION FORWARD BEARING IS LIGHT PRESS FIT IN HOUSING BORE.
3. LINK MUST BE BOLTED TO BELLCRANK BEFORE BELLCRANK AND SHAFT ASSEMBLY ARE INSTALLED.
4. BEARINGS INSTALLED WITH LOCKING COMPOUND. THE TWO SHAFT ASSEMBLY BEARINGS BONDED ONLY AFTER SHIMMING FOR BACKLASH.
5. USED ON 369D/E/FF - 500N HELICOPTERS ONLY.

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Figure 408. Inboard Collective Stick Socket Assembly (L/H Command)

- (4). Remove cotter pin, nut, two washers and bolt that attach female bearing end of bungee to the bungee bracket.
- (5). Remove collective bungee and installation tool as a unit.
- (6). Remove cotter pin, nut and washer from over-center fitting.
- (7). Remove bolt that secure over-center fitting to collective torque tube and remove fitting.

B. Collective Over-Center Fitting and Bungee – Installation and Preliminary Adjustment

Consumable Materials (Ref. Section 91-00-00)	
Item	Nomenclature
CM116	Grease, aircraft and instrument

Special Tools (Ref. Section 91-00-00)	
Item	Nomenclature
ST508	Collective bungee installation tool

- (1). Lubricate sliding surfaces of over-center fitting with grease (CM116) and position on collective torque tube.
- (2). Install bolt and washer through fitting and torque tube, and adjust to obtain 0.30 in. (7.62 mm) preliminary adjustment between upper surface of fitting and tips on torque tube fitting.
- (3). Install washer and nut on bolt and torque to **30 - 40 inch-pounds (3.39 - 4.52 Nm)**; install cotter pin.
- (4). Position collective bungee, compressed in installation tool (ST508), so that female bearing assembly is forward and aligns with mating hole in bungee bracket. Check that slotted bushing for bracket lug is in place, install bolt, two washers, nut and cotter pin.
- (5). Position male bearing to align with mating hole in bungee over-center fitting. Install bolt, washers, nut and install cotter pin.



Do not turn female bearing assembly spring retainer while bungee installation tool is spring loaded.

- (6). Raise collective stick so that torque tube over-center action compresses spring until bungee installation tool can be removed; remove tool.
- (7). With collective stick at full down position, preliminary adjustment of bungee installation is:
369D/E/FF - 500N; 2.2 ±0.05 inch (5.588 ±0.127 cm)
600N; 2.70 ±0.05 inch (6.86 ±0.127 cm).
- (8). Flight test helicopter and complete adjustment of collective bungee.

12. Inboard Collective Stick Socket Assembly Replacement

(Ref. Figure 408)

A. Inboard Collective Stick Socket Assembly Removal

- (1). Remove pilot's seat cover and controls access door.
- (2). Disconnect collective mixer tunnel-routed control rod.
- (3). Disconnect gas producer control rod from idler.
- (4). Remove N_R disable switch (369D/E/FF - 500N only) (Ref. Chap. 95).
- (5). Remove four nuts and washers that attach socket assembly to collective torque tube and remove assembly.

NOTE: If disassembly is not intended, install four spacers and reinstall washers and nuts on protruding bolts to keep assembly intact.

B. Inboard Collective Stick Socket Assembly Installation

Consumable Materials (Ref. Section 91-00-00)	
Item	Nomenclature
CM318	Primer

- (1). Remove four nuts washers and spacers from socket assembly mounting bolts.

- (2). With throttle grip on pilot's collective stick at midtravel, rotate bellcrank back and forth slightly to engage socket assembly to gearshaft on hexagonal end of gas producer interconnect torque tube. Bellcrank centerline, N_1 pinion gear centerline toothspace and pilot's throttle must be as shown.

NOTE:

- With pilot's throttle grip at midtravel, two grip attach bolts should be approximately straight down. Simultaneously, idler-to-gas producer control rod bolt holes should be in line with centerline of inboard stick assembly housing cap.
 - At midtravel, inboard N_1 pinion gear spline wide toothspace should be at approximately one o'clock as viewed looking aft into open end of socket.
- (3). Install N_R disable switch (369D/E/FF - 500N only) (Ref. Sec. 95) and secure socket assembly housing to collective torque tube.
 - (4). Rotate pilot's throttle and check for zero backlash between gas producer interconnect torque tube and hexagonal interior of drive gearshaft in socket assembly housing.
 - (5). Eliminate backlash by removing housing cap and gearshaft, and then removing pipe plug in end of torque tube.
 - (6). Coat pipe plug with wet zinc chromate primer (CM318), reinstall and tighten it so there is no backlash between torque tube and control gearshaft at each end of the tube.
 - (7). If the normally installed plug does not sufficiently expand tube, a 1/8-27 internal-wrenching pipe plug 0.38 inch (9.65 mm) long may be substituted. Whichever plug is used, it must not protrude more than 0.030 inch (0.762 mm) when tightened.
 - (8). Zero degree backlash is required at both ends of tube.
 - (9). After plug is tightened, reinstall gearshaft and housing cap.

- (10). Connect gas producer control rod to idler.
- (11). Connect collective mixer tunnel-routed control rod.
- (12). Remove bungee installation tool.
- (13). Reinstall pilot's seat cover and the controls access door.
- (14). Check that inboard collective pitch stick socket gears are at midtravel when pilot's collective pitch stick throttle grip is set to midtravel. If not, adjust collective pitch stick(s) gas producer control linkage.
- (15). Adjust N_R disable switch (369D/E/FF - 500N only) (Ref. Chap. 95).

13. Cyclic Control Stick Replacement (Inboard)

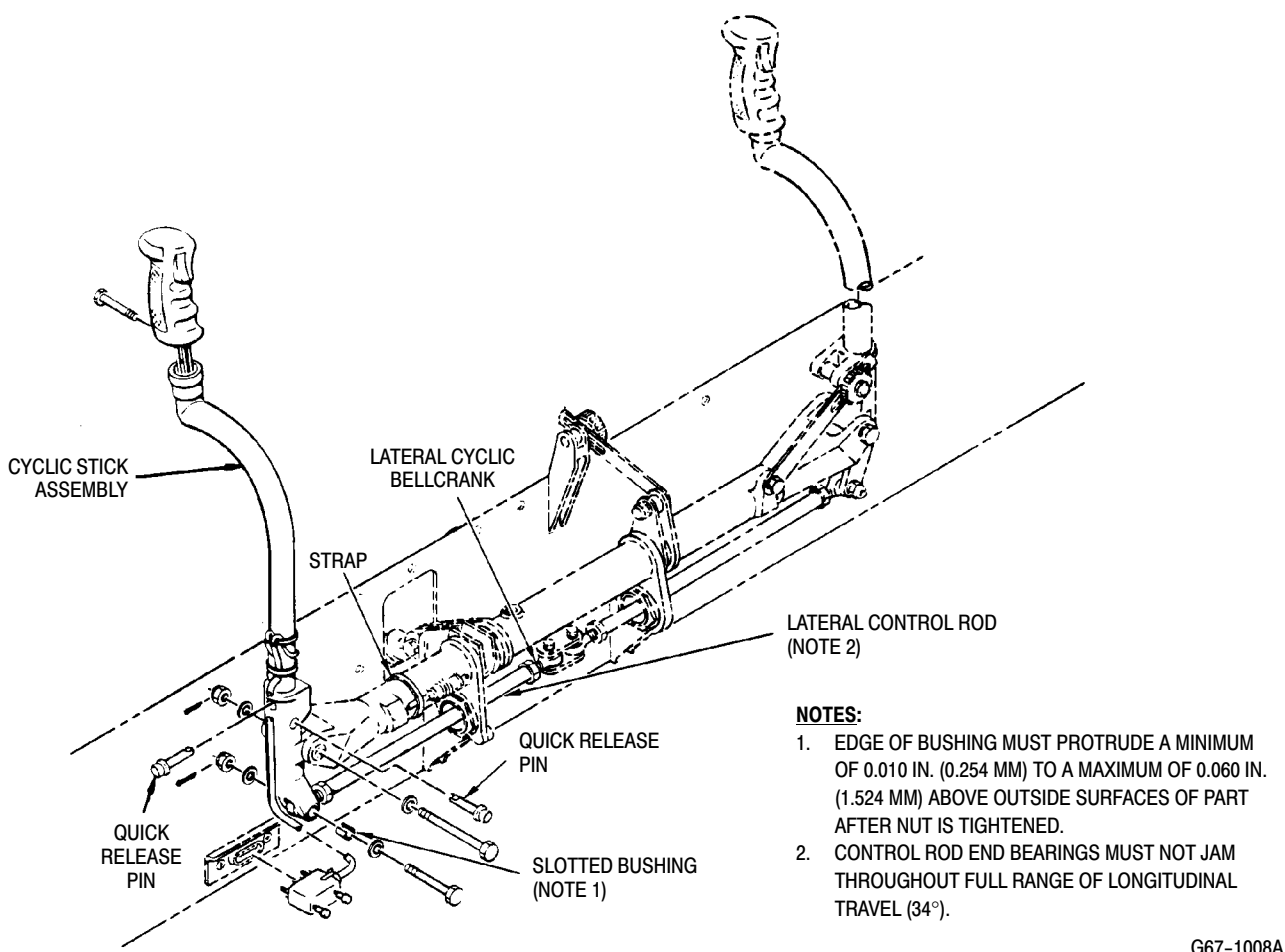
(Ref. Figure 409)

A. Cyclic Control Stick Removal (Inboard)

- (1). Disconnect control stick electrical plug.
- (2). Remove hardware that secures pilot's lateral control rod to stick socket.
- (3). Remove hardware that attaches lateral friction mechanism link to cyclic torque tube.
- (4). Remove hardware that attaches stick socket to end of cyclic torque tube; remove stick with lateral friction mechanism attached.

B. Cyclic Control Stick Installation (Inboard)

- (1). Position pilot's cyclic control stick to align with mating holes in torque tube.
- (2). Install attaching hardware.
- (3). Check that slotted bushing is in place; then align pilot's lateral control rod with stick socket. Install attaching hardware.
- (4). Position guide link to align with mating hole in torque tube. Install bolt, sleeve bushing three washers, nut and cotter pin.
- (5). Connect electrical plug.



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Figure 409. Cyclic Stick Assembly Installation (Inboard)

14. Cyclic Control Stick Replacement (Outboard)

(Ref. Figure 410)

A. Cyclic Control Stick Removal (Outboard)

- (1). Disconnect control stick electrical plug.

NOTE: Omit steps (2). and (3). below to remove stick without removing stick socket.

- (2). Remove cotter pin, nut, washers and bolt securing copilot's lateral control rod to stick socket.
- (3). Remove cotter pin, nut, washers and bolt attaching stick socket to end of cyclic torque tube. Remove stick tube with stick socket attached.
- (4). Remove two quick-release pins attaching stick tube to stick socket.

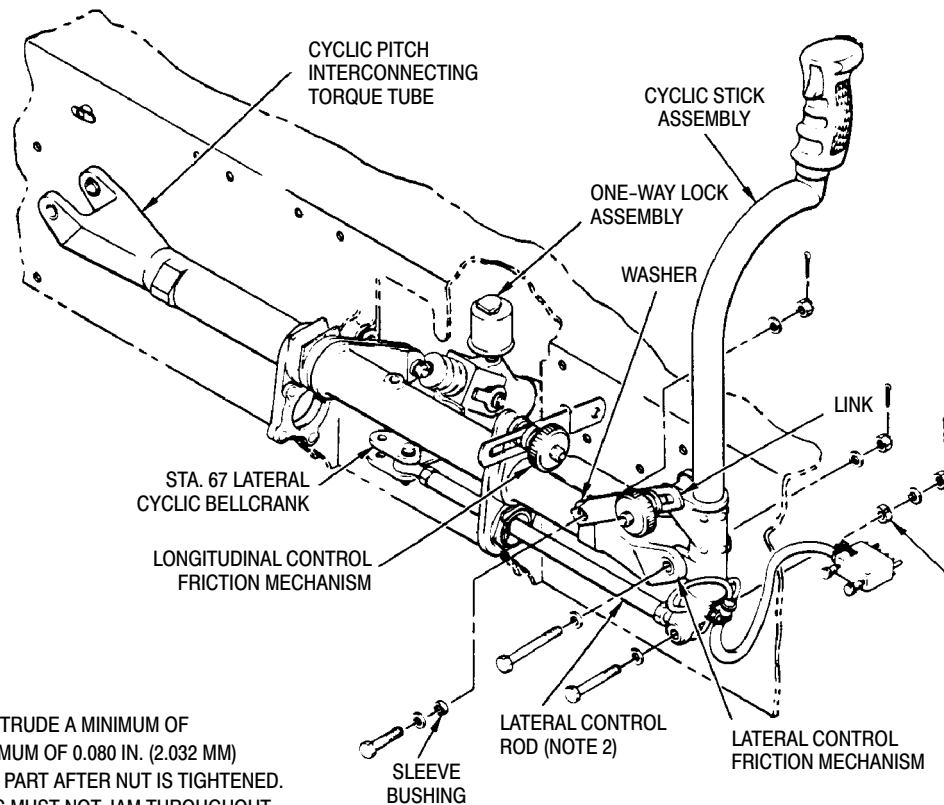
- (5). Remove stick tube from socket.

B. Cyclic Control Stick Installation (Outboard)

- (1). Insert stick tube into stick socket and install two quick-release pins.

NOTE: Omit steps (2). thru (4). when installing stick without socket.

- (2). Position cyclic stick to align holes in socket with mating holes in torque tube.
- (3). Install bolt, two washers, nut and new cotter pin.
- (4). Check that slotted bushing is in place; then align copilot's lateral control rod with stick socket. Install bolt, two washers, nut and new cotter pin.
- (5). Connect electrical plug.

**NOTES:**

1. EDGE OF BUSHING MUST PROTRUDE A MINIMUM OF 0.010 IN. (0.254 MM) TO A MAXIMUM OF 0.080 IN. (2.032 MM) ABOVE OUTSIDE SURFACE OF PART AFTER NUT IS TIGHTENED.
2. CONTROL ROD END BEARINGS MUST NOT JAM THROUGHOUT FULL RANGE OF LONGITUDINAL TRAVEL (34°).

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Figure 410. Cyclic Stick Assembly Installation (Outboard)**15. Lateral Control Rods and Sta. 67 Lateral Cyclic Bellcrank Replacement (L/H Command)**

between rod end bearing centers for use at replacement.

(Ref. Figure 411)

A. Lateral Control Rods and Sta. 67 Lateral Cyclic Bellcrank Removal (L/H Command)

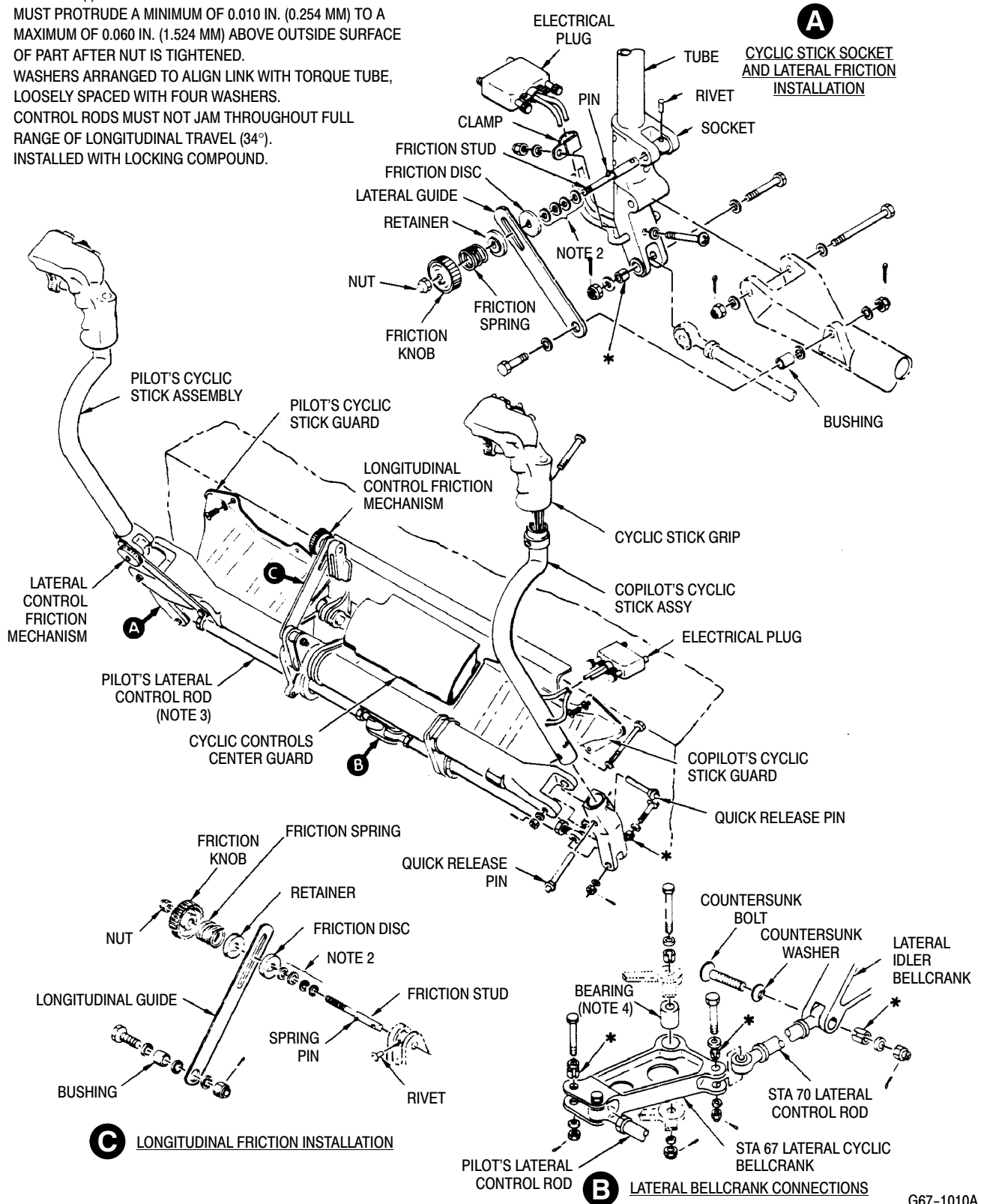
- (1). Remove large (central) cyclic stick guard.
- (2). Remove pilot's seat cover, and controls access door from Sta. 78.50 canted bulkhead.
- (3). Remove pilot's lateral control rod, or Sta. 70 lateral control rod, as applicable.
- (4). Remove Sta. 67 lateral cyclic bellcrank from seat structure fitting.
- (5). If rod or rod ends require replacement, accurately measure and record distance

B. Lateral Control Rods and Sta. 67 Lateral Cyclic Bellcrank Installation (L/H Command)

- (1). Check that slotted bushing is in upper web of seat structure fitting. Align Sta. 67 lateral cyclic bellcrank and install attaching hardware.
- (2). Check that slotted bushings are in place and install Sta. 70 lateral control rod and pilot's lateral control rod.
- (3). Move cyclic stick full forward, then full aft and set pilot's lateral control rod end bearing angularity so that bearings do not jam at full travel positions.
- (4). If control rod or rod ends are replaced, perform a cyclic control rigging check.

NOTES:

1. ASTERISK (*) IDENTIFIES SLOTTED BUSHING. EDGE OF BUSHING MUST PROTRUDE A MINIMUM OF 0.010 IN. (0.254 MM) TO A MAXIMUM OF 0.060 IN. (1.524 MM) ABOVE OUTSIDE SURFACE OF PART AFTER NUT IS TIGHTENED.
2. WASHERS ARRANGED TO ALIGN LINK WITH TORQUE TUBE, LOOSELY SPACED WITH FOUR WASHERS.
3. CONTROL RODS MUST NOT JAM THROUGHOUT FULL RANGE OF LONGITUDINAL TRAVEL (34°).
4. INSTALLED WITH LOCKING COMPOUND.



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Figure 411. Cyclic Controls (R/H Command)

16. Lateral Control Rods and Sta. 67 Lateral Cyclic Bellcrank Replacement (R/H Command)

(Ref. Figure 411)

A. Lateral Control Rods and Sta. 67 Lateral Cyclic Bellcrank Removal (R/H Command)

- (1). Remove cyclic stick guards.
- (2). Install large (central) cyclic stick guard pilot's seat cover and controls access door.
- (3). Remove pilot's collective pitch stick cover, and controls access door and left foot support fairing from Sta. 78.50 canted bulkhead.
- (4). Remove cotter pin, two washers and bolt from each end of pilot's lateral control rod, copilot's lateral control rod, or Sta. 70 lateral control rod, as applicable; remove rod assembly.
- (5). Remove cotter pin, nut, two washers and bolt securing Sta. 67 lateral cyclic bellcrank to seat structure fitting; remove bellcrank.
- (6). If rod or rod ends require replacement, accurately measure and record distance between rod end bearing centers for future reference; use trammel method, or equivalent.

B. Lateral Control Rods and Sta. 67 Lateral Cyclic Bellcrank Installation (R/H Command)

- (1). Check that slotted bushing is in upper web of seat structure fitting. Align Sta. 67 lateral cyclic bellcrank and install bolt, two washers, nut and new cotter pin.
- (2). Check that slotted bushings are in place and install Sta. 70 lateral control rod. Install both lateral control rods at

each end with a bolt, two washers, nut and new cotter pin.

- (3). Move both cyclic sticks full forward, then full aft and set both lateral control rods so that rod end bearings do not jam at full throw positions; hold rod ends and tighten jam nuts.
- (4). If control rod or rod ends were replaced, perform cyclic control rigging check.
- (5). Install cyclic stick guards, pilot's collective pitch stick cover, controls access door, and foot fairing.

17. Cyclic Pitch Interconnecting Torque Tube Replacement (L/H Command)

(Ref. Figure 412)

A. Cyclic Pitch Interconnecting Torque Tube Removal (L/H Command)

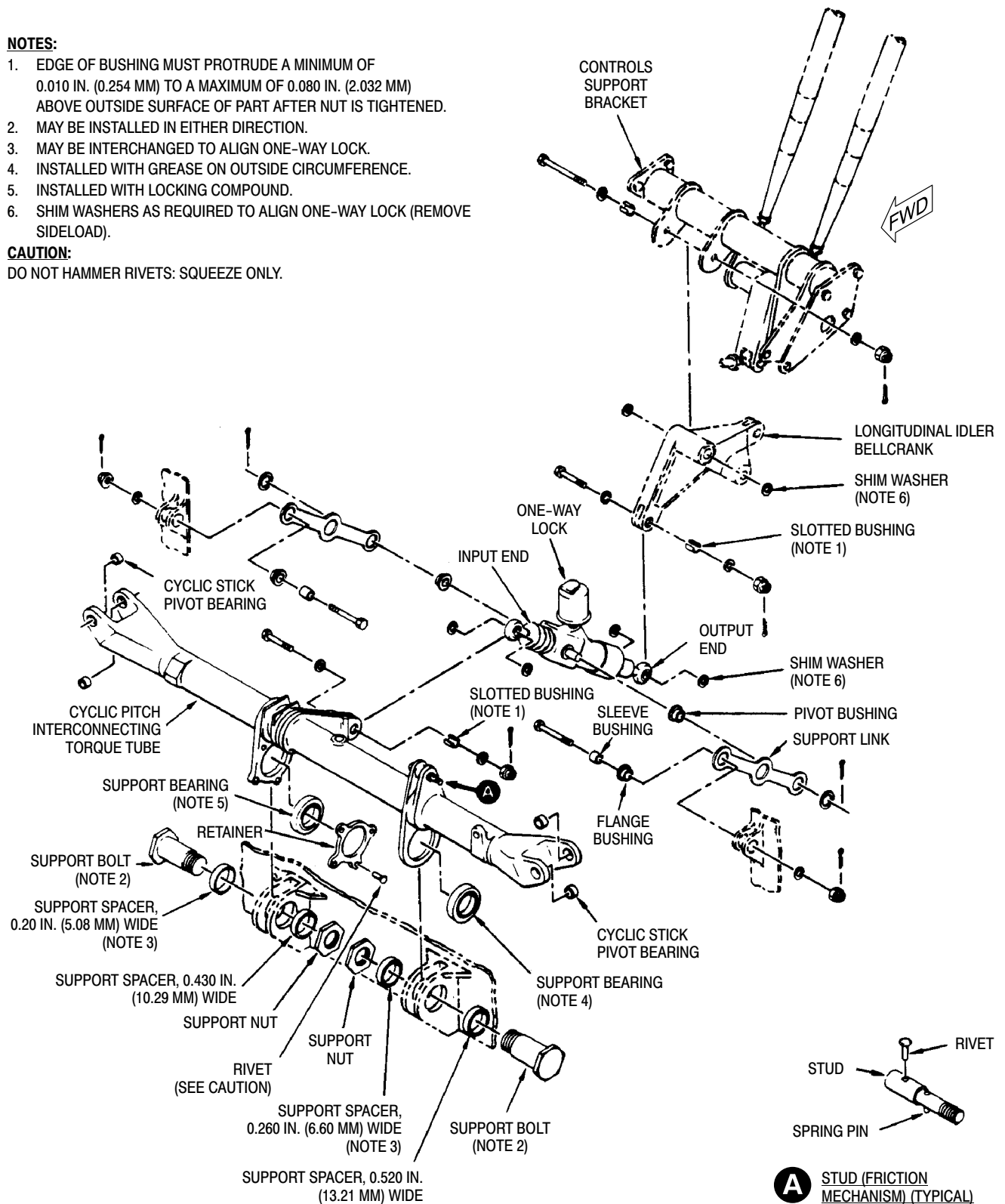
- (1). Remove pilot's seat cover.
- (2). Position pilot's cyclic stick to align holes in one-way lock support links with bolt that attaches forward end of one-way lock to torque tube; tighten longitudinal friction. Disconnect rod end from torque tube arm.
- (3). Remove pilot's cyclic stick.
- (4). Remove all of cyclic stick guard installation except small guard next to pilot's cyclic stick.
- (5). Remove longitudinal control friction mechanism.
- (6). Remove pilot's lateral control rod from Sta. 67 lateral cyclic bellcrank.
- (7). Cut lockwire and remove support nuts, support bolts and two wide (L/H) support spacers from seat structure fitting lugs and torque tube. Prevent torque tube from dropping as bolts are removed.
- (8). Remove torque tube and two narrow (R/H) support spacers.

NOTES:

1. EDGE OF BUSHING MUST PROTRUDE A MINIMUM OF 0.010 IN. (0.254 MM) TO A MAXIMUM OF 0.080 IN. (2.032 MM) ABOVE OUTSIDE SURFACE OF PART AFTER NUT IS TIGHTENED.
2. MAY BE INSTALLED IN EITHER DIRECTION.
3. MAY BE INTERCHANGED TO ALIGN ONE-WAY LOCK.
4. INSTALLED WITH GREASE ON OUTSIDE CIRCUMFERENCE.
5. INSTALLED WITH LOCKING COMPOUND.
6. SHIM WASHERS AS REQUIRED TO ALIGN ONE-WAY LOCK (REMOVE SIDELOAD).

CAUTION:

DO NOT HAMMER RIVETS: SQUEEZE ONLY.



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Figure 412. Cyclic Torque Tube and One-Way Lock Installation

B. Cyclic Pitch Interconnecting Torque Tube Installation (L/H Command)

Consumable Materials
(Ref. Section 91-00-00)

Item	Nomenclature
CM702	Lockwire CRES

- (1). Align cyclic torque tube support bearings with holes in structure fitting lugs. Place narrow support spacer on right side of each support bearing, and install two wide support spacers and support bolts.

NOTE: Support bolts may be installed from either direction, and two narrowest (R/H) support spacers are to be interchanged for best alignment of torque tube with one-way lock.

- (2). Check that slotted bushing is in torque tube arm, and fit one-way lock rod end against unbushed lug of arm. If tightening of attachment bolt will apply sideload on the rod end, interchange two narrowest (R/H) support spacers, and/or adjust lateral position shimming of longitudinal idler bellcrank or one-way lock rod ends until there is no sideload on one-way lock control system. Check that no structural interference results from spacer interchange.
- (3). Without sideload on one-way lock, install and tighten support nuts. Using lockwire (CM702), safetywire each nut to hole in threaded end of mating bolt. When installing lockwire do not damage aluminum nut and bolt.
- (4). Install pilot's lateral control rod (riveted rod) end to Sta. 67 lateral cyclic bellcrank.
- (5). Install longitudinal control friction mechanism.
- (6). Install cyclic stick guards.
- (7). Install pilot's cyclic stick.
- (8). Position pilot's cyclic stick to align bolt holes in torque tube arm with holes in

one-way lock support links; install attaching hardware.

- (9). Install pilot's seat cover.

18. Cyclic Pitch Interconnecting Torque Tube Replacement (R/H Command)

(Ref. Figure 411)

A. Cyclic Pitch Interconnecting Torque Tube Removal (R/H Command)

Removal of torque tube is essentially the same as L/H command except note the following:

- (1). Remove pilot's collective pitch stick cover.
- (2). Remove pilot's cyclic stick and copilot's cyclic stick.
- (3). Remove cyclic stick guards.
- (4). Remove longitudinal control friction mechanism.
- (5). Remove both lateral control rods from Sta. 67 lateral cyclic bellcrank.

B. Cyclic Pitch Interconnecting Torque Tube Installation (R/H Command)

Installation of torque tube is essentially the same as L/H command except note the following:

- (1). Install pilot's and copilot's lateral control rods (riveted rod ends) to Sta. 67 lateral cyclic bellcrank.
- (2). Install longitudinal control friction mechanism.
- (3). Install cyclic stick guards.
- (4). Install pilot's cyclic stick and copilot's cyclic stick.
- (5). Install pilot's collective pitch stick cover.

19. One-Way Lock Replacement

(Ref. Figure 412)

A. One-Way Lock Removal

- (1). Remove pilot's seat cover or inboard collective pitch stick cover and controls access door from Sta. 78.50 canted bulkhead.

- (2). Remove cyclic stick guard.
- (3). Position pilot's cyclic stick to align holes in one-way lock support links with bolt that attaches forward end of one-way lock to cyclic torque tube; tighten longitudinal friction. Disconnect rod end from torque tube arm.
- (4). Disconnect one-way lock lower rod end from longitudinal idler bellcrank.
- (5). Disconnect upper end of each support link from seat structure and remove one-way lock with links attached.
- (6). Remove two cotter pins, washers and links. Do not remove pivot bushings from links unless replacement is necessary.

B. One-Way Lock Installation

- (1). Check that rod end bearing center-to-center distance is correct.
- (2). Attach lower ends of links to one-way lock with bushings, washers and cotter pins.
- (3). Align upper ends of links with mating holes in seat structure fitting and attach each link with bolt, sleeve bushing, washer, nut and cotter pin.
- (4). Check that slotted bushing is in place in longitudinal idler bellcrank; then fit lower rod end bearing against unbushed lug of bellcrank to check if sideloading occurs when attachment bolt is tightened. There must be no sideloading of one-way lock mechanism. Arrange shim washers, as necessary, to position longitudinal idler bellcrank and/or lower rod end for alignment without sideload.
- (5). Position pilot's cyclic stick to align holes in support links with hingeline for upper end of one-way lock and cyclic torque tube arm; tighten longitudinal friction.
- (6). Repeat check for sideload on one-way lock, step (4)., and arrange shim washers, if necessary, to position upper rod end for alignment without sideload.

NOTE: Two narrowest (R/H) cyclic torque tube support spacers may also be interchanged to align one-way lock.

- (7). Without sideload on one-way lock, secure each rod end bearing with attaching hardware.
- (8). Check reservoir fluid level (Ref. Sec. 12-00-00).
- (9). Install cyclic stick guard.
- (10). Install pilot's seat cover or inboard collective pitch stick cover and control access door.

20. Cyclic Trim Actuator Replacement

(Ref. Figure 403)

A. Cyclic Trim Actuator Removal

- (1). Jack helicopter (Ref. Sec. 07-00-00) until landing gear is fully extended and clears ground.
- (2). Remove foot fairing, controls access door from Sta. 78.50 canted bulkhead and open pilot's compartment floor access door.
- (3). Disconnect bonding jumper and electrical connector from actuator housing.
- (4). Disconnect upper end of trim actuator. Keep pivot bushing with actuator unless actuator is being replaced.
- (5). Disconnect lower end of trim actuator. Access to attaching nut is through hole in under-floor compartment aft bulkhead, near centerline beam.
- (6). Remove trim actuator. Reinstall original lower end attaching hardware if actuator is being replaced; new actuator includes this hardware.

B. Cyclic Trim Actuator Installation

- (1). Check trim actuator spring assembly for free play between spring and spring adapters. Adjust spring adapter screw until 0.010-0.050 inch (0.254-1.27 mm) is felt while pushing or pulling on spring assembly.
- (2). Remove hardware supplied in housing end of new trim actuator.

- (3). Check that slotted bushings are in place in actuator housing. Place one washer around each side of pivot bearing in center beam support lug and align actuator housing with bearing. Install bolt, two washers and nut (and cotter pin if old style).
- (4). Align actuator with idler bellcrank. Check that slotted bushing is in bellcrank lug; install actuator pivot bushing if actuator is a replacement. Pivot bushing must rotate freely in actuator. Install bolt, two washers, nut and cotter pin. After bolt is tightened, pivot bushing must not rotate in idler bellcrank.

NOTE: Lateral actuator upper hingeline has 3/16 inch (4.7625 mm) bolt hole; longitudinal has 1/4 inch (6.35 mm) bolt hole.

- (5). Connect bonding jumper. Connect electrical plug to actuator.
- (6). With main rotor blades lifted off droop stops, perform power-on operational check of cyclic trim actuator. Actuator must not bind throughout travel range in either direction, and must maintain at least 0.015 inch (0.381 mm) minimum clearance with center beam structure.
- (7). Lower helicopter and remove jacks.