

**CHAPTER 67****FLIGHT CONTROLS**

<u>Section</u>	<u>Title</u>	<u>Page</u>
67-00	Description . . . . .	67.1
67-10	Cyclic Controls . . . . .	67.1
67-11	Cyclic Control Assembly . . . . .	67.1
67-12	Cyclic Grip Assembly . . . . .	67.4
67-13	Cyclic Friction Assembly . . . . .	67.6
67-20	Collective Control . . . . .	67.6
67-21	Collective Stick Assembly . . . . .	67.6
67-22	Collective Friction . . . . .	67.8
67-30	Jackshaft and Strut Assembly . . . . .	67.8
67-31	Jackshaft . . . . .	67.8
67-40	Swashplate . . . . .	67.9
67-41	Swashplate Tilting Friction Adjustment . . . . .	67.11
67-42	Upper and Lower Scissor Assemblies . . . . .	67.11
67-50	Tail Rotor Controls . . . . .	67.13
67-51	Pedals . . . . .	67.13
67-52	Pitch Control . . . . .	67.14
67-60	Bellcranks . . . . .	67.15
67-61	C317-5 or C317-9 Bellcrank . . . . .	67.15
67-62	C317-7 Bellcrank . . . . .	67.16
67-63	F316-1 Bellcrank . . . . .	67.17
67-64	A331-4 Bellcrank . . . . .	67.18
67-65	A120-5 Bellcrank . . . . .	67.18

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## CHAPTER 67

### FLIGHT CONTROLS

#### 67-00 Description

*Dual controls, which are removable on the left side, are standard equipment. All primary controls are actuated through push-pull tubes and bellcranks. Bearings used throughout the control system are either sealed ball bearings or have self-lubricated Teflon® liners.*

*R66 flight controls operate conventionally. The cyclic stick appears different, but the grip moves the same as in other helicopters due to the free hinge at the center pivot. The cyclic grip is free to move vertically allowing the pilot to rest his forearm on his knee if he chooses.*

*The collective control is also conventional. A twist grip provides input to the engine fuel control, and raising or lowering the collective provides power turbine governor inputs via an interconnecting linkage.*

*Pilot-side tail rotor pedals are adjustable. To adjust, extract quick-release pin on each pedal by depressing button and pulling. Slide pedal fore or aft to most comfortable of three adjustment positions, and reinstall quick-release pin. Verify pins secure before flight.*

*See R66 Pilot's Operating Handbook (POH) Section 7 for instructions to remove (removable) flight controls.*

*See Section 67-50 for hydraulic system description.*

#### **WARNING**

**Assembly of flight controls is critical and requires inspection by a qualified person. If a second person is not available, the installer must take a 5-minute break prior to inspecting flight control connections he has assembled.**

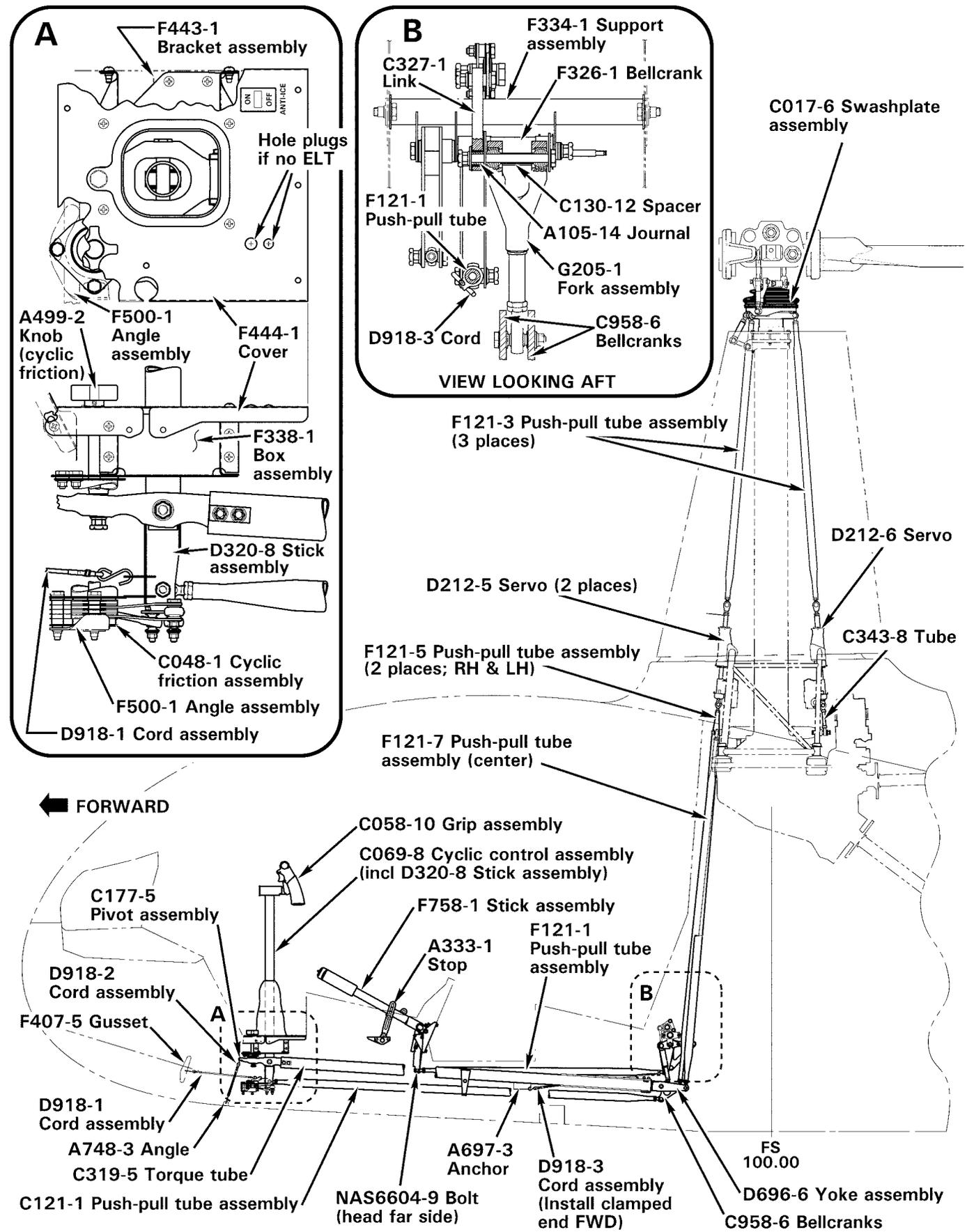
#### 67-10 Cyclic Controls

Refer to R66 Illustrated Parts Catalog (IPC) Chapter 67.

#### 67-11 Cyclic Control Assembly

##### **A. Removal**

1. Refer to Section 6-70. Remove F794-1 (forward) and F794-2 (aft) belly panels, F680-3 (pilot collective) and F445-1 (forward tunnel) cover assemblies, and F461-1 (collective cross tube) and F463-1 (aft tunnel) cover assemblies. Open upper console, disconnect OAT gage and hourmeter wiring connectors, and remove radio faceplate. Remove plastic hole plug from vertical keel panel beneath RH, aft seat.
2. Turn cyclic friction OFF. Gently punch out cyclic friction knob spring pin and remove knob. Remove hardware securing F444-1 cover assembly to F338-1 box, unsnap boot, and lift cover assembly to expose wire harness connectors. Disconnect anti-ice, pitot heat, and ELT switch (if installed) wiring. Snap boot together at top of cyclic stick to secure cover. Install pin on cyclic friction shaft to retain spacers.
3. Refer to Figure 67-1. Unhook D918-1 cord assembly from C069-8 (cyclic) stick assembly and D918-2 cord assembly from C177-5 pivot assembly.
4. Disconnect wiring exiting D320-8 stick at connectors near bottom of stick.



**FIGURE 67-1 MAIN ROTOR FLIGHT CONTROLS**

67-11 Cyclic Control Assembly (continued)**A. Removal (continued)**

5. Remove hardware securing C121-1 push-pull tube assembly to D320-8 stick assembly. Remove hardware securing C319-5 torque tube assembly to C177-5 pivot assembly. Move push-pull tube and torque tube assemblies aft, and protect from scratching.
6. Disconnect, but do not remove, two bolts securing cyclic friction assembly to cabin. Apply some cyclic friction to keep plates assembled.
7. Remove screws securing F338-1 cyclic box to cabin. Lift and remove cyclic control assembly with attached cyclic box and friction assembly. Install nuts onto two cyclic friction assembly bolts, hand tight, to retain bolts and spacers.
8. Remove hardware securing both outboard, vertical F121-5 push-pull tube assemblies and C130-47 spacer to D696-6 yoke assembly.
9. Remove hardware securing center, vertical F121-7 push-pull tube assemblies to C958-6 bellcrank.
10. Remove hardware securing G205-1 fork assembly to F334-1 support assembly.
11. Pull D175-5 cyclic pivot assembly (torque tube, yoke, bellcranks, fork, and push-pull tube assembly) aft through belly.

**B. Installation**

1. Refer to Figure 67-1. Verify center-to-center distance between rod end and spherical bearings in G205-5 fork is  $5.40 \pm 0.03$  inches; adjust as required. Standard torque jam nut and palnut per Section 20-32. Install C175-5 cyclic pivot assembly (torque tube, yoke, bellcranks, fork, and push-pull tube assemblies) thru aft belly.
2. Connect G205-1 fork assembly to F326-1 bellcrank and standard torque bolt per Section 20-32.
3. Connect lower end of center F121-7 push-pull tube to C958-6 bellcranks and standard torque bolt per Section 20-32.
4. Connect lower ends of both outboard F121-6 push-pull tubes to D696-6 yoke using a NAS6605-46 bolt and C130-47 spacer and standard torque per Section 20-32. Install plastic hole plug in vertical keel panel beneath RH, aft seat.
5. Remove temporary nuts from cyclic friction assembly bolts. Position cyclic box with attached cyclic control and friction assemblies between keel panels. Install all screws fastening cyclic box to cabin. Fasten cyclic friction assembly to cabin and standard torque bolts per Section 20-32.
6. Connect C319-5 torque tube assembly to C177-5 pivot and standard torque bolts per Section 20-32.
7. Connect forward end of C121-1 push-pull tube to D320-8 cyclic stick and standard torque bolts per Section 20-32.

67-11 Cyclic Control Assembly (continued)**B. Installation (continued)**

8. Connect all electrical plugs at bottom of cyclic stick. Ensure protective sleeving covers maximum amount of wiring possible and sleeving ends are secured with lacing tape.
9. Connect D918-1 cord to D320-8 cyclic stick. Connect D918-2 cord to C177-5 pivot.
10. Move cyclic control through all positions and verify operating and no binding.
11. Install radio face plate, connect OAT gage and hourmeter wiring connectors, and ty-rap as required. Close and secure upper console.
12. Connect cyclic box cover anti-ice, pitot heat (if installed), and ELT (if installed) switch wiring connectors and secure cover.
13. Install cyclic friction knob and secure with spring pin. Close and secure cyclic stick boot.
14. Install F794-1 (forward) and F794-2 (aft) belly panels, F680-3 (pilot collective) and F445-1 (forward tunnel) cover assemblies, and F461-1 (collective cross tube) and F463-1 (aft tunnel) cover assemblies.

67-12 Cyclic Grip Assembly**A. Removal****NOTE**

This may be accomplished without removal of complete cyclic assembly from rotorcraft.

1. Remove forward belly panel.
2. Refer to Figure 67-1. Disconnect wiring connectors attached to wiring exiting base of D320-8 cyclic stick. Using pin extractor, remove pins from housings (wires 112, 138, & 355 may remain installed) and retain housings. Remove lacing tape from both ends of protective sleeving covering wires exiting base of stick assembly. Attach a 3 foot length of safety wire or wire lacing tape to one removed pin.
3. As required, rotate grip assembly by pushing in on spring-loaded stop pin so exposed wire loom does not wrap around top of D320-8 cyclic stick. Remove circular plug, D684-1 spring, cotter pin, castellated nut, and washer where grip assembly attaches to D320-8 cyclic stick.
4. Remove grommet atop cyclic stick at grip assembly wiring entrance. With a soft-faced hammer, gently tap cyclic grip assembly pivot and remove grip assembly and attached wiring from stick assembly. Ensure safety wire or lacing attached to internal wiring protrudes from top and bottom of stick assembly. Also, ensure pivot bearings remain with stick assembly.

**NOTE**

Do not damage bearings while removing.

67-12 Cyclic Grip Assembly (continued)**B. Installation**

1. Refer to Figure 67-1. Ensure protective sleeving covers wires exiting grip assembly with one grommet in grip and one (for cyclic stick) on wire bundle (spare grommets may be installed if desired).
2. Slide grip assembly into bearings in stick assembly. Install washer, castellated nut and cotter pin.

**CAUTION**

Tighten castellated nut only until there is no axial movement of bearings and cyclic grip assembly. Overtightening nut will damage bearings.

3. Install D684-1 spring so that when grip assembly is rotated one turn clockwise, with co-pilot grip removed, pilot grip (tube) will float just above horizontal and stay full-up when placed full-up. Install circular plug.
4. Temporarily attach grip assembly wiring to safety wire (or lacing) exiting atop cyclic stick. Carefully pull wires thru cyclic stick. Install grommet, included with grip assembly wiring, into cyclic stick wiring entrance hole. Remove safety wire (or lacing).
5. Position protective sleeving on wiring exiting cyclic stick bottom to cover maximum amount of wiring possible. Secure sleeving ends with lacing tape.
6. Install pins on each wire into proper position in housings. Refer to Figure 98-5 | for pin positions.
7. Connect cyclic and airframe wiring at connectors and secure using ty-raps. Cinch | ty-raps until snug without over-tightening, and trim tips flush with heads. Move cyclic control through all positions and verify clearance and no binding.
8. Turn BATTERY switch on and verify correct function of all switches on grip assembly and cyclic stick.
9. Install forward belly panel.

67-13 Cyclic Friction Assembly**NOTE**

The cyclic friction assembly is located below the forward left corner of the cyclic box. Turning friction knob clockwise applies friction to both longitudinal and lateral cyclic axes. Adjustment is required if friction cannot be applied.

**A. Friction Adjustment**

1. Turn friction knob counter-clockwise until it stops.
2. Remove roll pin connecting knob to shaft.
3. Lift knob off shaft.
4. Install NAS1149F0432P or NAS1149F0463P washers under knob washer, as required, so knob rotates 1/8 to 1 turn before adding friction. With friction off, force at grip to move cyclic shall not exceed 1.75 pounds longitudinal and lateral within hydraulic servo deadbands.
5. Replace knob and install roll pin.
6. Move flight controls throughout complete travel. Verify no binding.

67-20 Collective Control67-21 Collective Stick Assembly**A. Removal**

1. Refer to Figure 67-1. Disconnect A333-1 collective-travel stop from F348-1 anchor by removing NAS6603 bolt at bottom of stop. Position stop parallel to collective stick and apply collective friction.
2. Refer to Figure 6-8. Remove F445-1 forward tunnel cover, F680-3 pilot's collective cover, F680-1 co-pilot's collective cover, F463-1 mid-tunnel cover, and F461-1 collective cross tube cover.

**CAUTION**

If Garmin FCS is installed in the helicopter, do not allow G356-1 transducer assembly's cable to snap back when disconnecting C522-10 throttle control. Transducer cable must retract slowly; allowing cable to freely retract can damage transducer.

3. Pivot pilot's seat bottom to the open position. Remove bolt securing inboard end of collective stick to pilot's seat structure. Refer to Figures 76-1 and 22-6. Disconnect throttle control inner wire from A462-4 fitting at outboard end of collective. Remove three screws securing C522-10 throttle control (and G356-1 transducer assembly's cable, if installed) to collective cross tube.

67-21 Collective Stick Assembly (continued)**A. Removal (continued)**

4. Disconnect wiring exiting aft end of center collective stick from airframe harness connector. Remove ty-raps as required.
5. Disconnect forward end of F121-1 push-pull tube from collective stick assembly.
6. Remove bolt securing outboard end of collective stick to F303-1 support. Remove two remaining screws securing F303-1 support to cabin. Slide support, with attached micro-switches, down to allow aft movement of collective stick.
7. Pivot pilot's seat bottom to the open position. Remove bolt securing collective stick assembly to pilot's seat structure.
8. Carefully move collective stick assembly aft and remove from helicopter.

**B. Installation**

1. Refer to Figure 67-1. Position A333-1 collective-travel stop parallel to collective stick and apply collective friction. From aft side of co-pilot's seat, carefully position collective stick assembly in helicopter.
2. Pivot pilot's seat bottom to the open position. Install bolt from inside pilot's seat structure thru bearing block into tunnel and secure to inboard end of collective stick assembly. Standard torque bolt, install stamped nut, and torque stripe per Figure 5-1.
3. At outboard end of collective stick, slide F303-1 support, and attached micro-switches, up behind collective cross tube and secure support to cabin with two screws.
4. Install journal in outboard pivot bearing of collective stick assembly. Position journal & bearing between flanges of F303-1 support and insert NAS6604 bolt. Standard torque bolt per § 20-32, install stamped nut, and torque stripe per Figure 5-1.
5. Connect forward end of F121-1 push-pull tube to collective stick assembly with NAS6604-9 bolt head facing right side of helicopter. Standard torque bolt per § 20-32, install stamped nut, and torque stripe per Figure 5-1.
6. Slide F680-3 collective cover over pilot collective stick aft of friction assembly.
7. Insert A130-4 spacer into lower end of A333-1 collective-travel stop. Position spacer and stop in F348-1 anchor. Install NAS1149F0432P and 0463P washers on spacer on either side of stop as required to obtain 0.001/0.035 inch axial play and align stop with collective. Secure stop to anchor with NAS6603 bolt, standard torque per § 20-32, install stamped nut, and torque stripe per Figure 5-1. Move collective up & down and verify no binding of stop.
8. Connect wiring exiting center collective stick to airframe wire harness connector. Secure connector to airframe harness with Ty-raps as required. Move collective up & down and verify wiring clearance with no strain.

67-21 Collective Stick Assembly (continued)**B. Installation (continued)**

9. Refer to Figure 76-1. Secure C522-10 throttle control to collective stick weldment with three clamps and screws. If Garmin FCS is installed in helicopter, secure G356-1 transducer assembly's cable to collective per Figure 22-6 and perform collective position sensor calibration per § 22-16-2 Part B. Position throttle control inner wire in A462-4 fitting and rig per § 76-11.
10. Refer to Figure 6-8. Install and secure F445-1 forward tunnel cover, F680-3 pilot's collective cover, F680-1 co-pilot's collective cover, F463-1 mid-tunnel cover, and F461-1 collective cross tube cover.
11. Adjust collective friction per § 67-22.

67-22 Collective Friction

Adjust friction on F334-1 to produce a force within servo dead bands of 4–5 lb when pulling up at collective grip with friction on collective full off, then adjust friction on collective as required to produce a force of 18–22 lb when pulling up at grip when full on.

67-30 Jackshaft and Strut Assembly67-31 Jackshaft**A. Removal****NOTE**

Rigging check is not necessary if jackshaft support rod end and push-pull tube lengths are not altered.

1. Disconnect push-pull tubes from F339-1 jackshaft.
2. Disconnect two bolts connecting jackshaft to G201-1 frame.
3. Remove jackshaft.

**B. Installation**

1. Ensure A105-6 journal is installed in jackshaft aft support on G201-1 frame. Position F339-1 jackshaft on G201-1 frame and install bolts. Standard torque bolts per § 20-32, install stamped nuts, and torque stripe per Figure 5-1.
2. Insert bolt forward thru forward jackshaft arm and connect to upper end of F121-7 push-pull tube. Install A115-1 spacer, A214-3 washer and nut. Standard torque bolt per § 20-32, install stamped nut, and torque stripe per Figure 5-1.
3. Insert bolt aft thru aft jackshaft arm and connect to lower rod end on C343-8 tube. Install A115-1 spacer, A214-3 washer and nut. Standard torque bolt per § 20-32, install stamped nut, and torque stripe per Figure 5-1.
4. Verify no binding and/no interference with control system exists throughout flight control travel.

67-40 Swashplate**A. Removal****NOTE**

Rigging check is not required if push-pull tube rod end center-to-center dimension does not change.

1. Remove main rotor blades and hub per §§ 62-10 and 62-20.
2. Atop of C251 main rotor drive shaft, remove D226 brackets, D151 teeter stops, and C150 droop stops by removing NAS6608 bolt.
3. Disconnect upper C204 arm from C203 yokes.
4. Disconnect and remove C203 yokes, A210 key, and chord arm weights.
5. Remove swashplate boot by cutting plastic ty-raps.
6. Disconnect three push-pull tubes and A205 fork assembly from lower (non-rotating) swashplate.
7. Lift swashplate with attached fork and pitch links off slider tube and remove from helicopter.

**B. Installation**

1. Install swashplate onto slider tube assembly. Connect lower scissors' fork to left side of middle of three lugs on lower, non-rotating swashplate. Connect aft push-pull tube to right side of aft, single lug on lower swashplate. Standard torque bolts per § 20-32. Install palnuts and standard torque per § 20-32.
2. Verify swashplate tilting friction per § 67-41; adjust as required.
3. Slide swashplate boot over main rotor drive shaft and set in place.
4. Install C203 yokes on C251 main rotor drive shaft upper flange using A210 key to index yokes to shaft. Finger tighten clamping hardware.

**NOTE**

Round edge of A210 key to fit into drive shaft flange indexing slot.

5. Standard torque NAS6605 bolt thru yokes and A210 key first per § 20-32. Install palnuts and standard torque per § 20-32.
6. Standard torque bolt thru yokes opposite A210 key per 20-32. A slight gap between yokes opposite A210 key is normal.
7. Install previously removed chord arm weights and standard torque bolt per § 20-32. Install palnut, standard torque per §20-32, and torque stripe per Figure 5-1.

67-40 Swashplate (continued)**B. Installation (continued)**

8. If required, fill remainder of rod end threaded hole in upper A205 fork with B270-4 or -13 sealant (see § 20-70).
9. With bolt heads in direction of rotation, connect upper A205 fork to upper C204 arm and connect arm to C203 yokes. Standard torque bolts per § 20-32. Verify 0.001/0.005 inch axial play in both pivots; adjust C117 shim thickness between nut-side journal & thrust washer as required. Verify bolt, arm, and clamped hardware in upper scissor's pivots rotate together. Install palnuts, standard torque per § 20-32, and torque stripe per Figure 5-1.
10. Verify bolt, arm, and clamped hardware in lower scissor's pivots rotate together. Connect forward push-pull tube rod ends to remaining lower lugs on swashplate and standard torque bolts per § 20-32. Install palnut, standard torque per § 20-32, and torque stripe per Figure 5-1.
11. Connect upper A205 fork rod end and lower rod end of C258 pitch link to interrupter-side swashplate ear and standard torque bolt per § 20-32. Install palnut, standard torque per § 20-32, and torque stripe per Figure 5-1.
12. Position swashplate boot on rotating swashplate with inner lip contacting C203 yoke. Secure with ty-raps.
13. Attach two A255-3 counterweights and lower rod end of C258 pitch link to swashplate ear opposite interrupter and standard torque bolt per § 20-32. Install palnut, standard torque per § 20-32, and torque stripe per Figure 5-1.
14. Install main rotor hub and blades per §§ 62-10 and 62-20.
15. Verify safety washers (or counterweight) and C115 spacers installed on all rod ends per Figure 5-1. Torque stripe fasteners per Figure 5-1.
16. Verify no interference with control movement throughout flight control travel and swashplate movement corresponds with cyclic and collective movement.
17. Track and balance main rotor per § 18-10.

### 67-41 Swashplate Tilting Friction Adjustment

Swashplate tilting friction is established by C197-1 through C197-6 shims controlling clamping force of Teflon®-lined sleeves on the ball assembly.

1. Mark for reassembly and disconnect boot, pitch links and drive linkage (scissors) from upper swashplate and both forward push-pull tubes from lower swashplate.
2. Align upper swashplate arms with lateral axis of helicopter and center cyclic stick. Using MT359-1 spring scale (or equivalent) connected to upper swashplate arm bolt hole, pull down and note scale reading while swashplate is moving; do not use breakaway reading. Force required to tilt swashplate must be free-without-looseness minimum to 5 pounds maximum.
3. To adjust friction, remove outer screws from upper swashplate and raise and secure retainers to allow access to inner screws on lower, non-rotating swashplate. Remove inner screws securing sleeve to lower swashplate.
4. Raise sleeve and measure thickness of C197 shim stack. Adjust shim stack thickness as required to achieve proper tilting friction. Decreasing shim stack thickness increases tilting friction while increasing spacer stack thickness decreases tilting friction. Install, and special torque per § 20-33, all inner screws on lower swashplate and at least two screws thru retainers in upper swashplate prior to measuring tilting friction.
5. Connect both forward push-pull tubes to lower swashplate and standard torque per § 20-32. Install palnut, special torque per § 20-33, and torque stripe per Figure 5-1.
6. Connect both pitch links and drive linkage to upper swashplate (interrupter on same side as drive linkage) and standard torque per § 20-32. Install palnuts, special torque per § 20-33, and torque stripe per Figure 5-1.

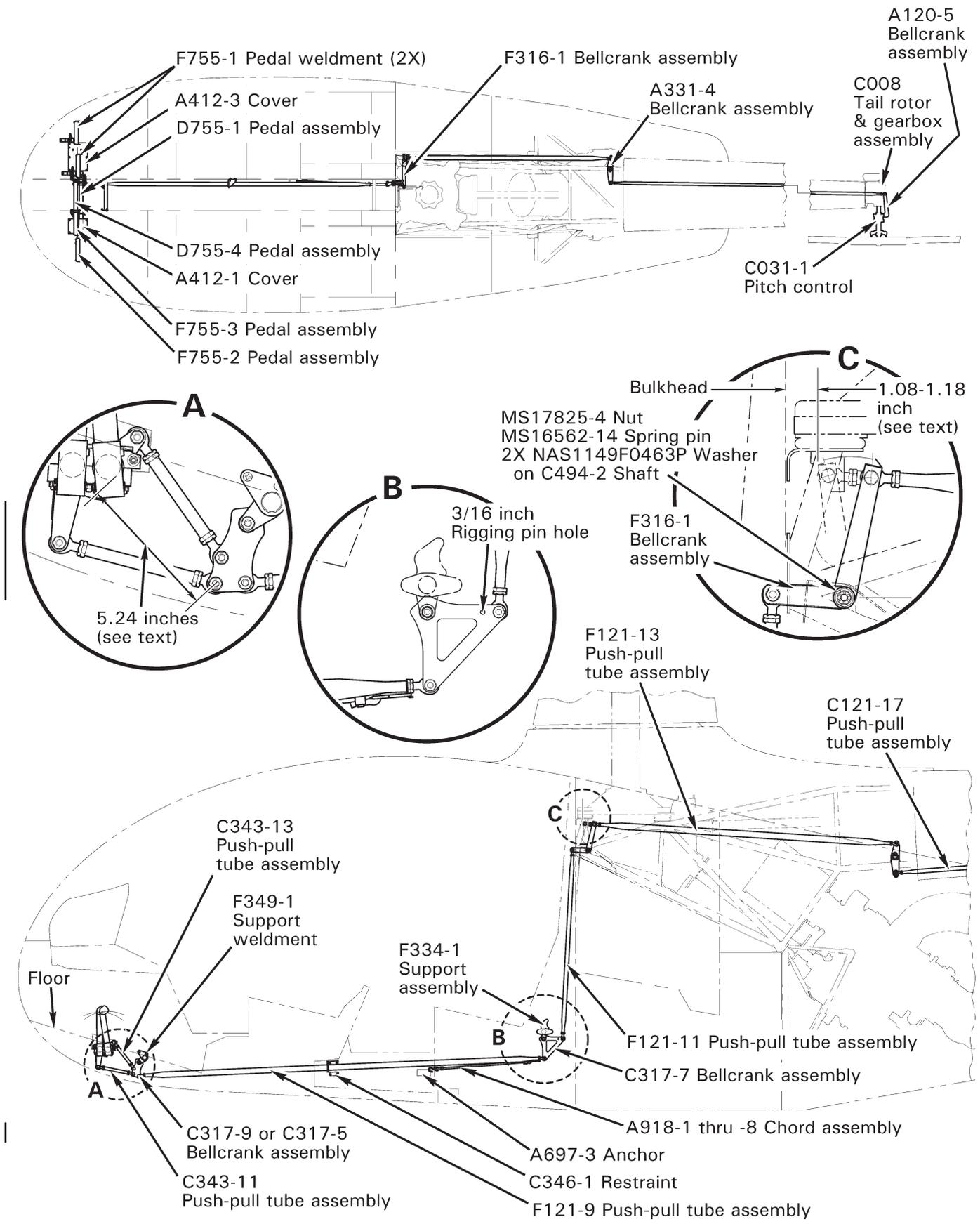
### 67-42 Upper and Lower Scissor Assemblies

#### **A. Bearing Removal**

C648-2 journal bearings may be removed with a press. Press from inner side of bearings while supporting outboard side of yoke or fork. Use a socket or other suitable pressing tool to apply the force.

#### **B. Bearing Installation**

1. Clean mating surfaces of A205 fork or C203 yoke where C648 bearing is installed. Deburr any sharp edges that may damage bearings during installation.
2. Coat yoke or fork bearing bores with zinc chromate or epoxy primer. While primer is still wet, press in C648-2 bearing while supporting backside of fork or yoke.



**FIGURE 67-3 TAIL ROTOR FLIGHT CONTROLS**

67-50 Tail Rotor Controls67-51 Pedals**A. Removal**

1. Peel back carpet as required to access pedal covers per § 25-30 Part D.
2. Remove screws securing pedal covers to cabin floor and remove covers.
3. Remove screws securing upper console to side panels; pivot console up and aft.

**CAUTION**

Do not change the length of or remove rod ends from C343-11 and -13 push-pull tube assemblies.

4. Remove hardware securing D755 pedal assemblies to C343-11 and -13 push-pull tube assemblies.

**NOTE**

Pedal bearing blocks (upper and lower) are a machined, matched set as indicated by matching letter or number on the upper and lower portion of blocks. **DO NOT** mix them or alignment problems may develop on installation.

5. Remove bolts securing A318-1 and -2 bearing block halves together and remove lower bearing blocks.
6. Remove pedal assemblies one at a time by lifting one end and lowering other into chin. Remove pedals thru pilot-side opening.

**NOTE**

On reassembly, the right pedal assembly is mounted forward in the bearing blocks and the left is mounted aft.

**B. Installation**

1. Fill the grooves in the pedal bearing blocks with A257-1 grease.
2. Install the pedal assemblies into the bearing blocks and torque bearing block attach bolts per § 20-32.

**NOTE**

If a force greater than 5 lbs is required to move pedals, check the bearing blocks to ensure they are matched correctly.

67-51 Pedals (continued)**B. Installation (continued)**

3. Connect both pedal assemblies to the push-pull tubes and torque the NAS6604-9 bolts to per § 20-32 and install palnuts.
4. Move the pedals through the full range of travel to ensure there is no interference or binding.
5. Secure console. Install the pedal covers and carpeting. Use B270-7 or -8 adhesive to attach carpeting.

67-52 Pitch Control**A. Removal**

1. Remove tail rotor assembly per § 64-10. Mark corresponding tail rotor blade grips, tail rotor pitch change to each of the pitch control ears, for later reinstallation so re-rigging is not required.
2. Disconnect and remove A120-5 aft bellcrank per § 67-65.
3. Remove C031-1 pitch control from tail rotor output shaft. Clean output shaft.

**B. Installation**

1. Verify inner bore of C031-1 pitch control is clean. Scrub interior of pitch control bore with clean, dry toothbrush followed by lint-free wipe; do NOT use, or immerse in, solvent due to potential compromise of oil-impregnated bushings. Slide pitch control assembly onto clean output shaft.
2. With pitch control's input stud thru short arm of A120-5 bellcrank assembly, position bellcrank on tail rotor gearbox and install NAS6604-25 bolt, one AN960-416L washer under bolt head, two MS20002-4 washers, one on each side of bearing and MS21042-L4 nut. Tighten but don't torque at this time.
3. Measure vertical gap between A120-5 bellcrank arm and flange on pitch control stud. Install sufficient C117-34, -35 and -36 washers between bellcrank and stud to fill gap within  $\pm 0.003$  inch. Install one NAS1149F0432P washer and MS21042-L5 nut on protruding end of stud. Torque nut to 200 in.-lb plus nut drag while holding stud from rotating. Install palnut and special torque per § 20-33.
4. Standard torque bolt thru A120-5 bellcrank pivot per § 20-32 and install palnut and special torque per § 20-33.
5. Attach aft end of C121-17 push-pull tube to A120-5 bellcrank and standard torque bolt per § 20-32.
6. Install hardware securing pitch links. Note that an optional A215-012 o-ring may be installed between A214-3 washer and A115-1 spacer at pitch control ears (refer to IPC). Standard torque bolts and palnuts per § 20-32, and torque stripe per Figure 5-1.
7. Install tail rotor assembly per § 64-10.

## 67-60 Bellcranks

Refer to R66 Illustrated Parts Catalog (IPC) Figure 67-37.

### 67-61 C317-5 or C317-9 Bellcrank

#### A. Removal

1. Remove screws securing upper console to side panels; pivot console up and aft.
2. Remove installed avionics located in center console per Chapter 97. Remove hardware securing face plate and avionics trays to side panels and remove plate and trays.

#### CAUTION

Do not change the length of or remove rod ends from C343-11 and -13 push-pull tube assemblies.

3. Remove hardware securing C343-11 and C343-13 push-pull tube assemblies and F121-9 push-pull tube assembly to C317-5 or C317-9 bellcrank assembly.
4. Remove hardware securing F349-1 support assembly to side panels and remove support with attached bellcrank.
5. Remove hardware securing bellcrank to support and remove bellcrank (carefully remove journals from bellcrank bearing).

#### B. Installation

1. Insert journals inside C317-5 or C317-9 bellcrank assembly's bearing. Align washers and bellcrank with F349-1 support assembly flange holes and install hardware. Standard torque nut and palnut per § 20-32 and torque stripe per Figure 5-1.
2. Position support with attached bellcrank in helicopter and install hardware securing support to side panels. Verify security.
3. Verify C343-11 push-pull tube's rod end center-to-center dimension is  $5.82 \pm 0.03$  inches and C343-13 push-pull tube's rod end center-to-center dimension is  $5.30 \pm 0.03$  inches. Install hardware securing push-pull tubes to bellcrank. Standard torque nuts and palnuts per § 20-32 and torque stripe per Figure 5-1.
4. Install hardware securing F121-9 push-pull tube assembly to bellcrank. Standard torque nut and palnut per § 20-32 and torque stripe per § 20-33.
5. Perform tail rotor flight control rigging per § 18-50.
6. Actuate pedals through full control travel and verify smooth operation without binding.
7. Pivot upper console forward and down. Position avionics tray and face plate in helicopter and install hardware securing trays and plate to side panels. Verify security.
8. Install avionics in center console per Chapter 97. Install screws securing console to side panels and verify console security.

**67-62 C317-7 Bellcrank****A. Removal**

1. Refer to § 6-70. Remove F794-2 aft belly cover, F932-1 middle seat backrest assembly, and F474-2 middle seat cover.
2. Disconnect F121-9 and F121-11 push-pull tubes from the C317-7 bellcrank.
3. Remove nuts and accompanying washers securing NAS6604-67 bolt in F334-1 support assembly. Withdraw bolt sufficient to remove C317-7 bellcrank and remove bellcrank, two A141-3 washers, and two A105-3 journals.

**B. Installation**

1. Install two A105-3 journals in C317-7 bellcrank's pivot bearing bore. With 3/16 inch rigging pin hole aft and an A141-3 washer against outboard face of each journal, install bellcrank on F334-1 support assembly and retain with NAS6604-67 bolt.
2. Install two NAS1149F0463P and one NAS1149F0432P washer followed by MS21042L4 nut on NAS6604-67 bolt. Standard torque bolt per § 20-32. Install palnut, special torque per § 20-33, and torque stripe per Figure 5-1.
3. Connect F121-9 push-pull tube assembly to C317-7 bellcrank and standard torque bolt per § 20-32. Install palnut, special torque per § 20-33, and torque stripe per Figure 5-1.
4. Move pedals full travel. Verify smooth movement and no interference.
5. Install F794-2 aft belly cover, F932-1 middle seat backrest assembly, and F474-2 middle seat cover.

67-63 F316-1 Bellcrank**A. Removal**

1. Remove main rotor gearbox per § 63-20.
2. Disconnect F121-11 push-pull tube from F316-1 bellcrank assembly.
3. Disconnect F121-13 push-pull tube from F316-1 bellcrank assembly.
4. Remove nuts and spacer from outboard end of C494-2 shaft. Move shaft slightly inboard and remove washer from between frame tab and bellcrank.
5. Remove spring pin, castellated nut, and washers from inboard end of C494-2 shaft. Move shaft slightly outboard and remove washer from between bellcrank and inboard support.
6. Remove bellcrank.

**B. Installation**

1. Install one A141-3 washer on C494-2 shaft adjacent to both inboard and outboard end of F316-1 bellcrank.
2. Install bellcrank with washers in helicopter with longer arm pointing up.
3. On inboard end of C494-2 shaft, install two NAS1149F0463P washers followed by MS17825-4 castellated nut. Tighten nut until it aligns with hole in shaft and install new MS16562-14 spring pin.
4. On outboard end of shaft install C130-34 spacer and MS21042L4 nut. Special torque nut per § 20-33. Install palnut and standard torque per § 20-32. Torque stripe inboard and outboard nuts per Figure 5-1.
5. Connect F121-13 push-pull tube to bellcrank and standard torque bolt per § 20-32. Install palnut, standard torque per § 20-32, and torque stripe per Figure 5-1.
6. Connect F121-11 push-pull tube to bellcrank and standard torque bolt per § 20-32. Install palnut, standard torque per § 20-32, and torque stripe per Figure 5-1.
7. Move pedal full travel. Verify smooth movement and no interference.
8. Install main rotor gearbox per § 63-20.

67-64 A331-4 Bellcrank**A. Removal**

1. Disconnect F121-13 and C121-17 push-pull tubes from A331-4 bellcrank.
2. Disconnect NAS6604-35 attach bolt and remove bellcrank and two A105-3 journals.

**B. Installation**

1. Install two A105-3 journals in C331-4 bellcrank's pivot bearings. Install an NAS1149F0432P washer under head of an NAS6604-35 bolt followed by an A141-3 washer and insert bolt thru journals. Install an A141-3 washer on bolt against journal face, followed by an NAS1149F0432P washer.
2. Install bellcrank, with straight side aft, on F020-1 frame's boss, and secure to frame with an NAS1149F0432P washer and MS21042L4 nut. Standard torque bolt per § 20-32. Install palnut, standard torque per § 20-32, and torque stripe per Figure 5-1.

67-65 A120-5 Bellcrank**A. Removal**

1. Remove hardware securing C121-17 push-pull tube assembly to A120-5 bellcrank assembly.
2. Disconnect bellcrank pivot from C021-1 tail rotor gearbox.
3. Remove nut holding bellcrank to the pitch control. Remove bellcrank and reinstall nut, and shims found between bellcrank and pitch control.

**B. Installation**

1. Install pitch control per § 67-52.