SECTION 6

AILERON CONTROL SYSTEM

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6-1. AILERON CONTROL SYSTEM. (Refer to figure 6-1.)

6-2. DESCRIPTION. The aileron control system is comprised of push-pull tubes, bellcranks, cables, pulleys, sprockets and components forward of the instrument panel, all of which, link the control wheels to the ailerons.

6-3. TROUBLE SHOOTING.

NOTE

Due to remedy procedures in the following trouble shooting chart it may be necessary to re-rig system, refer to paragraph 6-20.

TROUBLE	PROBABLE CAUSE	REMEDY
LOST MOTION IN CONTROL WHEEL.	Loose control cables.	Check cable tension. Adjust cables to proper tension.
	Broken pulley or bracket, cable off pulley or worn rod end bearings.	Check visually. Replace worn or broken parts, install cables correctly.
	Deformed bellcrank or pulley bracket.	Check visually. Replace deformed parts.
	Loose chains.	Adjust chains in accordance with paragraph 6-20.
RESISTANCE TO CONTROL WHEEL MOVEMENT.	Cables too tight.	Check cable tension. Adjust cables to proper tension.
	Pulleys binding or cable off.	Observe motion of the pulleys. Check cables visually. Replace defective pulleys. Install cables correctly.
	Bellcrank distorted or damaged.	Check visually. Replace defective bellcrank.
	Clevis bolts in system too tight.	Check connections where used. Loosen, then tighten properly.

6-3. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
RESISTANCE TO CONTROL WHEEL MOVEMENT (Cont).	Defective bearing in bearing blocks at sprockets.	Disconnect chains and check for binding. Replace defective parts.
	Rusty chain.	Check visually. Replace chain.
	Chain binding with sprockets.	Check freedom of movement. Replace defective parts.
	Defective bearings in sleeve weld assembly on control wheel tube.	Disconnect chains and check for binding. Replace defective parts.
	Nuts securing shaft in bearing blocks on firewall too tight.	Loosen nuts the least amount required to eliminate binding and align cotter pin hole, but not over .030" maximum clearance.
PILOT CONTROL WHEEL NOT LEVEL WITH AILERONS NEUTRAL.	Improper adjustment of chains or cables.	Adjust in accordance with paragraph 6-20.
	Improper adjustment of aileron push-pull tubes.	Adjust push-pull tubes to obtain proper alignment.
DUAL CONTROL WHEELS NOT COORDINATED.	Chains not properly adjusted on sprockets.	Adjust in accordance with paragraph 6-20.
INCORRECT AILERON TRAVEL.	Push-pull tubes not adjusted properly.	Adjust in accordance with paragraph 6-20.
	Incorrect adjustment of travel stop bolts.	Adjust in accordance with paragraph 6-20.

6-4. CONTROL COLUMN. (Refer to figure 6-2.)

6-5. DESCRIPTION. Rotation of the control wheel rotates four bearing roller assemblies (8) on the end of the control wheel tube (2), which in turn, rotates a square control tube assembly (17) inside and extending from the control wheel tube. Attached to this square tube (17) is a sprocket (23) which operates the aileron system. This same arrangement is provided for both control wheels and synchronization of the control wheels is obtained by the crossover chains (26) and turnbuckles (27). The forward end of the square control tube (17) is mounted in a bearing block (20) on the firewall and does not move fore-and-aft, but rotates with the control wheel. The four bearing roller assemblies (8) on the end of the control wheel tube reduce friction as the control wheel is moved fore-and-aft for elevator system operation. A sleeve weld assembly (6), containing bearings which permit the control wheel tube to rotate within it, is secured to the control wheel tube by a sleeve and retaining rings in such a manner it moves fore-and-aft with the control wheel tube. This movement allows the clamp blocks (7) attached to the sleeve weld assembly (6) to move the elevator cable. When dual controls are installed, the copilot's control wheel is linked to the aileron and elevator control systems in the same manner as the pilot's control wheel.

6-6. REMOVAL AND INSTALLATION.

a. CONTROL WHEEL TUBE - REAR SECTION.

1. THRU AIRCRAFT SERIALS 33701398 AND F33700045. Remove lower screw securing decorative collar (33), slide collar toward instrument panel and remove remainder of screws securing control wheel (32) to control wheel tube (2).

2. BEGINNING WITH AIRCRAFT SERIALS 33701399 AND F33700046. Slide cover (58) toward instrument panel to expose adapter (57) and remove screws securing adapter (57) to rear section of tube (2).

3. ALL AIRCRAFT. Disconnect electrical wiring at connector (34).

NOTE

On aircraft equipped with the ribbon wire (39), mark the ribbon wire and the connector at the control wheel for reference on reinstallation. IT IS POSSIBLE TO PLUG THIS CONNECTION BACKWARDS.

4. Carefully remove control wheel.
5. Remove screw securing adjustable glide plug (15) to control tube assembly (17) and remove plug and glide.
6. THRU AIRCRAFT SERIAL 337-0239. Cut safety wire, remove bolts (4) and remove clamp halves (5) to detach the rear section of control wheel tube (2) from the forward section. Pull rear section of tube (2) aft, out through the instrument panel to remove.
7. BEGINNING WITH AIRCRAFT SERIAL 337-0240. Cut safety wire and remove studs (9) from collar (10) to detach the rear section of control wheel tube (2) from the forward section. Pull rear section of tube (2) aft, out through the instrument panel to remove. Do not drop collar (10) into tunnel area.
8. Reverse the preceding steps for reinstallation. Safety wire all items previously safetied, check rigging of aileron system and rig, if necessary, in accordance with paragraph 6-20.

b. CONTROL WHEEL TUBE - FORWARD SECTION.
1. Complete steps 1 thru 7 of subparagraph "a."
2. Remove bolt securing shaft (19) and forward control column stop (18) to control tube assembly (17). Pull tube assembly aft, out through the instrument panel.
3. Remove bolts securing clamp blocks (7) and slide blocks out of sleeve weld assembly (6).
4. THRU AIRCRAFT SERIAL 33701193. Disconnect microphone cable (37) terminals at terminal block (38) and carefully work forward section of control wheel tube (2) out from under instrument panel.
5. BEGINNING WITH AIRCRAFT SERIALS 33701194 AND F33700001. Cut sta-strap securing ribbon wire to forward section of control wheel tube (2) and carefully pull ribbon wire out of tube. Carefully work forward section of control wheel tube (2) out from under instrument panel.
6. Reverse the preceding steps for reinstallation. Safety wire all items previously safetied, check rigging of aileron system and rig, if necessary, in accordance with paragraph 6-20.
7. If control column works hard, or drags fore-and-aft, loosen screw securing adjustable glide plug (15).
8. The nuts (25) securing shafts (19) to the firewall should be tightened snugly, then loosened the least amount required to eliminate binding and to align a cotter pin hole, but not more than .030" maximum clearance.

6-7. REPAIR. Worn, damaged or defective shafts, bearings, sprockets, roller chains or other components should be replaced. Refer to Section 2 for lubrication requirements.

6-8. BEARING ROLLER ADJUSTMENT. Each bearing roller (29) has an 0.062" eccentric adjustment when installed, for adjustment of the control wheel tube (2), control tube assembly (17) and bracket (28). For adjustment, proceed as follows:
a. Adjust bearing rollers (29) until control wheel tube (2) is centered in bracket (28).
b. Operate ailerons and elevators through several cycles and check for binding. If binding is evident, readjust bearing rollers individually until binding is eliminated.

6-9. BELLCRANKS. (Refer to figure 6-1.)

6-10. REMOVAL AND INSTALLATION.
a. Remove access plate adjacent to bellcrank (25) on underside of wing and remove plug button for access to pivot bolt (23).
b. Remove wing strut fairings or headliner as necessary to gain access to turnbuckle (7, 9 or 13).
c. Remove safety wire and relieve tension at turnbuckle.
d. Disconnect cables (14 and 15) at bellcrank.
e. Disconnect push-pull tube (24) at bellcrank.
f. Remove safety wire from pivot bolt (23) and remove bolt.
g. Remove bellcrank through access opening, using care that bushing (26) is not dropped from bellcrank.

NOTE

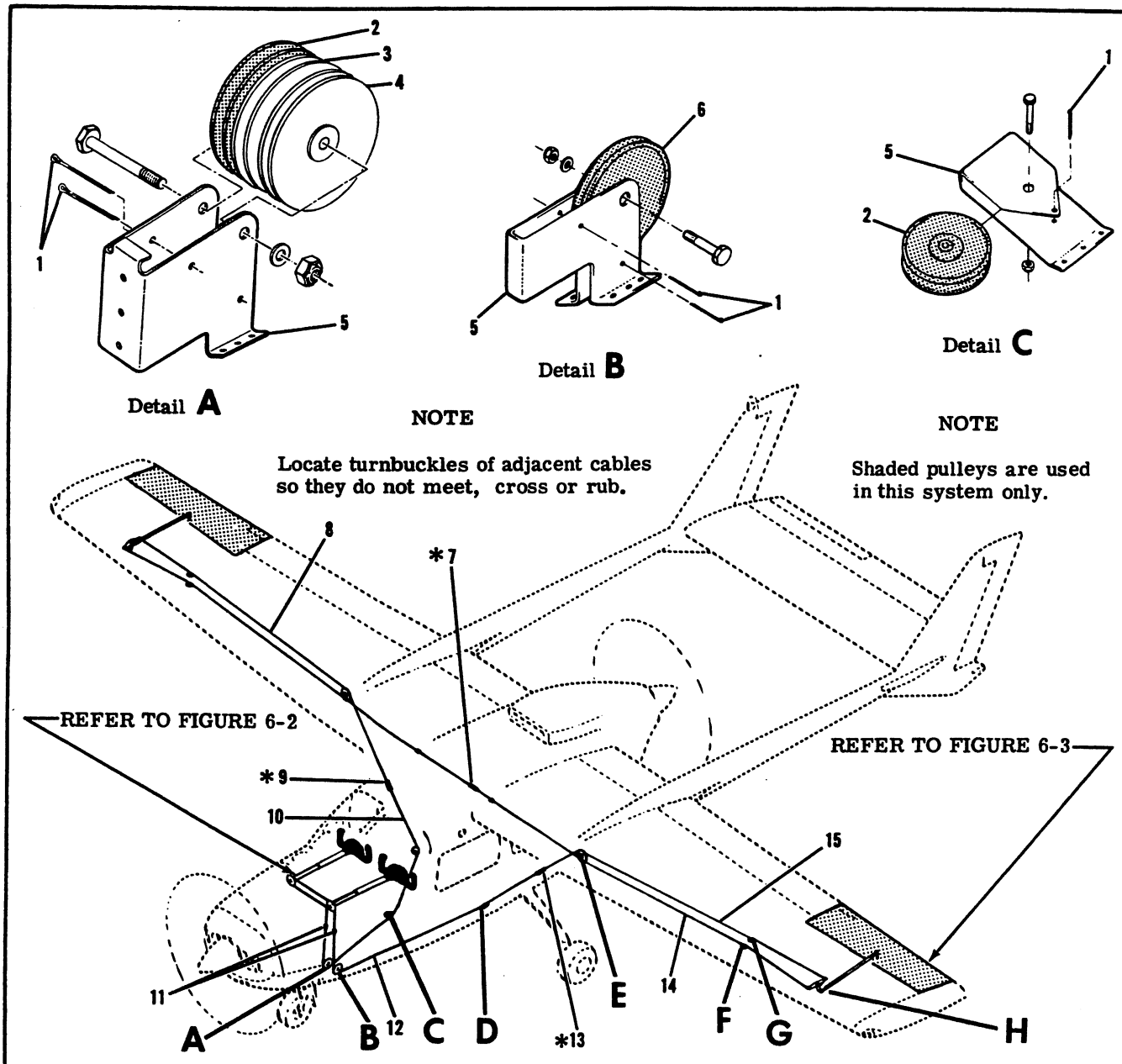
Brass washers (21) may be used as shims between upper and lower ends of bellcrank and brackets (18 and 22). Retain these shims. Tape open ends of bellcrank to prevent dust and dirt from entering bellcrank needle bearings (20).

h. Reverse the preceding steps for reinstallation. Rig system in accordance with paragraph 6-20, safety wire turnbuckle and pivot bolt and reinstall all items removed for access.

6-11. REPAIR. Repair of bellcranks is limited to replacement of defective bearings and bushings. If needle bearings are dirty or in need of lubrication, clean thoroughly and lubricate as outlined in Section 2.

6-12. AILERONS. (Refer to figure 6-3.)

6-13. REMOVAL AND INSTALLATION.
a. Run flaps to full DOWN position for access to inboard hinge bolt.
b. Remove wing tip for access to outboard hinge bolt.
c. Remove access plate (8) and plug buttons from underside of aileron.
d. Remove bolt (7) securing push-pull tube (6) to aileron.
e. Remove pivot bolts (3) and pull aileron aft to remove.



1. Cable Guard
2. Pulley (RH Direct Cable)
3. Pulley (Elevator Down)
4. Pulley (Elevator Up)
5. Bracket
6. Pulley (LH Direct Cable)
7. Turnbuckle (Carry-Thru Cable)
8. Cable (RH Outboard Direct)
9. Turnbuckle (RH Direct Cable)
10. Cable (RH Inboard Direct)
11. Clevis
12. Cable (LH Inboard Direct)
13. Turnbuckle (LH Direct Cable)
14. Cable (Carry-Thru)
15. Cable (LH Outboard Direct)
16. Pulley (Carry-Thru Cable)
17. Bushing
18. Upper Bracket
19. Travel Stop Bolt
20. Bearing
21. Brass Washer
22. Lower Bracket
23. Pivot Bolt
24. Push-Pull Tube
25. Bellcrank
26. Bushing

*Safety wire these items.

NOTE

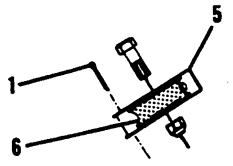
Refer to figure 4-2 for cable routing through wing strut fairleads.

CAUTION

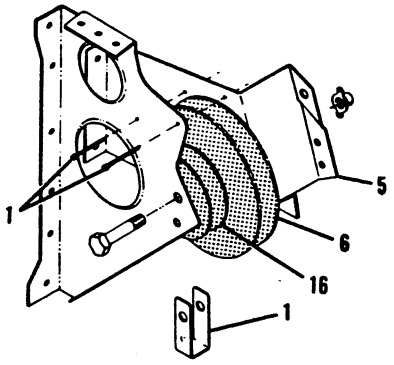
MAINTAIN PROPER CONTROL CABLE TENSION.

CABLE TENSION:
30 ± 10 LBS (AT AVERAGE TEMPERATURE FOR THE AREA.)
REFER TO FIGURE 1-1 FOR TRAVEL.

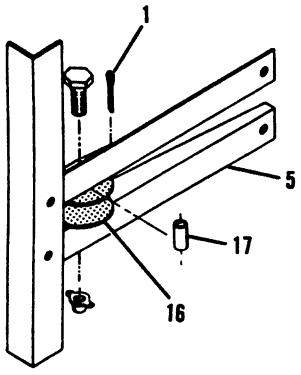
Figure 6-1. Aileron Control System (Sheet 1 of 2)



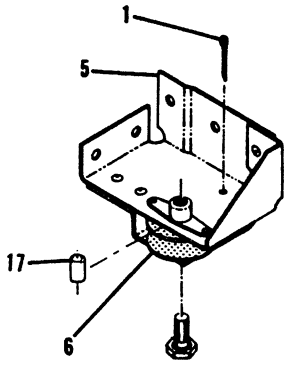
Detail **D**



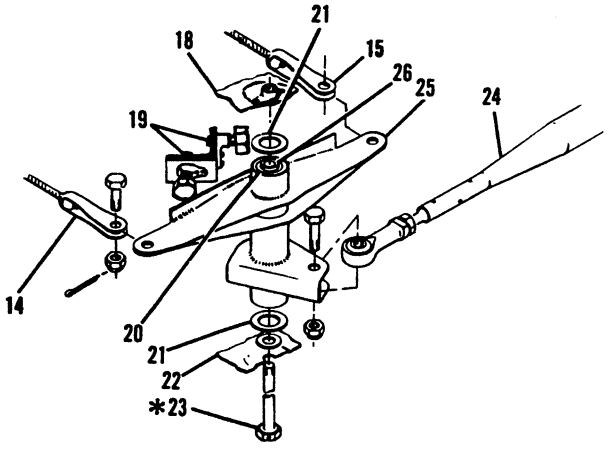
Detail **E**



Detail **F**



Detail **G**



Detail **H**

NOTE

Direction of stop bolts (19) may be reversed if rigging interference occurs.

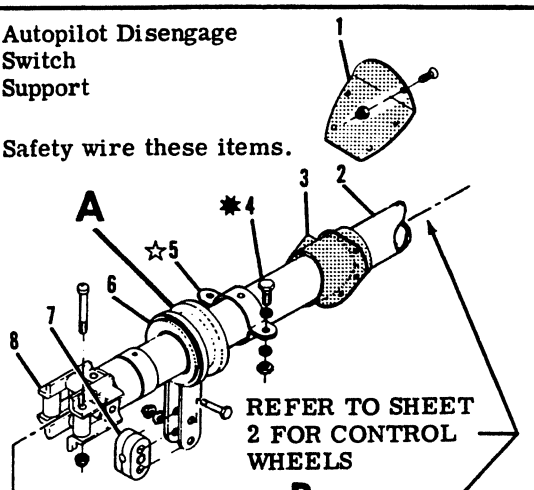
*Safety wire these items.

DETAILS D THRU H ARE TYPICAL
FOR LEFT AND RIGHT HAND SIDES

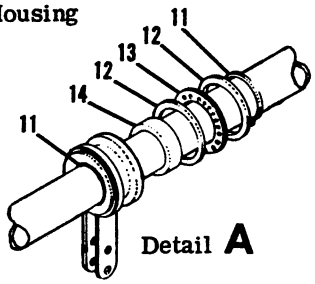
Figure 6-1. Aileron Control System (Sheet 2 of 2)

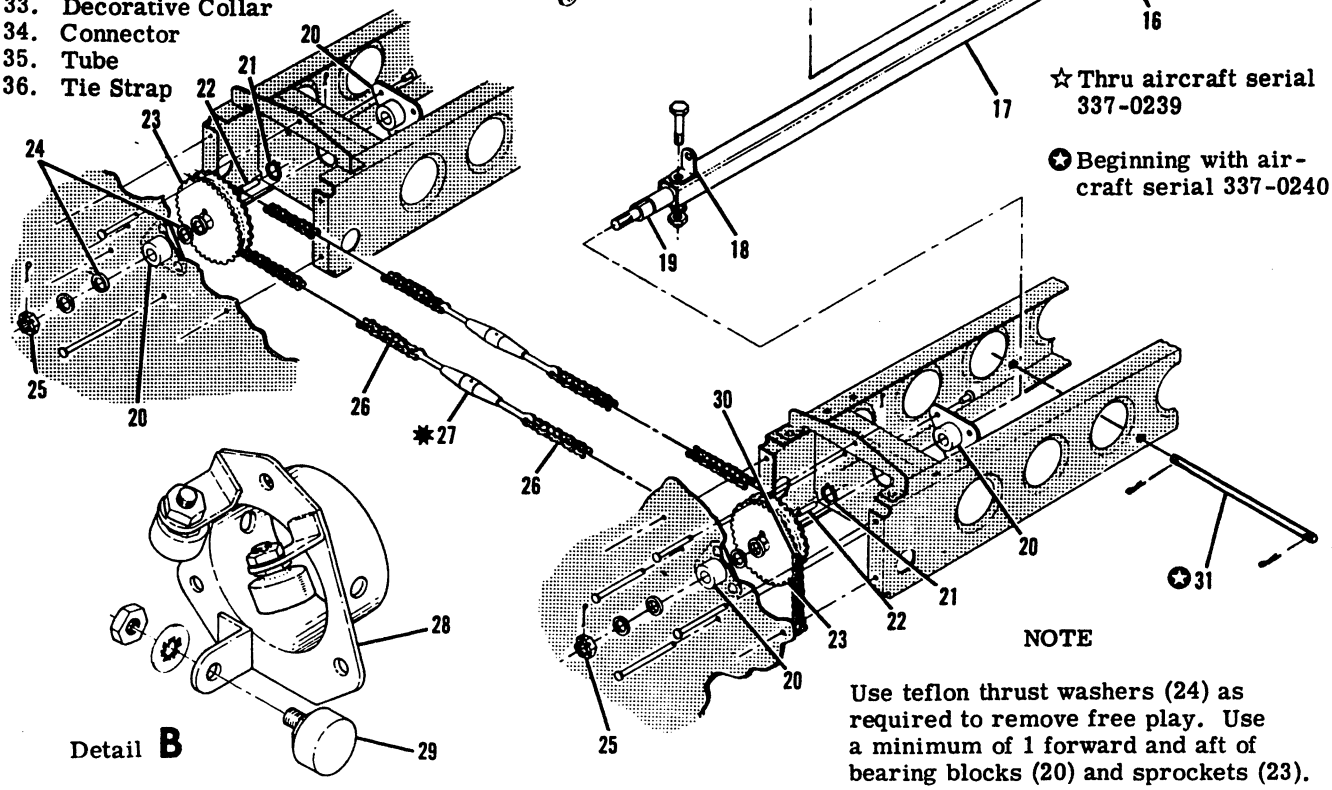
1. Single Controls Cover
2. Control Wheel Tube
3. Collar
4. Bolt
5. Clamp Halves
6. Sleeve Weld Assembly
7. Terminal Blocks
8. Roller Assembly
9. Stud
10. Collar
11. Retainer Ring
12. Thrust Bearing Race
13. Thrust Bearing
14. Needle Bearing
15. Adjustable Glide Plug
16. Glide Assembly
17. Control Tube Assembly
18. Forward Control Column Stop
19. Shaft
20. Bearing Block
21. Retainer Ring
22. Dowel Pin
23. Sprocket
24. Teflon Thrust Washer
25. Nut
26. Crossover Chain
27. Crossover Chain Turnbuckle
28. Bracket
29. Roller
30. Direct Chain
31. Aft Control Column Stop
32. Control Wheel
33. Decorative Collar
34. Connector
35. Tube
36. Tie Strap
37. Microphone Cable
38. Terminal Block
39. Cable Assembly
40. Relay
41. Socket
42. Fuse
43. Microphone Switch
44. Plug
45. Setscrew
46. Electric Trim Switch
47. Circuit Board Shield
48. Circuit Board Assembly
49. Insulator
50. Bracket
51. Pad
52. Map Light Assembly
53. Map Light Rheostat
54. Plate
55. Spacer
56. Rubber Cover
57. Adapter
58. Cover
59. Electric Trim Disengage Switch
60. Housing
61. Autopilot Disengage Switch
62. Support

✱Safety wire these items.



Beginning with aircraft serials 33701463 and F33700056





☆Thru aircraft serial 337-0239

✪Beginning with aircraft serial 337-0240

NOTE

Use teflon thrust washers (24) as required to remove free play. Use a minimum of 1 forward and aft of bearing blocks (20) and sprockets (23).

Figure 6-2. Control Column Installation (Sheet 1 of 2)

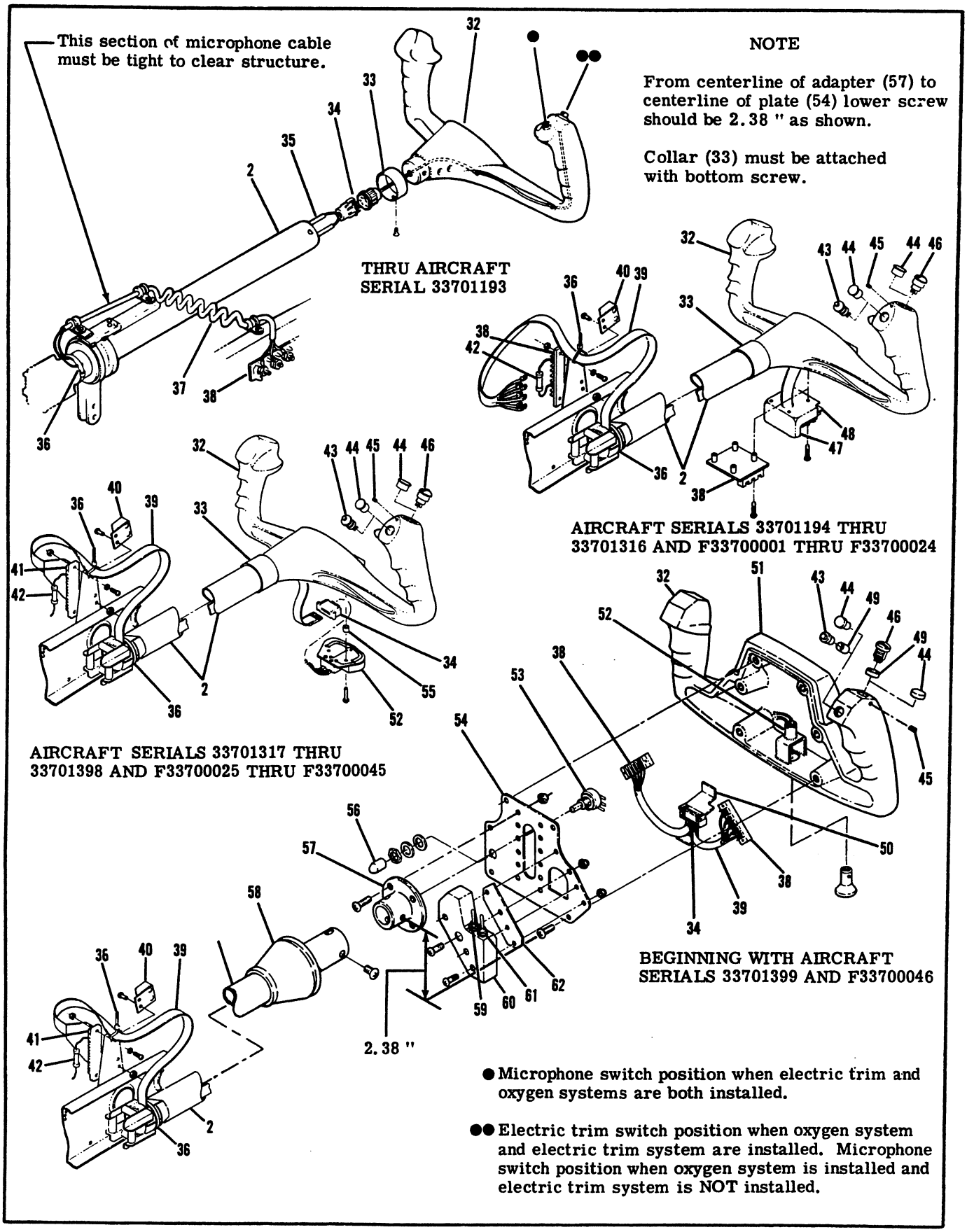


Figure 6-2. Control Column Installation (Sheet 2 of 2)

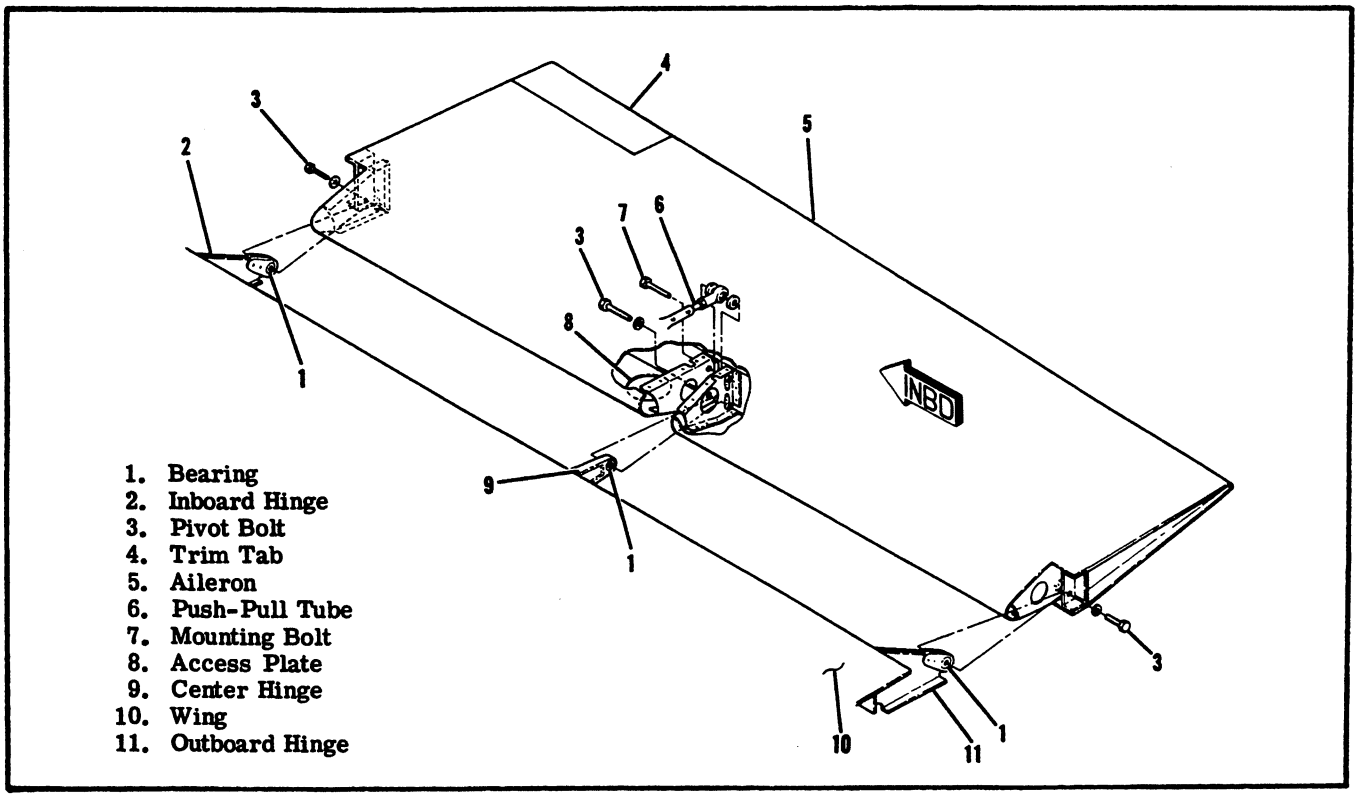


Figure 6-3. Aileron Installation

f. Reverse the preceding steps for reinstallation. If rigging was correct and push-pull tube rod end adjustment was not disturbed, it should not be necessary to re-rig system. Check aileron travel and alignment, re-rig if necessary, in accordance with paragraph 6-20. Install all items removed for access.

6-14. REPAIR. Aileron repair may be accomplished in accordance with instructions outlined in Section 16.

6-15. AILERON TRIM TABS. (Refer to figure 6-3.)

6-16. REMOVAL AND INSTALLATION.

a. Remove screws from lower side of tab.
b. Drill out rivets on upper side of tab.
c. Reverse the preceding steps for reinstallation.

6-17. ADJUSTMENT. Adjustment is accomplished by loosening the screws, shifting the tab trailing edge UP to correct for a wing-heavy condition or DOWN for a wing-light condition, then tightening the screws. Beginning with aircraft serial 337-0240 divide the correction equally on both tabs. When installing a new wing or aileron, set the tabs in neutral and adjust as necessary after flight test.

6-18. CABLES AND PULLEYS. (Refer to figure 6-1.)

6-19. REMOVAL AND INSTALLATION.

NOTE

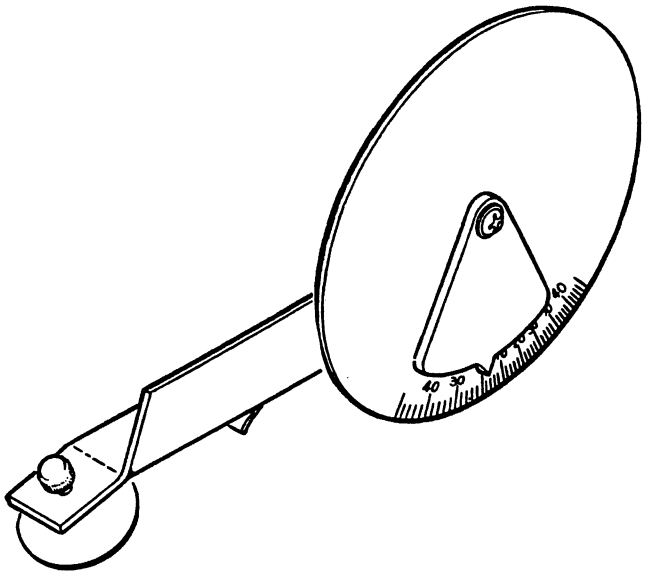
The following procedures are written for cables on the left side of the aircraft. Cables on the right side are removed in a similar manner.

a. DIRECT CABLE-INBOARD.

1. Remove seats and access plates as necessary to expose Details B and D.
2. Remove wing strut fairings as necessary to expose turnbuckle (13).
3. Remove safety wire and relieve cable tension at turnbuckle (13). Disconnect cable (12) end from turnbuckle barrel.
4. Disconnect cable (12) at clevis (11).
5. Remove cable guards and pulleys as necessary to work cable free of aircraft.

NOTE

To ease routing of cable, a length of wire may be attached to the end of cable before being withdrawn from the aircraft. Leave wire in place, routed through structure; then attach the cable being installed and use wire to pull cable into position.



AVAILABLE FROM CESSNA SERVICE PARTS CENTER (TOOL NO. SE 716)

Figure 6-4. Inclinometer for Measuring Control Surface Travel

6. After cable is routed in position, install pulleys and cable guards. Ensure cable is positioned properly through strut fairleads and in pulley grooves before installing guards.

7. Re-rig aileron system in accordance with paragraph 6-20, safety turnbuckle (13) and reinstall all items removed for access.

b. DIRECT CABLE-OUTBOARD.

1. Remove access plates as necessary to expose Details E, G and H.

2. Remove wing strut fairings as necessary to expose turnbuckle (13).

3. Remove safety wire and relieve cable tension at turnbuckle barrel.

4. Disconnect cable (15) at bellcrank (25).

5. Complete step 5 of subparagraph "a."

6. After cable is routed in position, install pulleys and cable guards. Ensure cable is positioned properly through strut fairleads and in pulley grooves before installing guards.

7. Re-rig aileron system in accordance with paragraph 6-20, safety turnbuckle (13) and reinstall all items removed for access.

c. CARRY-THRU CABLE.

1. Remove wing root fairings and access plates as necessary to expose Details E, F and H.

2. Remove headliner as necessary to expose turnbuckle (7).

3. Remove safety wire and relieve cable tension at turnbuckle (7). Disconnect cable (14) end from turnbuckle barrel.

4. Disconnect cable (14) at bellcrank (25).

5. Complete step 5 of subparagraph "a."

6. After cable is routed in position, install pulleys and cable guards. Ensure cable is positioned in pulley grooves before installing guards.

7. Re-rig aileron system in accordance with paragraph 6-20, safety turnbuckle (7) and reinstall all items removed for access.

6-20. RIGGING. (Refer to figure 6-1.)

a. Remove access plates and the outer plug button adjacent to bellcranks (25) on underside of wings.

b. Remove wing strut fairings and headliner as necessary to gain access to turnbuckles (7, 9 and 13).

c. Run flaps to full UP position.

d. With aileron faired (aileron trailing edge aligned with flap trailing edge), loosen jam nuts and adjust push-pull tube (24) so the nut securing the push-pull tube to the bellcrank is centered above the plug button hole. A 3/8" deep-socket, long enough to extend through the plug button hole when placed on the attaching nut, may be used as a rigging tool. Tighten jam nuts.

e. Complete step "d" for opposite push-pull tube.

f. Install the control lock to place pilot's control wheel in neutral position.

g. (Refer to figure 6-2.) Check that the direct chain (30) is engaged on the forward sprocket (23) and that the chain has approximately an equal number of links extending from the sprocket on both sides. If necessary, loosen the direct cable turnbuckles and reposition chain on sprocket.

h. (Refer to figure 6-1.) With the control lock still in place, adjust the direct and carry-thru cable turnbuckles to align both ailerons in neutral position and to obtain proper cable tension. Results to turnbuckle adjustments are as follows:

1. Loosening the carry-thru cable turnbuckle (7) and tightening either direct cable turnbuckle (9 or 13) will move the aileron for that particular side down.

2. Loosening the carry-thru cable turnbuckle (7) and tightening both direct cable turnbuckles (9 and 13) will move both ailerons down.

3. Loosening either direct cable turnbuckle (9 or 13) and tightening carry-thru cable turnbuckle (7) will move the aileron for that particular side up.

4. Loosening both direct cable turnbuckles (9 and 13) and tightening the carry-thru cable turnbuckle (7) will move both ailerons up.

i. (Refer to figure 6-2.) To synchronize the co-pilot's control wheel with the pilot's control wheel, adjust crossover chain turnbuckles (27) so that both control wheels are in neutral position with the control lock installed. Chain tension should be the minimum required to remove slack from chain.

j. (Refer to figure 6-1.) Remove control lock and adjust stop-bolts (19) at each bellcrank (25) to degree of travel specified in figure 1-1. If the thickness of the stop-bolt heads should interfere with rigging, the stop-bolts may be reversed in their nutplates.

NOTE

An inclinometer for measuring control surface travel is available from the Cessna Service Parts Center. Refer to figure 6-4.

k. Safety wire all turnbuckles, tighten all jam nuts and reinstall all items removed for access.

WARNING

Be sure ailerons move in the correct direction when operated by the control wheels.

SHOP NOTES: