SECTION 7

WING FLAP CONTROL SYSTEM

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7-1. WING FLAP CONTROL SYSTEM. (See figure 7-1.)

7-2. DESCRIPTION. The wing flap control system consists of the following: an electric drive motor and transmission assembly, drive pulleys and cables, push-pull rods, a follow-up control cable and a flap control lever/switch assembly mounted on the instrument panel. The drive motor and transmission assembly mounts directly to the right hand flap in the right wing and is connected to the left hand flap via cables. Switches mounted on the flap control lever assembly (refer to figure 7-3) control electric power to the motor and hence determine flap position and direction of travel. The switch assembly is linked to flap motion using the follow-up control, thus ensuring that the switches interrupt flap travel at the selected position. In addition, limit switches mounted on the motor/transmission assembly prevent over-travel at the full UP or DOWN positions. A final switch connect into the landing gear/stall warning circuit is set to actuate and warn the pilot when the flaps reach 25° with the landing gear still retracted.

7-3. OPERATIONAL CHECK.

a. Operate flaps through their full range of travel observing for uneven travel, jumpy motion, binding or lost motion. Ensure flaps are moving together through their full range of travel.

b. Check for positive shut-off of motor at flap travel extremes to prevent damage to actuator assembly.

c. With flaps full UP, mount an inclinometer on one flap and set to 0°. Lower flaps to full DOWN position and check flap angle as specified in figure 1-1. Check approximate mid-range percentage setting against degrees as indicated on inclinometer. Repeat the same procedure for opposite flap.

NOTE

An inclinometer for measuring control surface travel is available from the Cessna Supply Division. Refer to Section 6.

e. Remove access plates adjacent to flap drive pulleys and attempt to rock pulleys to check for bearing wear.

f. Inspect flap rollers and tracks for evidence of binding or defective parts.

7-4. TROUBLE SHOOTING.

NOTE

Due to remedy procedures in the following trouble shooting chart it may be necessary to re-rig system, refer to paragraphs 7-18 and 7-19.

TROUBLE	PROBABLE CAUSE	REMEDY
BOTH FLAPS FAIL TO MOVE.	Open circuit breaker.	Reset and check continuity. Replace breaker if defective.
	Defective switch.	Place jumper across switch. Replace switch if defective.
	Defective motor.	Remove and bench test. Replace motor if defective.
	Broken or disconnected wires.	Run continuity check of wiring. Connect or repair wiring as necessary.
	Disconnected or defective transmission.	Connect transmission. Remove, bench test and replace transmission if defective.
	Defective limit switch.	Check continuity of switches. Replace switches found defective.
	Follow-up control disconnected or slipping.	Secure control or replace if defective.
BINDING IN SYSTEM AS FLAPS ARE RAISED AND LOWERED.	Cables not riding on pulleys.	Open access plates and observe pulleys. Route cables correctly over pulleys.
	Bind in drive pulleys.	Check drive pulleys in motion. Replace drive pulleys found defective.
	Broken or binding pulleys.	Check pulleys for free rotation or breaks. Replace defective pulleys.
	Frayed cable.	Check condition of cables. Replace defective cables.
	Flaps binding on tracks.	Observe flap tracks and rollers. Replace defective parts.

7-4. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
LEFT FLAP FAILS TO MOVE.	Disconnected or broken cable.	Check cable tension. Connect or replace cable.
	Disconnected push-pull rod.	Attach push-pull rod.
FLAPS FAIL TO RETRACT.	Disconnected or defective flaps UP operating switch.	Check continuity of switch. Connect or replace switch.
FLAPS FAIL TO EXTEND.	Disconnected or defective flaps DOWN operating switch.	Check continuity of switch. Connect or replace switch.
INCORRECT FLAP TRAVEL.	Incorrect rigging.	Refer to paragraph 7-18.

7-5. FLAP MOTOR AND TRANSMISSION ASSEMBLY.

7-6. REMOVAL AND INSTALLATION. (See figure 7-2.)

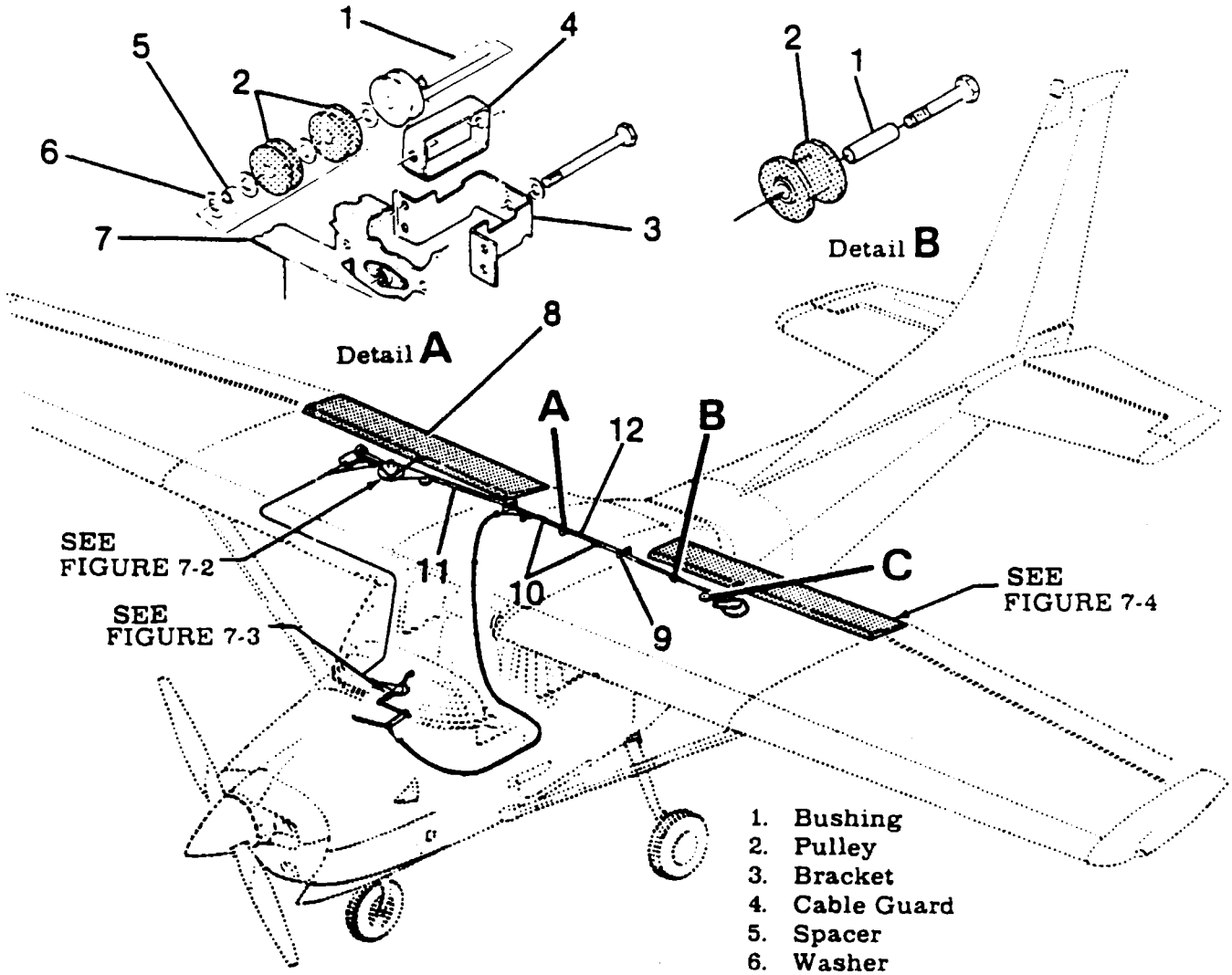
a. Run flaps to full DOWN position.
b. Disconnect battery ground cable and insulate terminal as a safety precaution.
c. Remove access plates beneath flap motor and transmission assembly in right wing.

NOTE

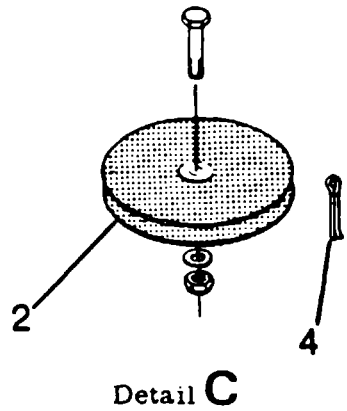
Flap motor (9), transmission (7), hinge assembly (10) and actuating tube (5) are removed from the aircraft as a unit. On aircraft equipped with long range fuel tank, it may be easier to detach motor and transmission assembly from other components before removal from wing.

d. Remove bolt (20) securing actuating tube (5) to drive pulley (13).
e. Screw actuating tube (5) in toward transmission (7) as far as possible by hand.
f. Remove bolt securing flap motor hinge (10) to wing. Retain brass washer between hinge and wing structure for use on reinstallation.
g. Disconnect motor electrical leads at quick-disconnects.
h. Disconnect wiring at limit switches (23 and 26).
i. Carefully work assembly from wing through access opening.
j. Reverse preceding steps for reinstallation. If hinge assembly (10) was removed from the transmission (7) for any reason, ensure that short end of hinge is reinstalled toward the top.
k. Use Loctite grade CV adhesive on threads of setscrew (6) and collar (24) whenever actuating tube (5) is removed. Torque setscrew to 40 inch-pounds.
l. Complete operational check as outlined in paragraph 7-3 and rerig system in accordance with paragraph 7-18 and 7-19.

7-7. REPAIR. Repair consists of replacement of motor, transmission, actuating tube and associated hardware. Bearings in hinge assembly may also be replaced. Lubricate as outlined in Section 2.



1. Bushing
2. Pulley
3. Bracket
4. Cable Guard
5. Spacer
6. Washer
7. Rear Spar
8. Flap
9. Rub Strip
10. Turnbuckle
11. Retract Cable
12. Direct Cable



Detail C

CAUTION

MAINTAIN SPECIFIED CONTROL CABLE TENSION

CABLE TENSION

THRU R18201384 & FR18200070
70 LBS ± 10 LBS
BEGINNING WITH R18201385
35 LBS ± 5 LBS
AT AVERAGE TEMPERATURE FOR THE AREA

SEE FIGURE 1-1 FOR TRAVEL.

Figure 7-1. Wing Flap Control System

7-8. FLAP CONTROL LEVER. (See figure 7-3.)

7-9. REMOVAL AND INSTALLATION.

a. Remove follow-up control torque tube (17) from switch mounting arm (23).
b. Remove flap operating switches (22 and 24) from switch mounting arm (23). DO NOT disconnect electrical wiring at switches.
c. Remove knob (15) from control lever (14).
d. Remove remaining items by removing bolt (27). Use care not to drop parts into tunnel area.
e. Reverse the preceding steps for reinstallation. Do not overtighten bolt (27) causing lever (14) to bind. Rig system in accordance with paragraphs 7-18 and 7-19.

NOTE

Ensure that insulators (21) are installed between switches (22 and 24) and switch mounting arm (23). Apply Loctite grade "c" sealant to threads of knob (15) on installation. Torque clamp nut (8) to 40-50 inch pounds and lock with second nut.

f. Rig system in accordance with paragraphs 7-18 and 7-19.

7-10. DRIVE PULLEYS. (See figure 7-2.)

7-11. REMOVAL AND INSTALLATION.

a. Remove access plate adjacent to drive pulley (13) in right wing.
b. Unzip or remove headliner as necessary for access to turnbuckles (index 6, figure 7-1). remove safety wire and loosen turnbuckles.
c. Remove bolt (19) securing flap push-pull rod (14) to drive pulley (13) and lower RIGHT flap gently.
d. Remove Bolt (20) securing actuating tube (5) to drive pulley (13) lower flap gently. Retain bushing.
e. Remove cable locks (12) securing control cables to drive pulley (13). Tag cables for reference on reinstallation.
f. Remove bolt (11) attaching drive pulley (13) to wing structure.
g. Using care, remove drive pulley through access opening, being careful not to drop bushing. Retain brass washer between drive pulley and wing structure for use on reinstallation. Tape open ends of drive pulley after removal to protect bearings.
h. To remove left wing drive pulley, use this same procedure omitting step "d".
i. Reverse the preceding steps for reinstallation. Rig system in accordance with paragraph 7-18. Safety turnbuckles and reinstall all items removed for access.

7-12. REPAIR. Repair is limited to replacement of bearings. Cracked, bent or excessively worn drive pulleys must be replaced. Lubricate bearings as outlined Section 2.

7-13. FLAPS. (See figure 7-4.)

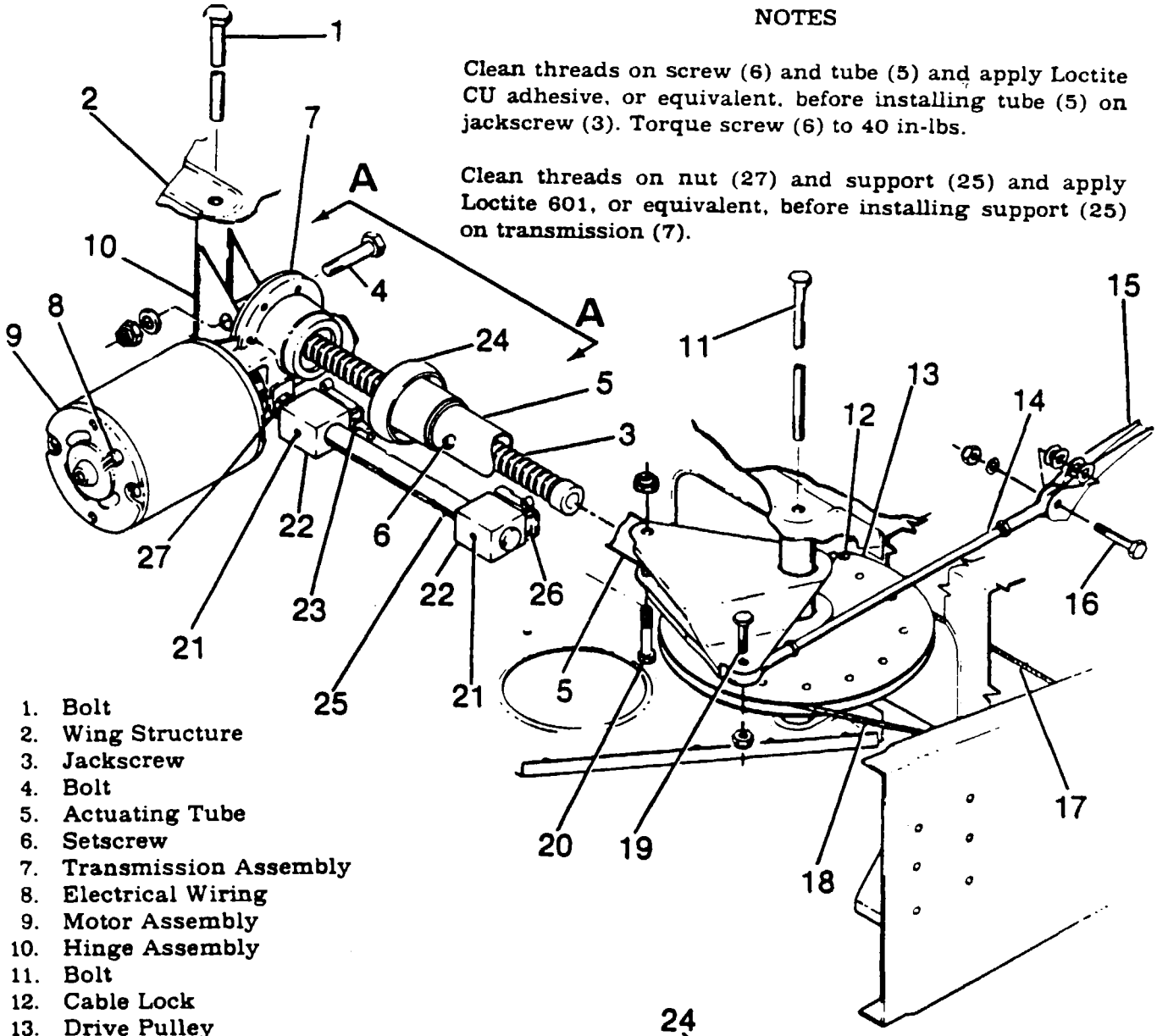
7-14. REMOVAL AND INSTALLATION.

a. Run flaps to full DOWN position.
b. Remove access plates (1) from top leading edge of flap.
c. Disconnect push-pull rod (6) at flap bracket (7).

NOTES

Clean threads on screw (6) and tube (5) and apply Loctite CU adhesive, or equivalent, before installing tube (5) on jackscrew (3). Torque screw (6) to 40 in-lbs.

Clean threads on nut (27) and support (25) and apply Loctite 601, or equivalent, before installing support (25) on transmission (7).



1. Bolt
2. Wing Structure
3. Jackscrew
4. Bolt
5. Actuating Tube
6. Setscrew
7. Transmission Assembly
8. Electrical Wiring
9. Motor Assembly
10. Hinge Assembly
11. Bolt
12. Cable Lock
13. Drive Pulley
14. Push-Pull Rod
15. Attach Bracket
16. Bolt
17. Direct Cable
18. Retract Cable
19. Bolt
20. Bolt
21. Setscrew
22. Switch Adjustment Block
23. Up-Limit Switch
24. Switch Actuating Collar
25. Support
26. Down-Limit Switch
27. Nut

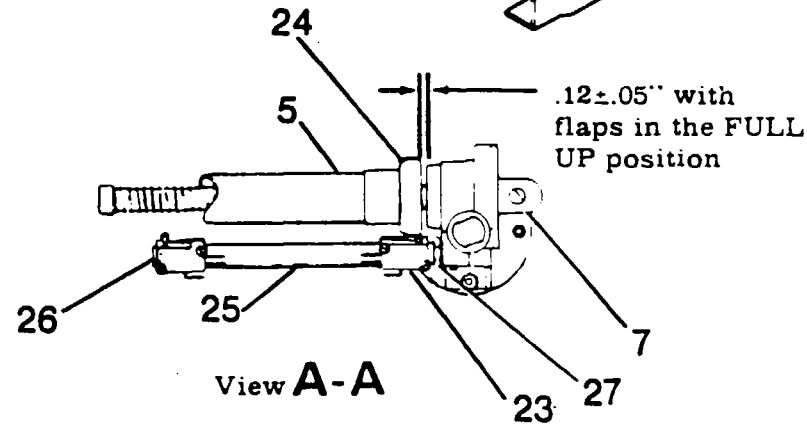
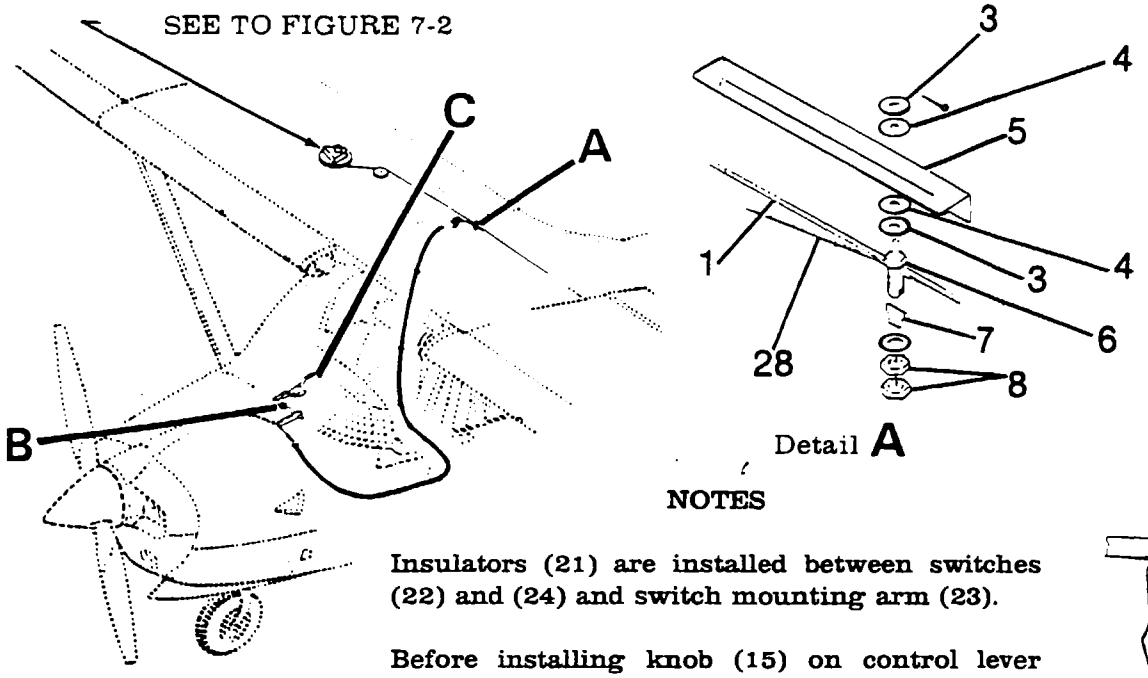
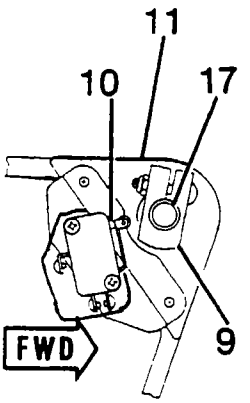


Figure 7-2. Flap Motor and Transmission Installation





NOTES

Insulators (21) are installed between switches (22) and (24) and switch mounting arm (23).

Before installing knob (15) on control lever (14), clean threads on control control lever with MEK or equivalent. After threads have thoroughly dried, prime with grade T primer, and allow primer to flash off or dry from three to five minutes. Apply grade CU Loctite (MIL-S-22473) Loctite 271, STA-LOK Catalog No. 800, or equivalent to threads of control lever (14). Install knob (15) and allow Loctite to cure from five to 20 minutes before service use.

1. Retract Cable
2. Clevis
3. Metal Washer
4. Teflon Washer
5. Guide
6. Clamp Assembly
7. Clamp Bar
8. Clamp Nut
9. Cam
10. Switch
11. Pedestal Structure
12. Washer
13. Cam
14. Control Lever
15. Knob
16. Bracket
17. Torque Tube
18. Spring
19. Arm Assembly
20. Position Indicator
21. Insulator
22. Flaps UP Operating Switch
23. Switch Mounting Arm
24. Flaps DOWN Operating Switch
25. Support
26. Bracket
27. Bolt
28. Follow-Up Cable
29. Bushing

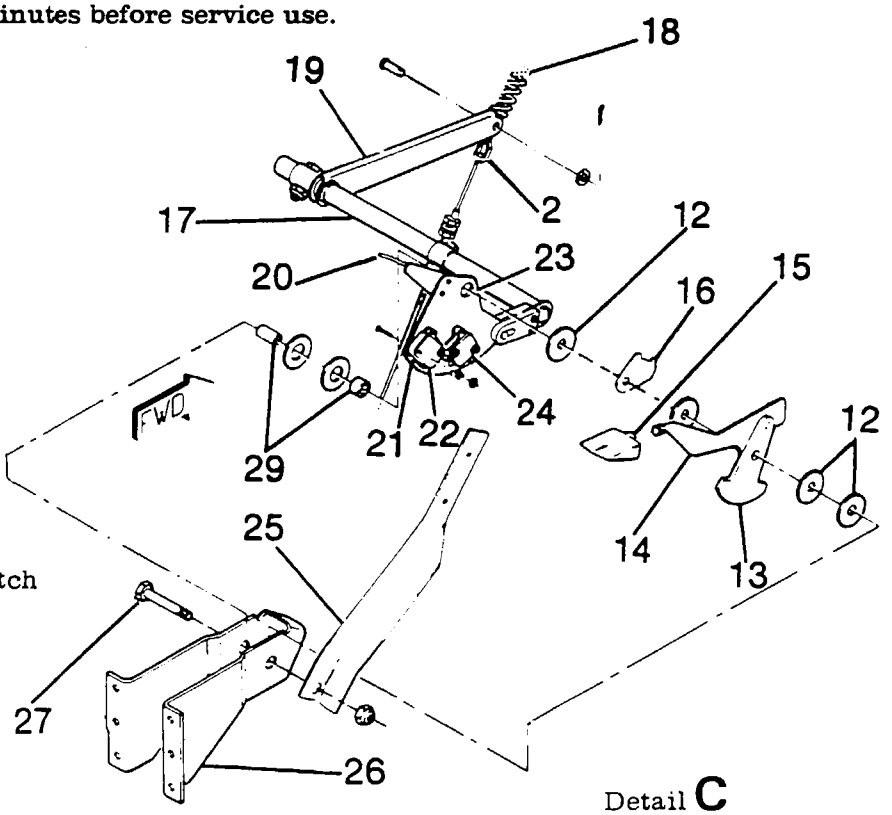
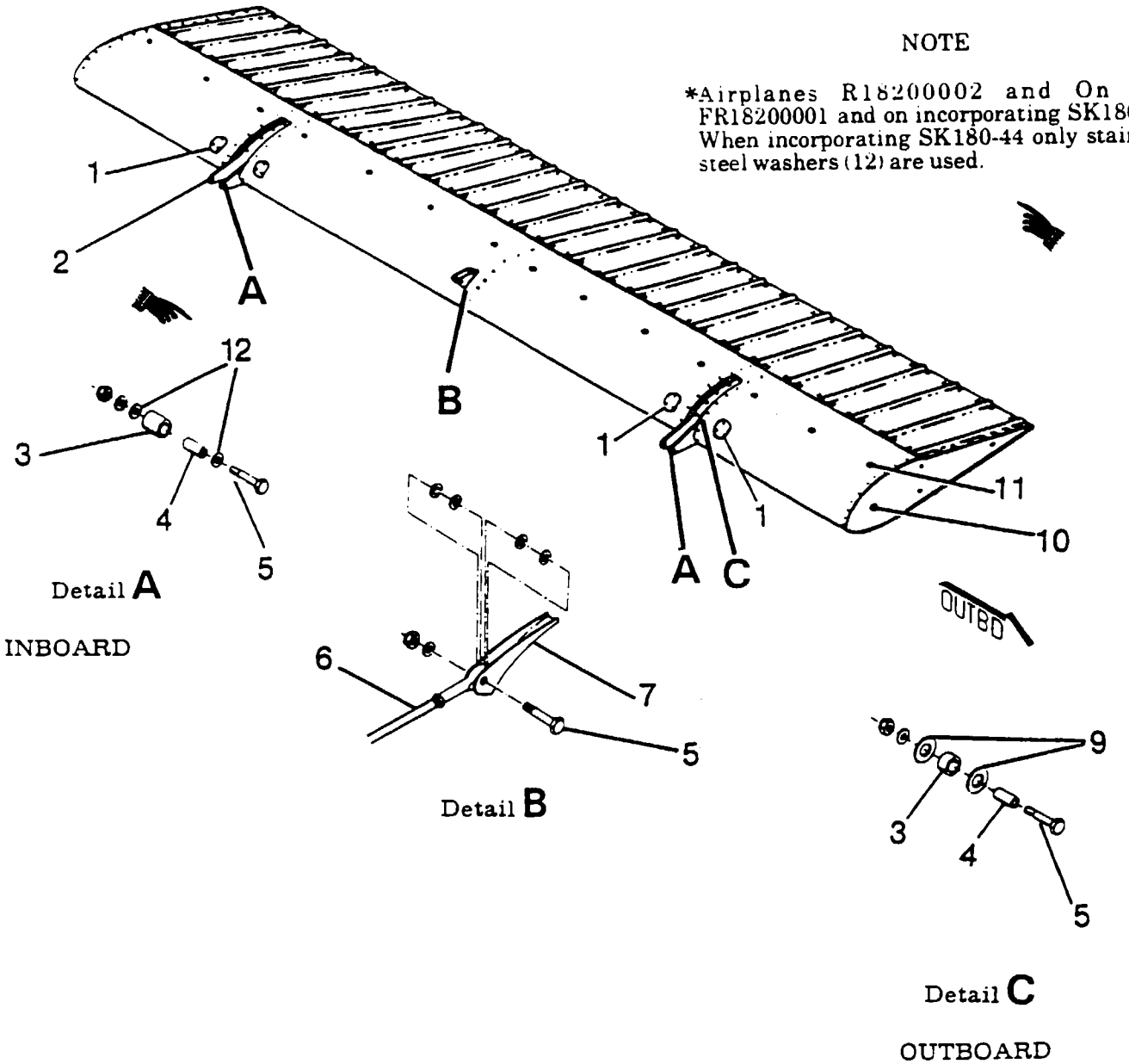


Figure 7-3. Flap Control Lever and Follow-Up Installation



1. Access Plate
2. Flap Support
3. Roller Assembly
4. Bushing
5. Bolt
6. Push-Pull Rod
7. Flap Bracket
8. Bolt
9. Spacer
10. Plug Button
11. Nylon Plug Button
12. Stainless Steel Washer *

NOTE

Beginning with serial R18202012 access plates (1) are enlarged and attached with recessed head screws in place of truss head screws.

Figure 7-4. Flap Installation

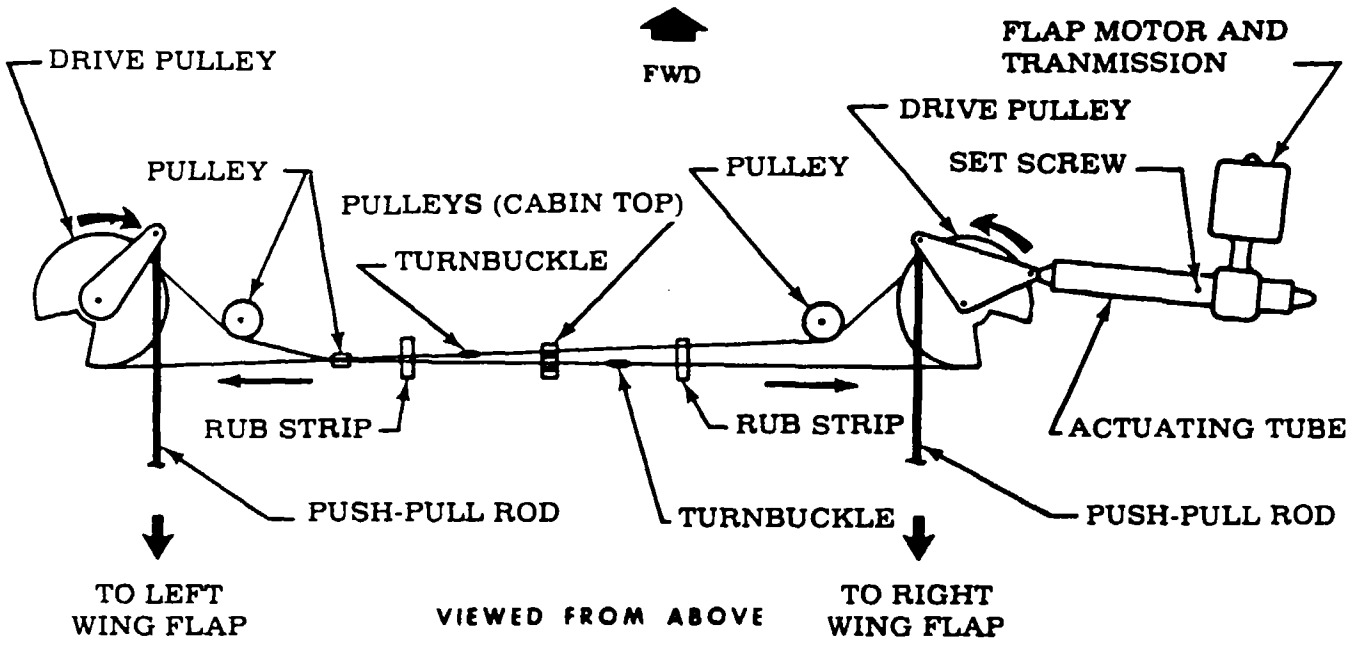


Figure 7-5. Flap System Schematic

d. Remove bolts (5) at each flap track. As flap is removed from wing, all washers, rollers and bushings will fall free. Retain these for reinstallation.
e. Reverse the preceding steps for reinstallation. If push-pull rod (6) adjustment is not disturbed, re-rigging of system should not be necessary. Check flap travel and rig in accordance with paragraph 7-18, if necessary.

NOTE

Bushings (4), rollers (3) and spacers (9) are first positioned through slots in flap tracks, then are secured to the flap roller supports (2) with attaching bolts, washers and nuts. Nylon plug buttons (11) prevent wing flap from chafing with trailing edge. Position spacers (9) and direction of bolts (5) as required to provide adequate flap clearance at wing root, flap well skin and aileron. Some lateral movement of flap is inherant due to the width of rollers. This movement should be considered when positioning spacers and direction of bolts.

7-15. REPAIR. (Refer to Section 17.)

7-16. CABLES AND PULLEYS. (See figure 7-1.)

7-17. REMOVAL AND INSTALLATION.

a. Remove access plates, fairings, headliner and upholstery as necessary for access.
b. If retract cable (11) is to be removed, disconnect follow-up cable at clamp (index 6, figure 7-3).
c. Remove safety wire, relieve cable tension, disconnect turnbuckles (6) and carefully lower LEFT flap.
d. Disconnect cables at drive pulleys, remove cable guards and pulleys as necessary to work cables free of aircraft.

NOTE

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

e. Reverse the preceding steps for reinstallation.
f. After cables are routed in position, install pulleys and cable guards. Ensure cables are positioned in pulley grooves before installing guards.
g. Re-rig flap system in accordance with paragraph 7-18 and safety turnbuckles.
h. Re-rig follow-up system in accordance with paragraph 7-19 and reinstall all items removed in step "a".

7-18. RIGGING FLAPS. (See figure 7-2.)

a. Unzip or remove headliner as necessary for access to turnbuckles (index 10, figure 7-1).
b. Remove safety wire, relieve cable tension, disconnect turnbuckles and carefully lower LEFT flap.
c. Disconnect push-pull rods (14) at drive pulleys (13) in both wings and lower RIGHT flap gently.
d. Disconnect actuating tube (5) from drive pulley (13).

NOTE

If control cables are not connected to left and right drive pulleys, actuating tube (5) and push-pull rods (14) must be disconnected before installing cables. If drive pulleys (13) are not installed, attach control cables before installing drive pulleys in the wings as illustrated in figure 7-5.

e. The 3/32 inch retract cable connects to the forward side of the right drive pulley and to the aft side of the left drive pulley. The 1/8 inch direct cable connects to the aft side of the right drive pulley and to the forward side of the left drive pulley.
f. Adjust both push-pull rods (14) to 8.83±.12 inches between centers of rod end bearings and tighten locknuts on both ends. Connect push-pull rods to flaps and drive pulleys.

NOTE

Temporarily connect cables at turnbuckles (index 10, figure 7-1) and test flaps by hand to ensure both flaps extend and retract together. If they will not, the cables are incorrectly attached to the drive pulleys. Ensure that the right drive pulley rotates clockwise, when viewed from below, as the flaps are extended. Tag cables for reference and disconnect turnbuckles again.

g. Screw actuating tube (5) IN toward transmission (7) by hand to .12±.05 inches between switch actuating collar (24) and transmission as illustrated in VIEW A-A. Loosen setscrew (6) securing actuating tube (5) to switch actuating collar (24), hold actuating collar to maintain .12±.05 inches, hold RIGHT flap in the full UP position and adjust actuating tube (5) IN or OUT as necessary to align with attachment hole in drive pulley (13). Tighten setscrew (6) in accordance with procedures outlined in the following note and secure tube to drive pulley with bolt (20).

NOTE

Apply Loctite grade CV sealant to threads of setscrew (6) and torque to 40 inch-pounds.

If actuating tube (5) is too long to allow attachment to drive pulley after completion of step "g", proceed to step "h".

h. Disconnect push-pull rod (14) at drive pulley (13), then connect actuating tube (5) to drive pulley.

i. Manually hold RIGHT flap in full UP position and readjust push-pull rod (14) to align with attachment hole in drive pulley. Connect push-pull rod and tighten locknuts.

NOTE

The right flap and actuator must be correctly rigged before cables and left flap can be rigged.

j. Mount an inclinometer on trailing edge of RIGHT flap.

NOTE

An inclinometer for measuring control surface travel is available from the Cessna Supply Division. Refer to Section 6.

k. With RIGHT flap in full UP position, loosen setscrew (21) and slide UP limit switch (23) and adjustment block (22) on support (25) to activate switch and shut off electrical power to motor at this position. Tighten setscrew (21).

l. Run RIGHT flap full DOWN position and adjust DOWN limit switch (26) to activate and shut off motor at degree of travel specified in figure 1-1. Tighten setscrew (21).

m. Run RIGHT flap to full UP position, manually hold LEFT flap full UP and connect control cables at turnbuckles (index 10, figure 7-1). Remove reference tags previously installed in step "f" as turnbuckles are connected.

n. With flaps full UP, adjust turnbuckles to obtain 70 ± 10 pounds tension on cables thru R18201384 and FR18200070. Beginning with R18201385 and on, maintain 35 ± 5 pounds cable tension.

NOTE

Ensure cables are positioned in pulley grooves and cable ends are positioned correctly at drive pulleys before tightening turnbuckles.

o. Disconnect push-pull rod at left drive pulley. Run motor to extend flaps approximately 20° and check tension on each flap cable. If necessary, readjust turnbuckles to maintain 70 ± 10 pounds tension thru R18201384 and FR18200070. Beginning with R18201385 and on, maintain 35 ± 5 pounds cable tension.

p. Fully retract right flap. Manually hold left flap in full up position and readjust push-pull rod to align with attaching hole in drive pulley. Connect push-pull rod and tighten locknuts.

q. After completion of steps "a" thru "p", operate flaps and check for positive shut off of flap motor through several cycles. Check for specified flap travel with inclinometer mounted on each flap separately.

NOTE

Since the flap rollers may not bottom in the flap tracks with flaps fully extended, some free play may be noticed in this position.

7-19. RIGGING-FLAP CONTROL LEVER AND FOLLOW-UP. (See figure 7-3.)

NOTE

Flaps must be rigged per paragraph 7-18 prior to rigging flap follow-up system.

a. Run flaps to full UP position.
b. Remove upholstery and headliner as necessary.
c. Disconnect follow-up cable (28) from flap retract cable (1) at clamp (6).
d. With position indicator (20) in full UP position, pull all slack from follow-up control cable (28) and secure follow-up cable (28) to retract cable (1) with clamp assembly (6). Torque clamp nut (26) to 40-50 inch-pounds and lock with second nut.
e. With control lever (14) in full up position, adjust switches (22 and 24) in slotted holes until cam (13) is centered between switch rollers.
f. Mount an inclinometer on trailing edge of one flap and set to 0°. Turn master switch ON and move control lever to 10° position. If flap travel is more than 10° ±2°, adjust flaps DOWN operating switch (24) away from cam (13) and recycle flaps. If flap travel is less than 10° ±2°, adjust flaps DOWN operating switch (24) closer to cam (13) and recycles.

NOTE

An inclinometer for measuring control surface travel is available from the Cessna Supply Division. Refer to figure Section 6.

g. Repeat step "f" for 20° flap position (flap travel: 20° ±2°).
h. Adjust flaps UP operating switch (22) in slotted holes for .062 inch clearance between switch roller and cam (13) when the flaps DOWN operating switch has just opened in the 10° and 20° position.

NOTE

Flap travel on UP cycle may deviate a maximum of 4° from indicated position.

i. Adjust flap/landing gear warning switch cam (9) on torque tube (17) to close switch (10) with flaps down 25°.
j. Run flaps through several complete cycles and check indicator (20) for smoothness of operation.
k. Reinstall all items removed for access.