

SECTION 12

PROPELLERS AND PROPELLER GOVERNORS

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12-1. PROPELLERS. (Refer to figure 12-1.)

12-2. DESCRIPTION. The aircraft is equipped with McCauley all-metal, constant-speed, full-feathering, governor-regulated, two-bladed propellers employing a six bolt flange mount hub. The front propeller is a tractor-type and the rear propeller is a pusher-type. The front propeller rotates clockwise as viewed from the rear of the aircraft, while the rear propeller, equipped with left hand blades, rotates counterclockwise as viewed from the rear of the aircraft. Both propellers operate in the same manner. Each propeller is single-acting in which oil pressure from its engine, boosted and regulated by a governor, is used to decrease blade pitch while the forces produced by external counterweights and internal springs are used to increase blade pitch and to feather. An internal, pressure-operated latching mechanism prevents feathering during engine shutdown. Beginning with aircraft serials 33701195 and F33700001, a new centrifugal feathering latch is installed in the propellers. The function of the new latch depends on spring tension and centrifugal force thereby eliminating the variables of differential oil pressure used by the propeller on the earlier model-years. Beginning with aircraft serials 33701317 and

F33700025, a new threadless blade propeller is installed. With this design, the blades use split retaining rings which are assembled around the blade base after the blade is assembled into the propeller hub. Unfeathering the propeller is accomplished by placing the propeller control lever forward of the feathered position and rotating the blades to low pitch position, or by starting the engine with the propeller control lever forward of the feathered position. An optional unfeathering system, discussed later, may be installed. Also, an optional automatic propeller synchronizing system, discussed later, may be installed. Refer to Section 13 for the propeller anti-ice system which may be installed as optional equipment.

12-3. REPAIR. Metal propeller repair first involves evaluating the damage and determining whether the repair will be a major or minor one. Federal Aviation Regulations, Part 43 (FAR 43), and Federal Aviation Agency, Advisory Circular No. 43.13 (FAA AC No. 43.13), define major and minor repairs, alterations and who may accomplish them. When making repairs or alterations to a propeller FAR 43, FAA AC No. 43.13 and the propeller manufacturer's instructions must be observed.

12-4. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
FAILURE TO CHANGE PITCH.	Governor control disconnected or broken.	Connect or replace control.
	Governor not correct for propeller. (Sensing wrong.)	Replace governor.
	Defective governor.	Refer to paragraph 12-9.
	Defective pitch changing mechanism inside propeller or excessive propeller blade friction.	Check propeller manually, repair or replace as required.
FAILURE TO CHANGE PITCH FULLY.	Improper rigging of governor control.	Check that governor control arm and control have full travel. Rig control and arm as required.
	Defective governor.	Refer to paragraph 12-9.
SLUGGISH RESPONSE TO PROPELLER CONTROL.	Excessive friction in pitch changing mechanism inside propeller or excessive blade friction.	Check propeller manually, repair or replace as required.
STATIC RPM TOO HIGH.	Governor high-rpm stop set too high.	Refer to paragraph 12-12.
	Defective governor.	Refer to paragraph 12-9.
	Incorrect propeller or incorrect low pitch blade angle.	Check aircraft specification and install correct propeller with correct blade angle.
STATIC RPM TOO LOW.	Governor high-rpm stop set too low.	Refer to paragraph 12-12.
	Defective governor.	Refer to paragraph 12-9.
	Incorrect propeller or incorrect low pitch blade angle.	Check aircraft specification and install correct propeller with correct blade angle.
ENGINE SPEED WILL NOT STABILIZE.	Sludge in governor.	Refer to paragraph 12-9.
	Air trapped in propeller actuating cylinder.	Trapped air should be purged by exercising the propeller several times prior to take-off, after propeller has been re-installed or has been idle for an extended period.
	Excessive friction in pitch changing mechanism inside propeller or excessive blade friction.	Check propeller manually, repair or replace as required.
	Defective governor.	Refer to paragraph 12-9.

12-4. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
OIL LEAKAGE AT PROPELLER MOUNTING FLANGE.	Damaged O-ring seal between engine crankshaft flange and propeller.	Remove propeller and install new O-ring seal.
	Foreign material between engine crankshaft flange and propeller mating surfaces or mounting nuts not tight.	Remove propeller and clean mating surfaces; install new O-ring and tighten mounting nuts evenly to torque value shown in figure 12-1.
OIL LEAKAGE AT ANY OTHER PLACE.	Defective seals, gaskets, threads, etc., or incorrect assembly.	Propeller repair or replacement is required.
FAILURE TO FEATHER OR UNFEATHER.	Defective governor.	Refer to paragraph 12-9.
	Defective pitch changing mechanism or excessive blade friction.	Check propeller manually, repair or replace as required.
	Incorrect rigging of governor control.	Check that arm on governor has full travel. Rig in accordance with Section 10.
	Defective latching mechanism inside propeller.	Propeller repair or replacement is required.
PROPELLER FEATHERS DURING ENGINE SHUT-DOWN.	Latching mechanism does not engage.	A propeller may occasionally feather during shut-down. If this occurs repeatedly, the latching mechanism is defective. Repair or replace as required.

12-5. REMOVAL. (Refer to figure 12-1.)

a. Start engines, feather propellers and shut down engines. Propellers should be removed in the "FEATHERED" positions.

b. If optional unfeathering systems are installed, dissipate system pressure as follows:

1. After the front propeller has been feathered and the front engine shut down, move front propeller control out of "FEATHER" position until blades start to unfeather, then quickly pull the control back into "FEATHER."

2. Continue to "milk" pressure out of the system with the propeller control until the propeller blades will no longer move. This may require from 15 to 20 movements of the propeller control.

3. Do not allow propeller blades to rotate far enough to let high pitch latches engage, or engine will have to be restarted, propeller feathered again and the procedure repeated.

4. After the front propeller has been feathered and system pressure dissipated, repeat the procedure to place the rear propeller in the feathered position with system pressure dissipated.

NOTE

Either the front or rear engine propeller and propeller spinner may be removed as a complete unit.

c. If spinner is to be removed, remove attaching screws and remove spinner, spinner support and spacers. Retain any spacers behind spinner support.

d. (Front propeller.) Remove cowling and nose cap as necessary to gain access to propeller attaching nuts. Either the right or left nose cap may be removed.

e. (Rear propeller.) Remove cowl side panels and tail cap as necessary to gain access to propeller attaching nuts.

f. Loosen propeller mounting nuts until they contact the crankcase, then pull propeller away from crankcase until halted by mounting nuts.

NOTE

As the propeller is separated from the engine, oil will drain from the propeller and crankshaft cavities.

g. Remove propeller mounting nuts and washers and pull propeller forward to remove from engine crankshaft.

h. If desired the propeller spinner bulkhead may be removed from the propeller by removing the attaching bolts.

12-6. INSTALLATION. (Refer to figure 12-1.)

a. If removed, install spinner bulkhead on propeller hub. Align blade cutouts in bulkhead fillet with propeller blades.

b. Clean propeller hub and engine crankshaft cavities and mating surfaces.

c. Lightly lubricate a new O-ring and engine crankshaft pilot with clean engine oil and install O-ring in propeller hub.

d. Align propeller mounting studs and dowel pins with correct holes in engine crankshaft flange and slide propeller over crankshaft pilot until hub flange is approximately 1/4 inch from crankshaft flange.

e. Install propeller attaching washers and nuts and work propeller aft as far as possible, then tighten nuts evenly and torque to 55-65 lb ft.

f. Install spacers and spinner support. The spacers are used as required (maximum of 4) to cause a snug fit between the support and the spinner.

g. Install spinner and cowling removed for access.

12-7. PROPELLER GOVERNORS.

12-8. DESCRIPTION. The propeller governor is a single-acting, centrifugal type, which boosts oil pressure from the engine and directs it to the propeller where the oil is used to increase blade pitch. A single-acting governor uses oil pressure to effect a pitch change in one direction only; a pitch change in the opposite direction results from a combination of centrifugal twisting moment of rotating blades and compressed springs. Oil pressure is boosted in the governor by a gear type oil pump. A pilot valve, fly weights and speeder spring act together to open and close governor oil passages as required to maintain a constant engine speed.

NOTE

Whether oil pressure is used to increase or decrease blade pitch cannot be determined by the outward physical appearance of the governors. Always be sure the correct governors, with correct part numbers, are used.

12-9. TROUBLE SHOOTING. When trouble shooting a propeller-governor combination, it is recommended that a governor known to be in good condition be installed to check whether the propeller or the governor is at fault. Removal and replacement, high-speed stop adjustment, desludging and replacement of the mounting gasket are not major repairs and may be accomplished in the field. Repairs to governors are classed as propeller major repairs in Federal Aviation Regulations, which also define who may accomplish such repairs.

12-10. REMOVAL.

a. Remove cowling and baffles as required for access.

b. If an optional unfeathering system is not installed, place propeller control in high rpm-position.

c. Disconnect propeller control from governor.

NOTE

Note position of all washers so that washers may be installed in the same position on re-installation.

d. If an optional unfeathering system is installed, release accumulator pressure, then disconnect accumulator hose from governor fitting.

CAUTION

Always release accumulator pressure through filler valve, before disconnecting hose between accumulator and governor or removing accumulator.

e. If an optional propeller synchronizing system is installed, remove the magnetic pick-up from governor.

f. Remove nuts and washers securing governor and pull governor from mounting studs.

g. Remove gasket between governor and engine mounting pad.

12-11. INSTALLATION.

a. Wipe governor and engine mounting pad clean.

b. Install a new gasket, with the raised surface of the screen away from the engine pad.

c. Position governor on mounting studs, aligning governor splines with splines in engine and install mounting washers and nuts. Do not force spline engagement. Rotate engine crankshaft and splines will engage smoothly when aligned.

d. If an optional unfeathering system is installed, connect accumulator hose to governor and recharge the accumulator.

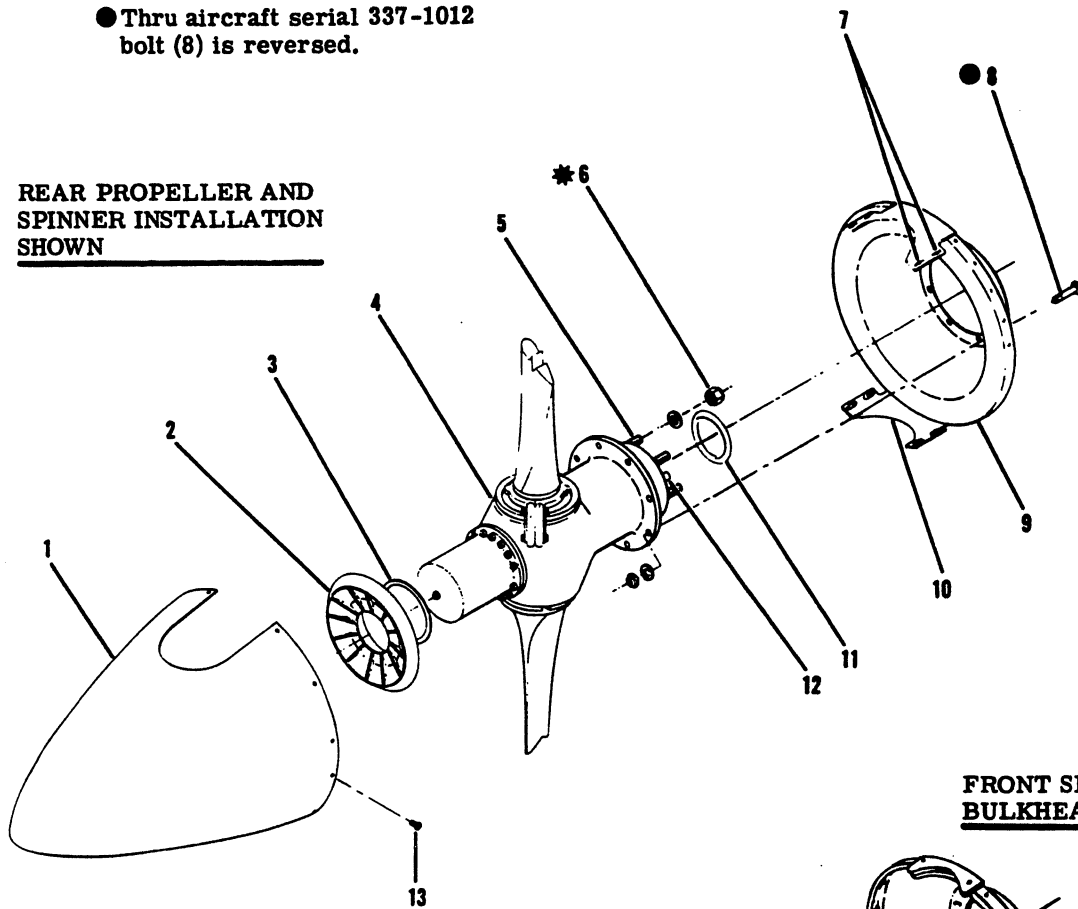
e. If an optional propeller synchronizing system is installed, connect the magnetic pick-up to governor.

f. Connect governor arm. If rod-end adjustment was not disturbed, it should not be necessary to rig the control. Check rigging and adjust as required. Refer to Section 10.

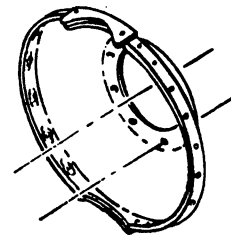
g. Reinstall baffles and cowling removed for access.

● Thru aircraft serial 337-1012
bolt (8) is reversed.

**REAR PROPELLER AND
SPINNER INSTALLATION
SHOWN**



**FRONT SPINNER
BULKHEAD**



* TORQUE TO 660 - 780 LB-IN. (55 - 65 LB-FT.)

1. Spinner
2. Spinner Support
3. Spacer
4. Propeller
5. Stud
6. Mounting Nut
7. Nutplates
8. Bolt
9. Bulkhead Assembly
10. Doubler
11. O-Ring
12. Dowel Pin
13. Screw

NOTE

Use spacers (3) as required (maximum of 4) to cause a snug fit between the spinner (1) and the spinner support (2).

The front propeller and spinner installation is the same as the rear, except that right hand instead of left hand blades are used, the counterweights are opposite and the hub is shorter.

Figure 12-1. Propeller Installation

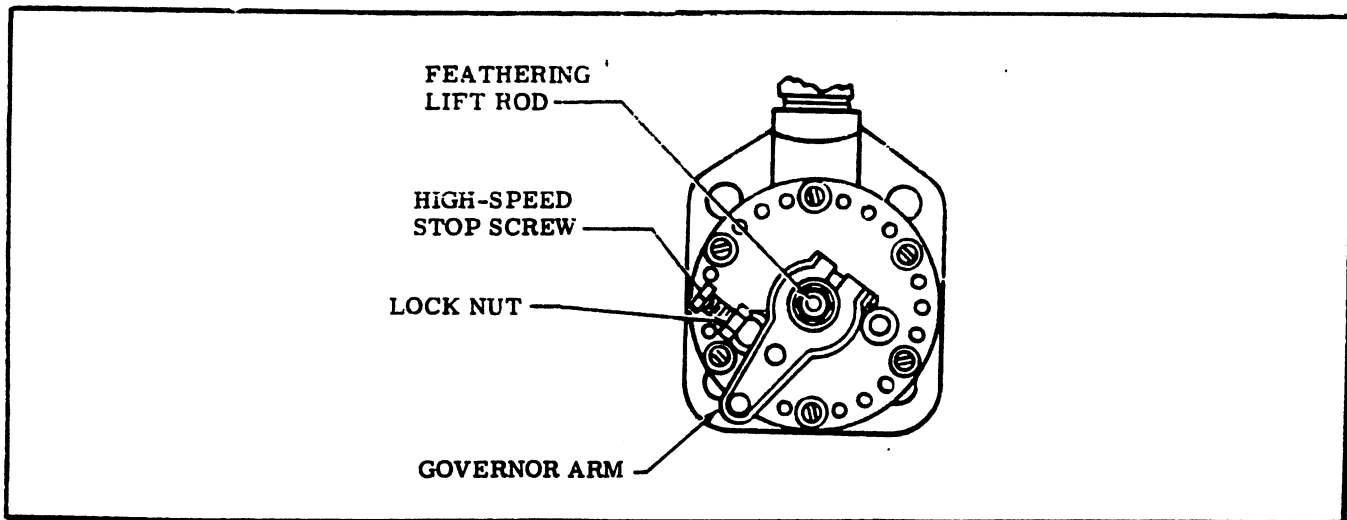


Figure 12-2. High-Rpm Stop Adjustment

12-12. HIGH-RPM STOP ADJUSTMENT. (Refer to figure 12-2.)

- a. Remove engine cowling and baffles as necessary for access.
- b. Loosen lock nut on high-speed stop screw.
- c. Turn the screw IN to decrease maximum rpm and OUT to increase maximum rpm. One full turn of the stop screw causes a change of approximately 25 rpm.
- d. Make propeller control adjustments as required for full travel and proper cushion at the control quadrant. Refer to Section 10.
- e. Tighten the lock nut on the high-speed stop screw.
- f. Reinstall baffles and cowling removed for access.
- g. Test operate the propellers and governors.

NOTE

It is possible for either the propeller low pitch (high-rpm) stop or the governor high-rpm stop to be the high-rpm limiting factor. It is desirable for the governor stop to limit the high-rpm at the maximum rated rpm for a particular aircraft. Due to climatic conditions, field evaluation, low-pitch blade angle and other considerations, an engine may not reach rated rpm on the ground. It may be necessary to readjust the governor stop after test flying to obtain maximum rated rpm when airborne.

12-13. OVERHAUL. The propeller governor should be overhauled at each recommended engine overhaul period. If an engine is required to be overhauled prematurely, and it is suspected the governor has been affected also (oil contamination, etc.), then the governor should be overhauled as well. This is strictly a matter of judgement. The governor overhaul manual is available from the Cessna Service Parts Center.

12-14. PROPELLER FEATHERING CONTROLS.

Each propeller feathering control mechanism is housed in the handle of the propeller control lever. By lifting the handle (pulling it out) and moving the control aft, an additional 15° of travel pulls the governor arm into the feathering position. The handle may be disassembled by removing the knob and carefully lifting the outer sleeve. As sleeve is raised, the spring and link will fall free. Note position of components for reassembly.

12-15. FEATHERING LIFT ROD ADJUSTMENT.

(Refer to figure 12-2.) Minor adjustment of the feathering lift rod may be necessary to obtain proper feathering action and rpm stabilization. While holding feathering lift rod, loosen jam nut and then turn feathering lift rod clockwise to increase stabilization rpm with corresponding increased time to feather or counterclockwise to decrease rpm and time.

a. Start and run engine at 1000 rpm until oil and cylinder head temperature is in normal operating range.

b. With propeller control lever in full increase position, set throttle to obtain 1800 rpm. Retard propeller control lever to the safety step at the full decrease position while monitoring the tachometer. There should be no change in rpm. Retard propeller control lever over the step to the full feather position. Rpm should drop to 1200 rpm within 3 seconds. Promptly recover rpm by moving propeller control lever to the full increase position.

c. Advance throttle to 2400 rpm. Retard propeller control lever to the safety step at the full decrease position. Rpm should stabilize at 2100 plus or minus 100 rpm.

d. Adjust feathering lift rod if not within the preceding prescribed limits. One-half revolution of the lift rod clockwise will lower the feathering rpm approximately 100 revolutions.

12-16. UNFEATHERING SYSTEMS. (Refer to figure 12-3.)

12-17. DESCRIPTION. Each optional unfeathering system consists of a nitrogen-charged accumulator, a special governor and a hose running between the governor and the accumulator. The governor contains a spring-loaded check valve which is unseated while the propeller control is in any position except "FEATHER", thus permitting governor-pressurized oil to flow to and from the accumulator. When the propeller control is moved to "FEATHER" position, the check valve is seated and oil under governor pressure is trapped in the accumulator and hose. As the propeller control is moved from the "FEATHER" position, the trapped pressurized oil flows back through the governor to the propeller to unfeather it.

12-18. MAINTENANCE.

CAUTION

Always release system pressure by placing propeller control in high-rpm position and release accumulator pressure through the filler valve, before disconnecting hose between accumulator and governor or removing accumulator.

- a. Place propeller control in the high-rpm position before charging the accumulator to prevent the possibility of oil under pressure being trapped in the accumulator.
- b. Although the accumulator will function properly when charged with air, nitrogen gas is recommended to minimize corrosion.
- c. Either too much pressure or not enough pressure in the accumulator will reduce efficiency of the unfeathering system. With a normal amount of friction within the propeller, optimum pressure is the approximate mid-range of the pressures specified in figure 12-3.
- d. Always check that the filler valve does not leak after charging an accumulator.

12-19. ACCUMULATOR OVERHAUL. The propeller unfeathering accumulator should be overhauled at each recommended engine overhaul period. If an engine or governor is required to be overhauled prematurely and it is suspected the accumulator has been affected also (oil contamination etc), then the accumulator should be overhauled as well. This is strictly a matter of judgement. The propeller unfeathering accumulator overhaul manual is available from the Cessna Service Parts Center.

12-20. PROPELLER SYNCHRONIZER SYSTEM. (Refer to figure 12-4.)

12-21. DESCRIPTION. The propeller synchronizing system is comprised of a controller mounted in the cabin, an actuator attached to the rear engine firewall/mount, special governors with magnetic impulse pick-ups, a control switch mounted on the engine control pedestal, a flexible control shaft from

the actuator to the rear engine governor and electrical wiring. With the engines operating within approximately 30 rpm of each other, placing the control switch to the CN position will cause the rear engine rpm to be automatically adjusted to the same rpm as that of the front engine. The rear engine rpm may be manually changed by the governor control lever at any time. The control range that the front engine and controller has over the rear engine, when the control switch is ON, is approximately 60 rpm; therefore, the propeller should be manually synchronized within this controlling range before placing the control switch to the ON position. When the control switch is in the OFF position, the controller automatically adjusts the rear engine adjustable rod end to the center of its range. The rear engine is then controlled manually by the propeller control lever.

12-22. CONTROLLER REMOVAL AND INSTALLATION.

- a. Disconnect electrical plug and remove control switch from control pedestal.
- b. Disconnect indicator light electrical leads from control switch.
- c. Remove four screws, washers and nuts attaching controller to bottom of glove box.
- d. Reverse the preceding steps for reinstallation.

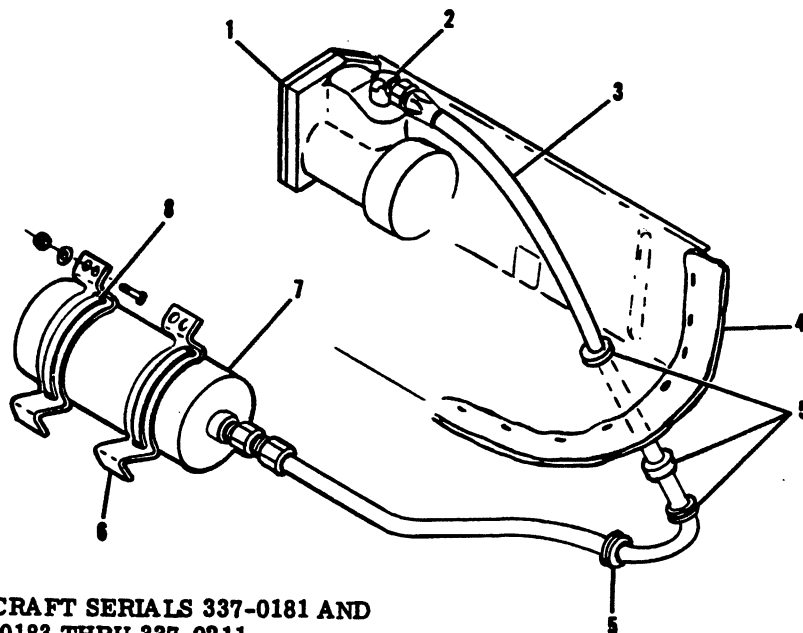
12-23. ACTUATOR REMOVAL, INSTALLATION AND RIGGING.

- a. Remove rear engine cowling as necessary for access.
- b. Cut safety wire and disconnect electrical plug from actuator.
- c. Disconnect flexible shaft from actuator.
- d. Remove four bolts, washers and nuts attaching actuator to brackets on engine mount/firewall.
- e. Install actuator by installing attaching bolts, washers and nuts and connecting electrical plug to actuator.
- f. With flexible shaft disconnect and control switch OFF, place master switch ON. This will cause the actuator to be centered.
- g. Rotate flexible shaft to place adjustable rod end in the center of its travel range.
- h. Connect flexible shaft to the actuator and safety electrical plug.
- i. Install engine cowling and perform functional test.

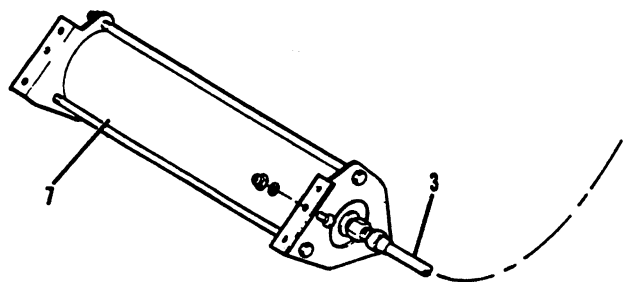
12-24. ADJUSTABLE ROD END REMOVAL AND INSTALLATION.

- a. Remove engine cowling as necessary to gain access to propeller governor.
- b. Cut safety wire and disconnect flexible shaft from rod end.
- c. Disconnect rod end from governor control arm and remove rod end from governor control.
- d. Install rod end on governor control.
- e. With adjustable rod end set at its mid-point of travel, rig governor as outlined in Section 10.
- f. Rotate the splined shaft in rod end assembly to one end of its travel. Move the propeller control lever through its entire range of travel and observe the governor control arm to be certain it hits both the maximum and minimum rpm stops.

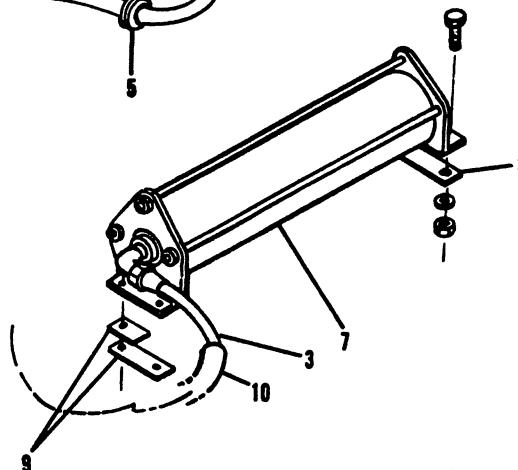
FRONT ENGINE



**AIRCRAFT SERIALS 337-0181 AND
337-0183 THRU 337-0211**



**AIRCRAFT SERIALS 337-0182 AND
337-0212 THRU 337-01398**



**BEGINNING WITH AIRCRAFT SERIALS
337-01399 AND F337-00046**

1. Governor
2. Elbow
3. Hose Assembly
4. Baffle
5. Grommet
6. Bracket
7. Accumulator Assembly
8. Clamp
9. Spacer
10. Fire Sleeve
11. Engine Mount
12. Line Assembly
13. Union

NOTE

Beginning with aircraft serials 337-0467 and F33700001, a Woodward or a McCauley unfeathering accumulator may be installed. Removal and installation procedures are similar, however, charge pressure for the Woodward accumulator is 100-125 PSI and for the McCauley is 90-100 PSI.

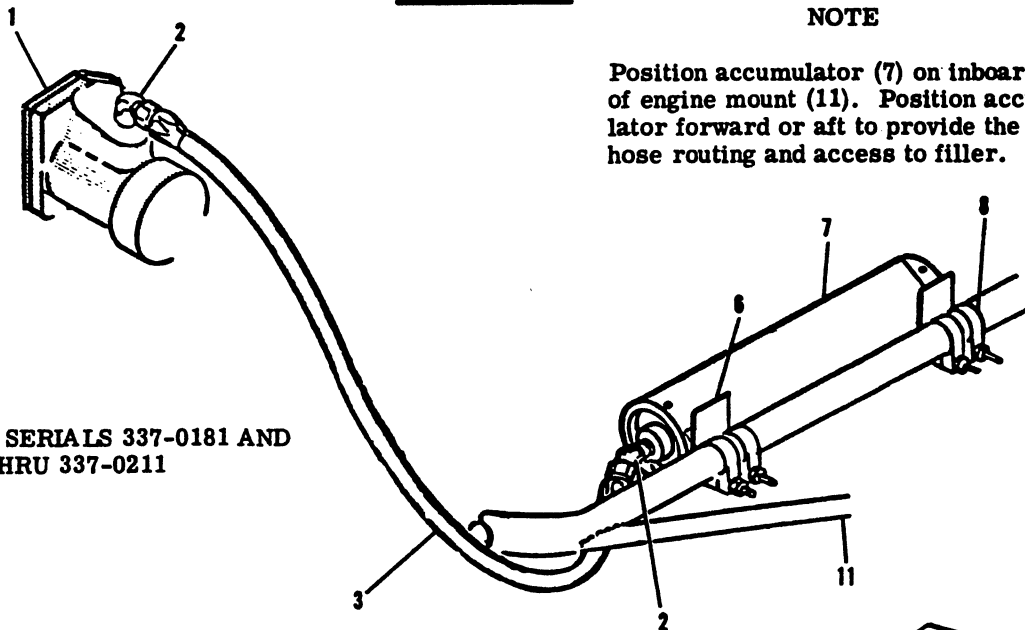
Figure 12-3. Unfeathering Systems (Sheet 1 of 2)

REAR ENGINE

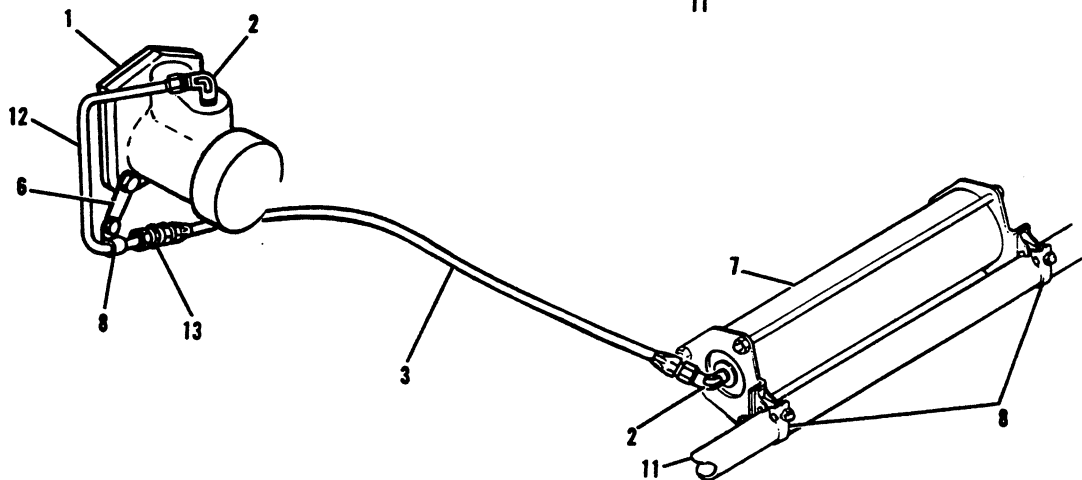
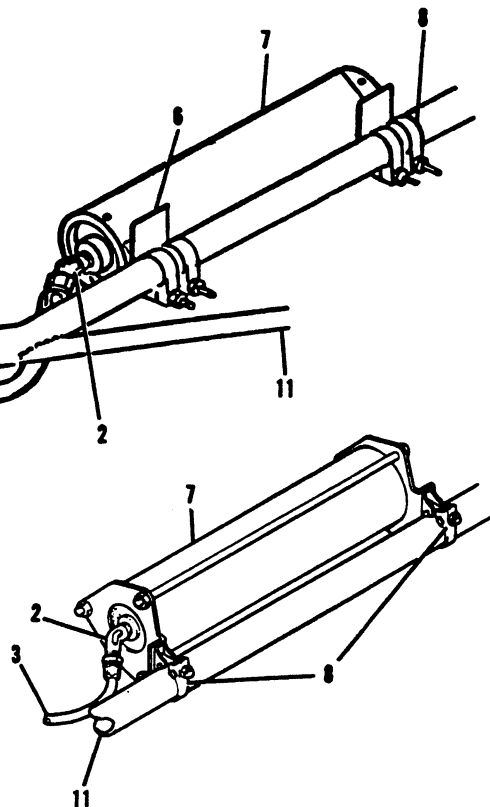
NOTE

Position accumulator (7) on inboard side of engine mount (11). Position accumulator forward or aft to provide the best hose routing and access to filler.

AIRCRAFT SERIALS 337-0181 AND 337-0183 THRU 337-0211



AIRCRAFT SERIALS 337-0182 AND 33700212 THRU 33701229 AND F337-00001 THRU F33700009



BEGINNING WITH AIRCRAFT SERIALS 33701230 AND F33700010

Figure 12-3. Unfeathering Systems (Sheet 2 of 2)

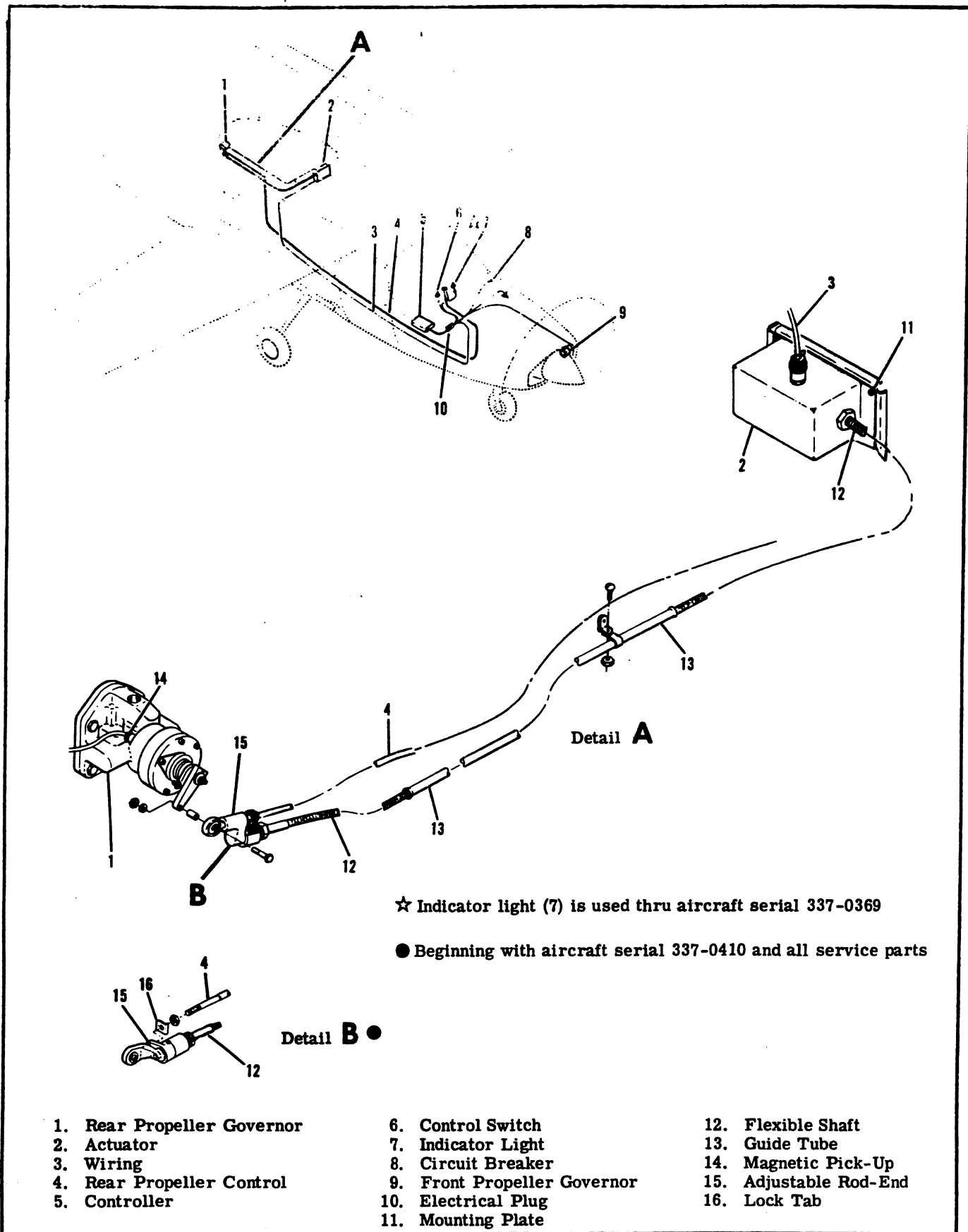


Figure 12-4. Synchronizer System

g. Manually rotate splined shaft in rod end assembly to the opposite end of its travel and repeat check in step "f." This assures that propeller control rigging allows stop-to-stop travel with any possible rod end setting.

h. Connect flexible shaft to rod end assembly and safety.

i. Disconnect flexible shaft from actuator and with control switch OFF, place master switch ON. This will allow actuator to run to the center of its range.

j. Connect flexible shaft to actuator and safety.

k. Install engine cowling and perform functional test.

12-25. FLEXIBLE SHAFT AND/OR GUIDE TUBE REMOVAL AND INSTALLATION.

a. Disconnect flexible shaft from actuator and rod end assembly.

b. Remove clamps attaching guide tube to engine.

c. At rod end of flexible shaft, remove lock ring and hex nut and pull flexible shaft from guide tube.

d. Secure guide tube to engine using clamps removed in step "b."

e. Remove lock ring and hex nut from flexible shaft.

f. Lubricate flexible shaft housing (MIL-G-21164), where it will slide in the guide tube.

g. Insert flexible shaft through the guide tube so that lock ring end of the flexible shaft will mate with adjustable rod end and install hex nut and lock ring.

h. Connect flexible shaft to rod end assembly and rotate shaft to obtain center of rod end travel range.

i. With control switch OFF, place master switch ON. This will allow actuator to run to the center of its range.

j. Connect flexible shaft to actuator and safety.

k. Install engine cowling.

12-26. MAGNETIC PICK-UP REMOVAL, INSTALLATION AND ADJUSTMENT. Refer to Woodward Governor Bulletin No. 33049A for replacement or adjustment.

12-27. SYNCHRONIZER FUNCTIONAL TEST. To make a functional test of the synchronizer system in flight, first determine the limited rpm range through which the rear engine will remain synchronized with the front engine. To do this, manually synchronize the propellers and then turn on the control switch. Slowly move the front engine propeller control lever to increase and decrease rpm, noting the range of rpm through which the rear engine will remain synchronized. This is the limited operating range of the synchronizer. With the control switch turned on, move the front engine propeller control lever close to either end of this limited range. Turn off the control switch to develop an unsynchronized condition as the actuator returns to its mid-position. Turn on the control switch and check that automatic synchronization occurs.

NOTE

The flexible shaft must be free to slide in the guide tube when the governor control is operated.