CHAPTER 76 — ENGINE CONTROLS

CONTENTS — MAINTENANCE PROCEDURES

CONTENTS — MAINTENANCE PROCEDURES (CONT)

FIGURES

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ENGINE CONTROLS

76-1. ENGINE CONTROLS

Major components of the engine control system are the Automatic Fuel Control Units (AFCU), Manual Fuel Control Units (MFCU), power turbine (N2) governors, Torque Control Unit (TCU), droop compensator control linkage and power level control linkage (Figure 76-1).

The engine control system permits the pilot to obtain maximum engine performance with minimum attention. Under normal flight conditions, the power turbine (N2) speed is controlled by Automatic Fuel Control Units (2 and 7), power turbine governors (37 and 41), and droop compensator (46).

The Automatic Fuel Control Units (2 and 7) safeguard engine power sections against overloading. On acceleration and deceleration, the Automatic Fuel Control Units avoid engine damage and/or flameout due to sudden power changes.

The Manual Fuel Control Units (3 and 8) can be operated in either automatic or manual mode. The pilot can select AUTO or MAN operation by means of engine GOV switches. When operating in MANUAL mode, the pilot positions lever (4) and/or (9) on manual fuel controls by means of twist grip throttles (29 and/or 30).

Power turbine (N2) speed and ROTOR rpm (NR) are adjustable by means of a linear actuator (44) connected to the engine No. 1 (ENG 1) and engine No. 2 (ENG 2) power turbine governors through a jackshaft (40). The adjustment (beep) range is 97 to 101.5%.

The TCU provides torque limiting and torque matching between engine 1 and engine 2. Helicopters modified by Technical Bulletin 212-91-138 or 212-93-145 the TCU provides torque limiting function only and an additional actuator (35) connected to the engine No. 2 power turbine governor is used to provide either torque matching or Inter-Turbine Temperature (ITT) matching of ENG 1 and ENG 2.

Refer to Pratt & Whitney Aircraft of Canada Ltd. PT6T-3 Series Maintenance Manual for detailed description of engine mounted components.

ENGINE (N1) POWER CONTROLS

76-2. ENGINE POWER CONTROLS

The (N1) power lever control system consists of two parallel mechanical linkage subsystems, connecting dual throttle control twist grip (29 and 30, Figure 76-1) to Manual Fuel Control Units (3 and 8), on engine power sections. From the collective jackshaft, the power level control linkage extends aft under the cabin floor between the main beams, then up inside the pylon, and through the cabin roof into the inlet fairing forward of the engine accessory gearboxes.

The power lever control linkages are actuated by throttle twist grips (29 and 30). A friction control is provided on pilots throttle only. The upper twist grip (30) marked ENG 1, controls engine 1 gas producer (GAS PROD) rpm for left (No. 1) power section. The lower twist grip (29), marked ENG 2, controls engine 2 gas producer (GAS PROD) rpm for right (No. 2) power section. Both twist grips are marked with arrows showing direction of movement to increase (INCR) rpm. When twist grip is turned right, rpm will be reduced until linkage contacts idle stop at approximately 61% GAS PROD rpm.

Idle stop solenoids (1 and 15) are operated by IDLE STOP ENG 1 and ENG 2 release switch on pilot collective switch box. When either idle stop release switch is activated, the corresponding idle stop solenoid plunger will retract allowing MFCU to be placed in cut-off position. The idle stop plunger will not retract if excessive pressure is applied by the twist grip toward the closed position.

76-3. POWER LEVER (N1) CONTROL RIGGING

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications and source.

NUMBER	NOMENCLATURE
C-101	Corrosion Preventive Compound

NOTE

If dual controls kit P/N 212-706-005-003 or -007 is installed refer to BHT-212-SI-4 for installation and removal instructions.

1. Comply with the following general procedures when rigging power lever controls.

a. When a rigging procedure requires a specific position to accomplish steps, manually hold controls in position or secure controls in position with pilot friction adjustment.

b. Tolerance for rigging dimensions is ± 0.030 in. (0.76 mm) unless stated otherwise.

c. All adjustable control tubes shall have a maximum of 1.00 in. (25.4 mm) of exposed threads after adjustment. If control tubes have inspection holes, threads shall engage sufficiently to cover holes.

d. Apply corrosion preventive compound (C-101) to exposed threads of all adjustable rod bearings and clevises after adjustment.

e. Torque control tube jamnuts 80 to 100 in-lbs (9.0 to 11.3 Nm) after adjustment unless otherwise specified.

f. Control tubes must be free to rotate several degrees about longitudinal axis. If necessary, loosen jamnuts, adjust end fitting and re-torque jamnuts.

2. If not previously accomplished, rig collective control system (Chapter 67).

3. Verify proper throttle flex shaft to gear sector engagement as follows:

a. Disconnect tubes (25 and 11, Figure 76-2).

b. Disconnect control tube (16) from rod end bearing (17).

c. Disconnect control tube (21) rod end bearing (22).

d. Inspect marked tooth (41) on pilot engine 1 flex shaft (40) to ensure engagement of tenth tooth space on pilot engine 1 gear sector.

e. Inspect marked tooth on pilot engine 2 flex shaft (39) to ensure engagement of tenth tooth space on pilot engine 2 gear sector (42).

1. Idle stop solenoid and bracket
2. Automatic Fuel Control Unit (AFCU), ENG 2
3. Manual Fuel Control Unit (MFCU), ENG 2
4. Lever
5. Control tube
6. Boot
7. Automatic Fuel Control Unit (AFCU), ENG 1
8. Manual Fuel Control Unit (MFCU), ENG 1
9. Lever
10. Link
11. Jackshaft
12. Boot
13. Control tube
14. Torque tubes
15. Idle stop solenoid and bracket
16. Control tube
17. Boot
18. Jackshaft
19. Jackshaft
20. Control tube
21. Control tube
22. Control tube
23. Bellcranks
24. Control tubes
25. Bellcranks
26. Control tube
27. Control tube
28. Collective jackshaft (copilot stick not shown)
29. Throttle twist grip and friction, ENG 2
30. Throttle twist grip and friction, ENG 1
31. Idle stop release switch
32. Control tube
33. Control tube
34. Boot

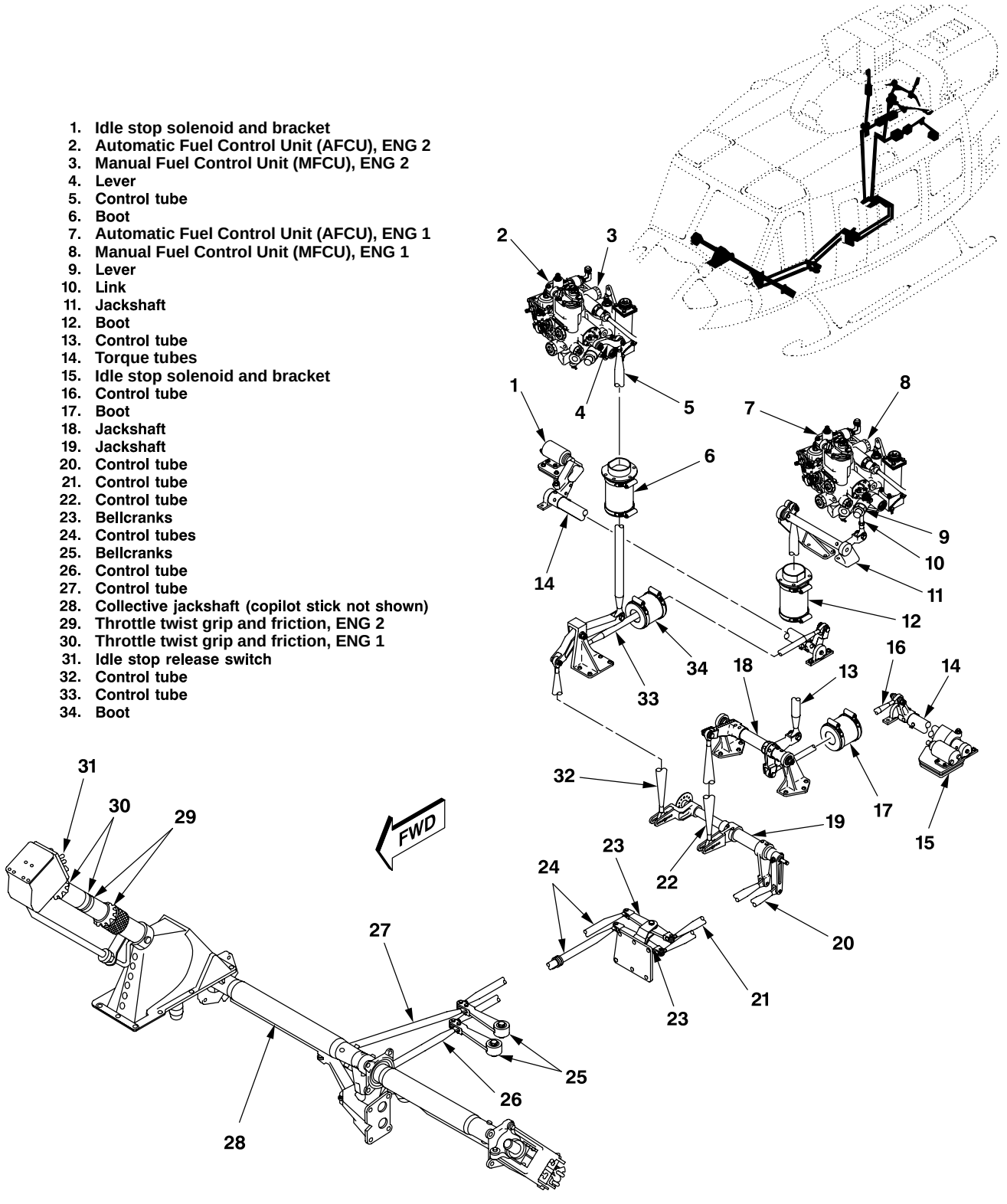

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Figure 76-1. Engine Controls (Sheet 1 of 2)

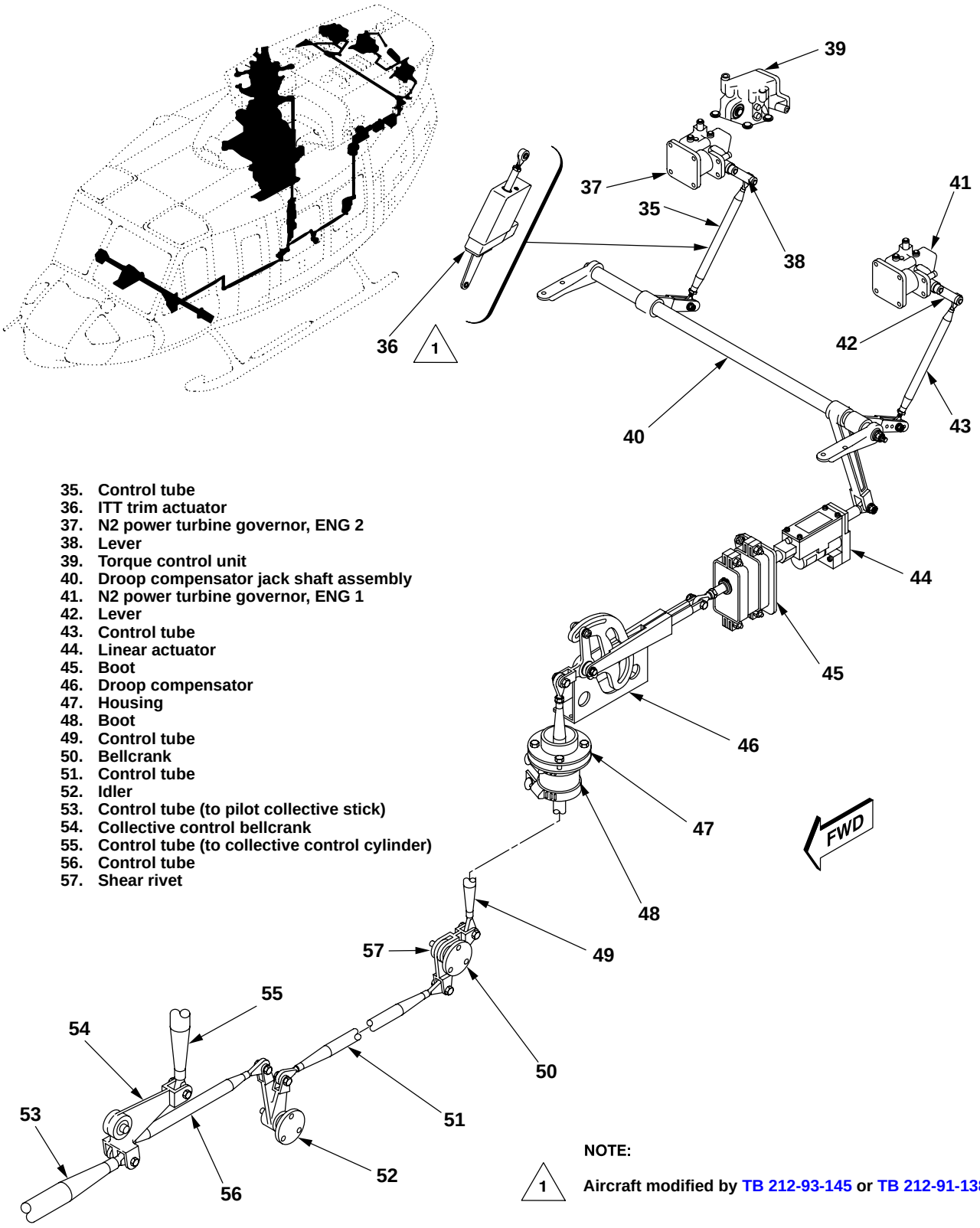

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Figure 76-1. Engine Controls (Sheet 2 of 2)

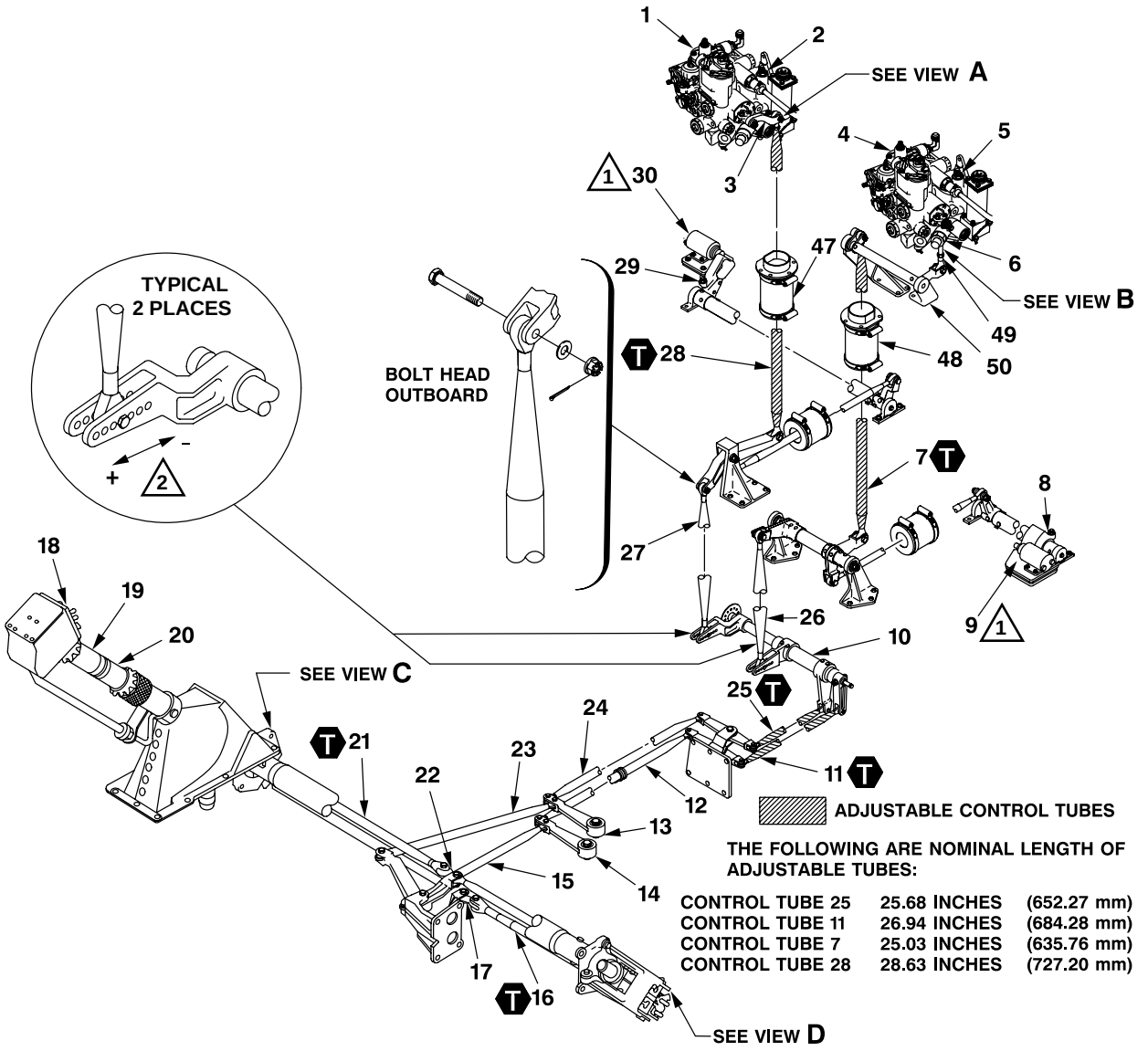

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Figure 76-2. Power Lever (N1) Controls Rigging (Sheet 1 of 3)

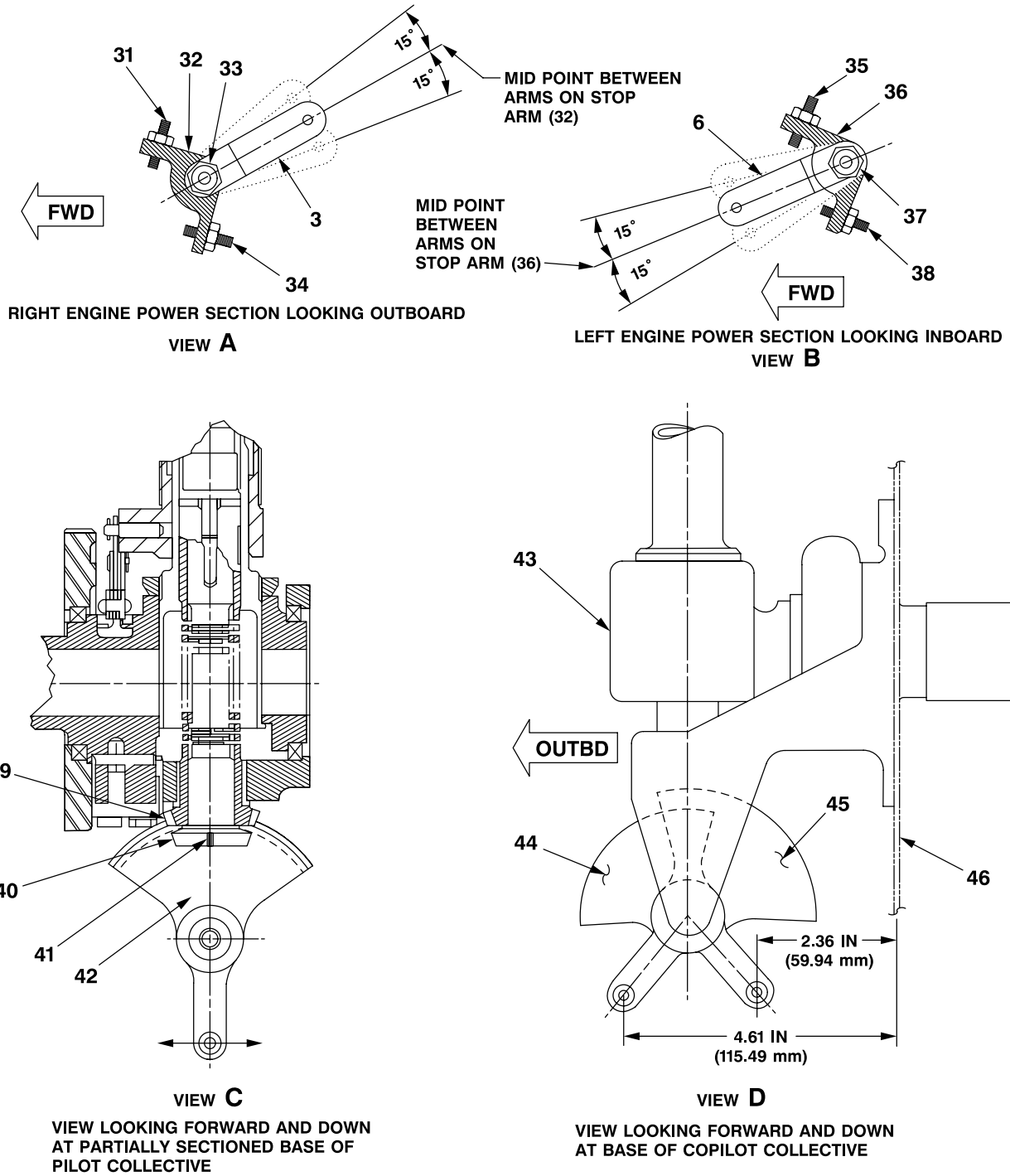

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Figure 76-2. Power Lever (N1) Controls Rigging (Sheet 2 of 3)

1. Automatic Fuel Control Unit (AFCU), ENG 2
2. Manual Fuel Control Unit (MFCU), ENG 2
3. Lever
4. Automatic Fuel Control Unit (AFCU), ENG 2
5. Manual Fuel Control Unit (MFCU), ENG 2
6. Lever
7. Control tube
8. Idle stop lever
9. Idle stop solenoid
10. Jackshaft
11. Control tube
12. Control tube
13. Bellcrank
14. Bellcrank
15. Control tube
16. Control tube
17. Double rod end bearing
18. IDLE STOP release switch
19. Throttle twist grip, ENG 1
20. Throttle twist grip, ENG 2
21. Control tube
22. Double rod end bearlng
23. Control tube
24. Control tube
25. Control tube
26. Control tube
27. Control tube
28. Control tube
29. Idle stop lever
30. Idle stop solenoid
31. MInImum stop screw, manual fuel control
32. Stop arm, manual fuel control
33. Nut
34. Maximum stop screw, manual fuel control
35. Minimum stop screw, manual fuel control
36. Stop arm – manual fuel control
37. Nut
38. Maximum stop screw, manual fuel control
39. PIlot engIne 2 flex shaft
40. PIlot engIne 1 flex shaft
41. Marked tooth on flex shaft (40)
42. Pilot engine 2 gear sector
43. Copilot collective elbow and support
44. Copilot engine 1 gear sector
45. Copilot engine 2 gear sector
46. Structure
47. Boot
48. Boot
49. Link
50. Jackshaft

NOTES

1. During rigging procedure, a small wooden block may be placed between the shoulder of the idle stop plunger and flange of idle stop solenoid mounting bracket to assist in holding the idle stop plunger in the retract position.

2. To increase travel, reposition rod end in (+) direction, to decrease travel, reposition rod end in (-) direction.

T Torque control tube jamnuts 80 to 100 in.-lbs (9.0 to 11.3 Nm).

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Figure 76-2. Power Lever (N1) Controls Rigging (Sheet 3 of 3)

f. Inspect two gear sectors and flex shafts at base of copilot collective stick in same manner outlined in step d and step e.

NOTE

If dual controls are installed accomplish step g, do not accomplish step h. If dual controls are not installed accomplish step h, do not accomplish step g.

g. If dual controls are installed, position pilot ENG 1 (19) and ENG 2 (20) throttles to full open position against stops. Position copilot ENG 1 and ENG 2 throttles to full open. Hold twist grips in position against stops. Do not accomplish step h. Proceed to step i.

h. If dual controls are not installed, position pilot ENG 1 (19) and ENG 2 (20) throttles to full open position against stops. Hold twist grips in position against stops. Position copilot engine 1 and engine 2 gear sectors (44 and 45) as shown in View D. Hold gear sectors in position while accomplishing step i and step j.

NOTE

Controls must be positioned as described in step g or step h as applicable, prior to accomplishing step i and step j.

i. Adjust control tube (21) to fit double rod end bearing (22). Torque jamnut on control tube clevis. Install control tube on double rod end bearing.

j. Adjust control tube (16) to fit double rod end bearing (17). Torque jamnut on control tube clevis. Install control tube on double rod end bearing.

k. Move pilot throttle controls through the full range and verify for binding and/or obstruction of control movement.

l. Check pilot engine 2 gear sector (42) at base of pilot collective and pilot engine 2 flex shaft (39) when engine 2 throttle (20) is moved through full range to ensure gear sector is a minimum of one tooth of rolling off flex shaft pinion.

m. Check pilot engine 1 flex shaft (40) pinion and mating gear sector at base of pilot collective in same manner described in step l.

n. Check gear sectors (44 and 45) at the base of copilot collective in the same manner described in step k and step l.

4. Comply with the following rigging procedure for engine 2 (ENG 2).

a. For ENG 2, inspect lever (3, Figure 76-2) for correct position in relation to stop arm (32, View A). If lever is not aligned within 15° of center line, loosen nut (33), position lever on shaft of MFCU (2) within 15° of center line, and tighten nut. Ensure serrations on lever are properly engaged with serrations on shaft. Install cotter pin to secure nut.

b. Disconnect tubes (28, 27, and 11).

c. Loosen clamps holding boot (47) on tube (28) and allow boot to float on tube.

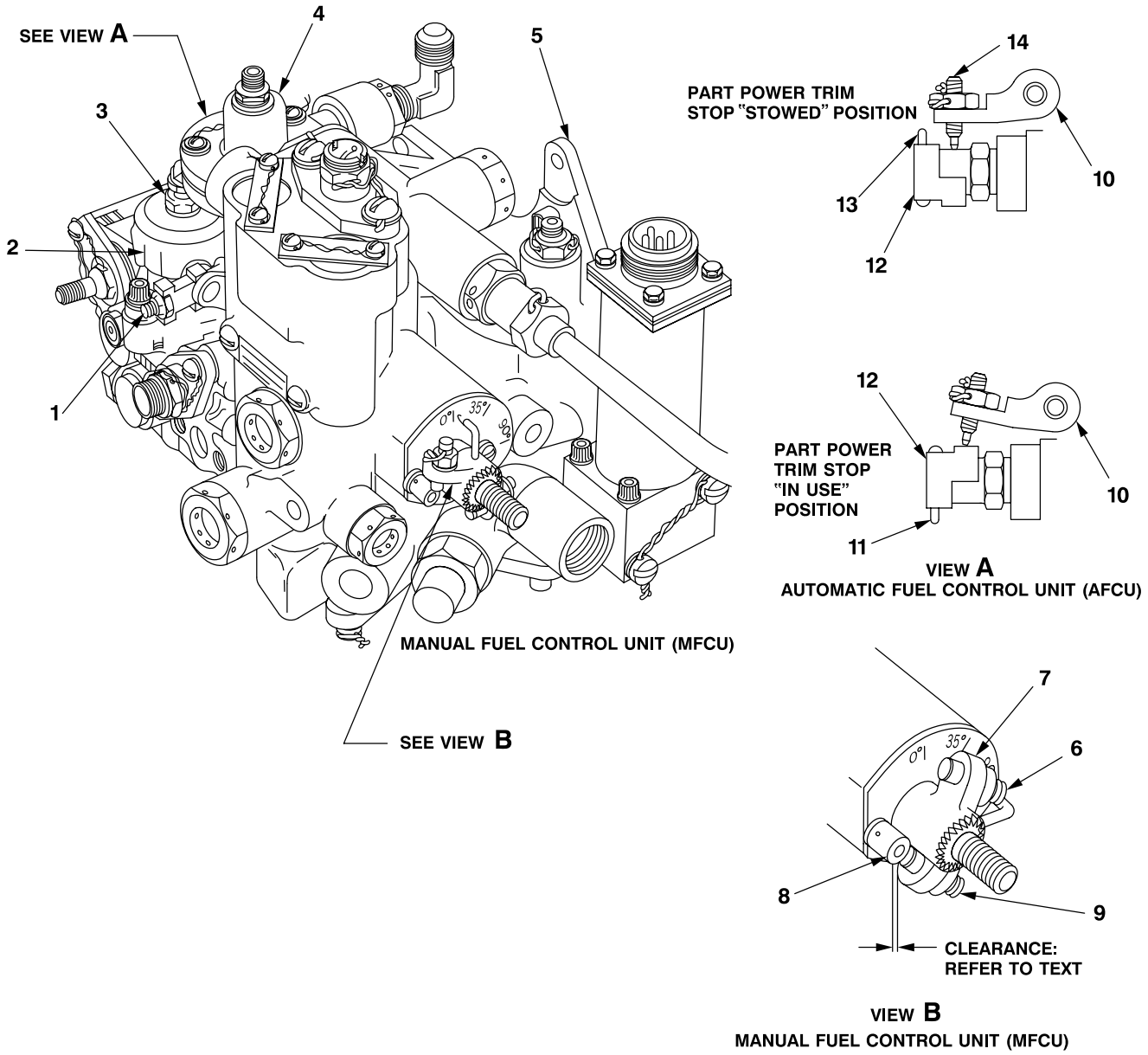
d. Adjust tube (28) to a nominal dimension of 28.63 inches (727.20 mm). The measurement is from center of the bearing bolt hole to the center of the other bearing bolt hole.

e. Adjust tube (11) to a nominal dimension to 26.94 inches (684.28 mm). The measurement is from center of the bearing bolt hole to the center of the other bearing bolt hole.

NOTE

Refer to applicable Pratt & Whitney PT6T-3 Series Maintenance Manual for MFCU clearance adjustment procedure.

f. With part power trim stop (12, Figure 76-3) in stowed position, rotate lever (3, Figure 76-2) until Automatic Fuel Control Unit (AFCU) (1) max stop is contacted. Check for 0.015 to 0.020 inch (0.38 to 0.51 mm) clearance between Manual Fuel Control Unit (MFCU) stop (8, Figure 76-3) and maximum stop screw (9). If required, adjust AFCU/MFCU interconnect linkage as per applicable Pratt & Whitney PT6T-3 Series Maintenance Manual to obtain required clearance.



1. Manual - automatic fuel control interconnect linkage
2. Datum line
3. Acceleration adjuster
4. Automatic Fuel Control Unit (AFCU)
5. Manual Fuel Control Unit (MFCU)
6. Minimum stop screw
7. Stop arm
8. Stop
9. Maximum stop screw
10. Fuel control arm
11. Cotter pin
12. Part power trim stop
13. Cotter pin
14. Maximum stop adjustment screw

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Figure 76-3. Manual and Automatic Fuel Control Adjustment

NOTE

During following steps a small wooden block can be used as a work aid to hold idle stop solenoid plunger in the retracted position.

g. Connect tube (28), Figure 76-2) to lever (3). With idle solenoid (30) plunger retracted, check for power lever travel from FULL OFF to MAX POWER. Ensure maximum stop screw (9, Figure 76-3) and minimum stop screw (6) contact stop (8).

h. Connect tube (27, Figure 76-2) in the center hole of jackshaft (10) arm lever and extend plunger of idle stop solenoid (30) (remove wooden block).

i. Rotate jackshaft (10) to contact idle solenoid stop. Ensure MFCU (2) pointer is aligned at approximately 37 degrees. If not, adjust tube (28) for proper alignment. Check for smooth rotation.

j. Connect tube (11) and hold idle stop solenoid (30) plunger in retracted position (install wooden block)

k. Rotate ENG 2 throttle twist grip (20) to full open and check overtravel (cushion). Twist grip should rotate an additional 4 to 6 degrees after maximum stop screw (9, Figure 76-3) contacts stop (8). Rotate throttle twist grip (20, Figure 76-2) to full closed. The twist grip should rotate an additional 4 to 6 degrees after minimum stop screw (6, Figure 76-3) contacts stop (8).

l. If overtravel is not equal between the full open and full closed positions, adjust tube (11, Figure 76-2). Ensure rod end of tube (11) is visible in witness hole. If twist grip (20) does not have sufficient travel, move tube (27) to next hole towards end of arm on jackshaft (10). If twist grip (20) has too much travel, move tube (27) to the next hole in arm nearer jackshaft (10) (refer to Figure 76-2).

m. Rotate ENG 2 throttle twist grip (20) to full open and hold with friction. Secure boot (47) on tube (28) with clamps.

n. Extend idle stop solenoid (30) plunger (remove wooden block). With idle stop lever (29) against plunger, verify that MFCU (2) pointer is aligned to approximately 37 degrees. If not, adjust idle stop adjustment screw (1, Figure 76-4). If available adjustment of idle stop adjustment screw (1) is not adequate (insufficient threads), replace four NAS43DD3 spacers (5) under the idle stop solenoid (3) with longer or short lengths as required.

NOTE

Idle stop solenoid (30, Figure 76-2) is operated by IDLE STOP release switch (18) on pilot collective stick. When IDLE STOP release switch is activated, the corresponding idle stop solenoid plunger is retracted for 5 seconds.

o. Move IDLE STOP switch (18) to ENG 2 position and check clearance between plunger (4, Figure 76-4) and idle stop lever (2). Acceptable clearance is 0.003 to 0.015 in. (0.1 to 0.3 mm). If clearance is not within tolerance, adjust position of idle stop solenoid (30, Figure 76-4) on serrated bracket assembly (10) and base (11) to obtain acceptable clearance.

p. Inspect all linkages shown on Figure 76-2 for proper installation of bolts nuts, and cotter pins.

5. Comply with the following rigging procedure for engine 1 (ENG 1).

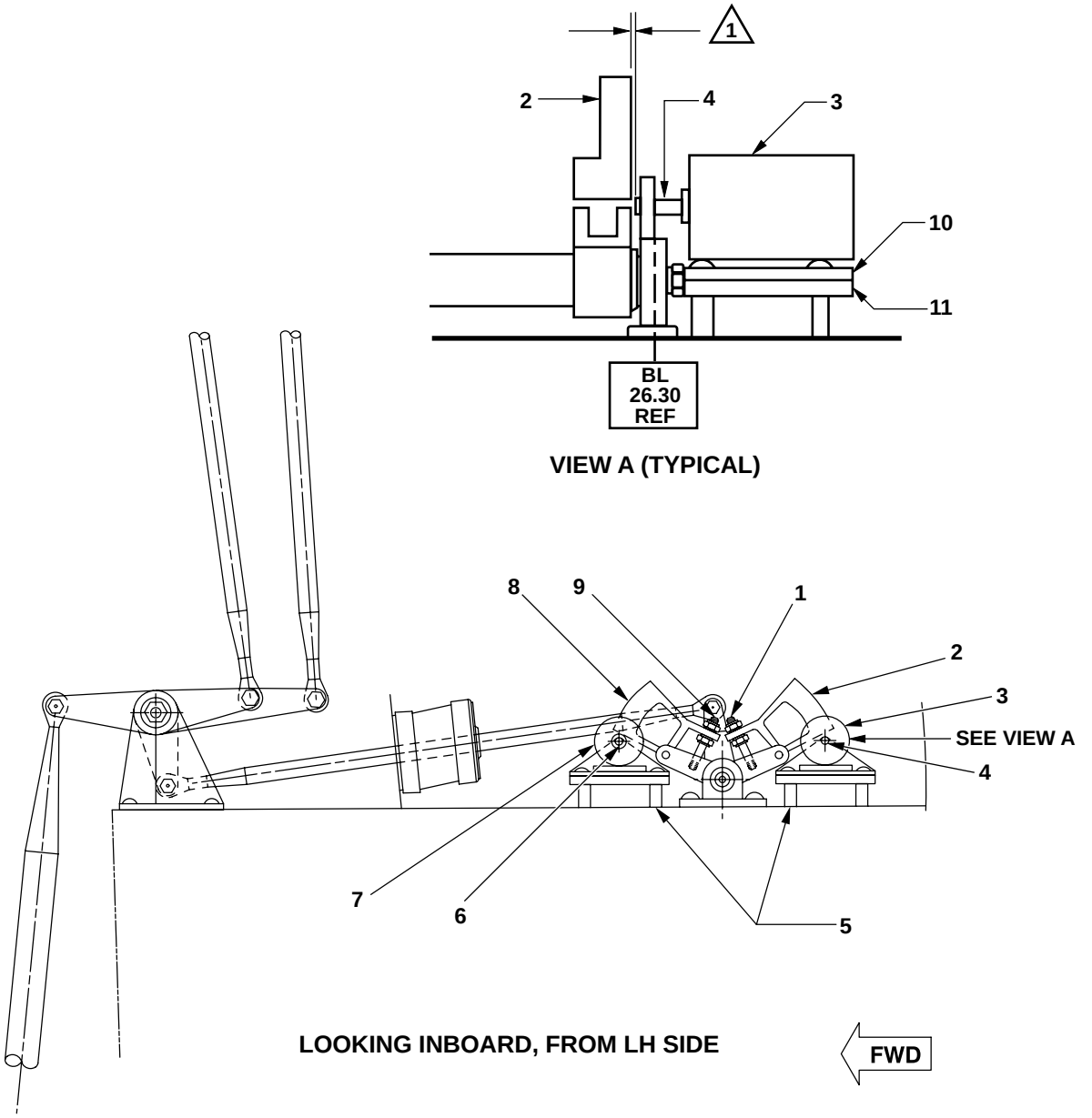
a. For ENG 1, inspect lever (6, Figure 76-2) for correct position in relation to stop arm (36, view B). If lever is not aligned within 15 degrees of centerline, loosen nut (37), position lever (6) on shaft of MFCU (5) within 15 degrees of centerline, and tighten nut (37). Ensure serrations on lever are properly engaged with serrations on shaft. Install cotter pin to secure nut (37).

b. Disconnect tubes (7, 26, and 25) and link (49).

c. Loosen clamps holding boot (48) on tube (7) and allow boot to float on tube.

d. Adjust tube (7) to a nominal dimension of 25.03 in. (635.76 mm). The measurement is from center of the bearing bolt hole to the center of the other bearing bolt hole.

e. Adjust tube (25) to a nominal dimension of 25.68 in. (654.27 mm). The measurement is from center of the bearing bolt hole to the center of the other bearing bolt hole.



1. Idle stop adjustment screw (ENG 2)
2. Idle stop lever (ENG 2)
3. Idle stop solenoid (ENG 2)
4. Plunger
5. NAS43DD3 spacers
6. Plunger
7. Idle stop solenoid (ENG 1)
8. Idle stop lever (ENG 1)
9. Idle stop adjustment screw (ENG 1)
10. Bracket assembly
11. Base

NOTES

1. 0.003 to 0.015 in. (0.08 to 0.38 mm) gap typical with plunger retracted.

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Figure 76-4. Engine Idle Adjustment

NOTE

Refer to applicable Pratt & Whitney Aircraft of Canada Ltd. PT6T-3 Series Maintenance Manual for MFCU clearance adjustment procedure.

f. With part power trim stop (12, Figure 76-3) in stowed position rotate lever (6, Figure 76-2) until AFCU (4) max stop is contacted. Check for 0.015 to 0.020 in. (0.38 to 0.51 mm) clearance between MFCU stop (8, Figure 76-3) and maximum stop screw (9). If required, adjust AFCU/MFCU interconnect linkage as per applicable Pratt & Whitney Aircraft of Canada Ltd. PT6T-3 Series Maintenance Manual to obtain required clearance.

NOTE

During following steps a small wooden block can be used as a work aid to hold idle stop solenoid plunger in the retracted position.

g. Connect tube (7, Figure 76-2) to jackshaft (50) and link (49) to lever (6). With idle stop solenoid (9) plunger retracted, check for power lever travel from FULL OFF to MAX POWER without fouling between jackshaft (50) and tube (7). Ensure maximum stop screw (9, Figure 76-3) and minimum stop screw (6) contact stop (8). In case of fouling between jackshaft (50, Figure 76-2) and tube (7), offset lever (6) by one serration (±15 degrees) and repeat step.

h. Connect tube (26, Figure 76-2) in the center hole of jackshaft (10) arm lever and extend plunger of idle stop solenoid (9) (remove wooden block).

i. Rotate the jackshaft (10) to contact idle solenoid stop. Ensure MFCU (5) pointer is aligned at approximately 37 degrees. If not, adjust tube (7) for proper alignment. Check for smooth rotation.

j. Connect tube (25) and hold idle stop solenoid (9) plunger in retracted position (install wooden block).

k. Rotate ENG 1 throttle twist grip (19) to full open and check overtravel (cushion). Twist grip should rotate an additional 4 to 6 degrees after maximum stop screw (9, Figure 76-3) contacts stop (8). Rotate throttle twist grip (19, Figure 76-2) to full closed. The twist grip should rotate an additional 4 to 6 degrees after minimum stop screw (6, Figure 76-3) contacts stop (8).

l. If overtravel is not equal between full open and full closed positions, adjust tube (25, Figure 76-2). Ensure rod end of tube (25) is visible in witness hole. If twist grip (19) does not have sufficient travel, move tube (26) to next hole towards end of arm on jackshaft (10). If twist grip (9) has too much travel, move tube (26) to the next hole in arm nearer jackshaft (10) (refer to Figure 76-2).

m. Rotate ENG 1 throttle twist grip (19) to full open and hold with friction. Secure boot (48) on tube (7) with clamps.

n. Extend idle stop solenoid (9) plunger (remove wooden block). With idle stop lever (8) against plunger, verify that MFCU (5) pointer is aligned to approximately 37 degrees. If not, adjust idle stop adjustment screw (9, Figure 76-4). If available adjustment of idle stop adjustment screw (9) is not adequate (insufficient threads), replace four NAS43DD3 spacers (5) under the idle stop solenoid (7) with longer or short lengths as required.

NOTE

Idle stop solenoid (9, Figure 76-2) is operated by IDLE STOP release switch (18) on pilot collective stick. When IDLE STOP release switch is activated, the corresponding idle stop solenoid plunger is retracted for 5 seconds.

o. Move IDLE STOP switch (18) to ENG 1 position and check clearance between plunger (6, Figure 76-4) and idle stop lever (8). Acceptable clearance is 0.003 to 0.015 in. (0.1 to 0.3 mm). If clearance is not within tolerance, adjust position of idle stop solenoid (7) on serrated bracket assembly (10) and base (11) to obtain acceptable clearance.

p. Inspect all linkage shown on Figure 76-2 for proper installation of bolts, nuts, and cotter pins.

76-4. ENGINE TEMPERATURE COMPENSATOR VERIFICATIONS (ITT TRIM VALUES)

NOTE

Reference in the Pratt & Whitney Aircraft of Canada Ltd. PT6T-3 Series Maintenance Manual to indicated temperature (T5) refers to ITT indicators on helicopter instrument panel.

1. Start engines and operate for 5 minutes to stabilize operating temperatures.

NOTE

Helicopters S/N 30554 and subsequent refer to step 3.

2. Pull appropriate ENG 1 ITT COMP or ENG 2 ITT COMP circuit breaker. Note corresponding ITT indicator reading increase to trim value listed on power section data plate. If values are not the same, remove lockwire and protective cap. Adjust T5 trim compensator adjustment screw as necessary. Push ENG 1 ITT COMP and ENG 2 ITT COMP circuit breakers in. Indicated temperature (ITT) should drop by an amount equal to trim value.

3. For helicopters S/N 30554 and sub, remove top power connection from trim compensator and note indicated ITT rises by amount equal to trim value on power section data plate. If values are not the same, remove lockwire and protective cap. Adjust trim compensator adjustment screw as necessary. Connect top power connection to trim compensator. Indicated temperature (ITT) should drop by an amount equal to the trim value.

76-5. ENGINE TORQUE TRANSMITTER ADJUSTMENT AND FUNCTIONAL CHECK

Any time a transmitter, or combining gearbox is removed or replaced for any reason, functional check should be performed to verify proper calibration.

The Bendix P/N 3567758-6501, -6503 and Courter P/N 18-1814 torque transmitters were located on combining gearbox on helicopter S/N 30501 through 30999, 31101 through 31124, and 32101 through 32142. To reduce vibration levels some transmitters are mounted on aft firewall as per TB 212-81-52. The 412-075-205 torque transmitter must be installed on aft firewall. Helicopter S/N 31125 through 31311 and 35001 and subsequent have transmitters installed on aft firewall. All torque transmitters types are covered in the following procedure.

When torque transmitter is mounted on firewall instead of combining gearbox, compensation must be made for fluid line head pressure. At zero engine torque, approximately 0.4 psig (2.76 kPa) head pressure is at transmitter, representing 0.5 percent error at full scale. To compensate P/N 3567758-6501, -6503, and 18-1814 transmitters, reset index on transmitters in following procedures to value recorded on gearbox data plate plus 0.8 (i.e. 6 + 0.8 = 6.8). To compensate 412-075-205-101 transmitter, apply a calibration pressure of 35.4 ± 0.25 psig (244.1 ± 1.72 kPa) in place of 35.0 psig (241.3 kPa) in the following procedures.

SPECIAL TEST EQUIPMENT

TYPE OR MODEL	NOMENCLATURE
Barfield Model 2311F or Equivalent	Pressure Tester 0 – 150 psi (0 - 1034 kPa)
302-00102	Pressure Gauge

1. Perform the following on helicopters with PT6T-3 engines with Bendix (35667758-6501 and -6503) or Courter (18-1814) torque transmitter.

NOTE

Refer to step 2 for helicopters with 412-075-205-101 torque transmitter installed.

a. Gearbox mounted torque transmitters.

(1) Remove electrical connector and vent line from transmitter.

(2) Remove transmitter from engine.

(3) Reconnect electrical connector.

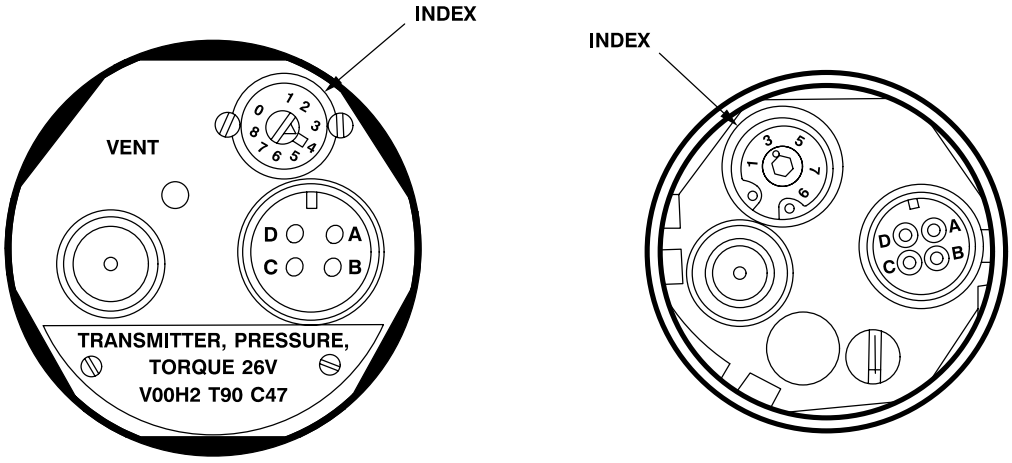
b. Firewall mounted torque transmitter.

(1) Disconnect pressure line from torque transmitter.

c. Record index setting on transmitter and set index to 6 (Figure 76-5). Attach pressure tester (Figure 76-6) to transmitter input port.

d. Apply electrical power to helicopter electrical system.

e. Set inverter switch to ON.



1 BENDIX
P/N 3567758-6501
or 3567758-6503

1 COURTER
P/N 18-1814

NOTE:

1 BENDIX OR COURTER torque transmitters on helicopters S/N 30501 through 30999, 31101 through 31124 and 32101 through 32142 with PT6T-3 engines, are located on gearbox or firewall. These transmitters on S/N 31125 and 32143 and subsequent and helicopters modified by TB 212-81-52 are mounted on the firewall.

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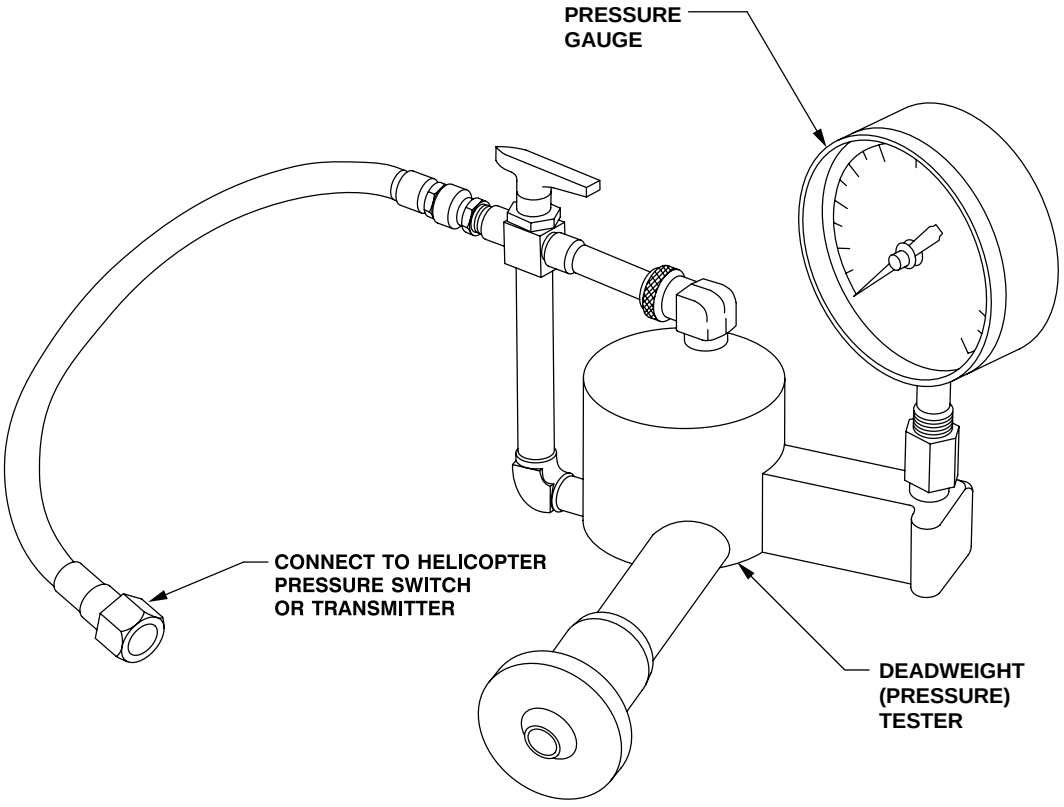
Figure 76-5. Torque Transmitter Index/Valve Settings



CAUTION

Ensure pressure tester is serviced with same oil as used in combining gearbox.

212_M_76_6_c01

Figure 76-6. Pressure Tester

CAUTION

DO NOT EXCEED 75 PSIG (517.1 KPA) APPLIED PRESSURE TO TRANSMITTER.

f. Apply 66.9 ±1.0 PSIG (461.3 ±6.90 kPa) to transmitter input port and check the following:

(1) Dual torque indicators read 90% on inner (ENGINE) scale of engine being checked. Other engine pointer remains at low end of scale.

(2) TRANSMISSION cursor indicates sum of both engines.

g. Reduce applied pressure to 37.2 ±0.5 PSIG (256.5 ±3.44 kPa) and check the following:

(1) Dual torque indicators read 50% on inner (ENGINE) scale of engine being checked. Other engine pointer remains at low end of scale.

(2) TRANSMISSION cursor indicates sum of both engine pointers.

h. Reduce applied pressure to zero. Verify ENGINE 1 and 2, and TRANSMISSION cursor are at low end of scale on both indicators.

i. If indications are not within tolerance, replace indicator or transmitter, as applicable. Repeat functional check.

j. Set inverter switch to OFF, and turn electrical power off.

k. For engine mounted torque pressure transmitter, perform the following:

(1) Remove electrical connector.

(2) Remove pressure tester.

(3) Reset index to setting recorded in step c. Verify setting coincides with reduction gearbox data plate.

(4) Reinstall transmitter. Connect vent line and electrical connector.

l. For firewall mounted torque pressure transmitter, perform the following:

(1) Remove pressure tester.

(2) Connect pressure line to transmitter.

(3) Reset index to setting recorded on reduction gearbox data plate plus 0.8 (i.e., 6.0 + 0.8 = 6.8).

m. Ensure pressure line does not leak.

2. Helicopters with PT6T-3B engines and 412-075-205-101 torque transmitters, perform the following:

a. If a new transmitter has been installed and transmitter valve positions are not known, perform the following:

(1) Locate data plate on reduction gearbox and record torque transmitter settings for left power section. Example: Torque transmitter settings for left data plate are: L.H. VALVES ABD, L.H. ∝° 87.7.

NOTE

If data plate has ALL, setting of all valves are ON.

(2) Remove cover from left torque transmitter (Figure 76-7). See Detail A for view of valves A, B, C, and D, with cover removed. Set valves to ON or OFF positions recorded in step (1). Note that valves A, B, and D are ON and valve C is OFF on sample shown in Detail A.

b. Record ∝° value from data plate on reduction gearbox and locate applicable reading in Table 76-1. Record corresponding torque indicating reading. Note this value is 47.6% for sample.

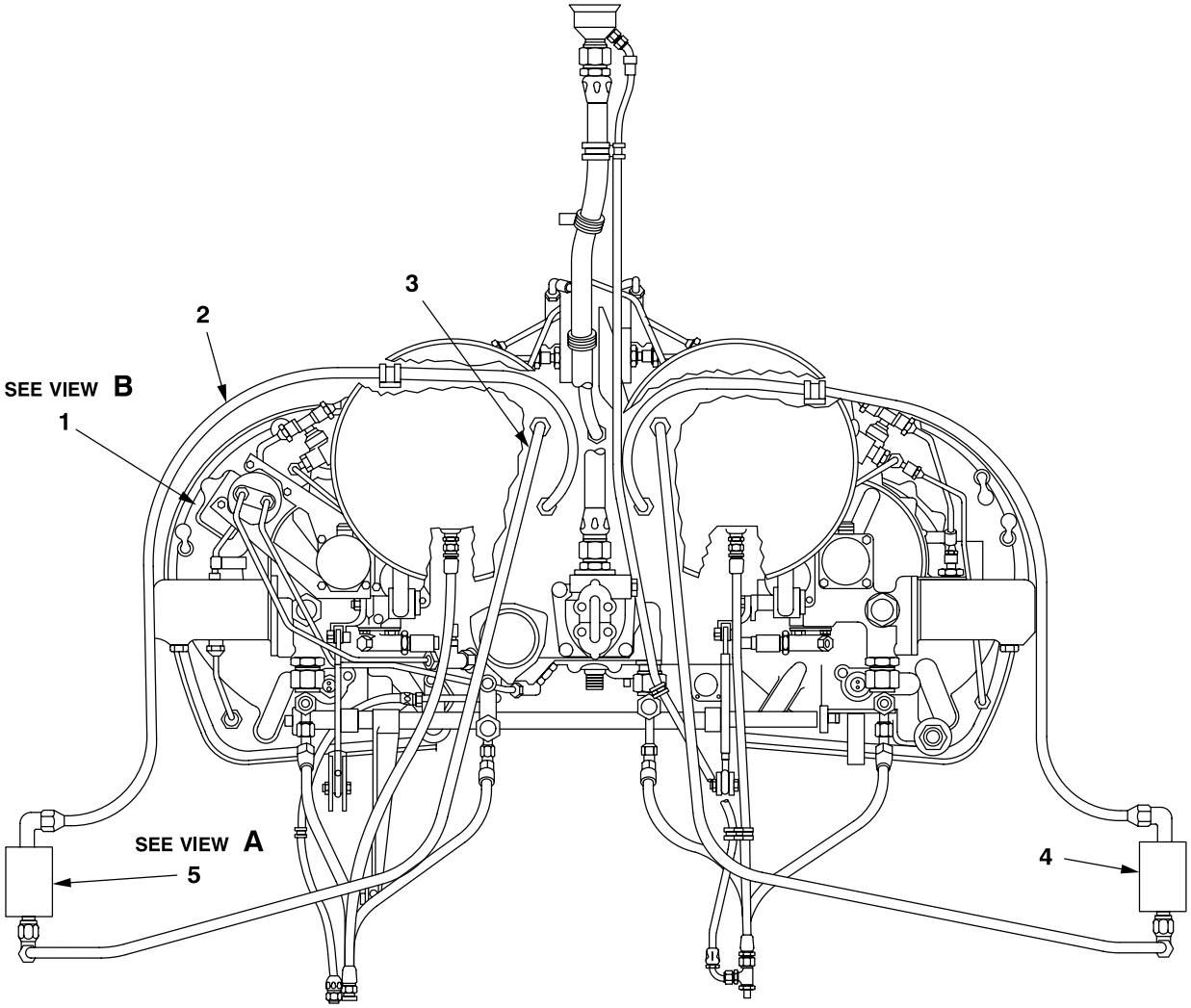
NOTE

The applicable torque for 35 ±0.25 PSIG (241.3 ±1.72 kPa) input can be calculated by using following formula:

$$\% \text{ torque} = \frac{\propto^\circ}{1.842}$$

c. Disconnect pressure line (2, Figure 76-7) from torque transmitter (5) and connect a pressure tester (Figure 76-6) to transmitter input pressure port.

d. Apply electrical power to helicopter electrical system.

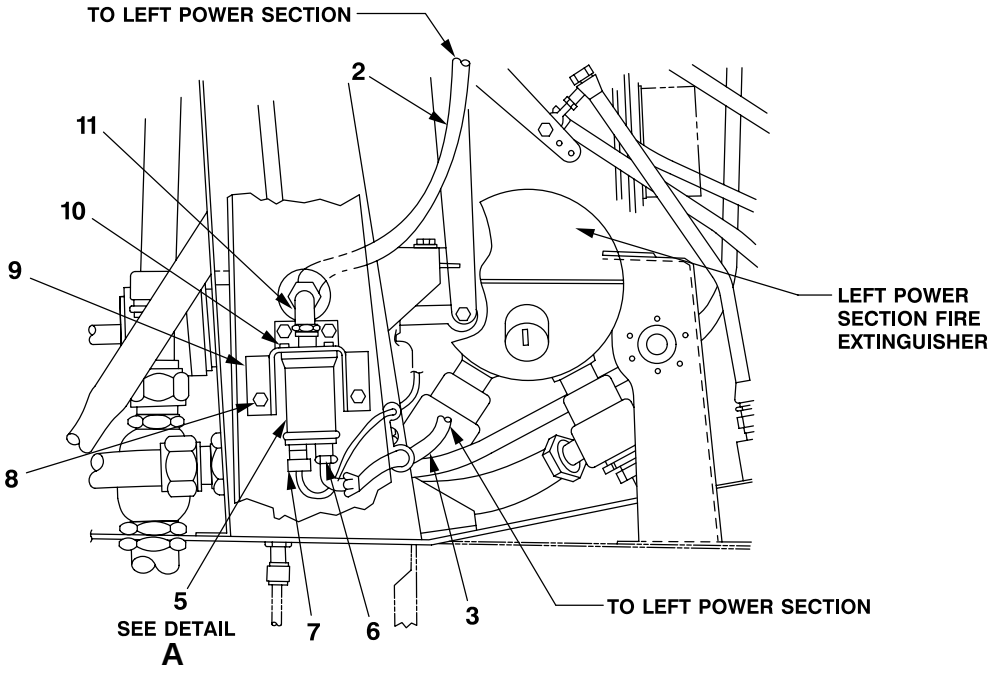


VIEW LOOKING FORWARD AT ENGINE

1. Data plate (Torque transmltter settlng instruction plate)
2. Hose assembly
3. Hose assembly
4. Torque transmitter (right)
5. Torque transmitter (left)
6. Union and packing
7. Electrical connector
8. Bolts, nuts and washers (four requlred)
9. Bracket
10. Nut and washer (AN960C1716)
11. Elbow and nut

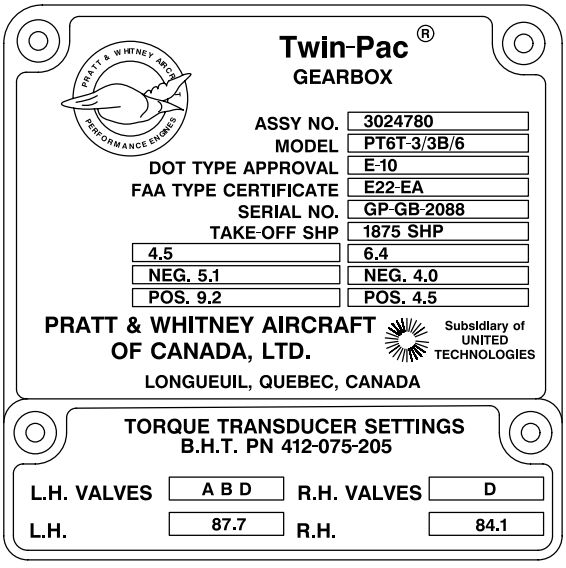
212_M_76_7_1

Figure 76-7. Torque Transmitter (Typical) (Sheet 1 of 3)



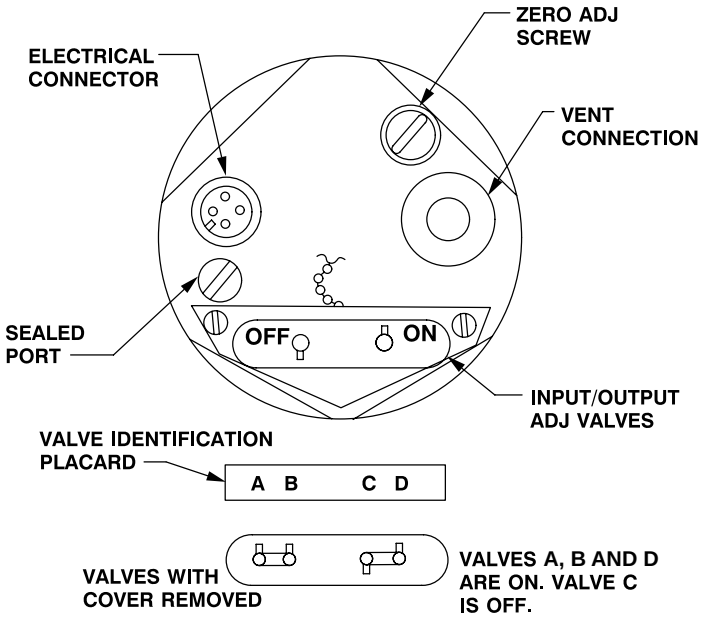
VIEW LOOKING INBOARD AT LEFT POWER SECTION TORQUE TRANSMITTER (5). RIGHT POWER SECTION TORQUE TRANSMITTER (4) IS OPPOSITE.

VIEW **A**



DATA PLATE (TORQUE TRANSMITTER SETTING INSTRUCTION PLATE)

VIEW **B**



BOTTOM VIEW OF TORQUE TRANSMITTER SAMPLE TORQUE TRANSMITTER SETTING

DETAIL **A**

212_M_76_7_2_c01

Figure 76-7. Torque Transmitter (Typical) (Sheet 2 of 3)

Gearbox Data Plate Slope Setting	Transducer Slope Switch Setting
NIL	1
A	2
B	3
AB	4
D	5
AD	6
BD	7
ABD	8
BCD	9
ALL	10

TRANSDUCER SETTING CHART
DETAIL B

212_M_76_7_3_c01

Figure 76-7. Torque Transmitter (Typical) (Sheet 3 of 3)

Table 76-1. Torque Pressure Conversion Chart

DATA PLATE SETTING ⚠1	PERCENT TORQUE ⚠2	DATA PLATE SETTING ⚠1	PERCENT TORQUE ⚠2
84.0	45.6	87.6	47.6
84.1	45.7	87.7	47.6
84.2	45.7	87.8	47.7
84.3	45.8	87.9	47.7
84.4	45.8	88.0	47.8
84.5	45.9	88.1	47.8
84.6	45.9	88.2	47.9
84.7	46.0	88.3	47.9
84.8	46.0	88.4	48.0
84.9	46.1	88.5	48.0
85.0	46.1	88.5	48.1
85.1	46.2	88.7	48.2
85.2	46.3	88.8	48.2
85.3	46.3	88.9	48.3
85.4	46.4	89.0	48.3
85.5	46.4	89.1	48.4
85.6	46.5	89.2	48.4
85.7	46.5	89.3	48.5
85.8	46.6	89.4	48.5
85.9	46.6	89.5	48.6
86.0	46.7	89.6	48.6
86.1	46.7	89.7	48.7
86.2	46.8	89.8	48.8
86.3	46.8	89.9	48.8
86.4	46.9	90.0	48.9
86.5	47.0	90.1	48.9
86.6	47.0	90.2	49.0
86.7	47.1	90.3	49.0
86.8	47.1	90.4	49.1
86.9	47.2	90.5	49.1
87.0	47.2	90.6	49.2
87.1	47.3	90.7	49.2
87.2	47.3	90.8	49.3
87.3	47.4	90.9	49.3
87.4	47.4	91.0	49.4
87.5	47.5		

NOTES:

⚠1 Combining gearbox data plate torque transmitter ∝° setting.

⚠2 Torque indicator (212-070-160) reading in percent corresponding to ∝° values at 35 ± 0.25 psig (241.32 ± 1.72 kPa) applied to torque transmitter.

e. Set inverter switch to ON.

f. Apply a pressure of 35.4 ±0.25 PSIG (244.1 ±1.72 kPa) to transmitter and note percentage torque reading on TORQUE pressure ENGINE indicator.

g. Rotate zero adjustment screw, if required, on transmitter (Figure 76-7, Detail A) until indicator agrees with reference percentage computed in step b. A counterclockwise rotation increases indicated torque. Vibrate torque transmitter during adjustment to reduce friction.

h. If indications are not within tolerance, replace indicator or transmitter, as applicable. Repeat operational check.

i. Reduce pressure to zero and disconnect pressure tester from torque transmitter. Reconnect pressure line and ensure line does not leak.

j. Set inverter switch to OFF, and turn electrical power off.

k. Disconnect and remove pressure tester.

l. Connect pressure line (2) on transmitter (5).

m. Install valve cover (Detail A) on transmitter (5).

n. Start applicable power section (refer to Flight Manual) and observe TRIPLE TORQUE indicator. If indicator needle fluctuates, bleed air from hose (2) and transmitter (5).

76-5A. ENGINE TORQUE TRANSMITTER ADJUSTMENT AND FUNCTIONAL CHECK — BENZ SYSTEM

NOTE

The following adjustment procedures are applicable to the Benz Model 800-0001 torque transmitting system (Post TB 212-01-187).

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
BM 200 or BT 51	Megohmeter Dead
10-10525	Weight Tester

NOTE

The following torque adjustment procedure is required when the combining gearbox is removed or replaced and/or when either torque transmitter is changed. This will ensure proper calibration of the system.

NOTE

If additional information on torque indicating systems is required, refer to Chapter 95 and Chapter 96. Torque transmitter adjustment procedures for left power section are given. Adjustment procedures for right power section are similar.

1. Locate data plate (1, Figure 76-7B) on engine reduction gearbox and record the torque transducer setting codes and alpha codes for the left side of the helicopter.

2. Remove the zero and slope adjustment cover located on torque signal converter (9) for the left engine, and set the slope adjustment in accordance with the following reference chart, to agree with the valve setting codes specified on the data plate (1).

SLOPE ADJUSTMENT REFERENCE CHART

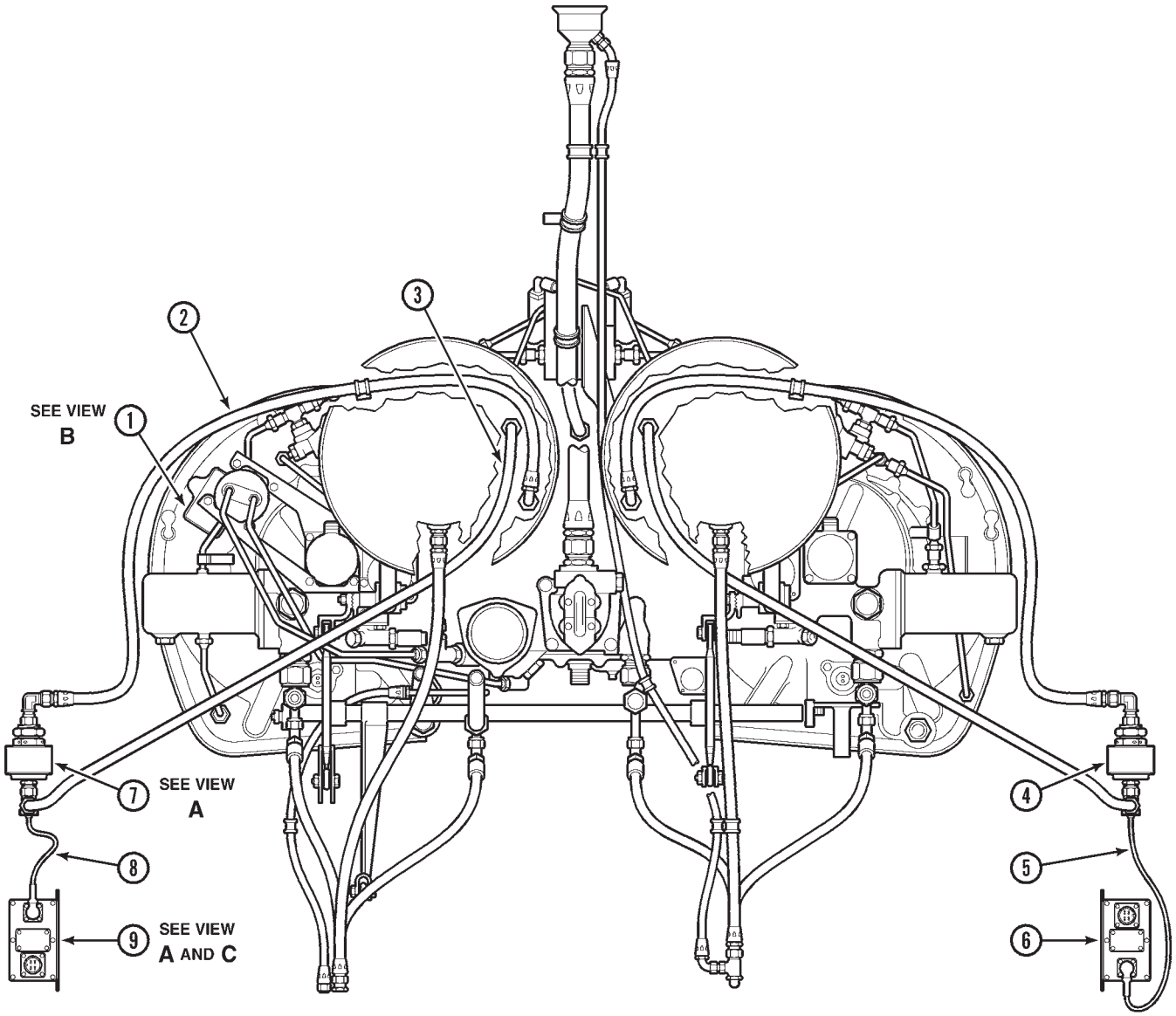
COMBINING GEARBOX VALVE SETTING CODE	SLOPE SWITCH SETTING ON TORQUE CONVERTER
NIL	1
A	2
B	3
AB	4
D	5
AD	6
BD	7
ABD	8
BCD	9
ALL	10

°C Value from Torque Transmitter Setting Instruction Plate	Corresponding Torque Indicator Reading (%) for °C Value at Left	°C Value from Torque Transmitter Setting Instruction Plate	Corresponding Torque Indicator Reading (%) for °C Value at Left	°C Value from Torque Transmitter Setting Instruction Plate	Corresponding Torque Indicator Reading (%) for °C Value at Left
82.0	44.52	85.4	46.36	88.8	48.21
82.1	44.57	85.5	46.42	88.9	48.26
82.2	44.65	85.6	46.47	89.0	48.32
82.3	44.68	85.7	46.53	89.1	48.37
82.4	44.73	85.8	46.58	89.2	48.43
82.5	44.79	85.9	46.63	89.3	48.48
82.6	44.84	86.0	46.69	89.4	48.53
82.7	44.90	86.1	46.74	89.5	48.59
82.8	44.95	86.2	46.80	89.6	48.64
82.9	45.01	86.3	46.85	89.7	48.70
83.0	45.06	86.4	46.91	89.8	48.75
83.1	45.11	86.5	46.96	89.9	48.81
83.2	45.17	86.6	47.01	90.0	48.86
83.3	45.22	86.7	47.07	90.1	48.91
83.4	45.28	86.8	47.07	90.2	48.97
83.5	45.33	86.9	47.18	90.3	49.02
83.6	45.39	87.0	47.23	90.4	49.08
83.7	45.44	87.1	47.29	90.5	49.13
83.8	45.49	87.2	47.34	90.6	49.19
83.9	45.55	87.3	47.39	90.7	49.24
84.0	45.60	87.4	47.45	90.8	49.29
84.1	45.66	87.5	47.50	90.9	49.35
84.2	45.71	87.6	47.56	91.0	49.40
84.3	45.77	87.7	47.61	91.1	49.46
84.4	45.82	87.8	47.67		
84.5	45.87	87.9	47.72		
84.6	45.93	88.0	47.77		
84.7	45.98	88.1	47.83		
84.8	46.04	88.2	47.88		
84.9	46.09	88.3	47.94		
85.0	46.15	88.4	47.99		
85.1	46.20	88.5	48.05		
85.2	46.25	88.6	48.10		
85.3	46.31	88.7	48.15		

$$\frac{°C}{K} = \% \text{ Torque Indicator Reading}$$

K = 1.842
Test pressure is 35.4 PSIG

Figure 76-7A. Torque Transmitter Calibration — Benz System

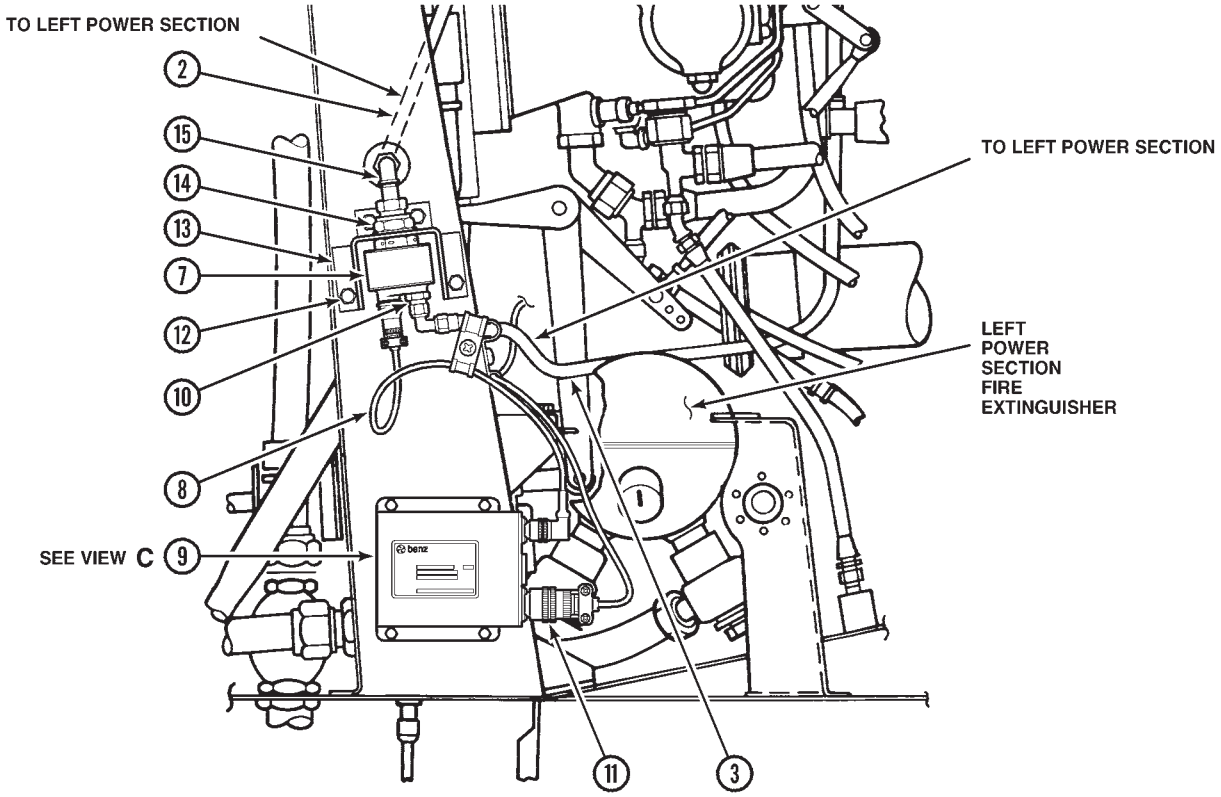


VIEW LOOKING FORWARD AT ENGINE

1. Data plate (Torque transmitter setting instruction plate)
2. Hose assembly
3. Hose assembly
4. Pressure transducer (right)
5. Interface cable (right)
6. Torque signal converter (right)
7. Pressure transducer (left)
8. Interface cable (left)
9. Torque signal converter (left)
10. Union and packing
11. Electrical connector
12. Bolts, nuts and washers (four required)
13. Bracket
14. Nut and washer (NAS1149C1790R)
15. Elbow and nut

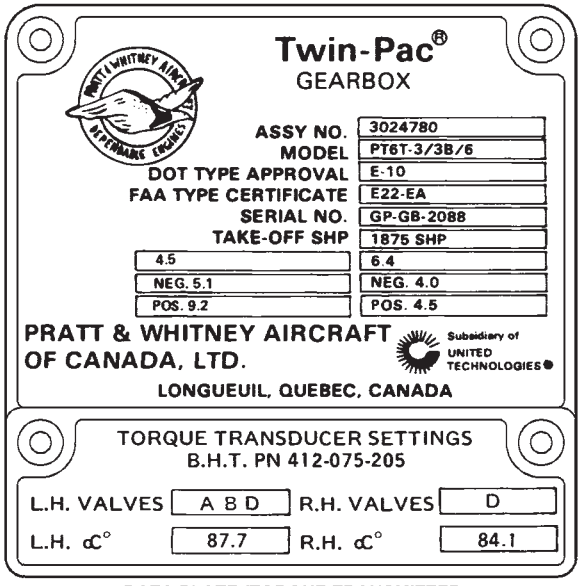
412N_MM_76_0002a

Figure 76-7B. Torque Transmitter (Typical) — Benz System (Sheet 1 of 2)



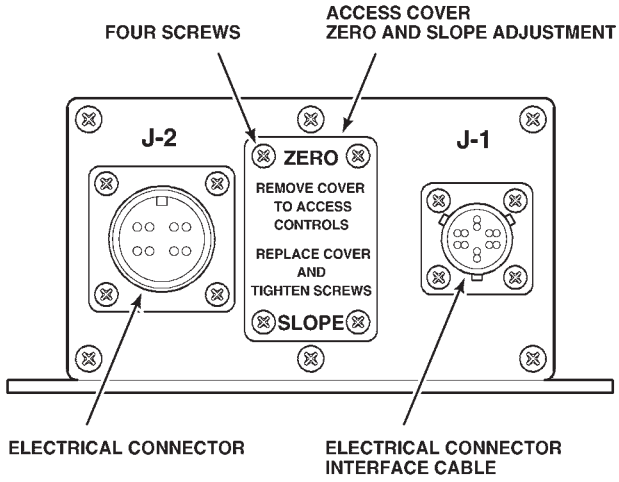
VIEW LOOKING INBOARD AT LEFT POWER SECTION TORQUE TRANSMITTING SYSTEM.
RIGHT POWER SECTION TORQUE TRANSMITTING SYSTEM IS OPPOSITE.

VIEW A



DATA PLATE (TORQUE TRANSMITTER
SETTING INSTRUCTION PLATE)

VIEW B



TORQUE SIGNAL CONVERTER
VIEW OF CONNECTORS AND ACCESS COVER

VIEW C

412N_MM_76_0002b

Figure 76-7B. Torque Transmitter (Typical) — Benz System (Sheet 2 of 2)

3. With the torque indicators disconnected, use a megohmeter and measure resistance between pins C and D to airframe ground. Resistance should be 10 meg ohm or greater.

4. With electrical connector removed from the transmitter(s), apply helicopter power. Voltage across pins A to B at the transmitter connector should be 26 VAC ±2V.

5. Turn off all helicopter electrical power.

6. Install connectors on the torque signal converter(s) and transducer(s).

7. Turn on helicopter electrical power.

8. Depress circuit breakers one at a time. The indicator(s) should read approximately zero.

9. Disconnect the pressure line from the top of the torque pressure transducer (7) and connect a dead weight tester to the input port of the transducer. Exercise care to ensure the pressure line is free of trapped air.

10. Position the dead weight tester in the same horizontal plane as the pressure transducer. Apply power to the helicopter electrical system. Calibrate the system one at a time with power removed (pull circuit breaker) from the opposite system.

11. Apply a test pressure of 35.4 ±0.1 PSIG and record pilot and copilot torque percent indications.

NOTE

Verify that the copilot indicator reading is within 1% of pilot indicator reading. If not within 1%, the pilot and/or copilot indicator may be out of calibration.

12. Refer to the data plate to locate the alpha code for the left side. Divide the alpha code by the K factor or use the conversion chart (both found in Figure 76-7A) and adjust the zero adjustment located on the torque signal converter (9, Figure 76-7B) until the pilot torque gauge reads this percent setting ±0.25%. See the following example:

- EXAMPLE for Model 212 with torque indicator 212-070-160-XXX:

  At test pressure of 35.4 PSI, pilot torque indicator reads 40%. Alpha Code is 87.7 divided by K Factor of 1.842 = 47.61. Adjust the Zero adjustment to make the pilot torque indicator read 47.61%.

13. Return applied pressure to zero. Turn off electrical power from the system. Disconnect and remove the dead weight tester. Install the hose assembly (2) from the engine reduction gearbox to the top of the torque pressure transducer (7). Exercise care to ensure the pressure line is free of trapped air. Installation torque on pressure line fittings are to be in accordance with BHT-ALL-SPM.

14. Install the zero and slope adjustment cover onto torque signal converter (9).

15. Start left engine power section and observe engine 1 torque indicator.

76-6. MAXIMUM TORQUE CHECK AND CONTROL LIMIT SETTING

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
2311F	Deadweight Tester or Equivalent
302-00102	Pressure Gauge

CAUTION

PERFORM TORQUE LIMITER CHECK AND ADJUSTMENT PROCEDURE AFTER EACH CHANGE OF REDUCTION GEARBOX AND/OR TORQUE CONTROL UNIT (TCU).

NOTE

Procedures outlined in paragraph 76-7 or paragraph 76-8 are applicable to all 212 helicopters.

There are two preferred methods to adjust and check the Torque Control Unit (TCU) maximum torque limit setting. The primary method (paragraph 76-7) requires operation of the engines. The alternate method (paragraph 76-8) is performed without operating the engines. Both of these procedures are performed on

the ground. Refer to paragraph 76-9 for an additional method applicable to 212 helicopters not modified by TB 212-91-138 only.

76-7. Torque Limit Adjustment

1. For aircraft equipped with Torque Control Unit (TCU) per Figure 76-8 proceed as follows:

a. Remove lockwire and disconnect tube assemblies (6 and 7) from fittings (5 and 8).

b. Plug open ends of tubes (6 and 7).

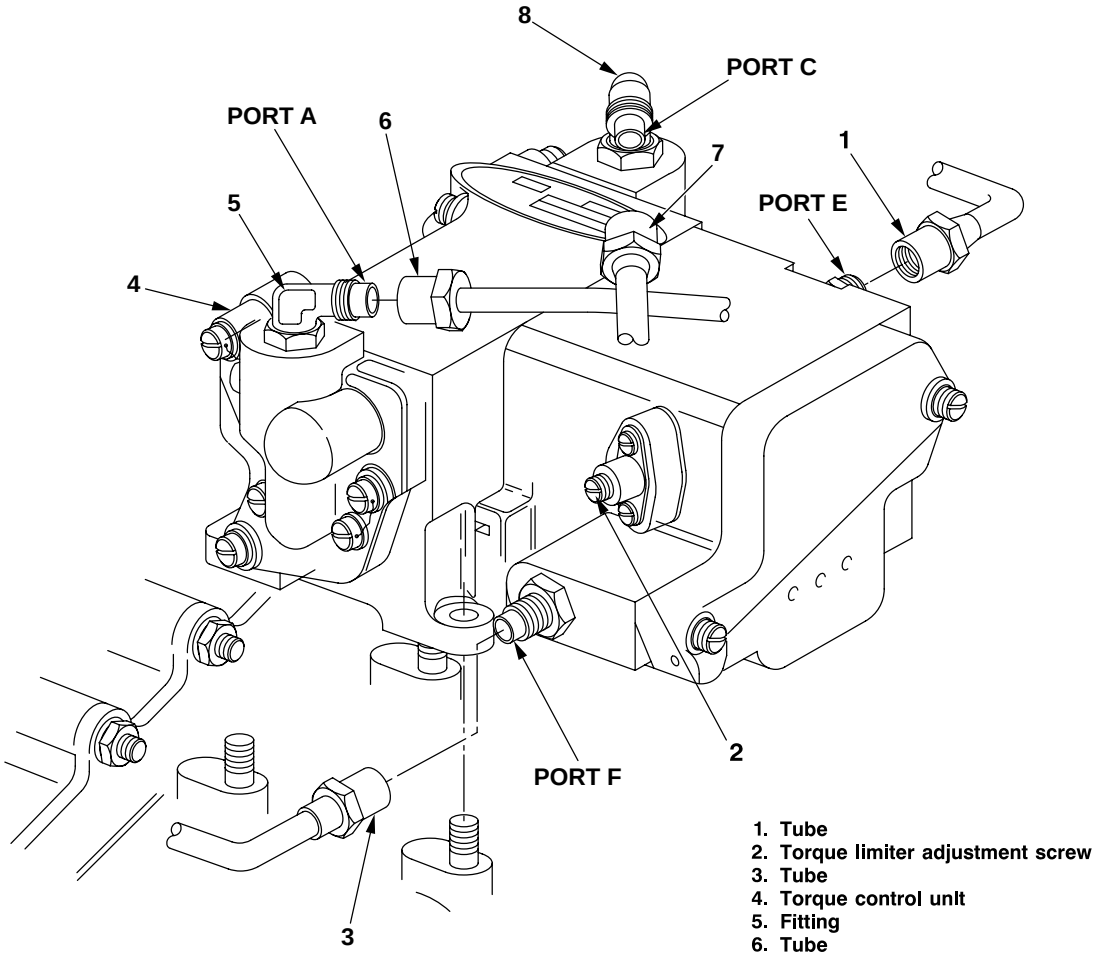
c. Using test equipment (Figure 76-6 or equivalent) with a tee fitting and two lines. Connect one line of the pressure tester to fitting (5) and one line to fitting (8).

2. For aircraft equipped with Torque Control Unit (TCU) as shown in Figure 76-9 or universal Torque Control Unit (TCU) as shown in Figure 76-10 proceed as follows:

a. Remove lockwire and disconnect tube assemblies (1 and 2) from tee fittings (3 and 4).

b. Plug open ends of the tube assemblies (1 and 2) and cap port "D" on tee fitting (4).

c. Using test equipment hoses, connect pressure tester to port "A" on tee fitting (3). Connect test hose between ports "B" and "C".



NOTE

1. **Port B and Port D not applicable to this installation.**

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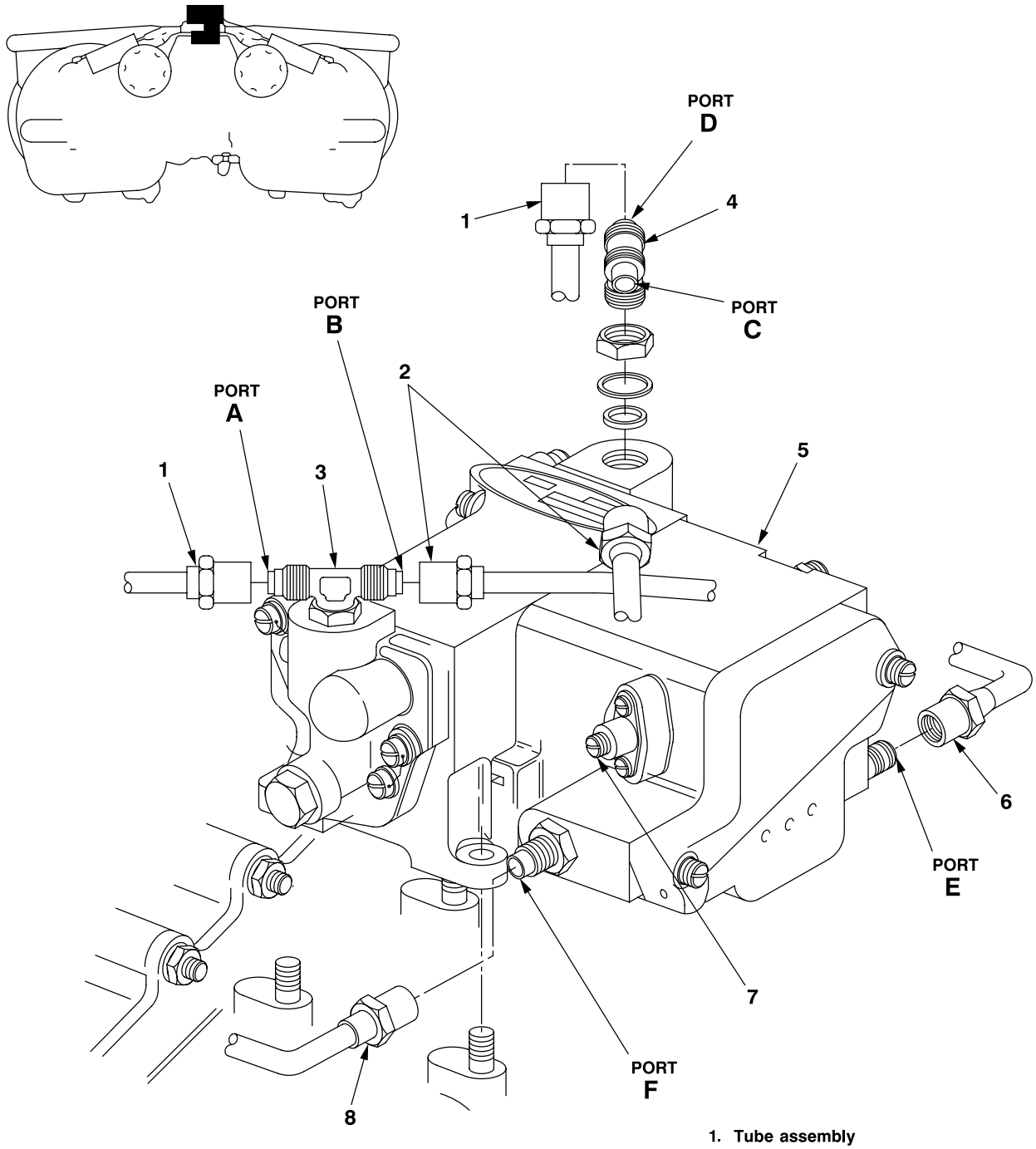
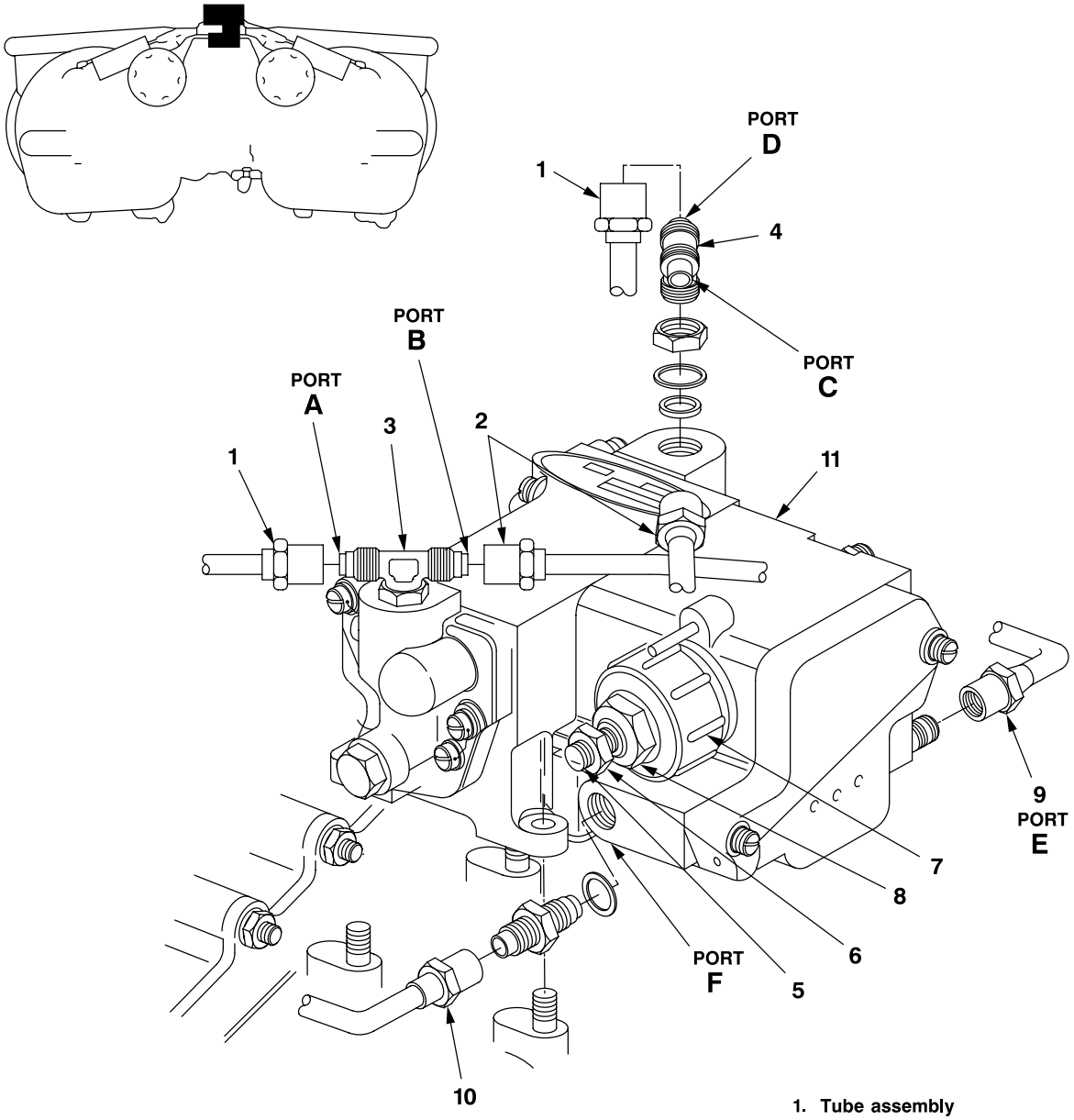
Figure 76-8. Torque Control Unit (TCU) Adjustment



1. Tube assembly
2. Tube assembly
3. Tee fitting
4. Tee fitting
5. Torque control unit
6. Pg tube assembly
7. Torque limlter adjustment screw
8. Pg tube assembly

212_M_76_9_c01

Figure 76-9. Torque Control Unit (TCU) Torque Limit Adjustment



1. Tube assembly
2. Tube assembly
3. Tee fitting
4. Tee fitting
5. Fine adjustment screw
6. Fine adjustment locknut
7. Coarse adjustment dome
8. Coarse adjustment locknut
9. Pg tube assembly
10. Pg tube assembly
11. Torque control unit (TCU)

212_M_76_10

Figure 76-10. Universal Torque Control Unit (TCU) Torque Limit Adjustment

CAUTION

ENSURE PRESSURE TESTER IS SERVICED WITH SAME OIL AS USED IN COMBINING GEARBOX.

CAUTION

PRESSURE TESTER AND GAUGE SHALL BE AT SAME HEIGHT AS REDUCTION GEARBOX TORQUEMETER (APPROXIMATE LEVEL OF OIL COOLER BLOWER CENTER LINE).

3. Fill and bleed pressure tester, fitting and hoses.

4. Calculate torque limiter setting (Figure 76-7) as follows:

NOTE

In the following steps Table 76-2 is used as an example. Use the following charts, as applicable, to determine the correct table for the specific helicopter configuration.

212	Table 76-2
212 Modified by Technical Bulletin 212-91-138	Table 76-3

a. Locate data plate on reduction (combining) gearbox and record "SPAN" and "ZERO" setting for left and right power section. See Figure 76-7, detail B for sample date plate. The "span" and "zero" setting for left and right power sections on the sample data plate are:

LH ZERO NEG 5.1 RH ZERO NEG 4.0

LH SPAN POS 9.2 RH SPAN POS 4.5

b. For left and right sides combining gearbox determine torque pressure equivalent to limiting torque as follows:

NOTE

If "SPAN" number falls between two ranges (e.g., is 5.0 or 8.0 etc.), use row at next higher range (e.g., if "SPAN" number is 5.0, follow row corresponding to 5 to 6 range).

c. Enter in Table 76-2 on left side row corresponding to range in which "SPAN" number falls.

NOTE

If "ZERO" number falls between two ranges (e.g., is 7 or 9 etc.), use row at the next lower (less negative) range (e.g. if "ZERO" number is –7.0, use column corresponding to –6 to –7.0 range).

d. Follow row from left to right until under column corresponding to range in which "ZERO" number falls. Record number at this location.

e. The pressure at which torque limiting should occur is the average left and right pressures found in steps (c) and (d). Calculate this as follows:

$$\text{Average pressure} = \frac{(\text{LH press} + \text{RH press})}{2}$$

EXAMPLE:

LH ZERO = NEG 5.1 RH ZERO = NEG 4.0
LH SPAN = POS 9.2 RH SPAN = POS 4.5

For left hand pressure, enter left side of Table 76-2 at row corresponding to range 9 to 10. Follow this row until under column corresponding to range –5 to –6. The pressure at this location is 38.43 psig.

For RH pressure, enter left side of Table 76-2 at row corresponding to range 4 to 5. Follow this row until under column corresponding to range –3 to –4 (the lower is used as directed by NOTE above). The pressure at this location is 39.11 psig.

Average pressure for LH and RH sides:

$$\frac{38.43 + 39.11}{2} = 38.77 \text{ psig rounded to } 38.80 \text{ psig.}$$

5. Aircraft equipped with TCU (11, Figure 76-10) adjust as follows prior to ground run.

Table 76-2. Model 212 Pratt and Whitney PT6T-3/3B Torquemeter Pressure at Torque Limit

Zero Inc.	–12	–11	–10	–9	–8	–7	–6	–5	–4	–3	–2	–1	0	1	2
Span Ratio															
22															
21	38.60	38.24	37.88	37.52	37.16	36.80	36.44	36.08	35.72	35.36	35.00	34.65	34.29	33.93	
20	38.79	38.43	38.07	37.71	37.35	36.99	36.63	36.27	35.91	35.54	35.18	34.82	34.46	34.10	
19	38.99	38.63	38.27	37.90	37.54	37.18	36.82	36.45	36.09	35.73	35.36	35.00	34.64	34.28	
18	39.19	38.83	38.47	38.10	37.74	37.37	37.01	36.64	36.28	35.91	35.55	35.18	34.82	34.45	
17	39.40	39.03	38.67	38.30	37.93	37.57	37.20	36.83	36.47	36.10	35.73	35.37	35.00	34.63	
16	39.60	39.24	38.87	38.50	38.13	37.76	37.39	37.02	36.66	36.29	35.92	35.55	35.18	34.81	
15	39.81	39.44	39.07	38.70	38.33	37.96	37.59	37.22	36.85	36.48	36.11	35.74	35.37	35.00	
14	40.02	39.65	39.28	38.90	38.53	38.16	37.79	37.41	37.04	36.67	36.30	35.93	35.55	35.18	
13	40.23	39.86	39.49	39.11	38.74	38.36	37.99	37.61	37.24	36.86	36.49	36.12	35.74	35.37	
12	40.45	40.07	39.70	39.32	38.94	38.57	38.19	37.81	37.44	37.06	36.68	36.31	35.93	35.56	
11	40.67	40.29	39.91	39.53	39.15	38.77	38.40	38.02	37.64	37.26	36.88	36.50	36.12	35.75	
10	40.89	40.50	40.12	39.74	39.36	38.98	38.60	38.22	37.84	37.46	37.08	36.70	36.32	35.94	
9	41.11	40.72	40.34	39.96	39.58	39.19	38.81	38.43	38.05	37.66	37.28	36.90	36.52	36.13	
8	41.33	40.95	40.56	40.18	39.79	39.41	39.02	38.64	38.25	37.87	37.48	37.10	36.72	36.33	
7	41.56	41.17	40.78	40.40	40.01	39.62	39.24	38.85	38.46	38.08	37.69	37.30	36.92	36.53	
6	41.79	41.40	41.01	40.62	40.23	39.84	39.45	39.06	38.68	38.29	37.90	37.51	37.12	36.73	
5	42.02	41.63	41.24	40.84	40.45	40.06	39.67	39.28	38.89	38.50	38.11	37.72	37.33	36.93	
4	42.25	41.86	41.47	41.07	40.68	40.29	39.89	39.50	39.11	38.71	38.32	37.93	37.53	37.14	
3	42.49	42.09	41.70	41.30	40.91	40.51	40.12	39.72	39.33	38.93	38.53	38.14	37.74	37.35	
2	42.73	42.33	41.93	41.53	41.14	40.74	40.34	39.94	39.55	39.15	38.75	38.35	37.96	37.56	
1	42.97	42.57	42.17	41.77	41.37	40.97	40.57	40.17	39.77	39.37	38.97	38.57	38.17	37.77	
0	43.21	42.81	42.41	42.01	41.61	41.20	40.80	40.40	40.00	39.60	39.19	38.79	38.39	37.99	
–1	43.46	43.06	42.65	42.25	41.84	41.44	41.04	40.63	40.23	39.82	39.42	39.01	38.61	38.20	
–2	43.71	43.31	42.90	42.49	42.09	41.68	41.27	40.87	40.46	40.05	39.64	39.24	38.83	38.42	
–3	43.97	43.56	43.15	42.74	42.33	41.92	41.51	41.10	40.69	40.28	39.87	39.47	39.06	38.65	
–4	44.22	43.81	43.40	42.99	42.58	42.16	41.75	41.34	40.93	40.52	40.11	39.70	39.28	38.87	

Table 76-3. Model 212 HP Pratt and Whitney PT6T-3/3B Torquemeter Pressure at Torque Limit

Zero Inc.	–12	–11	–10	–9	–8	–7	–6	–5	–4	–3	–2	–1	0	1	2
Span Ratio															
22															
21	42.29	41.93	41.57	41.22	40.86	40.50	40.14	39.78	39.42	39.06	38.70	38.34	37.98	37.62	
20	42.51	42.15	41.79	41.43	41.07	40.70	40.34	39.98	39.62	39.26	38.90	38.54	38.18	37.82	
19	42.73	42.37	42.00	41.64	41.28	40.91	40.55	40.19	39.82	39.46	39.10	38.74	38.37	38.01	
18	42.95	42.58	42.22	41.85	41.49	41.13	40.76	40.40	40.03	39.67	39.30	38.94	38.57	38.21	
17	43.17	42.81	42.44	42.07	41.71	41.34	40.97	40.61	40.24	39.87	39.51	39.14	38.77	38.41	
16	43.40	43.03	42.66	42.29	41.92	41.55	41.19	40.82	40.45	40.08	39.71	39.34	38.97	38.61	
15	43.63	43.25	42.88	42.51	42.14	41.77	41.40	41.03	40.66	40.29	39.92	39.55	39.18	38.81	
14	43.86	43.48	43.11	42.74	42.37	41.99	41.62	41.25	40.88	40.50	40.13	39.76	39.39	39.01	
13	44.09	43.71	43.34	42.96	42.59	42.22	41.84	41.47	41.09	40.72	40.34	39.97	39.59	39.22	
12	44.32	43.95	43.57	43.19	42.82	42.44	42.06	41.69	41.31	40.94	40.56	40.18	39.81	39.43	
11	44.56	44.18	43.80	43.43	43.05	42.67	42.29	41.91	41.53	41.15	40.78	40.40	40.02	39.64	
10	44.80	44.42	44.04	43.66	43.28	42.90	42.52	42.14	41.76	41.38	41.00	40.62	40.24	39.85	
9	45.04	44.66	44.28	43.90	43.51	43.13	42.75	42.37	41.98	41.60	41.22	40.84	40.45	40.07	
8	45.29	44.90	44.52	44.14	43.75	43.37	42.98	42.60	42.21	41.83	41.44	41.06	40.67	40.29	
7	45.54	45.15	44.76	44.38	43.99	43.60	43.22	42.83	42.44	42.06	41.67	41.28	40.90	40.51	
6	45.79	45.40	45.01	44.62	44.23	43.84	43.46	43.07	42.68	42.29	41.90	41.51	41.12	40.73	
5	46.04	45.65	45.26	44.87	44.48	44.09	43.70	43.30	42.91	42.52	42.13	41.74	41.35	40.96	
4	46.30	45.91	45.51	45.12	44.73	44.33	43.94	43.55	43.15	42.76	42.37	41.97	41.58	41.19	
3	46.56	46.16	45.77	45.37	44.98	44.58	44.19	43.79	43.39	43.00	42.60	42.21	41.81	41.42	
2	46.82	46.42	46.02	45.63	45.23	44.83	44.43	44.04	43.64	43.24	42.84	42.45	42.05	41.65	
1	47.09	46.69	46.29	45.89	45.49	45.09	44.69	44.29	43.89	43.49	43.09	42.69	42.29	41.89	
0	47.35	46.95	46.55	46.15	45.75	45.34	44.94	44.54	44.14	43.73	43.33	42.93	42.53	42.13	
–1	47.63	47.22	46.82	46.41	46.01	45.60	45.20	44.79	44.39	43.98	43.58	43.18	42.77	42.37	
–2	47.90	47.49	47.09	46.68	46.27	45.87	45.46	45.05	44.65	44.24	43.83	43.42	43.02	42.61	
–3	48.18	47.77	47.36	46.95	46.54	46.13	45.72	45.31	44.90	44.49	44.09	43.68	43.27	42.86	
–4	48.46	48.05	47.64	47.22	46.81	46.40	45.99	45.58	45.17	44.75	44.34	43.93	43.52	43.11	

CAUTION

ON A NEW TCU, THREE LOCKWIRE/SEALS ARE INSTALLED FOR QUALITY CONTROL. THE SEAL BETWEEN THE COARSE ADJUSTMENT DOME AND THE COARSE ADJUSTMENT LOCKNUT MUST NOT BE REMOVED OR WARRANTY WILL BE VOIDED.

NOTE

Seals between the coarse adjustment dome and TCU and between the fine adjustment locknut can be removed and lockwire as required for maintenance.

a. Remove the lockwire/seal between the coarse adjustment dome (7) and TCU (11) body.

b. Remove the lockwire/seal between the fine adjustment screw (5) and fine adjustment screw locknut (6).

NOTE

On fine adjustment screw, internal stops allow nearly half a turn in each direction. Full travel (stop to stop) is equivalent to one coarse adjustment position change. The fine adjustment screw should be returned to the nominal (center) position prior to any coarse adjustment change (marks on inner and outer screw aligned).

c. Verify the fine adjustment screw (5) is in the nominal position (center); if necessary reset the fine adjustment screw before adjusting the coarse adjustment dome (7).

d. Set the coarse adjustment dome to the position (1 to 9) matching coarse adjustment range as per Table 76-4. The coarse adjustment range corresponds to the addition of LH and RH pressure as determined from Table 76-2. From the example, 38.43 + 39.11 = 77.54; this corresponds to dial position 2 from Table 76-4.

Table 76-4. Coarse Adjustment Dome Range

DIAL POSITION	COARSE ADJUSTMENT RANGE
1	56.6 TO 68.4
2	68.5 TO 80.3
3	80.4 TO 92.2
4	92.3 TO 104.1
5	104.2 TO 116.0
6	116.1 TO 127.9
7	128.0 TO 140.8
8	140.9 TO 152.7
9	152.8 TO 164.6

6. Check torque limiter adjustment as follows:

a. Start both power sections and stabilize at idle for 5 minutes. Verify ENG 1 and ENG 2 switches are in AUTO position.

b. Increase twin-engine power to achieve 100% ROTOR (Nr) rpm, while maintaining flat pitch.

CAUTION

TO AVOID DAMAGE TO TCU, DO NOT EXCEED 57 PSIG FROM PRESSURE TESTER.

c. Increase Pressure (57 psig maximum) from hand pressure calibrator and record what pressure ROTOR (Nr) rpm begins to droop.

NOTE

A 1/8 of a turn of screw (2, Figure 76-8), or (7, Figure 76-9) or (5, Figure 76-10) will change pressure at which droop occurs by approximately 3.0 psig.

d. If droop does not occur at calculated pressure ±0.35 psig (as read on tester), decrease applied pressure and adjust TCU adjustment screw clockwise to increase pressure or counterclockwise to decrease pressure.

e. Repeat steps c and d until limiter setting is adjusted within ±0.35 psig of pressure calculated.

f. Shut down power sections.

7. Remove pressure test equipment.

8. For aircraft equipped with Torque Control Unit (TCU) per Figure 76-8 proceed as follows:

a. Remove plugs from end of tubes (6 and 7).

b. Connect tubes assemblies (6 and 7) to fittings (5 and 8) and lockwire.

9. For aircraft equipped with Torque Control Unit (TCU) per Figures 76-9 and 76-10 proceed as follows:

a. Remove test hose between port "B" and "C".

b. Remove plugs from tube assemblies (1 and 2) and from port "D" on tee fitting (4).

c. Connect tubes (1 and 2) to tee fittings (3 and 4) and lockwire.

76-8. Torque Limit Adjustment, Alternate Method

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
Commercial	Filtered, regulated air pressure source

NOTE

This alternate procedure can be used when it is desirable to adjust the torque limiter without operating the engines.

1. Install equipment and calculate the torque limiter setting as per paragraph 76-7, steps 1 through 5.

2. Connect filtered air with in-line regulator to one or both Pg air ports (E and F, Figures 76-8, 76-9 or 76-10) on right and/or left side of TCU.

3. Adjust air pressure (Pg) to approximately 15 psig.

CAUTION

TO AVOID DAMAGE TO TCU, DO NOT EXCEED 57 PSIG FROM PRESSURE TESTER.

4. Increase pressure from pressure tester and record at what oil pressure the air pressure begins to drop.

NOTE

A 1/8 of a turn of screw (2, Figure 76-8), or (7, Figure 76-9) or (5, Figure 76-10) will change pressure at which droop occurs by approximately 3.0 psig.

5. If air pressure drop does not occur at calculated pressure ±0.35 psig (as read on tester), decrease applied pressure and adjust TCU adjustment screw clockwise to increase pressure or counterclockwise to decrease pressure.

6. Repeat steps 4 and 5 until limiter setting is adjusted within ±0.35 psig of pressure calculated.

7. Remove test equipment.

8. For aircraft equipped with Torque Control Unit (TCU) per Figure 76-8 proceed as follows.

a. Remove plugs from end of tubes (6 and 7).

b. Connect tubes assemblies (6 and 7) to fittings (5 and 8) and lockwire.

9. For aircraft equipped with Torque Control Unit (TCU) per Figures 76-9 and 76-10 proceed as follows.

a. Remove test hose between port "B" and "C".

b. Remove plugs from tube assemblies (1 and 2) and from port "D" on tee fitting (4).

c. Connect tubes (1 and 2) to tee fittings (3 and 4) and lockwire.

76-9. Maximum Torque Check and Control Limit Setting Helicopters Not Modified by TB 212-91-138

CAUTION

PERFORM TORQUE LIMITER CHECK AND ADJUSTMENT PROCEDURE AFTER EACH CHANGE OF REDUCTION GEARBOX AND/OR TORQUE CONTROL UNIT (TCU). WHEN PERFORMING THE FOLLOWING STEPS, DO NOT EXCEED OPERATIONAL LIMITATIONS.

NOTE

This procedure is applicable to helicopters not modified by TB 212-91-138 only. It should only be used if test equipment listed in paragraph 76-7 is not available.

1. Start both power section and let idle for 5 minutes.

NOTE

On a hot day or at high altitude conditions, it may not be possible to reach torque limit required by the following test. For maintenance purposes only, it is permissible to pull between 100 and 104% torque for a maximum of 5 seconds.

2. Perform a maximum power climb and record point at which torque limiting begins. This is indicated by ROTOR RPM decaying with further power application and GAS PROD RPM appearing to be low or to have reached engine topping. Torque limiting should start to occur at 104%.

CAUTION

IF ITT IS REACHED BEFORE ATTAINING DESIRED INITIAL TORQUE, DO NOT MAKE ANY ADJUSTMENT TO TORQUE CONTROL UNIT.

3. If torque limiting does not occur before reaching either the maximum initial value (104%) turn adjustment screw (2, Figure 76-8 or 7, Figure 76-9) counterclockwise in 1/8 turn increments and repeat step 2 after each adjustment until torque limiting occurs within desired initial range.

4. Insert a wrench in adjustment screw (2 or 7) and mark the starting location with a soft lead pencil or other removable marker. Rotate adjustment screw 3/8 turn clockwise to establish new limiting setting.

76-10. AUTOMATIC FUEL CONTROL IDLE SPEED CHECK

NOTE

Refer to Pratt & Whitney PT6T-3 Series Maintenance Manual for greater detail on adjustment procedure.

1. Start both engines and let idle for 5 minutes.

2. Activate ENG 1 IDLE STOP release switch (18, Figure 76-2). Rotate ENG 1 throttle twist grip (19) below the idle stop so that Manual Fuel Control Unit (MFCU) (5, Figure 76-11) pointer (15) is positioned between 30 and 35° on the quadrant (16).

3. Aircraft with PT6T-3/3B engine, verify that gas producer speed (N1) is between 51.0 and 52.5%. If necessary, adjust the Automatic Fuel Control Unit (AFCU) (4, Figure 76-11) idle to bring N1 within required range.

NOTE

The difference between N1 IDLE speeds of both engines must not exceed 1%.

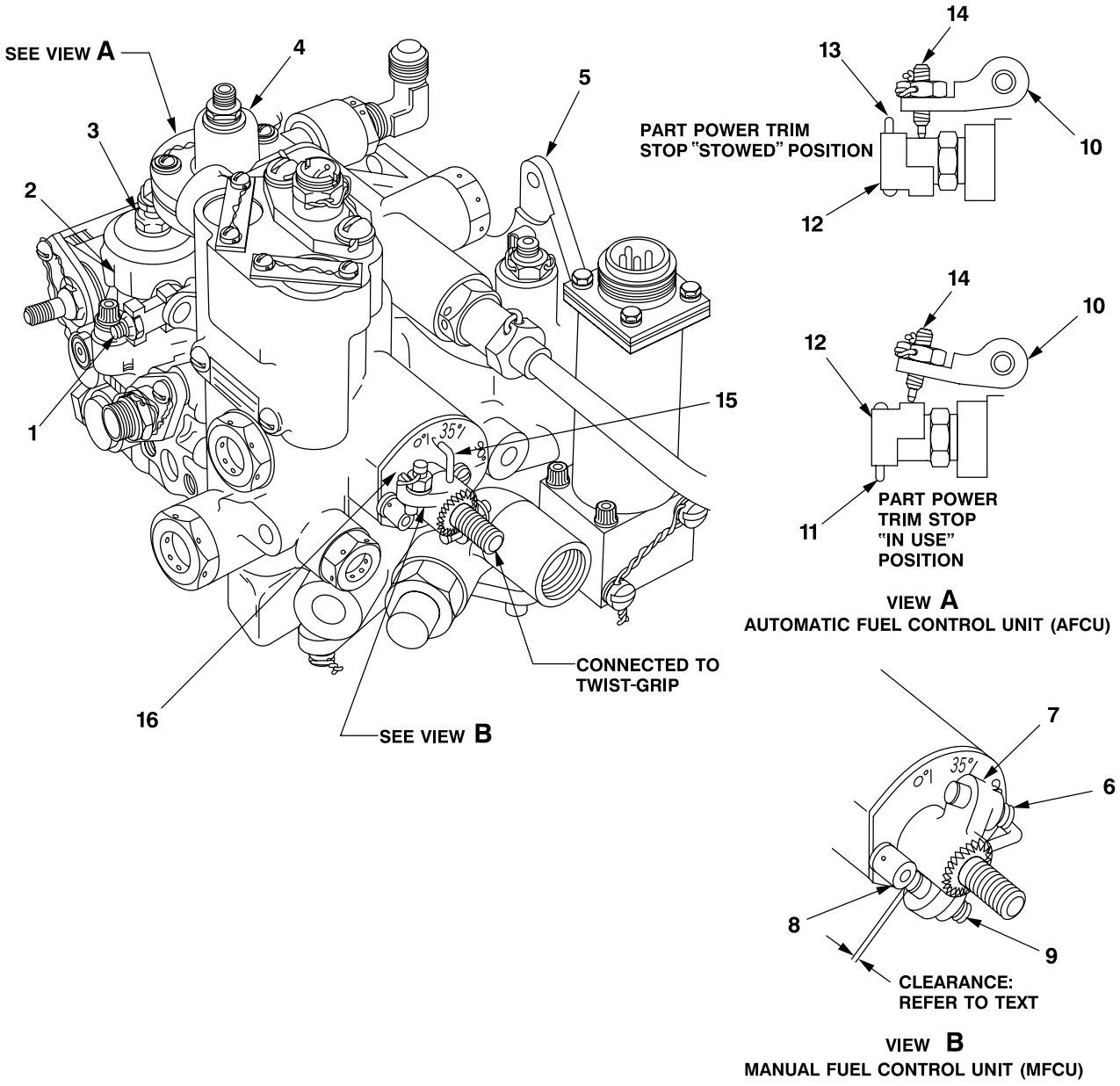
4. Repeat step 2 and step 3 above with ENG 2.

5. Torque idle stop locknut and lockwire (refer to Pratt & Whitney Maintenance Manual).

76-11. POWER SECTION ACCELERATION AND DECELERATION CHECK

NOTE

Refer to Pratt & Whitney PT6T-3 Series Maintenance Manual for greater detail on adjustment procedure.



1. Manual - automatic fuel control interconnect linkage
2. Datum line
3. Acceleration Adjuster (dome)
4. Automatic Fuel Control Unit (AFCU)
5. Manual Fuel Control Unit (MFCU)
6. Minimum stop screw
7. Stop arm
8. Stop
9. Maximum stop screw
10. Fuel control arm
11. Cotter pin
12. Part power trim stop
13. Cotter pin
14. Maximum stop adjustment screw
15. Pointer
16. Quadrant

212_M_76_11_c01

Figure 76-11. Manual and Automatic Fuel Control Adjustment Provisions

1. Perform automatic fuel control idle speed check per Paragraph 76-10 prior to accomplishing acceleration and deceleration check.

2. Start both engines and let idle for 5 minutes.

3. With collective at flat pitch and both engines at IDLE, increase N2 to maximum beep. Set N1 IDLE speed to 61% on each power section, using throttles.

4. Check acceleration time from 61 to 90% N1 for ENG 1 as follows:

CAUTION

MONITOR ENGINE TORQUE AND ITT DURING THIS PROCEDURE.

NOTE

Measurement of acceleration time begins when ENG throttle is snapped to FULL OPEN and stops when N1 reaches 90%.

a. Set ENG 2 throttle to IDLE and apply friction to hold it in position.

b. Snap open ENG 1 throttle to FULL OPEN. Start timing.

c. When 90% N1 is reached, snap ENG 1 throttle back to IDLE. Stop timing.

NOTE

Acceleration time from 61 to 90% N1 should be 4 seconds maximum. Acceleration times less than 3 seconds are acceptable if outside air temperature is below 32°F (0°C), provided there is no compressor surge.

Match both power sections acceleration times as close as possible. The maximum acceptable difference in acceleration time is 0.5 second.

d. If acceleration time is too slow or too fast (compressor surge), adjust acceleration dome (3, Figure 76-11) (refer to Pratt & Whitney Maintenance Manual).

5. Repeat step 4 with ENG 2.

6. Check deceleration time from 90 to 61% N1 for ENG 1 as follows:

NOTE

Measurement of deceleration time begins when ENG throttle is snapped to IDLE and stops when N1 reaches 61%.

a. Set ENG 2 throttle to IDLE and apply friction to hold it in position.

b. Gradually open ENG 1 throttle to FULL OPEN.

c. Increase power to 90% N1 and stabilize, then snap ENG 1 throttle back to IDLE.

d. Confirm deceleration time from 90 to 61% N1 of 5 seconds maximum below 6000 ft pressure altitude, and smooth deceleration to a stabilized IDLE of 61% N1.

7. Repeat step 6 with ENG 2.

76-12. AUTOMATIC MODE MAXIMUM GAS PRODUCER SPEED CHECK AND AFCU MAXIMUM N1 STOP ADJUSTMENT

76-13. PT6T-3 Engine

NOTE

Refer to Pratt & Whitney Aircraft of Canada Ltd. PT6T-3 Series Maintenance Manual No. 3017042 for detailed procedure.

This single power section check to be performed with helicopter heavily loaded and light on skids. However, pilot must be prepared for the possibility helicopter may become airborne.

1. Rotate in place and secure part power trim stop (12, Figure 76-11).

2. Start both engines and let idle for 5 minutes.

3. With collective at flat pitch and both engines at IDLE, increase ENG 1 throttle to FULL OPEN. Using INCR/DECR switch increase ROTOR RPM (NR) to full INCR.

NOTE

Maximum gas producer (N1) speed (topping) is achieved when N1 ceases to increase and N2/NR droops as collective is further applied. Do not droop below 90% N2. The observed reading at this point should be 96.1 to 97.1% N1 with part power trim stop and 92.4 to 92.9% N1 with slave stop at temperatures below +25°F (-4°C). A minimum value of 96.3 or 92.6% N1 (slave stop) is required to assure in flight topping at 100.0% N1.

4. Gradually increase collective until N1 topping is achieved and note N1 value.

NOTE

If maximum stop screw is adjusted, re-adjust the interconnect linkage for proper AUTO/MANUAL gap and throttle cushions per paragraph 76-3 and Pratt & Whitney Aircraft of Canada Ltd. PT6T-3 Series Maintenance Manual. This is accomplished once maximum gas producer (N1) speed is attained and part power trim stop is retracted.

5. If required, adjust the topping adjustment screw and repeat step 4.

6. Repeat step 3, step 4, and step 5 with ENG 2.

76-14. PT6T-3 Engine AFCU Maximum N1 Stop Adjustment, Alternate Procedure

CAUTION

DO NOT EXCEED TORQUE LIMIT OF 71.8% OR ITT LIMIT OF 810°C.

MAXIMUM N1 TOPPING CHECKS SHOULD ONLY BE PERFORMED AFTER ENGINE CONTROL RIGGING IS ADJUSTED OR WHEN ANY OF THE FOLLOWING COMPONENTS ARE REPLACED: (TWO POWER SECTIONS AND REDUCTION GEARBOX), POWER SECTION, AFCU, MFCU, AND FUEL PUMP.

NOTE

Field experience, particularly in warm climates, has revealed it is not possible to operate both power sections at 100.0% N1 RPM at any altitude without exceeding maximum ITT limit of 810°C. This condition does not prevent engine from achieving required performance, but does present a functional test problem.

This single power section check to be performed in flight or with helicopter heavily loaded and light on skids. However, pilot must be prepared for the possibility helicopter may become airborne.

1. Start both engines and let idle for 5 minutes.

2. Increase both throttles to FULL OPEN one at a time and adjust ENG N2 RPM to INCR with RPM INCR/DECR switch.

3. Decrease throttle of one engine to flight IDLE leaving the other at FULL OPEN with ENG N2 RPM to full INCR.

4. Increase power by raising the collective, drooping ENG RPM to approximately 97% to obtain 100.0% N1 RPM.

NOTE

If maximum stop screw is adjusted, re-adjust the interconnect linkage for proper AUTO/MANUAL gap and throttle cushions per paragraph 76-3 and Pratt & Whitney Aircraft of Canada Ltd. PT6T-3 Series Maintenance Manual. This is accomplished once maximum gas producer (N1) speed is attained and part power trim is retracted.

a. If ENG RPM droops below 97% prior to obtaining 100.0% N1 RPM, increase topping. Turn stop screw (14, Figure 76-11) counterclockwise to increase.

b. If 100.0% N1 RPM is reached without ENG RPM droop, apply power to a maximum of 100.5% N1 RPM. If droop does not occur between 100.0% and 100.5% N1 RPM, decrease topping. Turn stop screw (14) clockwise to decrease.

5. If stop screw (14) was adjusted, tighten jam nuts and lockwire.

76-15. PT6T-3B Engine

NOTE

Refer to Pratt & Whitney PT6T-3 Series Maintenance Manual No. 3017042 for detail procedure.

This single power section check to be performed with helicopter heavily loaded and light on skids. However, pilot must be prepared for the possibility helicopter may become airborne.

1. Rotate in place and secure part power trim stop (12, Figure 76-11).

2. Start both engines and let idle for 5 minutes.

3. With collective at flat pitch and both engines at IDLE, increase ENG 1 throttle to FULL OPEN. Using INCR/DECR switch increase ROTOR RPM NR to full INCR.

NOTE

Maximum gas producer (N1) speed (topping) is achieved when N1 ceases to increase and N2/NR droops as collective is further applied. Do not droop below 90% N2. The observed reading at this point should be 99.8 to 100.8% N1 or 96.1 to 96.7 N1 with slave stop at temperatures below +25°F (-4°C). A minimum value of 100.1 or 96.4% (slave stops) N1 is required to assure in flight topping at 103.4% N1.

4. Gradually increase collective until N1 topping is achieved and note N1 value.

NOTE

If maximum stop screw is adjusted, re-adjust the interconnect linkage for proper AUTO/MANUAL gap and throttle cushions per paragraph 76-3 and Pratt & Whitney PT6T-3 Series Maintenance Manual. This is accomplished once maximum gas generator (N1) speed is attained and part power trim stop is retracted.

5. If required, adjust the topping adjustment screw and repeat step 4.

6. Repeat step 3, step 4, and step 5 with ENG 2.

76-16. PT6T-3B Engine AFCU Maximum N1 Stop Adjustment, Alternate Procedure

CAUTION

DO NOT EXCEED TORQUE LIMIT OF 79.4% OR ITT LIMIT OF 850°C.

MAXIMUM N1 TOPPING CHECKS SHOULD ONLY BE PERFORMED AFTER ENGINE CONTROL RIGGING IS ADJUSTED OR WHEN ANY OF THE FOLLOWING COMPONENTS ARE REPLACED: (TWO POWER SECTIONS AND REDUCTION GEARBOX), POWER SECTION, AFCU, MFCU, AND FUEL PUMP.

NOTE

Field experience, particularly in warm climates, has revealed it is not possible to operate both power sections at 102.4% N1 RPM with indicator 212-075-037-101/105 or 103.4% N1 RPM with indicator 212-075-037-113 at any altitude without exceeding maximum ITT limit of 850°C. This condition does not prevent engine from achieving required performance, but does present a functional test problem.

This single power section check to be performed in flight or with helicopter heavily loaded and light on skids. However, pilot must be prepared for the possibility helicopter may become airborne.

1. Start both engines and let idle for 5 minutes.

2. Increase both throttles to FULL OPEN one at a time and adjust ENG N2 rpm to INCR with RPM INCR/DECR switch.

3. Decrease throttle of one engine to flight IDLE leaving the other at FULL OPEN with ENG N2 rpm to full INCR.

NOTE

N1 values with indicator 212-075-037-101 installed is 102.4% and 103.4% for indicator 212-075-037-113. For maintenance purposes only adjust maximum N1 to 103.4% for both indicators.

4. Increase power by raising the collective, drooping ENG rpm to approximately 97% to obtain 103.4% N1 rpm.

NOTE

If maximum stop screw is adjusted, re-adjust the interconnect linkage for proper AUTO/MANUAL gap and throttle cushions per Paragraph 76-3 and Pratt & Whitney Aircraft of Canada Ltd. PT6T-3 Series Maintenance Manual. This is accomplished once maximum gas producer (N1) speed is attained and part power trim stop is retracted.

a. If ENG rpm droops below 97% prior to obtaining 103.4% N1 rpm, increase topping. Turn stop screw (14, Figure 76-11) counterclockwise to increase.

b. If 103.4% N1 rpm is reached without ENG rpm droop, apply power to a maximum of 103.6% N1 rpm. If droop does not occur between 103.4% and 103.6% N1 rpm, decrease topping. Turn stop screw (14) clockwise to decrease.

5. If stop screw (14) was adjusted, tighten jamnuts and lockwire.

76-17. ENGINE IDLE SPEED ADJUSTMENT

1. Start both engines and let idle for 5 minutes.

2. With collective at flat pitch and both engines at IDLE, set ENG 1 N1 at 61% using throttle.

3. Gradually increase ENG 1 throttle to FULL OPEN, then retard throttle to IDLE.

4. Verify ENG 1 idle speed is 61 ± 1% N1. If required, adjust idle stop adjustment screw (9, Figure 76-4). If available adjustment of idle stop adjustment screw (9) is not adequate (insufficient threads), replace four NAS43DD3 spacers (5) under the idle stop solenoid (7) with longer or short lengths as required (refer to Paragraph 76-3).

5. Repeat steps 3 and 4 above with ENG 2.

76-18. MANUAL CHANGE-OVER CHECK

NOTE

The reference in engine manual to Fuel Control Selector Switch refers to ENG 1 GOV and ENG 2 GOV switches in aircraft.

If operator flies below 5000 feet, refer to Pratt & Whitney Aircraft of Canada Ltd. PT6T-3 Series Maintenance Manual for procedures.

If operator flies higher than 5000 feet, accomplish check at 6000 feet altitude.

1. Fly helicopter to 6000 feet altitude.

2. Rotate ENG 1 throttle to IDLE. GAS PROD (N1) rpm should be 61 ± 1%. Record rpm indication.

NOTE

MANUAL GAS PROD (N1) rpm should be recorded within approximately 2 to 3 seconds after selecting ENG GOV switch.

3. Position ENG 1 GOV switch to MANUAL. GAS PROD rpm should be 61 ± 5%. Record rpm indication.

4. Position ENG 1 GOV switch to AUTO. Record rpm indication.

5. Repeat steps 2 through 4 for ENG 2.

6. If either power section is out of acceptable limit 61 ± 5% adjust AUTO/MANUAL interconnect linkage (refer to Paragraph 76-3 and Pratt & Whitney Aircraft of Canada Ltd. PT6T-3 Series Maintenance Manual).

DROOP COMPENSATOR (N2) CONTROLS

76-19. DROOP COMPENSATOR

The droop compensator linkage extends through droop compensator (46, Figure 76-1) and linear actuator (44) to N2 power turbine governors (37 and 41). The linear actuator (44) can be retracted or extended by use of the RPM INCR/DECR (beep) switch on pilot or co-pilot collective switchbox to set engine turbine ENG (N2) rpm range.

Helicopters modified by Technical Bulletin 212-91-138 or Technical Bulletin 212-93-145 have a +2/–2 switch included in RPM INCR/DECR switch located on pilot collective switchbox (Figure 76-12). The +2/-2 switch controls the ITT actuator (36, Figure 76-1), connected to ENG 2 power turbine governor (37), can be extended or retracted to provide torque or ITT matching.

When pilot/copilot collective controls are moved, droop compensator linkage control tubes are also moved. This repositions cam in droop compensator (46) and positions power turbine governors (37 and 41) to accommodate the need for increased or reduced power as main rotor blades change pitch.

76-20. LINEAR ACTUATOR

76-21. Removal

1. Remove cotter pin (2, Figure 76-13), nut (3), washer (4), and bolt (21).

2. Loosen jamnut (19). Remove rod end bearing (20).

3. Remove spring (9).

4. Remove cotter pin (15), nut (14), washers (13, 16, 8, and 10), and bolt (11).

5. Index three wires on terminal block (17) for reinstallation in same location. Disconnect wires from terminal block.

6. Move actuator (7) aft out of the split bushing (5) and remove from helicopter.

7. Install jam nut (19) and rod end bearing (20) in actuator (7) tube.

76-22. Inspection

1. Inspect actuator (7, Figure 76-13) for secure installation and damage.

2. Inspect electrical connector terminal block (17) and associated electrical wiring for damage.

3. Inspect split bushing (5) for damage.

76-23. Installation and Rigging

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications and source.

NUMBER	NOMENCLATURE
C-104	Corrosion Preventive Compound

1. Remove rod end bearing (20, Figure 76-13) and jam nut (19) from actuator (7).

2. Position actuator (7) tube through split bushing (5). Install jamnut (19) and rod end bearing (20).

NOTE

Ensure electrical wires are connected to correct terminals.

3. Connect three wires to terminal block (17) (Chapter 98).

4. Position aft end of actuator (7) in jackshaft lever (12). Install bolt (11), washers (10, 8, 16, and 13), nut (14), and cotter pin (15).

5. If not previously accomplished, adjust total stroke (from full retract to full extend) of actuator (7) as follows:

a. While measuring actuator (7) stroke, position power turbine governor lever against maximum power stop by holding lever (12) full down (forward).

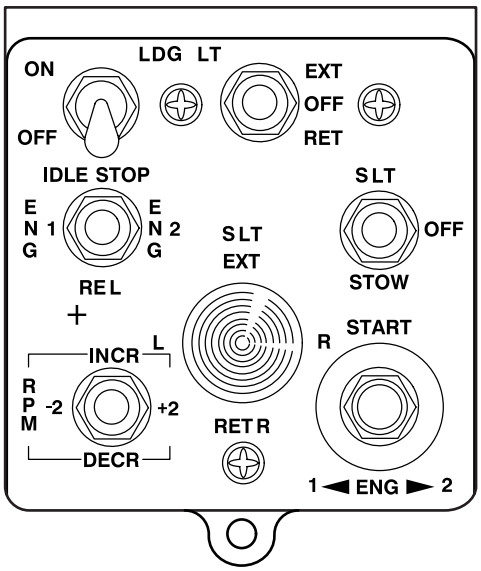


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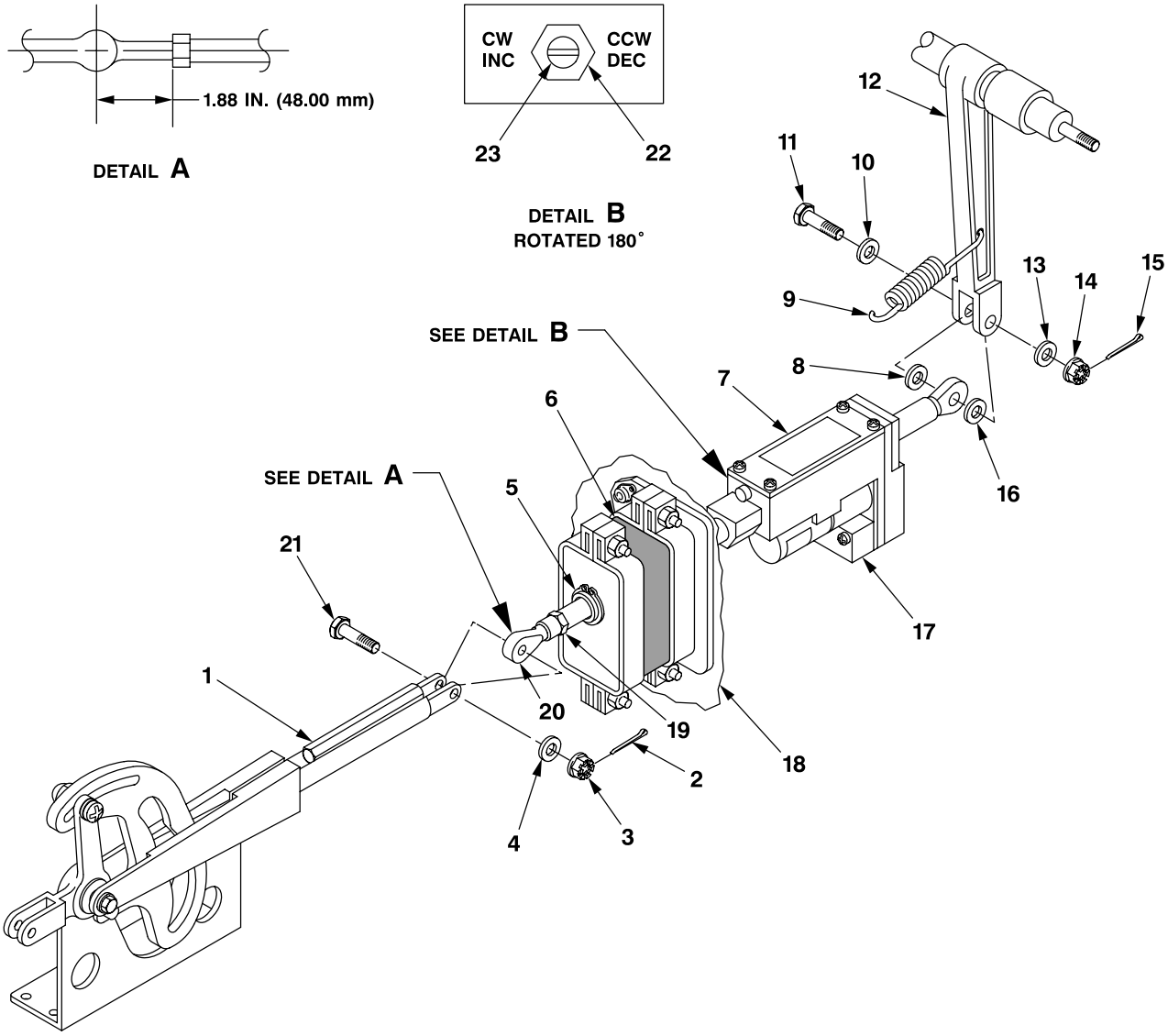
Figure 76-12. Pilot Collective Panel Aircraft Modified by TB 212-93-145 or TB 212-91-138



1. Droop compensator cambox slider
2. Cotter pin
3. Nut
4. Washer
5. Split bushing
6. Boot
7. Linear actuator
8. Aluminum washer
9. Spring
10. Thin aluminum washer
11. Bolt
12. Jackshaft lever
13. Thin aluminum washer
14. Nut
15. Cotter pin
16. Aluminum washer
17. Terminal block
18. Firewall
19. Jamnut
20. Rod end bearing
21. Bolt
22. Jamnut
23. Adjustment screw

212_M_76_13_c01

Figure 76-13. Linear Actuator

b. Position RPM switch on collective switch box to DECR. Hold until actuator (7) reaches full extend position.

NOTE

In the following steps a locally fabricated metal block or similar device may be used as a work aid to assist measuring the actuator stroke.

c. Place a metal block on service deck in contact with forward end of actuator (7).

d. Place RPM INCR/DECR switch to INCR. Hold until actuator (7) reaches full retract position.

e. Measure and record distance between block positioned in step c, and forward end of actuator (7) rod. If distance is 0.620 in. (16 mm), proceed to step g. If distance is not 0.620 (16 mm) accomplish steps f and g.

CAUTION

SET ACTUATOR (7) TO MIDPOINT TRAVEL WITH RPM SWITCH PRIOR TO MAKING ADJUSTMENT ON SCREW (23) OR DAMAGE TO ACTUATOR (7) MAY RESULT.

f. Set actuator (7) to midpoint of travel. Loosen jamnut (22) and rotate screw (23) slightly in INCR direction or DECR direction in accordance with arrows on decal. Repeat making small adjustments until total stroke is set to the proper dimension. Tighten jamnut.

g. Remove metal block (installed in step c) from service deck.

6. Coat threads of rod end bearing (20) with corrosion preventive compound (C-104). Install rod end bearing (20) and jamnut (19) on actuator (7). Dimension from center of rod end bearing (20) bolt hole to edge of jamnut (19) to be 1.88 in. (47.8 mm).

7. Install bolt (21), nut (3), washer (4), and cotter pin (2).

8. Install spring (9).

76-24. ITT ACTUATOR (ENG 2 ACTUATOR)

76-25. Removal

1. Remove electrical cover (8, Figure 76-14) to gain access to the three wires.

2. Index three wires on terminal block (9) for reinstallation in same location. Disconnect wires from terminal block.

3. Remove cotter pin (2), nut (3), washers (4 and 5), and bolt (6) from lever (7).

4. Remove cotter pin (10), nut (11), washers (12 and 13), and bolt (14) from jackshaft (15).

5. Remove actuator (1) from helicopter.

76-26. Inspection

1. Inspect actuator (1, Figure 76-14) for secure installation and damage.

2. Inspect terminal block (9) and associated electrical wiring for damage.

76-27. Installation and Rigging

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications and source.

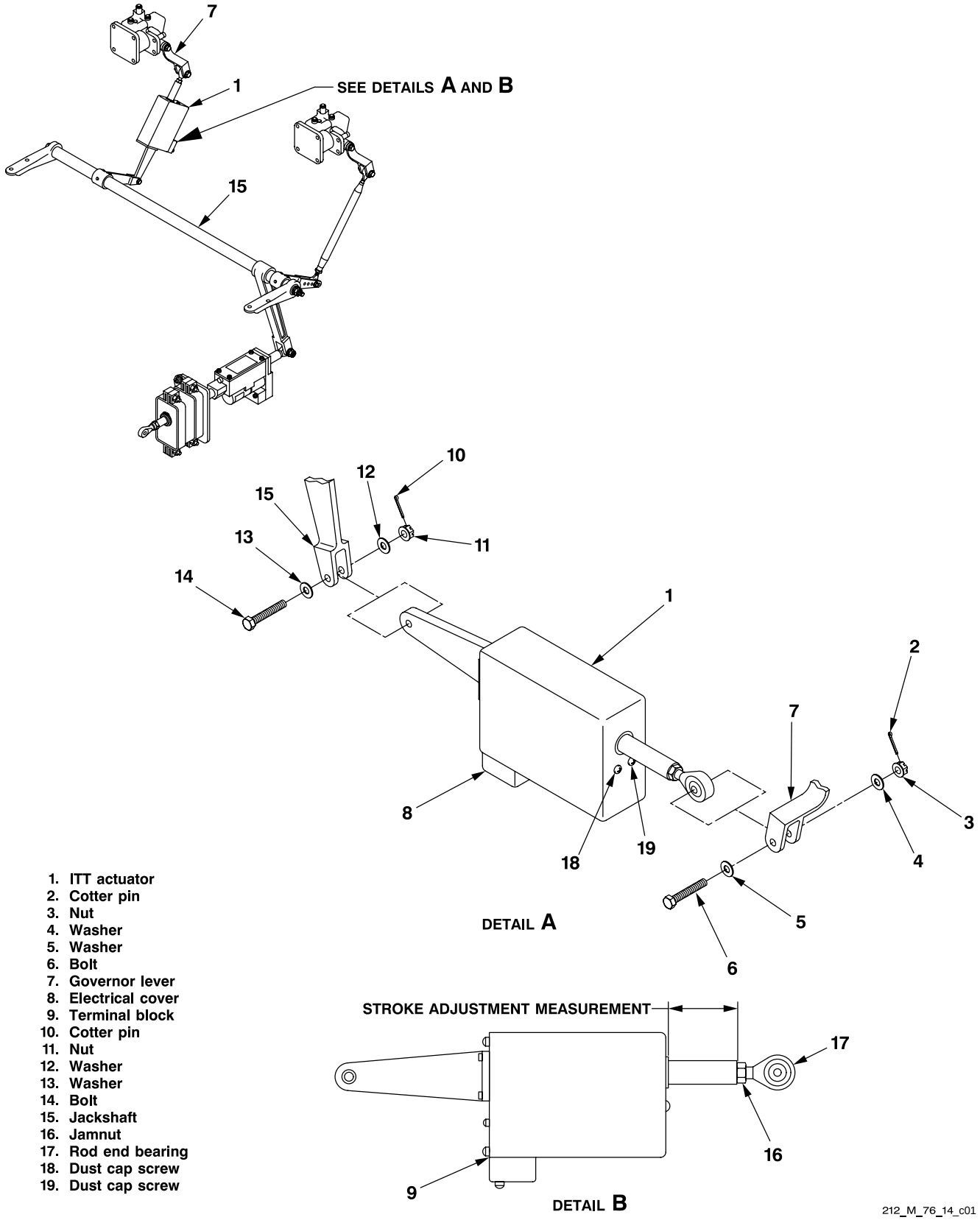
NUMBER	NOMENCLATURE
C-101	Corrosion Preventive Compound

NOTE

ITT actuator (1, Figure 76-14) is installed with fixed end connected to jackshaft (15), terminal block (9) facing down, and adjustable rod end (17) connected to lever (7).

1. Position fixed end of actuator (1) on jackshaft (15).

2. Install bolt (14), washers (12 and 13), nut (11), and cotter pin (10).



1. ITT actuator
2. Cotter pin
3. Nut
4. Washer
5. Washer
6. Bolt
7. Governor lever
8. Electrical cover
9. Terminal block
10. Cotter pin
11. Nut
12. Washer
13. Washer
14. Bolt
15. Jackshaft
16. Jamnut
17. Rod end bearing
18. Dust cap screw
19. Dust cap screw

Figure 76-14. ITT Actuator Installation

NOTE

Ensure wires are connected to correct terminals.

3. Connect three wires to terminal block (9) (Chapter 98).

4. Install actuator electrical cover (8).

5. If not previous accomplished, adjust total stroke on actuator (1) to 0.150 in. (3.81 mm) as follows:

a. Gain access to adjustment screws on actuator (1) by removing dust cap screws (18 and 19).

b. Turn both adjustment screws in direction of arrows till the screws bottom out.

c. Using RPM (INCR/DECREASE+2/–2) switch on pilot collective stick box, activate the +2 so that the actuator is fully retracted. Using a fine marker, draw a line on the shaft at the entrance of the actuator body.

d. Using RPM (INCR/DECREASE+2/–2) switch on pilot collective stick box, activate the –2 so that the actuator is fully extended. Measure the distance from marker line on the shaft to the entrance of the actuator body and record.

e. The recorded value is the total stroke dimension of the actuator. Divide the total stroke by 2 and record.

f. The recorded value is the mid stroke of the actuator. Using mid stroke dimension, measure from the marker line on shaft performed in step c towards the actuator body. Using a fine marker, draw a line on the shaft. This will be the mid stroke of the actuator.

g. Remove marker line on shaft that was installed in step c.

h. Using RPM (INCR/DECREASE+2/–2) switch on pilot collective stick box, activate the +2 so that the actuator retracts to the mid stroke mark on the shaft.

i. From the mid position using RPM (INCR/DECREASE+2/–2) switch on pilot collective stick box, activate the –2 so that the actuator extends to 0.075 in. (1.90 mm).

j. Turn the EXT (extend) screw in the opposite direction of the arrow (Figure 76-14) until the EXT (extend) electrical stop switch is engaged. This will be observed by a clicking sound and the adjustment screw will no longer turn.

k. From the extend position using RPM (INCR/DECREASE+2/–2) switch on pilot collective stick box, activate the +2 so that the actuator retracts to 0.150 in. (3.81 mm).

l. Turn the RET (retract) screw in the opposite direction of the arrow (Figure 76-14) until the RET (retract) electrical stop switch is engaged. This will be observed by a clicking sound and the adjustment screw will no longer turn.

m. Verify actuator total stroke is 0.150 in. (3.81 mm).

n. Install dust cap screws (18 and 19).

6. With actuator full extended, loosen jamnut (16) and turn rod end bearing (17) to adjust the total length of the actuator to 9.415 in. (239.140 mm). Tighten jamnut (16). The measurement is taken between attachment points (center of rod end bearing (17) to the center of the actuator attachment hole).

7. Install actuator rod end bearing (17) into governor lever (7).

8. Install bolt (6), washers (5 and 4), nut (3), and cotter pin (2).

9. Apply corrosion preventive compound (C-101) to external threads and attachment hardware after installation.

76-28. DROOP COMPENSATOR CAMBOX

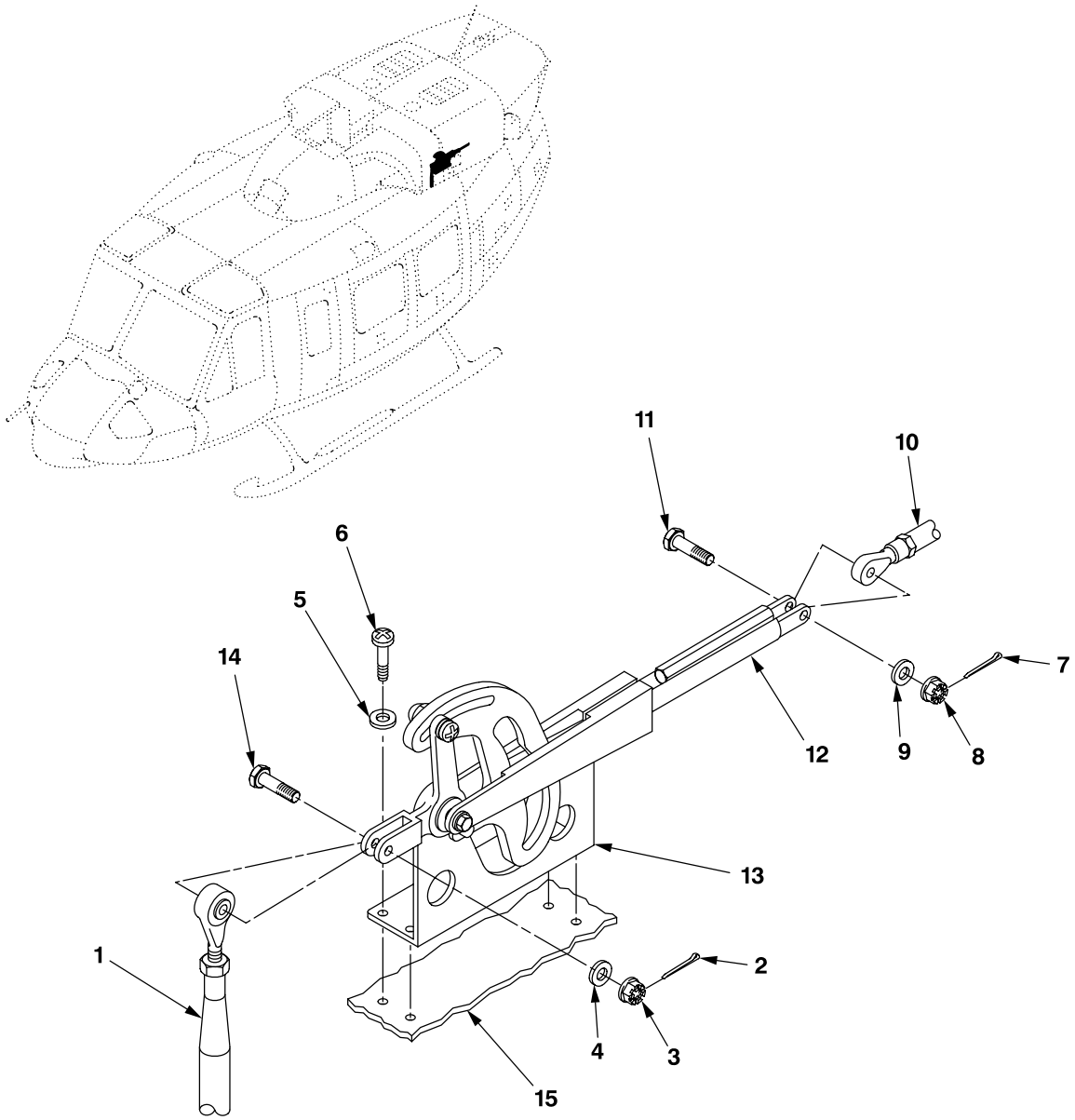
76-29. Removal

1. Remove cotter pin (7, Figure 76-15), nut (8), washer (9), and bolt (11).

2. Remove cotter pin (2), nut (3), washer (4), and bolt (14).

3. Remove four screws (6) and washers (5).

4. Remove cambox (13) from service deck (15).



1. Fuel and governor engine control tube
2. Cotter pin
3. Nut
4. Washer (AN960C10)
5. Thin steel washer
6. Screw
7. Cotter pin
8. Nut
9. Washer (AN960C10)
10. Linear actuator tube
11. Bolt
12. SIlder assembly
13. Droop compensator cambox assembly
14. Bolt
15. Service deck

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Figure 76-15. Droop Compensator Cambox

76-30. Inspection

1. Inspect cambox (13, Figure 76-15) for secure installation.

2. Inspect cambox for binding when collective controls are moved through full range.

76-31. Installation

1. Position cambox (13, Figure 76-15) on service deck (15).

2. Install screws (6) and washers (5).

3. Position tube (10) on slider (12). Install bolt (11), washer (9), nut (8), and cotter pin (7).

4. Position tube (1) on forward end of cambox (13). Install bolt (14), washer (4), nut (3), and cotter pin (2).

5. Move collective controls through full range and inspect for binding and interference in droop compensator control installation.

6. Rig droop compensator controls per Paragraph 76-32 or 76-33 depending on aircraft configuration.

76-32. N2 CONTROL RIGGING

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications and source.

NUMBER	NOMENCLATURE
C-101	Corrosion Preventive Compound

NOTE

Refer to Paragraph 76-3 for N1 (power lever control) rigging.

1. Comply with the following general procedures when rigging droop compensator controls.

a. When a rigging procedure requires a specific position to accomplish following steps, manually hold controls in position or secure controls in position with pilot friction adjustment.

b. Tolerance for rigging dimensions is ±0.030 in. (0.76 mm) unless otherwise stated.

c. All adjustable control tubes must have a maximum of 1.00 in. (25.4 mm) of exposed threads after adjustment. If control tubes have inspection holes, threads must be engaged sufficiently to cover holes.

d. Apply corrosion preventive compound (C-101) to external threads of all adjustable rod end bearings and clevises after adjustment.

e. Torque control jamnuts 80 to 100 in-lbs (9.0 to 11.3 Nm) after adjustment unless otherwise specified.

f. Control tubes must be free to rotate several degrees about longitudinal axis. If necessary, loosen jamnuts, adjust end fitting and retorque jamnuts.

2. Ensure collective pitch control system rigging has been accomplished (Chapter 67).

3. Verify levers (2 and 6, Figure 76-16) are correctly installed on control shafts of power turbine governors (1 and 5). Nominal setting positions the centerline of levers (2 and 6) 15 degrees (one serration) clockwise from centerline of governor stop arm (21), viewed from left looking inward (detail A). In subsequent steps levers (2 and 6) may be repositioned ±15 degrees (one serration) from the nominal setting if required to achieve proper rigging and eliminate any fouling conditions.

4. Connect control tube (3) to governor lever (2) and jackshaft (4).

NOTE

The dimension given in step 5 is approximate for initial rigging. Minor adjustments may be necessary during ground and flight test.

5. Verify adjustable tube (7) is approximately 9.34 in. (237.23 mm) measured between attachment points (center of rod end bearings).

6. Connect tube (7) to governor lever (6) and to the middle hole of jackshaft lever (28) (detail C).

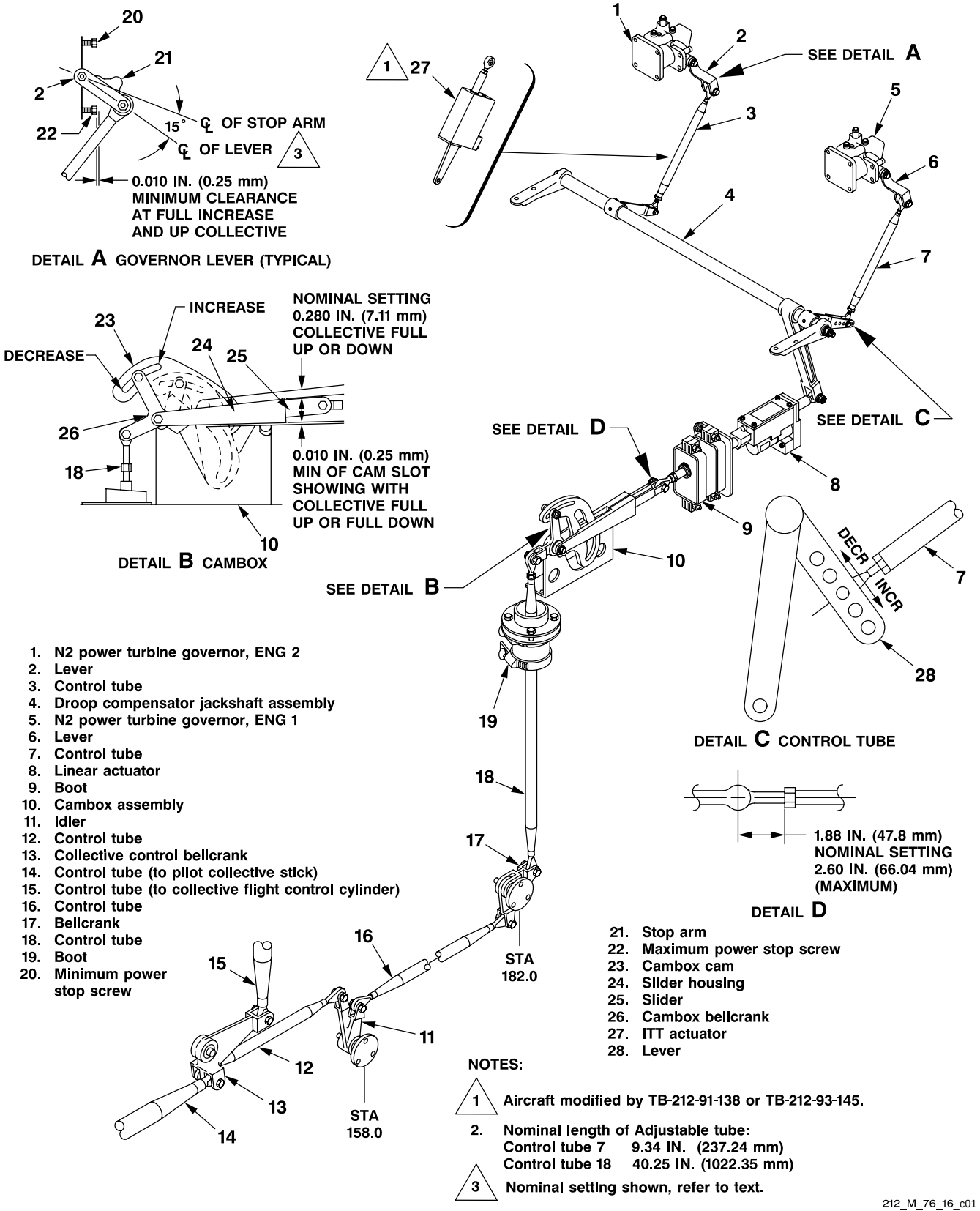


Figure 76-16. Droop Compensator Controls

7. Disconnect actuator (8) from lever of jackshaft (4).

8. Disconnect actuator (8) rod end bearing from cambox slider (25).

9. Disconnect tube (18) from cambox (10) and adjust tube (18) length to 40.25 in. (1022.35 mm).

NOTE

The dimensions given in step 10 is approximate for initial rigging. Minor adjustment may be necessary during ground and flight test.

10. Verify long arm of cambox bellcrank (26) is attached approximately in the middle of adjustment slot of cam (23) (detail B).

11. Use RPM INCR/DECR (beep) switch on collective switchbox to operate actuator. Verify linear actuator (8) is adjusted to a total stroke of approximately 0.62 in. (16 mm) from full extend (DECR) to full retract (INCR) positions. If not, refer to Paragraph 76-23 for linear actuator rigging procedure.

12. Adjust rod end on actuator (8) to approximately 1.88 in. (48 mm) from center of bearing bolt hole to face of jamnut (detail D).

13. Connect actuator (8) rod end bearing to cambox slider (25).

14. Connect actuator (8) to lever of jackshaft (4).

15. Connect tube (18) to cambox (10).

16. Disconnect tube (16) from bellcrank (17) and rotate bellcrank (17) to ensure there is no fouling. Rotate cambox bellcrank (26) (detail B) and ensure there is no fouling.

17. Connect tube (16) to bellcrank (17).

NOTE

If hydraulic test unit is not available disconnect control tube (15).

18. Connect hydraulic test unit (Chapter 29).

19. With hydraulic boost ON, place collective stick full down. Adjust the length of tube (18) to hold cam (23) so lower end of cam slot is approximately 0.280 in. (7.11 mm) below slider housing (24).

20. With hydraulic boost ON, place collective stick full up. Verify that approximately 0.280 in. (7.11 mm) above slider housing (24).

21. With collective stick full up. Hold RPM INCR/DECR switch to INCR until actuator (8) is fully retracted. Verify minimum clearance of 0.010 in. (0.25 mm) (detail A) between stop arm (21) and maximum power stop screw (22) on both governors (1 and 5).

22. With hydraulic boost ON, place collective stick full down. Hold RPM INCR/DECR switch to DECR until actuator (8) is fully extended. Verify minimum clearance of 0.010 in. (0.25 mm) between stop arm (21) and minimum power stop screw (20) on both governors (1 and 5).

23. Disconnect hydraulic test unit or connect control tube (15) as applicable.

CAUTION

VERIFY ALL CONTROLS ARE PROPERLY CONNECTED PRIOR TO GROUND RUN AND FLIGHT TEST.

NOTE

Prior to accomplishing ground run verify Automatic Fuel Control Unit (AFCU) and Manual Fuel Control Unit (MFCU) maximum stops screws are being contacted with throttles full open (refer to Paragraph 76-3). During ground run verify acceleration time difference between power sections is within 0.5 seconds (refer to Paragraph 76-11).

24. Start both power sections per Flight Manual and idle for 5 minutes.

25. Actuate RPM INCR/DECR switch to full DECR.

26. Place collective stick full down. Rotate ENG 2 throttle to full INCR. Record ROTOR rpm NR. The recorded value should be 95% NR rpm. If ROTOR rpm is not 95% adjust as follows:

CAUTION

RETURN ENGINES TO IDLE FOR ANY ADJUSTMENTS TO CONTROLS WITH ENGINE RUNNING.

NOTE

Three turns of actuator (8) rod end is equal to 1% ROTOR rpm change.

a. If ROTOR rpm is below 95%, shorten rod end on actuator (8).

b. If ROTOR rpm is above 95%, lengthen rod end on actuator (8).

NOTE

The single engine beep range should be 95 to 99.5% ROTOR rpm.

27. Slowly actuate RPM INCR/DECR switch to full INCR and verify the ROTOR rpm is 99 to 99.5%. If the range is not within limits adjust linear actuator (8) stroke per Paragraph 76-23.

28. Actuate RPM INCR/DECR switch to full DECR.

29. Return ENG 2 to IDLE, rotate ENG 1 throttle to full INCR. Record ROTOR rpm. The recorded value should be 95% ROTOR rpm. If ROTOR rpm is not 95% adjust as follows:

CAUTION

RETURN ENGINES TO IDLE FOR ANY ADJUSTMENTS TO CONTROLS WITH ENGINE RUNNING.

NOTE

Two turns of tube (7) rod end is equal to 1% ROTOR rpm change.

a. If ROTOR rpm is below 95%, shorten rod end on tube (7, Figure 76-16).

b. If ROTOR rpm is above 95%, lengthen rod end on tube (7).

NOTE

The single engine beep range should be 95 to 99.5% ROTOR rpm.

30. Slowly actuate RPM INCR/DECR switch to full INCR and verify the ROTOR rpm is 99 to 99.5%.

NOTE

When performing the following steps helicopter will become airborne.

31. Return ENG 1 to IDLE, rotate ENG 2 to full INCR. Slowly actuate RPM INCR/DECR switch to 98% ROTOR rpm. Gradually increase collective from flat pitch to 60% engine torque and not static ROTOR rpm droop.

32. Return ENG 2 to IDLE, rotate ENG 1 to full INCR. Slowly actuate RPM INCR/DECR switch to 98% ROTOR rpm. Gradually increase collective from flat pitch to 60% engine torque and not static ROTOR rpm droop.

33. If more than 2% ROTOR rpm droop is encountered perform troubleshooting of engine pneumatic lines and N2 power turbine governor per Pratt & Whitney Maintenance Manual before proceeding with further adjustments.

34. Actuate RPM INCR/DECR switch to full DECR.

35. With collective stick full down, rotate ENG 1 and ENG 2 throttles to FULL INCR. Actuate RPM INCR/DECR switch to 100% ROTOR rpm.

NOTE

Engine torque difference (split) between ENG 1 and ENG 2 shall not exceed 4% from flat pitch to maximum power.

36. Gradually increase collective from flat pitch to full power (either transmission torque, ITT or N1 limit) and note the difference in engine torque readings. If not within limits, adjust as follows:

a. If ENG 1 torque reading is greater than ENG 2 by more than 4% throughout the collective range, lengthen tube (7).

b. If ENG 1 torque reading is less than ENG 2 by more than 4% throughout the collective range, shorten tube (7).

c. If ENG 1 torque reading is greater than ENG 2 by more than 4% at high power range and too low at low power range, move tube (7) rod end forward (DECR) on lever (28) (detail C).

d. If ENG 1 torque reading is less than ENG 2 by more than 4% at high power range and/or too low at low power range, move tube (7) rod end AFT (INCR) on lever (28) (detail C).

37. Place collective stick full down; rotate both engine throttles to full INCR. Use RPM INCR/DECR switch to obtain 100% ROTOR rpm. Increase collective pitch slowly in a series of equal steps from flat pitch to full power (either transmission torque, ITT or N1 limit). ROTOR rpm (NR) should remain at 100 ± 1% throughout power sweep.

38. If ROTOR rpm droops (decays below tolerance) or overspeeds (increases above tolerance) during power applications, make a cam rate adjustment.

NOTE

Make adjustments in small increments of approximately 0.125 in. (3.18 mm) measured on cam slot.

a. For increased cam compensation to correct droop, adjust cam (23) counterclockwise relative to bellcrank (26) (detail B).

b. For reduced cam compensation to correct overspeed, adjust cam (23) clockwise relative to bellcrank (26).

c. After each cam adjustment, move the collective to "full down" and then "full up" positions to ensure there is no fouling between slider housing (24) and cambox slot. Verify that a minimum of 0.010 in. (0.25 mm) cam slot shows below and above slider housing (24). If required adjust tube (18) for proper clearance.

CAUTION

RETURN ENGINES TO IDLE FOR ANY ADJUSTMENTS TO CONTROLS WITH ENGINE RUNNING.

NOTE

Adjustments to achieve proper twin-engine rpm range and adjustments to avoid torque needle split will supersede the initial single engine beep ranges.

Three turns of actuator (8) rod end is equal to 1% ROTOR rpm change.

39. Actuate RPM INCR/DECR switch to full decrease with collective in full down position. Rotate both engine throttles to full INCR and record ROTOR rpm. The recorded ROTOR rpm should be 97%. If not, adjust actuator (8) rod end.

40. Actuate RPM INCR/DECR switch to full INCR and verify ROTOR rpm is 101.5%. The required range for twin-engine beep is 97 to 101.5% ROTOR rpm. If not, adjust actuator (8) stroke per Paragraph 76-23.

NOTE

If hydraulic test unit is not available disconnect control tube (15).

41. With collective stick full up. Hold RPM INCR/DECR switch to INCR until actuator (8) is fully retracted. Verify minimum clearance of 0.010 in. (0.25 mm) (detail A) between stop arm (21) and maximum power stop screw (22) on both governors (1 and 5).

42. Check complete system for security of all parts and ensure no interference exists. Apply corrosion preventive compound (C-101) to all exposed threads.

76-33. N2 CONTROL RIGGING (AIRCRAFT MODIFIED BY TECHNICAL BULLETIN 212-91-138 OR 212-93-145)

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications and source.

NUMBER	NOMENCLATURE
C-101	Corrosion Preventive Compound

NOTE

Refer to Paragraph 76-3 for N1 (power control) rigging.

1. Comply with the following general procedures when rigging droop compensator controls.

a. When a rigging procedure requires a specific position to accomplish following steps, manually hold controls in position or secure controls in position with pilot friction adjustment.

b. Tolerance for rigging dimensions is ±0.030 in. (0.76 mm) unless otherwise stated.

c. All adjustable controls tubes must have a maximum of 1.00 in. (25.4 mm) of exposed threads after adjustment. If control tubes have inspection holes, threads must be engaged sufficiently to cover holes.

d. Apply corrosion preventive compound (C-101) to threads of all adjustable rod end bearings and clevises after adjustment.

e. Torque control jamnuts 80 to 100 in-lbs (9.0 to 11.3 Nm) after adjustment unless otherwise specified.

f. Control tubes must be free to rotate several degrees about longitudinal axis. If necessary, loosen jamnuts adjust end fitting and retorque jamnuts.

2. Ensure collective pitch control system rigging has been accomplished (Chapter 67).

3. Verify levers (2 and 6, Figure 76-16) are correctly installed on control shafts of power turbine governors (1 and 5). Nominal setting positions the centerline of levers (2 and 6) 15 degrees (one serration) clockwise from centerline of governor stop arm (21), viewed from left looking inboard (detail A) In subsequent steps levers (2 and 6) may be repositioned ±15 degrees (one serration) from the nominal setting if required to achieve proper rigging and eliminate any fouling conditions.

4. Connect ENG 2 ITT actuator (27) to governor lever (2) and jackshaft (4). Verify total stroke of actuator (27) is 0.150 in. (3.81 mm) and total length is 9.415 in. (239.14 mm) with actuator fully extended. (Refer to Paragraph 76-27 for installation and rigging procedure).

NOTE

The dimension given in step 5 is approximate for initial rigging. Minor adjustments may be necessary during ground and flight test.

5. Verify adjustable tube (7) is approximately 9.34 in. (237.23 mm) measured between attachment points (center of rod end bearings).

6. Connect tube (7) to governor lever (6) and to the middle hole of jackshaft lever (28) (detail C).

7. Disconnect actuator (8) from lever of jackshaft (4).

8. Disconnect actuator (8) rod end bearing from cambox slider (25).

9. Disconnect tube (18) from cambox (10) and adjust tube (18) to a nominal adjustment of 40.25 in. (1022.35 mm).

NOTE

The dimension given in step 10 is approximate for initial rigging. Minor adjustments may be necessary during ground and flight test.

10. Verify long arm of cambox bellcrank (26) is attached approximately in the middle of adjustment slot of cam (23) (detail B).

11. Use RPM INCR/DECR (beep) switch on collective switchbox to operate actuator. Verify actuator (8) is adjusted to a total stroke of approximately 0.62 inch (16 mm) from full extend (DECR) to full retract (INCR) positions. If not, refer to paragraph 76-23 for actuator rigging procedure.

12. Adjust rod end on actuator (8) to approximately 1.88 inches (48 mm) from center of bearing bolt hole to face of jamnut (detail D).

13. Connect actuator (8) rod end bearing to cambox slider (25).

14. Connect actuator (8) to lever of jackshaft (4).

15. Connect tube (18) to cambox (10).

16. Disconnect tube (16) from bellcrank (17) and rotate bellcrank to ensure there is no fouling. Rotate cambox bellcrank (26) (Detail B) and ensure there is no fouling.

17. Connect tube (16) to bellcrank (17).

NOTE

If hydraulic test unit is available disconnect control tube (15).

18. Connect hydraulic test unit (Chapter 29).

19. With hydraulic boost ON, place collective stick full down. Adjust the length of tube (18) to hold cam (23) so lower end of cam slot is approximately 0.280 inch (7.1 mm) below slider housing (24).

20. With hydraulic boost ON, place collective stick full up. Verify that approximately 0.280 inch (7.1 mm) above slider housing (24).

21. With collective stick full up. Hold RPM INCR/DECR switch to INCR until actuator (8) is fully retracted. Hold ENG 2 (+2/–2) switch to +2 until ITT actuator (27) is fully retracted. Verify minimum clearance of 0.010 inch (0.25 mm) (Detail A) between stop arm (21) and maximum power stop screw (22) on both governors (1 and 5).

22. With hydraulic boost ON, place collective stick full down. Hold RPM INCR/DECR switch to DECR until actuator (8) is fully extended. Hold ENG 2 (+2/-2) switch to -2 until ITT actuator (27) is fully extended. Verify minimum clearance of 0.010 inch (0.25 mm) between stop arm (21) and minimum power stop screw (20) on both governors (1 and 5).

23. Disconnect hydraulic test unit or connect control tube (15) as applicable.

CAUTION

VERIFY ALL CONTROLS ARE PROPERLY CONNECTED PRIOR TO GROUND RUN AND FLIGHT TEST.

NOTE

Prior to accomplishing ground run, verify Automatic Fuel Control Unit (AFCU) and Manual Fuel Control Unit (MFCU) maximum stops screws are being contacted with throttles full open (paragraph 76-3). During ground run, verify acceleration time difference between power sections is within 0.5 seconds (paragraph 76-11).

24. Start both power sections per Flight Manual and idle for 5 minutes.

25. Actuate RPM INCR/DECR switch to full DECR.

NOTE

Positioning of ENG 2 ITT actuator (27) to mid stroke can be done during ground run by actuating ENG 2 (+2/-2) switch to full +2, record ROTOR RPM. Actuate ENG 2 (+2/-2) switch to full -2, record ROTOR RPM. Actuate ENG 2 (+2/-2) switch to set ROTOR RPM to middle of recorded range.

26. Ensure ENG 2 ITT actuator (27) is at mid stroke position, 9.34 inches (237.2 mm) before proceeding to step 27.

27. Place collective stick full down. Rotate ENG 2 throttle to full INCR. Record ROTOR RPM (NR). Slowly actuate RPM INCR/DECR switch to full INCR but not to exceed 101% ROTOR RPM. Record ROTOR RPM. The minimum full INCR should be 99% ROTOR RPM.

CAUTION

RETURN ENGINES TO IDLE FOR ANY ADJUSTMENTS TO CONTROLS WITH ENGINE RUNNING.

NOTE

Three turns of actuator (8) rod end is equal to 1% ROTOR rpm change.

28. If minimum ROTOR rpm cannot be obtained, make an interim adjustment to the rod end of actuator (8).

29. With the collective full down, rotate ENG 2 throttle to full INCR. Actuate RPM INCR/DECR switch to full DECR and ENG 2 (+2/–2) switch to full +2. Record ROTOR rpm. Actuate ENG 2 (+2/–2) switch to full –2 and record ROTOR rpm. The total spread between ROTOR rpm should be 2 1/4 ± 1/4%. If spread is not within limits, adjust ITT actuator (27) stroke per Paragraph 76-21.

30. Return ENG 2 to IDLE, rotate ENG 1 throttle to full INCR. Record ROTOR rpm. Slowly actuate RPM INCR/DECR switch to full INCR but not to exceed 101% ROTOR rpm. Record ROTOR rpm. The minimum full INCR should be 99% ROTOR rpm.

CAUTION

RETURN ENGINES TO IDLE FOR ANY ADJUSTMENTS TO CONTROLS WITH ENGINE RUNNING.

NOTE

Two turns of tube (7) rod end is equal to 1% ROTOR rpm change.

31. If the minimum ROTOR rpm cannot be obtained, make an interim adjustment to the rod end of tube (7).

NOTE

When performing the following steps helicopter will become airborne.

32. Return ENG 1 to IDLE, rotate ENG 2 to full INCR. Slowly actuate RPM INCR/DECR switch to 98% ROTOR rpm. Gradually increase collective from flat pitch to 60% engine torque and not static ROTOR rpm droop.

33. Return ENG 2 to IDLE, rotate ENG 1 to full INCR. Slowly actuate RPM INCR/DECR switch to 98% ROTOR rpm. Gradually increase collective from flat pitch to 60% engine torque and not static ROTOR rpm droop.

34. If more than 2% ROTOR rpm droop is encountered perform troubleshooting of engine pneumatic lines and N2 power turbine governor per Pratt & Whitney Maintenance Manual before proceeding with further adjustments.

35. With rotor at flat pitch, increase both throttles to full INCR and adjust NR rpm to 100% using RPM INCR/DECR switch.

36. Gradually increase collective from flat pitch to approximately 60% transmission torque. Using the +2/–2 switch, trim ENG 2 to minimum, and then to maximum and note the torque split. The torque split should be approximately equal above and below ENG 1 torque indication. If the torque split difference is greater than 5% above or below ENG 1 torque, adjust length of tube (7) as follows:

NOTE

Half turn of rod end on tube (7) is equal to approximately 5% engine torque change.

a. To increase torque on ENG 1, shorten rod end of tube (7).

b. To decrease torque on ENG 1, lengthen rod end of tube (7).

NOTE

Engine torque difference (split) between ENG 1 and ENG 2 shall not exceed 4% during power application throughout this maintenance procedure. However, during normal operation torque split may exceed 4%. +2/–2 switch may be used to trim engines for either torque matching or ITT matching.

37. At 100% ROTOR rpm, gradually increase collective to 60% mast torque and match engines torques using +2/–2 switch. Gradually decrease collective to flat pitch and note the torque split. Gradually increase collective to full power (either transmission torque, ITT, or N1) and note the torque split throughout the power range, torque matching should remain constant within 4%. If torque does not remain constant throughout the power range, adjust as follows:

a. If ENG 1 torque reading is greater than ENG 2 by more than 4%, move tube (7) rod end forward (DECR) on lever (28) (detail C).

b. If ENG 1 torque reading is less than ENG 2 by more than 4%, move tube (7) rod end AFT (INCR) on lever (28) (detail C).

38. Place collective stick full down, rotate both engine throttles to full INCR. Use RPM INCR/DECR switch to obtain 100% ROTOR rpm and match engine torques using +2/–2 switch. Increase collective pitch slowly in a series of equal steps from flat pitch to full power (either transmission torque, engine ITT or N1 limit). ROTOR rpm should remain at 100 ± 1% throughout power sweep.

39. If ROTOR rpm droops (decays below tolerance) or overspeeds (increase above tolerance) during power applications, make a cam rate adjustment.

NOTE

Make adjustments in small increments of approximately 0.125 in. (3.18 mm) measured on cam slot.

a. For increased cam compensation to correct droop, adjust cam (23) counterclockwise relative to bellcrank (26) (detail B).

b. For reduced cam compensation to correct overspeed, adjust cam (23) clockwise relative to bellcrank (26).

c. After each cam adjustment, move the collective to "full down" and then "full up" positions to ensure there is no fouling between slider housing (24) and cambox slot. Verify that a minimum of 0.010 in. (0.25 mm) cam slot shows below and above slider housing (24). If required adjust tube (18) for proper clearance.

CAUTION

RETURN ENGINES TO IDLE FOR ANY ADJUSTMENTS TO CONTROLS WITH ENGINE RUNNING.

NOTE

Three turns of actuator (8) rod end is equal to 1% ROTOR rpm change.

40. Actuate RPM INCR/DECR switch to full decrease with collective in the full down position. Rotate both engine throttles to full INCR and record ROTOR rpm. The recorded ROTOR rpm should be 97%. If not adjust actuator (8) rod end.

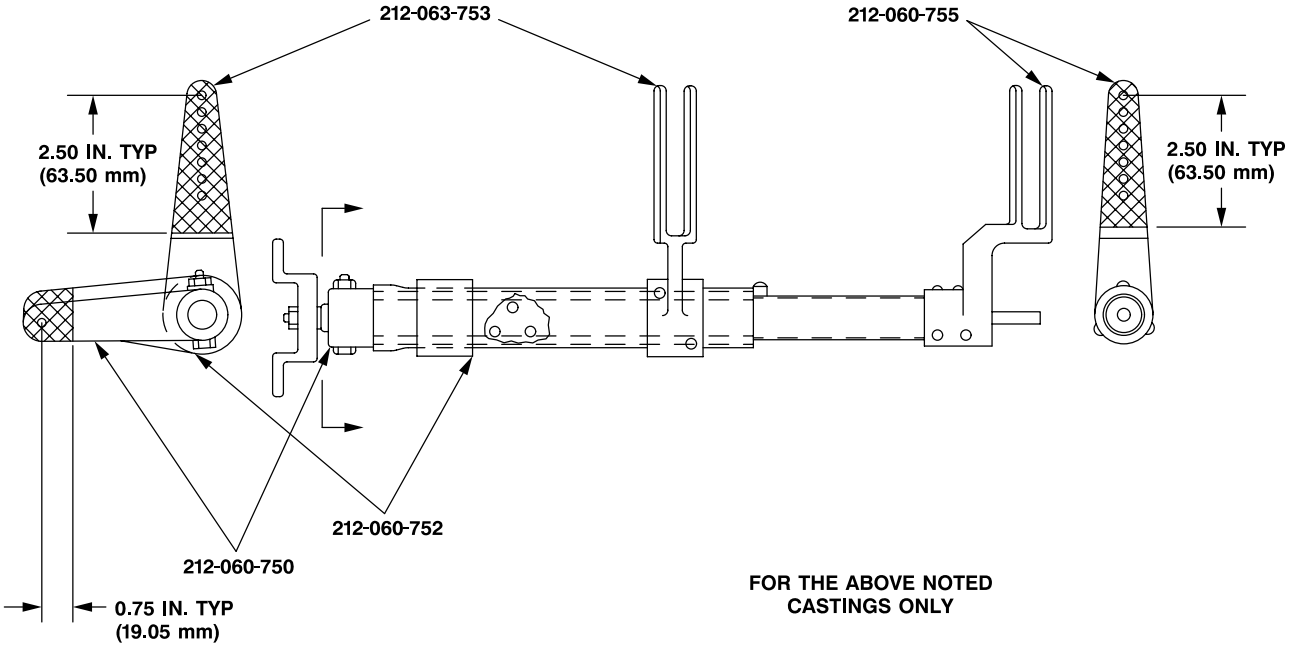
41. Actuate RPM INCR/DECR switch to full INCR and verify ROTOR rpm is 101.5%. The required range for twin-engine beep is 97 to 101.5% ROTOR rpm.

NOTE

If hydraulic test unit is not available disconnect control tube (15).

42. With collective stick full up. Hold RPM INCR/DECR switch to INCR until actuator (8) is fully retracted. Hold +2/–2 switch to +2 until ITT actuator (27) is fully retracted. Verify minimum clearance of 0.010 in. (0.25 mm) (detail A) between stop arm (21) and maximum power stop screw (22) on both governors (1 and 5).

43. Check complete system for security of all parts and ensure no interference exists. Apply corrosion preventive compound (C-101) to all exposed threads.



FOR THE ABOVE NOTED CASTINGS ONLY

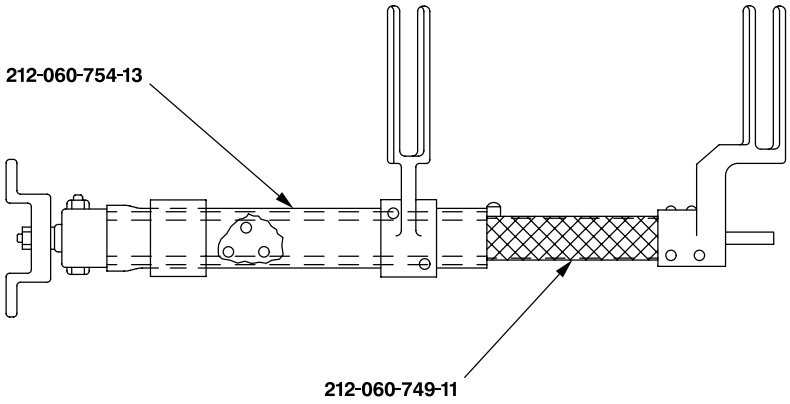
DAMAGE AREA REPAIR SYMBOLS

MAXIMUM DEPTHS AND REPAIR AREAS

TYPE OF DAMAGE		
MECHANICAL DAMAGE	0.020 IN.	0.040 IN.
CORROSION DAMAGE		
(BEFORE CLEAN-UP)	0.010 IN.	0.020 IN.
(AFTER CLEAN-UP)	0.020 IN.	0.040 IN.
MAXIMUM AREA PER FULL DEPTH REPAIR	0.10 SQ. IN.	0.25 SQ. IN.
NUMBER OF REPAIRS	One per lug	Two per area
EDGE CHAMFER	0.030 IN.	0.050 IN.
BORE DAMAGE	0.001 IN. for 1/4 circumference	

212_M_76_17_1

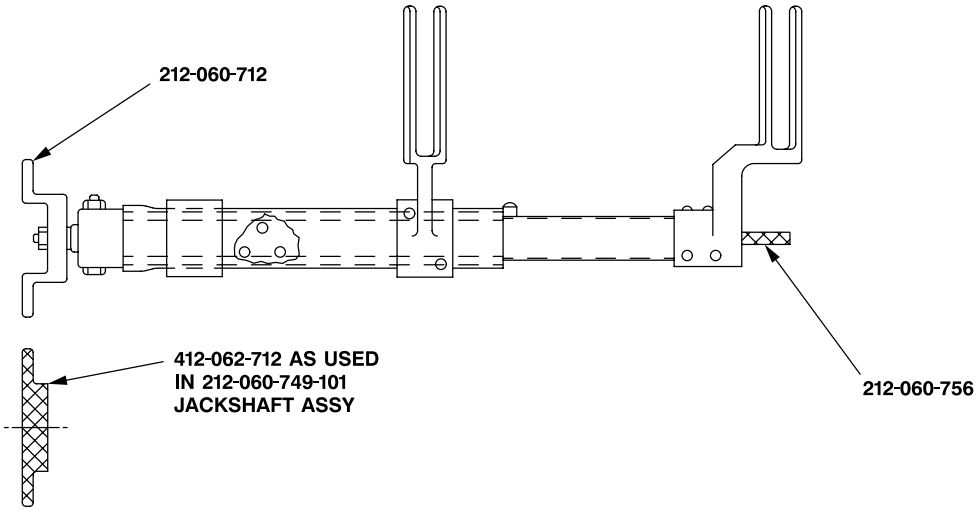
Figure 76-17. Jackshaft Assembly (212-060-749) Mechanical and Corrosion Damage Limits (Sheet 1 of 4)



	DAMAGE VALUES FOR	
	212-060-749-11 TUBE ONLY	212-060-754-13 ONLY
	DAMAGE AREA REPAIR SYMBOLS	
	MAXIMUM DEPTHS AND REPAIR AREAS	
TYPE OF DAMAGE		
MECHANICAL DAMAGE	0.006 IN.	0.010 IN.
CORROSION DAMAGE (BEFORE CLEAN-UP) (AFTER CLEAN-UP)	 0.003 IN. 0.006 IN.	 0.005 IN. 0.010 IN.
MAXIMUM AREA PER FULL DEPTH REPAIR	0.10 SQ. IN.	0.25 SQ. IN.
NUMBER OF REPAIRS	One	One
EDGE CHAMFER	0.015 IN.	0.020 IN.
BORE DAMAGE	0.003 IN. for 1/4 circumference	0.001 IN. for 1/4 circumference

212_M_76_17_2

Figure 76-17. Jackshaft Assembly (212-060-749) Mechanical and Corrosion Damage Limits (Sheet 2)



FOR THE ABOVE NOTED
FITTINGS ONLY

DAMAGE AREA REPAIR SYMBOLS

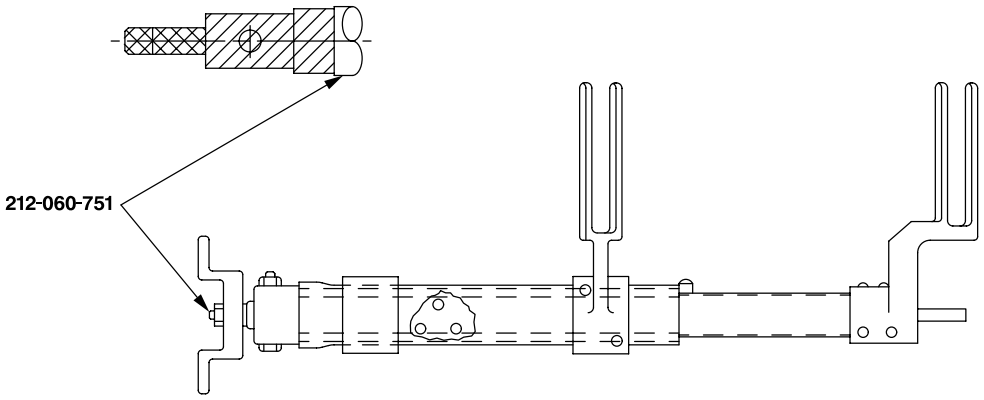
MAXIMUM DEPTHS AND REPAIR AREAS

TYPE OF DAMAGE		
MECHANICAL DAMAGE	0.006 IN.	0.010 IN.
CORROSION DAMAGE		
(BEFORE CLEAN-UP)	0.003 IN.	0.005 IN.
(AFTER CLEAN-UP)	0.006 IN.	0.010 IN.
MAXIMUM AREA PER FULL DEPTH REPAIR	0.10 SQ. IN.	0.25 SQ. IN.
NUMBER OF REPAIRS	One *	One **
EDGE CHAMFER	0.020 IN.	0.0030 IN.
BORE DAMAGE	0.001 IN. for 1/4 circumference for 412-062-712 and 212-060-712 bearing bore only	

* ONE PER LEG FOR 412-062-712
** ONE PER LEG FOR 212-060-712

212_M_76_17_3

Figure 76-17. Jackshaft Assembly (212-060-749) Mechanical and Corrosion Damage Limits (Sheet 3)



DAMAGE AREA REPAIR SYMBOLS

MAXIMUM DEPTHS AND REPAIR AREAS

TYPE OF DAMAGE		
MECHANICAL DAMAGE	0.010 IN.	0.020 IN.
CORROSION DAMAGE		
(BEFORE CLEAN-UP)	0.005 IN.	0.010 IN.
(AFTER CLEAN-UP)	0.010 IN.	0.020 IN.
MAXIMUM AREA PER FULL DEPTH REPAIR	0.10 SQ. IN.	0.25 SQ. IN.
NUMBER OF REPAIRS	One	One
EDGE CHAMFER	0.020 IN.	0.030 IN.
BORE DAMAGE	0.010 IN. for 1/4 clrcumference	0.001 IN. for 1/4 clrcumference
THREAD DAMAGE DEPTH 1/3 of thread LENGTH 0.25 IN. NUMBER Two per hole pin		

212_M_76_17_4

Figure 76-17. Jackshaft Assembly (212-060-749) Mechanical and Corrosion Damage Limits (Sheet 4)