PROPELLER (HARTZELL) - MAINTENANCE PRACTICES

1. General

A. This section gives the maintenance procedures for the removal and installation of the Hartzell HC-B3TN-3AF and the HC-B3MN-3 propeller assemblies.

(1) The Hartzell HC-B3TN-3AF propeller assemblies are installed on airplanes with the PT6A-140 engine. The assemblies have aluminum blades and do not have an option for electric deicing.

(2) The Hartzell HC-B3MN-3 propeller assemblies are installed on airplanes with the PT6A-114/PT6A-114A engines. The assemblies have composite blades and can have an electric deicing system installed.

B. The adjustment tests procedures are given for the, Beta feedback ring axial runout check, feather blade angle check and adjustment, the low pitch stop check and adjustment and the blade clamp lubrication.

2. Propeller Removal/Installation

A. Remove Propeller (Refer to Figure 201).

(1) Make sure all electrical power switches are in OFF position.

(2) Open upper right cowling door and remove right nose cap.

(3) Remove propeller reversing lever (1) and carbon block (3) from propeller Beta feed back ring (4). For the removal procedures for the propeller reversing lever refer to the applicable Pratt & Whitney Engine Maintenance Manual found in the Introduction List of Publications.

(4) Remove spinner (15) by removing screws and fiber washers (5) securing spinner to spinner bulkhead (22).

NOTE: Mark an index on spinner and spinner bulkhead to ensure reinstallation of spinner as originally installed.

CAUTION: Do not use masking or other adhesive tapes to secure brushes as adhesive will degrade conductivity.

(5) If propeller has electric anti-ice system installed, loosen nuts securing propeller anti-ice system brush block assembly (32) to engine reduction gearbox (33) and carefully insert a length of safety-wire between brushes and slip ring (31). Tie safety-wire around brush holder to secure brushes in holder and remove brush block, brushes, and bracket.

CAUTION: Ensure beta system compressor tool is not cocked. Do not forcibly pull the feedback ring against the guide which limits forward travel.

(6) Position Beta system compressor tool at forward portion of propeller. Attach tool flanges to rod end ring of propeller servo piston (16). Tighten tool until propeller feedback ring (4) is pulled forward to allow access to 12 point bolts (25).

(7) Attach lifting sling to hoist and position hoist forward of airplane. Attach sling to propeller by positioning blades at 10 o'clock and 2 o'clock positions.

(8) Position drip pan under propeller to catch residual oil which will drain from propeller when removed.

(9) Cut safety-wire from bolts (25) and using proper wrench extension, loosen and remove bolts.

(10) With propeller supported in sling, remove propeller from airplane and O-ring (19) from propeller shaft. Discard O-ring.

(11) To remove spinner bulkhead (22), loosen jam nuts (26) and using flats of low stop rods (17), turn low stop rods one-third turn each in sequence to evenly back rods out of Beta follow-up ring (4).

NOTE: If any single low stop rod is turned more than one-third turn at a time, remaining two stop guides will bind up in follow up ring.

B. Install the Propeller (Refer to Figure 201). For the PT6A-140 with the HC-B3TN-3AF propeller installation (Refer to Figure 202). For the PT6A-144/PT6A-114A and HC-B3MN-3 propeller installation (Refer to Figure 203).

(1) If propeller is equipped with electric anti-ice system, install slip ring (31).

(2) Install spinner bulkhead (if removed) by installing guide lugs (28), spinner bulkhead support (21), retaining rings (27), and spinner bulkhead (22) over low pitch stop rods (17) at back of propeller. Install bolts (29).

(3) Place jam nuts (26) onto low pitch stop rods. Position Beta follow-up ring (4) to low pitch stop rods (17) and using flats on stop rods thread into follow-up ring one-third turn at a time on each stop rod.

NOTE: If any single low stop rod is turned more than one-third turn at a time, remaining two stop guides will bind up in follow up ring.

(4) Measure distance from forward side of follow-up ring (4) to aft side of spinner bulkhead (22) at each low pitch stop

rod location to ensure follow-up ring alignment. Adjust stop rods as required to make all three dimensions equal and tighten jam nuts (26).

(5) Install Beta system compressor tool on propeller.

CAUTION: Ensure beta system compressor tool is not cocked. Do not forcibly pull feedback ring against guide which limits forward travel.

(6) Operate Beta system compressor tool to pull feedback ring forward while observing for smooth movement without binding or interference. Leave feedback ring pulled forward during installation for access to engine propeller flange (23).

(7) Lightly lubricate O-ring (19) with engine oil and install on engine propeller flange (23).

(8) Lift propeller into position at front of airplane using hoisting sling and hoist.

CAUTION: New propeller mounting bolts must be used when you initially install a new or overhauled propeller.

(9) Lubricate threads and bolt washer face of 12-point bolts (25) with Hartzell A-3338-1 lubricant or equivalent lubricant conforming to AMS 2518 or MIL-T-83483.

CAUTION: The ID chamfer of the washer must face toward the bolt head. Washers without chamfer must be installed with the rolled edges toward the bolt head.

(10) Make sure that the propeller hub flange and the engine flange mating surfaces are clean.

CAUTION: Make sure that there is complete and correct surface contact between the propeller hub flange and the engine flange.

(11) Very carefully position propeller onto the engine shaft, using extreme caution to avoid damaging feedback ring (4). Install washers (24) onto bolts (25) with chamfered ID of washer under bolt head.

NOTE: If the propeller was installed for a temporary amount of time the bolts and washers can be used again if they are serviceable.

(12) Install the bolts (25). For airplanes with the PT6A-140 engine and the HC-B3TN-3AF propeller installed refer to Figure 202 and for airplanes with the PT6A-114/PT6A-114A engine and the HC-B3MN-3 propeller installed refer to Figure 203.

(a) Torque the bolts to 40 foot-pounds using torque sequence A.

(b) Repeat sequence A but torque to 80 foot-pounds.

(c) Final torque all bolts from 100 to 105 foot-pounds using sequence B.

(d) Safety two each of the bolts together with wire. Refer to Chapter 20, Safetying - Maintenance Practices.

(13) Remove Beta system compressor tool.

(14) Check that carbon block (3) will slide freely in groove of Beta feedback ring (4) at all points without binding or excessive friction.

NOTE: The carbon block initially supplied with each propeller has been prefit. If a different carbon block is being installed, it may be necessary to sand it to obtain a total clearance between carbon block and side of groove of 0.001 to 0.002 inch at the tightest point.

(15) Install carbon block (3) onto reversing lever (1).

NOTE: The lower end of the propeller reversing lever is machined with a stepped notch.

CAUTION: Make sure the stepped notch at the end of the propeller reversing lever (1) is under the guide pin (16) in the reversing lever guide pin bracket (15).

(16) Install reversing lever (1) to Beta valve clevis (2) and follow-up ring (4). For the installation procedures for the propeller reversing lever refer to the applicable Pratt & Whitney Engine Maintenance Manual found in the Introduction List of Publications.

(17) Position spinner (15) to spinner bulkhead (22) as indexed during removal procedure and secure with screws and fiber washers (5).

(18) Install right nose cap.

(19) Check clearance between spinner (15) and nose cap, clearance should be 0.32 inch, +0.10 or -0.10 inch.

(20) For procedures to install and adjust TKS system propeller components, refer to Chapter 30, TKS Anti-Ice Propeller

(McCauley) - Maintenance Practices.

3. Adjustment/Checks

A. Beta Feedback Ring Axial Runout Check.

NOTE: Checking adjustment of the Beta feedback ring axial runout is not required unless there is reason to believe linkage settings have been tampered with or feedback ring is bent.

(1) Open right upper cowling door.

(2) Remove right nosecap.

(3) Clamp dial indicator in position to check axial runout of forward inside face of Beta feedback ring groove.

(4) Rotate propeller by hand and check that axial runout does not exceed 0.010 inch total indicator reading and that there is no binding between carbon block and feedback ring.

NOTE: The carbon block initially supplied with each propeller has been prefit. If a different carbon block is being installed, it may be necessary to sand it to obtain a total clearance between carbon block and side of groove of 0.001 to 0.002 inch at the tightest point.

(5) If Beta feedback ring runout is excessive proceed as follows:

(a) Index mark location of spinner to spinner bulkhead and remove spinner.

(b) Mark one of the three low pitch stop rods. Do not change setting on this rod.

(c) On the other two rods, loosen jam-nuts at Beta feedback ring and jam-nuts aft of rod end ring.

(d) Adjust runout by carefully screwing the two rods into or out of Beta feedback ring using flats on the rods.

(e) When feedback ring axial runout is within tolerance, torque jam-nuts at feedback ring to 180 inch-pounds, +18 or -15 inch-pounds.

NOTE: Inability to obtain satisfactory runout adjustment is reason to suspect feedback ring is bent or warped which can usually be confirmed by visual inspection. If this is the case, propeller must be removed and repaired on a propeller test stand in accordance with Hartzell Turbine Propeller Overhaul Instructions Manual No. 118-E or returned to Hartzell for repair.

NOTE: Rotation of the low pitch stop rods will not cause low pitch stop nut adjustment to change. Do not change position of stop nuts.

(f) On rod that was marked and not adjusted, measure distance between low stop nut and propeller piston boss with a precision measuring instrument, such as an inside micrometer or vernier or dial calipers. Adjust other two low stop nuts to match.

(g) Adjust elastic stop nuts forward of rod end ring so that ring is an equal distance from the ends of all three rods. Torque jam-nuts aft of ring to 180 inch-pounds, +18 or -18 inch- pounds.

(h) Remove dial indicator.

(i) Install spinner as indexed in removal procedure.

(j) Install right nose cap.

B. Feather Blade Angle Check and Adjustment (Refer to Figure 203).

(1) Position airplane out of the wind.

NOTE: Airplane must remain in a stable position throughout this procedure.

(2) Remove spinner by removing screws and fiber washers securing spinner to spinner bulkhead.

NOTE: Mark an index on spinner and spinner bulkhead to ensure reinstallation of spinner as originally installed.

(3) Zero propeller protractor on propeller servo piston by using a parallel bar. Recheck by turning parallel bar over. If readings are different, parallel bar is not parallel and rod end ring should be removed to zero the propeller protractor directly on the servo piston. This method should be used if a parallel bar is not available.

(4) Rotate each blade to a horizontal position and measure each feather blade angle on the back of blade at the 42-inch station.

(5) The average of the three individual blade angles must be 78.4 degrees, +0.2 or -0.2 degrees.

(6) If adjustment is not required, replace rod end ring if it was removed, and torque jam-nuts to 180 inch-pounds, +18 or -

18 inch-pounds. Install spinner using fiber washers and screws as indexed during removal.

(7) If adjustment of the feather blade angles is required, proceed as follows:

(a) Place drip pan under propeller to catch residual oil.

(b) Using precision measuring instrument, such as inside micrometer or dial or vernier calipers, measure distance between one low pitch stop nut and servo piston boss, and record dimension.

(c) Remove forward rod end ring (7) and low pitch stop nuts (8) from all three low pitch stop rods (6).

(d) Remove Flexlock nut (4) from servo piston (5). Remove link pin units (9) from side of servo piston (5).

(e) Remove piston (5) from cylinder.

(f) Remove safety-wire from the four feather adjustment screws (3).

(g) Equally adjust the four feather adjustment screws (3) on front of spring cup (2) to provide required feather angle. One turn equals 1.5 degrees of blade angle change with blade angle increasing when screws are turned in and decreasing when screws are turned out. Record number and direction of turns to nearest eighth turn.

(h) Safety-wire feather adjustment screws (3).

(i) Slide piston (5) onto cylinder.

(j) Install link arms (10) into slots on piston (5) and install link pin units (9).

(k) Install Flexlock nut (4) and torque to 120 foot-pounds, +12 or -12 foot-pounds. Ensure that piston does not rotate against low pitch stop rods (6) and cause binding.

(l) Recheck blade feather angles per steps B.(4) and B.(5). If angles are not satisfactory, readjust per steps B.(7) (d) through (k).

(m) Reinstall low pitch stop nuts (8). Adjust nuts using a precision measuring instrument so that distance between low pitch stop nuts and piston boss is equal to original distance per step B.(7)(b), corrected for feather adjustment as follows: Each turn IN of feather adjustment screws, ADD 0.031 inch to original distance. Each turn OUT of feather screws, SUBTRACT 0.031 inch from original distance.

EXAMPLE

Original stop nut distance =	+ 2.683 inches
First feather adjustment correction:	
1 3/8 turns IN x 0.031 inch =	+ 0.043 inch
Second feather adjustment correction:	
1/2 turn OUT x 0.031 inch =	- 0.016 inch
Corrected low pitch stop nut distance:	+ 2.710 inches

(n) Reinstall forward rod end ring (7). Adjust three elastic nuts forward of the ring so ring is an equal distance from end of all three rods. Torque three jam-nuts to 180 inch-pounds, +18 or -18 inch-pounds.

(o) Install spinner as indexed during removal and secure with screws and fiber washers.

C. Low Pitch Stop Check and Adjustment (Refer to Figure 204).

(1) Position airplane out of wind.

NOTE: Airplane must remain in a stable position throughout this procedure.

(2) Remove spinner by removing screws and fiber washers securing spinner to spinner bulkhead.

NOTE: Mark an index on spinner and spinner bulkhead to ensure reinstallation of spinner as originally installed.

(3) Measure and record distance between piston bosses and low pitch stop nuts using a precision measuring instrument, such as an inside micrometer or dial or vernier calipers. All three distances should be equal unless tampering has occurred. If not equal, adjust any two nuts so that distances are equal to the third.

(4) Place drip pan under propeller to catch residual oil which is lost during next step.

(5) Remove Flexlock nut (4) from front of piston (5).

(6) Grasp counterweights and pull forward to rotate blades to a lower angle. Pull alternate counterweights to allow piston to slide forward as evenly as possible without excessive cocking. Pull forward until piston bosses are firmly and

squarely in contact with all three low stop nuts, but feedback linkage is not pulled forward.

(7) Zero propeller protractor on horizontal portion of servo piston, except that use of parallel bar or removal of rod end retaining ring is not required. Check zero as propeller is rotated to three equally spaced positions. Different readings indicate that servo piston is excessively cocked due to not being firmly and squarely in contact with all three low pitch stop nuts per step 6.

(8) Rotate each blade to a horizontal position and measure each low pitch blade angle on back of blade at 42-inch station. Record each angle.

(9) The average of the three individual blade angles must be as follows:

NOTE: The propeller low pitch blade angle tolerance can only be achieved accurately with propeller installed on a test bench. Do not attempt adjustment of an installed propeller if blade angle is within the +0.5 or -0.5 degree tolerance.

(a) For airplanes with the HC-B3TN-3AFX/T10890CNB propeller assembly, 8.5 degrees, +0.5 or -0.5 degrees.

(b) For airplanes with the HC-B3MN-3/M10083 propeller assembly installed, 9.0 degrees, +0.5 or -0.5 degrees.

(10) Rotate blades back to feathered position using caution when re-engaging the hole in front of piston with threaded pilot.

(11) Install Flexlock nut (4) and torque to 120 foot-pounds, +12 or -12 foot-pounds. Ensure that piston (5) does not rotate against low pitch stop rods (6) causing binding.

CAUTION: If there is any doubt as to how to measure, calculate, or adjust required low pitch stop nut distance, seek assistance before attempting adjustment.

(12) If adjustment of low pitch blade angle is required, adjust the pitch stop nuts so that distance from piston bosses to low pitch stop nuts is equal to original recorded distance per step C(3) corrected for required blade angle change as follows:

(a) If measured blade angle is too LOW, SUBTRACT 0.035 inches for each degree of difference between 9.0 degrees and measured blade angle.

(b) If measured blade angle is too HIGH, ADD 0.035 inches for each degree of difference between measured blade angle and 9.0 degrees.

EXAMPLE 1: Blade angle too LOW - Subtract correction

Measured blade angle: (7.8 degrees)	
Original low stop nut distance:	2.683 inches
Correction: (9.0-7.8) x 0.035 inch =	-0.042 inch
Corrected low stop nut distance =	2.641 inches

EXAMPLE 2: Blade angle too HIGH - Add correction

Measured blade angle: (9.8 degrees)	
Original low stop nut distance:	2.683 inches
Correction: (9.8-9.0) x 0.035 inch =	+0.028 inch
Corrected low stop nut distance =	2.711 inches

D. Propeller Blade Clamp Lubrication.

(1) The propeller manufacturer recommends that propeller blade clamps be lubricated each 100 hours. Blade clamps are greased through zerk fittings (two each per blade clamp). Lubricate as follows:

CAUTION: Care must be taken to avoid blowing out blade clamp gaskets. This is accomplished by removing one of two zerks of each blade clamp.

(2) Remove spinner.

(3) Remove one each of the two zerk fittings from each blade clamp.

(4) Using grease conforming to specification shown in Chapter 12 and a pressure type grease gun, pump grease into zerk fitting not removed from each blade clamp. Stop pumping when new grease flows from hole where zerk was

removed.

(5) Replace removed zerk fitting.

(6) Reinstall spinner.

Figure 201 : Sheet 1 : Hartzell Propeller Installation

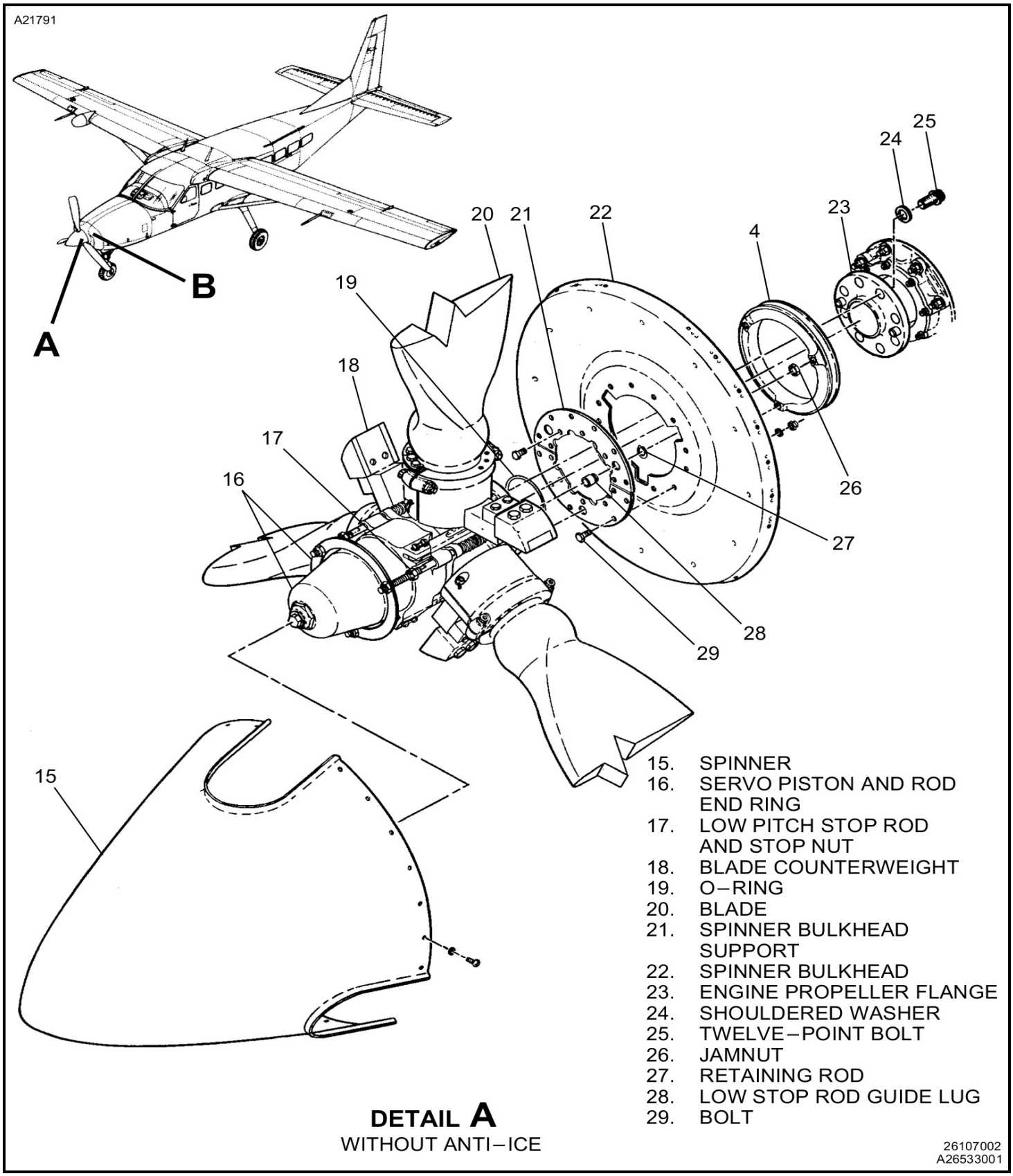


Figure 201 : Sheet 2 : Hartzell Propeller Installation

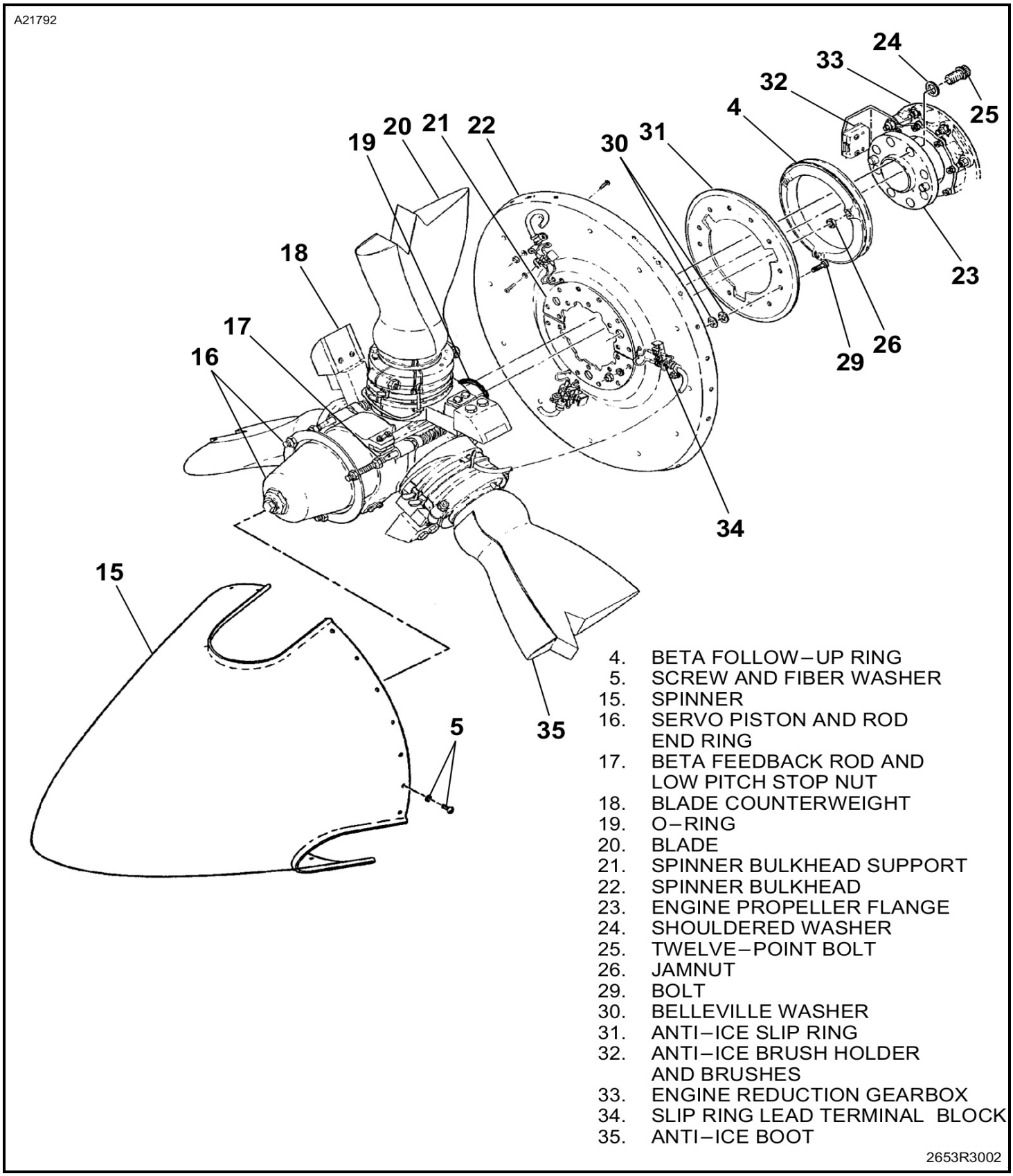
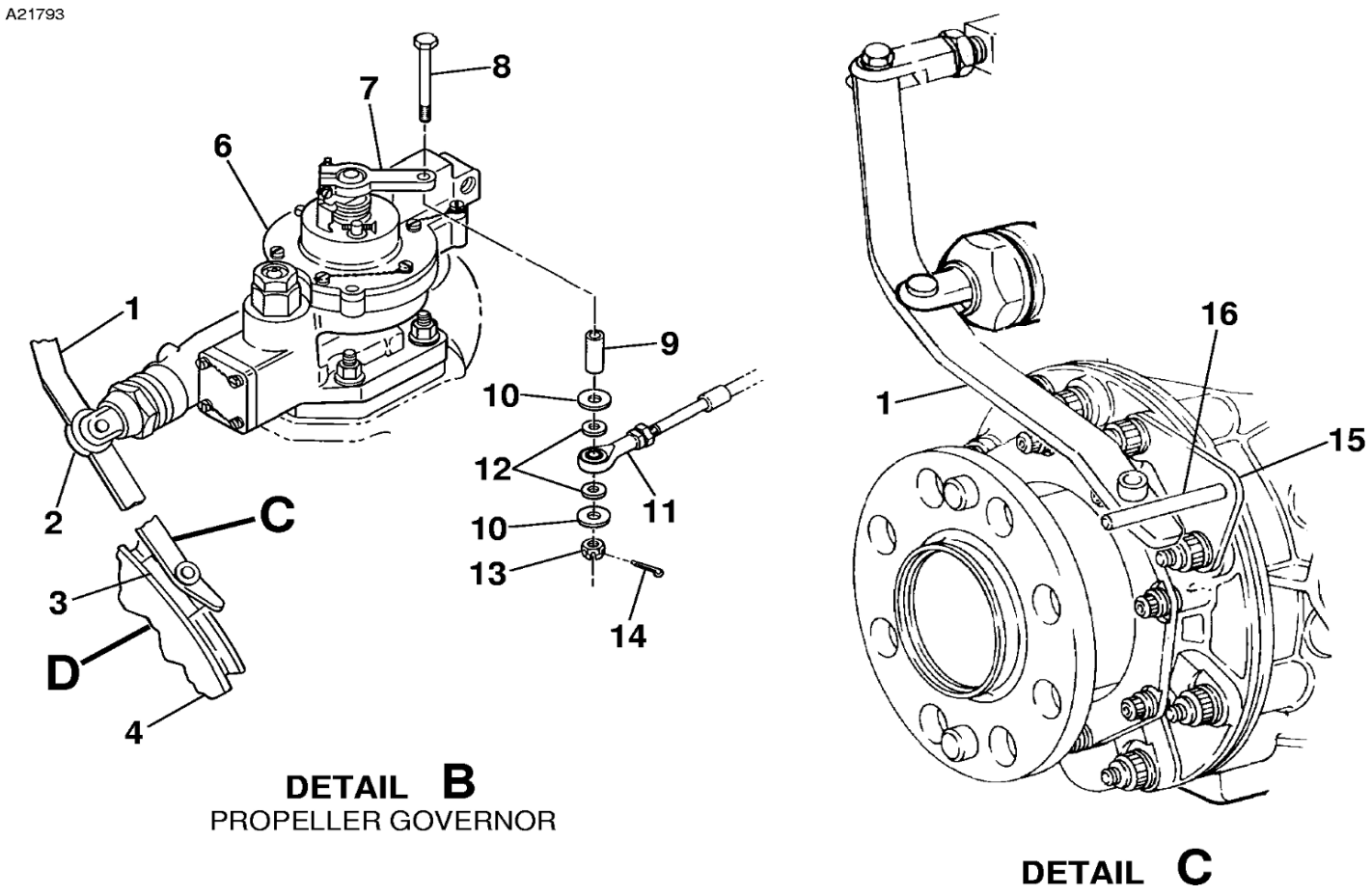


Figure 201 : Sheet 3 : Hartzell Propeller Installation



1. REVERSING LEVER
2. BETA VALVE CLEVIS
3. CARBON BLOCK
4. BETA FOLLOWUP RING
5. SCREW AND FIBER WASHER
6. PROPELLER GOVERNOR
7. PROPELLER SPEED ADJUSTING LEVER
8. BOLT
9. SPACER
10. WASHER
11. SPEED CONTROL CABLE ROD END
12. WASHER
13. NUT
14. COTTER PIN
15. GUIDE PIN BRACKET
16. GUIDE PIN

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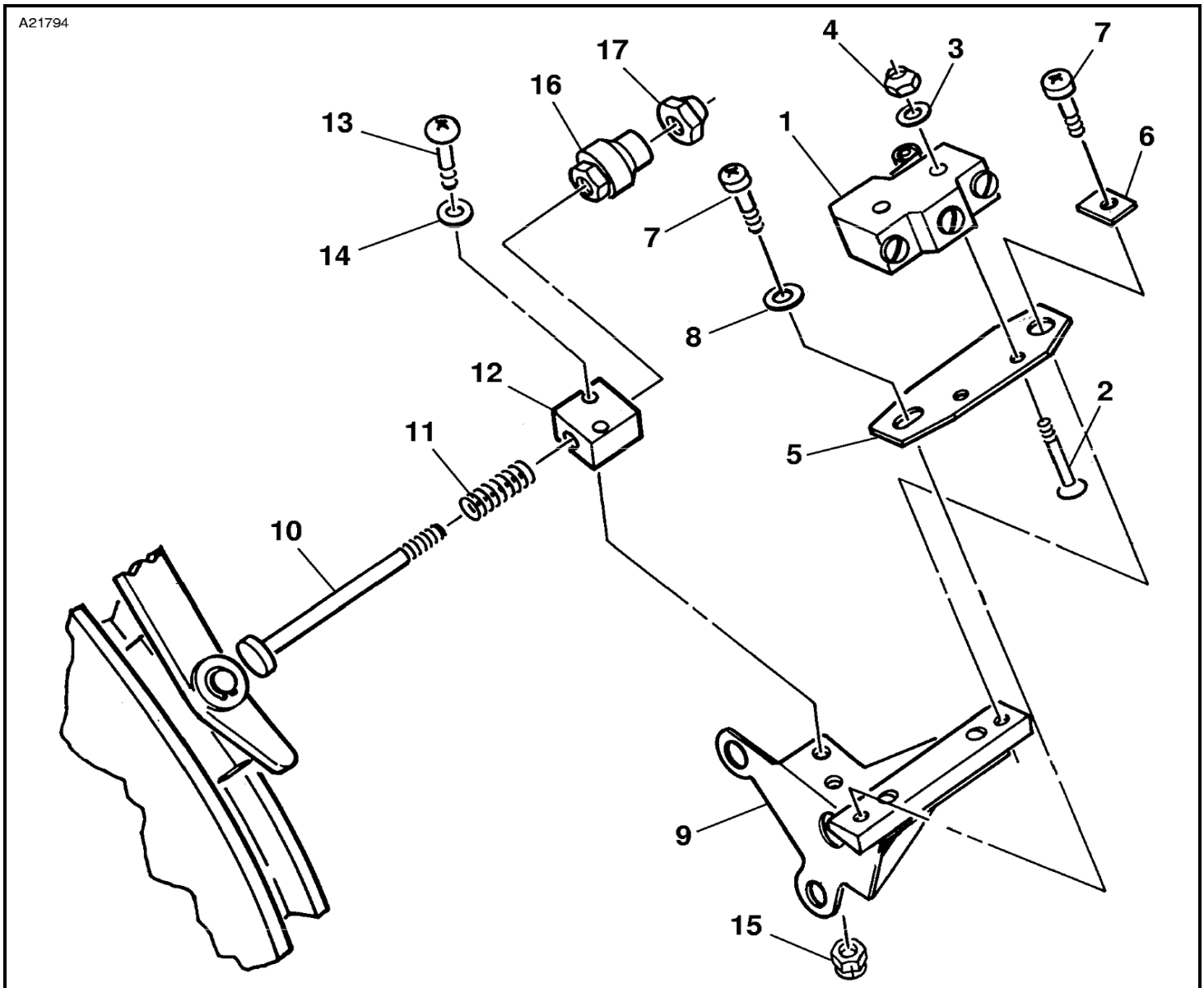
Figure 201 : Sheet 4 : Hartzell Propeller Installation



1. BETA SWITCH
2. SCREW
3. NUT
4. WASHER
5. PLATE
6. AFT PLATE
7. SCREW
8. WASHER
9. BETA SWITCH BRACKET
10. PLUNGER
11. SPRING
12. BLOCK
13. SCREW
14. WASHER
15. NUT
16. CAM
17. JAM NUT

DETAIL D

BRAZILIAN AND BRITISH CERTIFIED AIRPLANES
BETA INDICATING SYSTEM

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Figure 202 : Sheet 1 : Propeller Mounting Bolt Torque (HC-B3TN-3AF)

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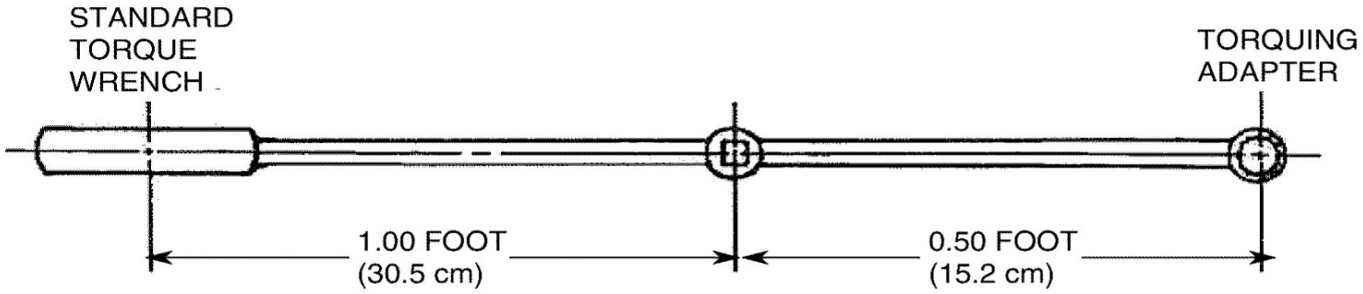


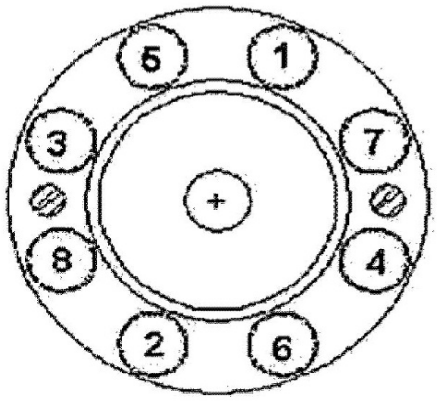
$$\frac{\text{(ACTUAL TORQUE REQUIRED) x (TORQUE WRENCH LENGTH)}}{\text{(TORQUE WRENCH LENGTH) + (LENGTH OF ADAPTER)}} = \text{TORQUE WRENCH READING TO ACHIEVE REQUIRED ACTUAL TORQUE}$$

EXAMPLE:

$$\frac{\text{100 FT-LB (136 N·m) x 1 FT (30.5 cm)}}{\text{1 FT (30.5 cm) + 0.50 FT (15.2 cm)}} = \text{66.7 FT-LB (90.1 N·m)}$$

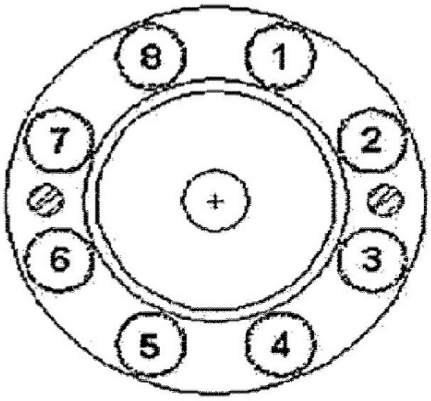
< READING ON TORQUE WRENCH WITH 6-INCH (15.2 cm) ADAPTER FOR ACTUAL TORQUE OF 100 FT-LB (136 N·m)

THE CORRECTION SHOWN IS FOR AN ADAPTER THAT IS ALIGNED WITH THE CENTERLINE OF THE TORQUE WRENCH. IF THE ADAPTER IS ANGLED 90 DEGREES RELATIVE TO THE TORQUE WRENCH CENTERLINE, THE TORQUE WRENCH READING AND ACTUAL TORQUE APPLIED WILL BE EQUAL.



SEQUENCE A

USE SEQUENCE A FOR STEPS ON AND TWO



SEQUENCE B

USE SEQUENCE B FOR STEP THREE

STEP 1 - TORQUE ALL BOLTS TO 40 FT-LBS (54 N·m)
STEP 2 - TORQUE ALL BOLTS TO 80 FT-LBS (108 N·m)
STEP 3 - TORQUE ALL BOLTS TO TABLE 3-3.

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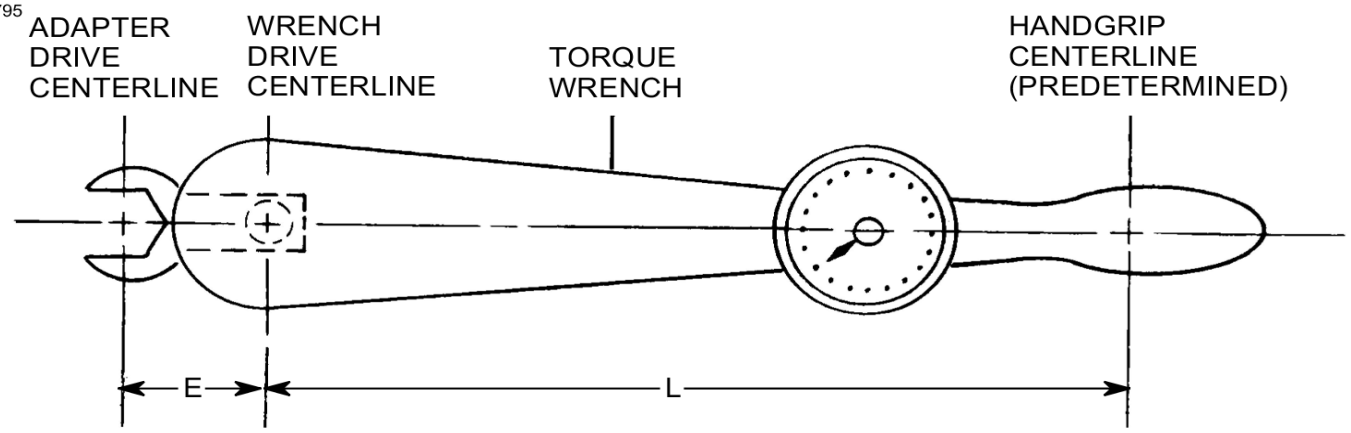
2655R1013

Figure 203 : Sheet 1 : Propeller Mounting Bolt Torque (HC-B3MN-3)

A21795

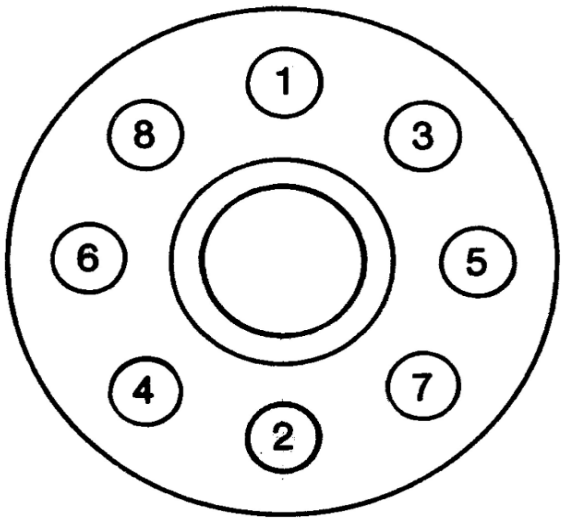


FORMULA	LEGEND	EXAMPLE **(NOTE)**
$\frac{T \times L}{L+E} = Y$	T=ACTUAL (DESIRED) TORQUE	T=80 FOOT POUNDS (DESIRED TORQUE)
	Y=APPARENT (INDICATED) TORQUE	Y=UNKNOWN
	L=EFFECTIVE LENGTH LEVER	L=16 INCHES (1.33 FEET)
	E=EFFECTIVE LENGTH OF EXTENSION	E=9 INCHES (0.75 FEET)

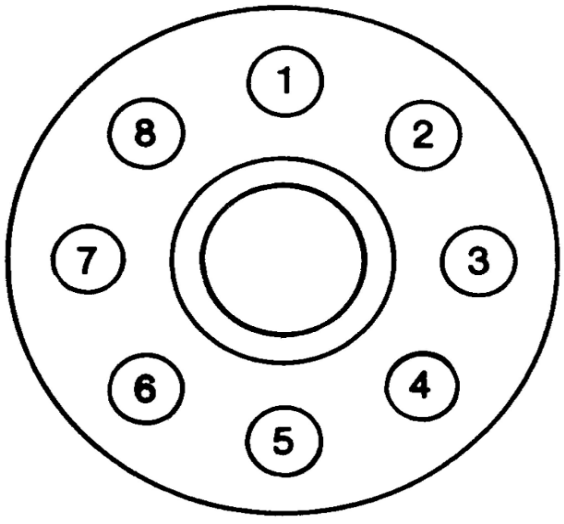
SOLVE

$$Y = \frac{80 \times 1.33}{1.33 + 0.75} = \frac{106.4}{2.08} = 51.15 \text{ FOOT POUNDS}$$

NOTE: WRENCH LENGTH (L) AND EXTENSION LENGTH (E) MUST BE EXPRESSED IN SIMILAR UNITS WHEN USING THE ABOVE FORMULA. IF DIFFERENT UNITS OF MEASURE ARE MIXED, AN OVERTORQUE OR UNDERTORQUE VALUE WILL RESULT.



SEQUENCE A



SEQUENCE B

TIGHTENING SEQUENCE

1. TIGHTEN ALL BOLTS TO 40 FOOT POUNDS USING SEQUENCE A.
2. AFTER COMPLETING STEP 1, TIGHTEN ALL BOLTS TO 80 FOOT POUNDS USING SEQUENCE A.
3. AFTER COMPLETING STEPS 1 AND 2, FINAL TIGHTEN ALL BOLTS TO 100–105 FOOT POUNDS USING SEQUENCE B.

2655R1019
2655R1013

Figure 204 : Sheet 1 : Feather and Low Pitch Blade Angle Adjustment Cutaway