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REPORT C73701

INSTALLATION AND POST MAINTENANCE RE-INSTALLATION INSTRUCTIONS, HARTZELL HC-E4N-5D/D9690(B) PROPELLER

FAIRCHILD SA226-TC

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PREPARED	AERO CONSULTING SERVICES LTD.	REPORT NO.
Matthew Hicks		C73701
DATE		PAGE NO.
20 NOV 01		a

LOG OF REVISIONS AND APPROVALS

REV	DATE	DESCRIPTION	PAGES AFFECTED	ACS APPROVED
N/C	20 Nov 01	INITIAL RELEASE	ALL	Matthew Hicks

1.0 INTRODUCTION

1.1 PURPOSE

This report provides comprehensive instructions for the installation of Hartzell HC-E4N-5D/D9690(B) propellers on Fairchild SA226-TC aircraft.

1.2 GENERAL DESCRIPTION

The installation of Hartzell HC-E4N-5D/D9690(B) four bladed propellers requires the accomplishment of airframe and engine modifications included in this document. Modifications described in this report are completely reversible. Instructions contained herein have been adopted from the publications listed in section 1.3.

1.3 PUBLICATIONS REFERENCES

Allied Signal Engine Maintenance Manual 72-00-45
Allied Signal Illustrated Parts Catalogue 72-00-44
Fairchild Aircraft Corporation SA226 Series,
Maintenance Manual 61-00-00, 61-10-00, 71-00-10.
Hartzell Propeller Owner's Manual 149
ACS Drawing C73721
Fairchild SB 226-30-103

1.4 SERVICE BULLETIN REFERENCES

The following shall be accomplished prior to or concurrent with this document. The accomplishment instructions outlined in this document and each service bulletin is stand alone; therefore, compliance with this document does not indicate compliance with any service bulletin.

Service Bulletin No.	Service Bulletin Title
A72-0857	Inspect and/or Replace Gasket (Propeller Pitch Control) P/N 865664-4 with P/N 865664-5

It is acceptable for Fairchild service bulletin 226-30-103 (Option 1 or 2) to be embodied prior to the subject propeller installation.

1.5 MAN HOURS

Approximate man-hours required to accomplish this installation are as follows:

Section 2.0	Three Bladed Propeller Removal	2.0 hours
Section 3.0	Engine Modifications	7.0 hours
Section 4.0	Four Bladed Propeller Installation	3.0 hours
Section 5.0	Propeller Adjustment / Test	2.0 hours
Section 6.0	De-ice Kit Installation	31.0 hours[1]
Section 7.0	Spinner Installation	0.5 hours
Section 8.0	Post Installation Function Tests	1.0 hours
Section 9.0	Document Preparation	1.5 hours
	TOTAL	48.0 hours

[1] If service bulletin 226-30-013 Option 1 or 2 is embodied, this time is reduced.

2.0 THREE BLADED PROPELLER REMOVAL

a) Remove the chin cowl.

b) Feather the propeller prior to removal by not placing the blades on the start locks during shutdown.

NOTE: If propeller was not feathered during shutdown, it will be necessary to remove the spinner before manually feathering.

c) Remove the spinner.

1. Place an index mark on the spinner and on the spinner back plate so that it can be reinstalled just as removed.

2. Remove the screws from around the spinner circumference.

d) If the propeller was not feathered during shutdown, feather manually as follows:

1. Actuate the engine stop and feather control or manually rotate the blades with a paddle.

2. While the blades are off the start locks, depress and hold start lock pins in the retracted position so that the blades can move into feather.

CAUTION: TAKE CARE WHEN USING A PADDLE TO PREVENT ABRUPT FEATHERING AFTER THE BLADES ARE RELEASED FROM THE START LOCKS.

e) Feather the propeller.

CAUTION: USE EXTREME CARE IN THE REMOVAL AND STORAGE OF THE BETA TUBE.

f) Remove the beta tube.

1. Remove the beta tube retainer bolt.

2. Unscrew and remove the beta tube.

g) While supporting the propeller, remove the propeller bolts.

h) Remove the propeller assembly.

3.0 ENGINE MODIFICATIONS

Complete each of the following engine modifications. Part replacements may be accomplished by reworking the original parts or obtaining new parts per STC SE00-6.

3.1 PROPELLER PITCH CONTROL

a) Remove existing propeller pitch control P/N 869130-19.

b) Inspect and/or Replace Gasket (Propeller Pitch Control) P/N 865664-4 with P/N 865664-5 [Ref Sec 1.4, Service Bulletin A72-0857]

c) Install propeller pitch control P/N 869130-30.

3.2 PROPELLER SHAFT PLUG

a) Remove propeller shaft plug P/N 866563-1.

b) Install propeller shaft plug P/N 3103328-1.

3.3 BETA SWITCH

a) Remove Beta pressure switch P/N 897542-6.

b) Install Beta pressure switch P/N 897542-10.

4.0 FOUR BLADED PROPELLER INSTALLATION

Install new propellers and spinners in accordance with instructions provided below. These instructions have been adopted from Hartzell Propeller Owner's Manual 149. In the event of a discrepancy between this document and Hartzell Propeller Owner's Manual 149, Hartzell Propeller Owner's Manual 149 should be deemed correct.

4.1 PRECAUTIONS

WARNING 1: WHEN INSTALLING THE PROPELLER, FOLLOW THE AIRFRAME MANUFACTURER'S MANUALS AND PROCEDURES, AS THEY MAY CONTAIN ISSUE VITAL TO AIRCRAFT SAFETY THAT ARE NOT CONTAINED IN THIS DOCUMENT.

CAUTION: AVOID THE USE OF BLADE PADDLES. DO NOT PLACE THE BLADE PADDLE IN THE AREA OF THE DE-ICE BOOT WHEN APPLYING TORQUE TO A BLADE ASSEMBLY. PLACE THE BLADE PADDLE IN THE THICKEST AREA OF THE BLADE, JUST OUTSIDE OF THE DE-ICE BOOT. USE ONE BLADE PADDLE PER BLADE.

4.2 INSTALLING THE HC-E4N-5D PROPELLER

WARNING: MAKE SURE THE SLING IS RATED UP TO 800 LBS (363 KG) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING INSTALLATION.

NOTE: Propeller Must Be Feathered Before Installation.

a) With a suitable crane hoist and sling, carefully move the propeller assembly to the aircraft engine mounting flange.

b) Make sure the propeller hub flange and the engine flange mating surfaces are clean.

c) Remove the pitch change rod cap, if applicable.

d) Install O-ring, P/N C-3317-230 on the engine flange.

e) Align the mounting and dowel pin holes in the propeller hub flange with the mounting holes and dowel pins in the engine flange.

f) Slide the propeller flange onto the engine flange.

4.2 INSTALLING THE HC-E4N-5D PROPELLER (cont'd)

CAUTION 1: MAKE SURE THAT COMPLETE AND TRUE SURFACE CONTACT IS ESTABLISHED BETWEEN THE PROPELLER HUB FLANGE AND THE ENGINE FLANGE.

CAUTION 2: NEW PROPELLER MOUNTING BOLTS (P/N 57A339-1) MUST BE USED WHEN INITIALLY INSTALLING A NEW OR OVERHAULED PROPELLER.

g) Apply an MIL-T-83483 anti-seize compound to the threaded surfaces of the mounting bolts.

NOTE: If the propeller is removed between overhaul intervals, mounting bolts and washers may be reused if they are not damaged or corroded.

CAUTION: ID CHAMFER OF WASHER MUST BE FACING TOWARD THE BOLT HEAD. WASHERS WITHOUT CHAMFER MUST BE INSTALLED WITH THE ROLLED EDGES TOWARD THE BOLT HEAD. SEE FIGURE 4.2-1.

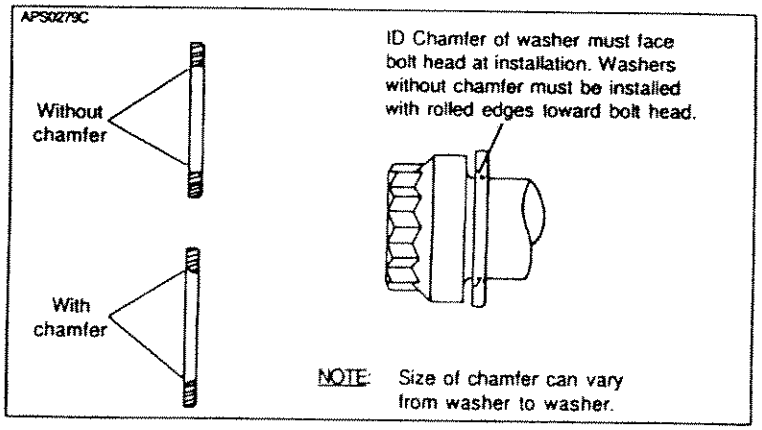
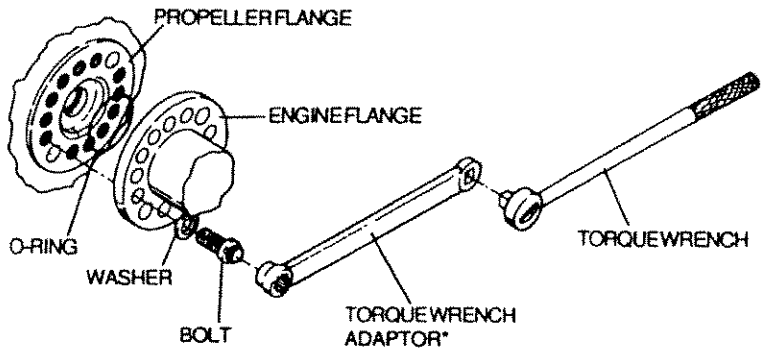


Figure 4.2-1
Mounting Bolt and Washer

4.2 INSTALLING THE HC-E4N-5D PROPELLER (cont'd)

h) Install the mounting bolts with washers through the engine flange and into the propeller hub flange.



*Note: If torque wrench adaptor is used, use the calculation in Figure 4.2-3 to determine correct torque wrench setting.

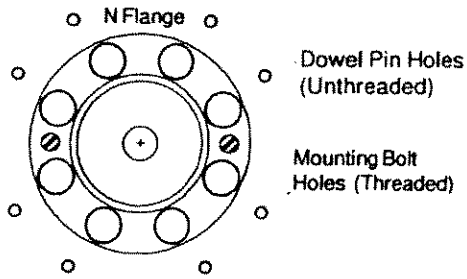
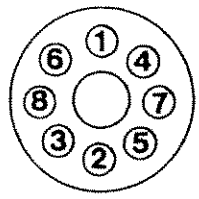


Figure 4.2-2
Installing Propeller on Flange

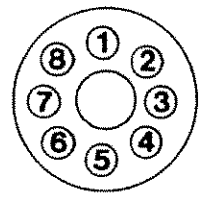
4.2 INSTALLING THE HC-E4N-5D PROPELLER (cont'd)

i) Use a torque wrench and a torque wrench adapter (Hartzell P/N AST-2877 or equivalent) to torque all mounting bolts in sequences and steps shown in Figure 4.2-3 below. Refer to Figure 4.2-4 to determine the proper torque value.



SEQUENCE A

Use Sequence A for steps one and two.



SEQUENCE B

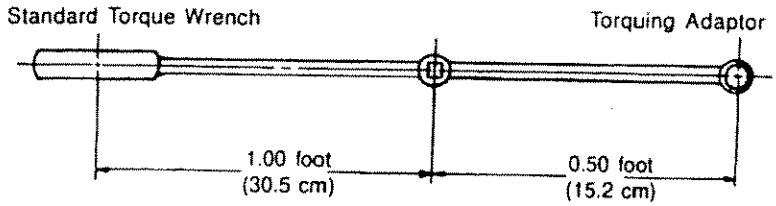
Use Sequence B for step three.

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 100-105 Ft-Lbs (136-142 N-m) Wet

NOTE: Torque values with "Wet" noted after them are based on lubricated threads with approved anti-seize compound MIL-T-83483.

Figure 4.2-3
Torquing Sequence for Propeller Mounting Bolts

4.2 INSTALLING THE HC-E4N-5D PROPELLER (cont'd)



$$\frac{\text{(actual torque required) X (torque wrench length)}}{\text{(torque wrench length) + (length of adaptor)}} = \text{Torque wrench reading to achieve required actual torque}$$

EXAMPLE:

$$\frac{\text{100 Ft-Lb (136 N•m) x 1 ft (30.5 cm)}}{\text{1 ft (30.5 cm) + 0.50 ft (15.2 cm)}} = \text{66.7 Ft-Lb (90 N•m)} < \text{reading on torque wrench with 6-inch (15.2 cm) adaptor for actual torque of 100 Ft-Lb (136 N•m)}$$

Figure 4.2-4
Determining Torque Value When Using Torquing Adaptor

j) Safety all mounting bolts with 0.032 inch (0.81 mm) minimum diameter stainless steel wire. (Two bolts per safety.)

k) Install beta tube P/N 866533-8.

Note: Do not install beta tube retaining bolt at this time. Beta tube retaining bolt will be installed after flight idle blade angle is set. (See Section 5.2)

5.0 PROPELLER ADJUSTMENT / TEST

The applicable blade angle position and values for the HC-E4N-5D/D9690(B) propeller when installed on the SA226-TC aircraft are as follows:

FLIGHT IDLE	REVERSE	FEATHER	START LOCK
+13.0° ± 0.2°	-7.0° ± 1.0°	86.0° ± 0.5°	+1.6° ± 0.5°

Table 5.0-1

The flight idle blade angle is set with the beta tube through the propeller control. The reverse blade angle is determined by the cam in the pitch control. The feather, start lock and reverse stop blade positions are set at the factory or overhaul facility and are not field adjustable.

5.1 BLADE ANGLE ADJUSTMENT

a) All blade angle measurements should be made using a propeller protractor. The protractor must be zeroed on the propeller piston while the blades are on the start locks. Fairchild has determined that the most accurate zeroing is accomplished with an adapter block positioned on the propeller piston. Dimensions for the local manufacture of this block are provided in the Service Information section of Fairchild Aircraft Corporation Maintenance Manual, Chapter 61.

b) The actual measurement of each blade's angle must be taken at the 30 inch radius, usually identified by a yellow mark on the aft (thrust) side of the propeller, for greatest accuracy. Because of the blade's curvature, a square steel bar must be used as a rest for the protractor. Dimensions for the local manufacture of this bar are provided in the Service Information section of Fairchild Aircraft Corporation Maintenance Manual, Chapter 61.

c) When performing checks in which the unfeather pump is used to move the blades (flight idle, reverse) observe the pump duty cycle of one half minute with hot oil or one minute with cold oil. If the unfeather pump changes pitch while running (indicating the oil tank is empty) release the unfeather switch at once. Motor the engine by using the starter test switch or turn the propeller by hand as necessary to return the oil from the engine to the tank.

5.2 FLIGHT IDLE ADJUSTMENT

a) Zero the protractor.

b) Place the power lever in the flight idle position.

c) Move the starter / unfeather test switch to the unfeather position.

WARNING: DO NOT MOVE THE SWITCH TO THE STARTER TEST POSITION. SERIOUS INJURY TO THE PERSON CHECKING THE BLADE ANGLES COULD RESULT.

d) Using the blade bar and protractor, measure the propeller blade angle at the 30 inch radius. The correct blade angles are shown in Table 5.0-1.

e) If the blade angles are incorrect, adjust as follows:

1. Rotate the beta tube clockwise to decrease blade angle or counterclockwise to increase.

2. Install the beta tube retainer bolt and torque to 40 inch-pounds.

6.0 DE-ICE KIT INSTALLATION

The installation instructions for the Goodrich de-ice kit is dependent on the status of the existing aircraft wiring with respect to Fairchild service bulletin 226-30-013.

The following table identifies the relevant section for the different configurations:

DE-ICE KIT INSTALLATION INSTRUCTIONS	
SECTION	**APPLICABILITY**
6.1	All aircraft prior to step 6.2 **OR** 6.3 **OR** 6.4
6.2	Aircraft **WITHOUT** Service Bulletin 226-30-013 embodied
6.3	Aircraft **WITH** Service Bulletin 226-30-013 *option 1* embodied
6.4	Aircraft **WITH** Service Bulletin 226-30-013 *option 2* embodied

Note: Some aircraft were delivered from the factory with de-ice system wiring which conforms to SM 226-30-013. In these cases, conformity to the service bulletin must be verified by physical inspection.

Install de-ice kit in accordance with BFG drawing 5E2647 Revision H, General Arrangement Electrical Prop De-Icer System.

6.1 DE-ICE KIT INSTALLATION INSTRUCTIONS (ALL AIRCRAFT)

a) Remove existing de-ice components as listed in Table 6.0-1 below.

DESCRIPTION	PART NUMBER
Circuit Breaker	MS25244-20
Tri-Meter	27-82341-001
Shunt	MS-91586-10

Table 6.0-1

b) Rework the tri-meter assembly.

1. Disassemble the tri-meter assembly.
2. Remove existing de-ice ammeter module P/N 111.
3. Install de-ice ammeter module P/N 111-SP1.

   Note: Existing de-ice ammeter module may be used if remarked with 0-30 amp scale, with operating range (green arc), 17-24 amps.

4. Reassemble the tri-meter.

6.1 DE-ICE KIT INSTALLATION INSTRUCTIONS (ALL AIRCRAFT) (cont'd)

d) Install de-ice components as listed in Table 6.0-2 below.

DESCRIPTION	PART NUMBER
Circuit Breaker	MS25244-30
Tri-Meter	27-82341-001
Shunt	MS91586-1

Table 6.0-2

6.2 DE-ICE KIT INSTALLATION INSTRUCTIONS (PRE SB 226-30-013)

a) Refer to ACS Drawing C73721. Modify the aircraft wiring in accordance with drawing C73721-1.

6.3 DE-ICE KIT INSTALLATION INSTRUCTIONS (AIRCRAFT WITH SB 226-30-013 OPTION 1)

Note:
SB 226-30-013 OPTION 1 introduces a high current relay for each propeller circuit for the 3 blade propeller.

Because of the increased current demand of the 4 blade propeller and the introduction of a 30 Ampere circuit breaker, all associated wiring must be further modified to a minimum of AWG 12.

a) Refer to ACS Drawing C73721-2. Modify the aircraft wiring in accordance with drawing C73721-2 by replacing aircraft wiring in accordance with the following table.

Note:
All wiring to be replaced with wiring conforming to MIL-W-81044/9 or MIL-W-22759/16.

6.3 DE-ICE KIT INSTALLATION INSTRUCTIONS (AIRCRAFT WITH SB 226-30-013 OPTION 1) (cont'd)

WIRE IDENT	MODIFICATION INSTRUCTION
2300-14	Replace with AWG 12 wire and re-identify as 2300-12.
2301-14	Replace with AWG 10 wire and re-identify as 2301-10.
2302-14	Replace with AWG 12 wire and re-identify as 2302-12.
2305-14	Replace with AWG 12 wire and re-identify as 2305-12.
2306-14	Replace with AWG 10 wire and re-identify as K2306-10.
2306AA-14	Replace with AWG 10 wire and re-identify as K2306AA-10.
2307-14	Replace with AWG 10 wire and re-identify as K2307-10.
2307AA-14	Replace with AWG 10 wire and re-identify as K2307AA-10.
2308-14	Replace with AWG 10 wire and re-identify as K2308-10.
2308AA-14	Replace with AWG 10 wire and re-identify as K2308AA-10.
2309-14	Replace with AWG 10 wire and re-identify as K2309-10.
2309AA-14	Replace with AWG 10 wire and re-identify as K2309AA-10.
2311-14 (LEFT PROP)	Replace with AWG 10 wire and re-identify as K2311-10.
2311-14 (RIGHT PROP)	Replace with AWG 10 wire and re-identify as K2311-10.
2312-14 (LEFT PROP)	Replace with AWG 10 wire and re-identify as K2312-10.
2312-14 (RIGHT PROP)	Replace with AWG 10 wire and re-identify as K2312-10.
2316-14	Replace with AWG 12 wire and re-identify as 2316-12.
2317-14	Replace with AWG 10 wire and re-identify as 2317-10.
2318-14	Replace with AWG 12 wire and re-identify as 2318-12.
2319-14	Replace with AWG 12 wire and re-identify as 2319-12.
2320-14	Replace with AWG 12 wire and re-identify as 2320-12.
2321-14	Replace with AWG 12 wire and re-identify as 2321-12.
2322-14	Replace with AWG 12 wire and re-identify as 2322-12.
2323-14	Replace with AWG 12 wire and re-identify as 2323-12.
2324-14	Replace 2324-14 *AND* 2325-14 with a single AWG 10 wire. Re-identify as K2325-10.
2325-14	
2326-14	Replace 2326-14 *AND* 2327-14 with a single AWG 10 wire. Re-identify as K2326-10.
2327-14	
2328-14N	Replace with AWG 10 wire and re-identify as 2328-10N.
2329-14	Replace 2329-14 *AND* 2330-14 with a single AWG 10 wire. Re-identify as K2330-10.
2330-14	
2331-14	Replace 2331-14 *AND* 2332-14 with a single AWG 10 wire. Re-identify as K2331-10.
2332-14	
2333-14N	Replace with AWG 10 wire and re-identify as 2333-10N.

6.4 DE-ICE KIT INSTALLATION INSTRUCTIONS (AIRCRAFT WITH SB 226-30-013 OPTION 2)

Note:
SB 226-30-013 OPTION 2 introduces heavier wire gauges for each propeller circuit for the 3 blade propeller.

Because of the increased current demand of the 4 blade, the switching circuit must be modified to accommodate the increase in current. Further, the introduction of a 30 Ampere circuit breaker requires an increase in wire gauge for the prop de-ice ammeter circuit.

a) Refer to Fairchild Service Bulletin SB 226-30-013. Install propeller de-ice control relays in accordance with SB 226-30-013 accomplishment instructions section B steps 1 through 13 ONLY with the following exceptions:

i) Where AWG 14 wire is called out, use AWG 12.

ii) Wire conforming to MIL-W-22759/16 may be used as an alternate to MIL-W-81044/9 wire called for in the service bulletin.

iii) Mark the added wires in accordance with idents defined in ACS Drawing C73721.

b) Refer to ACS Drawing C73721-3. Modify the aircraft wiring in accordance with drawing C73721-3 by replacing aircraft wiring in accordance with the following table.

Note:
All wiring to be replaced with wiring conforming to MIL-W-81044/9 or MIL-W-22759/16.

WIRE IDENT	MODIFICATION INSTRUCTION
2318-14	Replace with AWG 12 wire and re-identify as 2318-12.
2319-14	Replace with AWG 12 wire and re-identify as 2319-12.
2320-14	Replace with AWG 12 wire and re-identify as 2320-12.
2321-14	Replace with AWG 12 wire and re-identify as 2321-12.
2322-14	Replace with AWG 12 wire and re-identify as 2322-12.
2323-14	Replace with AWG 12 wire and re-identify as 2323-12.

7.0 SPINNER ASSEMBLY INSTALLATION

CAUTION 1: TO PREVENT DAMAGE TO THE BLADE AND BLADE PAINT, WRAP THE BLADE SHANKS IN SEVERAL LAYERS OF MASKING OR DUCT TAPE BEFORE INSTALLING THE SPINNER. REMOVE THE TAPE AFTER THE SPINNER IN INSTALLED.

CAUTION 2: SPINNER DOME WILL WOBBLE IF NOT ALIGNED PROPERLY. THIS MAY AFFECT DYNAMIC BALANCE OF THE PROPELLER.

a) The spinner dome is supported by a forward bulkhead unit (see Figure 7.0-1) that encircles the propeller cylinder. If the forward bulkhead unit does not fit snugly on the cylinder, the cylinder may need to be wrapped with one or more layers of fluroglas or UHMW tape (Hartzell P/N B6654-100 or equivalent). Apply a layer of tape, check, and repeat until the forward bulkhead unit fits snugly on the cylinder.

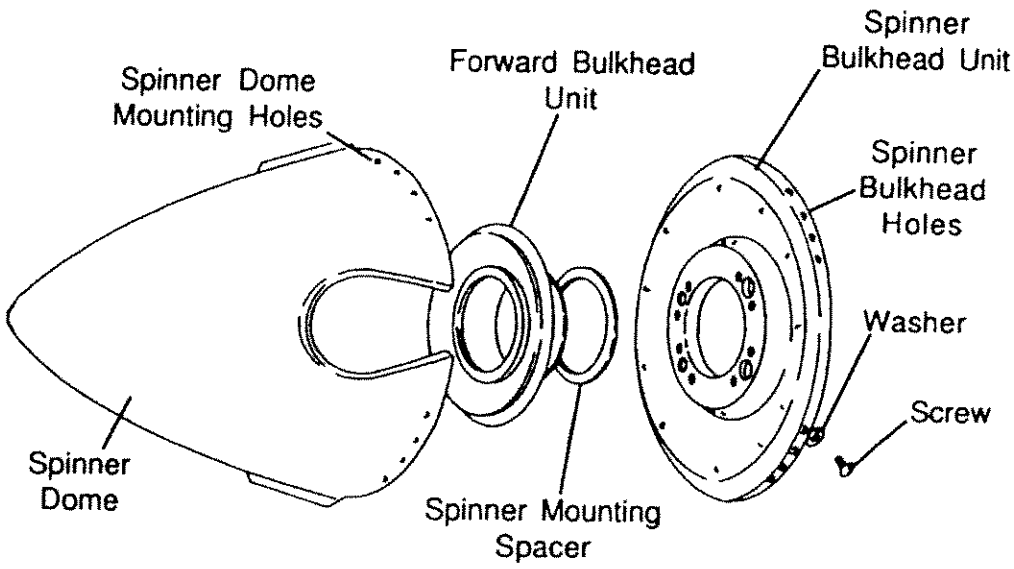


Figure 7.0-1 Spinner Assembly

7.0 SPINNER ASSEMBLY INSTALLATION (cont'd)

NOTE 1: The forward bulkhead unit is positioned away from the cylinder with spacers to cause the spinner dome mounting holes to stop short of full alignment with the bulkhead holes by 25 percent of the spinner dome mounting hole diameter. (Refer to Figure 7.0-2)

NOTE 2: Positioning of the spinner dome mounting holes and foreword bulkhead unit is accomplished by installing or removing spacers that are between the cylinder and forward bulkhead. (Refer to Figure 7.0-2)

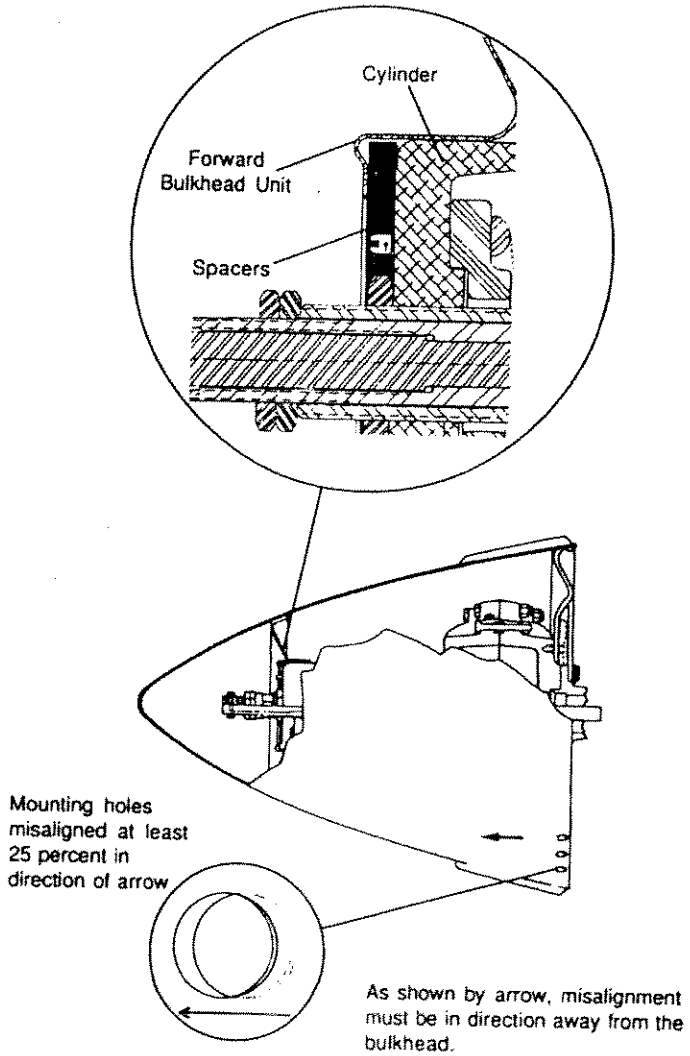


Figure 7.0-2 Spinner Reassembly Procedures

7.0 SPINNER ASSEMBLY INSTALLATION (cont'd)

b) Carefully slide the spinner dome over the propeller and forward bulkhead to check for proper positioning of the spinner dome mounting holes. Add or remove spacers to obtain the spinner dome mounting hole and spinner bulkhead hole misalignment.

c) Push the spinner dome with firm pressure toward the spinner bulkhead unit to ensure the spinner dome mounting holes fully align with the spinner bulkhead holes. Remove a minimum quantity of spacers to obtain hole alignment while maintaining preload.

NOTE: Tension induced by hole misalignment improves spinner longevity and reduces vibration induced wear.

d) Attach the spinner dome to the spinner bulkhead with the supplied screws and washers.

e) Install the chin cowl.

8.0 POST INSTALLATION FUNCTION TESTS

8.1 ENGINE OPERATIONAL CHECKS

Perform engine operational checks in accordance with Fairchild Aircraft Corporation Maintenance Manual 71-00-10.

8.2 DE-ICE SYSTEM FUNCTIONAL CHECK

After completion of de-ice system installation, run a functional check of the de-ice system on both propellers. Assure that the ammeter is operating in the green arc between 17-24 amps. Refer to B F Goodrich General Arrangement Drawing 5E2647 for additional system information.

9.0 DOCUMENT PREPARATION

The following tasks must be completed to return the aircraft to service.

a) Amend Equipment List.

b) Amend Weight and Balance in accordance with Table 9.0-1 and 9.0-2.

Qty	Item	Item Weight	Total Weight	Arm	Moment
2	HC-B3TN-5 Propeller	129	258	170	43860
2	D3434P Spinner & Bulkhead Assy	15.5	31	167	5177
2	65-025-2 De-Ice Kit	2	4	175	700

Table 9.0-1
Removed Items

Qty	Item	Item Weight	Total Weight	Arm	Moment
2	HC-E4N-5/D9690 Propeller & Bulkhead Assy	154	308	170	52360
2	D5320-P Spinner Dome	6.5	13	175	2275
2	5E2647-1 De-Ice Kit	2	4	175	700

Table 9.0-2
Added Items

c) Complete Log Book Entries.

d) Attach Airplane Flight Manual Supplement B67790 to the Fairchild Aircraft Airplane Flight Manual.