Manual 154
Revision 4
October 2013

Propeller Owner's Manual & Log Book

Series HC-A6( )-3( )( )

Six-Blade Lightweight Turbine Propeller

Hartzell Propeller Inc.
One Propeller Place
Piqua, OH 45356-2634 U.S.A.
Ph: 937-778-4200 (Hartzell Propeller Inc.)
Ph: 937-778-4379 (Product Support)
Product Support Fax: 937-778-4391

REVISION HIGHLIGHTS

Revision 4, dated October 2013, incorporates the following:

- Revised Cover for Revision 4
- Revised Revision Highlights section
- Revised Record of Revisions section
- Added Airworthiness Limitations Section
- Revised List of Effective Pages section

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RECORD OF REVISIONS

Rev. No.	Issue Date	Date Inserted	Inserted By
Rev 1	5/87	5/87	HPI
Rev. 2	5/92	5/92	HPI
Rev. 3	1/94	1/94	HPI
Rev. 4	10/13	10/13	HPI

RECORD OF REVISIONS

Rev. No.	Issue Date	Date Inserted	Inserted By

AIRWORTHINESS LIMITATIONS

The Airworthiness Limitations section is FAA approved and specifies maintenance required under 14 CFR §§ 43.16 and 91.403 of the Federal Aviation Regulations unless an alternative program has been FAA approved.

FAA APPROVED

by: _____ date: 10/25/2013

Manager, Chicago Aircraft Certification Office,
ACE-115C
Federal Aviation Administration

Rev. No.	Description of Revision
4	Adds Airworthiness Limitations Section to the manual and incorporates component life limits as specified in Hartzell Propeller Inc. Service Bulletin 152E

AIRWORTHINESS LIMITATIONS

1. The FAA establishes specific life limits for certain component parts as well as the entire propeller. Such limits require replacement of the identified parts after a specified number of hours of use.

2. The following data summarizes all current information concerning Hartzell Propeller Inc. life limited parts as related to propeller models affected by this manual. These parts are not life limited on other installations; however, time accumulated toward life limit accrues when first operated on aircraft/engine/propeller combinations listed and continues regardless of subsequent installations (that may or may not be life limited).

   A. The following list specifies life limits for certain components limited to HC-A6A-3A propeller models installed on Short Brothers SD3-60-300 aircraft that **have complied with Hartzell Propeller Inc. Service Bulletin SB 168.**

Part Number	Component	Life Limit
D-4905	Pitch Change Rod	37,000 hours

FAA APPROVED

by:  date: 10/25/2013

Manager, Chicago Aircraft Certification Office,
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Federal Aviation Administration

B. The following list specifies life limits for certain components limited to HC-A6A-3A propeller models installed on Short Brothers SD3-60-300 aircraft **that have NOT complied with Hartzell Propeller Inc. Service Bulletin SB 168.**

(1) Life limits identified with an asterisk (*) are applicable **ONLY** for propellers that have complied with Hartzell Propeller Inc. Service Bulletin 162 (Installation of A-386 Reverse Stop Kit) **AND** have **NOT** complied with Hartzell Propeller Inc. Service Bulletin 166 or 166A (requiring removal of the A-386 kit).

Part Number	Component	Life Limit
C-1062	Spring Can	2,000 hours
B-365*	Reverse Stop Rod	11,000* hours
C-376*	Bracket Retaining Ring	11,000* hours
C-379*	Bracket	11,000* hours

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LIST OF EFFECTIVE PAGES

Chapter	Page	Revision	Date
Cover	Cover and Inside Cover	Rev. 4	Oct/13
Revision Highlights	1 and 2	Rev. 4	Oct/13
Record of Revisions	1 and 2	Rev. 4	Oct/13
Airworthiness Limitations	1 thru 4	Rev. 4	Oct/13
List of Effective Pages	1 and 2	Rev. 4	Oct/13
	1 and 2	Rev. 2	May/92
	2a and 2b	Rev. 2	May/92
	3 thru 5	Rev. 2	May/92
	6 thu 8	Original	Apr/87
	9	Rev. 2	May/92
	10	Original	Apr/87
	11 and 12	Rev. 2	May/92
	13	Original	Apr/87
	14 thru 17	Rev. 2	May/92
	18 and 19	Removed (Rev. 2)	
	20 thru 23	Rev. 2	May/92
	24 thru 28	Original	Apr/87
	29 thru 33	Rev. 2	May/92
	33a and 33b	Rev. 2	May/92
	34 and 35	Original	Apr/87
	36 and 37	Rev. 2	May/92
	38 thru 61	Removed (Rev. 2)	
	62	Rev. 2	May/92
	63 thru 70	Original	Apr/87
Composite Blade Maintenance			
	Cover and Inside Cover	Rev. B	Oct/97
	1 thru 34	Rev. B	Oct/97

LIST OF EFFECTIVE PAGES

Chapter	Page	Revision	Date

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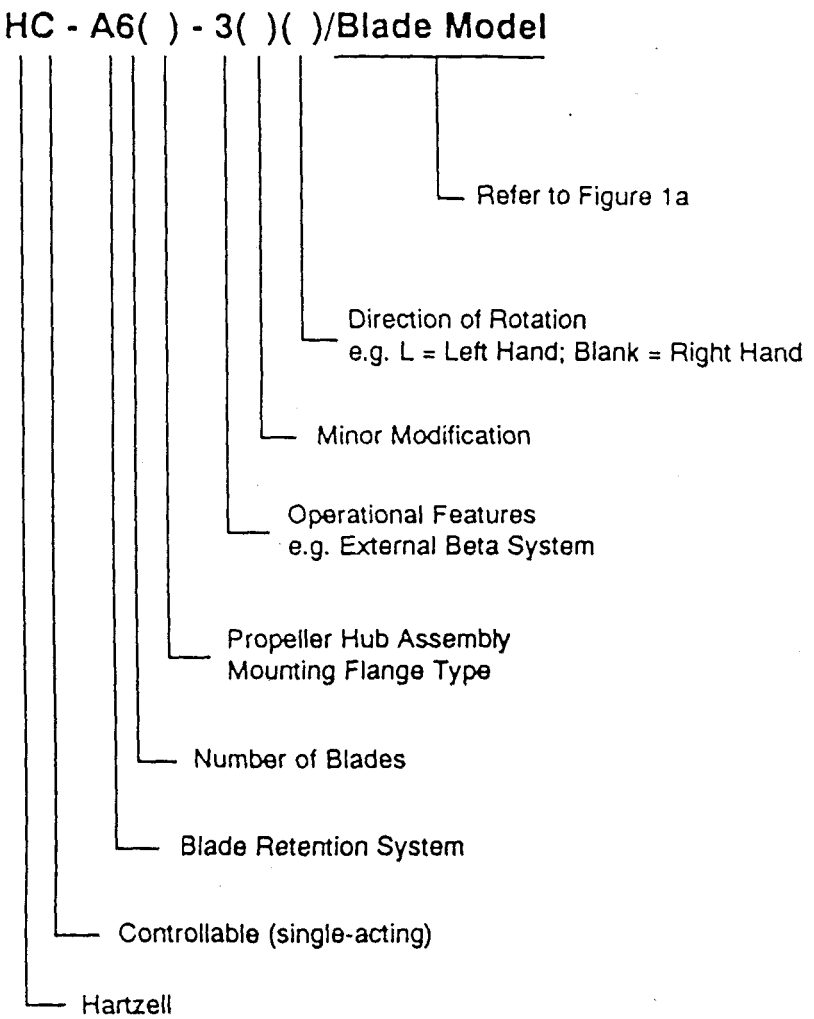
HARTZELL PROPELLER INC.
Manual No. 154

CONTENTS

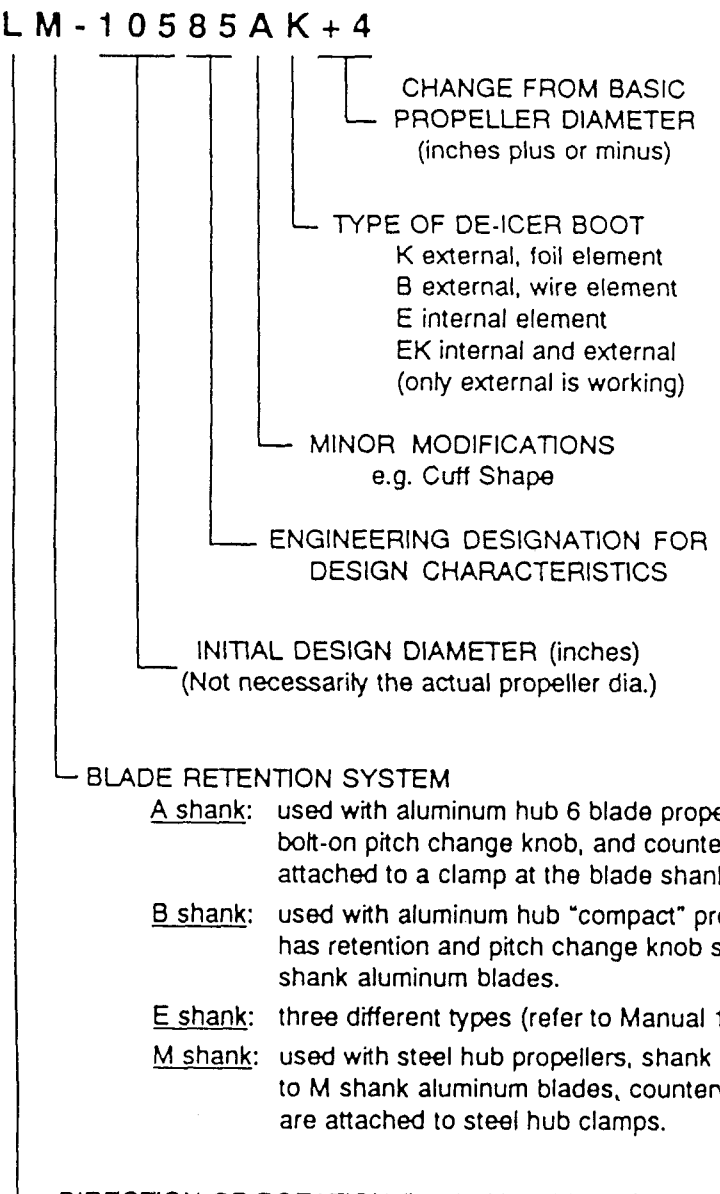
Typical Single-Acting, Six Blade Lightweight Turbine Propeller



NOTE: Parentheses in the model designation system can indicate either that an option or modification is included in the hub assembly or that it is not included in the hub assembly.

Model Designation System
Figure 1

Typical Composite Blade Model Number



Blade Model Designation
Figure 1a

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1. Required Publications

It is important to note that this manual is not the sole document required in order to maintain the propellers described in this manual. Other Hartzell mauals referenced in the text, such as the applicable Propeller Overhaul Manual or Blade Repair Manual provide essential information. One or more of the following publications, as applicable, are to be used in addition to this manual to maintain the proller models covered herein. Consult the applicable Hartzell publications for additional information regarding specific recommendations and procedures.

Manual No.:

148( ): Composite Spinner Inspection, Maintenance and Repair

135( ): Composite Blade Inspection, Repair and Overhaul Instructions

126( ): Active Service Letters, Bulletins, Instruction, and Advisories

144( ): HC-A6A-3( ) Propeller Overhaul and Parts List

Consult the applicable manufacturer's manual for de-icer system inspection, repair and overhaul instructions.

2. Definitions of Propeller Life and Service

CAUTION: ALL OVERHAUL AND REWORK PROCEDURES MUST BE PERFORMED IN THE HARTZELL FACTORY OR IN A FACTORY-APPROVED FACILITY.

A. Overhaul is the periodic disassembly, inspection, reconditioning and reassembly of the propeller assembly which is constructed of a number of moveable, detachable parts.

1) The period between overhauls generally is based on hours of service (operating time) or on calendar time.

2) At such specified periods, the propeller hub assembly and the blade assemblies should be completely disassembled and inspected for cracks, wear, corrosion and other unusual or abnormal conditions. As specified, certain parts should be refinished, and certain other parts should be replaced. The propeller can then be reassembled and balanced.

3) Overhaul procedures must be performed in the Hartzell factory or in a factory-approved facility.

B. Rework is correction of major damage caused by physical mishap or failure.

1) Rework is done on an irregular basis as necessary and required. The propeller must be rebalanced after rework.

2) Amount, degree and extent of major damage determine whether or not a hub assembly or blade assembly can be reworked without overhaul. If in doubt, overhaul the assembly.

3) All rework must be performed in the Hartzell factory or in a factory-approved facility.

4) When a metal propeller blade is bent or twisted, repair is major, and the blade must be overhauled.

C. Repair is correction of minor damage caused during normal operations.

1) Most repair procedures may be performed in the field by a qualified mechanic.

2) Repair can be made without overhaul.

D. Propeller Life is expressed in terms of total hours of service (TT, or Total Time) and in terms of hours of service since overhaul (TSO, or Time Since Overhaul). Both references are necessary in defining the life of the propeller.

1) Overhaul returns the propeller assembly to zero hours TSO (Time Since Overhaul), but not to zero hours TT (Total Time).

2) Rework without overhaul does not affect TSO or TT.

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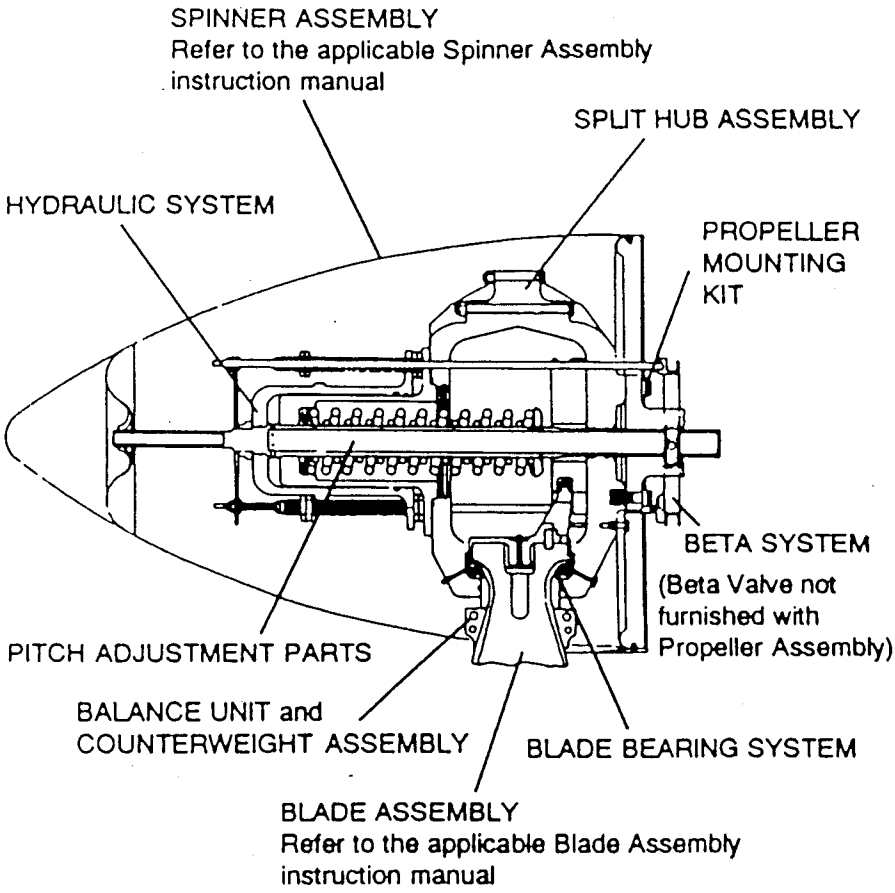

Basic Components of the HC-A6( )-3( )( ) Six-Blade
Lightweight Turbine Propeller
Figure 2

4. General Description and Components (refer to Figure 2)

The Hartzell Series HC-A6( )-3( )( ) Six-Blade, Single-Acting Light-weight Turbine Propeller is a constant-speed, hydraulically actuated type of propeller with feathering and reversing capabilities. It is designed primarily for use with Pratt & Whitney Series PT-6 turbo-prop engines.

A 105-degree (105°) pitch range is available with externally adjustable feather angle, reverse angle and low pitch stop. These adjustments do not interact with each other.

In the single-acting control system, propeller rpm is controlled by the governor which is installed on the engine and supplies pressurized engine oil. The governor has been modified to act as a hydraulic low pitch valve and as a beta valve when the propeller is in the reverse mode of operation.

NOTE: The beta valve itself usually is built into the base of the governor.

An increase in pressure into the propeller from zero (0) psi to approximately 385 psi (27.07 kg/cm^2) causes propeller pitch to decrease in the positive range and to increase in the negative (reversing) range. A reduction of governor oil pressure causes an increase in blade angle.

A loss of oil supply from the governor results in feathering the propeller since the combined action of feathering spring and blade counterweights forces oil from the propeller back into the engine.

Engine oil pressurized from the governor forced into a cavity between the piston and the cylinder moves the piston forward from high to low pitch position range. This linear motion is transmitted from the piston to each blade assembly through a pitch change rod, a slotted fork unit and a blade pitch change assembly. Blade pitch is controlled by a knob bolted and pinned to the shank of the blade. A slider block on the end of the knob minimizes friction and provides blade-to-blade pitch angle adjustment.

Each blade is supported by a blade retention split-bearing which permits pitch change. Counterweights mounted on the blades, and the large feathering spring inside the cylinder, oppose governor oil pressure and increase pitch to the feathered position.

The governor is linked to the propeller piston through external mechanisms which shut off the governor oil supply when the piston reaches its predetermined low pitch setting and prevent the governor from moving the piston beyond the prescribed low pitch position.

The piston engages beta rods. Movement of the blades to a lower pitch causes the rods to move the beta ring away from the engine.

A carbon block assembly rides in the groove of the beta ring. Linear motion from the low pitch position into the beta and reverse pitch range is transmitted from the rotating propeller assembly to the fixed engine through the beta ring and carbon block assembly.

The carbon block assembly is attached to an engine-supplied lever. This lever is connected to a beta valve mounted on a governor and to the power lever which is controlled in the cockpit. Blade movement below the preadjusted low pitch angle will move the beta lever and cause the beta valve to interrupt the hydraulic connection between propeller and governor. This prevents further travel of the blade pitch to a lower angle.

5. Basic Operating Principles

CAUTION: USE A TOW-BAR TO MOVE THE AIRCRAFT. DO NOT USE THE PROPELLER BLADES TO MOVE THE AIRCRAFT. BLADES CAN EASILY BE PUSHED OR PULLED OUT-OF-TRACK, RESULTING IN A CONDITION OF DYNAMIC IMBALANCE.

Avoid operating the aircraft in areas where loose stone or gravel can be pulled into the blades causing damage to the blade face and leading edge.

A. Feathering the Propeller

The propeller is feathered by releasing the governor oil pressure. This allows the counterweights and feathering spring to feather the blades.

Pulling the governor pitch control back to the limit of its travel opens a port in the governor. This allows the feathering spring to force oil out of the propeller back into the engine and increase blade angle to the feathered position.

Because of such variables as blade design and counterweight mass, elapsed time up to fifteen (15) seconds is typical for feathering with this system.

B. Unfeathering the Propeller

The propeller is installed (or removed) with the blades in a feathered position. The propeller has no centrifugal high pitch stops, so it feathers itself when stationary.

The propeller is unfeathered by pushing the governor control back into normal flight range position, restarting the engine, and using the governor to pump oil into the propeller. When the propeller has rotated a few turns, the governor will start to unfeather the blades.

When the propeller is unfeathered in flight, "windmilling" occurs and reduces the time required to accomplish unfeathering.

C. Reversing the Propeller

In the reverse mode of operation, the governor is reset to act as a source of pressurized oil. Control of the propeller then is transferred to the beta valve which controls blade angle rather than rpm.

NOTE: The beta valve usually is built into the base of the governor.

The propeller is reversed by manually repositioning the cockpit-controlled cable to cause the beta valve to supply oil from the governor pump to the propeller.

When the propeller reaches desired reverse position, movement of the beta ring and carbon block assembly cause the beta valve to shut off flow of oil to the propeller, holding the blade in a fixed position.

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6. Lightning Strike on Hub

CAUTION: ANY PROPELLER ASSEMBLY WHICH IS EXPOSED TO LIGHTNING STRIKE MUST BE OVERHAULED BEFORE IT IS RETURNED TO SERVICE.

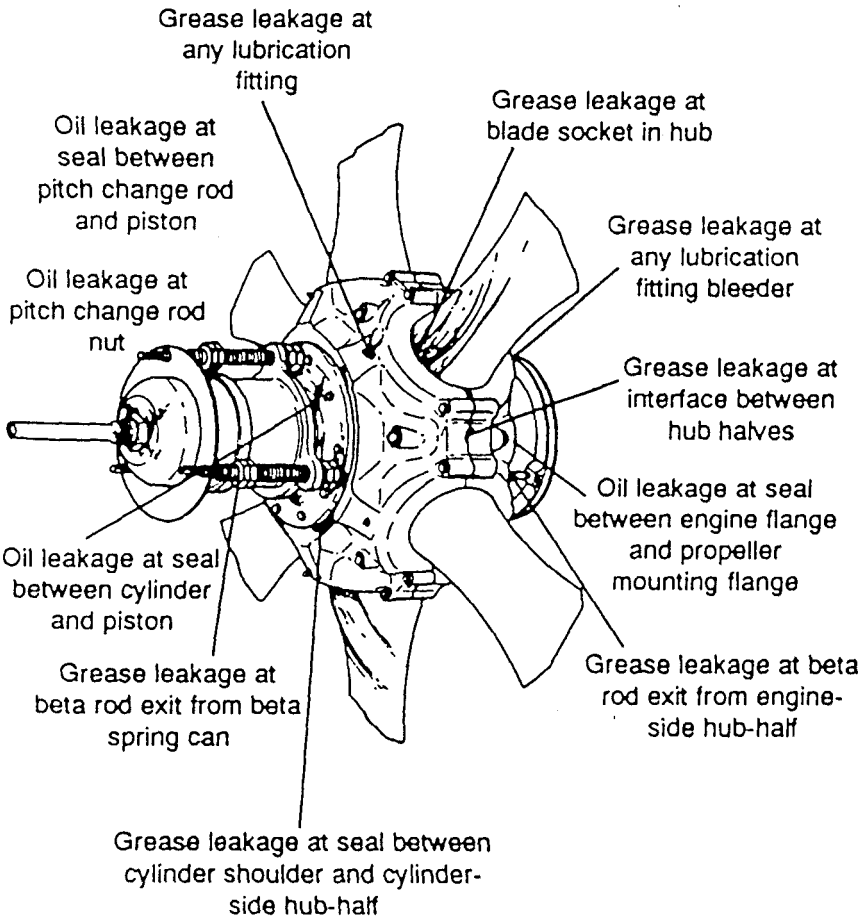
A. In a lightning strike, the blade retention split-bearing and the blade alignment bearing are subject to damage.

1) Arcing may occur, and this will be evident on the bearing races, balls and/or rollers.

B. In every lightning strike case, the flow of current has magnetized all of the steel parts.

1) Demagnetize all steel parts of the assembly.

NOTE: For lightning strike on composite blades, refer to the composite blade section in the back of this manual.



NOTE: The only potential source for grease leakage is in the blade retention area of the hub.

Areas to Inspect Daily for Evidence of Leaking Oil or Grease
Figure 5

7. Propeller Hub Assembly Inspection and Maintenance

CAUTION: FOLLOW ALL SPECIFIED PROCEDURES FOR PROPELLER HUB ASSEMBLY INSPECTION, MAINTENANCE AND LUBRICATION.

Inspect visible hub parts daily for surface damage.

Look for evidence of grease and/or oil leaks (see Figure 5).

Lubricate the assembly periodically in accordance with inspection and maintenance procedures detailed in this manual.

CAUTION: DO NOT ALLOW STEEL PARTS TO RUST.

If the cadmium plating wears off of a steel part, clean the surface, treat it, and apply Hartzell Polane paint as a temporary measure until the part can be re-plated.

8. Propeller Blade Assembly Inspection

Inspect propeller blades in accordance with the composite blade section in hte back of this manual.

9. Required Inspections

A. 100-Hour Inspection

1) Remove the spinner dome.
2) Check for oil and grease leaks (see Figure 5).
3) Inspect all visible parts for wear and safety.
4) Inspect visible hub parts for cracks or wear.
5) Check blade edges and surfaces for corrosion, cracks, scratches, depressions, erosion and gouges.
   a) Check composite blade edges and surfaces for debond and delamination (see Figure 4).
6) Have any crack or gouge in a metal blade repaired before next flight (See Figure 6).

   NOTE: Minor damage to a composite blade does not necessarily have to be repaired before next flight.
7) If the propeller is equipped with external de-icer boots, make sure all de-icer boots are secure.
8) Inspect all attaching hardware for proper fit, torque requirements and safety.
9) Make an entry in the Log Book verifying that this inspection has been completed.

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(Pages 17 through 19, including Figures 7, 8, and 9,
have been removed being replaced
with the new composite blade section
in the back of this manual.)

B. 300 Hour Inspection

NOTE: Follow all steps of the 100-hour inspection procedure.

Proper and regular lubrication is essential to efficient, long-life operation of the Hartzell propeller.

CAUTION: THESE LUBRICATION PROCEDURES MUST BE FOLLOWED CORRECTLY TO MAINTAIN ACCURATE DYNAMIC BALANCE OF THE PROPELLER BLADE AND HUB ASSEMBLIES.

CAUTION: TO AVOID DISLODGING THE HUB O-RINGS, OPEN EACH BLEEDER FITTING ON THE ENGINE-HALF OF THE HUB UNIT A HALF-TURN BEFORE ADDING LUBRICANT THROUGH THE SIX LUBRICATION FITTINGS ON THE CYLINDER-HALF OF THE HUB UNIT.

CAUTION: USE A HARTZELL PROPELLER APPROVED LUBRICANT ONLY. DO NOT MIX DIFFERENT SPECIFICATIONS AND/OR BRANDS OF GREASE.

1) To lubricate the propeller assembly:

   a) As shown in Figure 10, open each of the six bleeder fittings on the engine-half of the hub unit far enough to ensure that none of the fittings is sealed.

   b) Add an equal number of pumps of lubricant through each of the six lubrication fittings on the cylinder-half of the hub unit.

   c) Lubrication of one blade retention split-bearing is completed when grease emerges from the bleeder fitting in a steady flow with no air pockets.

   d) At overhaul, install all new lubrication fittings, bleeder fittings and caps.

      NOTE: Make sure the ball of each lubrication fitting is properly seated.

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CAUTION: BEFORE ADDING LUBRICAN, OPEN EACH BLEEDER FITTING FAR ENOUGH TO ENSURE THAT IT IS NOT SEALED.

MAKE SURE THERE ARE NO AIR POCKETS IN LUBRICANT WHICH HAS BEEN ADDED.

USE HARTZELL PROPELLER APPROVED LUBRICANTS ONLY.

DO NOT MIX DIFFERENT SPECIFICATIONS AND/OR BRANDS OF GREASE.

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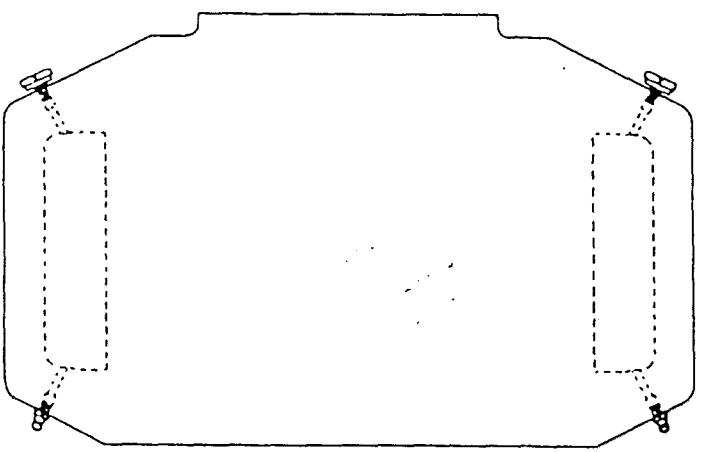
Open each of the six bleeder fittings on engine-half of hub unit far enough to ensure thtat no fitting is sealed.



Add an equal number of pumps of lubricant through each of the six lubrication fittings on cylinder-half of hub.

Procedure for Lubricating Blade Retention Split-Bearings
Figure 10

11. Approved Lubricants

The following greases are approved by Hartzell Propeller Inc.:

Aeroshell 5 with certain limitations, see Bulletin 159( )

Aeroshell 6

Aeroshell 7

Aeroshell 22

Exxon 5114EP

Royco 22C

NOTE: Other, previously issued, Hartzell documents indicate additional greases by brand name and/or MIL-specification. Not all of these greases meet our current performance standards. Hartzell has chosen to specify only those greasess which have sufficient testing or field experience to establish that they are acceptable.

NOTE: For further information, see Service Advisory 17( ).

12. Recommended Overhaul Periods

CAUTION: A PROPELLER WHICH HAS BEEN EXPOSED TO IMPACT DAMAGE, WHICH RENDERS ONE (OR MORE) BLADES NOT AIRWORTHY, OR TO LIGHTNING OR OVERSPEED GREATER THAN TEN PER CENT (10%) OF MAXIMUM RATING OF THE PROPELLER MUST BE OVERHAULED BEFORE RETURN TO SERVICE.

A. The recommended Time Between Overhauls (TBO) for the Hartzell propellers covered by this manual is found in Hartzell Service Bulletin No. 152( ).

CAUTION: OVERHAUL PROCEDURES MUST BE PERFORMED IN THE HARTZELL FACTORY OR IN A FACTORY-APPROVED FACILITY.

B. Overhaul Inspection

1) The overhaul inspection should include the following:
   a) Removal of propeller assembly from the aircraft engine.
   b) Complete disassembly of hub and blades.
   c) Visual inspection of all parts.
   d) Magnetic inspection of all steel parts.
   e) Dye penetrant insepction of aluminum or titanium parts.
   f) Cadmium re-plating and baking of certain steel parts.
   g) Repair, replacement or rework as required.
2) Make an entry in the Log Book verifying that the overhaul inspection procedures have been completed.

NOTE: Hartzell Service Letter 61( ) describes storage times and the affect on overhaul times.

12a. Continued Airworthiness Limitations

Certain component parts as well as the entire propeller may have specific life limits established by the F.A.A. Such limits call for replacement of items after a specific number of hours of use.

NOTE: Life limits may be subject to frequent revision until sufficient service experience has been established. Details concerning life limited parts are found in the latest revision to Hartzell Service Bulletin 152( ).

13. Troubleshooting Guide

NOTE: The Troubleshooting Guide which follows helps isolate probable causes and suggests possible remedies for some of the more common propeller service problems. In any case, the remedy for a problem should follow the procedures detailed in the applicable section of this manual.

Problem	Probable Cause	Remedy
A. Excessive Friction in Hub Mechanism	CAUTION: DO NOT INCREASE ANY CLEARANCE BY REMOVING MATERIAL ON PARTS WHICH HAVE SPECIAL COATINGS.	
	Insufficient clearance between various moving parts in the pitch change mechanism	Check the moving parts individually Increase clearances between individual parts as necessary to decrease frictio in the mechanism
or	Balls in the blade retention split-bearing are unusually rough or chipped	Replace the blade retention split-bearing assembly
B. Excessive Friction in Piston	Blade preload is excessive	Disassemble the propeller, and readjust blade preload
or	Lack of lubrication	Add approved lubricant
or	Balls in the blade retention split-bearing are usually rough or chipped	Replace the blade retention split-bearing assembly
or	Insufficient clearances between various moving parts in the pitch change mechanism	Increase clearances between the individual parts as necessary to decrease friction in the mechanism
or	Piston felt seal too tight	Replace the felt seal

C. Failure to Change Pitch (Sluggish rpm in both directions)	Excessive friction in moving parts	Refer to Problem A, "Excessive Friction in Hub Mechanism"
or	Oil passages are not clear and open	Inspect the hydraulic system
or	New governor has been installed with wrong direction of rotation or with bypass plug	Refer to governor manufacturer's manual for instructions on correct installation if necessary in wrong hole
D. Surging rpm or Torque	Excessive friction in pitch change mechanism	Refer to Problem A, "Excessive Friction in Hub Mechanism"
or	Air is trapped in the propeller actuating piston or in the engine shaft	The engine should have provision for allowing trapped air to escape from the system during one-half of the pitch cycle Before each flight, exercise the propeller by changing pitch or feathering
or	Governor pressure is too low	Refer to governor manufacturer's manual for instructions on adjusting relief pressure
or	Governor does not have sufficient dampening	Refer to governor manufacturer's manual for instructions on providing sufficient dampening
or	Incorrect beta system rigging	Refer to engine or aircraft for rigging instructions

E. Oil Leakage	Faulty O-ring seals between piston and cylinder	Disassemble the propeller, and inspect the O-rings and the surfaces they seal
Refer to Figure 5		Replace defective O-rings
or	Faulty O-ring seal between pitch change rod and piston	
or	Faulty seal on pitch change rod nut	
or	Faulty O-ring seal between engine flange and propeller mounting flange	
F. Grease Leakage	NOTE: The only potential source of grease leakage is in the blade retention area of the hub.	
Refer to Figure 5	Defective lubrication or bleeder fitting	Replace defective lubrication or bleeder fittings
or	Missing lubrication fitting cap	Replace missing lubrication fitting caps
NOTE:	Wire the lubrication fitting caps with .020-inch (.51 mm) minimum diameter stainless steel wire.	Make two wraps around the small diameter of each lubrication fitting cap, and tighten the wire enough to just bury it below the rubber surface of the cap
or	Faulty seal at blade socket in hub	Disassemble the propeller, and replace defective seal
or	Faulty seal at interface between hub halves	Disassemble the propeller, and add approved adhesive sealant to mating surface of the hub halves
or	Faulty seal at beta rod exit from hub or spring can	Replace defective seal

G. End-Play in Blade	CAUTION: NO END-PLAY IN BLADE IS ALLOWED.	
Refer to Figure 11	Buildup of manufacturing tolerances	Disassemble the propeller, and reset the preload
or	Blade retention bearing is worn	Follow Blade Retention Split-Bearing Inspection and Replacement
or	Blade alignment bearing is worn	Blade alignment bearing must be replaced
H. Fore-and-Aft Movement in Blade	CAUTION: NO FORE-AND-AFT BLADE MOVEMENT IS ALLOWED.	
Refer to Figure 11	Buildup of manufacturing tolerances	Disassemble the propeller, and reset the preload
		Replace pitch adjustment unit if necessary
or	Blade retention bearing is worn	Follow Blade Retention Split-Bearing Inspection and Replacement Procedures
or	Blade alignment bearing is worn	Blade alignment bearing must be replaced
I. In-and-Out Movement in Blade	CAUTION: NO IN-AND-OUT BLADE MOVEMENT IS ALLOWED.	
Refer to Figure 11	Buildup of manufacturing tolerances	Disassemble the propeller, an reset the preload
or	Blade retention bearing is worn	Follow Blade Retention Split-Bearing Inspection and Replacement Procedures

J. Excessive Radial Play in Blade (backlash) Refer to Figure 11	Blade Retention bearing is worn NOTE: Radial play of ±0.5-degree is allowed	Follow Blade Retention Split-Bearing Inspection and Replacement Procedures
or	Blade alignment bearing is worn	Blade alignment bearing must replaced
or	Pitch adjustment unit is worn or out of tolerance	Replace pitch adjustment unit
or	Buildup of manufacturing tolerances	Try another combination of parts
K. Blades Not Tracking	Ground strike damage	Refer to applicable Blade Manual for Repair Procedure
or	Blade face(s) are out of alignment	Refer to applicable Blade Manual for Face Alignment Procedure NOTE: If blade tip angle is not correct according to specifications, reject the blade.

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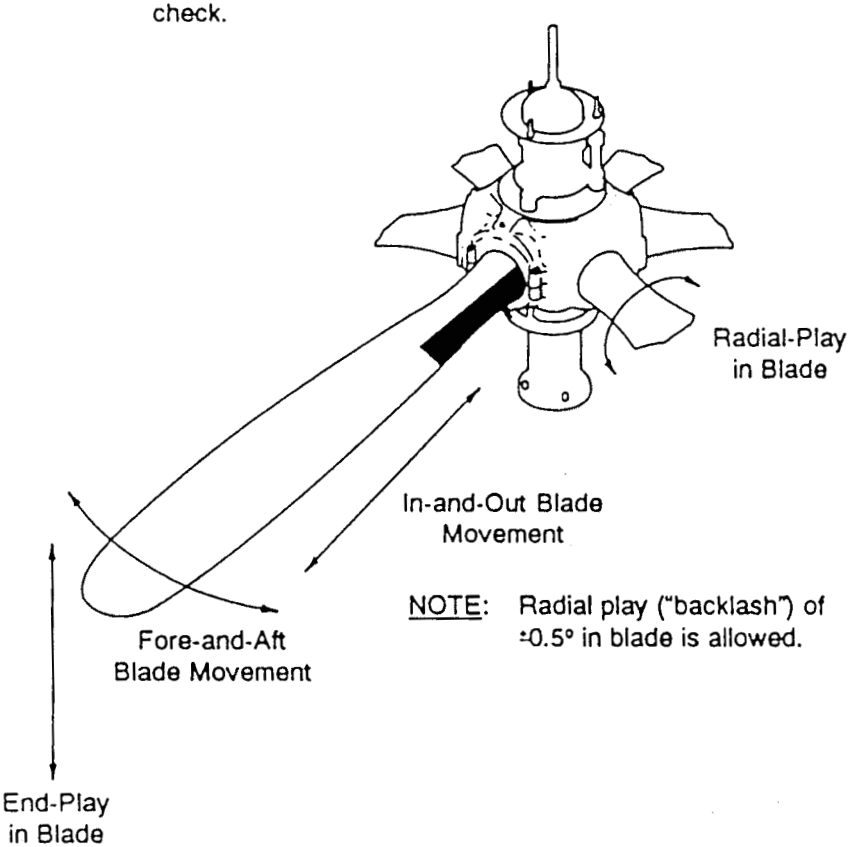
CAUTION: BLADE IS PRELOADED. NO END-PLAY, IN-AND-OUT, OR FORE-AND-AFT BLADE MOVEMENT IS ALLOWED.

NOTE: Use gentle hand pressure to check for fore-and-aft blade movement or end-play in blade. Excessive force will deflect the preload plate and cause an incorrect result of either check.



NOTE: Counterweight clamps removed for clarity.

Checking the Blade Preload
Figure 11

14. Removing the Propeller Assembly from the Aircraft Engine

A. With a suitable sling and mobile hoist, proceed as follows to disengage the propeller assembly from the aircraft engine:

1) Spinner Disassembly

a) Remove the screws and washers that attach the spinner dome to the engine-side bulkhead unit.

b) Remove the spinner dome and and store with care.

2) Beta Control Unit Removal

a) Disconnect the engine beta linkage and carbon block assembly from the beta ring.

b) Use the special tool, Figure 12, to compress the beta system and pull the beta ring forward to expose the double hex head propeller mounting bolts and washers.

3) Remove safety wire, and remove the propeller mounting bolts and washers.

4) Carefully remove the propeller assembly from the aircraft engine.

5) Decompress and remove the special beta system tool (Figure 12).

6) Remove and discard the propeller mounting O-ring.

15. Preparing a Propeller Assembly for Lengthy Storage

CAUTION: A PROPELLER ASSEMBLY WHICH IS NOT GOING TO BE INSTALLED ON A AIRCRAFT WITHIN A REASONABLE LENGTH OF TIME MUST BE STORED IN A MANNER WHICH PROVIDES SUFFICIENT PROTECT AGAINST PHYSICAL DAMAGE AND AGAINST DAMAGE FROM EXTREMES IN TEMPERATURE OR HUMIDITY.

A. If the propeller assembly is not installed on an aircraft immediately, store the assembly in a sturdy, dry container.

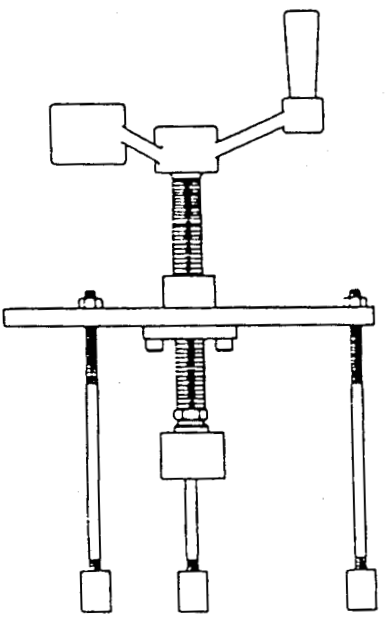
NOTE: As necessary, add a dehydrating agent.

16. Activating a Propeller Assembly after Lengthy Storage

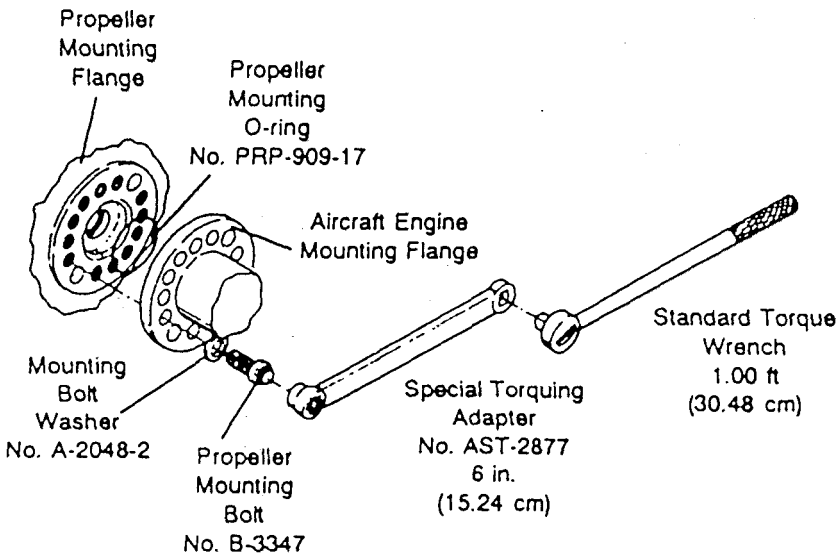
CAUTION: A PROPELLER ASSEMBLY BEING PLACED IN SERVICE AFTER LENGTHY STORAGE MUST COMPLY WITH ALL APPLICABLE FAA AIRWORTHINESS DIRECTIVES AS WELL AS APPLICABLE HARTZELL SERVICE LETTERS, BULLETINS, INSTRUCTIONS AND ADVISORY NOTICES.

A. Refer to Service Letter 61( ) to determine whether or not a propeller assembly has been stored for a longer period of time than is allowed without its being disassembled and inspected prior to being placed in service.

CPS-795



Special Tool (CST-2987)
to Compress the Beta System
Figure 12



When an adapter is used with a torque wrench, use the following equation to determine torque value:

$$\frac{\text{(actual torque required) x (torque wrench length)}}{\text{(torque wrench length) + (length of adapter)}} = \text{torque wrench reading to achieve required actual torque}$$

EXAMPLE:

$$\frac{100 \text{ lb-ft } (136 \text{ N·m}) \times 1 \text{ ft } (30.48 \text{ cm})}{1 \text{ ft } (30.48 \text{ cm}) + 6 \text{ in. } (15.24 \text{ cm})} = 66.7 \text{ lb-ft } (901 \text{ N·m})$$

66.7 lb-ft (901 N·m) — reading on torque wrench with 9 inch (22.86 cm) adapter for actual torque of 100 lb-ft (136 newton-meters)

Using Special Torquing Adapter (AST-2877)
with Standard Torque Wrench
to Torque Propeller Mounting Bolts
Figure 13

17. Installing the Propeller Assembly on the Aircraft Engine

A. Use the special tool, Figure 12, to compress the beta system.

B. With a suitable mobile hoist and sling, carefully move the propeller assembly up to the mounting flange on the aircraft engine.

NOTE: If the propeller is equipped with a de-icer system, follow the applicable manufacturer's instructions for installation.

1) Make sure the propeller hub flange and the engine flange are clean.

2) Line up the mounting holes in the propeller hub flange with the mounting holes in the engine flange.

3) Install the specified oil seal on the engine flange.

WARNING: USE ONLY PROPELLER MOUNTING BOLT PART NUMBER B-3347 FOR THE SIX-BLADE LIGHTWEIGHT TURBINE PROPELLER.

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

CAUTION: REPLACE ALL PROPELLER MOUNTING BOLTS AND WASHERS AT OVERHAUL. MOUNTING BOLTS AND WASHERS MAY BE RE-USED ONLY WHEN THE PROPELLER ASSEMBLY IS BEING REINSTALLED AFTER HAVING BEEN REMOVED BETWEEN OVERHAULS.

4) Apply approved anti-seize compound to the threaded surfaces of the twelve propeller mounting bolts.

NOTE: A petrolated graphite lubricant conforming to MIL-T-5544 or MIL-T-83483 is approved. The following kits are available from the factory for this installation:

	Net Weight		
Part No.	*Ounces*	*Grams*	*MIL SPEC*
A-3338-1	1/3	9	MIL-T-5544
A-3338-2	1	28	MIL-T-5544
A-3338-3	2	57	MIL-T-5544
A-3338-4	1/3	9	MIL-T-83483
A-3338-5	1	28	MIL-T-83483
A-3338-6	2	57	MIL-T-83483

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

6) Use wrench with special adapter, Figure 13, to torque all mounting bolts in the sequences and steps shown in Figure 14.

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a) Use a calibrated torque wrench and adapter that will assure correct torquing of the propeller mounting bolts.

NOTE: Refer to the formula in Figure 13 to determine correct calibration reading. The B-3347 mounting bolt has a 0.625 inch (15.875 mm) wrenching size.

7) Safety all mounting bolts in an airworthy manner with 0.032 inch (.81 mm) minimum diameter stainless steel wire.

8) Decompress the special tool on the beta system, and install the beta linkage. Then, remove the special beta system tool.

9) Proceed as follows to install the carbon block assembly (Figure 15) into the beta ring:

a) Install the carbon block(s) on the lever supplied by the airframe or engine manufacturer.

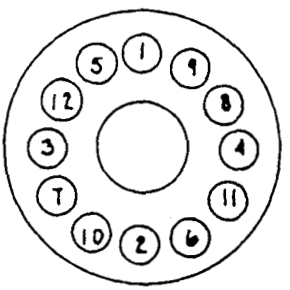
b) Fit the block(s) into the beta ring.

NOTE: As shown in Figure 15, side clearance at installation must be 0.001 inch (0.03 mm) to 0.002 inch (0.05 mm).

c) Dress the sides of the block(s) as necessary to establish the required clearance.

d) Safety wire the beta linkage in an airworthy manner.

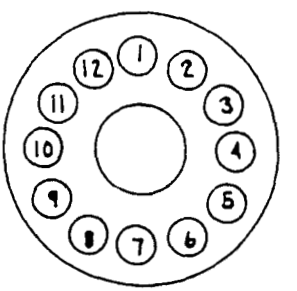
APS-817



SEQUENCE A

Step 1 - Torque all bolts to 40 lb-ft (54 N•m)

Step 2 - Torque all bolts to 80 lb-ft (108 N•m)

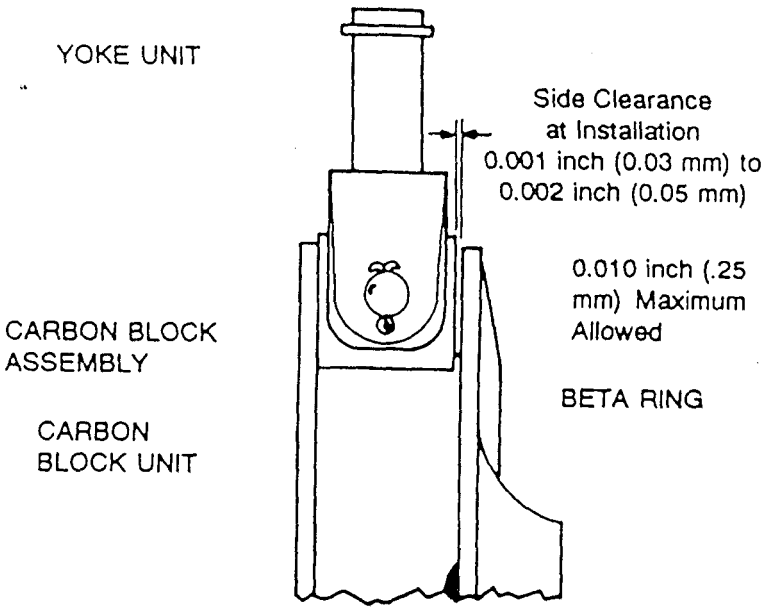


SEQUENCE B

Step 3 - Torque all bolts between 100 lb-ft (136 N•m) and 105 lb-ft (142 N•m)

Diagram of Torquing Procedures
for Propeller Mounting Bolts
Figure 14

APS-166



Clearance Dimensions
for Correct Fit of Carbon Block Assembly
in Beta Ring
Figure 15

C. Spinner Reassembly

1) Use new washers and screws to re-attach the spinner dome to the outer circumference of the engine-side bulkhead unit.

Installation of the propeller assembly is now complete.

(Pages 36 - 40 and 61 were removed in Revision 2.
Pages 41 through 60 have also been removed,
being replaced with the new composite blade section
in the back of this manual.)

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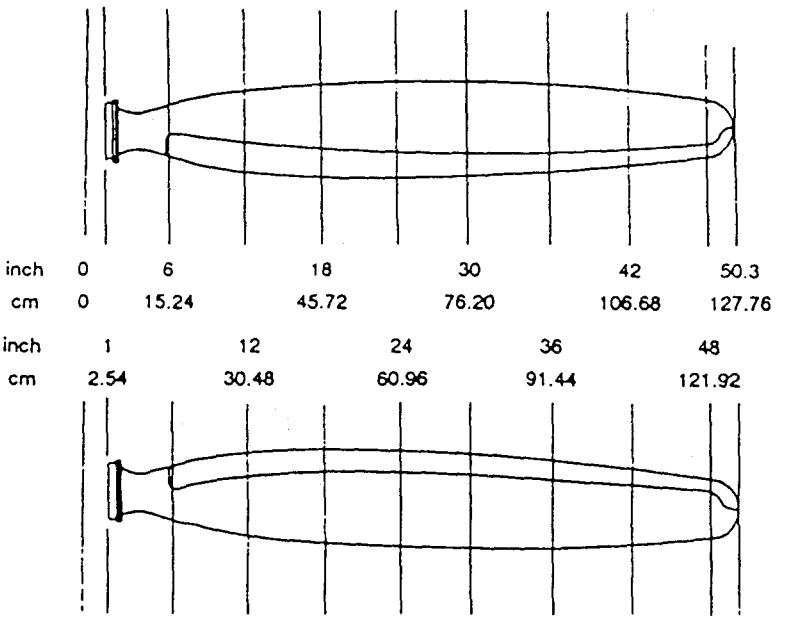
HARTZELL PROPELLER INC.
Manual No. 154

Record of Model A10460 Composite Blade Damage Repair

Blade Design _____

Blade Serial Number _____

APS-012



Location of Damage

Date of Entry	Flight Hours	Degree of Damage (airworthy/unairworthy) Description of Damage	Description of Repair	Repaired By

21. Record of Inspections, Repairs and Adjustments

A. Record every inspection, repair and adjustment made on the propeller hub assembly and blade assemblies in accordance with airworthiness directives, service bulletins, service letters.

B. This service record must be kept current and must remain with the equipment at all times.

Date	Tach Time	Description of Inspection, Repair or Adjustment	Signature

Record of Inspections, Repairs and Adjustments

Date	Tach Time	Description of Inspection, Repair or Adjustment	Signature

Record of Inspections, Repairs and Adjustments

Date	Tach Time	Description of Inspection, Repair or Adjustment	Signature

Record of Inspections, Repairs and Adjustments

Date	Tach Time	Description of Inspection, Repair or Adjustment	Signature

Record of Inspections, Repairs and Adjustments

Date	Tach Time	Description of Inspection, Repair or Adjustment	Signature

Record of Inspections, Repairs and Adjustments

Date	Tach Time	Description of Inspection, Repair or Adjustment	Signature

22. Propeller Assembly Vital Statistics

Record every inspection, maintenance and repair operation in the Log Book section of this manual.

Hub Model _____	Hub Model _____
Blade Design _____	Blade Design _____
Diameter _____	Diameter _____
Blade Serial Numbers: _____	Blade Serial Numbers: _____
Blade No. 1 _____	Blade No. 1 _____
Blade No. 2 _____	Blade No. 2 _____
Blade No. 3 _____	Blade No. 3 _____
Blade No. 4 _____	Blade No. 4 _____
Blade No. 5 _____	Blade No. 5 _____
Blade No. 6 _____	Blade No. 6 _____
Pitch Range:	Pitch Range:
High _____ Low _____	High _____ Low _____
Feather _____ Reverse _____	Feather _____ Reverse _____

Custody Record

Owner	Date Received

Revision B
October 1997

This Section Refers to *Composite Blades* Only

Models:

7690C

7890K

B7421K

M10083K

A10460(E)(K)

LM10585ANK+4

LM10585(A)B+4

M10877K

E10950K

E11990K

E12902K

Insert this section in Hartzell Propeller Inc. Manuals:
115, 139, 149, 154

COMPOSITE BLADE

Table of Contents

1. Introduction

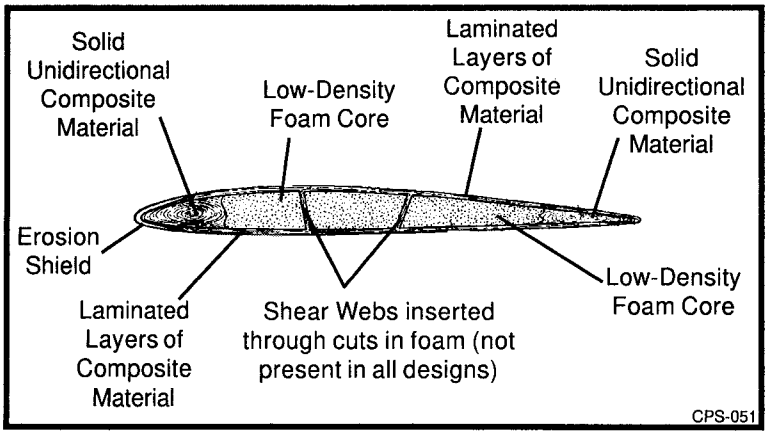
A. General Description

(1) The Hartzell composite blade is composed of a metal blade shank retention section into which is molded a low-density foam core that supports built-up layers of composite laminate (Figure 1).

(2) An erosion shield of electroformed nickel or stainless steel is incorporated into the fabrication to protect the blade leading edge from impact damage. Erosion shields are adhesively bonded to blades. The LM10585 blade was introduced with a stainless steel erosion shield. All other blades, as well as recent production of LM10585, use a nickel erosion shield.

(3) Some designs incorporate a stainless steel wire mesh into the fabrication to inhibit erosion in blade tip areas.

(4) Some designs incorporate a metal foil mesh on the surface of the blade to limit lightning strike damage.

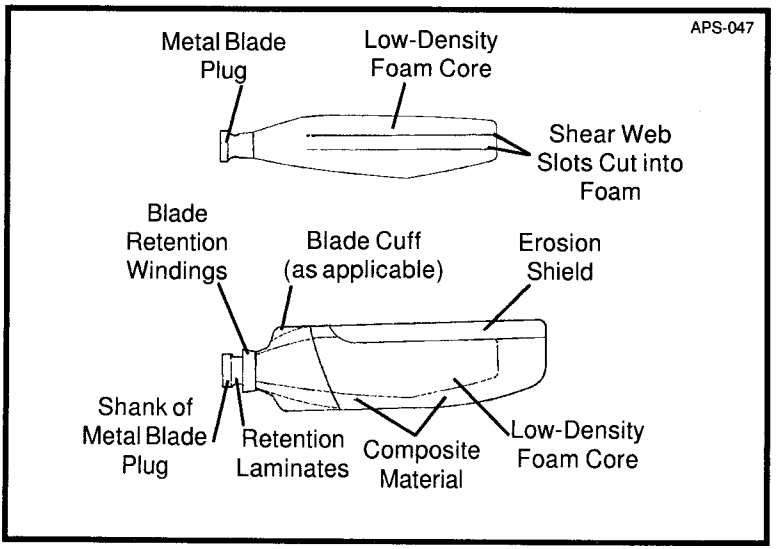


Section of Typical Composite Blade
Figure 1

(5) Some designs incorporate a non-structural blade cuff of low-density foam which is molded to the blade and covered with composite material (Figure 2).

(6) Filament windings of composite material provide blade retention of the blade material to the internal metal plug. The composite laminates which are an integral component of the blade also provide a retention load path directly under the clamp in steel hubs (or bearing in aluminum hubs) for blade retention.

(7) Some designs use a filament winding on the inboard end of the erosion shield to aid the retention of the erosion shield. This winding is sometimes referred to as an erosion shield winding and should not be confused with the blade retention winding used to secure the blade material to the internal metal plug.



Basic Components of the Composite Blade
Figure 2

(8) The composite blade is balanced in the horizontal plane during production by the addition of lead wool to a centrally located balance tube in the metal blade shank (which may protrude into the blade's foam core).

(9) A finish covering of polyurethane paint protects the entire blade from erosion as well as ultraviolet damage. Aircraft that require de-icing protection use an external de-icer boot except for the A10460E blade which was introduced with an internal heating element in lieu of boots. Standard de-icer boots for this model are an option.

B. Component Life and Service

(1) Overhaul or Major Periodic Inspection (MPI)

(a) Overhaul, or MPI, is the periodic disassembly, inspection, repair, refinish and reassembly of the composite blade assembly.

NOTE: The term "overhaul" is used throughout the text of this manual.

(b) At such specified periods, the propeller hub assembly and the blade assemblies are completely disassembled and inspected for cracks, wear, corrosion and other unusual or abnormal conditions. As specified, some blades are refinished, and other blades are replaced. The blades can then be reassembled and balanced.

(c) Overhaul is to be accomplished in accordance with the latest revision of Hartzell Manual No. 61-13-35 Composite Blade Manual and other applicable publications.

(d) Overhaul is to be accomplished only by a Hartzell Propeller Inc. approved repair station.

(2) Damage

(a) Airworthy Damage

Airworthy damage is damage that does not affect the safety or flight characteristics of the propeller blade. The maximum limits of airworthy damage are specified in this section. Although a blade may continue in service with airworthy damage, this type of damage **should be repaired at the earliest practical time** to prevent further damage to the blade.

(b) Unairworthy Damage

Unairworthy damage is damage that exceeds the maximum limits of airworthy damage. Unairworthy damage can affect the safety or flight characteristics of the propeller blade. **This type of damage must be repaired prior to the next flight.**

NOTE: Some forms of unairworthy damage do not require immmediate repair prior to next flight. There may be additional hours allowed for maintenance scheduling purposes. Additional flight hours, if allowed, are noted in the *Airworthy Damage Limits* section of this manual.

(3) Repair

(a) Minor Repair

Minor repair is correction of damage that may be safely performed in the field (preferably by appropriately trained personnel who has completed Hartzell composite blade training).

(b) Major Repair

1 Major repair is correction of damage that cannot be performed by elementary operations.

2 Major repair must be accepted by an FAA certified individual, preferably one that holds a Factory Training Certificate from Hartzell Propeller, Inc. All major repairs must be completed in an FAA approved repair station. The propeller shop must meet facility, tooling, and personnel requirements and is required to participate in Hartzell Sample Program. (Refer to Hartzell Manual No. 61-13-35 Composite Blade Manual).

(4) Blade Life

Blade life is expressed in terms of total hours of service (TT, or Total Time), time between overhauls (TBO) and in terms of service since overhaul (TSO, or Time Since Overhaul). All references are necessary in defining the life of the propeller.

C. Personnel Requirements

(1) Compliance to the personnel requirements established by the Federal Aviation Administration (FAA) is mandatory for anyone performing or accepting responsibility for any inspection and/or repair and/or overhaul of any Hartzell Propeller Inc. product.

(2) Any person signing for or performing inspections, repairs and/or overhauls to Hartzell composite parts should be familiar with the objectives and procedures associated with the inspecting, repair and/or overhaul of composite parts.

NOTE: It is strongly recommended that the individuals taking the responsibilities for or performing the tasks of inspecting, repairing and/or overhauling of composite parts attend Hartzell Propeller Inc. Factory Training Courses.

All persons who receive factory training will be provided with a "Certificate of Factory Training" after completion of training. A copy of all certificates will be kept on file at HPI.

To keep abreast of the new techniques for the inspection, repair and overhaul of composite parts, it is strongly recommended that training be received at least once every two years, with intermediate classes occurring as the need arises. Contact the Hartzell Product Support Department for class dates, arrangements, and information.

D. Definitions

A basic understanding of the following terms will assist maintenance personnel in maintaining and operating composite blades:

Term	Definition
Corrosion	gradual wearing away or deterioration due to chemical action.
Crack	irregularly shaped separation within a material, usually visible as a narrow opening at the surface.
Debond	separation of two materials that were originally bonded in a separate operation.
Delamination	internal separation of the layers of composite material.
Depression	surface area where the material has been compressed but not removed.
Distortion	alteration of the original shape or size of a component.
Erosion	gradual wearing away or deterioration due to action of the elements.
Exposure	leaving material open to action of the elements.

Term	Definition
Gouge	surface area where material has been removed.
Horizontal Balance	balance between the tip and the butt of the blade.
Impact Damage	occurs when the blade strikes or is struck by an object, either in-flight or on the ground.
Nick	removal of paint and possibly a small amount of composite material not exceeding one layer.
Porosity	an aggregation of microvoids. See "Voids."
Scratch	same as "Nick."
Split	delamination of blade extending to blade surface, normally found near trailing edge or tip.
Vertical Balance	balance between the leading and trailing edges; cannot be changed on a composite blade.
Voids	air or gas that has been trapped and cured into a laminate.

2. Determination of Repair

A. This section is arranged such that damage and repair are treated separately. This gives the operators and repair facilities greater clarification and freedom in dealing with composite blade damage.

(1) This section defines airworthy and unairworthy damage and also, lists the allowables for each.

(2) The type of repair is not dictated by the type of damage received. For example, a blade with airworthy damage may require a major repair.

B. Upon inspection of a composite propeller blade, an operator should first determine the type of damage: airworthy or unairworthy. (Limits are in this section.) Figure 3 illustrates the determination of repair.

(1) If the damage is determined to be airworthy, the aircraft may continue in service. However, the operator should make arrangements to have repairs performed as soon as practical.

(2) If the damage is determined to be unairworthy, the propeller blade cannot be used until a repair is performed.

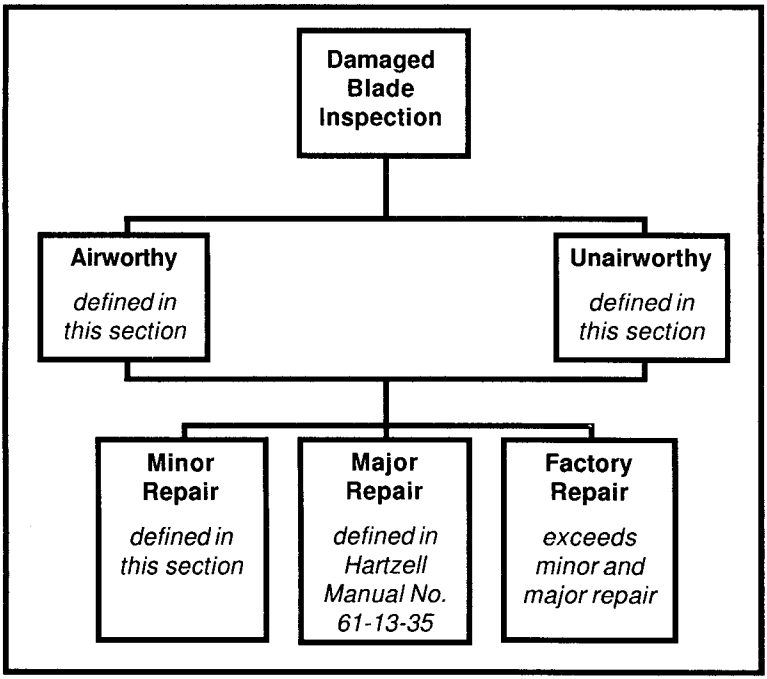
NOTE: Some forms of unairworthy damage do not require immmediate repair prior to next flight. There may be additional hours allowed for maintenance scheduling purposes. Additional flight hours, if allowed, are noted in the *Airworthy Damage Limits* section of this manual.

C. Next, the operator should determine if the repair falls into the category of minor or major. Limits for each repair are called out in the repair procedure.

(1) If the repair is minor, the repairs may be made on location. An individual approved by the FAA must sign off the acceptance of the return to service (refer to Personnel Requirements portion of this Section).

(2) If the repair is major, the operator must make arrangements to have the damage repaired at an FAA approved facility. The repair must be signed off by an individual that possesses FAA approval (see qualifications in this Section).

D. Due to the infinite types of damage possible, not all types of damage that can be considered airworthy are covered in this manual. If there is any doubt as to airworthiness of the blade, contact the Hartzell.



Determination of Repair Flow Chart
Figure 3

3. Inspection Requirements

A. Required Record-Keeping

Composite blade damage and a description of its repair must be recorded in the propeller log book. **Maintaining a good log book record is particularly important for composite propeller blades. Damage and/or repairs may suffer further degradation after continued use. Such degradation may be easily overlooked. Therefore it is important for inspectors to have access to accurate historical data when performing subsequent inspections.**

B. Preflight Inspection

(1) Follow propeller preflight inspection procedures as specified in the aircraft maintenance manual, or an air carrier's operational specifications, or this manual. In addition, perform the following inspections:

(a) Visually inspect entire blade for nicks, gouges, looseness of material, erosion, cracks and debonds.

(b) Visually inspect blades for lightning strike. Refer to "Lightning Strike Damage" in this section for description of damage.

(2) Defects or damage discovered during preflight inspection must be evaluated in accordance with allowables outlined in this section to determine whether repairs are required prior to further flight.

B. Maintenance Inspections

(1) Kevlar® Blade (Models: B7421(K), 7690C, 7890K M10083(K), A10460(E)(K), LM10585ANK+4, LM10585(A)NB+4, M10877K, E11990K, E12902K, E10950(P)K). Inspection procedures must be performed in accordance with this manual.

(a) Perform thorough visual inspection and coin-tap exposed section of the blade not to exceed 1200 hours and the erosion shield surface not to exceed 600 hours. Coin-tapping (described later in this Section) will indicate a delamination or debond by an apparent audible change.

(b) Review blade log book records and carefully inspect areas of airworthy damage and previously repaired areas for growth. If growing, estimate whether the flawed area will exceed airworthy damage limits prior to the next overhaul. If this is the case, make arrangements to repair at the earliest practical time to prevent further damage to the blade.

(c) Defects or damage discovered during scheduled inspections must be evaluated in accordance with allowables outlined later in this Section to determine whether repairs are required prior to further flight. Although repair of "airworthy damage" is not essential prior to further flight, such damage should always be repaired as soon as possible, to avoid further degradation. Any "unairworthy damage" must be repaired prior to further flight.

NOTE: Some forms of unairworthy damage do not require immmediate repair prior to next flight. There may be additional hours allowed for maintenance scheduling purposes. Additional flight hours, if allowed, are noted in the *Airworthy Damage Limits* section of this manual.

(d) LM10585B+4: If ice buildup on the inboard end of the cuff is a problem, the blades should be modified to LM10585ANK+4 design. This design incorporates a new cuff and de-icer boot design which will eliminate the icing problem. Send blades to the factory for modification.

(2) "P" Static Resistance Check (E10950(P)K Only)

Perform a resistance check of the "P" Static bonding path every 1200 hours by using an ohm meter capable of measuring up to 20 Megohms. Check the resistance between the erosion shield and one of the propeller hub clamping bolts. The measured resistance must be less than 0.1 Megohm (100,000 Ohms).

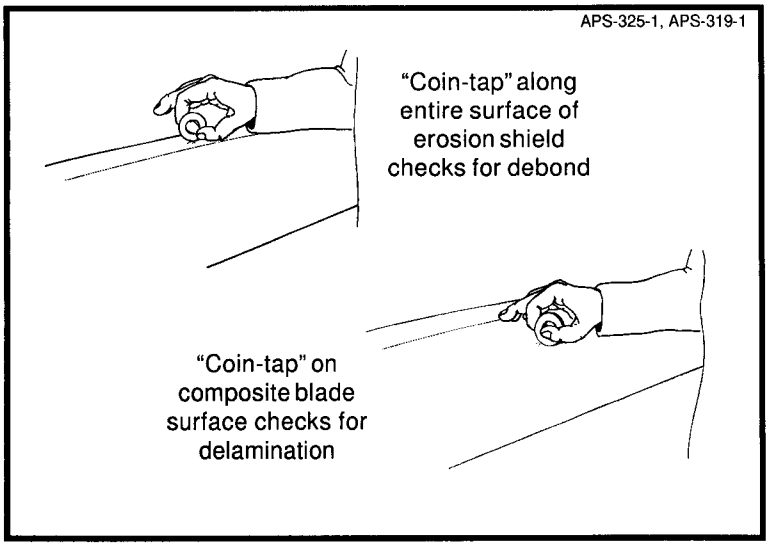
(3) Record details of all damage and/or repairs in propeller log book.

4. Coin-Tap Test (Figure 4)

A. Composite blades can be inspected for delaminations and debonds by tapping the blade, or cuff (if applicable), with a "metal washer."

B. Use a washer-shaped metal tapper, approximately 2.5 inches O.D. x 1.25 inches I.D. x 0.25 inch thick, and weighing no less than 3 oz. Tap the surface. If an audible change is apparent, sounding hollow or dead, a debond or delamination is likely.

NOTE: Blades which incorporate a "cuff" will have a different tone when coin-tapped in the cuff area. To avoid confusing sounds, the cuff area and the transition area between cuff and blade should be coin-tapped separately from the blade area.



Using "Coin-Tap" Test to Check for Debond and Delamination
Figure 4

C. "Mapping" of the area to be coin-tapped is desirable to assure that the entire surface is adequately inspected. Coin-tap within an imaginary grid or matrix consisting of 2 inch squares during scheduled aircraft inspections.

(1) A more thorough coin-tapping of the erosion shield is desirable due to its size and shape. Tap in a smaller grid pattern up and down the length of the erosion shield. Slight deformations in the erosion shield may be noticed with careful visual and manual (touch) inspection. Such deformations may be the result of a debond and should be given a careful coin-tap inspection.

(2) If a suspected delamination or debond is discovered, a localized, thorough coin-tap inspection is required to define precise area of delamination or debond.

D. Outline the suspect area with a grease pencil to determine approximate size of damage. Record damage/repairs in the propeller log book.

5. Airworthy Damage

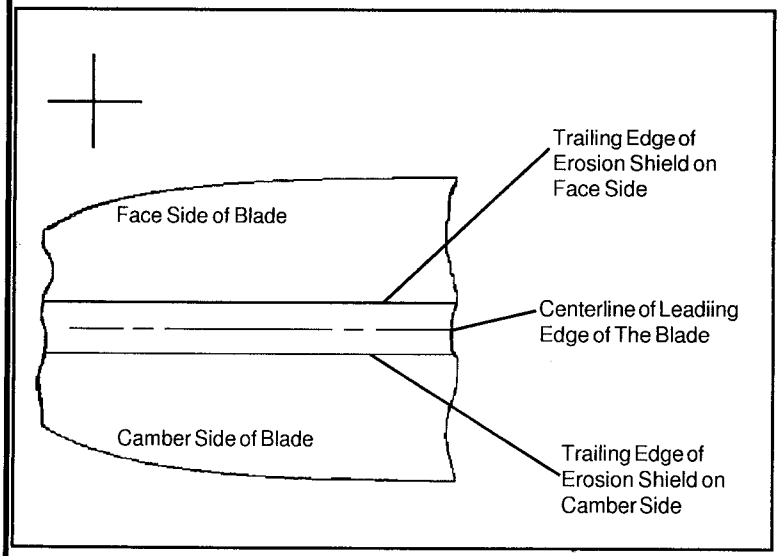
A. Airworthy damage does not exceed the following limits. This type of damage will not affect the safety or flight characteristics of the propeller.

B. Areas of airworthy damage should be monitored and repaired as soon as practical.

C. Airworthy Damage Limits

(1) Nickel Erosion Shield (All blade models)

NOTE: When calculating the area of damage and the proximity to other damage, the erosion shield should be viewed as a two dimensional shape, as if it were unfolded and laid flat where the face and camber sides of the blade could be viewed at the same time. Reference Figure 5 for the interpretation of the view of the erosion shield.



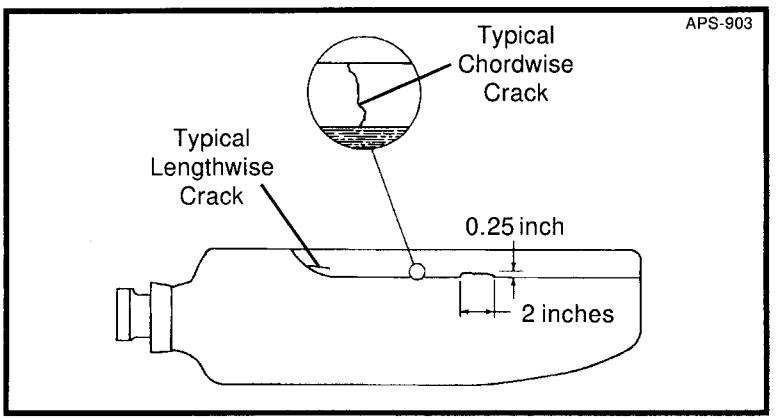
Interprtation of Erosion Shield Damage
Figure 5

(a) The following limits apply to the entire erosion shield:

1 Minor deformations due to impact damage and erosion that do not greatly affect the airfoil shape or penetrate through the shield are acceptable.

2 Gouges through the erosion shield up to 0.25 sq. inch are acceptable. Although this damage is acceptable it must be repaired as soon as possible to prevent further damage to the blade. Damage to the blade surface beneath the erosion shield may not be more than .020 inch (.51 mm) deep. This represents two layers of fibrous material.

3 Portions of the trailing edge of the erosion shield may be missing due to erosion or sanding performed during the erosion shield installation procedure. The maximum allowable missing area is 0.25 X 2.0 inch (.64 x 5.1 cm). Reference Figure 6 for an example of allowable missing material.



Missing Portions of Nickel Erosion Shield (Trail Side) and Typical Cracks
Figure 6

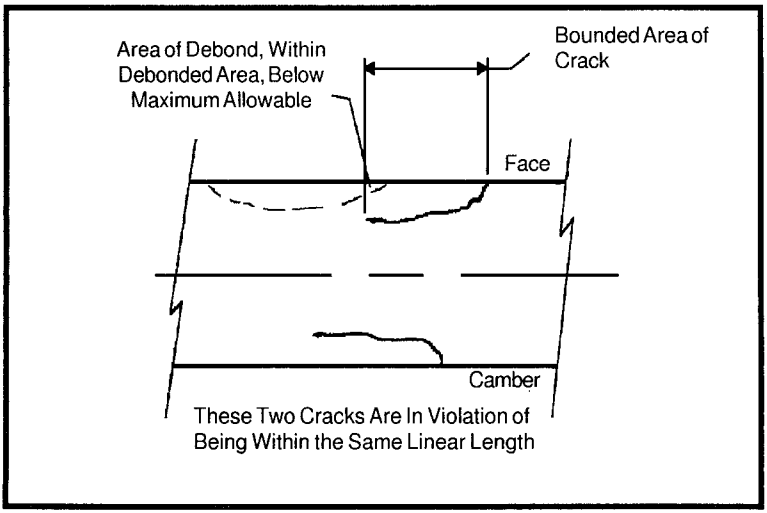
(b) The following limits apply to all sections of the erosion shield not covered by an external de-icer.

1 No more than 20% of the erosion shield may be debonded in any 6.0 inch (15.24 cm) length of the erosion shield.

2 No two, full width, chordwise cracks may occur within 6.0 inches (15.2 cm) of each other.

3 No lengthwise cracks may exceed 2.0 inches (5.1 cm) in length.

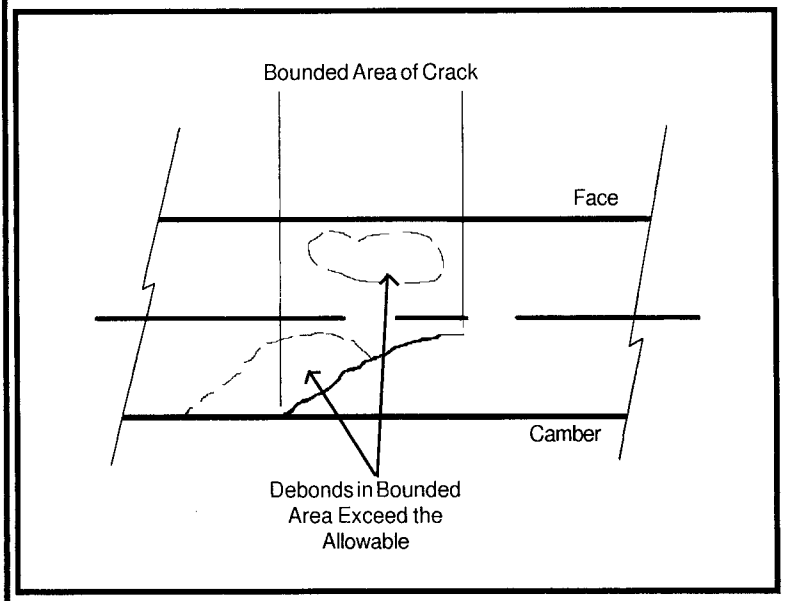
4 No two lengthwise cracks may be within the same linear length of the erosion shield. This includes cracks on opposite sides of the blade. Reference Figure 7 for an example in violation of this limit. Note that the cracks are on opposite sides of the blade.



Acceptable Erosion Shield Debond, Non-acceptable Crack Location Examples
Figure 7

5 No more than 20% of the area bounded by a lengthwise crack and the trailing edge of the erosion shield may be debonded. Figure 7 shows an example within this tolerance limit. Figure 8 shows an example of a debonded area that exceeds the 20% maximum allowable.

NOTE: The bounded area of a crack extends to both edges of the erosion shield.



Debonds in Excess of Allowable Limits
Figure 8

(c) The following limits apply to the erosion shield area that is covered by an external de-icer.

1 No more than 40% of the erosion shield may be debonded in any 6 inch (15.2 cm) length section of the erosion shield.

2 Any number of chordwise cracks are acceptable, even full width, but in each area, bounded by chordwise cracks, the total amount of debond may not exceed 40%.

3 No more than 40% of the area bounded by a lengthwise crack and the trailing edge of the erosion shield may be debonded. Figure 7 shows an example within this tolerance limit.

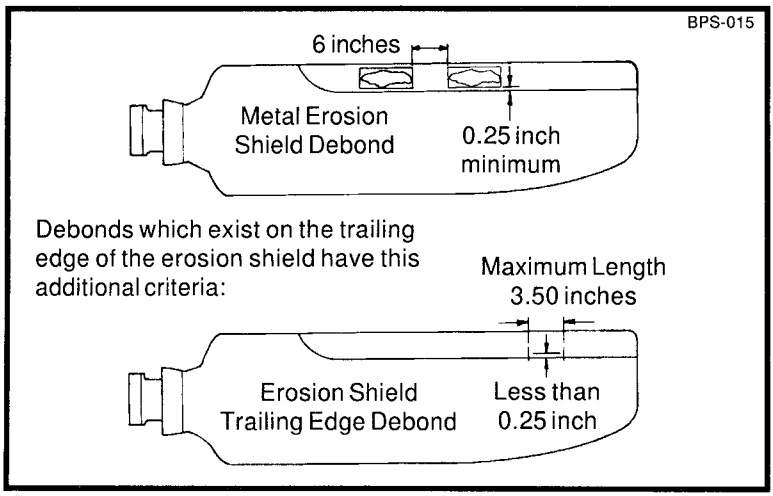
NOTE: The bounded area of a crack extends to both edges of the erosion shield.

(2) Stainless Steel Erosion Shield (Model: LM10585(A)(B,K)+4)

NOTE 1: Debond area requirements apply only to portions of the erosion shield not fastened with screws or rivets. If screw and rivet holes have lengthwise cracks extending from them, debond repair is no longer considered effective.

NOTE 2: The following damages, (a) through (c), cannot be resolved without replacement of the erosion shield, but within these limits, do not render the blade unairworthy.

(a) No single screw or rivet hole with a chordwise crack extending from it may have any lengthwise cracks also extending from it.



Airworthy Debond Limits for Stainless Steel Erosion Shields
Figure 9

(b) No two chordwise cracks may occur within 6 inches (15.24 cm) of each other.

(c) Minor deformations due to impact damage that do not greatly affect the airfoil shape.

NOTE: The following damages, (d) through (h), do not render the blade unairworthy but should be repaired as soon as practical to prevent degradation of the condition.

(d) Crack or gouge in the erosion shield which is less than 0.125 inch (3.175 mm) deep and less than 0.25 square inch (1.6 cm^2), not to exceed 0.5 inch (12.7 mm) length.

(e) Debond located along the trailing side of the erosion shield which is no longer than 3.5 inches (8.89 cm) and no wider than 0.25 inch (63.5 mm) (Figure 9).

(f) Debond which is located at least 0.25 inch (63.5 mm) from the erosion shield trail side and has total area less than 2.5 square inches (16.12 sq cm), and is separated by at least 6 inches (15.24 cm) from any other debond area on the same blade surface (Figure 9).

(g) The total debonded area of all debonds may not exceed 10 square inches (64.5 sq cm).

(h) No cadmium screw corrosion is permissible.

(3) Blade Cuff (Model: LM10585(N)(B,AK)+4)

(a) Nicks, scratches.

(b) Depressions less than 1 square inch (6.45 sq cm) area and less than 0.25 inch (63.5 mm) deep.

(c) Delaminations less than 2 sq in (12.9 sq cm).

(d) Cracks at the root end are airworthy, but should be sealed to protect the foam from contamination (Figure 10) until time of overhaul where these cracks can be permanently repaired.

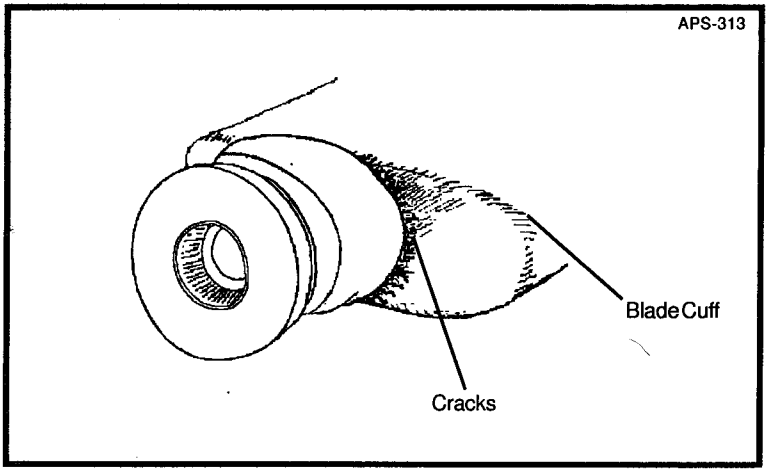
(e) Cracks located in the area where the cuff and blade meet must be within the limits as shown in Figure 11.

(f) No more than two other cracks may be located elsewhere on the cuff. These cracks must be less than 3.0 inches (7.62 cm) in length.

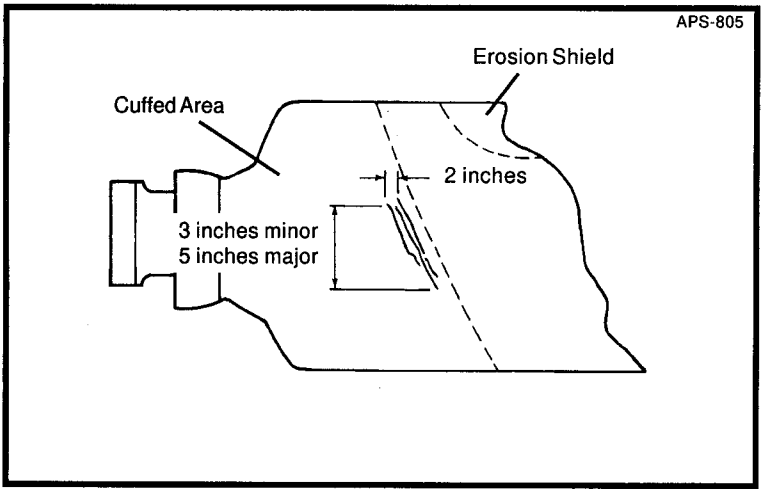
(g) No more than two damaged areas per side are permitted within 6 linear inches (15.24 cm) of each other. Root end cracks and cracks where the blade and cuff meet are not included in this requirement.

(h) Cuffs with no boot or erosion shield covering the leading edge may have no cracks within 2.0 inches (5.08 cm) of leading edge counterweight clamp that are not debonded.

(i) Cracks parallel to the leading edge totaling less than 6.0 inches (15.24 cm) in length and not extending beyond the inboard edge of the de-icer boot are airworthy but should be repaired during overhaul.



Blade Cuff Damage
Figure 10



Cracks in the Area
Where Cuff Meets Blade
Figure 11

(4) Kevlar® Blade Damage (Models: 7690C, 7890K, B7421(K), M10083(K), A10460(E)(K), LM10585ANK+4, LM10585(A)NB+4, M10877K, E10950(P)K, E11990K, E12902K

(a) Gouges

1 Gouges or loss of composite material less than 0.500 inch (12.7 mm) diameter or equivalent area (0.2 in^2 or 1.29 cm^2) and no more than 2.5 inches (6.35 cm) long and less than 0.020 inch (5.08 mm) deep anywhere on the outboard half of the blade.

2 Gouges, loss of composite material, or delaminations on the inboard half of the blade can be unairworthy and the factory should be consulted.

(b) Delamination

Delamination on outboard half of the blade totaling less than 2.0 square inches (12.9 sq cm) with no dark brown or black stain (indicating presence of grease).

(c) Paint Erosion

Exposure of less than 5.0 square inches (32.25 sq cm) of the composite material and/or the primer filler. This allowable does not refer to primer sealer.

NOTE: Propellers which have blades that exhibit paint erosion which exceeds airworthy damage limits may continue operation for an additional 250 hours or 1 (one) month, whichever comes first.

(d) Crushed or Cracked Trailing Edge (Figure 12)

1 E10950(P)K Design Only

a From the 15 to 20 inch station, crushed or cracked area no larger than 0.125 inch deep x 1.0 inch (3.18 x 25.4 mm) long.

b From the 20 inch station to the tip, crushed or cracked area no larger than 0.25 inch deep x 3.0 inch (6.35 x 76.2 mm) long.

2 All Composite Blade Designs except E10950(P)K

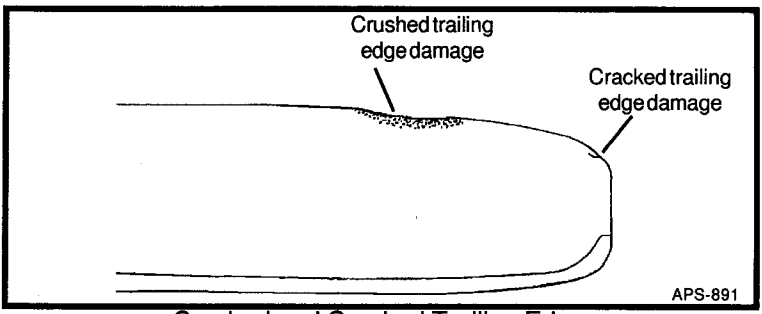
Crushed or cracked area no larger than 0.25 inch deep x 2.0 inch (6.35 x 25.4 mm) long on the outer half of the blade.

(e) Split Trailing Edge

1 E10950(P)K Design Only

a From the 14 to 20 inch station, split area no larger than 0.5 deep x 6.0 inches (12.7 x 152.4 mm) long.

b From the 20 inch station to the tip, split area no larger than 0.75 inch deep x 8.0 inches (19.05 x 203.2 mm) long.



Crushed and Cracked Trailing Edge
Figure 12

c No damaged fibers or exposed foam allowed.

2 All Kevlar® Composite Blade Designs except E10950(P)K:

Split area no larger than 0.5 inch deep x 6.0 inch (12.7 x 152.4 mm) long with no fiber damage or exposed foam.

(5) Erosion Screen (Models: M10083(K) and E10950(P)K)

(a) The limits of erosion screen damage which would require replacement at overhaul are given in the Hartzell Manual No. 61-13-35. Prior to overhaul, these limits may be exceeded, with the blades still considered airworthy.

(b) Operator should use best judgement as to whether screen should be replaced before overhaul. If damage is too severe, risk of rendering the blade unairworthy is possible.

(6) Blade Retention Windings (Models: M10083(K), LM10585( )( )+4, M10877K)

Cracks appearing in the paint over the blade retention windings are airworthy. These cracks should be repaired as soon as practical.

(7) Blade De-icer

The propeller de-icer system is controlled by the airframe manufacturer. All de-ice systems are manufactured by BF Goodrich (BFG). Refer to the applicable Aircraft Flight Manual (AFM), Aircraft Maintenance Manual (AMM) or BFG documentation for de-ice system inspections.

6. Unairworthy Damage

CAUTION: UNAIRWORTHY DAMAGE TO A HARTZELL COMPOSITE BLADE MUST BE REPAIRED BEFORE THE NEXT FLIGHT.

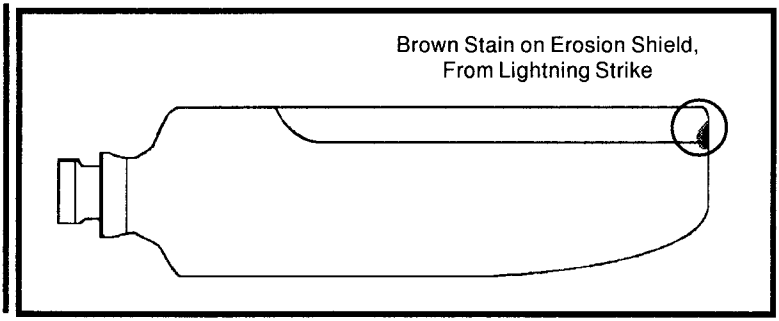
A. Any damage which exceeds that of airworthy is considered unairworthy.

B. Areas of unairworthy damage must be repaired prior to further flight.

7. Lightning Strike Damage (Figure 13)

CAUTION: ANY KEVLAR® COMPOSITE BLADE SUSPECTED OF LIGHTNING STRIKE MUST BE INSPECTED AND MAY REQUIRE OVERHAUL.

NOTE: Lightning usually enters the propeller through the metal erosion shield or the stainless steel mesh (if applicable) of a blade. The charge typically enters at the tip of the blade and travels through the erosion shield toward the hub. The charge exits the erosion shield at the inboard end and enters the next conductive element in the path.



Evidence of Lightning Strike Damage to Composite Blade
Figure 13

A. If a lightning strike is suspected, perform a thorough visual inspection looking for the indications of a lightning strike.

If lightning strike is present, a darkened area and possible pitting, usually in proximity of the tip and at the most inboard end of the metal erosion shield, will be noticeable. If the blade has a de-icer boot installed it may be debonded from the erosion shield due to the strike. In any case, the de-icer may be damaged. Lightning strikes may also cause one or all of the following: debonding, lifting, and buckling of the metal erosion shield and delamination and splitting of the laminate.

B. If no evidence of a lightning strike exists then no further maintenance action is required.

C. If evidence of a lightning strike is discovered, further inspection is required before further flight. It may be permissible for a propeller to be operated for an additional ten (10) hours prior to disassembly and inspection per applicable overhaul manual*. The additional ten (10) hours are permissable, if the propeller and blades are not severely damaged and blades meet airworthiness criteria discussed earlier in this section.

CAUTION: CONSULT AIRFRAME MANUFACTURER'S MANUALS. THERE MAY BE ADDITIONAL REQUIREMENTS SUCH AS DE-ICE SYSTEM CHECKS TO PERFORM IN THE EVENT OF PROPELLER LIGHTNING STRIKE.

(1) Procedure for Temporary Operation

(a) Remove spinner dome and perform visual inspection of propeller, spinner, and de-ice system for evidence of significant damage that would require repair prior to flight (such as broken de-ice wires or arcing damage to the propeller hub).

*Overhaul manuals are currently being revised. If overhaul manual does not state lightning strike criteria refer to Standard Practices Manual 61-01-02 (202A).

(b) Perform visual and coin tap inspections of the composite blades that have indications of arcing. If the damage is minor and does not exceed airworthy damage limits specified earlier in this section, then operation for ten (10) hours is acceptable prior to disassembly and inspection per applicable overhaul manual*.

(2) Required inspection in the event of a lightning strike.

Disassemble propeller and inspect per applicable overhaul manual*. This procedure must be performed by FAA approved personnel.

*Overhaul manuals are currently being revised. If overhaul manual does not state lightning strike criteria refer to Standard Practices Manual 61-01-02 (202A).

8. Minor Repair

A. A complete description of minor repair techniques, tools, and materials is available in Hartzell Manual No. 61-13-35 Composite Blade Manual.

B. It is *extremely important* that only those repair techniques, tools and materials described in Hartzell Manual No. 61-13-35 be used. Substitution of materials described in Manual No. 61-13-35 is not permitted (i.e. use of one part spray can lacquers and enamels is not permitted for refinishing blades between overhauls. Also, the use of "Quick Setting" epoxies, unless described in Manual No. 61-13-35, is not permitted when performing blade repairs).