HARTZELL PROPELLER INC.
One Propeller Place
Piqua, Ohio 45356-2634 U.S.A.
Telephone: 937.778.4200
Fax: 937.778.4391

HARTZELL

MANUAL REVISION TRANSMITTAL
Manual 146 (61-00-46)
Propeller Owner's Manual and Logbook

REVISION 3 dated June 2012

Attached is a copy of Revision 3 to Hartzell Propeller Inc. Manual 146.

Page Control Chart for Revision 3:

Remove Page No.	**Insert** Page No.
COVER AND INSIDE COVER	COVER AND INSIDE COVER
REVISION HIGHLIGHTS pages 5 and 6	REVISION HIGHLIGHTS pages 5 and 6
SERVICE DOCUMENTS LIST pages 11 and 12	SERVICE DOCUMENTS LIST pages 11 and 12
LIST OF EFFECTIVE PAGES pages 15 and 16	LIST OF EFFECTIVE PAGES pages 15 and 16
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MAINTENANCE PRACTICES pages 6-1 thru 6-36	MAINTENANCE PRACTICES pages 6-1 thru 6-38
DE-ICE SYSTEMS pages 7-1 thru 7-6	DE-ICE SYSTEMS pages 7-1 thru 7-6

NOTE 1: When the manual revision has been inserted in the manual, record the information required on the Record of Revisions page in this manual.

FAA Approved
Manual No. 146
61-00-46
Revision 3
June 2012

Propeller Owner's Manual
and Logbook

Models: **HC-B3MN-3**
HC-B4MN-5AL
HC-B4MP-3A

Steel Hub Turbine Propellers with Composite Blades

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 3, dated June 2012, incorporates the following:

- Revised the Cover, Revision Highlights, Service Documents List, List of Effective Pages and Table of Contents as required
- Added Caution statements about propeller critical parts where applicable throughout the manual
- Added Warning statements about propeller cleaning agents where applicable throughout the manual
- Revised references to "Hartzell" to become "Hartzell Propeller Inc." throughout the manual
- Revised references to "repair facility" to become "service facility" throughout the manual
- Revised illustration identification throughout the manual
- Introduction
  - Added information and definitions regarding propeller critical parts
- Description and Operation
  - Updated composite blade overview
- Installation and Removal
  - Updated Figure 3-6
  - Added caution and information about examining the beta feedback collar.

REVISION HIGHLIGHTS

1. Introduction

   A. General

      This is a list of current revisions that have been issued against this manual. Please compare it to the RECORD OF REVISIONS page to ensure that all revisions have been added to the manual.

   B. Components

      (1) Revision No. indicates the revisions incorporated in this manual.

      (2) Issue Date is the date of the revision.

      (3) Comments indicates the level of the revision.

         (a) New Issue is a new manual distribution. The manual is distributed in its entirety. All the page revision dates are the same and no change bars are used.

         (b) Reissue is a revision to an existing manual that includes major content and/or major format changes. The manual is distributed in its entirety. All the page revision dates are the same and no change bars are used.

         (c) Major Revision is a revision to an existing manual that includes major content or minor content changes over a large portion of the manual. The manual is distributed in its entirety. All the page revision dates are the same, but change bars are used to indicate the changes incorporated in the latest revision of the manual.

         (d) Minor Revision is a revision to an existing manual that includes minor content changes to the manual. Only the revised pages of the manual are distributed. Each page retains the date and the change bars associated with the last revision to that page.

Revision No.	Issue Date	Comments
Original	Oct/99	New Issue
Rev. 1	Oct/04	Minor Revision
Rev. 2	Jul/10	Minor Revision
Rev. 3	Jun/12	Minor Revision

SERVICE DOCUMENTS LIST

CAUTION 1: DO NOT USE OBSOLETE OR OUTDATED INFORMATION. PERFORM ALL INSPECTIONS OR WORK IN ACCORDANCE WITH THE MOST RECENT REVISION OF A SERVICE DOCUMENT. INFORMATION CONTAINED IN A SERVICE DOCUMENT MAY BE SIGNIFICANTLY CHANGED FROM EARLIER REVISIONS. FAILURE TO COMPLY WITH INFORMATION CONTAINED IN A SERVICE DOCUMENT OR THE USE OF OBSOLETE INFORMATION MAY CREATE AN UNSAFE CONDITION THAT MAY RESULT IN DEATH, SERIOUS BODILY INJURY, AND/OR SUBSTANTIAL PROPERTY DAMAGE.

CAUTION 2: THE INFORMATION FOR THE DOCUMENTS LISTED INDICATES THE REVISION LEVEL AND DATE AT THE TIME THAT THE DOCUMENT WAS INITIALLY INCORPORATED INTO THIS MANUAL. INFORMATION CONTAINED IN A SERVICE DOCUMENT MAY BE SIGNIFICANTLY CHANGED FROM EARLIER REVISIONS. REFER TO THE APPLICABLE SERVICE DOCUMENT INDEX FOR THE MOST RECENT REVISION LEVEL OF THE SERVICE DOCUMENT.

Service Document Number	Incorporation Rev/Date
Service Bulletins:	
SB 169A	Rev 2, Jul/10

SERVICE DOCUMENTS LIST

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1. Purpose

CAUTION: KEEP THIS MANUAL WITH THE PROPELLER, OR WITH THE AIRCRAFT ON WHICH IT IS INSTALLED, AT ALL TIMES. THE LOGBOOK RECORD WITHIN THIS MANUAL MUST BE MAINTAINED, RETAINED CONCURRENTLY, AND BECOME A PART OF THE AIRCRAFT AND ENGINE SERVICE RECORDS.

A. This manual supports constant speed feathering and reversing steel hub turbine propellers with composite blades.

B. The purpose of this manual is to enable qualified personnel to install, operate, and maintain a Hartzell Propeller Inc. Constant Speed Feathering and Reversing Propeller with composite blades. Separate manuals are available concerning overhaul procedures and specifications for the propeller.

C. This manual covers different design types.

(1) Sample hub and blade model numbers within each design are covered in the Description and Operation chapter of this manual.

NOTE: All propeller models included in this manual use composite propeller blades. Identical propeller types that use aluminum blades are supported by Hartzell Propeller Inc. Manual 139 (61-00-39).

2. Airworthiness Limits

Refer to the Airworthiness Limitations chapter of this manual for information about airworthiness limits.

3. Airframe or Engine Modifications

A. Propellers are approved vibrationwise on airframe and engine combinations based on tests or analysis of similar installations. This data has demonstrated that propeller stress levels are affected by airframe configuration, airspeed, weight, power, engine configuration, and flight maneuvers. Aircraft modifications which can effect propeller stress include, but are not limited to: aerodynamic changes ahead of or behind the propeller, realignment of the thrust axis, increasing airspeed limits, decreasing stall speed, increasing or decreasing weight limits (less significant on piston engines), and the addition of approved flight maneuvers (utility and aerobatic).

B. Engine modifications can also affect the propeller. The two primary categories of engine modifications are those which affect structure and those which affect power. An example of a structural engine modification is the alteration of the crankshaft or damper of a piston engine. Any change to the weight, stiffness or tuning of rotating components could result in a potentially dangerous resonant condition which is not detectable by the pilot. Most common engine modifications affect the power during some phase of operation. Some increase the maximum power output, while others improve the power available during hot and high operation (flat rating) or at off-peak conditions. Examples of such engine modifications include, but are not limited to: changes to the compressor, power turbine or hot section of a turboprop engine; and on piston engines, the addition or alteration of a turbocharger or turbonormalizer, increased compression ratio, increased RPM, altered ignition timing, electronic ignition, full authority digital electronic controls (FADEC), or tuned induction or exhaust.

C. All such modifications must be reviewed and approved by the propeller manufacturer prior to obtaining approval on the aircraft.

4. Restrictions and Placards

A. The propellers covered by this manual may have a restricted operating range that requires a cockpit placard. The restrictions, if present, will vary depending on the propeller, blade, engine, and/or aircraft model. Review the propeller and aircraft type certificate data sheet (TCDS), Pilot Operating Handbook (POH), and any applicable Airworthiness Directives for specific information.

WARNING: STABILIZED GROUND OPERATION WITHIN THE PROPELLER RESTRICTED RPM RANGE CAN GENERATE HIGH PROPELLER STRESSES AND RESULT IN FATIGUE DAMAGE TO THE PROPELLER. THIS DAMAGE CAN LEAD TO A REDUCED PROPELLER FATIGUE LIFE, PROPELLER FAILURE, AND LOSS OF CONTROL OF THE AIRCRAFT. THE PROPELLER RESTRICTED RPM RANGE IS DEFINED IN THE AIRPLANE FLIGHT MANUAL (AFM).

B. The propeller operating restrictions or limitations are found in the Airplane Flight Manual (AFM) or Airplane Flight Manual Supplement (AFMS).

C. If a propeller RPM operating restriction or limitation is violated, refer to the Special Inspections section in the Inspection and Check chapter of this manual for corrective actions.

5. General

A. Personnel Requirements

(1) Personnel performing maintenance on steel hub propellers are expected to have sufficient training and certifications (when required by the applicable Aviation Authority) to accomplish the work required in a safe and airworthy manner.

(2) Inspection, Repair, and Overhaul

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

B. Maintenance Practices

(1) The propeller and its components are highly vulnerable to damage while they are removed from the engine. Properly protect all components until they are reinstalled on the engine.

(2) Never attempt to move the aircraft by pulling on the propeller.

(3) 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) Use only the approved consumables, e.g., cleaning agents, lubricants, etc.

(5) Safe Handling of Paints and Chemicals

(a) Always use caution when handling or being exposed to paints and/or chemicals during propeller overhaul and maintenance procedures.

(b) Before using paint or chemicals, always read the manufacturer's label on the container and follow specified instructions and procedures.

(c) Refer to the product's Material Safety Data Sheet (MSDS) for detailed information about physical properties, health, and physical hazards of any chemical.

(6) Observe applicable torque values during maintenance.

(7) Before installing the propeller on the engine, the propeller must be statically balanced. New propellers are statically balanced at Hartzell Propeller Inc. Overhauled propellers must be statically balanced by an appropriately licensed propeller repair facility before return to service.

NOTE: Dynamic balancing is recommended, but may be accomplished at the discretion of the operator, unless specifically required by the airframe or engine manufacturer. Dynamic balancing must be accomplished in accordance with the procedures and limitations in the Maintenance Practices chapter of this manual. Additional procedures may be found in the aircraft maintenance manual.

(8) As necessary, use a soft, non-graphite pencil or crayon to make identifying marks on components.

(9) As applicable, follow military standard NASM33540 for safety wire and cotter pin general practices. Use 0.032 inch (0.81 mm) diameter stainless steel safety wire unless otherwise indicated.

(10) The airframe manufacturer's manuals should be used in addition to the information in this manual due to possible special requirements for specific aircraft applications.

(11) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller Inc., applicable instructions and technical information for the components supplied by Hartzell Propeller Inc. can be found in the following publications available on the Hartzell Propeller Inc. website at www.hartzellprop.com:

(a) Manual 180 (30-61-80) - Propeller Ice Protection System Manual

(b) Manual 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual

(c) Manual 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual.

(12) Propeller ice protection system components not supplied by Hartzell Propeller Inc. are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).

C. Continued Airworthiness

Operators are urged to keep informed of airworthiness information via Hartzell Propeller Inc. Service Bulletins and Service Letters, which are available from Hartzell Propeller Inc. distributors or from the Hartzell Propeller Inc. factory by subscription. Selected information is also available on the Hartzell Propeller Inc. website at www.hartzellprop.com.

D. Propeller Critical Parts

(1) The following maintenance procedures may involve propeller critical parts. These procedures have been substantiated based on Engineering analysis that expects this product will be operated and maintained using the procedures and inspections provided in the Instructions for Continued Airworthiness (ICA) for this product. Refer to the Illustrated Parts List chapter of the applicable maintenance manual for the applicable propeller model for the identification of specific Critical Parts.

(2) Numerous propeller system parts can produce a propeller Major or Hazardous effect, even though those parts may not be considered as Critical Parts. The operating and maintenance procedures and inspections provided in the ICA for this product are, therefore, expected to be accomplished for all propeller system parts.

6. Reference Publications

The following publications are referenced within this manual:

Hartzell Propeller Inc. Manual No. 118F (61-10-18) - Three and Four-Blade Steel Hub Turbine Propeller Maintenance Manual

Hartzell Propeller Inc. Manual No. 126 (61-00-26) - Active Service Bulletins, Letters, Instructions, and Advisories

Hartzell Propeller Inc. Manual No. 127 (61-16-27) - Spinner Assembly Maintenance Manual

Hartzell Propeller Inc. Manual No. 135F (61-13-35) - Composite Propeller Blade Maintenance Manual

Hartzell Propeller Inc. Manual No. 159 (61-02-59) - Application Guide (Also available on the Hartzell Propeller Inc. website at www.hartzellprop.com)

Hartzell Propeller Inc. Manual No. 165A (61-00-65) - Illustrated Tool and Equipment Manual

Hartzell Propeller Inc. Manual No. 180 (30-61-80) - Propeller Ice Protection System Manual (Also available on the Hartzell Propeller Inc. website at www.hartzellprop.com)

Hartzell Propeller Inc. Manual No. 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual (Also available on the Hartzell Propeller Inc. website at www.hartzellprop.com)

Hartzell Propeller Inc. Manual No. 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual (Also available on the Hartzell Propeller Inc. website at www.hartzellprop.com)

Hartzell Propeller Inc. Manual No. 202A (61-01-02) - Standard Practices Manual - Volumes 1 through 11

Hartzell Propeller Inc. Service Letter HC-SL-61-61Y - Propeller Overhaul Periods and Service Life Limits for Hartzell Propeller Inc. Propellers, Governors, and Propeller Damper Assemblies - (Also available on the Hartzell Propeller Inc. website at www.hartzellprop.com)

7. Definitions

A basic understanding of the following terms will assist in maintaining and operating Hartzell Propeller Inc. propeller systems.

Term	Definition
Annealed	Softening of material due to overexposure to heat.
Blade Angle	Measurement of blade airfoil location described as the angle between the blade airfoil and the surface described by propeller rotation.
Brinelling	A depression caused by failure of the material in compression.
Chord Line	A straight line between the leading and trailing edges of an airfoil.
Composite Material	Kevlar® (yellow) or graphite (black) fibers bound together with or encapsulated within an epoxy resin.
Constant Force	A force that is always present in some degree when the propeller is operating.
Constant Speed	A propeller system that employs a governing device to maintain a selected engine RPM.
Corrosion	Gradual material removal or deterioration due to chemical action.
Crack	Irregularly shaped separation within a material, sometimes visible as a narrow opening at the surface.
Debond	Separation of two materials that were originally bonded together in a separate operation.
Delamination	Internal separation between the layers of composite material.

Term	Definition
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	Material open to action of the elements.
Feathering	The capability of blades to be rotated parallel to the relative wind, thus reducing aerodynamic drag.
Fretting	Damage that develops when relative motion of small displacement takes place between contacting parts, wearing away the surface.
Gouge	Surface area where material has been removed.
Hazardous Propeller Effect	The hazardous propeller effects are defined in Title 14 CFR section 35.15(g)(1).
Horizontal Balance	Balance between the blade tip and the center of the hub.
Impact Damage	Damage that occurs when the propeller blade or hub assembly strikes, or is struck by, an object while in flight or on the ground.
Major Propeller Effect	The major propeller effects are defined in Title 14 CFR section 35.15(g)(2).
Nick	Removal of paint and possibly a small amount of material.
Onspeed	Condition in which the RPM selected by the pilot through the propeller control lever and the actual

Term	Definition
	engine (propeller) RPM are equal.
Overhaul	The periodic disassembly, inspection, repair, refinish, and reassembly of a propeller assembly to maintain airworthiness.
Overspeed	Condition in which the RPM of the propeller or engine exceeds predetermined maximum limits; the condition in which the engine (propeller) RPM is higher than the RPM selected by the pilot through the propeller control lever.
Overspeed Damage	Damage that occurs when the propeller hub assembly rotates at a speed greater than the maximum limit for which it is designed.
Pitting	Formation of a number of small, irregularly shaped cavities in surface material caused by corrosion or wear.
Propeller Critical Parts	A part on the propeller whose primary failure can result in a hazardous propeller effect, as determined by the safety analysis required by Title 14 CFR section 35.15.
Reversing	The capability of rotating blades to a position to generate reverse thrust to slow the aircraft or back up.
Scratch	Same as "Nick".
Single Acting	Hydraulically actuated propeller that uses a single oil supply for pitch control.
Split	Delamination of blade extending to the blade surface, normally found near the trailing edge or tip.

Term	Definition
Synchronizing	Adjusting the RPM of all the propellers of a multi-engine aircraft to the same RPM.
Synchrophasing	A form of propeller sychronization in which not only the RPM of the engines (propellers) are held constant, but also the position of the propellers in relation to each other.
Track	In an assembled propeller, a measurement of the location of the blade tip with respect to the plane of rotation, used to verify face alignment and to compare blade tip location with respect to the locations of the other blades in the assembly.
Underspeed	The condition in which the actual engine (propeller) RPM is lower than the RPM selected by the pilot through the propeller control lever
Variable Force	A force that may be applied or removed during propeller operation.
Windmilling	The rotation of an aircraft propeller caused by air flowing through it while the engine is not producing power.

8. Abbreviations

Abbreviation	Term
AMM	Aircraft Maintenance Manual
AN	Air Force-Navy (or Army-Navy)
AOG	Aircraft on Ground
FAA	Federal Aviation Administration
Ft-Lb	Foot-Pound
ICA	Instructions for Continued Airworthiness
ID	Inside Diameter
In-Lb	Inch-Pound
Lbs	Pounds
MIL-X-XXX	Military Specification
MPI	Major Periodic Inspection (Overhaul)
MS	Military Standard
MSDS	Material Safety Data Sheet
OD	Outside Diameter
NAS	National Aerospace Standards
N•m	Newton-Meters
POH	Pilot's Operating Handbook
PSI	Pounds per Square Inch
RPM	Revolutions per Minute
TBO	Time Between Overhaul
TSN	Time Since New
TSO	Time Since Overhaul

NOTE: TSN/TSO is considered as the time accumulated between rotation and landing, i.e., flight time.

9. Hartzell Propeller Inc. Product Support

Hartzell Propeller Inc. is ready to assist you with questions concerning your propeller system. Hartzell Propeller Inc. Product Support may be reached during business hours (8:00 a.m. through 5:00 p.m., United States Eastern Time) at (937) 778-4379 or at (800) 942-7767, toll free from the United States and Canada. Hartzell Propeller Inc. Product Support can also be reached by fax at (937) 778-4391, and by email at techsupport@hartzellprop.com.

After business hours, you may leave a message on our 24 hour product support line at (937) 778-4376 or at (800) 942-7767, toll free from the United States and Canada. A technical representative will contact you during normal business hours. Urgent AOG support is also available 24 hours per day, seven days per week via this message service.

Additional information is available on our website at www.hartzellprop.com.

NOTE: When calling from outside the United States, dial (001) before dialing the above telephone numbers.

10. Warranty Service

If you believe you have a warranty claim, it is necessary to contact Hartzell's Warranty Administrator. Hartzell's Warranty Administrator will provide you with a *Warranty Application* form. It is necessary to complete this form and return it to the Warranty Administrator for evaluation **before proceeding with repair or inspection work**. Upon receipt of this form, the Warranty Administrator will provide instructions on how to proceed. Hartzell Propeller Inc. Warranty may be reached during business hours (8:00 a.m. through 5:00 p.m., United States Eastern Time) at 937-778-4379, or toll free at (800) 942-7767. Hartzell Propeller Inc. Warranty Adminstration can also be reached by fax, at (937) 778-4391, or by email at warranty@hartzellprop.com.

NOTE: When calling from outside the United States, dial (001) before dialing the above telephone numbers.

11. Hartzell Propeller Inc. Recommended Facilities

    A. Hartzell Propeller Inc. recommends using Hartzell Propeller Inc. approved distributors and repair facilities for the purchase, repair and overhaul of Hartzell Propeller Inc. propeller assemblies or components.

    B. Information about the Hartzell Propeller Inc. worldwide network of aftermarket distributors and approved repair facilities is available on the Hartzell Propeller Inc. website at www.hartzellprop.com.

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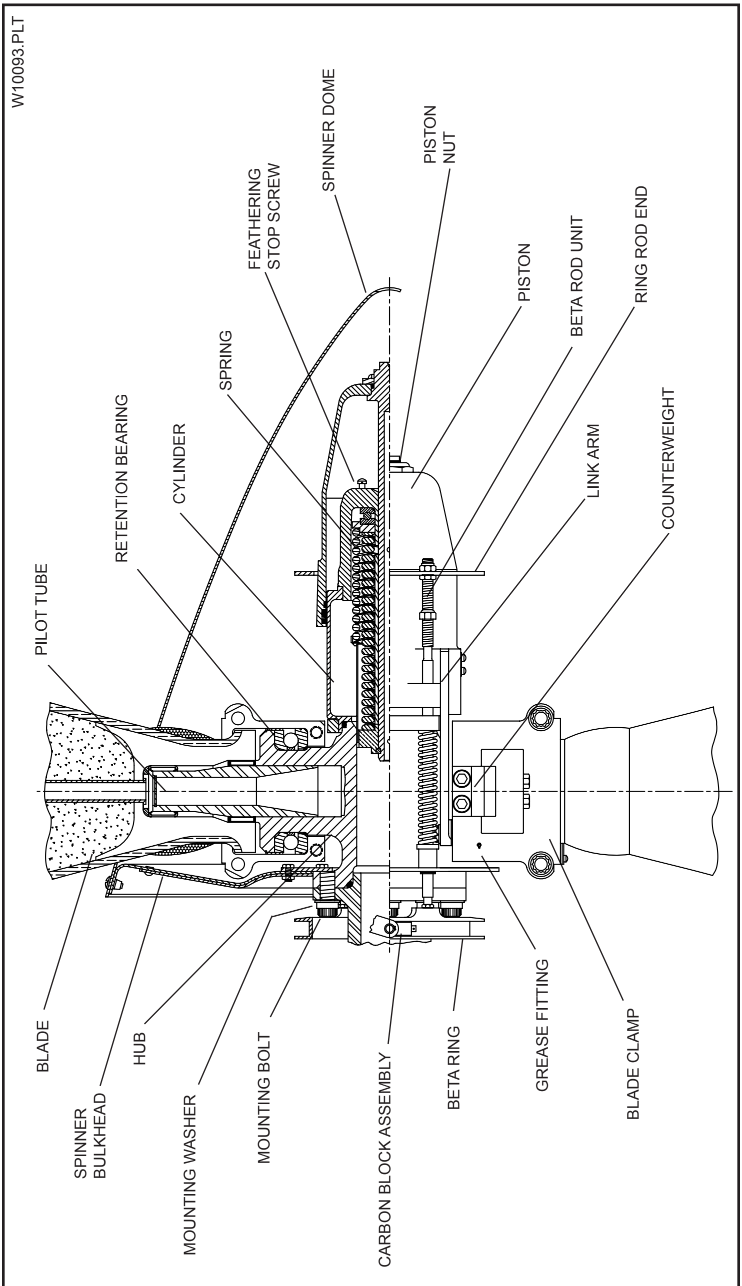

HC-B(3,4)( )( )-3( ) Propeller Assembly
Figure 2-1

1. Functional Description of Constant Speed Propeller Types

   A. Feathering and Reversing Propellers HC-B(3,4)( )( )-3( ) (External Beta System)

      Refer to Figure 2-1. The propellers described in this section are constant speed, feathering and reversing. They use a single oil supply from a governing device to hydraulically actuate a change in blade angle. The propellers can have three or four blades, and they are used primarily on Pratt and Whitney turbine engines.

      Propeller blades and bearing assemblies are mounted on the arms of a steel hub unit (Figure 2-2) and are held in place by two-piece blade clamps. A cylinder is threaded onto the hub, and a feathering spring assembly is installed in the cylinder. A piston is placed over the cylinder and is connected by a link arm to each blade clamp. Propeller blade angle change is accomplished through the linear motion of the hydraulically actuated piston that is transmitted to each blade through the link arms and blade clamps.

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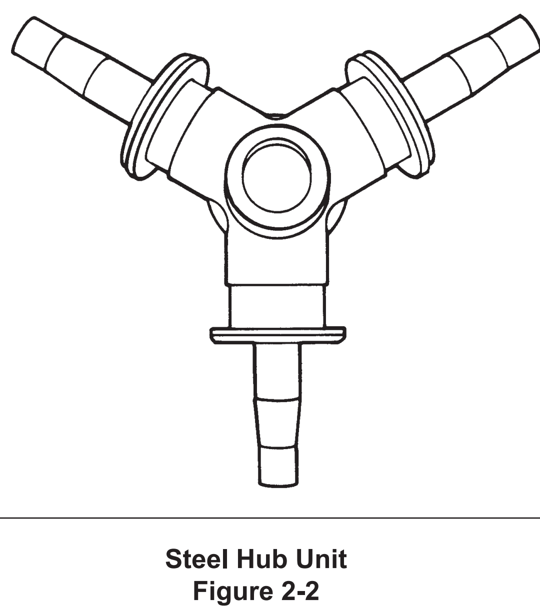


Steel Hub Unit
Figure 2-2

While the propeller is operating, the following forces are constantly present: 1) spring force, 2) counterweight force, 3) centrifugal twisting moment of each blade, and 4) blade aerodynamic twisting forces. The spring and counterweight forces attempt to rotate the blades to a higher blade angle, while the centrifugal twisting moment of each blade is generally acting toward lower blade angle. Blade aerodynamic twisting force is usually very small in relation to the other forces and can attempt to increase or decrease blade angle.

The summation of the propeller forces is toward higher pitch (low RPM) and is opposed by a variable force toward lower pitch (high RPM). The variable force is oil under pressure from a governor with an internal pump, which is mounted on and driven by the engine. The oil from the governor is supplied to the propeller and hydraulic piston through a hollow engine shaft. Increasing the volume of oil within the piston and cylinder will decrease the blade angle and increase propeller RPM. Decreasing the volume of oil will increase blade angle and decrease propeller RPM. By changing the blade angle, the governor can vary the load on the engine and maintain constant engine RPM (within limits), independent of where the power lever is set. The governor uses engine speed sensing mechanisms that allow it to supply or drain oil as necessary to maintain constant engine speed (RPM).

If governor supplied oil is lost during operation, the propeller will increase pitch and feather. Feathering occurs because the summation of internal propeller forces causes the oil to drain out of the propeller until the feather stop position is reached.

Normal in-flight feathering is accomplished when the pilot retards the propeller condition lever past the feather detent. This allows control oil to drain from the propeller and return to the engine sump. Engine shutdown is normally accomplished during the feathering process.

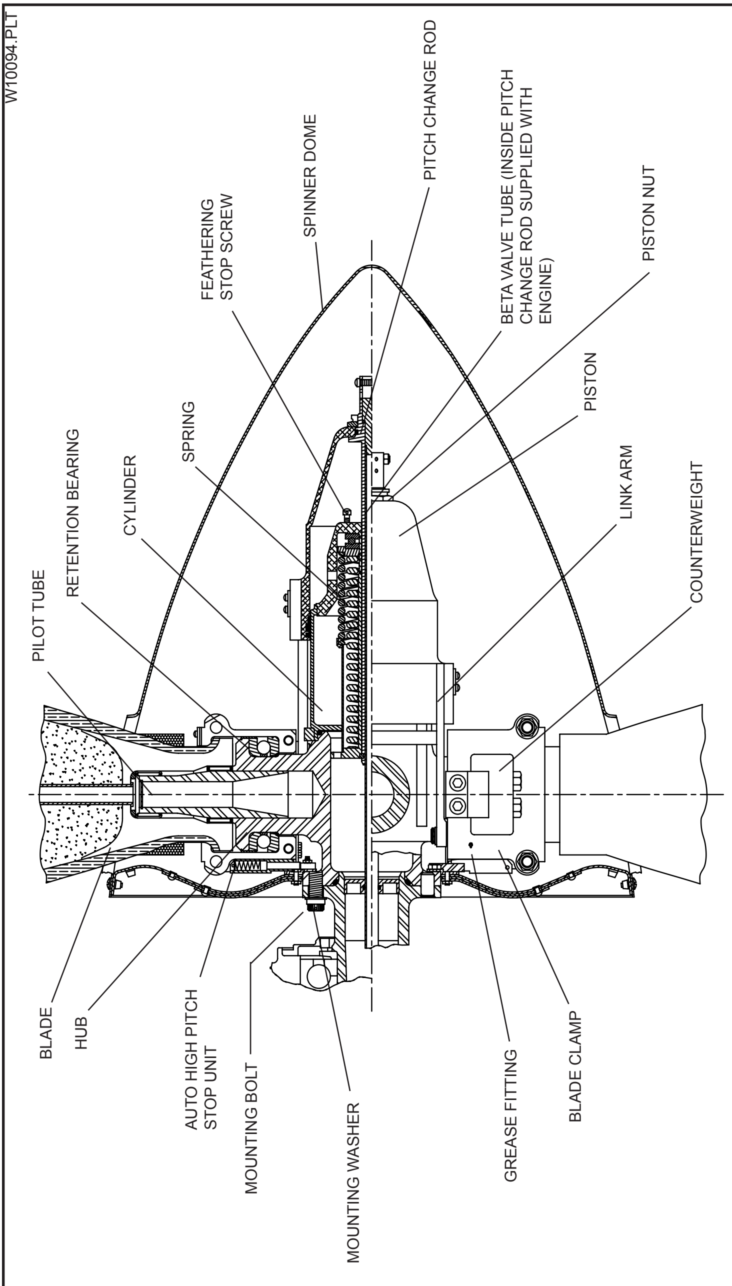
Normal in-flight unfeathering is accomplished when the pilot positions the propeller condition lever into the normal flight (governing) range and restarts the engine. As engine speed increases, the governor supplies oil to the propeller, and the blade angle decreases.

In reverse mode of operation, the governor operates in an underspeed condition to act strictly as a source of pressurized oil, without attempting to control RPM. The propeller blade angle in reverse is accomplished through the beta valve.

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

The propeller is reversed by manually repositioning the cockpit-control to cause the beta valve to supply oil from the governor pump to the propeller. An external propeller feedback mechanism, which includes a beta ring and carbon block assembly, communicates propeller blade angle position to the beta valve.

When the propeller reaches the desired reverse position, movement of the beta ring and carbon block assembly, initiated by the propeller piston, causes the beta valve to shut off the flow of oil to the propeller. Any additional unwanted movement of the propeller toward reverse, or any movement of the manually positioned beta valve control toward high pitch position will cause the beta valve to drain oil from the propeller to increase pitch.



HC-B(3,4)( )( )-5( ) Propeller Assembly
Figure 2-3

B. Feathering and Reversing Propeller HC-B(3,4)( )( )-5( ) (Internal Beta System)

Refer to Figure 2-3. The propellers described in this section are constant speed, feathering and reversing. They use a single oil supply from a governing device to hydraulically actuate a change in blade angle. The propellers can have three or four blades, and are used primarily on Garrett (Allied Signal) turbine engines.

Propeller blades and bearing assemblies are mounted on the arms of a steel hub unit (Figure 2-2) and are held in place by two-piece blade clamps. A cylinder is threaded onto the hub, and a feathering spring assembly is installed in the cylinder. A piston is placed over the cylinder and is connected by a link arm to each blade clamp. Propeller blade angle change is accomplished through the linear motion of the hydraulically actuated piston that is transmitted to each blade through the link arms and blade clamps.

While the propeller is operating, the following forces are constantly present: 1) spring force, 2) counterweight force, 3) centrifugal twisting moment of each blade, and 4) blade aerodynamic twisting forces. The spring and counterweight forces attempt to rotate the blades to higher blade angle, while the centrifugal twisting moment of each blade is generally toward lower blade angle. Blade aerodynamic twisting force is usually very small in relation to the other forces and can attempt to increase or decrease blade angle.

The summation of the propeller forces is toward higher pitch (low RPM) and is opposed by a variable force toward lower pitch (high RPM). The variable force is oil under pressure from a governor with an internal pump, which is driven by the engine. The oil from the governor is supplied to the propeller and hydraulic piston through a hollow engine shaft. Increasing the volume of oil within the piston and cylinder will decrease the blade angle and increase propeller RPM. Decreasing the volume of oil will increase blade angle and decrease propeller RPM. By changing the blade angle, the governor can vary the load on the engine and maintain constant engine RPM (within limits), independent of where the power lever is set. The governor uses engine speed sensing mechanisms that allow it to supply or drain oil as necessary to maintain constant engine speed (RPM).

If governor supplied oil is lost during operation, the propeller will increase pitch and feather. Feathering occurs because the summation of internal propeller forces causes the oil to drain out of the propeller until the feather stop position is reached.

Normal in-flight feathering is accomplished when the pilot places the propeller condition lever into feather position. This allows control oil to drain from the propeller and return to the engine sump. Engine shutdown is normally accomplished during the feathering process.

Normal in-flight unfeathering is accomplished when the pilot positions the propeller condition lever into the normal flight (governing) range, activates the auxiliary pump to decrease blade pitch, and restarts the engine. As engine speed increases, the governor supplies oil to the propeller, and the blade angle decreases until it reaches an onspeed condition.

In reverse mode of operation, the governor operates in an underspeed condition to act strictly as a source of pressurized oil, without attempting to control RPM. Propeller blade angle is then controlled by the pilot via the beta valve.

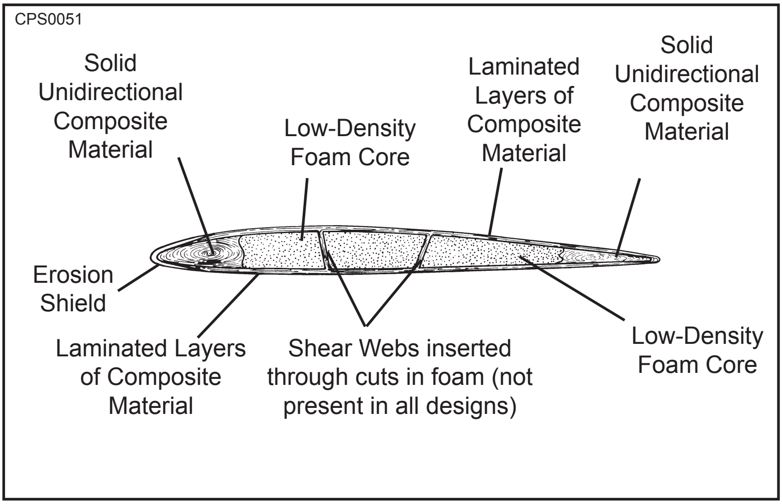
NOTE: The beta valve is normally located on the side of the reduction gearbox opposite the propeller.

The propeller is operated from ground idle to maximum reverse by manually repositioning the power lever within the beta range to cause the beta valve to supply oil from the governor pump to the propeller. A beta rod inserted into the front of the propeller communicates propeller blade angle position to the beta valve. When the propeller reaches the desired negative blade angle, movement of the beta rod causes the beta valve to shut off the flow of oil to the propeller. Any additional unwanted movement of the propeller toward reverse, or any movement of the manually positioned beta valve control toward high pitch position will cause the beta valve to drain oil from the propeller to increase pitch.

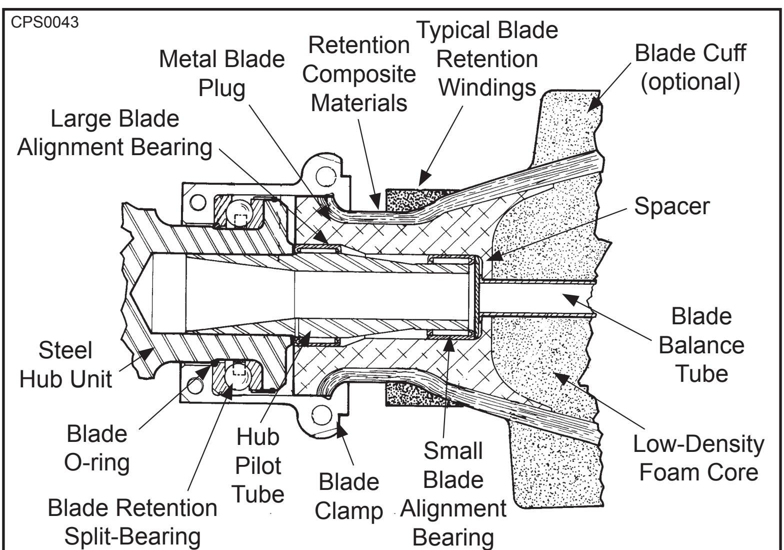
It is undesirable to feather the propeller when the engine is stopped after landing the aircraft. This propeller type is normally installed on a fixed shaft engine that causes the propeller to rotate during an engine start process. If the propeller is in feather position, an overload on the electric engine starter will occur.

To prevent feathering during normal engine shutdown, the propeller incorporates spring-energized latch pins called start lock units. These units are installed either on a two-piece spinner mounting plate or on the spinner bulkhead, which is bolted to the propeller hub flange. If propeller rotation is approximately 800 RPM or above, the auto high pitch stop units are disengaged from the blade clamp mounted plates by centrifugal force acting on the latch pins to compress the springs (within the units). When the RPM drops below 800, the springs overcome the centrifugal force and move the latch pins to engage the clamp-mounted plate, preventing blade angle movement to feather.

Shortly after engine start-up, with the propeller RPM above 800, the latch pins in the auto high pitch stop units will still retain the blade angle. To release the latch pins, it is necessary to manually actuate the propeller slightly toward reverse. This will move the clamp-mounted plate, allowing the latch pins to slide freely. Centrifugal force will compress the springs and disengage the pins from the plate.



Section of Typical Composite Blade
Figure 2-4



Composite Blade Retention System for Steel Hub
Figure 2-5

2. Overview of Composite Blades

A. Composite Blades

(1) Composite blades are composed of a metal blade shank (plug) into which is molded a low-density foam core.

(a) These internal components are covered by layers of laminated composite materials that make up the outer shell of the blade.

(b) The laminated blade then undergoes compressive molding that provides the final airfoil shape and bonds the composite materials to the blade plug.

(c) The foam core is used to support the layers of laminated composite materials during the manufacturing process.

(d) Refer to Figure 2-4 for the end view of a sectioned cord line.

NOTE: On some blade designs the original molded shape contains a recess on the leading edge for the de-ice boot and/or the erosion shield.

(2) The laminated composite materials that are an integral component of the blade provide a retention load path that extends directly under the clamp in steel hubs (or bearing in aluminum hubs) for blade retention. Refer to Figure 2-5.

(3) An electroformed nickel erosion shield is adhesively bonded over the leading edge of the blade to provide protection from impact and erosion damage.

(a) The LM10585 blade was introduced with a stainless steel erosion shield, but can only be replaced with a nickel shield.

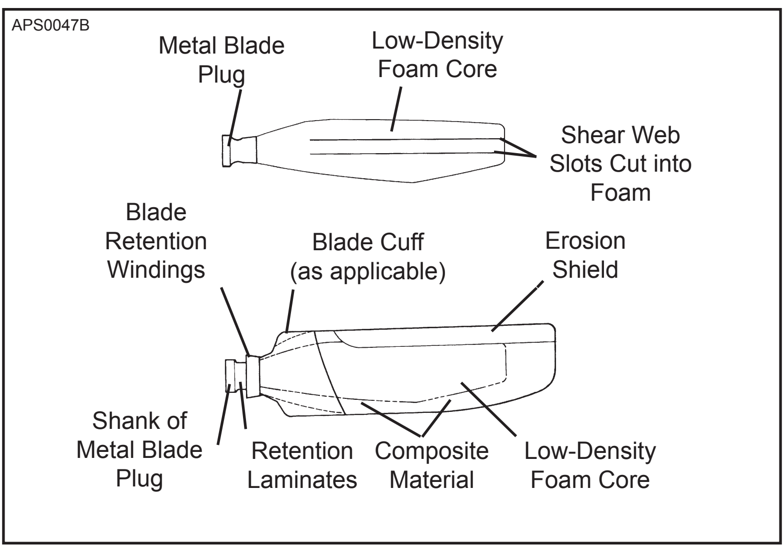
(4) Some designs incorporate a stainless steel wire mesh into the fabrication to inhibit erosion in blade tip areas.

(5) Some designs incorporate a non-structural blade cuff of low-density foam that is molded to the blade and covered with composite material. Refer to Figure 2-6.

(6) Filament windings of composite material provide additional retention of the blade composite materials to the internal metal plug. On some designs the windings also provide a machinable surface for the application of a blade/hub seal.

(7) Some designs use a filament winding on the inboard end of the erosion shield to aid the retention of the erosion shield.

(a) This winding is sometimes referred to as an erosion shield winding and should not be confused with the blade retention winding that is used to attach the blade material to the internal metal plug.



Basic Components of the Composite Blade
Figure 2-6

(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 (that may protrude into the foam core of the blade).

(9) A finish covering of polyurethane paint protects the entire blade from erosion and ultraviolet damage.

(10) For aircraft that require ice protection:

(a) Most composite blade models use an external de-ice boot.

1 The A10460E blade model was introduced with an internal heating element instead of a boot. A standard de-ice boot for this model is an option.

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3. Model Designation

A. Blade Model - Refer to Table 2-1

(1) Hartzell Propeller Inc. uses a propeller model designation to identify specific propeller and blade assemblies. Example: HC-B4MN-5( )/LM10585B+4. A slash mark separates the propeller and blade designations.

(2) The propeller model designation is permanently impression stamped on the propeller hub.

(3) The blade designation is permanently impression stamped on the butt end (internal to hub) of the blade.

NOTE: N-shank blades are constructed of serialized components.

(4) The external surface of the blade (outside of the hub) also has a label or ink stamping on the camber side that identifies the blade model, serial number, and revision level of the blade.

(5) Blade balance information is also included on the camber side of the blade on some designs.

B. Blade Shank Designs

(1) Hartzell Propeller Inc. composite blade designs are often referred to as an “A", "B", "E", “M", or "N" shank blade, in reference to the type of retention system incorporated on the blade.

(a) The shank type may be identified by the prefix letter of the blade model designation, such as the "M" in M10083(K). Refer to Table 2-1 for an explanation of shank designations.

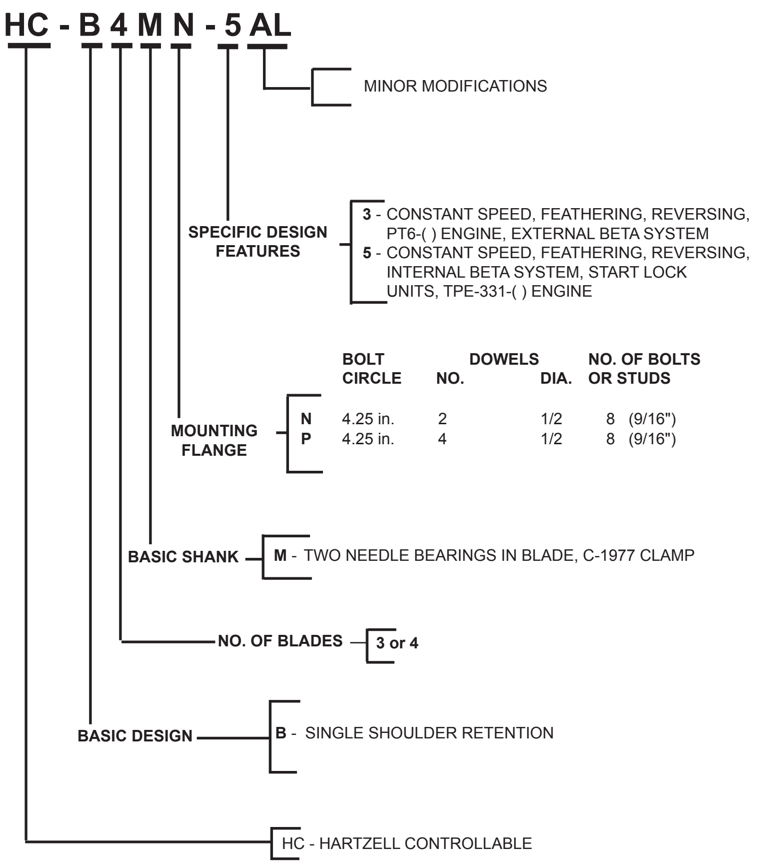
(2) Some blades that have been certified do not have a retention system designation in the model number.

(3) Refer to the Overhaul chapter in the Hartzell Propeller Inc. Composite Blade Manual 135F (61-13-35) to verify the dimensions of applicable machined windings.

C. Composite Blade Model Identification

The blade designation is impression-stamped on the blade butt end (internal) and is either on a decal, or ink-stamped on the blade camber side (external).

NOTE: Parentheses in the model designation system indicates that an option or modification may or may not be included in the blade assembly.



Typical Composite Blade Model Number
Table 2-1

HC - B 4 MN - 5 AL

MINOR MODIFICATIONS

HC-B3MN-3
(No Minor Modifications Apply)

HC-B4MN-5
A - 834-13 STOP COLLAR, A-3495 STOP PLATE, 838-97L CLAMP ASSEMBLY, 832-44L PISTON ASSEMBLY
L - LEFT HAND ROTATION

HC-B4MP-3
A - D-4846P SPINNER ASSEMBLY. 838-109 CLAMP ASSEMBLY

prop model/LM10585ANK+4

CHANGE FROM BASIC PROPELLER DIAMETER (inches plus or minus)

TYPE OF DE-ICE BOOT **
K tapered watt density (Foil elements)
B constant watt density (Wire elements)

MINOR MODIFICATIONS
e.g. *Nickel Erosion Shield

MINOR MODIFICATIONS
e.g. Cuff Shape

ENGINEERING DESIGNATION for DESIGN CHARACTERISTICS

INITIAL DESIGN DIAMETER (inches)
(Not necessarily the actual propeller dia.)

BLADE RETENTION SYSTEM (Not applicable to all designs)

M shank: used with steel hub propellers, shank is similar to M shank aluminum blades, counterweights are attached to steel hub clamps.

DIRECTION OF ROTATION (L = Left hand Blade)
(Right-hand rotation is not indicated)

*All other blades, as well as recent production LM10585( )( )+4, use a nickel erosion shield and do not have an "N" in the model designation.

** Applies to composite blades only.

Typical Composite Blade Model Number, continued
Table 2-1

D. Blade Type and Blade Model Designations

(1) For blade types and the associated blade model designation, refer to Table 2-2 in this chapter.

BLADE TYPE	BLADE MODEL DESIGNATION
Kevlar®	( )7690( )
	7890K
	B7421(K)
	E8190K
	M10083(K)
	A10460(E)(K)
	LM10585(A)(N)(B,K)
	M10877K
	E10950P(C)(B,K)
	E11990K
	E12902K
Carbon	E13890K
	E9193(B,K)

Blade Type and Blade Model Designations
Table 2-2

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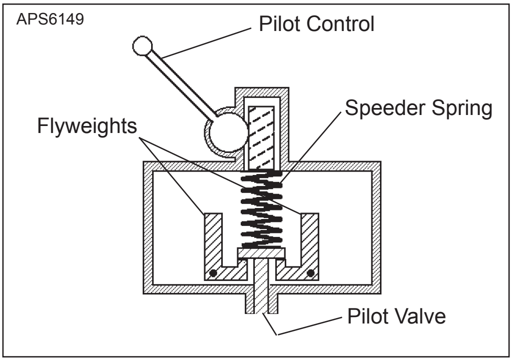
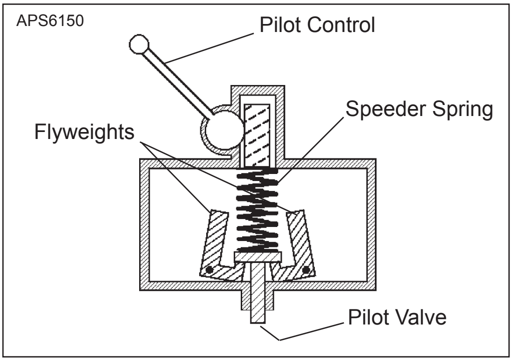
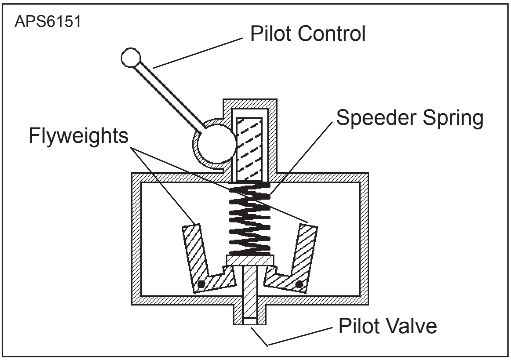


Governor in Onspeed Condition
Figure 2-7



Governor in Underspeed Condition
Figure 2-8



Governor in Overspeed Condition
Figure 2-9

4. Governors

A. Theory of Operation

(1) A governor is an engine RPM sensing device and high pressure oil pump. In a constant speed propeller system, the governor responds to a change in engine RPM by directing oil under pressure to the propeller hydraulic cylinder or by releasing oil from the hydraulic cylinder. The change in oil volume in the hydraulic cylinder changes the blade angle and maintains the propeller system RPM to the set value. The governor is set for a specific RPM via the cockpit propeller control that compresses or releases the governor speeder spring.

(2) When the engine is operating at the RPM set by the pilot using the cockpit control, the governor is operating **onspeed**. Refer to Figure 2-7. In an onspeed condition, the centrifugal force acting on the flyweights is balanced by the speeder spring, and the pilot valve is neither directing oil to nor from the propeller hydraulic cylinder.

(3) When the engine is operating below the RPM set by the pilot using the cockpit control, the governor is operating **underspeed**. Refer to Figure 2-8. In an underspeed condition, the flyweights tilt inward because there is not enough centrifugal force on the flyweights to overcome the force of the speeder spring. The pilot valve, forced down by the speeder spring, meters oil flow to decrease propeller pitch and raise engine RPM.

(4) When the engine is operating above the RPM set by the pilot using the cockpit control, the governor is operating **overspeed**. Refer to Figure 2-9. In an overspeed condition, the centrifugal force acting on the flyweights is greater than the speeder spring force. The flyweights tilt outward, and raise the pilot valve. The pilot valve then meters oil flow to increase propeller pitch and lower engine RPM.

(5) Feathering governors allow oil to be pushed from the propeller to the engine drain to increase propeller pitch to feather.

(6) A synchronizing system can be employed in a multi-engine aircraft to keep the engines operating at the same RPM. A synchrophasing system not only keeps RPM of the engines consistent, but also keeps the propeller blades operating in phase with each other. Both synchronizing and synchrophasing systems serve to reduce noise and vibration.

5. <u>Propeller De-ice System</u>

A Hartzell Propeller Inc. turbine propeller is sometimes equipped with a de-ice system.

A. Description

A propeller de-ice system is a system that allows ice to form, and then removes it by electrically heating the de-ice boots. The ice partially melts and is thrown from the blade by centrifugal force.

(1) A de-ice system consists of one or more on/off switches, a timer or cycling unit, a slip ring, brush blocks, and de-ice boots. The pilot controls the operation of the de-ice system by turning on one or more switches. All de-ice systems have a master switch, and may have another toggle switch for each propeller. Some systems also have a selector switch to adjust for light or heavy icing conditions.

(2) The timer or cycling unit determines the sequence of which blades (or portion thereof) are currently being de-iced, and for what length of time. The cycling unit applies power to each de-ice boot or boot segment in a sequential order.

(3) A brush block, which is normally mounted on the engine just behind the propeller, is used to transfer electricity to the slip ring. The slip ring rotates with the propeller and provides a current path to the blade de-ice boots.

(4) De-ice boots contain internal heating elements. These boots are securely attached to the leading edge of each blade with adhesive.

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FIGURES Page

TABLES Page

1. Tools, Consumables, and Expendables

The following tools, consumables, and expendables will be required for propeller removal or installation:

NOTE: The steel hub turbine propellers covered in this manual are manufactured with two basic flange designs, flange types N and P. The flange type used on a particular propeller installation is indicated in the propeller model identification number stamped on the hub. For example, HC-B3M**N**-3 indicates an N flange. Refer to the Steel Hub Model Identification in the Description and Operation chapter of this manual for a description of each flange type.

A. Tooling

N Flange
- Safety wire pliers
- Torque wrench
- Torque wrench adapter (Hartzell Propeller Inc. P/N AST-2877)

P Flange
- Safety wire pliers
- Torque wrench
- Torque wrench adapter (Hartzell Propeller Inc. P/N AST-2877)

B. Consumables
- Quick Dry Stoddard Solvent or Methyl-Ethyl-Ketone (MEK)

C. Expendables
- 0.032 inch Stainless steel Aircraft Safety Wire
- O-ring, Propeller to engine seal (see Table 3-1)

2. Pre-Installation

A. Inspection of Shipping Package

Examine the exterior of the shipping container for signs of shipping damage, especially the box ends around each blade. A hole, tear, or crushed appearance at the end of the box (blade tips) may indicate that the propeller was dropped during shipment, possibly damaging the blades.

B. Uncrating

(1) Place the propeller on a firm support.

(2) Remove the banding and any external wood bracing from the shipping container.

(3) Remove the cardboard from the hub and blades. Place the propeller on a padded surface that supports the propeller over a large area. Never stand the propeller on a blade tip.

(4) Remove the plastic dust cover cup from the propeller mounting flange (if installed).

C. Inspection after Shipment

After removing the propeller from the shipping container, examine the propeller components for shipping damage.

CAUTION: TO FACILITATE BOXING AND SHIPPING OF PROPELLERS, THE PISTON NUT (A-880-1 OR A-880-2) ON STEEL HUB TURBINE PROPELLERS MAY BE REMOVED TO ALLOW ROTATING OF THE BLADES BEFORE PACKAGING (SEE FIGURES 2-1 AND 2-3).

D. Reassembly of a Propeller Disassembled for Shipment

If a propeller was received disassembled for shipment, it must be reassembled by trained personnel in accordance with the applicable propeller maintenance manual.

3. Propeller Assembly Installation

A. Precautions

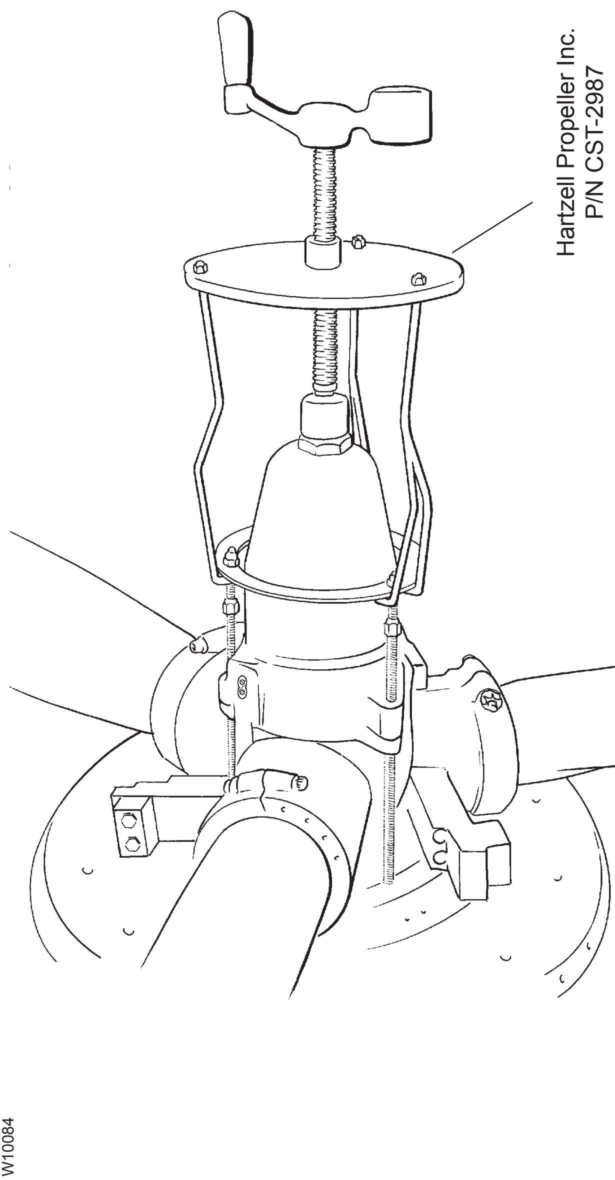
WARNING 1: DURING ENGINE INSTALLATION OR REMOVAL, USING THE PROPELLER TO SUPPORT THE WEIGHT OF THE ENGINE IS NOT AUTHORIZED. UNAPPROVED INSTALLATION AND REMOVAL TECHNIQUES MAY CAUSE DAMAGE TO THE PROPELLER THAT MAY LEAD TO FAILURE RESULTING IN AN AIRCRAFT ACCIDENT.

WARNING 2: WHEN INSTALLING THE PROPELLER, FOLLOW THE AIRFRAME MANUFACTURER'S MANUALS AND PROCEDURES, AS THEY MAY CONTAIN ISSUES VITAL TO AIRCRAFT SAFETY THAT ARE NOT CONTAINED IN THIS OWNER'S MANUAL.

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.

(1) Be sure the propeller is removed before the engine is removed or installed in the airframe.

(2) Follow the airframe manufacturer's instructions for installing the propeller. If such instructions are not in the airframe manufacturer's manual, then follow the instructions in this manual; however, mechanics must consider that this owner's manual does not describe important procedures that are outside the scope of this manual. In addition to propeller installation procedures, items such as rigging and preflight testing of flight idle blade angle, installation and adjustment of de-ice equipment, and propeller synchronization devices are normally found in the airframe manufacturer's manuals.



Beta System Puller for Decompressing HC-B(3,4)( )( )-3( ) External Beta System
Figure 3-1

B. Installing the HC-B(3,4)( )( )-3( ) Propeller on the Aircraft Engine

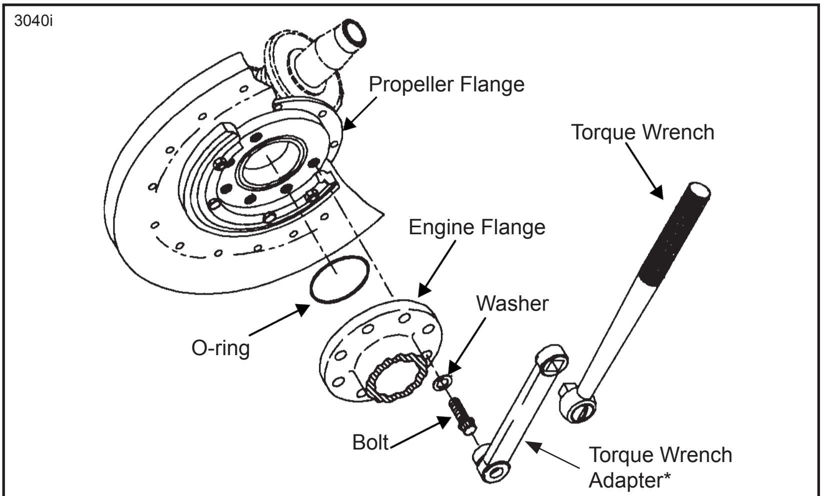
(1) Use a beta system puller CST-2987 (Figure 3-1) to compress the beta system and pull the beta ring forward to allow installation of the double hex head propeller mounting bolts.

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

CAUTION 1: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

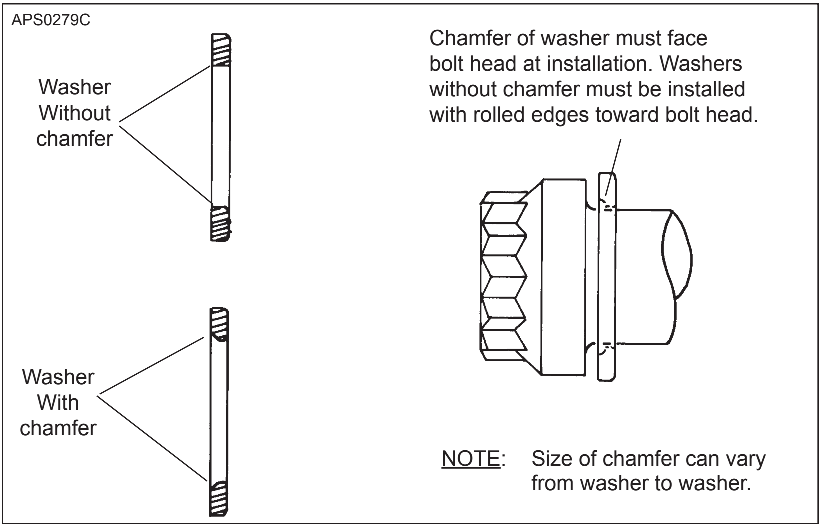
CAUTION 2: WHEN INSTALLING THE PROPELLER ON THE AIRCRAFT, DO NOT DAMAGE THE ICE PROTECTION SYSTEM COMPONENTS, IF APPLICABLE.

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



*Note: If torque wrench adaptor is used, use the calculation in Figure 3-7 to determine correct torque wrench setting.

Installing Propeller on Engine Flange
Figure 3-2



NOTE: Size of chamfer can vary from washer to washer.

Mounting Bolt and Washer
Figure 3-3

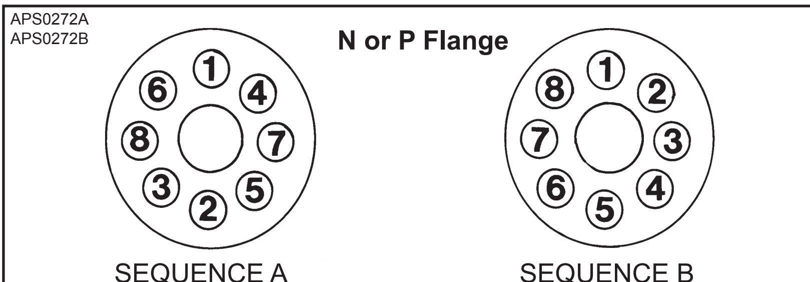
(3) Make sure the propeller hub flange and the engine flange mating surfaces are clean.

(4) Install the specified O-ring on the engine flange. Refer to Table 3-1.

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

Propeller/Engine Flange O-rings	
"N" flange O-ring	C-3317-230
"P" flange O-ring	C-3317-230
Propeller Mounting Hardware	
HC-B3MN-3	B-3339 Bolt and A-2048-2 Washer
HC-B4MN-5AL	B-3339 Bolt and A-2048-2 Washer
HC-B4MP-3A	B-3339 Bolt and A-2048-2 Washer

Propeller/Engine Flange O-rings and Mounting Hardware
Table 3-1



Use sequence A for steps 1 and 2

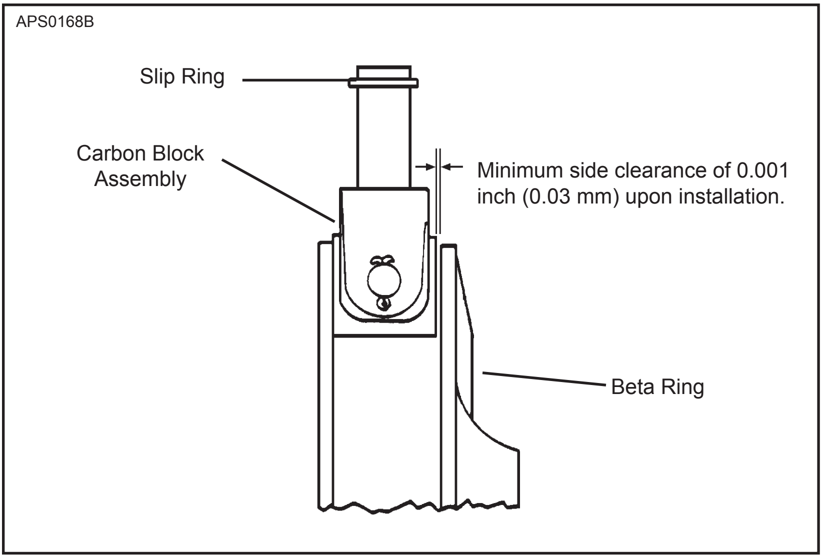
Step 1 - Torque all bolts to 40 Ft-Lbs (54 N•m).

Step 2 - Torque all bolts to 80 Ft-Lbs (108 N•m).

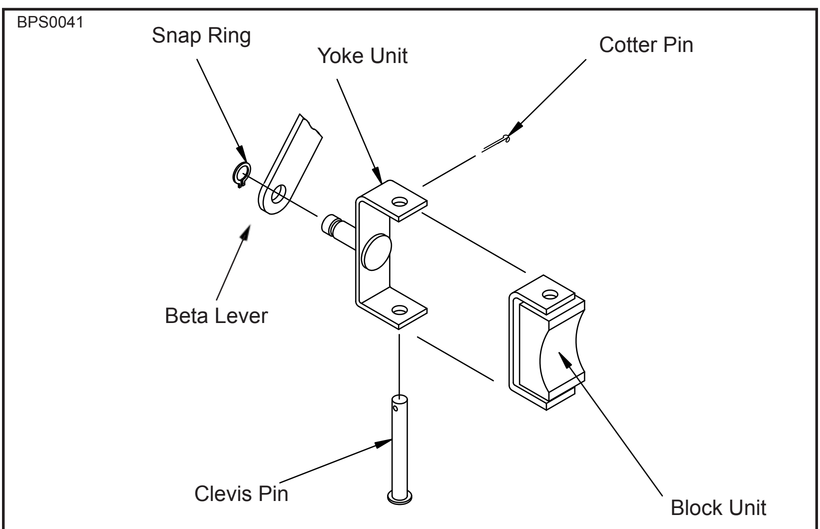
Use sequence B for step 3

Step 3 - Torque all bolts to Table 3-2.

Diagram of Torquing Sequence for Propeller Mounting Bolts
Figure 3-4



Carbon Block and Beta Ring Clearance
Figure 3-5



Carbon Block Assembly
Figure 3-6

(6) Slide the propeller flange onto the engine flange.

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 MUST BE USED WHEN INITIALLY INSTALLING A NEW OR OVERHAULED PROPELLER.

(7) Apply MIL-PRF-83483 anti-seize compound to the threaded surfaces of the mounting bolts. Refer to Table 3-1 for the correct mounting hardware.

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 ROLLED EDGES TOWARD THE BOLT HEAD. (REFER TO FIGURE 3-3).

(8) Install the mounting bolts through the engine flange and into the propeller hub flange. Refer to Figure 3-2.

(9) Use a torque wrench with a torque wrench adapter Hartzell Propeller Inc. P/N AST-2877 to torque all mounting bolts in sequences and steps shown in Figure 3-4. Refer to Table 3-2 and Figure 3-7 to determine the correct torque value.

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

(11) Decompress and remove the beta system puller.

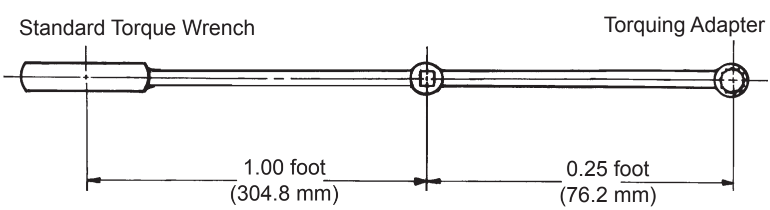
N flange propeller mounting bolts	100-105 Ft-Lbs (136-142 N•m)
P flange propeller mounting bolts	100-105 Ft-Lbs (136-142 N•m)
Piston flexlock nut	120 Ft-Lbs (163 N•m)*
Guide rod jam nuts	10 Ft-Lbs (14 N•m)*

* Torque tolerance is ± 10 percent unless otherwise noted.

NOTE: Torque values are based on non-lubricated threads, except for the torque value of propeller mounting bolts, which is based on threads with approved anti-seize compound MIL-PRF-83483.

Torque Values
Table 3-2

APS0212A



(actual torque required) X (torque wrench length) / (torque wrench length) + (length of adapter) = Torque wrench reading to achieve required actual torque

EXAMPLE:

100 Ft-Lb (136 N•m) x 1 ft (304.8 mm) / 1 ft (304.8 mm) + 0..25 ft (76.2 mm) = 80 Ft-Lb (108 N•m) < reading on torque wrench with 3-inch (76.2 mm) adapter for actual torque of 100 Ft-Lb (136 N•m)

Determining Torque Value When Using Torquing Adaptor
Figure 3-7

CAUTION: THE BETA FEEDBACK COLLAR MUST NOT CONTACT ANY ENGINE COMPONENT OR MOUNTING BOLT SAFETY WIRE. THE BETA FEEDBACK MECHANISM COULD BE DAMAGED IF IT CONTACTED ANY STATIC ENGINE COMPONENT WHILE ROTATING.

(12) Examine the beta feedback collar to make sure that it is not in contact with any engine components or mounting bolt safety wire.

(a) If there is contact between the beta feedback collar and any engine components or mounting bolt safety wire, consult qualified personnel at an appropriately licensed propeller service facility.

(13) Install the carbon block into the beta linkage lever per the airframe manufacturer's instructions.

CAUTION: FIT THE BLOCK IN THE BETA RING WITH A MINIMUM SIDE CLEARANCE OF 0.001 INCH (0.025 mm). REFER TO FIGURE 3-5.

(14) Install the carbon block assembly (Figure 3-6) into the beta ring.

(15) Install, adjust and safety the beta linkage per the airframe manufacturer's instructions.

CAUTION: TO FACILITATE BOXING AND SHIPPING OF PROPELLERS, THE PISTON NUT (A-880-1) ON HC-B(3,4)( )( )-3( ) STEEL HUB TURBINE PROPELLERS MAY BE REMOVED IN ORDER TO ALLOW ROTATING OF THE BLADES BEFORE PACKAGING.

NOTE: The ability to rotate the blades during propeller installation will allow easier access to the propeller mounting bolts.

(16) Procedure for reinstallation of piston nut, if applicable.

(a) Following the installation of the propeller, use a breaker bar and a 5/8 inch deep well socket to hold the pitch change rod.

(b) Using 1-7/16 inch crowfoot wrench and torque wrench, torque the A-880-1 nut. Refer to Table 3-2 and Figure 3-7 for the correct torque value.

NOTE: The removal and subsequent reinstallation of the piston nut does not require that the propeller blade angles be rechecked.

(17) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller Inc., applicable instructions and technical information for the components supplied by Hartzell Propeller Inc. can be found in the following publications available on the Hartzell Propeller Inc. website at www.hartzellprop.com.

(a) Manual 180 (30-61-80) - Propeller Ice Protection System Manual

(b) Manual 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual

(c) Manual 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual

(18) Propeller ice protection system components not supplied by Hartzell Propeller Inc. are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).

C. Installing the HC-B4MN-5AL Propeller on the Aircraft Engine

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

CAUTION 1: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

CAUTION 2: WHEN INSTALLING THE PROPELLER ON THE AIRCRAFT, DO NOT DAMAGE THE ICE PROTECTION SYSTEM COMPONENTS, IF APPLICABLE.

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

(2) Make sure that the propeller hub flange and engine flange are clean.

(3) Install the specified O-ring on the engine flange. Refer to Table 3-1.

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

(5) Slide the propeller flange onto the engine flange.

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 MUST BE USED WHEN INITIALLY INSTALLING A NEW OR OVERHAULED PROPELLER.

(6) Apply MIL-PRF-83483 anti-seize compound to the threaded surfaces of the mounting bolts. Refer to Table 3-1 for the correct mounting hardware.

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 ROLLED EDGES TOWARD THE BOLT HEAD (FIGURE 3-3).

(7) Install the mounting bolts with washers through the engine flange and into the propeller hub flange. Refer to Figure 3-2.

(8) Use a torque wrench and a torque wrench adapter Hartzell Propeller Inc. P/N AST-2877 to torque all mounting bolts in sequences and steps shown in Figure 3-4. Refer to Table 3-2 and Figure 3-7 to determine the correct torque value.

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

CAUTION: TO FACILITATE BOXING AND SHIPPING OF PROPELLERS, THE PISTON NUT (A-880-2) ON THE HC-B4MN-5AL STEEL HUB TURBINE PROPELLER MAY BE REMOVED IN ORDER TO ALLOW ROTATING OF THE BLADES BEFORE PACKAGING.

(10) Procedure for reinstallation of piston nut (if applicable).

(a) Following the installation of the propeller, use a breaker bar and a 5/8 inch deep well socket to hold the pitch change rod.

(b) Using a 1-13/16 inch crowfoot wrench and torque wrench, torque the A-880-2 nut. Refer to Table 3-2 and Figure 3-7 for the correct torque value.

NOTE: The removal and subsequent reinstallation of the piston nut does not require that the propeller blade angles be rechecked.

(11) Install the beta tube per the airframe and/or engine manufacturer's instructions.

NOTE 1: Follow the airframe manufacturer's instructions for adjusting the beta tube to obtain the correct low pitch (flight idle blade angle).

NOTE 2: Refer to the Aircraft Type Certificate Data Sheet for the low pitch blade angle setting.

(12) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller Inc., applicable instructions and technical information for the components supplied by Hartzell Propeller Inc. can be found in the following publications available on the Hartzell Propeller Inc. website at www.hartzellprop.com.

(a) Manual 180 (30-61-80) - Propeller Ice Protection System Manual

(b) Manual 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual

(c) Manual 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual

(13) Propeller ice protection system components not supplied by Hartzell Propeller Inc. are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).

4. Spinner Dome 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 DOME. REMOVE THE TAPE AFTER THE SPINNER IS INSTALLED.

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

A. Carefully slide the spinner dome over the reassembled propeller.

B. Secure the spinner dome to the spinner bulkhead with the supplied screws and washers.

5. Post-Installation Checks

A. Refer to the airframe manufacturer's instructions for post-installation checks.

B. Perform a static RPM check as outlined in the Maintenance Practices chapter of this manual.

6. Spinner Dome Removal

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

A. Remove the screws and washers that secure the spinner to the spinner bulkhead.

B. Remove the spinner dome.

7. Propeller Assembly Removal

A. Removal of HC-B(3,4)( )( )-3( ) Propellers

WARNING: FOR SAFETY REASONS, THE PROPELLER MUST BE PLACED IN THE FEATHER POSITION BEFORE IT IS REMOVED FROM THE AIRCRAFT.

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

(1) Remove the spinner dome in accordance with the procedures in the Spinner Removal section of this chapter.

(2) Disconnect the engine beta linkage and carbon block assembly from the beta ring per the airframe manufacturer's instructions. Refer to Figure 3-6.

NOTE: If the propeller is equipped with a de-ice system, follow the manufacturer's instructions for removing whichever components are necessary for propeller removal.

(a) Remove the snap ring that retains the carbon block assembly to the beta linkage.

(b) Remove the carbon block assembly.

(3) Use a beta system puller Hartzell Propeller Inc. P/N CST-2987 to compress the beta system spring and pull the beta ring forward to expose the propeller mounting bolts and washers.

WARNING 1: DURING ENGINE INSTALLATION OR REMOVAL, USING THE PROPELLER TO SUPPORT THE WEIGHT OF THE ENGINE IS NOT AUTHORIZED. UNAPPROVED INSTALLATION AND REMOVAL TECHNIQUES MAY CAUSE DAMAGE TO THE PROPELLER THAT MAY LEAD TO FAILURE AND RESULT IN AN AIRCRAFT ACCIDENT.

WARNING 2: DURING PROPELLER REMOVAL, AIRFRAME MANUFACTURER'S MANUALS AND PROCEDURES MUST BE FOLLOWED BECAUSE THEY MAY CONTAIN ISSUES VITAL TO AIRCRAFT SAFETY THAT ARE NOT CONTAINED IN THIS MANUAL OR THE HARTZELL PROPELLER INC. OVERHAUL MANUAL 118F.

WARNING 3: MAKE SURE THE SLING IS RATED UP TO 800 LBS (363 KG) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING REMOVAL.

(4) Cut and remove the safety wire on the propeller mounting bolts.

(5) Support the propeller assembly with a sling.

NOTE 1: Supporting the propeller with the sling may be delayed until all but two mounting bolts and washers have been removed to allow rotating the propeller for ease of nut removal.

NOTE 2: If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark on the propeller hub and a matching mark on the engine flange to make sure of the correct orientation during re-installation to prevent dynamic imbalance.

CAUTION: DISCARD THE PROPELLER MOUNTING BOLTS IF THEY ARE DAMAGED OR CORRODED, OR WHEN THE PROPELLER IS REMOVED FOR OVERHAUL.

(6) Remove the propeller mounting bolts and washers.

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

CAUTION: USE ADEQUATE PRECAUTIONS TO PROTECT THE PROPELLER ASSEMBLY FROM DAMAGE WHEN IT IS REMOVED FROM THE AIRCRAFT ENGINE AND WHEN IT IS STORED.

(7) Using the support sling, lift the propeller from the mounting flange.

(8) Remove and discard the propeller mounting O-ring.

(9) Decompress and remove the beta system puller.

(10) Place the propeller on a suitable cart for transportation.

B. Removal of HC-B4MN-5AL Propeller

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

(1) Remove the spinner dome in accordance with the procedures in the Spinner Removal section of this chapter.

NOTE: If the propeller is equipped with a de-ice system, follow the manufacturer's instructions for removing whichever components are necessary for propeller removal.

WARNING 1: DURING ENGINE INSTALLATION OR REMOVAL, USING THE PROPELLER TO SUPPORT THE WEIGHT OF THE ENGINE IS NOT AUTHORIZED. UNAPPROVED INSTALLATION AND REMOVAL TECHNIQUES MAY CAUSE DAMAGE TO THE PROPELLER THAT MAY LEAD TO FAILURE AND RESULT IN AN AIRCRAFT ACCIDENT.

WARNING 2: DURING PROPELLER REMOVAL, AIRFRAME MANUFACTURER'S MANUALS AND PROCEDURES MUST BE FOLLOWED BECAUSE THEY MAY CONTAIN ISSUES VITAL TO AIRCRAFT SAFETY THAT ARE NOT CONTAINED IN THIS MANUAL OR THE HARTZELL PROPELLER INC. OVERHAUL MANUAL 118F.

WARNING 3: FOR SAFETY REASONS, THE PROPELLER MUST BE PLACED IN THE FEATHER POSITION BEFORE IT IS REMOVED FROM THE AIRCRAFT.

(2) Place the propeller in feather position.

CAUTION: THE BETA TUBE MUST BE REMOVED BEFORE THE PROPELLER ASSEMBLY IS REMOVED FROM THE AIRCRAFT. REFER TO THE AIRCRAFT MAINTENANCE INSTRUCTION MANUAL.

(3) Remove the beta tube.

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

CAUTION: USE ADEQUATE PRECAUTIONS TO PROTECT THE PROPELLER ASSEMBLY FROM DAMAGE WHEN IT IS REMOVED FROM THE AIRCRAFT ENGINE AND WHEN IT IS STORED.

(4) Cut and remove the safety wire (if installed) on the propeller mounting bolts.

(5) Support the propeller assembly with a sling.

NOTE 1: Supporting the propeller with the sling may be delayed until all but two mounting bolts and washers have been removed to allow rotating the propeller for ease of nut removal.

NOTE 2: If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark on the propeller hub and a matching mark on the engine flange to make sure of the correct orientation during re-installation to prevent dynamic imbalance.

CAUTION: DISCARD THE PROPELLER MOUNTING BOLTS IF THEY ARE DAMAGED OR CORRODED, OR WHEN THE PROPELLER IS REMOVED FOR OVERHAUL.

(6) Remove the propeller mounting bolts and washers.

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

(7) Using the support sling, lift the propeller from the mounting flange.

(8) Remove and discard the propeller mounting O-ring.

(9) Place the propeller on a suitable cart for transportation.

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1. Operational Tests

Following propeller installation, the propeller hydraulic system must be purged of air, and correct operation verified.

WARNING: REFER TO THE AIRCRAFT MAINTENANCE MANUAL FOR ADDITIONAL PROCEDURES THAT MAY BE REQUIRED AFTER PROPELLER INSTALLATION.

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

A. Initial Run-Up

(1) Perform engine start and warm-up per the Pilot's Operating Handbook (POH).

(2) Cycle the condition lever through its operating pitch range from reverse to high (or as directed by the POH).

(3) Repeat this procedure at least three times to purge air from the propeller hydraulic system and to introduce warmed oil to the cylinder.

(4) Verify correct operation from reverse pitch to high pitch and throughout operating range.

(5) Shut down the engine in accordance with the POH.

NOTE: Air trapped in the propeller hydraulic system will cause the pitch control to be imprecise and may result in propeller surging.

B. Post-Run Check

After engine shutdown, check the propeller for signs of engine oil leakage.

C. Maximum RPM (Static) Hydraulic Low Pitch Stop Check

The Maximum RPM (hydraulic low pitch stop) is normally set at the factory per the aircraft manufacturer's requirements, and should not require any additional adjustment. Adjustments may be required after maintenance or because of specific aircraft variances.

Adjustments must be done in accordance with the airframe manufacturer's specifications found in the airframe manufacturer's manual.

D. Feathering Pitch Stop Adjustment

The feathering pitch stop is set at the factory per the aircraft manufacturer's recommendations. This stop is adjustable only by an appropriately licensed propeller service facility, aircraft manufacturer, or the Hartzell Propeller Inc. factory.

E. Start Lock Unit Adjustment

The start lock units are set at the factory per the aircraft manufacturer's recommendations. These stops are adjustable only by an appropriately licensed propeller service facility or at the Hartzell Propeller Inc. factory.

F. Electric De-ice System

NOTE: The Pilot Operating Handbook (POH) must be consulted regarding flight into conditions of known icing. The aircraft may not be certificated for flight in known icing conditions, even though propeller de-ice equipment is installed.

(1) Refer to the De-ice Systems chapter of this manual for functional tests of the De-ice system.

2. Troubleshooting

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

A. Hunting and Surging

Hunting is characterized by a cyclic variation in engine speed above and below desired speed. Surging is characterized by a large increase/decrease in engine speed, followed by a return to set speed after one or two occurrences.

(1) If the propeller is hunting, a service facility should check:

(a) Governor

(b) Fuel control

(c) Synchrophaser or synchronizer

(2) If the propeller is surging:

(a) Perform steps 1.A.(1) through 1.A.(5) in the Operational Tests section of this chapter, to release trapped air from the propeller. If surging recurs, it is most likely due to a faulty governor.

(b) Hunting and/or surging may also be caused by friction or binding within the governor control, or by internal corrosion, which causes the propeller to react slower to governor commands.

NOTE: The propeller must be tested on a test bench at a propeller service facility to isolate these faults.

B. Engine Speed Varies with Flight Altitude (or Airspeed)

(1) Small variances in engine speed are normal and are no cause for concern.

(2) Increase in engine speed while descending or increasing airspeed:

(a) Governor is not reducing oil volume.

(b) Friction in propeller.

(3) Decrease in engine speed while increasing airspeed:

(a) Governor pilot valve is stuck and is excessively decreasing oil volume.

(b) Feathering command engaged on propeller pitch control.

(4) Increase in engine speed while decreasing airspeed:

(a) Governor pilot valve is stuck and is excessively increasing oil volume.

(5) Decrease in engine speed while decreasing airspeed:

(a) Governor is not increasing oil volume in propeller.

(b) Friction in propeller.

C. Loss of Propeller Control

(1) Propeller goes to uncommanded high pitch (or feather)

(a) Loss of propeller oil pressure - check:

1 Governor pressure relief valve.

2 Governor drive.

3 Engine oil supply.

(b) Start Lock Unit not engaging.

(2) Propeller goes to uncommanded low pitch (high RPM)

(a) Governor pilot valve sticking.

(3) RPM increases with power and airspeed, propeller RPM control has little or no effect.

(a) Excessive friction in blade bearings or pitch change mechanism.

(b) Broken feathering spring.

(4) RPM control sluggish (especially on reducing RPM).

(a) Broken feathering spring.

D. Failure to Feather (or feathers slowly)

(1) Broken feathering spring.

(2) Check for correct function and rigging of propeller/ governor control linkage.

(3) Check governor drain function.

(4) Propeller must be checked for misadjustment or internal corrosion (usually in blade bearings or pitch changing mechanism) that results in excessive friction. This must be accomplished at a propeller service facility.

E. Failure to Unfeather

(1) Check for correct function and rigging of propeller control linkage.

(2) Check governor function.

(3) Propeller must be checked for misadjustment or internal corrosion (usually in blade bearings or pitch change mechanism) that results in excessive friction. This must be accomplished at a propeller service facility.

F. Start Lock Units Fail to Latch on Shutdown (HC-B4MN-5AL Model)

(1) Propeller was feathered before shutdown.

(2) Shutdown occurred at high RPM with propeller control off the low pitch stop.

The problem may be solved by using the engine auxiliary pump to reposition the propeller on the start lock unit.

(3) Excessive governor pump leakage.

The problem should be referred to an authorized service facility.

(4) Broken start lock unit.

The problem should be referred to an authorized propeller service facility.

G. Vibration

CAUTION: ANY VIBRATION THAT CAN BE DESCRIBED AS APPEARING SUDDENLY, OR IS ACCOMPANIED BY UNEXPLAINED GREASE LEAKAGE, SHOULD BE INVESTIGATED BY AN APPROPRIATELY LICENSED PROPELLER SERVICE FACILITY, BEFORE THE NEXT FLIGHT.

NOTE: Vibration problems due to propeller system imbalance are normally felt throughout the RPM range, with the intensity of vibration increasing with RPM. Vibration problems that occur in a narrow RPM range are a symptom of resonance, and are potentially harmful to the propeller. Avoid operation in that RPM range until the propeller can be checked by an appropriately licensed propeller service facility.

(1) Check:

(a) Control surfaces, exhaust system, landing gear doors, etc. for excessive play that may be causing vibration unrelated to the propeller.

(b) Uneven lubrication of the propeller.

(c) Correct engine/propeller flange mating.

(d) Blade track. (Refer to the Inspection and Check chapter of this manual for procedure.)

(e) Blade angles:

Blade angle must be within tolerance between blades and on the propeller as a whole. Refer to the Hartzell Propeller Inc. Overhaul Manual 118F (61-10-18) for blade angle check procedure.

(f) Spinner for cracks, incorrect installation or "wobble" during operation.

(g) Static balance.

(h) Airfoil profile identical between blades (after overhaul or rework for nicks - verify at an appropriately licensed propeller service facility).

(i) Hub, blade, or blade clamp for damage or cracking.

(j) Grease or oil leakage from a seemingly solid surface of the hub, blade clamp, or blade.

(k) Blade deformation.

NOTE: Dynamic balancing is recommended after installing or performing maintenance on a propeller. While normally an optional task, it may be required by the engine or airframe manufacturer to make certain the propeller/engine combination is balanced within close tolerances before operation. Refer to the engine or airframe manuals, and the Maintenance Practices chapter of this manual.

H. Propeller Overspeed

(1) Check:

(a) Low pitch stop adjustment.

(b) Governor maximum RPM set too high.

(c) Broken feathering spring.

(d) Governor pilot valve jammed, supplying high pressure only.

(e) Tachometer error.

I. Propeller Underspeed

(1) Check:

(a) Governor oil pressure low.

(b) Governor oil passage clogged.

(c) Tachometer error.

J. Oil or Grease Leakage

CAUTION: GREASE LEAKAGE THAT CAN BE DESCRIBED AS EXCESSIVE AND APPEARING SUDDENLY, ESPECIALLY WHEN ACCOMPANIED BY VIBRATION, SHOULD BE INVESTIGATED IMMEDIATELY BEFORE NEXT FLIGHT.

(1) Grease Leakage - Probable Cause:

(a) Incorrect torqued or loose lubrication fitting. (Tighten the fitting).

(b) Defective lubrication fitting. (Replace the fitting).

(c) Incorrect or damaged O-ring between the blade clamp and the propeller hub. (Refer to an authorized propeller service facility for replacement of the O-ring.)

(d) Grease leaks past the blade clamp seal gaskets. (Replace gaskets.) (Refer to an authorized propeller service facility for replacement of sealant.)

(e) Grease leaks from between the blade clamp and the blade. (Refer to an authorized propeller service facility for replacement of sealant.)

(f) Incorrect application of silicone sealant on the clamp radius of the bearing-to-clamp interface. (Refer to an authorized propeller service facility for reapplication of silicone sealant.)

(2) Oil Leakage - Probable Cause:

(a) Faulty or missing O-ring seal between the hub and the cylinder.

(b) Faulty or missing O-ring seal between the piston and the cylinder at the front of the piston.

(c) Displaced felt seal between the piston and the cylinder.

(d) Faulty or missing O-ring between the propeller hub and the engine flange.

(e) Faulty or missing O-ring between the piston and the pitch change rod.

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FIGURES Page

1. Pre-Flight Checks

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

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

A. Blades

(1) Visually inspect the entire blade and the erosion shield (lead, trail, face, and camber sides) for nicks, gouges, looseness of material, erosion, cracks, and debonds. Refer to the Maintenance Practices chapter of this manual for composite blade airworthy damage limits.

(2) Visually inspect the blades for lightning strike. Refer to lightning strike damage information in the Special Inspections section of this chapter.

(3) Defects or damage discovered during preflight inspection must be evaluated in accordance with allowables outlined in the Maintenance Practices chapter of this manual to determine if repairs are required before further flight.

B. Inspect the spinner and visible blade retention components for damage or cracks. Repair or replace components, as required, before further flight.

C. Check for loose/missing hardware. Retighten or reinstall as necessary.

WARNING: ABNORMAL GREASE LEAKAGE CAN BE AN INDICATION OF A FAILING PROPELLER BLADE OR BLADE RETENTION COMPONENT. AN IN-FLIGHT BLADE SEPARATION CAN RESULT IN A CATASTROPHIC AIRCRAFT ACCIDENT.

D. Inspect for grease and oil leakage, and determine the source.

E. Check blades for radial play or movement of blade tip (in and out, or back and forth). Refer to Loose Blades in the Inspection Procedures section of this chapter for blade play limits.

F. Inspect de-ice boots (if installed) for damage. Refer to the De-ice Systems chapter of this manual for inspection information.

G. Check the propeller speed control and operation from reverse or low pitch to high pitch, using the procedure specified in the Pilot Operating Handbook (POH) for the aircraft.

WARNING: ABNORMAL VIBRATION CAN BE AN INDICATION OF A FAILING PROPELLER BLADE OR BLADE RETENTION COMPONENT. AN IN-FLIGHT BLADE SEPARATION CAN RESULT IN A CATASTROPHIC AIRCRAFT ACCIDENT.

H. Perform initial run-up as outlined in Operational Tests 1.A.(1) through 1.A.(5) in the Testing and Troubleshooting chapter of this manual.

I. Check for any abnormal vibration during run-up. If vibration occurs, shut the engine down, determine the cause, and correct it before further flight. Refer to Vibration in the Testing and Troubleshooting chapter of this manual.

J. Refer to the Inspection Procedures section of this chapter for additional inspection information and possible corrections to any discrepancies discovered as a result of pre-flight checks.

2. <u>Operational Checks</u>

Refer to the airframe manufacturer's manual for operational checks.

3. <u>Required Periodic Inspections and Maintenance</u>

<u>CAUTION</u>: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

A. Periodic Inspections

Perform detailed inspection procedures at 400 hour intervals, not to exceed twelve (12) calendar months.

<u>NOTE 1</u>: Inspection and maintenance specified by an airframe manufacturer's maintenance program and approved by the applicable airworthiness agency may not coincide with the inspection time interval specified. In this situation the airframe manufacturer's schedule may be applied with the exception that the calendar limit for the inspection interval may not exceed twelve (12) calendar months.

<u>NOTE 2</u>: Refer to Inspection Procedures in this chapter for additional inspection information and possible corrections to any discrepancies discovered as a result of the periodic inspection.

(1) Remove the spinner dome.

(2) Visually inspect the entire blade and erosion shield for nicks, cracks, looseness of material, erosion, and debonds. If any damage is discovered, refer to the Blade Repairs section in the Maintenance Practices chapter of this manual for additional information. A cracked blade must be referred to an appropriately licensed propeller service facility.

(3) Inspect all visible propeller parts for cracks, wear, or unsafe conditions.

(4) Check for oil and grease leaks. Refer to Oil and Grease Leakage in the Inspection Procedures section of this chapter.

(5) Make an entry in the propeller logbook verifying this inspection.

B. Airworthiness Limitations

(1) Certain components, as well as the entire propeller, may have specific life limits established as part of the certification by the FAA. Such limits call for mandatory replacement of specified parts after a defined number of hours and/or cycles of use.

(2) Life limited component times are provided in the Airworthiness Limitations section of this manual.

(3) Operators are urged to keep informed of airworthiness information via Hartzell Propeller Inc. Service Bulletins and Service Letters, which are available from Hartzell Propeller Inc. distributors or from the Hartzell Propeller Inc. factory by subscription. Selected information is also available on the Hartzell Propeller Inc. website at www.hartzellprop.com.

C. Overhaul Periods

In flight, the propeller is constantly subjected to vibration from the engine and the airstream, as well as high centrifugal forces. The propeller is also subject to corrosion and general deterioration due to aging. Under these conditions, metal fatigue or mechanical failures can occur. To protect your safety and your investment, and to maximize the safe operating lifetime of your propeller, it is essential that the propeller be properly maintained and overhauled according to the recommended service procedures.

CAUTION 1: OVERHAUL PERIODS LISTED BELOW, ALTHOUGH CURRENT AT THE TIME OF PUBLICATION, ARE FOR REFERENCE PURPOSES ONLY. OVERHAUL PERIODS MAY BE INCREASED OR DECREASED AS A RESULT OF ENGINEERING EVALUATION.

CAUTION 2: CHECK THE LATEST REVISION OF HARTZELL PROPELLER INC. SERVICE LETTER HC-SL-61-61Y FOR THE MOST CURRENT INFORMATION.

(1) Hartzell Propeller Inc. steel hub propellers installed on turbine engine aircraft are to be overhauled at 3000 hours of operation or 60 calendar months, whichever occurs first.

(2) Agricultural aircraft are to be overhauled at 3000 hours of operation or 36 calendar months, whichever occurs first.

(a) Once used on an agricultural aircraft, the 36 month overhaul limit is to be maintained until an overhaul is accomplished, even if the propeller is later installed on other category airplanes.

D. Periodic Maintenance

Lubricate the propeller assembly. Refer to the Lubrication section in the Maintenance Practices chapter of this manual for intervals and procedures.

4. Inspection Procedures

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

The inspections detailed below are made on a regular basis, either before flight, during Periodic Inspections (described in this chapter), or if a problem is noted. Possible corrections to problems discovered during inspections, additional inspections, and limits are detailed in the following inspection procedures.

A. Blade Damage

(1) Refer to the Composite Blade section in the Maintenance Practices chapter of this manual for information regarding blade damage.

(2) For composite blade model M10083( ) installed on a Hartzell Propeller Inc. model HC-B3MN-3 that is on a Cessna 208 series Caravan aircraft:

(a) Inspect the blade at 250 hour intervals for cracks in the filament windings and at the end of a layer of laminate. Refer to the Maintenance Practices chapter of this manual for inspection procedures.

B. Grease or Oil Leakage

NOTE: A new or newly overhauled propeller may leak slightly during the first several hours of operation. This leakage may be caused by the seating of seals and O-rings, and the slinging of lubricants used during assembly. Such leakage should cease within the first ten hours of operation.

Leakage that persists beyond the first ten hours of operation on a new or newly overhauled propeller, or that occurs on a propeller that has been in service for some time, will require repair. A determination should be made as to the source of the leak. The only leakage that is field repairable is the removal and replacement of the O-ring seal between the engine and propeller flange. All other leakage repairs should be referred to an appropriately licensed propeller service facility. An instance of abnormal grease leakage should be inspected following the procedure below:

(1) Remove the spinner dome.

CAUTION: PERFORM VISUAL INSPECTION WITHOUT CLEANING PARTS. A TIGHT CRACK IS OFTEN EVIDENT DUE TO TRACES OF GREASE EMANATING FROM THE CRACK. CLEANING CAN REMOVE SUCH EVIDENCE AND MAKE A CRACK VIRTUALLY IMPOSSIBLE TO SEE.

(2) Perform a visual inspection of the blade clamps to locate the origin of the leakage. If the origin of the grease leakage is determined to be a noncritical part, such as an O-ring, gasket, or sealant, repairs can be accomplished during scheduled maintenance.

(3) If cracks in the blade clamp are suspected, perform additional inspections before further flight (by qualified personnel at an appropriately licensed propeller service facility) to verify the condition. Such inspections typically include disassembly of the propeller in accordance with published procedures.

(4) If cracks or failing components are found, these parts must be replaced before further flight. Report such occurrences to airworthiness authorities and to Hartzell Propeller Inc. Product Support.

C. Vibration

Instances of abnormal vibration should be investigated immediately. If the cause of the vibration is not readily apparent, the propeller may be inspected following the procedure below:

NOTE: It may sometimes be difficult to readily identify the cause of abnormal vibration. Vibration may originate in the engine, propeller, or airframe. Troubleshooting procedures typically begin with an investigation of the engine. Airframe components, such as engine mounts or loose landing gear doors, can also be the source of vibration. When investigating an abnormal vibration, the possibility of a failing blade or blade retention component should be considered as a potential source of the problem.

(1) Perform troubleshooting and evaluation of possible sources of vibration in accordance with engine or airframe manufacturer's instructions.

(2) Refer to the Vibration section in the Testing and Troubleshooting chapter of this manual. Perform the checks to determine possible cause of the vibration. If no cause is found, proceed with steps 4.C.(3) through 4.C.(8).

(3) Remove the spinner dome.

(4) Perform a visual inspection for cracks in the hub and blade clamps.

(5) If cracks in the hub or the blade clamp are suspected, additional inspections must be performed before further flight. These inspections must be performed by qualified personnel at an appropriately licensed propeller service facility to verify the condition. Such inspections typically include disassembly of the propeller in accordance with published procedures in Hartzell Propeller Inc. Manual 118F (61-10-18).

(6) Check the blades and compare blade-to-blade differences:

(a) Inspect the propeller blades for unusual looseness or movement. Refer to Loose Blades in this section.

(b) Check blade track. Refer to Blade Track in this section.

CAUTION: DO NOT USE BLADE PADDLES TO TURN BLADES.

(c) Manually (by hand) attempt to turn the blades (change pitch). Do not use a blade paddles.

(d) Visually check for damaged blades.

(7) If abnormal blade conditions or damage are found, perform additional inspections (by qualified personnel at an appropriately licensed propeller service facility) to evaluate the condition. Refer to the Composite Blades section in the Maintenance Practices chapter of this manual.

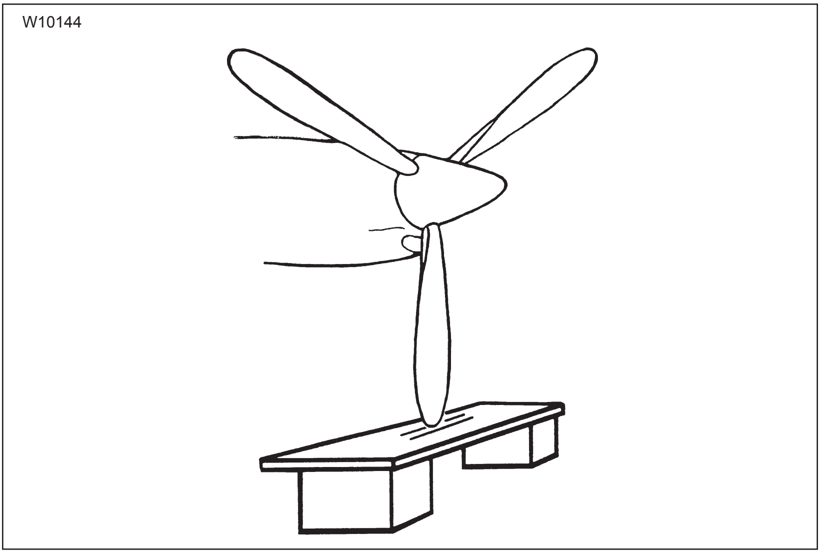
(8) If cracks or failing components are found, these parts must be replaced before further flight. Report such occurrences to airworthiness authorities and Hartzell Propeller Inc. Product Support.

D. Tachometer Inspection

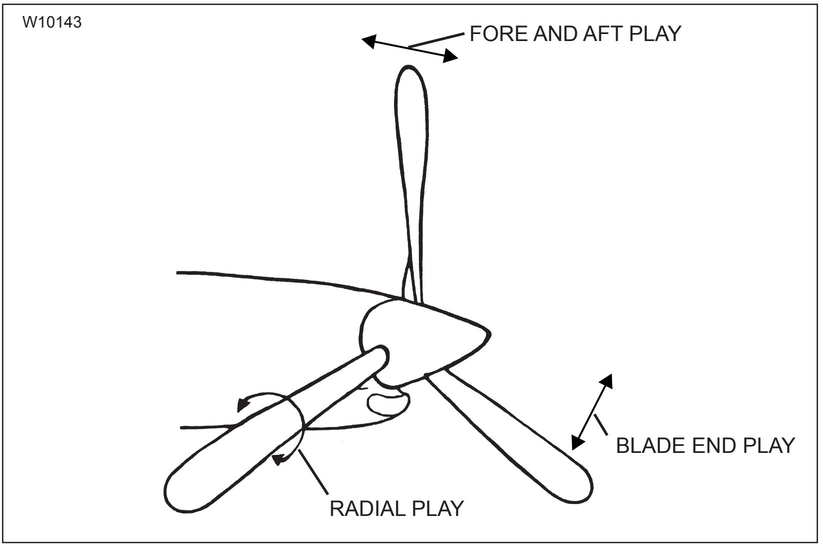
WARNING: OPERATION WITH AN INACCURATE TACHOMETER MAY RESULT IN RESTRICTED RPM OPERATION AND DAMAGING HIGH STRESSES. BLADE LIFE WILL BE SHORTENED AND COULD RESULT IN CATASTROPHIC FAILURE.

(1) Accuracy of the engine tachometer should be verified at 100 hour intervals or at annual inspection, whichever occurs first.

(2) Hartzell Propeller Inc. recommends using a tachometer that is accurate within +/- 10 RPM, has NIST calibration (traceable), and has an appropriate calibration schedule.



Checking Blade Track
Figure 5-1



Blade Play
Figure 5-2

E. Blade Track

(1) Check blade track as follows:

(a) Chock aircraft wheels securely.

(b) Refer to Figure 5-1. Place a fixed reference point beneath the propeller, within 0.25 inch (6.4 mm) of the lowest point of the propeller arc.

NOTE: This reference point may be a flat board with a sheet of paper attached to it. The board may then be blocked up to within 0.25 inch (6.4 mm) of the propeller arc.

(c) Remove the piston nut and move the blades to low pitch blade angle.

NOTE: An accurate blade track inspection can not be accomplished with the blades in feather position.

(d) Rotate the propeller by hand in the direction of normal rotation until a blade points directly at the paper. Mark the position of the blade tip in relation to the paper.

(e) Repeat this procedure with the remaining blades.

(f) Tracking tolerance is ± 0.125 inch (3.18 mm) or 0.25 inch (6.4 mm) total.

(g) Reinstall and torque the piston nut in accordance with Torque Table 3-2.

(2) Possible Correction

(a) Remove any foreign matter from the propeller mounting flange.

(b) If no foreign matter is present, refer to an appropriately licensed propeller service facility.

F. Loose Blades

Refer to Figure 5-2. Limits for blade looseness are as follows:

End Play	± 0.06 inch (1.5 mm)
Fore & Aft Movement	± 0.06 inch (1.5 mm)
Radial Play (pitch change)	± 0.5 degree (1 degree total)

NOTE: Blades are intended to be tight in the propeller; however, movement less than the allowable limits is acceptable if the blade returns to its original position when released. Blades with movement greater than the allowable limits, or that do not return to their original position when released may indicate internal wear or damage that should be referred to an appropriately licensed propeller service facility.

G. Corrosion

WARNING: REWORK THAT INVOLVES COLD WORKING THE METAL, RESULTING IN CONCEALMENT OF A DAMAGED AREA IS NOT PERMITTED.

Corrosion of any type on the hub or the blade clamp, or heavy corrosion on other parts that results in severe pitting, must be referred to an appropriately licensed propeller service facility.

H. Spinner Damage

Inspect the spinner for cracks, missing hardware, or other damage. Refer to Hartzell Propeller Inc. Metal Spinner Maintenance Manual 127 (61-16-27) or an appropriately licensed propeller service facility for spinner damage acceptance and repair information.

I. Electric De-ice System

Refer to the De-ice Systems chapter of this manual for inspection procedures.

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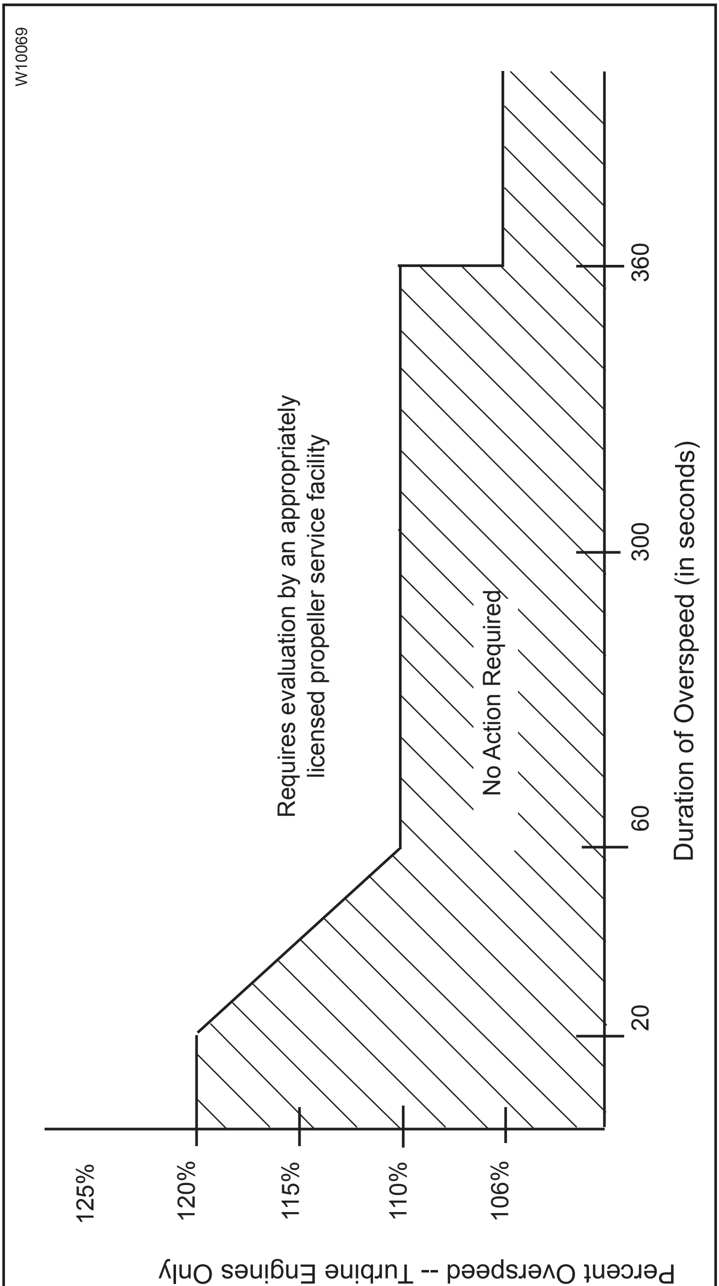
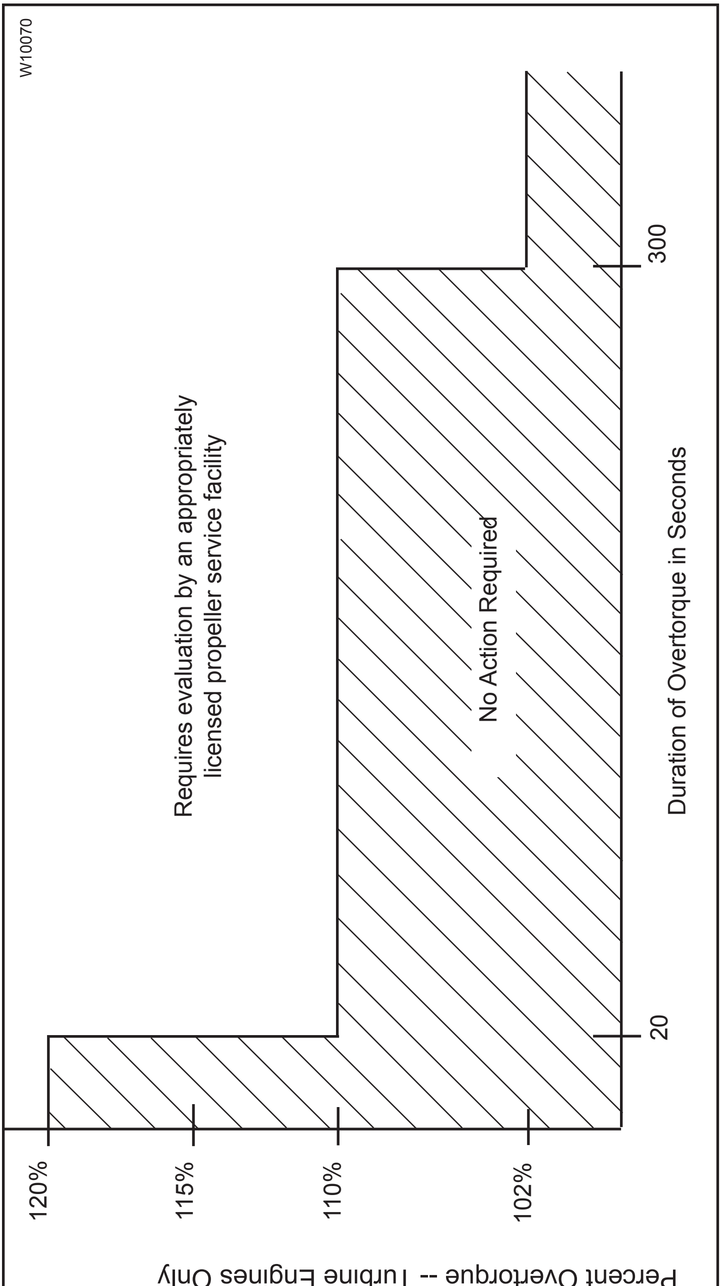


Turbine Engine Overspeed Limits
Figure 5-3



Turbine Engine Overtorque Limits
Figure 5-4

5. Special Inspections

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

A. Overspeed/Overtorque

An overspeed has occurred when the propeller RPM has exceeded the maximum RPM stated in the applicable Aircraft Type Certificate Data Sheet. An overtorque condition occurs when the engine load exceeds the limits established by the engine, propeller, or airframe manufacturer. The duration of time at overspeed/overtorque for a single event determines the corrective action that must be taken to ensure that no damage to the propeller has occurred.

The criteria for determining the required action after an overspeed are based on many factors. The additional centrifugal forces that occur during overspeed are not the only concern. Some applications have sharp increases in vibratory stresses at RPMs above the maximum rated for the airframe/engine/propeller combination.

(1) When a propeller installed on a turbine engine has an overspeed event, refer to the Turbine Engine Overspeed Limits (Figure 5-3) to determine the corrective action to be taken.

(2) When a propeller installed on a turbine engine has an overtorque event, refer to the Turbine Engine Overtorque Limits (Figure 5-4) to determine the corrective action to be taken.

(3) Make an entry in the propeller logbook to document the overspeed/overtorque event.

NOTE: Some aircraft installations have torque indicator values indicating 100% torque that are less than the maximum certified torque for the specific propeller model as listed in the propeller type certificate data sheet. If an overtorque occurs that requires propeller repair station evaluation, contact Hartzell Propeller Inc. Product Support to confirm actual overtorque percentage.

B. Lightning Strike

CAUTION 1: 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.

CAUTION 2: A 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.

(1) General

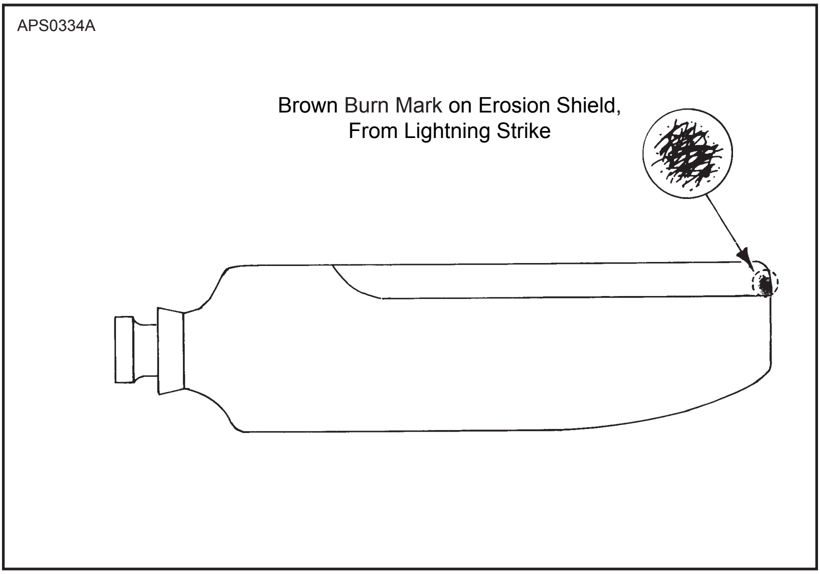
In the event of a propeller lightning strike, an inspection is required before further flight.

It may be permissible to operate a propeller for an additional ten (10) hours of operation if the propeller is not severely damaged and meets the requirements in Procedures for Temporary Operation in this section. Regardless of the outcome of the initial inspection, the propeller must eventually be removed from the aircraft, disassembled, evaluated, and/or repaired by an appropriately licensed propeller service facility.

(2) Procedure for Temporary Operation

If temporary additional operation is desired before propeller removal and disassembly:

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



Evidence of Lightning Strike Damage to Composite Blade
Figure 5-5

CAUTION: IF THE PROPELLER EXPERIENCES A LIGHTNING STRIKE, THE COMPOSITE BLADES MUST BE WITHIN AIRWORTHY LIMITS FOR ANY ADDITIONAL FLIGHT.

(b) Perform a thorough visual inspection of the blades, looking for the indications of a lightning strike. If lightning strike damage is present, a darkened area and possible pitting, usually in proximity to the tip and at the most inboard end of the metal erosion shield, will be noticeable (Figure 5-5).

If the blade has a de-ice boot installed, it may be debonded from the erosion shield due to the strike. In any case, the de-ice system 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.

(c) Perform a coin-tap inspection of the composite blades that have indications of arcing. If the only evident damage is minor arcing and all other criteria do not exceed airworthy damage limits, stated in the Maintenance Practices chapter, then operation for ten (10) hours is acceptable before disassembly and inspection.

(d) Perform a functional check of the propeller de-ice system (if installed) in accordance with aircraft maintenance manual procedures.

(e) Regardless of the degree of damage, make a log book entry to document the lightning strike.

(f) The propeller must be removed from the aircraft, disassembled, evaluated, and/or repaired by an appropriately licensed propeller service facility for flight beyond the temporary operation limits granted above.

C. Foreign Object Strike/Ground Strike

(1) General

(a) A foreign object strike can include a broad spectrum of damage, from a minor stone nick to severe ground impact damage. A conservative approach in evaluating the damage is required because there may be hidden damage that is not readily apparent during an on-wing, visual inspection.

(b) A foreign object strike is defined as:

1 Any incident, whether or not the engine is operating, that requires repair to the propeller other than minor dressing of the blades. Examples of foreign object strike include situations where an aircraft is stationary and the landing gear collapses causing one or more blades to be significantly damaged, or where a hangar door (or other object) strikes the propeller blade. These cases should be handled as foreign object strikes because of potentially severe side loading on the propeller hub, blades and retention bearings.

2 Any incident during engine operation in which the propeller impacts a solid object that causes a drop in revolutions per minute (RPM) and also requires structural repair of the propeller (incidents requiring only paint touch-up are not included). This is not restricted to propeller strikes against the ground.

3 A sudden RPM drop while impacting water, tall grass, or similar yielding medium, where propeller blade damage is not normally incurred.

(2) Procedure

(a) In the event of a foreign object strike, an inspection is required before further flight. If the inspection reveals one or more of the following indications, the propeller must be removed from the aircraft, disassembled, and overhauled in accordance with the applicable propeller and blade maintenance manuals.

1 A blade rotated in the clamp.

2 Any noticeable or **suspected** damage to the pitch change mechanism.

3 A bent blade (out of track or angle).

4 Any diameter reduction.

5 Blade Damage.

6 A bent, cracked, or failed engine shaft.

7 A blade rotated in the clamp.

8 Vibration during operation that was not present before the event.

(b) Unairworthy damage on composite blade surfaces or on the leading and trailing edges must be repaired before flight. Refer to the Composite Blade Unairworthy Damage section in the Maintenance Practices chapter of this manual.

(c) Engine mounted components such as governors, pumps, etc. may be damaged by a foreign object strike/ground strike, especially if the strike resulted in a sudden stoppage of the engine. These components should be inspected, repaired, or overhauled as recommended by the applicable component maintenance manual.

(d) Make an entry in the propeller log book about the foreign object strike/ground strike incident and any corrective action(s) taken.

D. Fire Damage or Heat Damage

WARNING 1: EXPOSING COMPOSITE BLADES TO HIGH TEMPERATURES MAY LEAD TO FAILURE THAT MAY CAUSE PERSONAL INJURY AND DEATH. COMPOSITE BLADES ARE SUBJECT TO DELAMINATIONS DUE TO HIGH TEMPERATURES.

WARNING 2: HUBS AND CLAMPS ARE MANUFACTURED FROM HEAT TREATED FORGINGS AND ARE SHOT PEENED. EXPOSURE TO HIGH TEMPERATURES CAN DESTROY THE FATIGUE RESISTANCE BENEFITS OBTAINED FROM THESE PROCESSES.

On rare occasions propellers may be exposed to fire or heat damage, such as an engine or hangar fire. In the event of such an incident, an inspection by an appropriately licensed propeller service facility is required before further flight.

6. Long Term Storage

   A. Parts shipped from the Hartzell Propeller Inc. factory are not shipped or packaged in a container that is designed for long term storage.

   B. Long term storage procedures may be obtained by contacting a Hartzell Propeller Inc. distributor, or the Hartzell Propeller Inc. factory via the Product Support number listed in the Introduction chapter of this manual. Storage information is also detailed in Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

   C. Information regarding the return of a propeller assembly to service after long term storage may be obtained by contacting a Hartzell Propeller Inc. distributor, or the Hartzell Propeller Inc. factory via the Product Support number listed in the Introduction chapter of this manual. This information is detailed in Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

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1. Cleaning

CAUTION 1: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

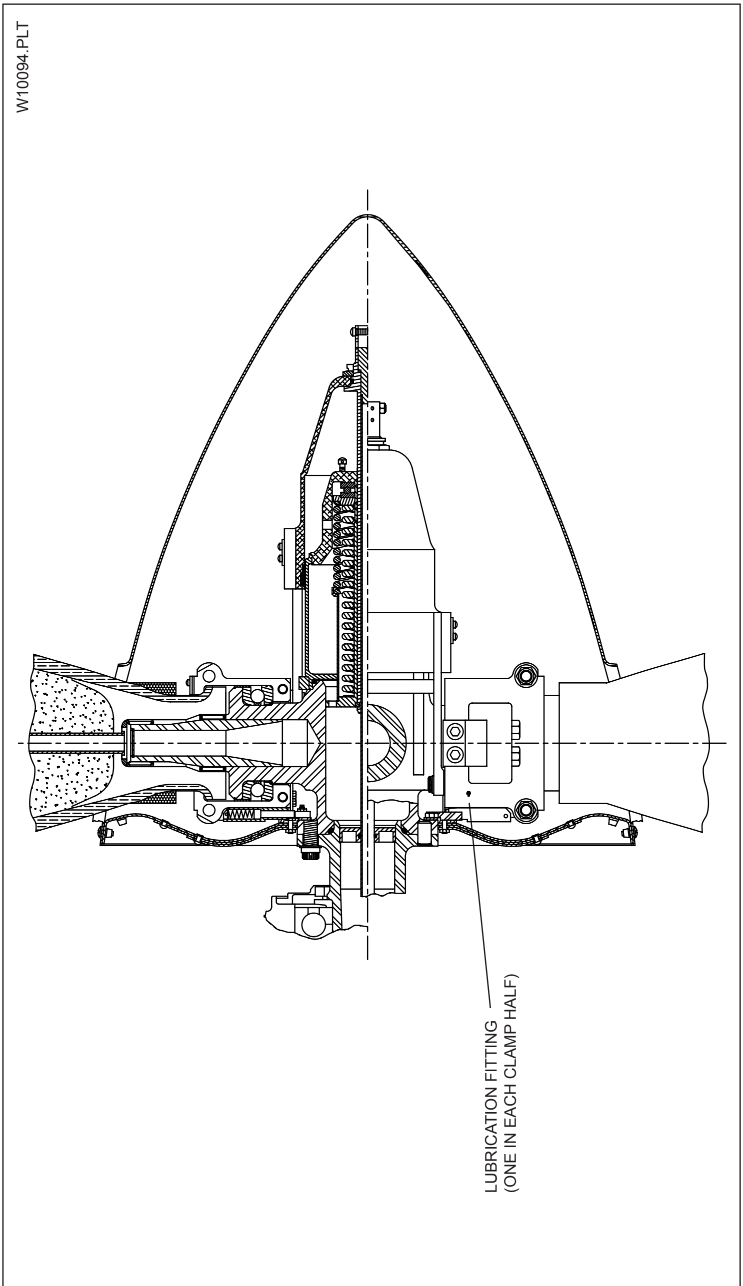
CAUTION 2: DO NOT USE PRESSURE WASHING EQUIPMENT TO CLEAN THE PROPELLER OR CONTROL COMPONENTS. PRESSURE WASHING CAN FORCE WATER AND/OR CLEANING SOLVENTS PAST SEALS, AND CAN LEAD TO INTERNAL CORROSION OF PROPELLER COMPONENTS.

A. General Cleaning

CAUTION 1: DO NOT CLEAN THE PROPELLER WITH CAUSTIC OR ACIDIC SOAP SOLUTIONS. IRREPARABLE CORROSION OF PROPELLER COMPONENTS MAY OCCUR.

CAUTION 2: WHEN CLEANING THE PROPELLER, DO NOT ALLOW SOAP OR SOLVENT SOLUTIONS TO RUN OR SPLASH INTO THE HUB AREA.

(1) Wash the propeller with a noncorrosive soap solution.



Lubrication Fitting
Figure 6-1

WARNING: CLEANING AGENTS (ACETONE, #700 LACQUER THINNER, AND MEK), ARE FLAMMABLE AND TOXIC TO THE SKIN, EYES AND RESPIRATORY TRACT. SKIN AND EYE PROTECTION ARE REQUIRED. AVOID PROLONGED CONTACT. USE IN WELL VENTILATED AREA.

CAUTION: DO NOT USE ANY SOLVENT DURING CLEANING THAT COULD SOFTEN OR DESTROY THE BOND BETWEEN CHEMICALLY ATTACHED PARTS.

(2) To remove grease or oil from propeller surfaces, apply Stoddard Solvent or equivalent to a clean cloth and wipe the part clean.

(3) Thoroughly rinse in water and allow the part to dry.

B. Spinner Cleaning and Polishing

(1) Clean the spinner using the General Cleaning procedures in this section.

(2) Polish the dome (if required) with an automotive-type aluminum polish.

2. Lubrication

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

A. Lubrication Intervals

(1) The propeller is to be lubricated at intervals not to exceed 200 hours or at 12 calendar months, whichever occurs first.

(a) If annual operation is significantly less than 100 hours, calendar lubrication intervals should be reduced to six months.

(b) If the aircraft is operated or stored under adverse atmospheric conditions, e.g., high humidity, salt air, calendar lubrication intervals should be reduced to 100 hours or six months.

(c) If the propeller is operated on a seaplane, the lubrication interval should be reduced to 100 hours or six months.

(d) If the propeller is leaking grease, the lubrication interval should be reduced to 100 hours until the grease leak issue is resolved.

(2) Owners of high use aircraft may wish to extend their lubrication intervals. Lubrication interval may be gradually extended after evaluation of previous propeller overhauls, with regard to bearing wear and internal corrosion.

(3) New or newly overhauled propellers should be lubricated after the first one or two hours of operation, because centrifugal loads will pack and redistribute grease.

(a) Purchasers of new aircraft should check the propeller logbook to verify whether the propeller was lubricated by the manufacturer during flight testing. If not, the propeller should be serviced at earliest convenience.

B. Lubrication Procedure

CAUTION: FOLLOW LUBRICATION PROCEDURES CORRECTLY TO MAINTAIN AN ACCURATE BALANCE OF THE PROPELLER ASSEMBLY.

(1) Remove the propeller spinner.

(2) Refer to Figure 6-1. Each blade clamp has two lubrication fittings. Remove both lubrication fitting caps and one of the lubrication fittings from each blade clamp.

(3) Use a piece of safety wire to loosen any blockage or hardened grease in the threaded holes where the lubrication fitting was removed.

WARNING: WHEN MIXING AEROSHELL GREASES 5 AND 6, AEROSHELL GREASE 5 MUST BE INDICATED ON THE LABEL (HARTZELL PROPELLER INC. P/N A-3594) AND THE AIRCRAFT MUST BE PLACARDED TO INDICATE THAT FLIGHT IS PROHIBITED IF THE OUTSIDE AIR TEMPERATURE IS LESS THAN -40°F (-40°C).

CAUTION: USE HARTZELL PROPELLER INC. APPROVED GREASE ONLY. EXCEPT IN THE CASE OF AEROSHELL GREASES 5 AND 6, DO NOT MIX DIFFERENT SPECIFICATIONS AND/OR BRANDS OF GREASE.

(4) Aeroshell greases 5 and 6 both have a mineral oil base and have the same thickening agent; therefore, mixing of these two greases is acceptable in Hartzell Propeller Inc. propellers.

(5) A label (Hartzell Propeller Inc. P/N A-3594) is normally applied to the propeller to indicate the type of grease previously used (Figure 6-2).

(a) This grease type should be used during re-lubrication, unless the propeller has been disassembled and the old grease removed.

(b) Purging of old grease through lubrication fittings is only about 30 percent effective.

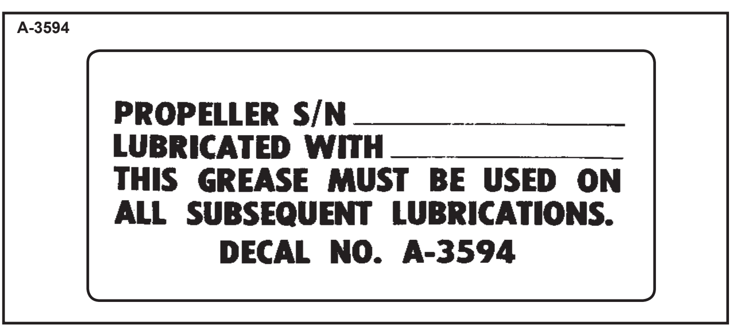
(c) To completely replace one grease with another, the propeller must be disassembled in accordance with the applicable overhaul manual.

<u>CAUTION 1</u>: IF A PNEUMATIC GREASE GUN IS USED, EXTRA CARE MUST BE TAKEN TO AVOID EXCESSIVE PRESSURE BUILDUP.

<u>CAUTION 2</u>: GREASE MUST BE APPLIED TO ALL BLADES OF A PROPELLER ASSEMBLY AT THE TIME OF LUBRICATION.

(6) Pump grease into the blade clamp lubrication fitting until grease emerges from the hole of the removed lubrication fitting.

<u>NOTE</u>: Lubrication is complete when grease emerges in a steady flow with no air pockets or moisture, and has the color and texture of the new grease.



Lubrication Label
Figure 6-2

(7) Repeat step 2.B.4 for each blade clamp assembly.

(8) Reinstall the removed lubrication fitting on each clamp.

(9) Tighten each lubrication fitting until snug.

(a) Make sure the ball of each lubrication fitting is correctly seated.

(10) Install a new lubrication fitting cap on each lubrication fitting.

C. Approved Lubricants

(1) The following lubricants are approved for use in Hartzell Propeller Inc. propellers:

Aeroshell 6 -	Recommended "all purpose" grease. Used in most new production propellers since 1989. Higher leakage/oil separation than Aeroshell 5 at higher temperatures.
Aeroshell 5 -	Good high temperature qualities, very little oil separation or leakage. Cannot be used in temperatures colder than -40° F (-40° C). Aircraft serviced with this grease must be placarded to indicate that flight is prohibited if the outside air temperature is less than -40° F (-40° C).
Aeroshell 7 -	Good low temperature grease, but high leakage/oil separation at higher temperatures. This grease has been associated with sporadic problems involving seal swelling.
Aeroshell 22 -	Qualities similar to Aeroshell 7.
Royco 22CF -	Not widely used. Qualities similar to Aeroshell 22.

(2) A label indicating the type of grease used for previous lubrication (if used) is installed on the propeller piston or on the blade clamp. If the propeller must be lubricated with a different type of grease, the propeller must be disassembled and cleaned of old grease before relubricating.

3. Carbon Block Assemblies

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

A. Inspection

Refer to Figures 3-5 and 3-6.

The clearance between the yoke pin and the corresponding linkage (beta lever bushing) can become too close due to a buildup of plating and foreign particles between the two pieces. This can cause a binding action, resulting in excessive wear to the carbon block, low stop collar, and beta linkage.

(1) Inspect the beta lever and carbon block interface for free movement. If there is binding, complete the following steps:

(a) Disconnect the beta linkage and remove the carbon block assemblies from the beta ring.

(b) Polish the yoke pin to provide adequate clearance and eliminate binding.

(c) Reinstall the carbon block assembly into the beta ring.

(d) Install, adjust and safety the beta linkage per the airframe manufacturer's instructions.

B. Replacement of A-3026 Carbon Block Unit in the A-3044 Carbon Block Assembly

Replace an A-3026 carbon block unit if the side clearance between the beta ring and carbon block exceeds 0.010 inch (0.25 mm)

(1) Remove the cotter pin from the end of the clevis pin.

(2) Slide the pin from the assembly and remove and discard the carbon block unit.

(3) Inspect the yoke for wear or cracks. Replace the yoke if necessary.

(4) Install a new carbon block unit and slide a new clevis pin into place.

(5) Secure the clevis pin with a T-head cotter pin (Figure 3-6).

(6) Refit the carbon block (Figure 3-5).

(a) Establish the required clearance by sanding the sides of the carbon block as needed.

C. Installation of the A-3044 Carbon Block Assembly

Refer to the Installation and Removal chapter of this manual for installation instructions.

4. Composite Blades

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

A. Component Life and Service

(1) Blade Life

Blade life is expressed in terms of total hours of service since new (TSN), time between overhauls (TBO) and in terms of service since overhaul (TSO). All references are necessary in defining the life of the propeller.

(2) 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 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 Propeller Inc. Composite Propeller Blade Maintenance Manual 135F (61-13-35) and other applicable publications.

B. Blade Maintenance Inspection Requirements

CAUTION: 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. IT IS IMPORTANT FOR INSPECTORS TO HAVE ACCESS TO ACCURATE HISTORICAL DATA WHEN PERFORMING SUBSEQUENT INSPECTIONS.

(1) Required Record-Keeping

Composite blade damage and a description of its repair must be recorded in the composite blade log book.

(2) Maintenance Inspections

Inspection procedures must be performed in accordance with this manual.

(a) Perform a thorough visual inspection.

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

(c) Review the blade log book records and carefully inspect areas of airworthy damage and previously repaired areas for growth. If the damaged areas have grown larger, estimate if they will exceed airworthy damage limits before the next overhaul. If this is the case, make arrangements to repair the damage at the earliest practical time to prevent further damage to the blade.

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(d) Defects or damage discovered during scheduled inspections must be evaluated in accordance with allowables outlined later in this section, to determine if repairs are required before further flight. Although repair of “airworthy damage” is not essential before further flight, such damage should always be repaired as soon as possible, to avoid further degradation. In most cases, “unairworthy damage” must be repaired before further flight.

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

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

“Coin-Tap” Test to Check for Debond and Delamination
Figure 6-3

C. Coin-Tap Test

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

(1) Procedure

Use a washer-shaped metal tapper, approximately 2.50 inches (63.5 mm) OD x 1.25 inches (31.8 mm) ID x 0.25 inch (6.4 mm) thick, and weighing no less than 3 ounces (85 gm). Tap the surface. If an audible change is apparent, sounding hollow or dead, a debond or delamination is likely (Figure 6-3).

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

(2) Mapping

“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 (5 cm) during scheduled aircraft inspections.

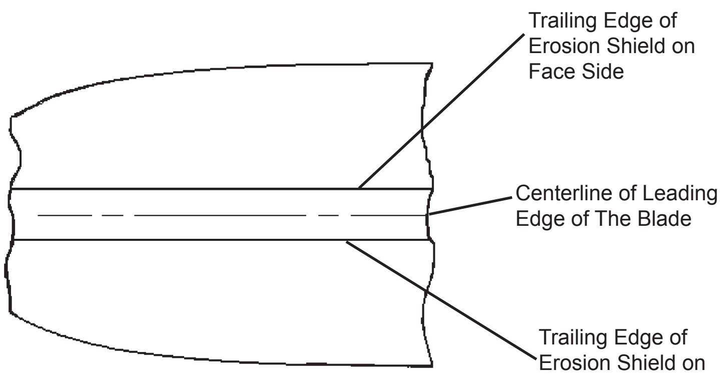
(a) A more thorough coin-tapping of the erosion shield is desirable due to its size and shape. Tap in a smaller grid pattern up and down the length of the erosion shield. Slight deformations in the erosion shield may be noticed with careful visual and manual (touch) inspection. Such deformations may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

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

(3) Recording Damage

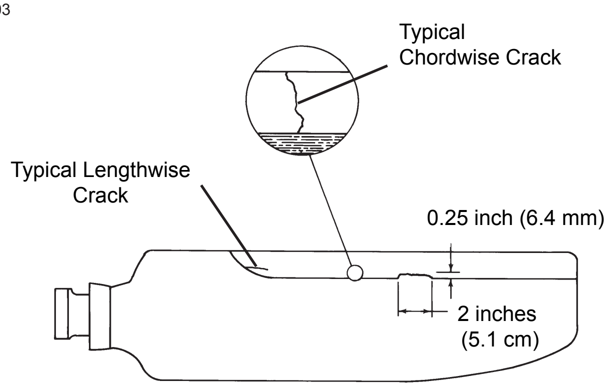
Outline the suspect area with a grease pencil to determine the approximate size of the damage. Record the damage/repairs in the propeller log book.

APS6041



Interpretation of Erosion Shield Damage
Figure 6-4

APS0903



Missing Portions of Nickel Erosion Shield (Trailing Edge)
and Typical Cracks
Figure 6-5

D. Composite Blade Airworthy Damage

CAUTION: ALTHOUGH A BLADE MAY CONTINUE IN SERVICE WITH AIRWORTHY DAMAGE, THIS TYPE OF DAMAGE SHOULD BE MONITORED AND REPAIRED AT THE EARLIEST PRACTICAL TIME TO PREVENT FURTHER DAMAGE TO THE BLADE.

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

NOTE: 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 Hartzell Propeller Inc.

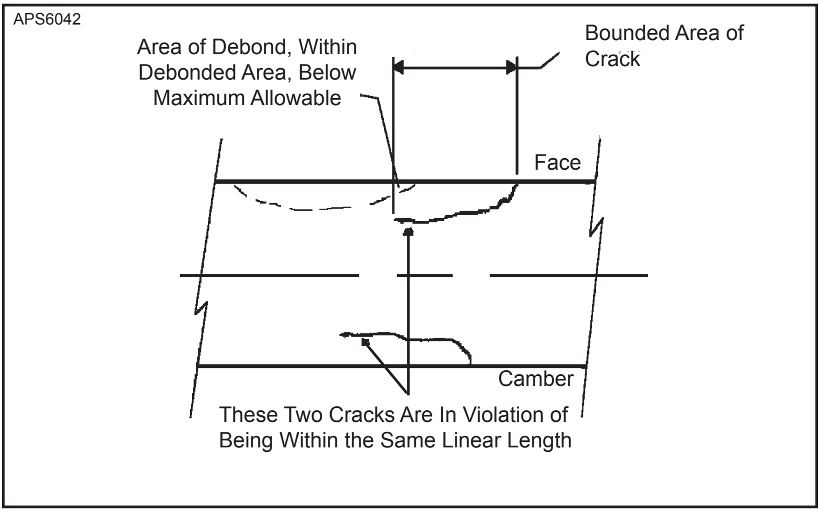
(1) Airworthy Damage Limits

(a) Nickel Erosion Shield
(Applies to blade models LM10585AN(K)+4, M10083(K) and M10877(K)

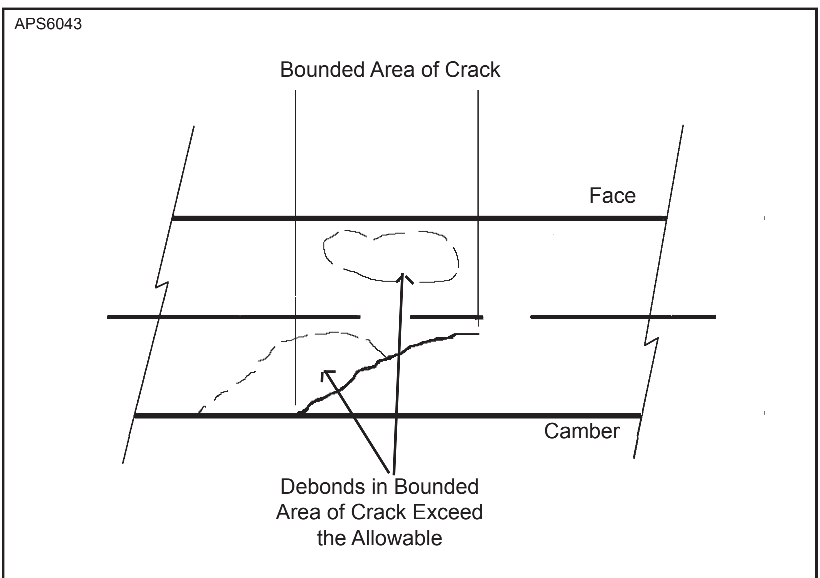
NOTE: When calculating the area of damage and the proximity to other damage, the erosion shield should be viewed as a two dimensional shape, as if it were unfolded and laid flat where the face and camber sides of the blade could be viewed at the same time. Refer to Figure 6-4 for the interpretation of the view of the erosion shield.

1 The following limits apply to the entire erosion shield:

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



Acceptable Erosion Shield Debond, Non-acceptable Crack Location Examples
Figure 6-6



Debonds in Excess of Allowable Limits
Figure 6-7

- b Gouges through the erosion shield up to 0.25 square inch (1.6 square cm) are acceptable. Although this damage is acceptable, it must be repaired as soon as practical to prevent further damage to the blade. Damage to the blade surface beneath the erosion shield cannot be more than 0.02 inch (0.5 mm) deep. This represents two layers of fibrous material.
- c 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 (0.6 x 5 cm). Refer to Figure 6-5 for an example of allowable missing material.

2 The following limits apply to all sections of the erosion shield not covered by a de-ice system:

- a No more than 20 percent of the erosion shield may be debonded in any 6.0 inch (15 cm) length of the erosion shield.
- b No two full width, chordwise cracks may occur within 6.0 inches (15 cm) of each other.
- c No lengthwise crack may exceed 2.0 inches (5 cm) in length.
- d No two lengthwise cracks may be within the same linear length of the erosion shield. This includes cracks on opposite sides of the blade. See Figure 6-6 for an example in violation of this limit. Note that the cracks are on opposite sides of the blade.

e No more than 20 percent of the area bounded by a lengthwise crack and the trailing edge of the erosion shield may be debonded. Figure 6-6 shows an example within this tolerance limit. Figure 6-7 shows an example of a debonded area that exceeds the 20 percent maximum allowable.

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

(b) 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, 3.H.(1)(b)1 through 3.H.(1)(b)3, cannot be resolved without replacement of the erosion shield, but within these limits, do not render the blade unairworthy.

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

2 No two chordwise cracks may occur within 6 inches (15 cm) of each other.

3 Minor deformations due to impact damage that do not greatly affect the airfoil shape.

NOTE: The following damages, 3.H.(1)(b)4 through 3.H.(1)(b)8, do not render the blade unairworthy, but should be repaired as soon as practical to prevent degradation of the condition.

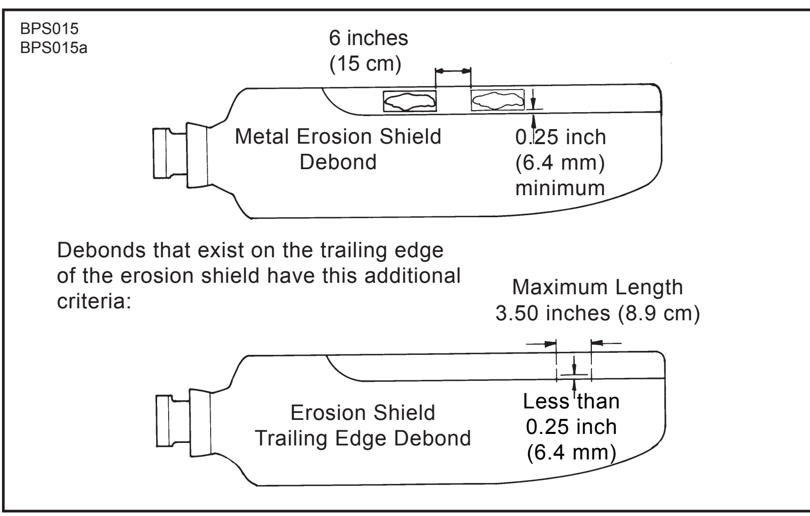
4 A crack or gouge in the erosion shield that is less than 0.125 inch (3.18 mm) deep, and less than 0.25 square inch (1.6 square cm), not to exceed 0.50 inch (12.7 mm) length.

5 Debond located along the trailing side of the erosion shield, that is no longer than 3.5 inches (9 cm) and no wider than 0.25 inch (6.4 mm) (Figure 6-8).

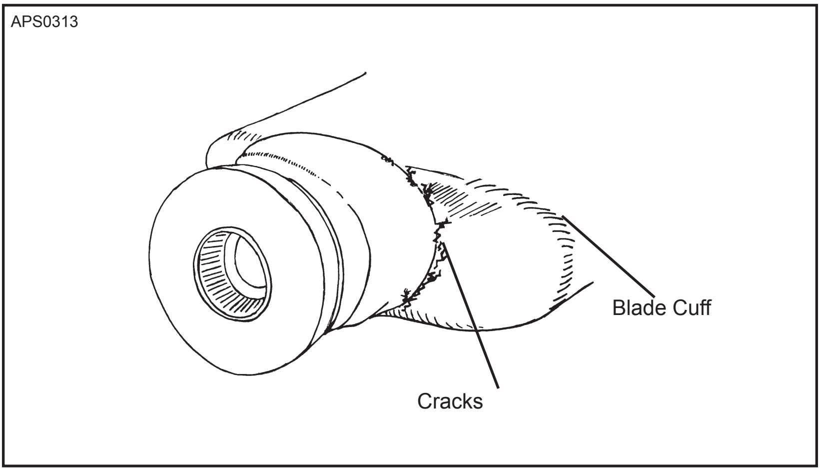
6 Debond that is located at least 0.25 inch (63.5 mm) from the erosion shield trail side, has a total area less than 2.5 square inches (16 square cm), and is separated by at least 6 inches (15 cm) from any other debond area on the same blade surface (Figure 6-8).

7 The total debonded area of all debonds may not exceed 10 square inches (65 square cm).

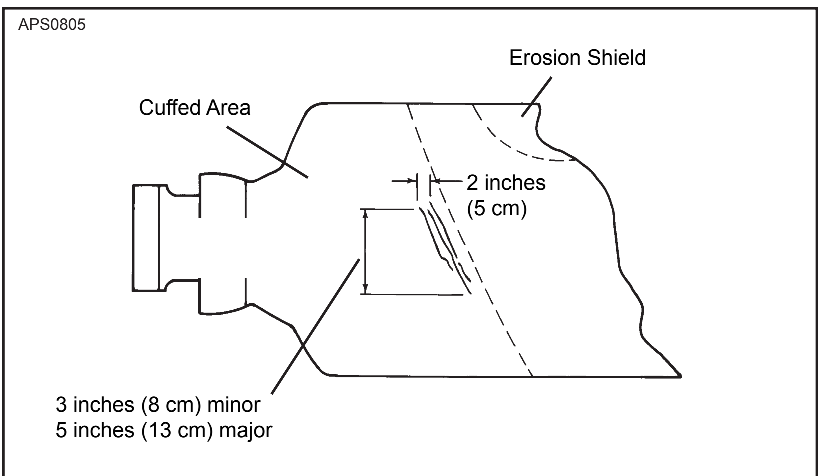
8 No cadmium screw corrosion is permissible.



Airworthy Debond Limits for Stainless Steel Erosion Shields
Figure 6-8



Blade Cuff Damage
Figure 6-9



Cracks in the Area Where Cuff Meets Blade
Figure 6-10

(c) Blade Cuff (Model: LM10585(AN)(B,K)+4)

1 Nicks, scratches.

2 Depressions less than 1 square inch (7 square cm) area and less than 0.25 inch (6.4 mm) deep.

3 Delaminations less than 2 square inches (13 square cm).

4 Cracks at the root end are airworthy, but should be sealed to protect the foam from contamination (Figure 6-9) until the time of overhaul, when these cracks can be permanently repaired.

5 Cracks located in the area where the cuff and blade meet must be within the limits as shown in Figure 6-10.

6 No more than two other cracks may be located elsewhere on the cuff. These cracks must be less than 3.0 inches (8 cm) each in length.

7 No more than two damaged areas per side are permitted within 6 linear inches (15 cm) of each other. Root end cracks and cracks where the blade and cuff meet are not included in this requirement.

8 Cuffs with no boot or erosion shield covering the leading edge may not have cracks within 2.0 inches (5 cm) of the leading edge counterweight clamp that are not debonded.

9 Cracks parallel to the leading edge totaling less than 6.0 inches (15.2 cm) in length and not extending beyond the inboard edge of the de-ice boot are airworthy, but should be repaired during overhaul.

(d) Blade Damage

1 Gouges

a Gouges or loss of composite material less than 0.50 inch (12.7 mm) diameter or equivalent area (0.20 square inch or 1.3 square cm) and no more than 2.5 inches (6.4 cm) long and less than 0.02 inch (5.1 mm) deep anywhere on the **outboard** half of the blade are acceptable.

b Gouges, loss of composite material, or delaminations on the **inboard** half of the blade must be referred to an authorized service facility for evaluation.

2 Delamination

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

3 Paint Erosion

Exposure of less than 5.0 square inches (32.3 square cm) of the composite material and/or the primer filler is acceptable. This allowable does not refer to primer sealer.

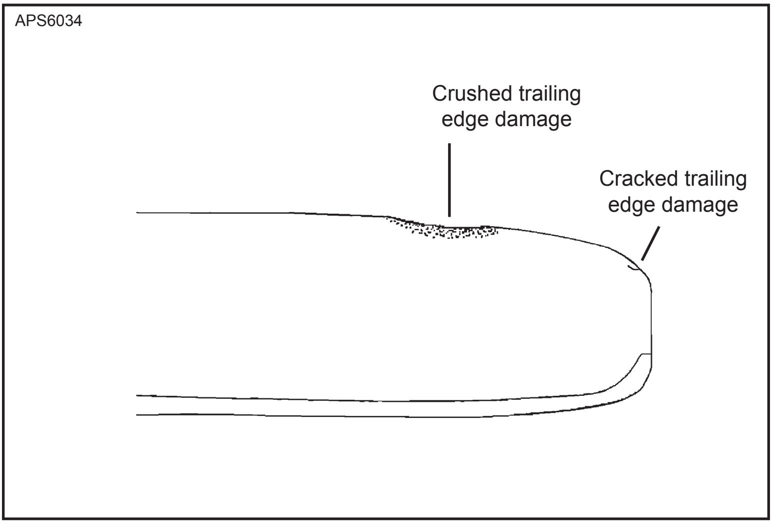
NOTE: Propellers that have blades that exhibit paint erosion exceeding the acceptable limits may continue operation for an additional 250 hours or one (1) month, whichever occurs first. Refer to the Painting of Composite Blades section of this chapter.

4 Crushed or Cracked Trailing Edge (Figure 6-11)

A crushed or cracked area no larger than 0.25 inch deep x 2.0 inch (6.4 x 50.8 mm) long on the outer half of the blade is acceptable.

5 Split Trailing Edge

A split area no larger than 0.5 inch deep x 6.0 inches (12.7 x 152.4 mm) long with no fiber damage or exposed foam is acceptable.



Crushed and Cracked Trailing Edge
Figure 6-11

(e) Erosion Screen (Model M10083[K])

CAUTION: IF DAMAGE IS TOO SEVERE, RISK OF RENDERING THE BLADE UNAIRWORTHY IS POSSIBLE.

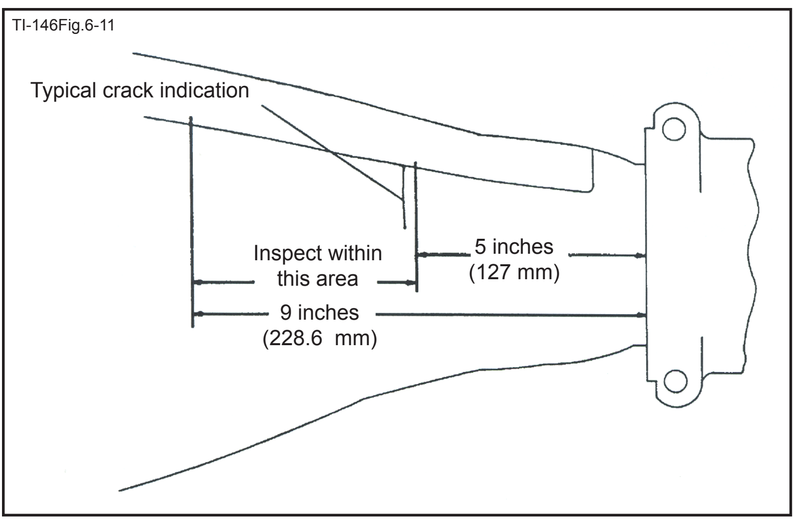
The erosion screen is located on the tip of the blade (face and camber sides) for the purpose of erosion protection.

Although no specific airworthy limits exist for the erosion screen, if the screen or part of the screen becomes loose from the blade, remove the loose piece(s) to prevent possible blade damage from occurring.

The limits of erosion screen damage that would require replacement at overhaul are given in Hartzell Propeller Inc. Composite Propeller Blade Maintenance Manual 135F (61-13-35).

(f) 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.



Blade Crack Location
Figure 6-12

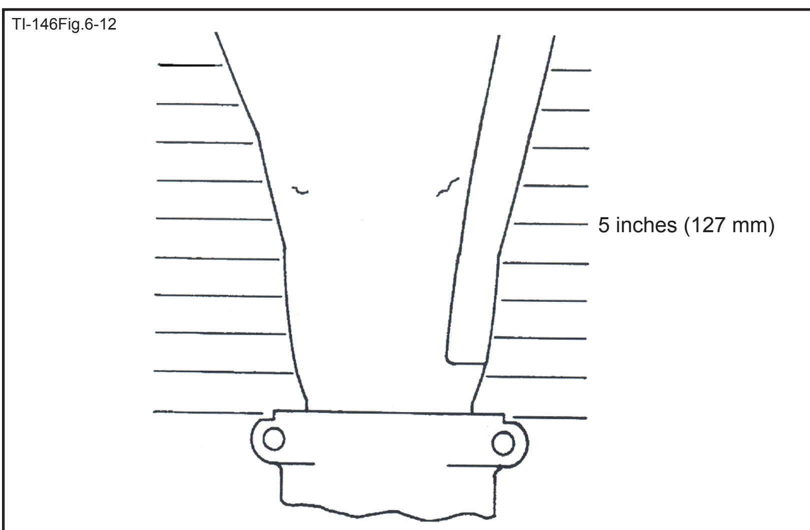
E. Cracks in Blade - Applies to Blade Model M10083( ) on HC-B3MN-3 propeller installed on a Cessna 208 Series Caravan

(1) Using a hand held magnifying glass, perform a visual inspection of the face side of the blade, 5 to 9 inches (127 to 228.6 mm). Refer to Figure 6-12.

(2) If a crack indication is found, use white paint to mark the ends of the crack indication to provide a growth indicator during subsequent inspections.

(3) If a chordwise crack(s) within the 5 inch (127 mm) area is greater than 3.5 inches long (Figure 6-13), notify Hartzell Propeller Inc. Product Support Department of the results within five days. The aircraft may remain in service during that time.

(4) Do not attempt to fill in or re-paint blades in areas containing crack indications.



Blade Crack Outboard of the 5 Inch (127 mm) Area
Figure 6-13

(5) If a previously identified crack(s) shows signs of growth beyond the paint marks, or if additional cracks have developed:

(a) If the total length of the crack growth is greater than 0.25 inch (6.3 mm), contact the Hartzell Propeller Inc. Product Support Department within five days for assistance.

(b) The aircraft may remain in service during that time.

(6) Crack(s) outboard of the 5 inch (127 mm) area, as shown in Figure 6-13, are not repairable. Notify the Hartzell Propeller Inc. Product Support Department.

(7) Make an entry in the propeller logbook about the condition found.

F. Composite Blade Unairworthy Damage

CAUTION: UNAIRWORTHY DAMAGE TO A HARTZELL PROPELLER INC. COMPOSITE BLADE MUST BE REPAIRED BEFORE THE NEXT FLIGHT. UNAIRWORTHY DAMAGE CAN AFFECT THE SAFETY OR FLIGHT CHARACTERISTICS OF THE PROPELLER BLADE.

(1) Definition

Any damage that exceeds the limits of airworthy damage is considered unairworthy.

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G. Painting of Composite Blades

(1) General

Propeller blades are painted with a durable specialized coating that is resistant to abrasion. If this coating becomes eroded over an area of more than 10 square inches (64.5 square cm), it is necessary to repaint the entire blade to provide proper corrosion and erosion protection. Painting should be performed in accordance with Hartzell Propeller Inc. Composite Propeller Blade Maintenance Manual 135F (61-13-35).

For paint erosion over an area of less than 10 square inches (64.5 square cm) it is permissible to perform a blade touch-up with aerosol paint in accordance with the procedures in this section.

Refer to Table 6-1 for paints that are approved for blade touch-up.

Vendor	Color/Type	Vendor P/N	Hartzell Propeller Inc. P/N
Tempo	Epoxy Black	A-150	n/a
Tempo	Epoxy Gray	A-151	n/a
Tempo	Epoxy White (tip stripe)	A-152	n/a
Tempo	Epoxy Red (tip stripe)	A-153	n/a
Tempo	Epoxy Yellow (tip stripe)	A-154	n/a
Sherwin-Williams	Black	F75KXB9958-4311	A-6741-145-1
Sherwin-Williams	Gray	F75KXA10445-4311	A-6741-146-1
Sherwin-Williams	White (tip stripe)	F75KXW10309-4311	A-6741-147-1
Sherwin-Williams	Gray Metallic (Raytheon Beech 1900D aircraft models only)	F75KXM9754-4311	A-6741-148-1
Sherwin-Williams	Red (tip stripe)	F75KXR12320-4311	A-6741-149-1
Sherwin-Williams	Yellow (tip stripe)	F75KXY11841-4311	A-6741-150-1

Approved Paints
Table 6-1

The paint manufacturers may be contacted via the information below:

Tempo Products Co.
A plasti-kote Company
1000 Lake Road
Medina, OH 44256
Tel: 800.321.6300
Fax: 216.349.4241
Cage Code: 07708

Sherwin Williams Co.
2390 Arbor Boulevard
Moraine, Ohio 45439
Tel: 937.298.8691
Fax: 937.298.3820
Cage Code: 0W199

(2) Procedure

WARNING: CLEANING AGENTS (ACETONE, #700 LACQUER THINNER, AND MEK), ARE FLAMMABLE AND TOXIC TO THE SKIN, EYES AND RESPIRATORY TRACT. SKIN AND EYE PROTECTION ARE REQUIRED. AVOID PROLONGED CONTACT. USE IN WELL VENTILATED AREA.

CAUTION 1: ANY REFINISHING PROCEDURE CAN ALTER PROPELLER BALANCE. PROPELLERS THAT ARE OUT OF BALANCE MAY EXPERIENCE EXCESSIVE VIBRATIONS WHILE IN OPERATION.

CAUTION 2: PAINT EROSION IS TYPICALLY VERY SIMILAR ON ALL BLADES IN A PROPELLER ASSEMBLY. ALL BLADES SHOULD BE PAINTED TO THE SAME THICKNESS TO MAINTAIN PROPER BALANCE AFTER REFINISHING.

(a) Using acetone, #700 lacquer thinner, or MEK, wipe the surface of the blade to remove any contaminants.

CAUTION: EXCESSIVE SANDING WILL CAUSE "FUZZING" OF THE KEVLAR MATERIAL, RESULTING IN A ROUGH FINISH.

(b) Feather the existing coatings away from the eroded or repaired area with 120 to 180 grit sandpaper.

(c) Use lacquer thinner #700 or MEK to wipe the surface of the blade. Allow the cleaning agent to evaporate.

(d) Mask off erosion shield, deice boot and tip stripes, as needed.

WARNING: FINISH COATINGS ARE FLAMMABLE AND TOXIC TO THE SKIN, EYES AND RESPIRATORY TRACT. SKIN AND EYE PROTECTION ARE REQUIRED. AVOID PROLONGED CONTACT. USE IN WELL VENTILATED AREA.

CAUTION: APPLY FINISH COATING ONLY TO THE DEGREE REQUIRED TO UNIFORMLY COVER THE REPAIR/ EROSION. AVOID EXCESSIVE PAINT BUILDUP ALONG THE TRAILING EDGE TO AVOID CHANGING BLADE PROFILE AND/OR P-STATIC CHARACTERISTICS.

(e) Apply sufficient finish coating to achieve 2 to 4 mil thickness when dry. Re-coat before 30 minutes, or after 48 hours.

(f) Remove masking from tip stripes and re-mask to allow for tip stripe refinishing if required.

(g) Apply the sufficient tip stripe coating to achieve 2 to 4 mils thickness when dry. Re-coat before 30 minutes, or after 48 hours.

(h) Remove tape immediately.

(i) Optionally, perform dynamic balancing in accordance with the procedures and limitations specified in the Dynamic Balance section of this chapter.

5. Dynamic Balance

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

A. Overview

NOTE: Dynamic balance is recommended to reduce vibrations that may be caused by a rotating system (propeller and engine) imbalance. Dynamic balancing can help prolong the life of the propeller, engine, airframe, and avionics.

(1) Static balancing is required when an overhaul or major repair is performed at an appropriately licensed propeller service facility.

NOTE: If static balancing is not accomplished before dynamic balancing, the propeller may be so severely unbalanced that dynamic balance may not be achieved.

(2) Dynamic balance is accomplished by using an accurate means of measuring the amount and location of the dynamic imbalance.

(3) The number of balance weights installed must not exceed the limits specified in this chapter.

(4) Follow the dynamic balance equipment manufacturer's instructions for dynamic balance, in addition to the specifications of this section.

NOTE: Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02), Chapter 600, also contains information on weight placement and balancing.

(5) Unless otherwise specified by the engine or airframe manufacturer, Hartzell Propeller Inc. recommends that the propeller be dynamically balanced to a reading of 0.2 IPS, or less.

B. Inspection Procedures Before Balancing

(1) Visually inspect the propeller assembly before dynamic balancing.

NOTE: The first run-up of a new or overhauled propeller assembly may leave a small amount of grease on the blades and inner surface of the spinner dome.

(a) Use a mild solvent to completely remove any grease from the blades or inner surface of the spinner dome.

(b) Visually check each propeller blade assembly for evidence of grease leakage.

(c) Visually inspect the inner surface of the spinner dome for evidence of grease leakage.

(2) If there is no evidence of grease leakage, lubricate the propeller in accordance with the Maintenance Practices chapter in this manual. If grease leakage is evident, determine the location of the leak and correct before re-lubricating the propeller and dynamic balancing.

(3) Before dynamic balancing, record the number and location of all balance weights.

C. Modifying Spinner Bulkhead to Accommodate Dynamic Balance Weights

CAUTION: ALL HOLE/BALANCE WEIGHT LOCATIONS MUST TAKE INTO CONSIDERATION AND MUST AVOID ANY POSSIBILITY OF INTERFERING WITH THE ADJACENT AIRFRAME, DE-ICE, AND ENGINE COMPONENTS.

(1) It is recommended that the placement of balance weights be in a radial location on the aluminum spinner bulkheads that have not been previously drilled.

(2) The radial location should be outboard of the de-ice slip ring or bulkhead doubler and inboard of the bend where the bulkhead creates the flange to attach the spinner dome.

(3) Twelve equally spaced locations for weight attachment are recommended.

(4) Installing nut plates (10-32 thread) of the type used to attach the spinner dome will allow convenient balance weight attachment on the engine side of the bulkhead.

(5) Alternatively, drilling holes for use with the AN3-( ) type bolts with self-locking nuts is acceptable.

NOTE: Chadwick-Helmuth Manual AW-9511-2, “The Smooth Propeller”, specifies several generic bulkhead rework procedures. These are acceptable, providing they comply with the conditions specified herein.

D. Placement of Balance Weights for Dynamic Balance

(1) The preferred method of attachment of dynamic balance weights is to add the weights to the spinner bulkhead.

NOTE: Many spinner bulkheads have factory installed self-locking nut plates provided for this purpose.

(2) If the location of static balance weights has not been altered, subsequent removal of the dynamic balance weights will return the propeller to its original static balance condition.

(3) Use only stainless or plated steel washers as dynamic balance weights on the spinner bulkhead.

(4) Do not exceed a maximum weight per location of 0.9 oz. (25.5 g).

NOTE: This is approximately equal to six AN970 style washers (0.188 inch ID, 0.875 inch OD, 0.063 inch thickness) (4.78 mm ID, 22.23 mm OD, 1.60 mm thickness).

(5) Install weights using aircraft quality #10-32 or AN-3( ) type screws or bolts.

(6) Balance weight screws attached to the spinner bulkhead must protrude through the self-locking nuts or nut plates a minimum of one thread and a maximum of four threads.

NOTE: It may be necessary to alter the number and/or location of static balance weights in order to achieve dynamic balance.

(7) Make a record in the propeller logbook of the number and location of dynamic balance weights and static balance weights, if they have been reconfigured, in the logbook.

6. De-ice Systems

A. Refer to the De-ice Systems chapter of this manual for de-ice system maintenance information.

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1. Propeller De-ice System

A. Introduction

A propeller de-ice system is a system that removes ice after it forms on the propeller blades. A de-ice system uses electrical heating elements to melt the ice layer that forms on the blades, allowing the ice to be thrown from the blade by centrifugal force. The de-ice system timer controls the application of current to the blades, alternately heating them and allowing them to cool. System components include a timer or cycling unit, electrical slip ring(s), brush block assembly, and blade mounted de-ice boots.

B. System Description

NOTE: Due to the many differences in various de-ice systems, the following description is general in nature. Consult the airframe manufacturer's manual for a description of your specific de-ice system and controls.

The de-ice system is controlled by the pilot via a cockpit control switch. This switch applies power to the de-ice system, which will operate as long as the switch is in the ON position. Depending upon the system, another set of cockpit controls may be available. One of these controls is a mode selector, which allows the pilot to select two cycling speeds for heavy or light icing conditions. Some systems on twin engine aircraft have a switch that provides a full de-ice mode, which allows the pilot to de-ice both propellers simultaneously. This switch may only be used for short periods, and is used when ice builds up on the propeller before the system is turned on.

(1) An ammeter, which indicates current drawn by the system, is normally located near the de-ice system switches. This meter may indicate total system load, or a separate meter may be supplied for each propeller.

(2) A timer, which is turned off and on by the cockpit control, is used to sequence the de-ice system. This timer turns the de-ice system on and off in proper sequence, controlling the heating interval for each propeller blade and ensuring even de-icing.

(3) A brush block, mounted on the engine immediately behind the propeller, supplies electrical current to the de-ice boot on each propeller blade via a slip ring. The slip ring is normally mounted on the spinner bulkhead.

(4) When the pilot places the de-ice system cockpit control switch in the ON position, the system timer begins to operate. As the timer sequences on, power is delivered to a power relay. The power relay delivers high current through the brush block and the slip ring and to the de-ice boot.

C. De-ice System Functional Tests

(1) Functional tests of the de-ice system should be performed in accordance with the following Hartzell Propeller Inc. Manuals, which are available on the Hartzell Propeller Inc. website at www.hartzellprop.com:

(a) <u>Hartzell Propeller Inc. Manual No. 181 (30-60-81)</u> - Propeller Ice Protection System Component Maintenance Manual

(b) <u>Hartzell Propeller Inc. Manual No. 182 (61-12-82)</u> - Propeller Electrical De-ice Boot Removal and Installation Manual

D. De-ice System Inspection

(1) Inspections must be made during the annual inspection or after 100 hours of operation, whichever comes first, as required by the Federal Aviation Regulations.

(2) Perform inspections in accordance with the following Hartzell Propeller Inc. Manuals, which are also available on the Hartzell Propeller Inc. website at www.hartzellprop.com:

(a) Hartzell Propeller Inc. Manual No. 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual

(b) Hartzell Propeller Inc. Manual No. 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual

E. De-ice System Troubleshooting

(1) Perform troubleshooting in accordance with the following Hartzell Propeller Inc. Manuals, which are also available on the Hartzell Propeller Inc. website at www.hartzellprop.com:

(a) Hartzell Propeller Inc. Manual No. 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual

(b) Hartzell Propeller Inc. Manual No. 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual

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