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HARTZELL

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

REVISION 4 dated June 2015

Attached is a copy of Revision 4 to Hartzell Propeller Inc. Manual 146.

Page Control Chart for Revision 4:

Remove Page No.	**Insert** Page No.
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NOTE: When the manual revision has been inserted in the manual, record the information required on the Record of Revisions page in this manual.

Manual No. 146
61-00-46
Revision 4
June 2015

Propeller Owner's Manual
and Logbook

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

Steel Hub Turbine Propellers with Composite Blades

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REVISION 4 HIGHLIGHTS

- COVER
  - Revised to match this revision
- REVISION HIGHLIGHTS
  - Revised to match this revision
- LIST OF EFFECTIVE PAGES
  - Revised to match this revision
- TABLE OF CONTENTS
  - Revised to match this revision
- INTRODUCTION
  - Revised the section "General"
  - Revised the section "Referenced Publications"
  - Revised wording about repair facilities
  - Made other minor language/format changes
- INSTALLATION AND REMOVAL
  - Revised the section "Tools, Consumables, and Expendables"
  - Revised wording about repair facilities
  - Made other minor language/format changes
- TESTING AND TROUBLESHOOTING
  - Revised wording about repair facilities
- INSPECTION AND CHECK
  - Revised Figure 5-4, "Turbine Engine Overtorque Limits"
  - Revised wording about repair facilities
  - Made other minor language/format changes
- MAINTENANCE PRACTICES
  - Added Figure 6-3 and Figure 6-4
  - Revised the section "Composite Blades"
  - Removed information about maintenance of Legacy Composite Blades and all applicable figures
  - Added references to Hartzell Propeller Inc, Composite Blade Field Maintenance and Minor Repair Manual 170 (61-13-70)
  - Revised wording about repair facilities
  - Made other minor language/format changes

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
Rev. 4	Jun/15	Minor Revision

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Record of Temporary Revisions	9 and 10	Original	Oct/99
Service Documents List	11 and 12	Rev. 3	Jun/12
Airworthiness Limitations	13 and 14	Rev. 2	Jul/10
List of Effective Pages	15 and 16	Rev. 4	Jun/15
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Testing and Troubleshooting	4-4 and 4-5	Rev. 4	Jun/15
Testing and Troubleshooting	4-6	Rev. 3	Jun/12
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Testing and Troubleshooting	4-9	Original	Oct/99

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Inspection and Check	5-13 and 5-14	Rev. 4	Jun/15
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4. Restrictions and Placards

   A. The propellers covered by this manual may have a restricted operating range that requires a cockpit placard.

      (1) The restrictions, if present, will vary depending on the propeller, blade, engine, and/or aircraft model.

      (2) 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) 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.

      (2) Personnel performing maintenance 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.

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 a certified propeller repair station with the appropriate rating 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.

WARNING: DO NOT USE OBSOLETE OR OUTDATED INFORMATION. PERFORM ALL INSPECTIONS OR WORK IN ACCORDANCE WITH THE MOST RECENT REVISION OF THIS MANUAL. INFORMATION CONTAINED IN THIS MANUAL MAY BE SIGNIFICANTLY CHANGED FROM EARLIER REVISIONS. USE OF OBSOLETE INFORMATION MAY RESULT IN DEATH, SERIOUS BODILY INJURY, AND/OR SUBSTANTIAL PROPERTY DAMAGE. FOR THE MOST RECENT REVISION LEVEL OF THIS MANUAL, REFER TO THE HARTZELL PROPELLER INC. WEBSITE AT WWW.HARTZELLPROP.COM.

(10) The information in this manual revision supersedes data in all previous published revisions of this manual.

(11) 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.

(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).

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:

Active Hartzell Propeller Inc. Service Bulletins, Service Letters, Service Instructions, and Service Advisories

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

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 - 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 - Available on the Hartzell website at www.hartzellprop.com

Hartzell Propeller Inc. Manual No. 170 (61-13-70) - Composite Propeller Blade Field Maintenance and Minor Repair Manual - Available on the Hartzell Propeller Inc. website at www.hartzellprop.com

Hartzell Propeller Inc. Manual No. 180 (30-61-80) - Propeller Ice Protection System Manual - 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 - 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 - 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 (Volume 7, Consumable Materials is available on the Hartzell Propeller Inc. website at www.hartzellprop.com)

Hartzell Propeller Inc. Service Letter HC-SL-61-61Y - Propeller Overhaul Periods and Service Life Limits for Hartzell Propeller Inc. Aviation Components - Propellers, Governors, Accumulators, and Propeller Damper Assemblies - (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.

Term	Definition
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.
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.

Term	Definition
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 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.

Term	Definition
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.
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.

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 (Alternate: Safety cable tool)
   • Torque wrench
   • Torque wrench adapter
   (Hartzell Propeller Inc. P/N AST-2877)

   P Flange

   • Safety wire pliers (Alternate: Safety cable tool)
   • 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
   (Alternate: 0.032 inch [0.81 mm] aircraft safety cable, and associated hardware)
   • 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.

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 a certified propeller repair station with the appropriate rating.

(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).

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 a certified propeller repair station with the appropriate rating, 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 a certified propeller repair station with the appropriate rating 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 certified propeller repair station with the appropriate rating 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 certified propeller repair station with the appropriate rating 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 certified propeller repair station with the appropriate rating.

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 certified propeller repair station with the appropriate rating.

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 a certified propeller repair station with the appropriate rating.
   (4) Broken start lock unit.

   The problem should be referred to a certified propeller repair station with the appropriate rating.

G. Vibration

CAUTION: ANY VIBRATION THAT CAN BE DESCRIBED AS APPEARING SUDDENLY, OR IS ACCOMPANIED BY UNEXPLAINED GREASE LEAKAGE, SHOULD BE INVESTIGATED BY A CERTIFIED PROPELLER REPAIR STATION WITH THE APPROPRIATE RATING, 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 a certified propeller repair station with the appropriate rating.

(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 a certified propeller repair station with the appropriate rating).

(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.

2. Operational Checks

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

3. Required Periodic Inspections and Maintenance

   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. Periodic Inspections

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

      NOTE 1: 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.

      NOTE 2: 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 a certified propeller repair station with the appropriate rating.

(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.

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 a certified propeller repair station with the appropriate rating. 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 a certified propeller repair station with the appropriate rating) 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 a certified propeller repair station with the appropriate rating 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 a certified propeller repair station with the appropriate rating) to evaluate the condition. Refer to the Composite Blades section in the Maintenance Practices chapter of this manual.

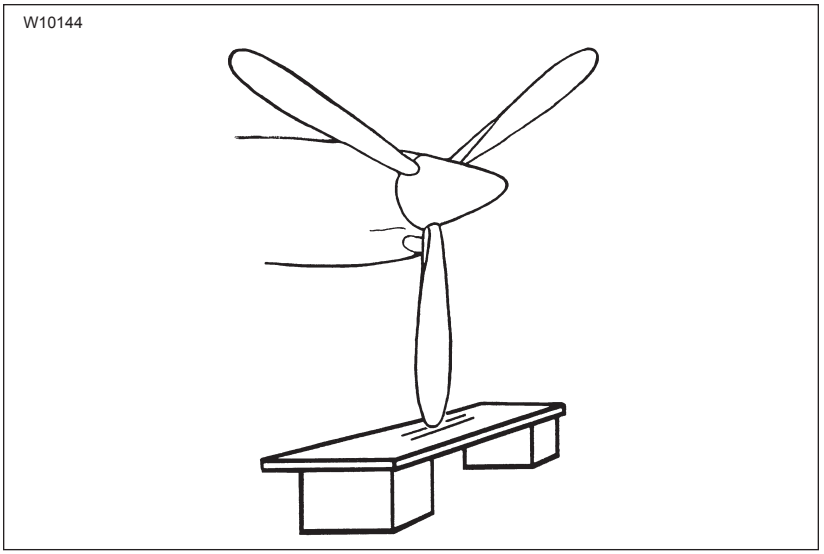
(8) If cracks or failing components are found, these parts must be replaced before further flight. Report such occurrences to airworthiness authorities and Hartzell Propeller Inc. Product Support.

D. Tachometer Inspection

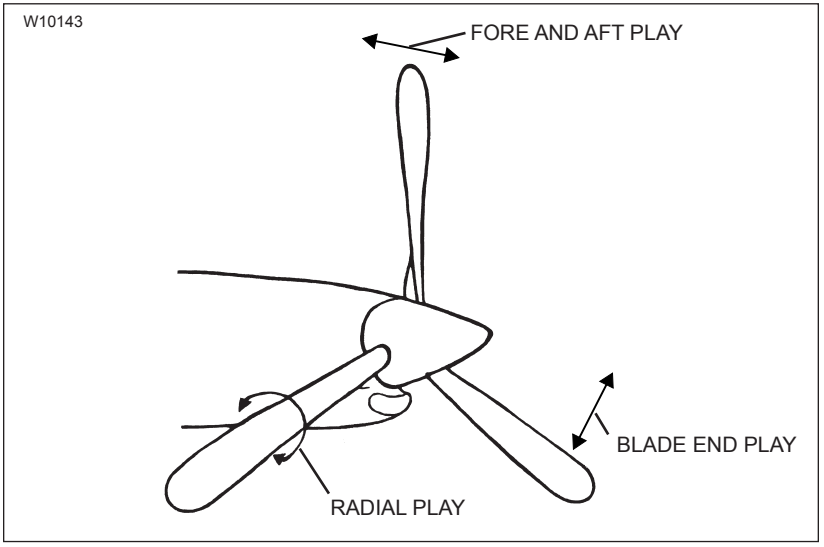
WARNING: OPERATION WITH AN INACCURATE TACHOMETER MAY RESULT IN RESTRICTED RPM OPERATION AND DAMAGING HIGH STRESSES. BLADE LIFE WILL BE SHORTENED AND COULD RESULT IN CATASTROPHIC FAILURE.

(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 a certified propeller repair station with the appropriate rating.

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 a certified propeller repair station with the appropriate rating.

G. Corrosion

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

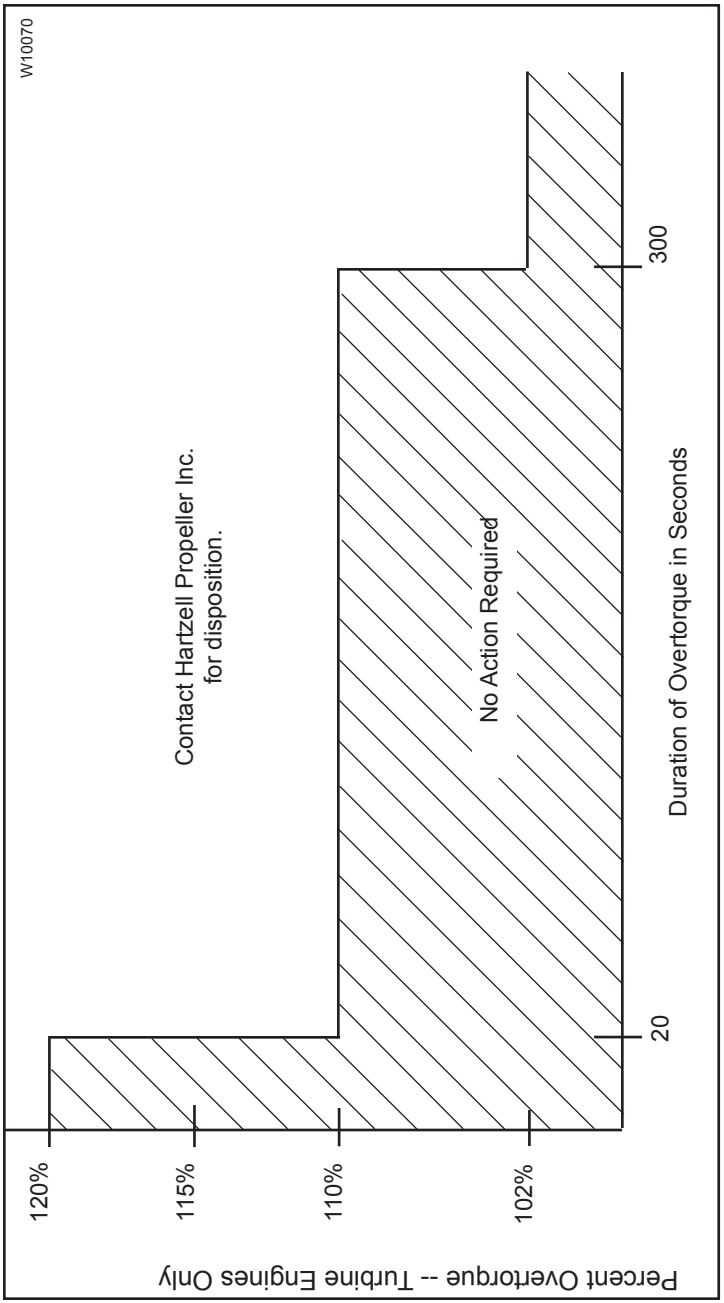
Corrosion of any type on the hub or the blade clamp, or heavy corrosion on other parts that results in severe pitting, must be referred to a certified propeller repair station with the appropriate rating.

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 a certified propeller repair station with the appropriate rating 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.



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

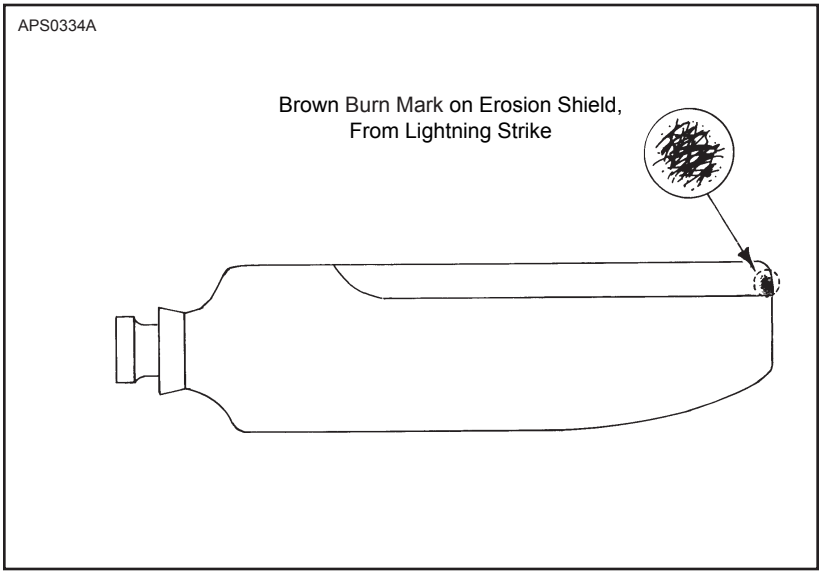
In the event of a propeller lightning strike, an inspection is required before further flight.

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 a certified propeller repair station with the appropriate rating.

(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 a certified propeller repair station with the appropriate rating 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 a certified propeller repair station with the appropriate rating is required before further flight.

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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.

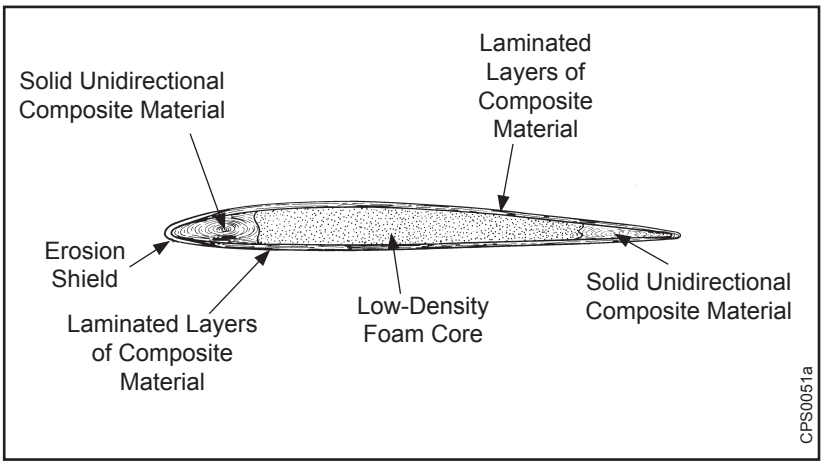
(5) Secure the clevis pin with a T-head cotter pin (Figure 3-6).

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

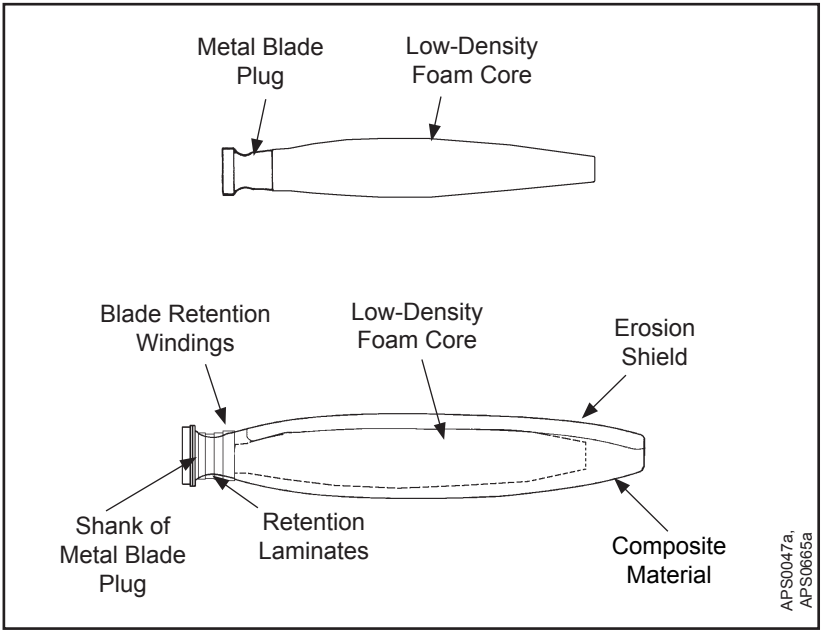
(a) Establish the required clearance by sanding the sides of the carbon block as needed.

C. Installation of the A-3044 Carbon Block Assembly

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



Section of Typical Legacy Composite Blade
Figure 6-3



Basic Components of a Legacy Composite Blade
Figure 6-4

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. General Description

(1) The Legacy composite blade is composed of a metal blade shank (plug) that has a low-density foam core molded into the metal blade shank.

(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 to the blade plug. Refer to Figure 6-3.

(2) The laminated composite materials that are an integral component of the blade provide a retention load path that extends directly under the bearing in aluminum hubs for blade retention.

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

(4) Filament windings of composite material provide additional retention of the blade composite materials to the internal metal plug. Refer to Figure 6-4.

(5) 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 used to attach the blade material to the internal metal plug.

(6) 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. The balance tube may protrude into the foam core of the blade.

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

(8) Aircraft that require ice protection use an external de-ice or anti-icing boot.

B. 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.

(d) Any propeller repair station that is appropriately certified by their local aviation authority may perform composite blade overhaul and minor repair.

(e) Any propeller repair station that is appropriately certified by their local aviation authority may perform composite blade overhaul and minor repair, but ONLY those facilities that employ personnel that have certification by Hartzell Propeller Inc. for Composite Blade Major Repair and Composite Blade Erosion Shield Replacement are granted official Hartzell Propeller Inc. certification and are listed on the Hartzell Propeller Inc. website.

C. Damage Evaluation

NOTE: Specific Hartzell Propeller Inc. manuals and service documents are available on the Hartzell website at www.hartzellprop.com. Refer to the Required Publications section in the Introduction chapter of this manual for the identification of these publications.

(1) Airworthy Damage

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

(a) Airworthy damage is a specific condition to a blade that does not affect the safety or flight characteristics of the propeller blade and conforms to its type design by meeting the condition inspection criteria limitations found in Hartzell Propeller Inc. Composite Propeller Blade Field Maintenance and Minor Repair Manual 170 (61-13-70).

1 The maximum limits of airworthy damage are specified in Hartzell Propeller Inc.Composite Propeller Blade Field Maintenance and Minor Repair Manual 170 (61-13-70).

2 Hartzell Propeller Inc. Composite Propeller Blade Field Maintenance and Minor Repair Manual 170 (61-13-70) provides inspection criteria and direction to evaluate damage to determine continued airworthiness.

(b) Although a blade may continue in service with airworthy damage, this type of damage should be repaired at the earliest practical time to prevent the damage from progressing to a condition that could require more extensive repair to the blade.

(2) Unairworthy Damage

CAUTION: IN MOST CASES, UNAIRWORTHY DAMAGE MUST BE REPAIRED BEFORE THE NEXT FLIGHT.

(a) Unairworthy damage is damage that exceeds the airworthy damage limits as specified in Hartzell Propeller Inc. Composite Blade Field Maintenance and Minor Repair Manual 170 (61-13-70).

1 Unairworthy damage can affect the safety or flight characteristics of the propeller blade and does not conform to its type design.

2 This condition deems the blade unairworthy, requiring appropriate corrective action to repair or remove it from service, as applicable.

D. Repair Determination

NOTE: Specific Hartzell Propeller Inc. manuals and service documents are available on the Hartzell website at www.hartzellprop.com. Refer to the Required Publications section in the Introduction chapter of this manual for the identification of these publications.

(1) Minor Repair

(a) Minor repair is correction of damage that may be safely performed in the field by elementary operations.

(b) For complete description of minor repair and allowable procedures, refer to Hartzell Propeller Inc. Composite Blade Field Maintenance and Minor Repair Manual 170 (61-13-70).

(2) Major Repair

(a) Major repair is correction of damage that cannot be performed by elementary operations.

(b) Major repair must be accepted by a certified aircraft mechanic with an appropriate rating, preferably one that holds a Factory Training Certificate from Hartzell Propeller Inc.

(c) All major repairs must be performed by a propeller repair station that is certified by Hartzell Propeller Inc. and is an appropriately rated propeller repair station certified by the Federal Aviation Administration (FAA) or international equivalent.

E. Personnel Requirements

NOTE: Specific Hartzell Propeller Inc. manuals and service documents are available on the Hartzell website at www.hartzellprop.com. Refer to the Required Publications section in the Introduction chapter of this manual for the identification of these publications.

(1) Anyone performing or accepting responsibility for an inspection, repair and/or overhaul of a Hartzell Propeller Inc. product must comply with the applicable regulatory requirements established by the appropriate Aviation Authority.

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

(3) For personnel requirements for repair of Hartzell Propeller Inc. composite blades, are specified in Hartzell Propeller Inc. Composite Propeller Blade Field Maintenance and Minor Repair Manual 170 (61-13-70).

F. Blade Inspection Requirements

CAUTION: MAINTAINING A GOOD LOGBOOK 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.

NOTE: Specific Hartzell Propeller Inc. manuals and service documents are available on the Hartzell website at www.hartzellprop.com. Refer to the Required Publications section in the Introduction chapter of this manual for the identification of these publications.

(1) Required Record-Keeping

(a) Composite blade damage and a description of the repair must be recorded in the composite blade logbook.

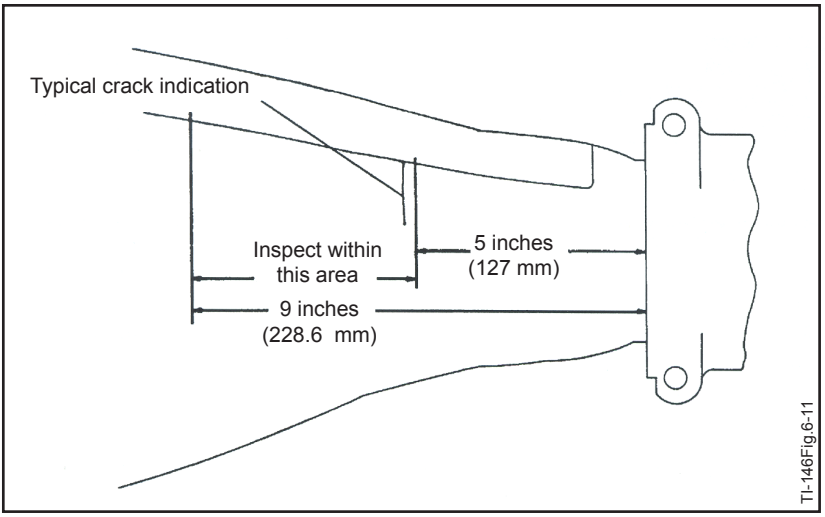
(2) Preflight Inspection

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

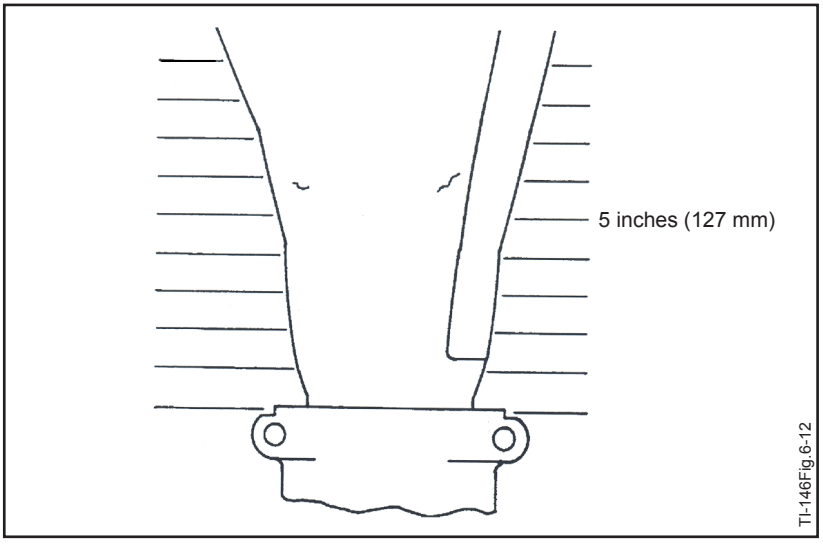
1 Visually inspect each entire blade for nicks, gouges, loose material, erosion, cracks, and debonds.

2 Visually inspect each blade for lightning strike. Refer to "Lightning Strike Damage" in the Inspection and Check of this manual for a description of damage.

(b) Defects or damage discovered during preflight inspection must be evaluated in accordance with Hartzell Propeller Inc. Composite Propeller Blade Field Maintenance and Minor Repair Manual 170 (61-13-70).



Blade Crack Location
Figure 6-5



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

(3) Maintenance Inspections

(a) Inspection procedures must be performed in accordance with this manual.

1 Perform a thorough visual inspection.

2 Perform a coin-tap test to the exposed section of the blade at intervals as required. For the required intervals, refer to the Periodic Inspections section of the Inspection and Check chapter of this manual.

a Coin-tapping will indicate a delamination or debond by an apparent audible change.

b For the coin tap procedure for composite blades, refer to Hartzell Propeller Inc. Composite Propeller Blade Field Maintenance and Minor Repair Manual 170 (61-13-70).

3 For M10083(K) blades - Erosion Screen

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

b 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.

c The limits of erosion screen damage that would require replacement at overhaul are given in Hartzell Propeller Inc. Composite Propeller Blade Field Maintenance and Minor Repair Manual 170 (61-13-70).

4 For M10083(K), LM10585( )( )+4 and M10877K - Blade Retention windings

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

5 For M10083( ) on HC-B3MN-3 propeller installed on a Cessna 208 Series Caravan - Cracks in Blade

a 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 6-5.

b 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.

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

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

(b) For LM10585B+4

1 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.

2 Send the blades to the factory for modification.

(c) Review the blade logbook records and carefully inspect areas of airworthy damage and previously repaired areas for growth.

1 If damage is growing, estimate if the damaged area will be greater than the permitted airworthy damage limits before the next overhaul.

2 If this is the case, make arrangements to repair the damage at the earliest practical time to prevent further damage to the blade.

(d) Defects or damage discovered during scheduled inspections must be evaluated in accordance with Hartzell Propeller Inc. Composite Propeller Blade Field Maintenance and Minor Repair Manual 170 (61-13-70).

5. Painting After Repair

A. General

(1) 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 a certified propeller repair station with the appropriate rating in accordance with Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(2) 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.

(3) 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

(4) 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

B. Painting of Composite Blades

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.

(1) 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.

(2) Using 120 to 180 grit sandpaper, sand to feather the existing coatings away from the eroded or repaired area.

(a) Erosion damage is typically very similar on all blades in a propeller assembly. If one blade has more extensive damage, e.g., in the tip area, sand all the blades in the tip area to replicate the repair of the most severely damaged blade tip. This practice is essential in maintaining balance after refinishing.

(3) Using lacquer thinner #700 or MEK, wipe the surface of the blade, and permit the solvent to evaporate.

(4) Apply masking material for the erosion shield, de-ice 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.

(5) Apply sufficient finish coating to achieve 2 to 4 mil thickness when dry.

(a) Re-coat before 30 minutes, or after 48 hours.

(b) If the paint is permitted to dry longer than four (4) hours, it must be lightly sanded before another coat is applied.

(6) Remove the masking material from the tip stripes and re-apply masking material for the tip stripe refinishing, if required.

(7) Apply the sufficient tip stripe coating to achieve 2 to 4 mils thickness when dry.

(a) Re-coat before 30 minutes, or after 48 hours.

(b) If the paint is permitted to dry longer than four (4) hours, it must be lightly sanded before another coat is applied.

(8) Remove the masking material immediately from the tip stripes and de-ice boot, if required.

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

6. 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), 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 1: 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.

CAUTION 2: DO NOT MODIFY A COMPOSITE SPINNER BULKHEAD TO ACCOMMODATE DYNAMIC BALANCE WEIGHTS.

(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.

7. De-ice Systems

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