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HARTZELL

MANUAL REVISION TRANSMITTAL
Manual 174 (61-00-74)
Propeller Owner's Manual and Logbook

REVISION 3 dated October 2015

Attached is a copy of Revision 3 to Hartzell Manual 174.

Page Control Chart for Revision 3:

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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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pages 6-19 and 6-20

MAINTENANCE PRACTICES

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pages 6-7 thru 6-16
pages 6-19 and 6-20

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.

NOTE 2: Pages distributed in this revision may include pages from previous revisions if they are on the opposite side of revised page. This is done as a convenience to those users who wish to print a two-sided copy of the new revision.

Manual No. 174
61-00-74
Revision 3
October 2015

Propeller Owner's Manual and Logbook

Steel Hub Reciprocating Propellers with Aluminum Blades

Two Blade

HC-A2(MV,V)20-4A1

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COVER 61-00-74

Inside Cover
Rev. 3 Oct/15

REVISION HIGHLIGHTS

Revision 3, dated October 2015, incorporates the following:

- COVER
 - Revised to match the manual revision
- REVISION HIGHLIGHTS
 - Revised to match the manual revision
- SERVICE DOCUMENT LIST
 - Revised to match the manual revision
- LIST OF EFFECTIVE PAGES
 - Revised to match the manual revision
- TABLE OF CONTENTS
 - Revised to match the manual revision
- INTRODUCTION
 - Revised the section "Purpose"
 - Added the section "Airframe or Engine Modifications"
 - Added the section "Restrictions and Placards"
 - Revised the section "Personnel Requirements"
 - Revised the section "Maintenance Practices"
 - Revised the section "Reference Publications"
 - Made other language/format changes
- INSTALLATION AND REMOVAL
 - Revised the section "Tools, Consumables, and Expendables"
 - Revised the section "Pre-Installation"
 - Revised the section "O-ring, Gasket, and Propeller Mounting Hardware Identification"
 - Revised the section "Post-Installation Checks"
 - Made other language/format changes
- INSPECTION AND CHECK
 - Revised the section "Long Term Storage"
 - Made other language/format changes

REVISION HIGHLIGHTS, CONTINUED

- MAINTENANCE PRACTICES
 - Revised the section "Lubrication Procedure"
 - Revised Table 6-1 "Approved Paints"
 - Made other language/format changes

REVISIONS HIGHLIGHTS1. 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.

<u>Revision No.</u>	<u>Issue Date</u>	<u>Comments</u>
Original	Feb/02	New Issue
Revision 1	Jun/10	Minor Revision
Revision 2	Jun/12	Minor Revision
Revision 3	Oct/15	Minor Revision

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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 THE SERVICE DOCUMENT. INFORMATION CONTAINED IN A SERVICE DOCUMENT MAY BE SIGNIFICANTLY CHANGED FROM EARLIER REVISIONS. USE OF OBSOLETE INFORMATION MAY CREATE AN UNSAFE CONDITION THAT MAY RESULT IN DEATH, SERIOUS BODILY INJURY, AND/OR SUBSTANTIAL PROPERTY DAMAGE. REFER TO THE APPLICABLE SERVICE DOCUMENT INDEX FOR THE MOST RECENT REVISION LEVEL OF THE SERVICE DOCUMENT.

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 Letters:	
HC-SL-61-320	Rev. 2 Jun/12
HC-SL-61-324	Rev. 2 Jun/12
Service Instructions:	
SI136	Original Feb/02

SERVICE DOCUMENTS LIST

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1. Purpose

- A. This manual has been reviewed and accepted by the FAA. Additionally, the Airworthiness Limitations section of this manual has been approved by the FAA.

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

- B. This manual supports Hartzell Propeller Inc. Model HC-A2(MV,V)20-4A1 constant speed, counterweighted, nonfeathering propellers.
- C. The purpose of this manual is to enable qualified personnel to install, operate, and maintain a Hartzell Propeller Inc. Model HC-A2(MV,V)20-4A1 constant speed propeller. Separate manuals are available addressing overhaul procedures and specifications for the propeller.
- D. This manual covers one design type. Sample hub and blade model numbers within this design are covered in the Description and Operation chapter of this manual.

2. Airworthiness Limits

- A. Refer to the Airworthiness Limitations chapter of this manual for Airworthiness Limits information.

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 approved flight maneuvers. Aircraft modifications that can effect propeller stress include, but are not limited to: aerodynamic changes ahead of or behind the propeller, realignment of the thrust axis, increasing or decreasing airspeed limits, increasing or decreasing weight limits (less significant on piston engines), and the addition of approved flight maneuvers (utility and aerobatic).

- B. Engine modifications can affect the propeller. The two primary categories of engine modifications are those that affect structure and those that 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 that is not detectable by the pilot. Most common engine modifications affect the power during some phase of operation. Some modifications 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 before 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.
 - (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.

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.
- (b) Personnel performing maintenance on aluminum 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.

B. Maintenance Practices

- (1) The propeller and its components are highly vulnerable to damage when 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. If blade paddles must be used, use at least two paddles. Do not put the blade paddle in the area of the de-ice boot when applying torque to a blade assembly. Put 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 for storage, preparation, mixing, and application.

- (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) Approved corrosion protection followed by approved paint must be applied to all aluminum blades. For information about the application of corrosion protection and paint, refer to the Maintenance Practices chapter of this manual. Operation of blades without the specified coatings and finishes, i.e., "polished blades", is not permitted.
- (8) 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 balance 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.

- (9) As necessary, use a soft, non-graphite pencil, crayon, or felt-tipped pen to make identifying marks on components.
- (10) As applicable, follow military standard NASM33540 for safety-wiring and cotter pin general practices. Use 0.032 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.

(11) The information in this manual supersedes data in all previously published revisions of this manual.

(12) 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.

C. Continued Airworthiness

(1) Operators are urged to keep abreast 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 Hartzell Propeller's 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 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 Propeller Critical Parts.

(2) Numerous propeller system parts can produce a propeller Major or Hazardous effect, even though those parts may not be considered as Propeller 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 contain information vital to the airworthiness of the propeller models covered in this manual:

Hartzell Propeller Inc. Manual No. 114C (61-10-14) - Steel Hub Propeller Maintenance Manual

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

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

Hartzell Propeller Inc. Manual No. 130B (61-23-30) - Mechanically Actuated Governor Maintenance Manual

Hartzell Propeller Inc. Manual No. 133C (61-13-33) - Aluminum 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 - 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 and Packaging and Storage is available on the Hartzell Propeller Inc. website at www.hartzellprop.com)

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

<u>Term</u>	<u>Definition</u>
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	A straight line distance between the leading and trailing edges of an airfoil.
Cold Rolling	Compressive rolling process that provides improved strength and resistance to fatigue.
Constant Force	A force which is always present in some degree when the propeller is operating.
Constant Speed	A propeller system which 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.
Depression	Surface area where the material has been compressed but not removed.

<u>Term</u>	<u>Definition</u>
Distortion	Alteration of the original shape or size of a component
Erosion	Gradual wearing away or deterioration due to action of the elements.
Exposure	Leaving material open to action of the elements.
Feathering	A propeller with blades that may be rotated to a position parallel to the relative wind, thus reducing aerodynamic drag.
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 engine (propeller) RPM are equal.
Overhaul.....	The periodic disassembly, inspection, repair, refinish, and reassembly of a propeller assembly to maintain airworthiness.

<u>Term</u>	<u>Definition</u>
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.
Pitch.....	Same as "Blade Angle" for constant speed propellers.
Pitting.....	Formation of a number of small, irregularly shaped cavities in surface material caused by corrosion or wear.
Propeller Critical Part....	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
Propeller Repair Station.....	A repair facility that is appropriately licensed and approved by their local aviation authority.
Scratch	Same as "Nick".
Single Acting.....	Hydraulically actuated propeller which utilizes a single oil supply for pitch control.
Synchronizing	Adjusting the RPM of all the propellers of a multi-engine aircraft to the same RPM.

<u>Term</u>	<u>Definition</u>
Synchrophasing.....	A form of propeller synchronization 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.
Vertical Balance.....	Balance between the leading and trailing edges of a two-blade propeller, with the blades positioned vertically.
Variable Force	A force which 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

<u>Abbreviation</u>	<u>Term</u>
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
NAS	National Aerospace Standards
N•m.....	Newton-Meters
OD	Outside Diameter
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.

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 from the United States and Canada at (800) 942-7767. Hartzell Propeller Inc. Warranty Administration can also be reached by fax at (937) 778-4391, or by e-mail 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 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. web site at www.hartzellprop.com.

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1. Tools, Consumables, and Expendables

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

A. Tooling

- Safety wire pliers (Alternate: Safety cable tool)
- Torque wrench (1/2 inch drive)
- Shaft Nut Wrench (Hartzell Propeller Inc. P/N BST-2910)
- 5/8 inch open end wrench

B. Consumables

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

C. Expendables

- 0.032 inch (0.81 mm) Stainless Steel Aircraft Safety wire (Alternate: 0.032 inch [0.81 mm] aircraft safety cable and associated washers and ferrules)
- O-ring, Propeller-to-Engine Seal (see Table 3-1)

2. Pre-Installation**A. Inspection of Shipping Package**

- (1) Examine the exterior of the shipping container, especially the box ends around each blade, for signs of shipping damage. 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) Put 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.

CAUTION: DO NOT STAND THE PROPELLER ON A BLADE TIP.

- (4) Put the propeller on a padded surface that supports the propeller over a large area.

C. Inspection after Shipment

- (1) After removing the propeller from the shipping container, examine the propeller components for shipping damage.

Part	Part No.
Hex Head Bolt, 5/16-18 (Oil Transfer Unit mounting)	B-3805
Washer (Oil Transfer Unit mounting)	B-3851-0563
Gasket, Oil Transfer Unit Mounting	A-135
Gasket, Governor Mounting	B-1104-1
Nut, Spinner Mounting	A-1373
Bolt, Spinner Mounting	B-3387-11
Washer, Spinner Mounting	B-3851-0763
Felt Dust Seal	B-1843
Spring Pin	B-6580-1000
O-ring, Piston	C-3317-343-1
O-ring, Shaft Seal (inner)	C-3317-231
O-ring, Shaft Seal (outer)	C-3317-232
Seal, Shaft Nut	A-2054
Pin, Cotter (on shaft nut)	B-3838-3-3
Nut, flex lock (on piston rod)	A-848-2
Washer, (on piston rod)	A-965
Nut, Shaft/Hub (propeller mounting)	A-2053
Sleeve, Rod (on piston rod)	A-827-2
Spacer, High Stop (on piston rod)	A-970-()
Block, Pitch Change	A-95-A
Socket Set Screw (fork)	A-2039

O-ring and Propeller Mounting Hardware Identification
Table 3-1

D. Reassembly of a Propeller Disassembled for Shipment

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

3. O-ring, Gasket and Propeller Mounting Hardware Identification

- A. Refer to Table 3-1 for applicable propeller mounting hardware and O-rings.

4. Propeller Assembly Installation

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER 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. 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 OR STC HOLDER'S MANUALS AND PROCEDURES, AS THEY MAY CONTAIN ISSUES VITAL TO AIRCRAFT SAFETY THAT ARE NOT CONTAINED IN THIS OWNER'S MANUAL.

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

Shaft nut

A-2053

300 Ft-Lb (407 N•m)*

Oil Transfer Unit mounting bolts

B-3805

18-22 Ft-Lb (24-30 N•m)**

Piston Rod Nut

A-848-2

20-22 Ft-Lb (27-29 N•m)

Spinner Mounting Nut

A-1373

30 Ft-Lb (41 N•m)**

Nut (Governor- to- "T" drive)

B-3808-5

18-20 Ft-Lb (24-26 N•m)**

* Torque tolerance is ± 10 Ft-Lb (± 13.6 N•m)

** Torque tolerance is ± 10 percent unless otherwise noted.

NOTE 1: Torque values are based on non-lubricated threads.

NOTE 2: Do not deviate from the torque values specified in this table when installing the propeller and component parts.

**Torque Values
Table 3-2**

CAUTION: INSTALLATION OF STC PROPELLERS MUST BE ACCOMPLISHED PER THE REQUIREMENTS SET BY THE STC HOLDER, NOT PER THE AIRCRAFT MANUFACTURER'S INSTALLATION PROCEDURES SET FOR OTHER PROPELLERS INSTALLED ON THE SAME AIRCRAFT.

- (2) Follow the STC holder's instructions for propeller installation.
 - (a) Hartzell Propeller Inc. STC SA1-570, for the Beech Bonanza, and Hartzell Propeller Inc. STC SA1-635 for Navion aircraft
 - (b) An STC packet for these aircraft may be obtained at no charge. Contact Hartzell Propeller Inc. Product Support at (937) 778-4379 or by email at techsupport@hartzellprop.com.

B. O-ring and Propeller Mounting Hardware Identification

- (1) Refer to Table 3-1 for specific part numbers of O-rings and propeller mounting hardware.

C. Installing A-224-() Oil Transfer Unit

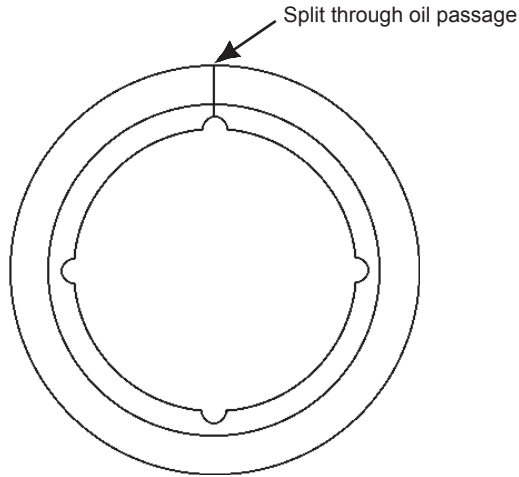
Refer to Figures 3-1 and 3-2.

WARNING: CLEANING AGENT METHYL-ETHYL-KETONE (MEK) IS FLAMMABLE AND TOXIC TO THE SKIN, EYES AND RESPIRATORY TRACT. SKIN AND EYE PROTECTION ARE REQUIRED. AVOID PROLONGED CONTACT. USE IN WELL VENTILATED AREA.

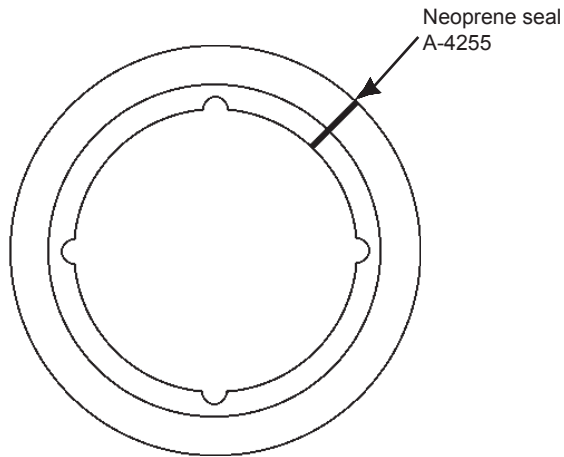
- (1) Verify that the crankshaft seal (Continental P/N 530589) is not installed. Remove the seal if it is installed.
- (2) Using Quick Dry Stoddard Solvent or MEK, clean the engine case encircling the engine shaft where the oil transfer unit will mount.
- (3) Install the oil transfer unit mounting gasket (Figure 3-2, Table 3-1) around the engine shaft on the engine case.

NOTE: Align the four holes in the gasket with the four threaded holes in the engine case.

A4254



Previous style rear cone, split at oil passage, no seal in split area



Current style rear cone, saw cut between oil passages with neoprene seal

Rear Cone
Figure 3-3

- (28) Attach the hose to the engine with the AN 742C12C clamps, as shown in Figure 3-14.
- NOTE:** Measure the depth of the hole in the housing, and measure the same length on the fitting to insure that no contact is made between the fitting and the oil transfer plug.
- (29) Remove the plastic plug and alignment pin from the pressure port of the oil transfer unit.
- (30) Install a B-6718-6 elbow (45 degrees) on the pressure side of the oil transfer unit, as shown in Figure 3-2.
- (31) Attach the oil line from the "T" drive to the elbow.
- (32) On engines that previously had an HC-12(X,V)20-7 propeller installed:
- Remove the old pressure and drain the lines.
 - Install 1/8 inch (3.17 mm) pipe plugs in the engine where the lines were removed.
- (33) Install the vernier control 4 inches (101.6 mm) to the right of the center of the cockpit, just below the dashboard.
- The vernier control is part number A-970BLO563 (Gerdes), 3A729-7 (Shakespeare) or A-970-10-0563 (ACS).
 - The control should go straight forward, through the 3/4 inch (19.05 mm) hole in the fire wall and through the five-piece Beech fireproof grommet.
NOTE: The grommet consists of (1) 112436-6 retainer, (2) 112413-4 ball half, and (2) 112412 split grommet.
 - Route the control over the generator and use the AN742D7C clamp to secure the control to the generator cover.
 - Route the control through the AN742D7C clamps on the B-197 Bracket. (See Figures 3-13 and 3-14).
- (34) Install the B-3368 check nut and the AN276-6 ball joint on the vernier control. Refer to Figure 3-11.

CAUTION: THERE MUST BE A MINIMUM OF FIVE THREADS OF THE VERNIER CONTROL IN THE AN276-6 BALL JOINT.

- (35) Push the vernier control handle in the cockpit to the forward or "in" position.
- (36) Attach the ball joint to the A-199 link with (2) AN960-416 washers and (1) B-3308-4 nut, as shown in Figure 3-13.
- (37) Tighten the clamps on the B-197 bracket and tighten the check nut against the ball joint.

NOTE: The normal position of the pulley wheel on the governor (hands off) is in high RPM position or low pitch (pulley wheel against the stop on governor). While the governor is in this position, the vernier control handle in the cockpit should be forward or "in" position.

5. Post-Installation Checks

- A. Refer to the airframe manufacturer's or STC instructions for post-installation checks.
- B. Perform a static RPM check as outlined in the Testing and Troubleshooting chapter of this manual.

6. Propeller Assembly Removal

A. Spinner Dome Removal

CAUTION: 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.

- (1) Remove the screws and washers that secure the spinner dome to the spinner bulkhead.
- (2) Remove the spinner dome.
- (3) Remove layers of masking or duct tape from each blade shank, if applicable.

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1. Pre-Flight Checks

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE CRITICAL PROPELLER 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 Pilot Operating Handbook (P.O.H.) or this manual. In addition, perform the following inspections:

A. Blades

- (1) Visually inspect the entire blade (lead, trail, face, and camber sides) for nicks, gouges, erosion, and cracks. Refer to the Maintenance Practices chapter of this manual for blade repair information. Normal blade lead edge erosion (sand-blasted appearance) is permitted and does not require removal before further flight.
- (2) Visually inspect the blades for lightning strike. Refer to the Lightning Strike Damage section in this chapter for a description of damage.

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 or missing hardware. Tighten 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 its source.

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.

- E. Check the blades for radial play or movement of the blade tip (in and out or, fore and aft, end play). Refer to Loose Blades, in the Periodic Inspections section of this chapter, for blade play limits.
- F. Refer to the Periodic Inspections section in this chapter for additional inspection information and possible corrections to any discrepancies discovered as a result of preflight checks.

2. Operational Checks

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER 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. Following propeller installation and before flight, perform initial run-up as outlined in Operational Tests in the Testing and Troubleshooting chapter of this manual.
- B. Check the propeller speed control and operation through 200 RPM, using the procedure specified in the Pilot Operating Handbook (POH) for the aircraft.
 - (1) Perform all ground functional and cycling checks with a minimum propeller RPM drop required to demonstrate function.
 - (2) A typical RPM drop is 100 to 300 RPM for non-feathering propellers.

- 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.
- C. Check for any abnormal vibration during this run-up. If vibration occurs, shut the engine down, determine the cause, and correct it before further flight. Refer to the Vibration section in the Testing and Troubleshooting chapter of this manual.
 - D. Refer to Periodic Inspections in this chapter for additional inspection information and possible corrections to any discrepancies discovered as a result of Pre-Flight Checks.
 - E. Refer to the airframe manufacturer's manual for additional operational checks.

3. Required Periodic Inspections and Maintenance

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER 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 Inspection

Perform detailed inspection procedures, as follows, at 100 hour intervals, not to exceed twelve (12) calendar month.

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 within 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 blades for nicks, gouges, and cracks. 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) Check the blade track. Refer to Blade Track in the Inspection Procedures section of this chapter.
 - (7) Check the accuracy of the tachometer. Refer to Tachometer Inspection in the Inspection Procedures section of this chapter.
 - (8) Make an entry in this log book verifying this inspection.
- B. Periodic Maintenance
- (1) Lubricate the propeller assembly. Refer to the Maintenance Practices chapter of this manual for applicable intervals and procedures.
- C. 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 require mandatory replacement of specified parts after a defined number of hours and/or cycles of use.
 - (2) Life limited component times may exist for the propeller models covered in this manual. Refer to the Airworthiness Limitations chapter 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 by subscription from the Hartzell Propeller Inc. Selected information is also available on Hartzell Propeller's website at www.hartzellprop.com.

D. 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, wear, 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 a 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 CONTINUING EVALUATION.

CAUTION 2: REFER TO THE LATEST REVISION OF HARTZELL PROPELLER INC. SERVICE LETTER HC-SL-61-61Y FOR THE MOST CURRENT INFORMATION. THIS DOCUMENT IS AVAILABLE ON HARTZELL PROPELLER'S WEBSITE AT WWW.HARTZELLPROP.COM.

- (1) Hartzell Propeller Inc. HC-A2(V,X)20-4A1 propellers must be overhauled at intervals as follows:
 - (a) All non-aerobatic and non-agricultural applications - 1000 hours or 60 calendar months (whichever occurs first).
- (2) Hartzell Propeller Inc. HC-A2MV20-4A1 propellers must be overhauled at intervals as follows:
 - (a) All non-aerobatic and non-agricultural applications - 2000 hours or 60 calendar months (whichever occurs first).

4. Inspection Procedures

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER 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 following inspections must be made on a regular basis, either before flight, during required periodic inspection, as 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

Refer to Blade Repairs section in the Maintenance Practices chapter of this manual for information regarding blade damage.

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 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. Leakage repairs should be referred to a certified propeller repair station with the appropriate rating. An instance of abnormal grease leakage should be inspected using the following procedure:

- (1) Remove the spinner dome.

CAUTION: PERFORM A VISUAL INSPECTION WITHOUT CLEANING THE 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 hub, blade clamps, and blades to locate the origin of 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, as long as flight safety is not compromised.
- (3) If cracks are suspected, additional inspections by qualified personnel at a certified propeller repair station with the appropriate rating must be performed before further flight to verify the condition. Such inspections typically include disassembly of the propeller followed by inspection of parts, using nondestructive methods 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, then consider that the origin of the problem could be the propeller and proceed with steps 4.C.(3) through 4.C.(8) in this chapter.
- (3) Remove the spinner dome.
- (4) Perform a visual inspection for cracks in the hub, blade clamps, and blades.

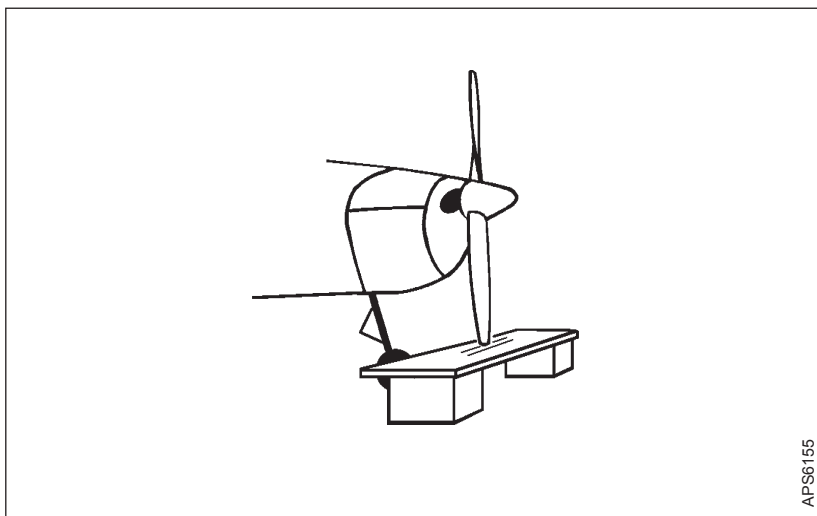
NOTE: A crack may be readily visible or may be indicated by grease leaking from a seemingly solid surface.

- (5) If cracks 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 followed by inspection of parts, using nondestructive methods in accordance with published procedures.
- (6) Check the blades and compare blade-to-blade differences:
 - (a) Inspect the propeller blades for unusual looseness or movement. Refer to the Loose Blades section of this chapter.
 - (b) Check blade track. Refer to the Blade Track section of this chapter.

CAUTION: DO NOT USE BLADE PADDLES TO TURN THE BLADES.

- (c) Manually (by hand) attempt to turn the blades (change pitch).
- (d) Visually check for damaged blades.

- (7) If abnormal blade conditions or damage are found, additional inspections must be performed at a certified propeller repair station with the appropriate rating before further flight to evaluate the condition. Refer to the Blade Repairs 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 to Hartzell Propeller Inc. Product Support.



**Checking Blade Track
Figure 5-1**

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.

NOTE: A certified propeller repair station with the appropriate rating may also be able to perform a tachometer inspection.

- (1) For installations that use a mechanical tachometer, perform the following tachometer inspection.
 - (a) Use a hand held tachometer to verify the accuracy of the engine tachometer at 100 hour intervals or at annual inspection, whichever occurs first.
 - (b) Hartzell Propeller Inc. recommends using a tachometer that is accurate within +/- 10 RPM, has NIST calibration (traceable), and has an appropriate calibration schedule.

E. Blade Track

- (1) Check the blade track as follows:
 - (a) Chock the aircraft wheels securely.
 - (b) Refer to Figure 5-1. Place a fixed reference point beneath the propeller, within 0.25 inch (6.0 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 (6.0 mm) of the propeller arc.

WARNING: MAKE SURE THE ENGINE MAGNETO IS GROUNDED (OFF) BEFORE ROTATING THE PROPELLER.

- (c) Rotate the propeller by hand (the opposite direction of normal rotation) until a blade points directly at the paper. Mark the position of the blade tip in relation to the paper.
- (d) Repeat this procedure with the remaining blade.
- (e) Tracking tolerance is ± 0.062 inch (1.57 mm) or 0.125 inch (3.17 mm) total.

(2) Possible Correction

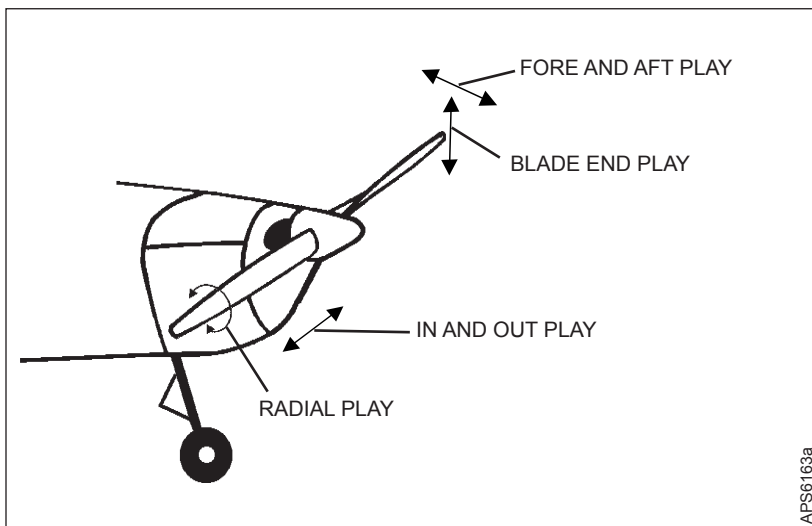
- (a) Remove foreign matter from the propeller rear cone.
- (b) If no foreign matter is present, refer to a certified propeller repair station with the appropriate rating.

F. Loose Blades

Refer to Figure 5-2. Blade movement is measured at the tip. Limits are as follows:

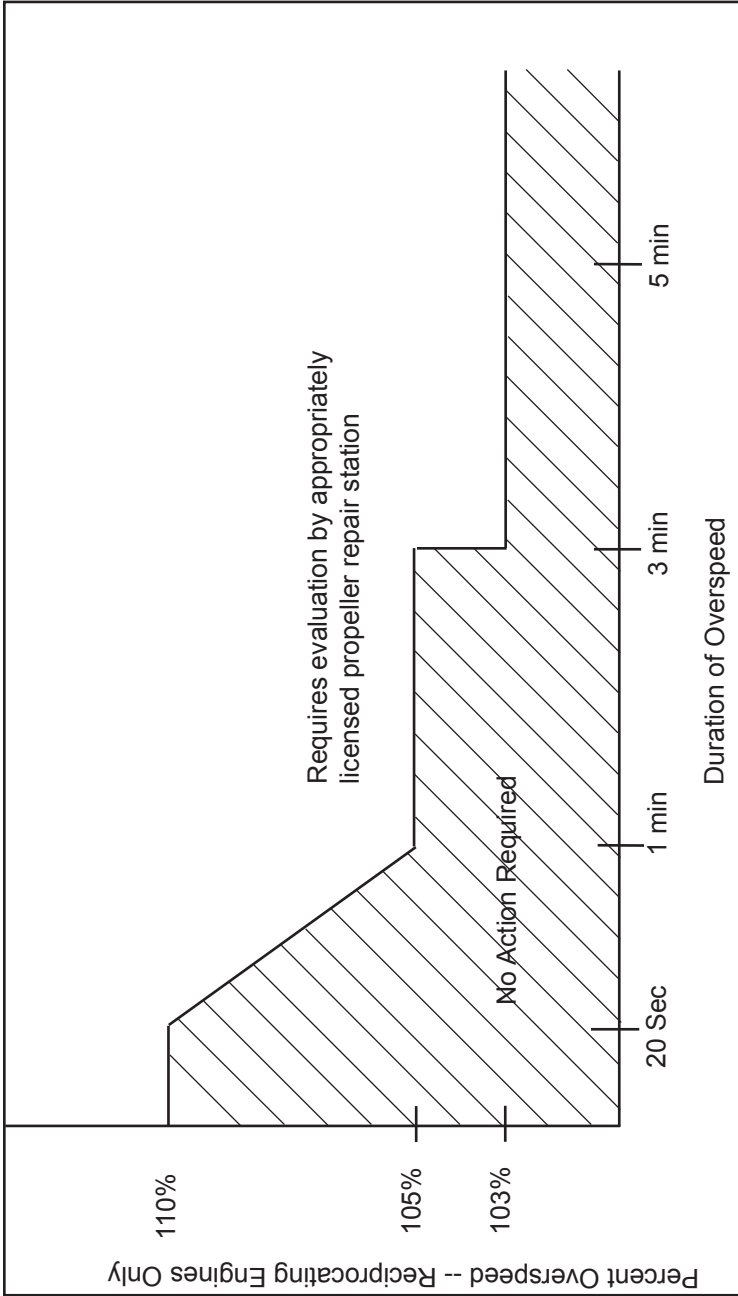
End Play	± 0.06 inch (1.5 mm)
Fore & Aft Movement	± 0.06 inch (1.5 mm)
In and Out Movement	± 0.032 inch (0.81 mm)
Radial Play (pitch change)	± 0.5 degree (1 degree total)

Blade movement beyond these limits should be referred to a certified propeller repair station with the appropriate rating.



Blade Play
Figure 5-2

APS6163a



Reciprocating Engine Overspeed Limits
Figure 5-3

G. Corrosion

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

Light corrosion on blades may be removed by qualified personnel in accordance with the Blade Repairs section in the Maintenance Practices chapter of this manual.

Heavy corrosion 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 a certified propeller repair station with the appropriate rating for spinner damage acceptance and repair information. There are no Hartzell Propeller Inc. approved field repairs to metal spinners. Contact the local airworthiness authority for repair approval.

5. Special Inspections

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER 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

An overspeed has occurred when the propeller RPM has exceeded the maximum RPM stated in the applicable Aircraft Type Certificate Data Sheet. The duration of time and magnitude of overspeed for a single event determines the corrective action that must be taken to make sure 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 reciprocating engine has an overspeed event, refer to the Reciprocating Engine Overspeed Limits (Figure 5-3) to determine the corrective action to be taken.
- (2) Make a log book entry to document the overspeed event.

B. Lightning Strike

CAUTION: ALSO CONSULT ENGINE AND AIRFRAME MANUFACTURER'S MANUALS. THERE MAY BE ADDITIONAL REQUIREMENTS, SUCH AS ENGINE SYSTEM CHECKS, TO PERFORM AFTER A PROPELLER LIGHTNING STRIKE.

(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 paragraph 5.B.(2) of this chapter. 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 the spinner dome and perform a visual inspection of the propeller and spinner for evidence of significant damage that would require repair before flight (such as arcing damage to propeller hub).

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

- (b) If the only evident damage is minor arcing burns to the blades, then operation for ten (10) hours is permitted before disassembly and inspection.
- (c) Regardless of the degree of damage, make a log book entry to document the lightning strike.

- (d) 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 at a certified propeller repair station with the appropriate rating 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 Vibration during operation
- (b) Nicks, gouges, and scratches on blade surfaces or the leading and trailing edges must be removed before flight. Refer to the Blade Repairs 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, 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 a log book entry to document the foreign object strike/ground strike incident and any corrective action(s) taken.

D. Fire Damage or Heat Damage

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

- (1) 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.

6. Long Term Storage

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.

- A. Parts shipped from the Hartzell Propeller Inc. factory are not shipped or packaged in a container that is designed for long term storage or shipping by ocean freight.
- 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 and preservation packaging is also detailed in Hartzell Propeller Inc. 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 also detailed in Hartzell Propeller Inc. Manual 202A (61-01-02).

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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.

- (3) 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 propellers.
- (4) 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) It is not possible to purge old grease through lubrication fittings.
 - (c) To completely replace one grease with another, the propeller must be disassembled in accordance with the applicable overhaul manual.

CAUTION 1: IF A PNEUMATIC GREASE GUN IS USED TO LUBRICATE THE PROPELLER, TAKE EXTRA CARE TO AVOID EXCESSIVE PRESSURE BUILDUP.

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

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

NOTE: 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.

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

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

(8) Tighten the lubrication fittings until snug.

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

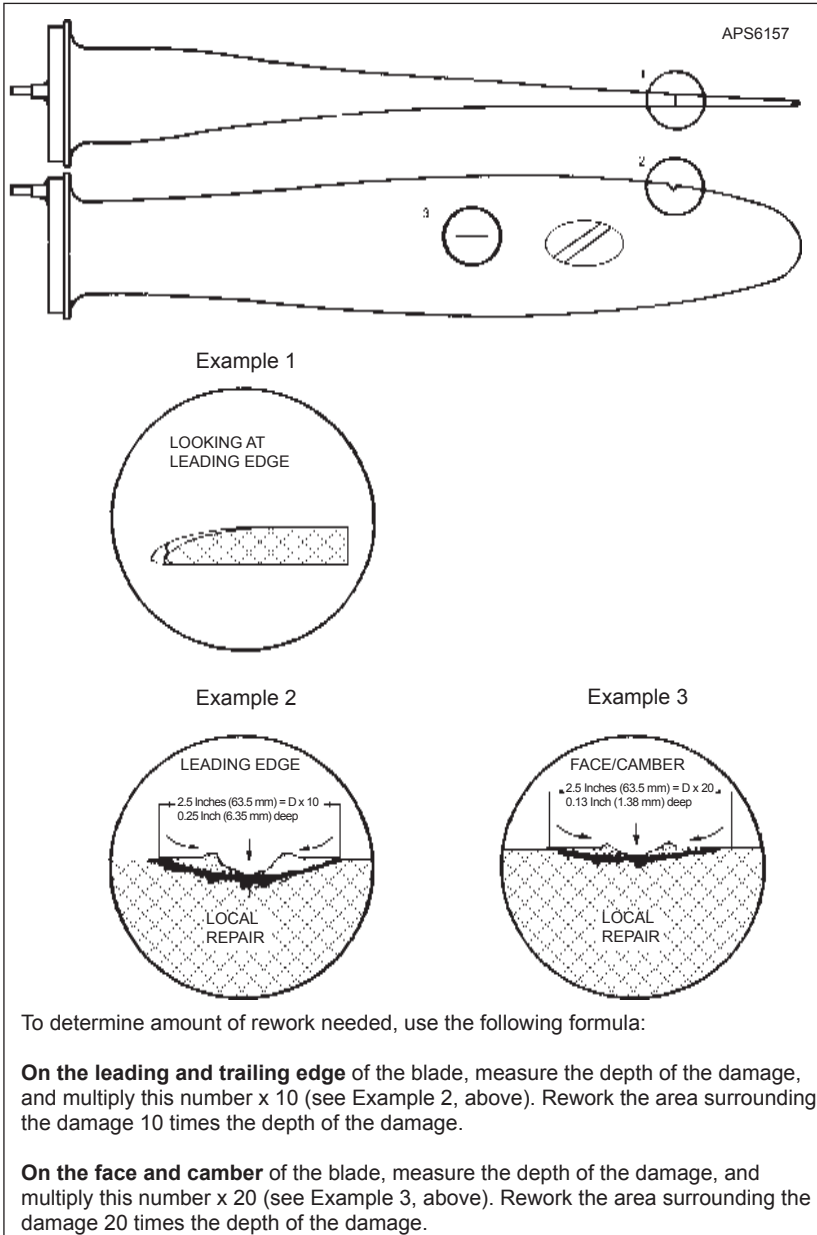
(9) Reinstall a lubrication cap on each lubrication fitting.

C. Approved Lubricants

- (1) The following lubricants are approved for use in Hartzell 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 (approximately 100°F [38°C]).
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 (Figure 6-2) 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.



Repair Limitations
Figure 6-3

3. Blade Repairs

WARNING: ALL NICKS, GOUGES, OR SCRATCHES OF ANY SIZE CAN CREATE A STRESS RISER THAT COULD POTENTIALLY LEAD TO BLADE CRACKING. ALL DAMAGE SHOULD BE VISUALLY EXAMINED CAREFULLY BEFORE FLIGHT FOR THE PRESENCE OF CRACKS OR OTHER ABNORMALITIES.

CAUTION 1: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER 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: BLADES THAT HAVE BEEN PREVIOUSLY REPAIRED OR OVERHAULED MAY HAVE BEEN DIMENSIONALLY REDUCED. BEFORE REPAIRING SIGNIFICANT DAMAGE OR MAKING REPAIRS ON BLADES THAT ARE APPROACHING SERVICEABLE LIMITS, CONTACT A CERTIFIED PROPELLER REPAIR STATION WITH THE APPROPRIATE RATING OR THE HARTZELL PROPELLER INC. PRODUCT SUPPORT DEPARTMENT FOR BLADE DIMENSIONAL LIMITS.

Nicks, gouges, and scratches on blade surfaces or on the leading or trailing edges of the blade, greater than 1/32 inch wide or deep, must be removed before flight. Field repair of small nicks and scratches may be performed by qualified personnel in accordance with FAA Advisory Circular 43.13-1B, as well as the procedures specified below. Normal blade lead edge erosion (sand-blasted appearance) is acceptable, and does not require removal before further flight.

A. Repair of Nicks or Gouges

Local repairs may be made using files, electrical or air powered equipment. Emery cloth, scotch brite, and crocus cloth must be used for final finishing. Refer to Figure 6-3.

CAUTION 1: REWORK THAT INVOLVES COLD WORKING THE METAL, RESULTING IN CONCEALMENT OF A DAMAGED AREA, IS NOT ACCEPTABLE. A STRESS CONCENTRATION MAY EXIST, WHICH CAN RESULT IN A BLADE FAILURE.

CAUTION 2: SHOT PEENED BLADES ARE IDENTIFIED WITH AN "S" FOLLOWING THE BLADE MODEL NUMBER, AS DESCRIBED IN THE DESCRIPTION AND OPERATION CHAPTER OF THIS MANUAL. BLADES THAT HAVE DAMAGE IN THE SHOT PEENED AREAS IN EXCESS OF 0.015 INCH (0.38 MM) DEEP ON THE FACE OR CAMBER OR 0.250 INCH (6.35 MM) ON THE LEADING OR TRAILING EDGES MUST BE REMOVED FROM SERVICE, AND THE REWORKED AREA SHOT PEENED BEFORE FURTHER FLIGHT. SHOT PEENING OF AN ALUMINUM BLADE MUST BE ACCOMPLISHED BY AN APPROPRIATELY LICENSED AND APPROVED REPAIR FACILITY IN ACCORDANCE WITH HARTZELL PROPELLER INC. ALUMINUM BLADE OVERHAUL MANUAL 133C (61-13-33).

- (1) Repairs to the leading or trailing edge must be accomplished by removing material from the bottom of the damaged area. Remove material from this point out to both sides of the damage, providing a smooth, blended depression which maintains the original airfoil general shape.
- (2) Repairs to the blade face or camber should be made in the same manner as above. Repairs that form a continuous line across the blade section (chordwise) are unacceptable.

- (3) The area of repair should be determined as follows:
Leading and trailing edge damage: Depth of nick x 10.
Face and camber: Depth of nick x 20. Refer to Figure 6-3.

NOTE: Leading edge includes the first 10 percent of chord from the leading edge. The trailing edge consists of the last 20 percent of chord adjacent to the trailing edge.

- (4) After filing or sanding of the damaged area, the area must then be polished with emery cloth, and finally with crocus cloth to remove any traces of filing.
- (5) Inspect the repaired area with a 10X magnifying glass. Make sure that no indication of the damage, file marks, or coarse surface finish remain.
- (6) If inspections shows any remaining blade damage, repeat steps 3.A.(4) and 3.A.(5) until no damage remains. Dye penetrant inspection is recommended in accordance with Hartzell Propeller Inc. Manual 202A (61-01-02).
- (7) Apply chemical conversion coating and approved paint to the repaired area before returning the blade to service. Refer to Painting After Repair in this section.

B. Repair of Bent Blades

CAUTION: DO NOT ATTEMPT TO "PRE-STRAIGHTEN" A BLADE BEFORE DELIVERY TO AN AIRWORTHINESS AGENCY APPROVED PROPELLER REPAIR STATION. THIS WILL CAUSE THE BLADE TO BE SCRAPPED BY THE REPAIR STATION.

- (1) Repair of a bent blade or blades is considered a major repair. This type of repair must be accomplished by a certified propeller repair station with the appropriate rating, and only within approved guidelines.

4. Painting After Repair

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER 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.

Propeller blades are painted with a durable specialized coating that is resistant to abrasion. If this coating becomes eroded, it is necessary to repaint the blades to provide proper corrosion and erosion protection.

Hartzell Propeller Inc. recommends that painting be performed by a certified propeller repair station with the appropriate rating in accordance with Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). However, it is permissible to perform a blade touch-up with aerosol paint in accordance with the procedures in Painting of Aluminum Blades, below.

The following paints (Table 6-1) are approved for blade touch-up:

Vendor	Color/Type	Vendor P/N	Hartzell Propeller Inc. P/N
Tempo	Epoxy Black	A-150	A-6741-145-2
Tempo	Epoxy Gray	A-151	A-6741-146-2
Tempo	Epoxy White (tip stripe)	A-152	A-6741-147-2
Tempo	Epoxy Red (tip stripe)	A-153	A-6741-149-2
Tempo	Epoxy Yellow (tip stripe)	A-154	A-6741-150-2
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	Red (tip stripe)	F75KXR12320-4311	A-6741-149-1
Sherwin-Williams	Yellow (tip stripe)	F75KXY11841-4311	A-6741-150-1
Sherwin-Williams	Silver Metallic	F63BXS0627-4389	A-6741-163-1

**Approved Paints
Table 6-1**

The paint manufacturers may be contacted as listed 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
Dayton, Ohio 45439
Tel: 937.298.8691
Fax: 937.298.3820
Cage Code: 0W199

A. Painting of Aluminum 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: ANY REFINISHING PROCEDURE CAN ALTER PROPELLER BALANCE. PROPELLERS THAT ARE OUT OF BALANCE MAY EXPERIENCE EXCESSIVE VIBRATIONS WHILE IN OPERATION.

- (1) Using acetone, #700 lacquer thinner, or MEK, wipe the surface of the blade to remove any contaminants.
- (2) Feather the existing coatings away from the eroded or repaired area with 120 to 180 grit sandpaper.

NOTE: Paint erosion is typically very similar on all blades in a propeller assembly. If one blade has more extensive damage, e.g. in the tip area, all the blades should be sanded 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) Use acetone, #700 lacquer thinner, or MEK to wipe the surface of the blade. Allow solvent to evaporate.

(4) Before refinishing the blades, apply an approved corrosion preventive coating to the bare aluminum surface. Oakite 31, Chromicote L-25, or Alodine 1201 are approved chemical conversion coatings. Apply these coatings in accordance with the directions provided by the product manufacturer.

(5) Apply masking material for 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 ONLY ENOUGH FINISH COATING TO UNIFORMLY COVER THE REPAIR/ EROSION. AVOID EXCESSIVE PAINT BUILD-UP ALONG THE TRAILING EDGE TO AVOID CHANGING BLADE PROFILE.

(6) Apply sufficient finish coating to achieve 2 to 4 mils thickness when dry. Re-coat before 30 minutes, or after 48 hours. If the paint is allowed to dry longer than four (4) hours, it must be lightly sanded before another coat is applied.

(7) Remove the masking material from the tip stripes and re-mask to allow for the tip stripe refinishing, if required.

(8) Apply sufficient tip stripe coating to achieve 2 to 4 mils thickness when dry. Re-coat before 30 minutes, or after 48 hours. If the paint is allowed to dry longer than four (4) hours, it must be lightly sanded before another coat is applied.

(9) Remove the masking material immediately from the tip stripes, if required.

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

6. Propeller Low Pitch Stop

WARNING: LOW PITCH BLADE ANGLE ADJUSTMENTS MUST BE MADE IN CONSULTATION WITH THE APPLICABLE TYPE CERTIFICATE OR SUPPLEMENTAL TYPE CERTIFICATE HOLDER'S MAINTENANCE DATA.

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER 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. Low Pitch Stop

- (a) The propeller low pitch stop is set at the factory to the aircraft TC or STC Holder's requirements and should not require any additional adjustment.
- (b) The aircraft TC or STC Holder provides the required low pitch stop blade angle and may also provide the acceptable RPM range for a maximum power static condition.
- (c) Be aware that the aircraft TC or STC holder may specify the static RPM to be less than the RPM to which the engine is rated.

B. Propeller Low Pitch Measurement

(a) Perform the following steps for low pitch measurement:

- 1 Rotate the blades by hand to move the blades and piston to low pitch.

NOTE: Low pitch is reached when a washer on the end of each piston guide rod stops against the guide collar.

- 2 With the blade in a horizontal position, measure the low pitch blade angle.
- 3 Check the measured blade angle against the required blade angle as specified in accordance with the aircraft TC or STC Holder's requirements.
- 4 If the blade angle requires adjustment, have the low pitch blade angle adjusted by a certified propeller repair station with the appropriate rating or by the Hartzell Propeller Inc. factory.

7. Propeller High Pitch (Minimum RPM) Stop

A. The high pitch stop is set at the factory per the aircraft manufacturer's or STC holder's recommendations. These stops are adjustable only by a certified propeller repair station with the appropriate rating or the Hartzell Propeller Inc. factory.