Manual No. 350
Revision 5
October 2024

Propeller Owner's Manual
and Logbook

WING-IN-GROUND-EFFECT CRAFT PROPELLERS

Lightweight Turbine Propellers
HM-(D,E)4N-3( )

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WARNING

People who operate Wing-In-Ground-effect (WIG) craft should recognize that various types of risks are involved; and they should take all precautions to minimize them, since they cannot be eliminated entirely. The propeller is a vital component of the craft. A mechanical failure of the propeller could create vibrations sufficiently severe to damage the craft, possibly causing it to become uncontrollable.

Propellers are subject to constant vibration stresses from the engine and airstream, which are added to high bending and centrifugal stresses.

Before a propeller is determined to be safe to operate on a craft, an adequate margin of safety must be demonstrated. Even though every precaution is taken in the design and manufacture of a propeller, history has revealed rare instances of failures, particularly of the fatigue type.

It is essential that the propeller is properly maintained according to the recommended service procedures and a close watch is exercised to detect impending problems before they become serious. Any grease or oil leakage, loss of air pressure, unusual vibration, or unusual operation should be investigated and repaired, as it could be a warning that something serious is wrong.

For operators of uncertified or experimental craft an even greater level of vigilance is required in the maintenance and inspection of the propeller. Experimental installations often use propeller-engine combinations that have not been tested and approved. In these cases, the stress on the propeller and, therefore, its safety margin is unknown. Failure could be as severe as loss of propeller or propeller blades and cause loss of propeller control and/or loss of craft control.

Experimental craft may operate with unapproved engines or propellers or engine modifications to increase horsepower, such as unapproved crankshaft damper configurations or high compression pistons. These issues affect the vibration output of the engine and the stress levels on the propeller. Significant propeller life reduction and failure are real possibilities.

Inspect the propeller/blades in accordance with the applicable operation/maintenance documents.

REVISION 5 HIGHLIGHTS

Revision 5, dated October 2024, incorporates the following:

Front matter (Cover, Revision Highlights, etc.), has been revised to match this revision.

Minor language/format changes and renumbering will be marked with a revision bar but not listed in this section.

DESCRIPTION AND OPERATION

- Revised Table 2-2, “Aluminum Blade Model Identification”

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REVISION 5 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	Aug/14	New Issue
Revision 1	Mar/21	Major Revision
Revision 2	Jul/21	Minor Revision
Revision 3	Jun/23	Major Revision
Revision 4	Jun/24	Minor Revision
Revision 5	Oct/24	Minor Revision

RECORD OF REVISIONS

Rev. No.	Issue Date	Date Inserted	Inserted By
Original	Aug/14	Aug/14	HPI
1	Mar/21	Mar/21	HPI
2	Jul/21	Jul/21	HPI
3	Jun/23	Jun/23	HPI
4	Jun/24	Jun/24	HP
5	Oct/24	Oct/24	HP

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RECORD OF TEMPORARY REVISIONS

TR No.	Issue Date	Date Inserted	Inserted By	Date Removed	Removed By

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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
HC-SL-003	Rev. 1 (Mar/21)

SERVICE DOCUMENTS LIST

Service Document Number	Incorporation Rev/Date

OPERATIONAL LIMITATIONS

1. Replacement Time (Life Limits)

   The applicable certification agency may establish specific life limits for certain component parts, as well as the entire propeller. Such limits require replacement of the identified parts after a specified number of hours of use.

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

   NOTE: Propeller models affected by this manual currently do not have any life limited parts.

Rev. No.	Description of Revision

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LIST OF EFFECTIVE PAGES

Chapter	Page	Revision	Date
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INTRODUCTION - CONTENTS, continued

1. General

A. Statement of Purpose

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

(1) The information in this manual can be used by qualified personnel to install, operate, and maintain the applicable Hartzell propeller assemblies.

(a) Additional manuals are available that include overhaul procedures and specifications for the propeller.

(2) This manual may include multiple design types.

(a) Parentheses shown in the propeller model designations in this or other Hartzell Propeller publications indicate letter(s) and/or number(s) that may or may not be present because of different configurations permitted on the various aircraft installations.

1 Refer to the Description and Operation chapter of this manual for propeller and blade model designation information.

(3) Where possible, this manual is written in the format specified by ATA iSpec 2200.

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 craft by pulling on the propeller.

(3) Avoid the use of blade paddles. If blade paddles must be used, use at least two paddles. Put the blade paddle in the thickest area of the blade. Use one blade paddle per blade.

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

(5) Observe applicable torque values during maintenance.

(6) Propellers must be statically balanced before installing on the engine.

(a) Hartzell Propeller statically balances all new propellers.

(b) Overhauled propellers must be statically balanced by personnel certified by the applicable regulatory agency before return to service.

(7) Dynamic balance is recommended, but may be accomplished at the discretion of the operator, unless specifically required by the craft or engine manufacturer.

1 Perform dynamic balancing in accordance with the Maintenance Practices chapter of this manual.

2 Additional procedures may be found in the applicable 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, safety cable, and cotter pin general practices. Use 0.032 inch (0.81 mm) diameter stainless steel safety wire unless otherwise indicated.

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

(11) Refer to the craft manufacturer's manuals in addition to the information in this manual because of possible special requirements for specific applications.

(12) Approved corrosion protection followed by approved paint must be applied to all aluminum blades.

(a) 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.

2. Craft or Engine Modifications

A. Propeller Stress Levels

(1) Propellers are approved vibrationwise on craft and engine combinations based on tests or analysis of similar installations. This data has demonstrated that propeller stress levels are affected by craft configuration, airspeed, weight, power, engine configuration and approved maneuvers. Craft 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).

B. Engine Modifications

(1) 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.

(a) Examples of turbine engine modifications include, but are not limited to: changes to the compressor, power turbine or hot section of a turboprop engine.

(b) Examples of reciprocating engine modifications include, but are not limited to: 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.

(2) All such modifications must be reviewed and approved by the propeller manufacturer before obtaining approval on the craft.

3. Restrictions and Placards

A. Important Information

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

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

(b) Review the applicable certification agency information and operating handbook 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 CRAFT. THE PROPELLER RESTRICTED RPM RANGE IS DEFINED IN THE CRAFT OPERATION MANUAL.

(2) The propeller operating restrictions or limitations are found in the craft manufacturer’s manuals.

(3) 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.

4. Reference Publications

A. Hartzell Propeller Publications

(1) Information published in Service Bulletins, Service Letters, Service Advisories, and Service Instructions may supersede information published in this manual. The reader must consult active Service Bulletins, Service Letters, Service Advisories, and Service Instructions for information that may have not yet been incorporated into the latest revision of this manual.

(2) In addition to this manual, one or more of the following publications are required for information regarding specific recommendations and procedures to maintain propeller assemblies that are included in this manual.

Manual No. (ATA No.)	Available at www.hartzellprop.com	Hartzell Propeller Manual Title
n/a	Yes	Active Hartzell Propeller Service Bulletins, Service Letters, Service Instructions, and Service Advisories
Manual 127 (61-16-27)	Yes	Metal Spinner Maintenance Manual
Manual 133C (61-13-33)	-	Aluminum Blade Overhaul Manual
Manual 148 (61-16-48)	Yes	Composite Spinner Maintenance Manual
Manual 159 (61-02-59)	Yes	Application Guide
Manual 165A (61-00-65)	Yes	Illustrated Tool and Equipment Manual
Manual 180 (30-61-80)	Yes	Ice Protection System Manual
Manual 202A (61-01-02)	Vol. 1, Yes Vol. 7, Yes Vol. 11, Yes	Standard Practices Manual, Volumes 1 through 11

B. Vendor Publications

None.

5. Personnel Requirements

   A. Service and Maintenance Procedures in this Manual

      (1) Personnel performing maintenance are expected to have sufficient training and certifications (when required by the applicable certification agency) to accomplish the work required in a safe manner.

      (2) Compliance to regulatory requirements established by the applicable certification agency is mandatory for anyone performing or accepting responsibility for the inspection and/or repair of any Hartzell Propeller LLC product.

         (a) Maintenance records must be kept in accordance with the requirements established by the applicable certification agency.

6. Special Tooling and Consumable Materials (Rev. 2)

   A. Special Tooling

      (1) Special tooling may be required for procedures in this manual. For further tooling information, refer to Hartzell Propeller Illustrated Tool and Equipment Manual 165A (61-00-65).

         (a) Tooling reference numbers appear with the prefix “TE” directly following the tool name to which they apply. For example, a template that is reference number 133 will appear as: template TE133.

   B. Consumable Materials

      (1) Consumable materials are referenced in certain sections throughout this manual. Specific approved materials are listed in the Consumable Materials chapter of Hartzell Propeller Standard Practices Manual 202A (61-01-02).

         (a) Consumable material reference numbers appear with the prefix “CM” directly following the material to which they apply. For example, an adhesive that is reference number 16 will appear as: adhesive CM16. Only the material(s) specified can be used.

7. Safe Handling of Paints and Chemicals (Rev.1)

   A. Instructions for Use

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

      (2) Before using paint or chemicals, always read the manufacturer's label on the container(s) and follow specified instructions and procedures for storage, preparation, mixing, and/or application.

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

8. Calendar Limits and Long Term Storage (Rev. 3)

   A. Calendar Limits

      (1) The effects of exposure to the environment over a period of time create a need for propeller overhaul regardless of flight time.

      (2) A calendar limit between overhauls is specified in Hartzell Propeller Service Letter HM-SL-001.

      (3) Experience has shown that special care, such as keeping the craft in a hangar, is not sufficient to permit extension of the calendar limit.

      (4) The start date for the calendar limit is when the propeller is first installed on an engine.

      (5) The calendar limit is not interrupted by subsequent removal and/or storage.

      (6) The start date for the calendar limit must not be confused with the warranty start date, that is with certain exceptions, the date of installation by the first retail customer.

   B. Long Term Storage

      (1) Propellers that have been in storage have additional inspection requirements before installation. Refer to the Packaging and Storage chapter of Hartzell Propeller Standard Practices Manual 202A (61-01-02).

9. Component Life and Overhaul (Rev. 3)

WARNING: CERTAIN PROPELLER COMPONENTS USED IN NON-AVIATION APPLICATIONS ARE MARKED WITH DIFFERENT PART NUMBERS TO DISTINGUISH THEM FROM COMPONENTS USED IN AVIATION APPLICATIONS. DO NOT ALTER THE PART NUMBERS SHOWN ON PARTS DESIGNATED FOR NON-AVIATION APPLICATIONS OR OTHERWISE APPLY THOSE PARTS FOR USE ON AVIATION APPLICATIONS.

A. Component Life

(1) Component life is expressed in terms of hours of service (Time Since New, TSN) and in terms of hours of service since overhaul (Time Since Overhaul, TSO).

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

(2) Time Since New (TSN) and Time Since Overhaul (TSO) records for the propeller hub and blades must be maintained in the propeller logbook.

(3) Both TSN and TSO are necessary for defining the life of the component. Certain components, or in some cases an entire propeller, may be “life limited”, which means that they must be replaced after a specified period of use (TSN).

(a) It is a regulatory requirement that a record of the Time Since New (TSN) be maintained for all life limited parts.

(b) Refer to the Operational Limitations chapter in the applicable Hartzell Propeller Owner’s Manual for a list of life limited components.

(4) When a component or assembly undergoes an overhaul, the TSO is returned to zero hours.

(a) Time Since New (TSN) can never be returned to zero.

(b) Repair without overhaul does not affect TSO or TSN.

(5) Blades and hubs are sometimes replaced while in service or at overhaul.

(a) Maintaining separate TSN and TSO histories for a replacement hub or blade is required.

(b) Hub replacement

1 If the hub is replaced, the replacement hub serial number must be recorded (the entry signed and dated) in the propeller logbook.

2 The propeller will be identified with the serial number of the replacement hub.

NOTE: Propeller assembly serial numbers are impression stamped on the hub. For stamping information, refer to the Parts Identification and Marking chapter of Hartzell Propeller Standard Practices Manual 202A (61-01-02).

3 The TSN and TSO of the replacement hub must be recorded and maintained in the propeller logbook.

4 If tracking any component(s) other than the hub/blades, maintain these TSN/TSO records separately in the propeller logbook.

NOTE: Hub replacement does not affect the TSN/TSO of any other propeller components.

B. Overhaul

(1) Overhaul is the periodic disassembly, cleaning, inspecting, repairing as necessary, reassembling, and testing in accordance with approved standards and technical data approved by Hartzell Propeller LLC.

(2) The overhaul interval is based on hours of service, i.e., operation time, or on calendar time.

(a) Overhaul intervals are specified in Hartzell Propeller Service Letter HM-SL-001.

(b) At such specified periods, the propeller hub assembly and the blade assemblies must be completely disassembled and inspected for cracks, wear, corrosion, and other unusual or abnormal conditions.

(3) Overhaul must be completed in accordance with the latest revision of the applicable component maintenance manual and other publications applicable to, or referenced in, the component maintenance manual.

(a) Parts that are not replaced at overhaul must be inspected in accordance with the check criteria in the applicable Hartzell Propeller component maintenance manual.

(b) Parts that must be replaced at overhaul are identified by a “Y” in the O/H column of the Illustrated Parts List in the applicable Hartzell Propeller component maintenance manual.

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

10. Damage/Repair Types (Rev. 2)

A. Operable/Inoperable Damage

(1) Operable damage is a specific condition to a propeller component that is within the serviceable limits specified in the applicable Hartzell Propeller component maintenance manual.

(a) Operable damage does not affect the safety or operational characteristics of the propeller and conforms to its type design.

(b) Operable damage does not require repair before further operation, but should be repaired as soon as possible to prevent degradation of the damage.

(2) Inoperable damage is a specific condition to a propeller component that exceeds the serviceable limits specified in the applicable Hartzell Propeller component maintenance manual.

(a) Inoperable damage can affect the safety or operational characteristics of the propeller and does not conform to its type design.

(b) Inoperable damage must be repaired before the propeller is returned to service.

B. Minor/Major Repair

(1) Minor Repair

(a) Minor repair is that which may be done safely in the field by a certified propeller mechanic.

1 For serviceable limits and repair criteria for Hartzell propeller components, refer to the applicable Hartzell Propeller component maintenance manual.

(2) Major Repair

(a) Major repair cannot be done by elementary operations.

(b) Major repair work must be accepted by an individual that is certified by the applicable regulatory agency.

1 Hartzell recommends that individuals performing major repairs also have a Factory Training Certificate from Hartzell Propeller LLC.

2 The repair station must meet facility, tooling, and personnel requirements and is required to participate in Hartzell Propeller Sample Programs as defined in the Approved Facilities chapter of Hartzell Propeller Standard Practices Manual 202A (61-01-02).

11. Propeller Critical Parts (Rev. 2)

A. Important Information

(1) Procedures in this manual may involve Propeller Critical Parts (PCP).

(a) 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.

(b) Refer to the Illustrated Parts List chapter in the applicable Hartzell Propeller maintenance manual to identify the 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.

(a) 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.

12. Warranty Service (Rev. 2)

A. Warranty Claims

(1) If you believe you have a warranty claim, contact the Hartzell Propeller Product Support Department to request a *Warranty Application* form. Complete this form and return it to Hartzell Product Support for evaluation **before proceeding with repair or inspection work**. Upon receipt of this form, the Hartzell Product Support Department will provide instructions on how to proceed.

(a) For Hartzell Propeller Product Support Department contact information, refer to the “Hartzell Propeller Contact Information” section in this chapter.

13. Hartzell Propeller Contact Information (Rev. 3)

A. Product Support Department

(1) Contact the Hartzell Propeller Product Support Department about any maintenance problems or to request information not included in this publication.

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

(a) The Product Support Department 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.

(b) The Product Support Department can also be reached by fax at (937) 778-4215, and by e-mail at techsupport@hartzellprop.com.

(c) 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.

1 A technical representative will contact you during normal business hours.

2 Urgent AOG support is also available 24 hours per day, seven days per week via this message service.

(d) Additional information is available on the Hartzell Propeller website at www.hartzellprop.com.

B. Technical Publications Department

(1) For Hartzell Propeller Inc. service literature and revisions, contact:

Hartzell Propeller LLC
Attn: Technical Publications Department
One Propeller Place
Piqua, Ohio 45356-2634 U.S.A.

E-mail: manuals@hartzellprop.com
Telephone: 937.778.4200
Fax: 937.778.4215

C. Recommended Facilities

(1) Hartzell Propeller LLC recommends using Hartzell-approved distributors and repair facilities for the purchase, repair, and overhaul of Hartzell propeller assemblies or components.

(2) Information about the Hartzell Propeller LLC worldwide network of aftermarket distributors and approved repair facilities is available on the Hartzell website at www.hartzellprop.com.

14. Definitions (Rev. 5)

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

Term	Definition
Annealed	Softening of material due to overexposure to heat
Aviation Certified	Intended for FAA or international equivalent type certificated aircraft applications. A TC and PC number must be stamped on the hub, and a PC number must be stamped on blades.
Aviation Experimental	Intended for aircraft/propeller applications not certified by the FAA or international equivalent. Products marked with an “X” at or near the end of the model number or part number are not certified by the FAA or international equivalent and are not intended to use on certificated aircraft.
Beta Operation	A mode of pitch control that is directed by the pilot rather than by the propeller governor
Beta Range	Blade angles between low pitch and maximum reverse blade angle
Beta System	Parts and/or equipment related to operation (manual control) of propeller blade angle between low pitch blade angle and full reverse blade angle
Blade Angle	Measurement of blade airfoil location described as the angle between the blade airfoil and the surface described by propeller rotation
Blade Centerline	An imaginary reference line through the length of a blade around which the blade rotates

Term	Definition
Blade Station	Refers to a location on an individual blade for blade inspection purposes. It is a measurement from the blade “zero” station to a location on a blade, used to apply blade specification data in blade overhaul manuals. Note: Do not confuse *blade station* with *reference blade radius*; they may not originate at the same location.
Blemish	An imperfection with visible attributes, but having no impact on safety or utility
Brinelling	A depression caused by failure of the material in compression
Bulge	An outward curve or bend
Camber	The surface of the blade that is directed toward the front of the aircraft. It is the low pressure, or suction, side of the blade. The camber side is convex in shape over the entire length of the blade.
Chord	A straight line distance between the leading and trailing edges of an airfoil
Chordwise	A direction that is generally from the leading edge to the trailing edge of an airfoil
Co-bonded	The act of bonding a composite laminate and simultaneously curing it to some other prepared surface
Composite Material	Kevlar®, carbon, or fiberglass fibers bound together with, or encapsulated within an epoxy resin
Compression Rolling	A process that provides improved strength and resistance to fatigue

Term	Definition
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 (Aluminum)	The chemical or electrochemical attack by an acid or alkaline that reacts with the protective oxide layer and results in damage of the base aluminum. Part failure can occur from corrosion due to loss of structural aluminum converted to corrosion product, pitting, a rough etched surface finish, and other strength reduction damage caused by corrosion.
Corrosion (Steel)	Typically, an electrochemical process that requires the simultaneous presence of iron (component of steel), moisture and oxygen. The iron is the reducing agent (gives up electrons) while the oxygen is the oxidizing agent (gains electrons). Iron or an iron alloy such as steel is oxidized in the presence of moisture and oxygen to produce rust. Corrosion is accelerated in the presence of salty water or acid rain. Part failure can occur from corrosion due to loss of structural steel converted to corrosion product, pitting, a rough etched surface finish and other strength reduction damage caused by corrosion.
Corrosion Product (Aluminum)	A white or dull gray powdery material that has an increased volume appearance (compared to non-corroded aluminum). Corrosion product is not to be confused with damage left in the base aluminum such as pits, worm holes, and etched surface finish.

Term	Definition
Corrosion Product (Steel)	When iron or an iron alloy such as steel corrodes, a corrosion product known as rust is formed. Rust is an iron oxide which is reddish in appearance and occupies approximately six times the volume of the original material. Rust is flakey and crumbly and has no structural integrity. Rust is permeable to air and water, therefore the interior metallic iron (steel) beneath a rust layer continues to corrode. Corrosion product is not to be confused with damage left in the base steel such as pits and etched surface finish.
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
Defect	An imperfection that affects safety or utility
Delamination	Internal separation of the layers of composite material
Dent	The permanent deflection of the cross section that is visible on both sides with no visible change in cross sectional thickness
Depression	Surface area where the material has been compressed but not removed
Distortion	Alteration of the original shape or size of a component
Edge Alignment	Distance from the blade centerline to the leading edge of the blade
Erosion	Gradual wearing away or deterioration due to action of the elements
Exposure	Leaving material open to action of the elements

Term	Definition
Face	The surface of the blade that is directed toward the rear of the aircraft. The face side is the high pressure, or thrusting, side of the blade. The blade airfoil sections are normally cambered or curved such that the face side of the blade may be flat or even concave in the midblade and tip region.
Face Alignment	Distance from the blade centerline to the highest point on the face side perpendicular to the chord line
Feathering	The capability of blades to be rotated parallel to the relative wind, thus reducing aerodynamic drag
Fraying	A raveling or shredding of material
Fretting	Damage that develops when relative motion of small displacement takes place between contacting parts, wearing away the surface
Galling	To fret or wear away by friction
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
Inboard	Toward the butt of the blade
Intergranular Corrosion	Corrosion that attacks along the grain boundaries of metal alloys
Jog	A term used to describe movement up/down, left/right, or on/off in short incremental motions

Term	Definition
Laminate	To unite composite material by using a bonding material, usually with pressure and heat
Lengthwise	A direction that is generally parallel to the pitch axis
Loose Material	Material that is no longer fixed or fully attached
Low Pitch	The lowest blade angle attainable by the governor for constant speed operation
Major Propeller Effect	The major propeller effects are defined in Title 14 CFR section 35.15(g)(2)
Minor Deformation	Deformed material not associated with a crack or missing material
Monocoque	A type of construction in which the outer skin carries all or a major part of the load
Nick	Removal of paint and possibly a small amount of material
Non-Aviation Certified	Intended for non-aircraft application, such as Hovercraft or Wing in Ground Effect (WIG) applications. These products are certificated by an authority other than FAA. The hub and blades will be stamped with an identification that is different from, but comparable to TC and PC.
Non-Aviation Experimental	Intended for non-aircraft application, such as Hovercraft or Wing-In-Ground effect (WIG) applications. Products marked with an “X” at or near the end of the model number or part number are not certified by any authority and are not intended for use on certificated craft.
Onspeed	Condition in which the RPM selected by the pilot through the propeller control/condition lever and the actual engine (propeller) RPM are equal

Term	Definition
Open Circuit	Connection of high or infinite resistance between points in a circuit which are normally lower
Outboard	Toward the tip of the blade
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/condition lever
Pitch	Same as “Blade Angle”
Pitting	Formation of a number of small, irregularly shaped cavities in surface material caused by corrosion or wear
Pitting (Linear)	The configuration of the majority of pits forming a pattern in the shape of a line
Porosity	An aggregation of microvoids. See “voids”.
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
Reference Blade Radius	Refers to the propeller reference blade radius in an assembled propeller, e.g., 30-inch radius. A measurement from the propeller hub centerline to a point on a blade, used for blade angle measurement in an assembled propeller. An adhesive stripe (blade angle reference tape CM160) is usually located at the reference blade radius location. Note: Do not confuse *reference blade radius* with *blade station*; they may not originate at the same point.

Term	Definition
Reversing	The capability of rotating blades to a position to generate reverse thrust to slow the aircraft or back up
Scratch	Same as “Nick”
Short Circuit	Connection of low resistance between points on a circuit between which the resistance is normally much greater
Shot Peening	Process where steel shot is impinged on a surface to create compressive surface stress, that provides improved strength and resistance to fatigue
Single Acting	Hydraulically actuated propeller that utilizes a single oil supply for pitch control
Split	Delamination of blade extending to the blade surface, normally found near the trailing edge or tip
Station Line	See "Blade Station"
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
Ticking	A series of parallel marks or scratches running circumferentially around the diameter of the blade
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

Term	Definition
Trailing Edge	The aft edge of an airfoil over which the air passes last
Trimline	Factory terminology referring to where the part was trimmed to length
Underspeed	The condition in which the actual engine (propeller) RPM is lower than the RPM selected by the pilot through the propeller control/condition lever
Unidirectional Material	A composite material in which the fibers are substantially oriented in the same direction
Variable Force	A force that may be applied or removed during propeller operation
Vertical Balance	Balance between the leading and trailing edges of a two-blade propeller with the blades positioned vertically
Voids	Air or gas that has been trapped and cured into a laminate
Windmilling	The rotation of an aircraft propeller caused by air flowing through it while the engine is not producing power
Woven Fabric	A material constructed by interlacing fiber to form a fabric pattern
Wrinkle (aluminum blade)	A wavy appearance caused by high and low material displacement
Wrinkle (composite blade)	Overlap or fold within the material

15. Abbreviations (Rev. 2)

Abbreviation	Term
AD	Airworthiness Directives
AMM	Aircraft Maintenance Manual
AOG	Aircraft on Ground
AR	As Required
ATA	Air Transport Association
CSU	Constant Speed Unit
FAA	Federal Aviation Administration
FH	Flight Hour
FM	Flight Manual
FMS	Flight Manual Supplement
Ft-Lb	Foot-Pound
HMI	Human Machine Interface
ICA	Instructions for Continued Airworthiness
ID	Inside Diameter
In-Lb	Inch-Pound
IPL	Illustrated Parts List
IPS	Inches Per Second
kPa	Kilopascals
Lb(s)	Pound(s)
Max.	Maximum
Min.	Minimum

Abbreviation	Term
MIL-X-XXX	Military Specification
MPI	Major Periodic Inspection (Overhaul)
MS	Military Standard
MSDS	Material Safety Data Sheet
N	Newtons
N/A	Not Applicable
NAS	National Aerospace Standards
NASM	National Aerospace Standards, Military
NDT	Nondestructive Testing
NIST	National Institute of Standards and Technology
N•m	Newton-Meters
OD	Outside Diameter
OPT	Optional
PC	Production Certificate
PCP	Propeller Critical Part
PLC	Programmable Logic Controller
PMB	Plastic Media Blasting (Cleaning)
POH	Pilot’s Operating Handbook
PSI	Pounds per Square Inch
RF	Reference
RPM	Revolutions per Minute
SAE	Society of Automotive Engineers

Abbreviation	Term
STC	Supplemental Type Certificate
TBO	Time Between Overhaul
TC	Type Certificate
TSI	Time Since Inspection
TSN	Time Since New
TSO	Time Since Overhaul
UID	Unique Identification
WIG	Wing-In-Ground-Effect

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DESCRIPTION AND OPERATION - CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. Description of Propellers and Systems

A. Feathering and Reversing Propellers
HM-(D,E)4N-3( ) Series

The propellers described in this section are constant speed, feathering and reversing. They use a single oil supply from a governing device to hydraulically actuate a change in blade angle. The propellers have four blades and are used primarily on Pratt & Whitney turbine engines.

A two piece aluminum hub retains each propeller blade on a thrust bearing. A cylinder is attached to the hub and contains a feathering spring and piston. The hydraulically actuated piston transmits linear motion through a pitch change rod and fork to each blade to result in blade angle change.

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

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

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

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

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

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

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

The propeller is reversed by manually repositioning the cockpit-control to cause the beta valve to supply oil from the governor pump to the propeller. Several external propeller mechanisms, which include a beta ring and carbon block assembly, communicate propeller blade angle position to the beta valve.

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

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

To prevent feathering during normal engine shutdown, the propeller incorporates spring-energized latch pins, called start locks. Two units are installed on the cylinder. If propeller rotation is approximately 800 RPM or above, the start locks disengage from the piston by centrifugal force acting on the latch pins to compress the spring (within the units). When RPM drops below 800 RPM, the springs overcome the centrifugal force and move the latch pins to engage the piston, preventing blade angle movement to feather.

Shortly after start up with the propeller RPM above 800 the latch pins in the start locks will still retain the blade angle. To release the latch pins, it is necessary to manually actuate the propeller slightly toward reverse. This will move the piston, allowing the latch pins to slide freely. Centrifugal force will compress the springs and disengage the pins from the piston.

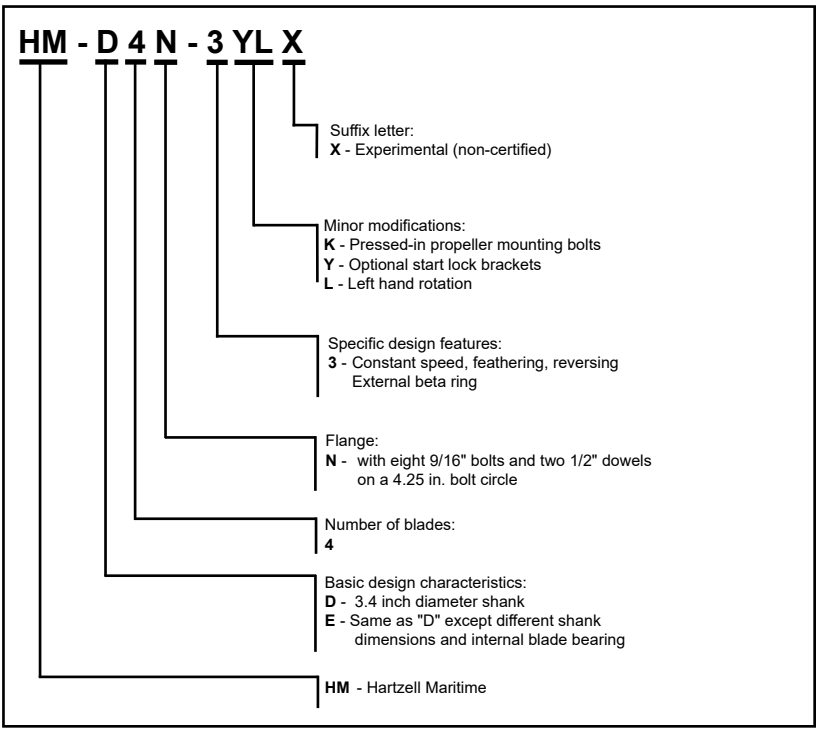
B. Propeller Model Designation

(1) Hartzell Propeller LLC uses a model number designation system to identify specific propeller and blade assemblies. The propeller model and blade model number are separated by a slash (/).

(a) Example: *propeller model number / blade model number*

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

(3) Refer to Table 2-1 for a description of the characters used in the propeller model number.



Propeller Model Identification
Table 2-1

2. Propeller Blades

A. Description of Aluminum Blades

(1) Aluminum propeller blades are manufactured from one solid piece of aluminum that has been forged and heat-treated prior to manufacture.

(2) Aluminum blades are identified by shank design, propeller diameter, tip configurations, and other blade characteristics.

(a) Refer to the section, "Blade Model Designation" in this chapter.

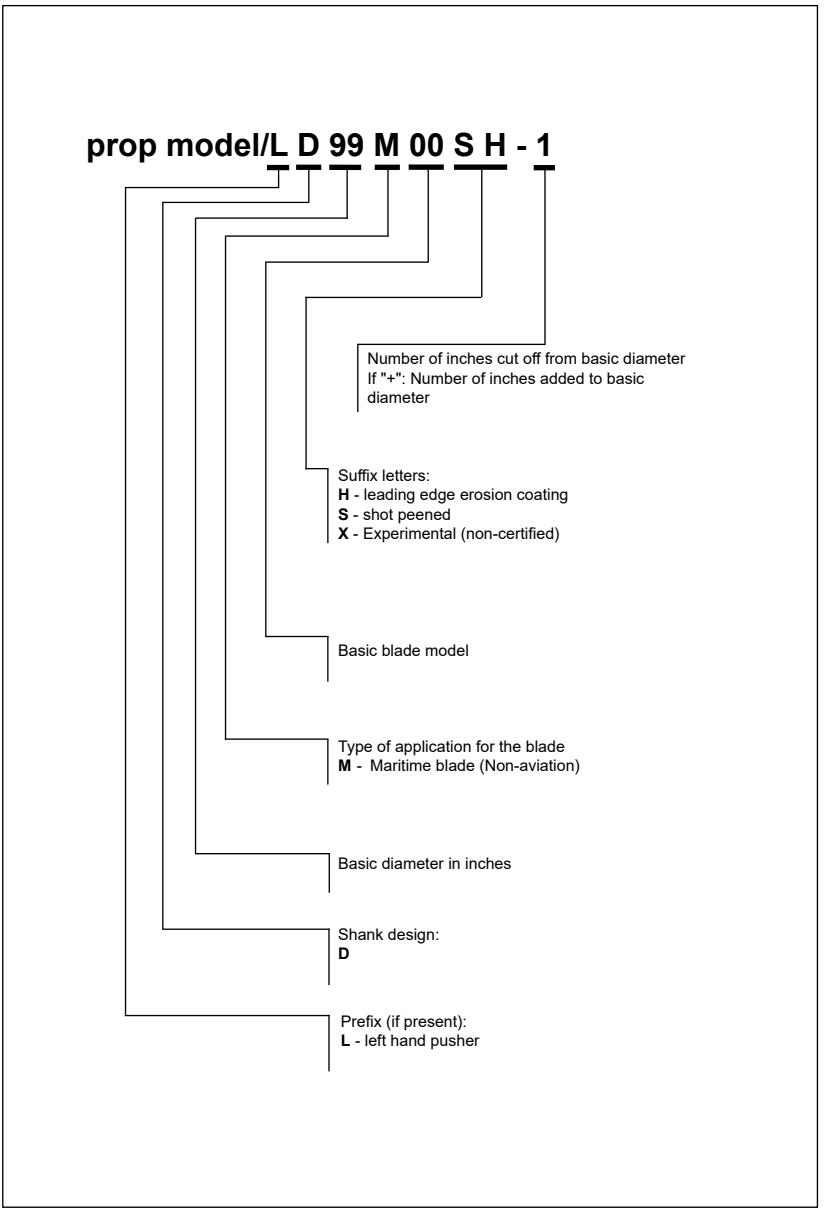
B. Blade Model Designation

(1) Hartzell Propeller LLC uses a model number designation system to identify specific propeller and blade assemblies. The propeller model number and blade model number are separated by a slash (/).

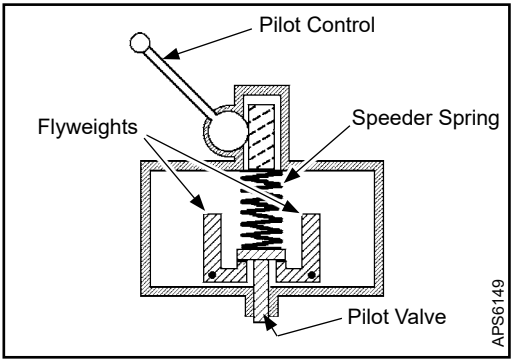
(a) Example: *propeller model number / blade model number*

(2) The blade model number is impression stamped on the butt end of the blade, and also identified by a label on the cylinder.

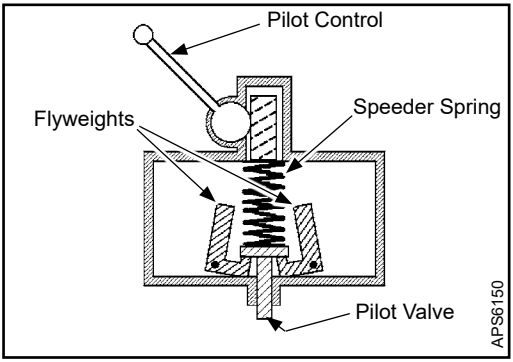
(3) Refer to the Table 2-2 for a description of the characters used in the blade model number:



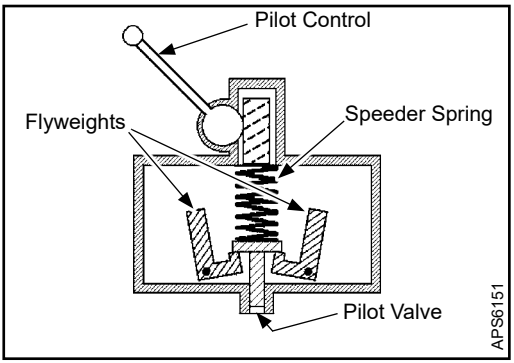
Aluminum Blade Model Identification
Table 2-2



Governor in Onspeed Condition
Figure 2-1



Governor in Underspeed Condition
Figure 2-2



Governor in Overspeed Condition
Figure 2-3

3. Governors (Rev. 1)

A. Theory of Operation

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

(2) When the engine is operating at the RPM set by the pilot using the cockpit control, the governor is operating **onspeed**. Refer to Figure 2-1. In an onspeed condition, the centrifugal force acting on the flyweights is balanced by the speeder spring, and the pilot valve is neither directing oil to nor from the propeller hydraulic cylinder.

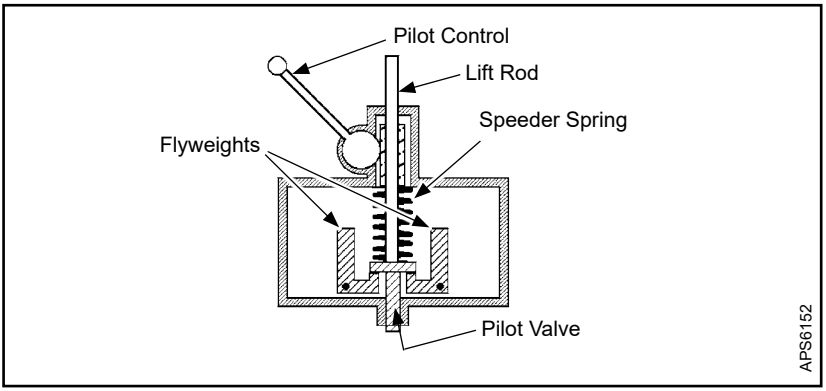
(3) When the engine is operating below the RPM set by the pilot using the cockpit control, the governor is operating **underspeed**. Refer to Figure 2-2. In an underspeed condition, the flyweights tilt inward because there is not enough centrifugal force on the flyweights to overcome the force of the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

(4) When the engine is operating above the RPM set by the pilot using the cockpit control, the governor is operating **overspeed**. Refer to Figure 2-3. In an overspeed condition, the centrifugal force acting on the flyweights is greater than the speeder spring force. The flyweights tilt outward, and raise the pilot valve. The pilot valve then meters oil flow to increase propeller pitch and lower engine RPM.

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

(a) Some governors will move the propeller to feather by electrically or mechanically actuating a valve that opens to drain the oil supply between the propeller and governor to increase propeller pitch and allow the propeller to feather.

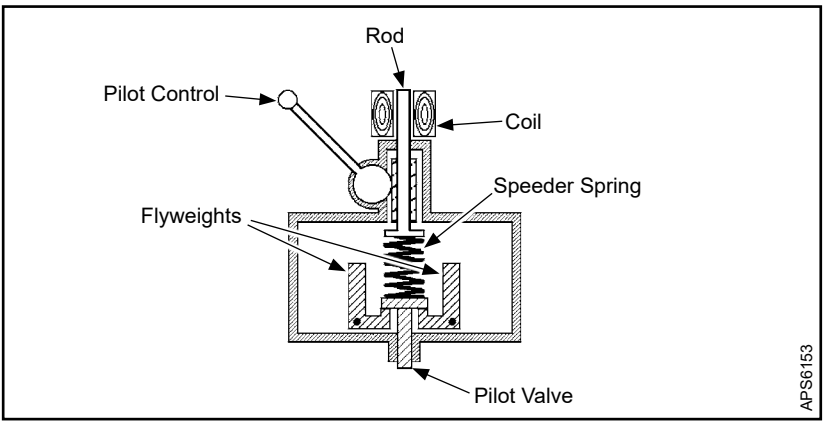
(b) Figure 2-4 illustrates another feathering propeller governor system. When it is desired to feather the propeller, the lift rod may be moved by the cockpit control to mechanically engage the valve. The lifted valve dumps oil to increase propeller pitch until the propeller feathers.



Feathering Governor
Figure 2-4

(6) A synchronizing system can be employed in a multi-engine aircraft to keep the engines operating at the same RPM. A synchrophasing system not only keeps RPM of the engines consistent, but also keeps the propeller blades operating in phase with each other. Both synchronizing and synchrophasing systems serve to reduce noise and vibration. Figure 2-5 illustrates a governor as a component of a synchronizing or synchrophasing system.

(a) Hartzell Propeller synchronizing or synchrophasing systems use one engine (the master engine) as an RPM and phase reference and adjust the RPM of the remaining engine(s) [slave engine(s)] to match it. The RPM of the master engine is monitored electronically, and this information is used to adjust the voltage applied to the electrical coil on the slave governor(s). The voltage to the coil either raises or lowers a rod which changes the force of the speeder spring. In this manner, engine RPM and phase of the propellers is synchronized or synchrophased.



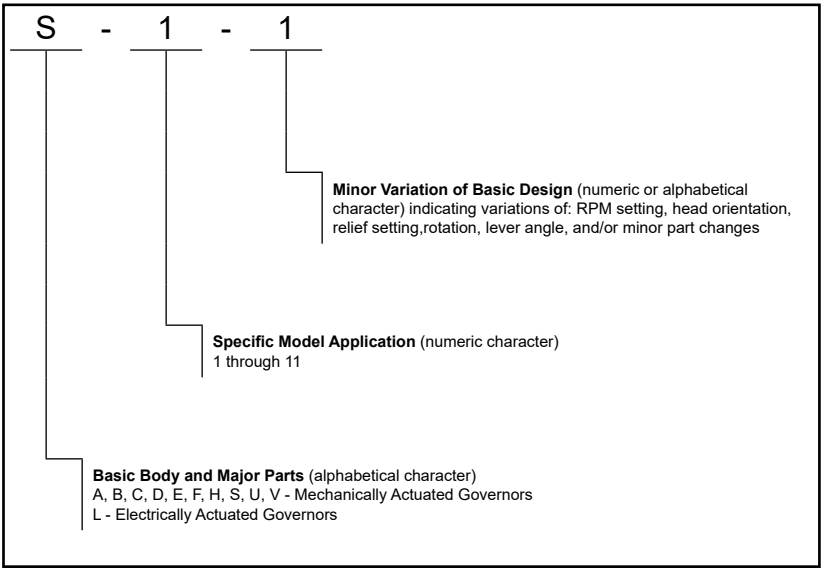
Synchronizer/Synchrophaser Governor
Figure 2-5

B. Governor Model Designation

(1) Hartzell Propeller LLC uses a model number designation system to identify specific governor models.

(2) The governor model number is stamped on the base and/or body of the governor assembly.

(3) Refer to Table 2-3 for a description of the characters used in the governor model number.



Governor Model Designations
Table 2-3

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INSTALLATION AND REMOVAL - CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. Tools, Consumables, and Expendables

   A. General

      (1) The following tools, consumables, and expendables are required for propeller removal or installation:

      (2) The lightweight turbine propellers included in this manual are manufactured with one basic flange design type,“N”. The flange type is indicated in the propeller model identification number stamped on the hub. For example, HM-D4N-3 indicates an N flange. Refer to Aluminum Hub Model Identification in the Description and Operation chapter of this manual for a description of the applicable flange type.

   B. Tooling

      N Flange

      • Safety wire pliers (Alternate: Safety cable tool)
      • Torque wrench
      • Torque wrench adapter TE5
      • Beta System Puller TE100

   C. Consumables

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

   D. Expendables

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

N-flange for:	O-ring	Bolt/Stud	Washer	Nut
HM-D4N-3YL	C-3317-230	B-3339-1	A-2048-2	n/a
HM-E4N-3KYL	C-3317-230	103560	A-2048-2	C-6006

Propeller Mounting Hardware
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) If the box is damaged, contact the freight company for a freight claim.

(b) A hole, tear, or crushed appearance at the end of the box (blade tips) may indicate the propeller was dropped during shipment, possibly damaging the blades.

1 If the propeller is damaged, contact Hartzell Propeller LLC. Refer to the section, “Hartzell Propeller Contact Information” in the Introduction chapter of this manual.

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 entire length of the propeller.

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

C. Inspection after Shipment

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

D. Reassembly of a Propeller Disassembled for Shipment

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

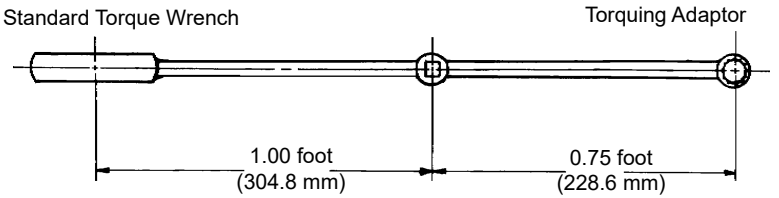
3. Propeller Mounting Hardware and Torque Information (Rev. 1)
   A. Propeller Mounting Hardware
      (1) Refer to Table 3-1 for part numbers of the propeller mounting hardware and O-rings.
   B. Torque Information
      (1) The structural integrity of joints in the propeller that are held together with threaded fasteners is dependent upon proper torque application.
         (a) Vibration can cause an incorrectly tightened fastener to fail in a matter of minutes.
         (b) Correct tension in a fastener depends on a variety of known load factors and can influence fastener service life.
         (c) Correct tension is achieved by application of measured torque.
      (2) Use accurate wrenches and professional procedures to make sure of correct tensioning.
      (3) Refer to Table 3-2 for the torque values to use when installing a Hartzell propeller.
      (4) When an adapter is used with a torque wrench, use the equation in Figure 3-1 to determine the correct torque value.
      (5) Refer to Figure 3-2 for the proper torquing sequence of the propeller mounting bolts/nuts.

CAUTION 1: TORQUE VALUES WITH "WET" NOTED AFTER THEM ARE BASED ON LUBRICATED THREADS WITH APPROVED ANTI-SEIZE COMPOUND MIL-PRF-83483( ).

CAUTION 2: REFER TO FIGURE 3-5 FOR TORQUE READING WHEN USING A TORQUE WRENCH ADAPTER.

Description	Torque Value
N flange propeller mounting bolts (Hartzell p/n B-3339-1)	100-105 Ft-Lbs (136-142 N•m) Wet
N flange propeller mounting nuts (Hartzell p/n C-6006)	120-130 Ft-Lbs (163-176 N•m) Wet

Torque Table
Table 3-2



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

EXAMPLE:

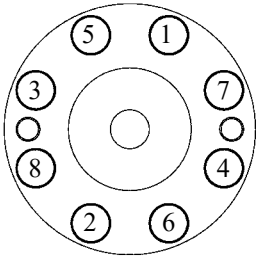
$$\frac{\text{100 Ft-Lb (136 N•m) x 1 ft (308.4 mm)}}{\text{1 ft (308.4 mm) + 0.75 ft (228.6 mm)}} = \text{57.1 Ft-Lb (77.4 N•m)} < \text{reading on torque wrench with 9-inch (228.6 mm) adapter for actual torque of 100 Ft-Lb (136 N•m)}$$

The correction shown is for an adapter that is aligned with the centerline of the torque wrench. If the adapter is angled 90 degrees relative to the torque wrench centerline, the torque wrench reading and actual torque applied will be equal.

APS212

Calculating Torque When Using a Torque Wrench Adapter
Figure 3-1

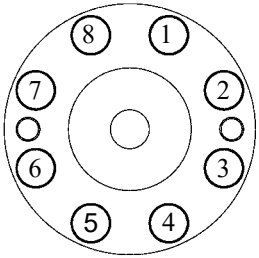
N Flange



SEQUENCE A

Use Sequence A for steps one and two.

Step 1 - Torque all bolts/nuts to 40 Ft-Lbs (54 N•m)
Step 2 - Torque all bolts/nuts to 80 Ft-Lbs (108 N•m)



SEQUENCE B

Use Sequence B for step three.

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

TPI-486-004

Torquing Sequence for Propeller Mounting Bolts/Nuts
Figure 3-2

4. Propeller 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.

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, WHICH MAY LEAD TO FAILURE DURING OPERATION.

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

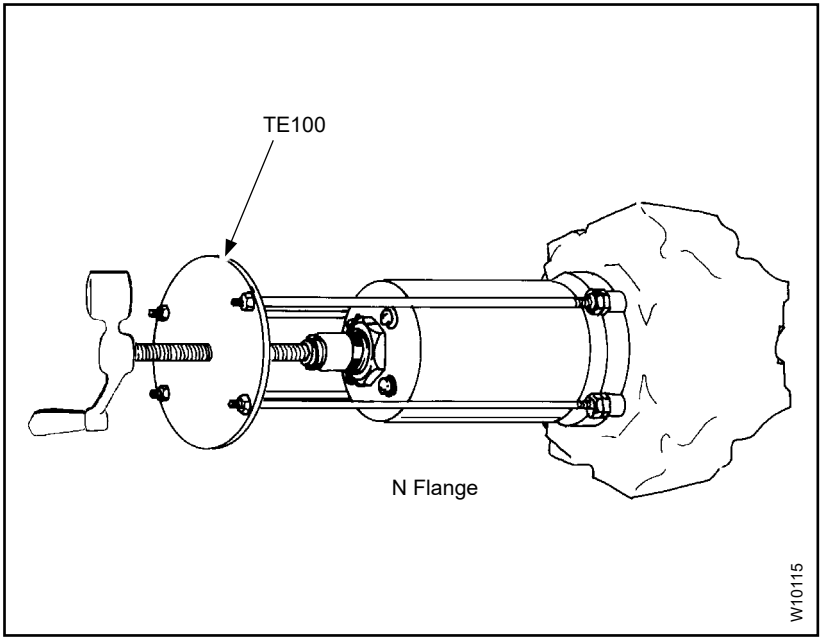
CAUTION: AVOID THE USE OF BLADE PADDLES. DO NOT PUT THE BLADE PADDLE IN THE AREA OF THE DE-ICE BOOT WHEN APPLYING TORQUE TO A BLADE ASSEMBLY. PUT THE BLADE PADDLE IN THE THICKEST AREA OF THE BLADE, JUST OUTSIDE OF THE DE-ICE BOOT. USE ONE BLADE PADDLE PER BLADE.

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

(2) Follow the craft manufacturer’s instructions for installing the propeller.

(a) If such instructions are not in the craft manufacturer’s manual, then follow the instructions in this manual; however, mechanics must consider that this owner’s manual does not describe important procedures that are outside the scope of this manual.

(b) In addition to propeller installation procedures, items such as rigging and pre-operational testing of idle blade angle, and propeller synchronization devices are normally found in the craft manufacturer’s manuals.



Compressing the External Beta System
Figure 3-3

B. Installation of HM-D4N-3YL Propellers

(1) Using a beta system puller TE100, compress the beta system and pull the beta ring forward to permit installation of the double hex head propeller mounting bolts. Refer to Figure 3-3.

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

CAUTION: A PROPELLER MUST BE CORRECTLY SUPPORTED DURING INSTALLATION ON THE ENGINE. AVOID ANY ROCKING OR SHIFTING OF THE PROPELLER WHEN IT IS PARTIALLY ENGAGED WITH THE ENGINE. ROCKING OF THE PROPELLER DURING PROPELLER INSTALLATION CAN DAMAGE THE PROPELLER HUB MOUNTING FACE, CAUSING ACTUATION OIL LEAKAGE OR DAMAGE THAT MAY SCRAP THE HUB. HUB DAMAGE CAN ALSO INTRODUCE METAL INTO THE PROPELLER OIL ACTUATION SYSTEM, WHICH COULD POSSIBLY DAMAGE THE ENGINE.

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

(a) Some propellers may require installation of an accessory drive pulley. If installation procedures are not in this manual, refer to the craft manufacturer's instructions.

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

(3) Using Quick Dry Stoddard Solvent or MEK, clean the engine flange and the propeller flange.

(4) Remove the pitch change rod cap, if applicable.

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

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

(7) Slide the propeller onto the engine flange.

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

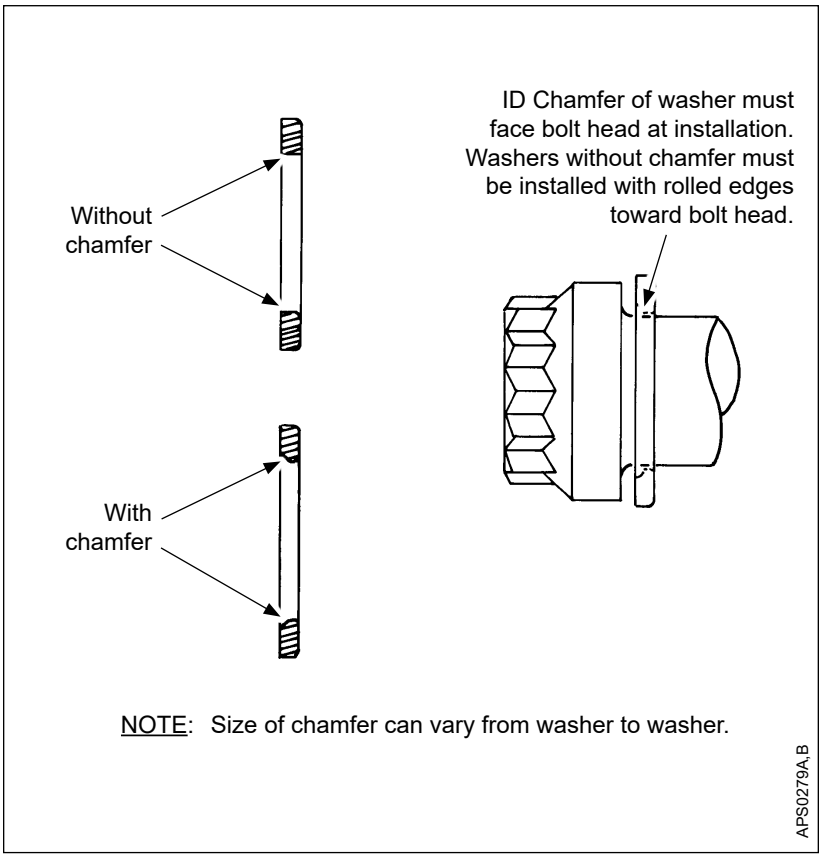
CAUTION 2: NEW PROPELLER MOUNTING BOLTS MUST BE USED WHEN INITIALLY INSTALLING A NEW OR OVERHAULED PROPELLER.

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

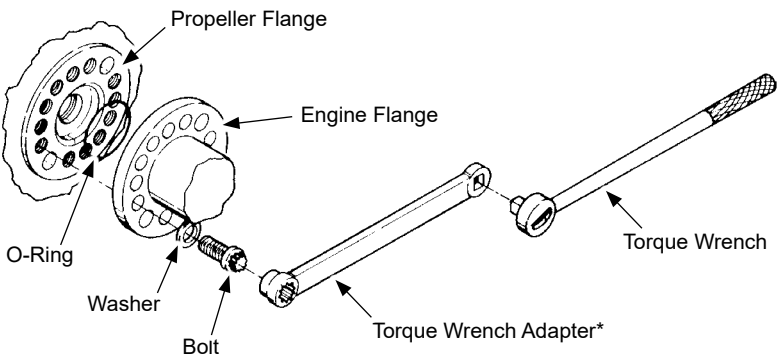
(a) If the propeller is removed between overhaul intervals, mounting bolts and washers may be reused if they are not damaged or corroded.

CAUTION: ID CHAMFER OF WASHER MUST BE FACING TOWARD THE BOLT HEAD. WASHERS WITHOUT CHAMFER MUST BE INSTALLED WITH ROLLED EDGES TOWARD THE BOLT HEAD. REFER TO FIGURE 3-4.

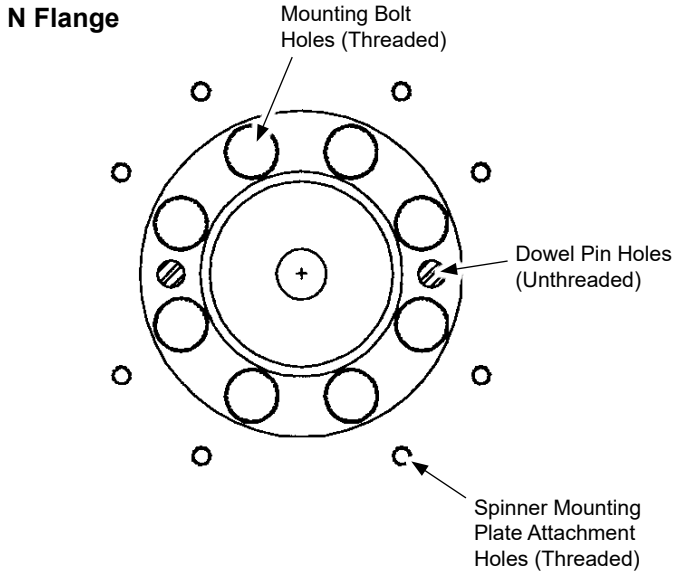
(9) Install the mounting bolts with washers through the engine flange and into the propeller hub flange. Refer to Figure 3-5.



Mounting Bolt and Washer
Figure 3-4



*NOTE: If a torque wrench adapter is used, use the calculation in Figure 3-1 to determine the correct torque wrench setting.



Installing Propeller on Engine Flange
Figure 3-5

(10) Using a torque wrench and torque wrench adapter TE5, torque all mounting bolts in sequences and steps shown in Figure 3-2. Refer to Table 3-2 and Figure 3-1 to determine the proper torque value.

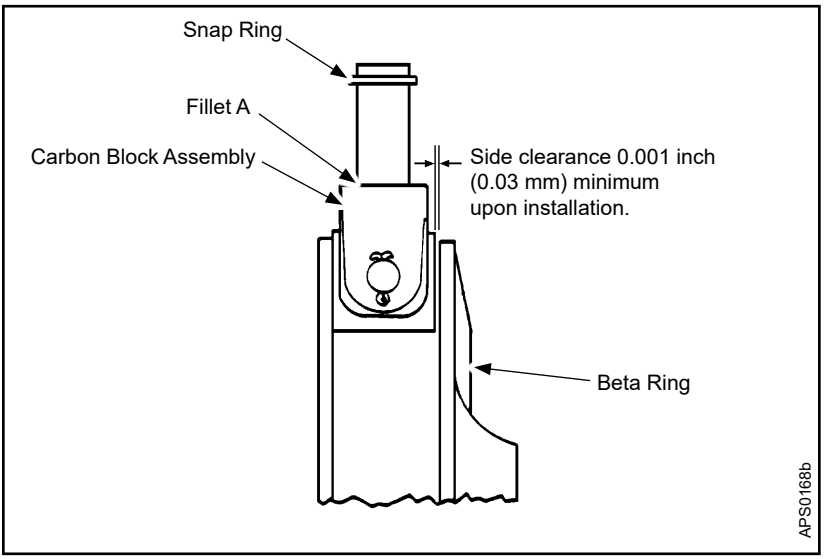
(11) Safety all mounting bolts with 0.032 inch (0.81 mm) minimum diameter stainless steel wire or equivalent aircraft safety cable and associated hardware. (Two bolts per safety.)

(12) Decompress the external beta system and remove the beta system puller.

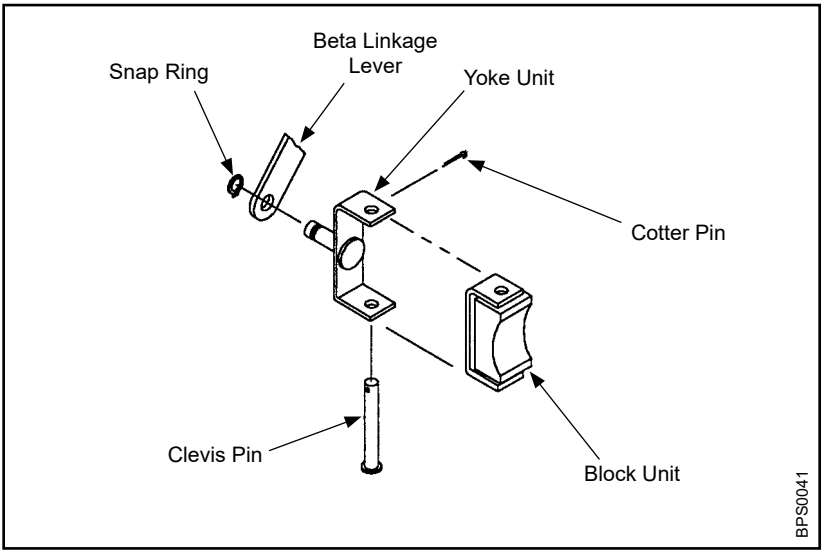
CAUTION: THE BETA FEEDBACK COLLAR MUST NOT CONTACT ANY ENGINE COMPONENT OR MOUNTING BOLT SAFETY WIRE. THE BETA FEEDBACK MECHANISM COULD BE DAMAGED IF IT CONTACTED ANY STATIC ENGINE COMPONENT WHILE ROTATING.

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

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



Carbon Block and Beta Ring Clearance
Figure 3-6



Carbon Block Assembly
Figure 3-7

(14)Install the carbon block into the beta linkage lever, in accordance with the craft manufacturer's instructions.

(a) If the beta linkage lever and the snap ring are not installed correctly, there may be interference between the beta linkage lever and Fillet A. Refer to Figure 3-6 and Figure 3-7.

1 If there is interference at Fillet A, make a chamfer in the beta linkage lever to clear Fillet A, as shown in Figure 3-6. The maximum radius in Fillet A as manufactured is 0.015 inch (0.38 mm).

CAUTION: FIT THE BLOCK IN THE BETA RING WITH A MINIMUM SIDE CLEARANCE OF 0.001 INCH (0.03 mm). REFER TO FIGURE 3-6.

(15)Install the carbon block assembly into the beta ring. Refer to Figure 3-6 and Figure 3-7.

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

(17)If the propeller is equipped with an accessory drive pulley, follow the applicable manufacturer's instructions for installation of the accessory drive pulley hardware.

(18)Install the propeller spinner dome in accordance with the section "Spinner Dome Installation" in this chapter.

C. Installation of HM-E4N-3KYL Propellers

(1) Using a beta ring puller TE100, compress the beta system and pull the beta ring forward to permit access to the propeller mounting flange. Refer to Figure 3-3.

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

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

CAUTION: IF THE PROPELLER IS REMOVED BETWEEN OVERHAUL INTERVALS, A TORQUE CHECK OF THE MOUNTING STUDS MUST BE PERFORMED.

(3) Using Quick Dry Stoddard Solvent or MEK, clean the engine flange and the propeller flange.

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

(5) Put the propeller onto the engine flange.

CAUTION 1: NEW PROPELLER MOUNTING NUTS MUST BE USED WHEN INITIALLY INSTALLING A NEW OR OVERHAULED PROPELLER.

CAUTION 2: THE SIDE OF THE WASHER WITH THE OD CHAMFER MUST BE AGAINST THE ENGINE FLANGE. REFER TO FIGURE 3-8.

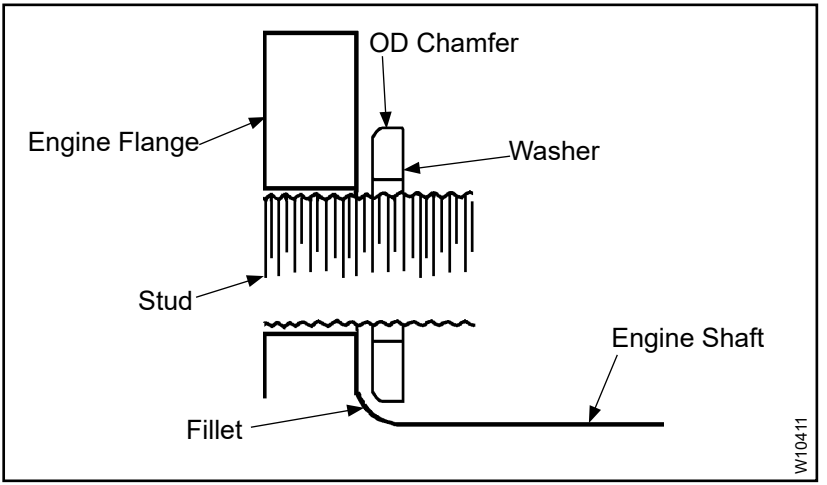
(6) Install self locking mounting nuts with washers onto the propeller mounting bolts with the OD chamfer on the washer against the engine flange in accordance with Figure 3-8.

(a) Refer to Table 3-1 for applicable mounting hardware.

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

(7) Using a torque wrench and torque wrench adapter TE5, torque all mounting bolts in sequences and steps shown in Figure 3-2.

(a) Refer to Table 3-2 and Figure 3-1 to find the correct torque value.



Installing the Washer on the Mounting Stud
Figure 3-8

(8) Safety all propeller mounting nuts with 0.032 inch (0.82 mm) minimum diameter stainless steel wire or equivalent aircraft safety cable. (Two nuts per safety.)

(9) Decompress the external beta system and remove the beta ring puller TE100.

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.

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

(a) If there is contact between the beta feedback collar and any engine components or mounting bolt safety wire, consult qualified personnel at an certified propeller repair station with the appropriate rating.

(11) Install the carbon block into the beta linkage lever, in accordance with the craft manufacturer’s instructions.

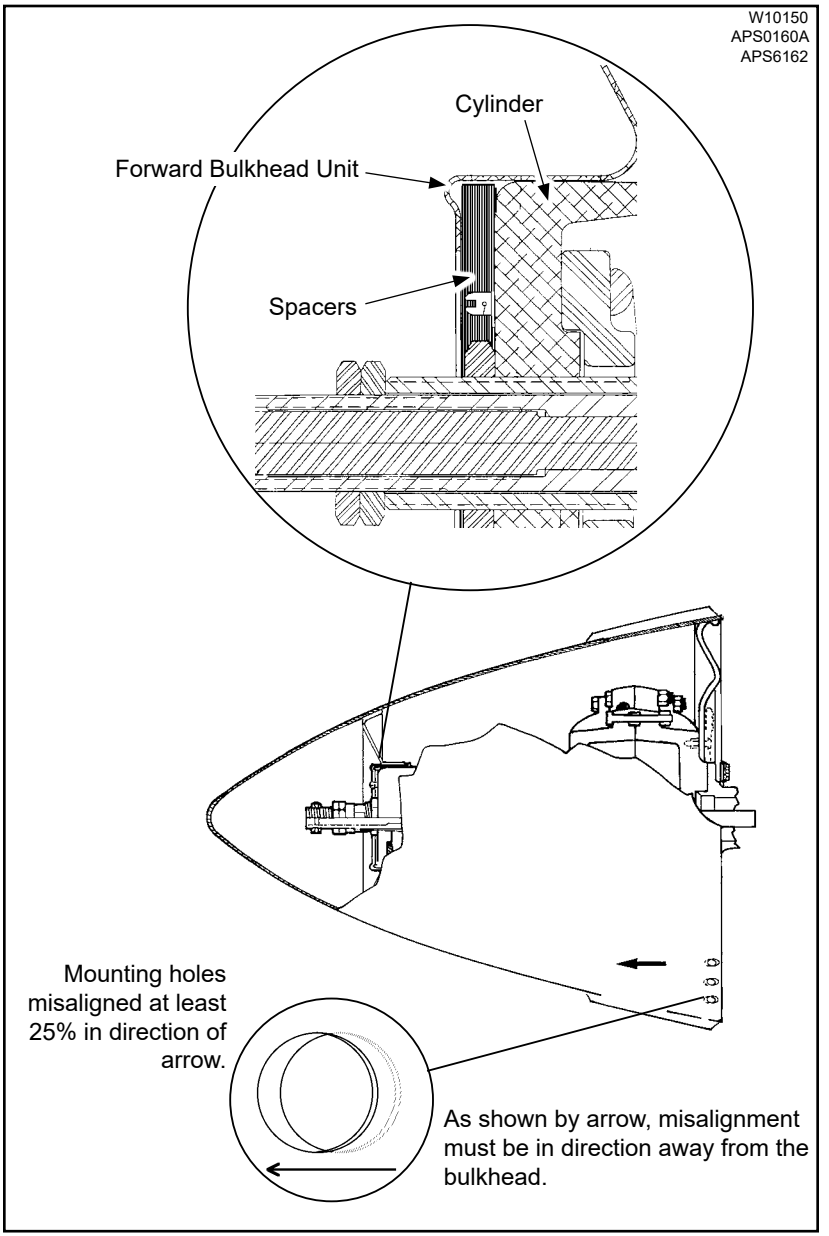
CAUTION: FIT THE BLOCK IN THE BETA RING WITH A SIDE CLEARANCE OF 0.001 TO 0.002 INCH (0.03 TO 0.05 mm). REFER TO FIGURE 3-6.

(12) Install the carbon block assembly into the beta ring. Refer to Figure 3-7.

(13) Install, adjust, and safety the beta linkage in accordance with the craft manufacturer’s instructions.

(14) If the propeller is equipped with an accessory drive pulley, follow the applicable manufacturer’s instructions for installation of the accessory drive pulley hardware.

(15) Install the propeller spinner dome in accordance with the section, “Spinner Dome Installation” in this chapter.



Spinner Dome Installation
Figure 3-9

5. Spinner Dome Installation

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

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

A. General

(1) The following instructions relate to Hartzell Propeller spinners only. In some cases, the craft manufacturer produced the spinner assembly. Refer to the craft manufacturer's manual for spinner installation instructions.

B. Propeller Models HM-(D,E)4N-3( ):
One-piece Spinner Dome and Forward Bulkhead

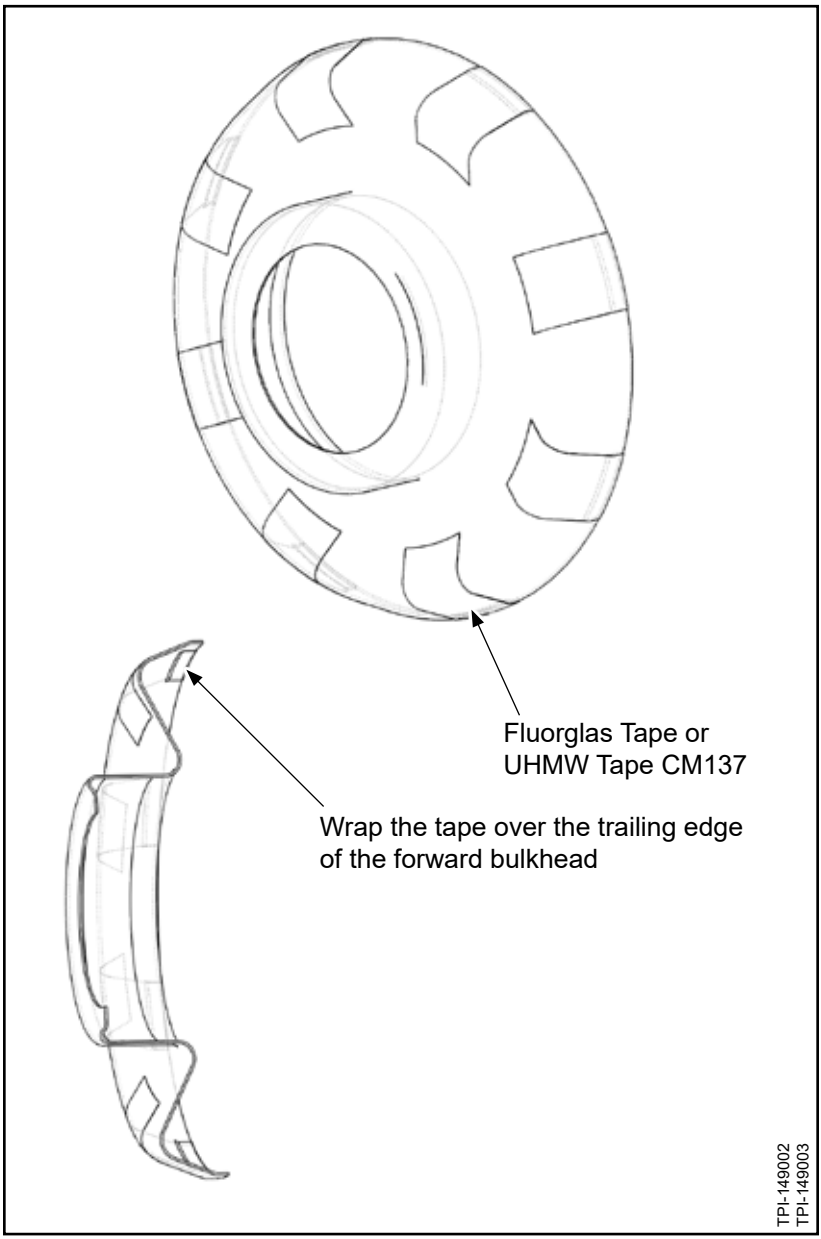
(1) The spinner dome is supported by a forward bulkhead unit that encircles the propeller cylinder. Refer to Figure 3-9.

(a) If the forward bulkhead unit does not fit snugly on the cylinder, the cylinder may need to be wrapped with one or more layers of fluoroglas or UHMW tape CM137.

1 Apply a layer of tape, check, and repeat until the forward bulkhead unit fits snugly on the cylinder.

(b) The forward bulkhead unit is positioned away from the cylinder with spacers to cause the spinner dome mounting holes to stop short of full alignment with the bulkhead holes by 25% of the spinner dome mounting hole diameter.

(c) Positioning of the spinner dome mounting holes and forward bulkhead unit is accomplished by installing or removing spacers that are between the cylinder and forward bulkhead.



Optional Tape on the Spinner Forward Bulkhead
Figure 3-10

(2) Optionally for a spinner dome that has a removable forward bulkhead, apply a layer of fluorglas tape or UHMW tape CM137 on the outboard flange of the forward bulkhead to prevent contact between the forward bulkhead and the spinner dome.

(a) Using acetone, denatured alcohol, or MEK, clean the area where the tape will be applied.

(b) Cut eight pieces of tape that are approximately 3 inches (76 mm) long.

(c) Apply the pieces of tape in equally spaced locations on the forward bulkhead as shown in Figure 3-10.

(d) Tape may be wrapped over the trailing edge of the forward bulkhead as necessary.

(3) Carefully slide the spinner dome over the propeller and forward bulkhead to check for proper positioning of the spinner dome mounting holes.

(a) Add or remove spacers to obtain the spinner dome mounting hole and spinner bulkhead hole misalignment. Refer to Figure 3-9.

(4) Push the spinner dome with firm pressure toward the spinner bulkhead unit to make sure that the spinner dome mounting holes will fully align with the spinner bulkhead holes. Remove a minimum quantity of spacers to obtain hole alignment while maintaining preload.

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

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

6. Post-Installation Checks

A. Procedures

(1) Refer to the craft manufacturer’s instructions for post-installation checks.

(2) Perform the Hydraulic Low Pitch Stop Setting in accordance with the Maintenance Practices chapter of this manual.

7. Spinner Dome Removal

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

A. Procedure

(1) Remove the screws and washers that secure the spinner dome to the spinner bulkhead.

(2) Remove the spinner dome.

8. Propeller Removal

A. Removal of HM-D4N-3YL Propellers

WARNING: FOR SAFETY REASONS, PUT THE PROPELLER IN THE FEATHER POSITION BEFORE IT IS REMOVED FROM THE CRAFT.

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.

(1) Remove the spinner dome in accordance with the section “Spinner Dome Removal” in this chapter.

(2) Some propellers may require removal of an accessory drive pulley. Refer to the craft manufacturer’s instructions.

(3) Disconnect the engine beta linkage and the carbon block assembly from the beta ring per the craft manufacturer’s instructions. Refer to Figure 3-7.

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

(5) Remove the carbon block assembly. Refer to Figure 3-6.

(6) Using the beta system puller TE100, compress the beta system and pull the beta ring forward to expose the propeller mounting bolts and washers. Refer to Figure 3-1.

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, WHICH MAY LEAD TO FAILURE DURING OPERATION.

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

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

(7) Support the propeller assembly with a sling.

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

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

(9) Remove the propeller mounting bolts and washers.

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

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

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

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

(12) Install suitable covers on the pitch change rod opening, propeller mounting flange, and engine flange to prevent the introduction of contamination.

(13) Decompress and remove the beta system puller.

(14) Put the propeller on a suitable cart for transportation.

B. Removal of HM-E4N-3KYL Propellers

WARNING: FOR SAFETY REASONS, PUT THE PROPELLER IN THE FEATHER POSITION BEFORE IT IS REMOVED FROM THE CRAFT.

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.

(1) Remove the spinner dome in accordance with the section, “Spinner Dome Removal” in this chapter.

(2) Some propellers may require removal of an accessory drive pulley. Refer to the craft manufacturer’s instructions.

(3) Disconnect the engine beta linkage and the carbon block assembly from the beta ring in accordance with the craft manufacturer’s instructions. Refer to Figure 3-6.

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

(5) Remove the carbon block assembly. Refer to Figure 3-7.

(6) Using the beta ring puller TE100, compress the beta system and pull the beta ring forward to expose the propeller mounting nuts and washers. Refer to Figure 3-3.

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

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

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

(7) Support the propeller assembly with a sling.

(8) Cut and remove the safety wire (if installed) on the propeller mounting nuts.

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

(9) Remove the propeller mounting nuts and washers.

(a) If the propeller is removed between overhaul intervals, mounting nuts and washers may be reused if they are not damaged or corroded.

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

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

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

(12) Install suitable covers on the pitch change rod opening, propeller mounting flange, and engine flange to prevent the introduction of contamination.

(13) Decompress and remove the beta ring puller TE100.

(14) Put the propeller on a suitable cart for transportation.

TESTING AND TROUBLESHOOTING - CONTENTS

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1. Operational Checks (Rev. 1)
   A. Operational Checks
      (1) Refer to the Inspection and Check chapter of this manual for operational checks including pre-flight, initial run-up, and post-run checks.

2. Troubleshooting

   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. Hunting and Surging (Rev. 2)
      (1) General
         (a) 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.
         (b) If the propeller is hunting, a certified airframe and powerplant mechanic with the appropriate rating or a certified propeller repair station with the appropriate rating should check:
            1 Governor
            2 Fuel control
            3 Synchrophaser, or synchronizer (if applicable)

(2) If the propeller is surging:

(a) Perform the “Initial Run-Up” in accordance with the Inspection and Check chapter of this manual to release trapped air from the propeller.

1 If surging reoccurs it is most likely due to a faulty governor.

a Have the governor tested by a certified propeller repair station with the appropriate rating.

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

1 To isolate these faults, the propeller must be tested on a test bench at a certified propeller repair station with the appropriate rating.

B. Engine Speed Varies with Airspeed

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

(2) Increase in engine speed while 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 the propeller.

(b) Engine oil transfer system leaking excessively.

(c) 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 locks 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 changing mechanism.
      (b) Broken feathering spring.
   (4) RPM control sluggish (especially on reducing RPM).
      (a) Broken feathering spring.

D. Failure to Feather (or feathers slowly) (Rev. 1)
   (1) Broken feathering spring.
   (2) Check for proper function and rigging of propeller/ governor control linkage.
   (3) Check governor drain function.
   (4) The propeller must be inspected for misadjustment or internal corrosion (usually in blade bearings or pitch changing mechanism) that results in excessive friction.
      (a) This inspection must be performed by a certified propeller repair station with the appropriate rating.

E. Failure to Unfeather (Rev. 1)
   (1) Check for proper function and rigging of propeller control linkage.
   (2) Check governor function.
   (3) The propeller must be inspected for misadjustment or internal corrosion (usually in blade bearings or pitch change mechanism) that results in excessive friction.
      (a) This inspection must be performed by a certified propeller repair station with the appropriate rating.

F. Start Locks (Anti-feather Latches) Fail to Latch on Shutdown

(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 restarting the engine, placing the propeller control in the proper shutdown position, and then shutting down the engine.

(3) Excessive governor pump leakage.

The problem should be referred to an authorized engine repair facility.

(4) Broken start lock.

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

G. Vibration (Rev. 1)

CAUTION 1: ANY VIBRATION THAT OCCURS SUDDENLY, OR IS ACCOMPANIED BY UNEXPLAINED OIL LEAKAGE, SHOULD BE INVESTIGATED IMMEDIATELY BEFORE FURTHER FLIGHT.

CAUTION 2: VIBRATION PROBLEMS BECAUSE OF 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 UNTIL THE PROPELLER CAN BE CHECKED BY A CERTIFIED PROPELLER REPAIR STATION WITH THE APPROPRIATE RATIING.

(1) Check:

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

(b) Isolation of engine controls and lines

(c) Engine mount wear

(d) Uneven or over-lubrication of propeller

(e) Proper engine/propeller flange mating

(f) Blade track:

1 Refer to the section, "Blade Track" in the Inspection and Check chapter of this manual.

(g) Blade angles:

1 Blade angles must be within specified tolerance between blades.

a Refer to a certified propeller repair station with the appropriate rating to check/adjust blade angles.

(h) Spinner for cracks, improper installation, or "wobble" during operation

(i) Static balance

(j) Hub damage or cracking

(k) Grease or oil leakage

(l) Blade deformation

(l) Blade deformation.

(2) Dynamic Balance

(a) Dynamic balancing is recommended after installing or performing maintenance on a propeller. While normally an optional task, it may be required by the engine or craft manufacturer to make certain the propeller/engine combination is balanced properly before operation.

1 Refer to the engine or craft manuals, and the Maintenance Practices chapter of this manual.

H. Propeller Overspeed
   (1) Check:
      (a) Low pitch stop adjustment.
      (b) Governor Maximum RPM set too high.
      (c) Broken feathering spring.
      (d) Governor pilot valve jammed, supplying high pressure only.
      (e) Tachometer error.

I. Propeller Underspeed
   (1) Check:
      (a) Governor oil pressure low.
      (b) Governor oil passage clogged.
      (c) Tachometer error.

INSPECTION AND CHECK - CONTENTS

INSPECTION AND CHECK - CONTENTS

FIGURES

1. Pre-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. Important Information

(1) Follow propeller pre-operation inspection procedures specified in the Pilot Operating Handbook (POH) in addition to the inspections specified in this section.

(2) Defects or damage found during the pre-operation inspection must be evaluated in accordance with the applicable section in the Testing and Troubleshooting chapter and/or the Maintenance Practices chapter of this manual.

B. Propeller Blades

(1) Visually examine the entire blade (leading edge, trailing edge, face, and camber sides) for nicks, gouges, erosion, and cracks.

(a) Normal paint erosion (sand-blasted appearance) on the leading edge of the blade is permitted and does not require removal before further operation.

(2) Visually inspect the blades for lightning strike indications in accordance with the section, “Lightning Strike” in this chapter.

(3) Check the blades for radial play or movement of the blade tip (in-and-out, fore-and-aft, and end play).

(a) Refer to the section, “Loose Blades” in this chapter for blade play limits.

C. Spinner Assembly and Blade Retention Components

(1) Inspect the spinner and the visible blade retention components for damage and/or cracks.

(a) Repair or replace components as required before further operation.

D. Hardware

(1) Check for loose or missing hardware.

(a) Retighten or reinstall as necessary.

WARNING: ABNORMAL GREASE/OIL LEAKAGE CAN BE AN INDICATION OF A FAILING PROPELLER BLADE OR BLADE RETENTION COMPONENT. BLADE SEPARATION DURING OPERATION CAN RESULT IN A CATASTROPHIC CRAFT ACCIDENT.

E. Grease/Oil Leakage

(1) Examine the face and camber-sides of the blades for evidence of grease/oil leakage.

(2) Using an appropriate light source, examine the propeller through the blade cut-outs in the spinner for signs of grease/oil leakage.

(a) Spinner removal is not required for this inspection.

(b) If grease/oil leakage is found, refer to the section, “Inspection Procedures” in this chapter.

F. Initial Run-Up

(1) Perform the Initial Run-Up procedure in accordance with the section, “Operational Checks” in this chapter.

G. Additional Information

(1) Refer to the craft manufacturer’s manual for additional pre-operation checks.

(2) Refer to the section, “Inspection Procedures” in this chapter for additional inspection/repair information.

2. Operational Checks (Rev. 3)

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. Initial Run-Up

(1) Following propeller installation and before operation, perform the Initial Run-Up procedure in accordance with the instructions in this section.

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

(2) Perform engine start and warm-up in accordance with the Pilot's Operating Handbook (POH).

CAUTION: AIR TRAPPED IN THE PROPELLER HYDRAULIC CYLINDER WILL CAUSE PITCH CONTROL TO BE IMPRECISE AND CAN CAUSE PROPELLER SURGING.

(3) Cycle the propeller control through the operating blade range from low pitch (or reverse), to high pitch (or as specified in the POH).

(a) Repeat this step at least three times.

NOTE: Cycling the propeller control purges air from the propeller hydraulic system and introduces warm oil to the cylinder.

(4) Check the propeller speed control and operation from low pitch (or reverse) to high pitch using the procedure specified in the POH.

(a) Perform all ground functional, feathering, and cycling checks with the minimum propeller RPM drop required to demonstrate the function.

WARNING: ABNORMAL VIBRATION CAN BE AN INDICATION OF A FAILING PROPELLER BLADE OR BLADE RETENTION COMPONENT. A BLADE SEPARATION DURING OPERATION CAN RESULT IN DEATH, SERIOUS BODILY INJURY, AND/OR SUBSTANTIAL PROPERTY DAMAGE.

(5) Check for any abnormal vibration during this run-up.

(a) If vibration occurs, shut the engine down, determine the cause, and correct it before further operation.

1 Refer to the section, “Vibration” in the Testing and Troubleshooting chapter of this manual to determine the cause/correction for the vibration.

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

(7) For additional inspection information (including possible corrections), refer to the section, “Inspection Procedures” in this chapter, and/or the Testing and Troubleshooting chapter of this manual.

(8) Refer to the POH and the craft manufacturer’s manual for additional operational checks.

B. Propeller Ground Idle RPM Check

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 PILOT OPERATING HANDBOOK (POH).

(1) General

(a) Propellers with four or more blades operating on turbine engines can be sensitive to operation within restricted RPM ranges. These restricted ranges are usually in the lower RPM ranges, requiring that ground idle RPM be set above a critical minimum value.

(b) This minimum propeller idle RPM operating restriction is the result of a specific vibratory resonant condition known as “reactionless mode”. During operation in these conditions the craft crew cannot feel the resulting high propeller vibration. Ground operation at or near an RPM that can create a reactionless mode vibratory resonance can cause very high stresses in the propeller blades and the hub. These high stresses are more severe when operating in a quartering tail wind condition.

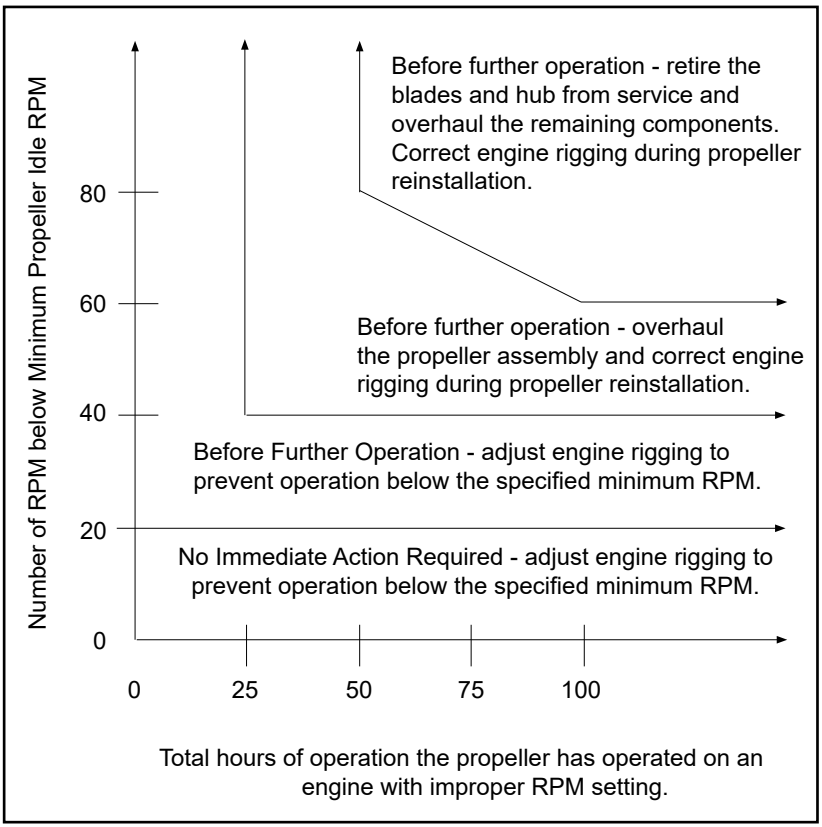
(c) If the propeller is operated within a restricted RPM range or below a minimum idle RPM restriction for an extended period of time, the propeller blades and hub can become inoperable because of fatigue. A failed blade or hub has the potential to cause a catastrophic blade separation.

(d) Use the “Periodic Ground Idle RPM Check” steps in this section to determine if the propeller is operating within the specified RPM limits.

(e) Refer to the “Corrective Action” steps in this section for maintenance information about propellers operating outside of the specified RPM range.

(2) Periodic Ground Idle RPM Check

NOTE: The accuracy of the tachometer is critical to the safe operation of the aircraft. Refer to the section, “Tachometer Calibration” in the Maintenance Practices chapter of this manual for important information.



Corrective Action Required
Figure 5-1

(a) Perform the RPM check in accordance with the craft manufacturer's manuals.

1 Refer to the craft manufacturer's manuals to determine if there are any propeller RPM restrictions or limitations.

(b) Perform an engine run up and determine if the engine and/or propeller rigging permits operation of the propeller below the minimum specified propeller idle RPM.

(c) If the propeller cannot be operated below the minimum specified propeller idle RPM, no further action is required.

(d) If the propeller can be operated below the minimum specified propeller idle RPM:

1 Refer to Figure 5-1 for corrective action requirements, and Figure 5-2 for an example of a ground idle RPM check evaluation.

Example:

Minimum propeller idle RPM listed in the AMM is 1180 RPM

Propeller idle is set at 1120 RPM

Propeller has operated with a RPM deviation of **60 RPM**

Engine was rigged 2 months ago and has operated **75 hours** since it was rigged

Figure 5-1 shows that with an RPM deviation of 60 RPM for 75 hours - the propeller assembly must be overhauled and engine rigging corrected before further operation.

Example of a Ground Idle RPM Check Evaluation
Figure 5-2

2 The corrective action is based on the amount the RPM is below the minimum propeller idle RPM and the total hours of operation the propeller has accumulated.

a Figure 5-1 applies to a craft that is operated in conventional service. “Hours of Operation” refers to the total number of hours the propeller is operated on an engine that has an improper RPM setting. It is not the number of hours the propeller is operated in a restricted range, which will be less than the total hours of operation.

(3) Corrective Action

(a) The required corrective action is determined by both the amount and duration of RPM deviation.

1 A turboprop propeller with four or more blades may have a variety of operating restrictions and these different restrictions may have different operating margins.

2 The greater the amount of the RPM deviation and the longer it is permitted to exist, the more severe the required corrective action.

3 The corrective action may vary from no action required, to retirement of the blades and the hub.

4 The chart in Figure 5-1 specifies the required corrective action for operation below the minimum idle RPM.

a The chart in Figure 5-1 does not apply to other propeller restrictions that are above the minimum idle RPM.

5 If the corrective action requires a propeller overhaul, overhaul the propeller in accordance with the applicable propeller overhaul manuals.

6 If the corrective action requires that the blades and the hub be retired from service, retire these components in accordance with the Part Retirement Procedures chapter of Hartzell Propeller Standard Practices Manual 202A (61-01-02) before further operation.

a A propeller hub or blade that has been retired from service because of a violation of the operating restrictions as specified in this section must not be reused on another craft application.

7 If the corrective action requires the correction of the propeller RPM setting, refer to the applicable installation and rigging instructions for the adjustment of engine torque, engine idle speed, and propeller RPM setting.

(b) Contact Hartzell Propeller Product Support Department to report the findings, or if a propeller restriction other than those described in Figure 5-1 has been violated.

1 Refer to the section, “Hartzell Propeller Contact Information” in the Introduction chapter of this manual.

C. Post-Run Check

(1) After engine shutdown, check propeller for signs of grease/oil leakage.

3. Required Periodic Inspections and Maintenance (Rev. 1)

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

(1) Perform the following inspection procedures at 400 hour intervals, not to exceed 12 calendar months. Procedures involved in these inspections are detailed below.

(a) Inspection and maintenance specified by a craft manufacturer's maintenance program and approved by the applicable certification agency may not coincide with the inspection time intervals specified.

1 In this situation, the craft manufacturer's schedule may be applied as long as the calendar limit for the inspection interval does not exceed 12 months.

(b) For additional inspection information (including possible corrections), refer to the section, "Inspection Procedures" in this chapter, and/or the Testing and Troubleshooting chapter of this manual.

(2) Remove the spinner dome.

(3) Visually examine the propeller blades (lead edge, trail edge, face, and camber sides) for nicks, gouges, erosion, cracks, etc.

(a) Refer to the section, "Aluminum Blades" in the Maintenance Practices chapter of this manual for damage evaluation and repair information.

(4) For propellers used in a “pusher” configuration:

CAUTION: ESTABLISH MORE FREQUENT INTERVALS FOR INSPECTION IF SERVICE EXPERIENCE INDICATES THAT SEVERE CORROSION IS FOUND DURING INSPECTIONS.

(a) Perform blade corrosion/paint inspections at intervals not to exceed 150 hours of operation,12 calendar months, or at annual inspection, whichever occurs first.

1 For scheduling purposes, the inspection interval has a maximum 10% additional non-cumulative operation hour tolerance.

2 For example, the initial 150 hour inspection is over-operated to 160 hours, and then inspected at this time. The next inspection must be accomplished 140 operation hours from previous inspection.

(b) Using Stoddard-type solvent, thoroughly clean each blade shank in areas exposed to engine exhaust and remove all foreign matter/exhaust residue.

(c) Visually examine the condition of the paint and any corrosion indications.

(d) Paint must be in good condition in the area exposed to exhaust gasses. Repair and repainting is required if:

1 Any of the underlying aluminum blade is exposed.

2 There are any indications of corrosion, such as pitting or pinpoint “blisters”.

(e) All corrosion indications require repair and subsequent repainting.

1 Refer to FAA Advisory Circular AC 43-4A (or subsequent revision) for additional information concerning corrosion. This circular provides definitions, repair procedures, safety precautions, etc.

(f) If repair and repainting are required, perform the procedures in accordance with the Maintenance Practices chapter in this manual.

(g) If there is severe corrosion, refer the propeller to an appropriately licensed service facility.

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

(6) Check for oil and grease leaks. Refer to the Inspection Procedures section in this chapter.

(7) If a blade track problem is suspected, check the blade track. Refer to the Inspection Procedures section in this chapter.

(8) Check preload plate set screw. Refer to the Preload Plate Set Screw information in the Inspection Procedures section of this chapter.

(9) Make an entry in the log book verifying the inspections.

B. Periodic Maintenance

(1) Lubricate the propeller assembly.

(a) Refer to the section, “Lubrication” in the Maintenance Practices chapter of this manual for intervals and procedures.

C. Operational Limitations

(1) Certain components, as well as the entire propeller may have specific life limits established as part of the certification. 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 may exist for the propeller models included in this manual. Refer to the Operational Limitations chapter of this manual.

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

D. Overhaul Periods

(1) During operation, the propeller is constantly subjected to vibration from the engine and the airstream, as well as high centrifugal forces.

(2) The propeller is also subject to corrosion, wear, and general deterioration due to aging. Under these conditions, metal fatigue or mechanical failures can occur.

(3) To protect your safety, 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.

(a) For propeller overhaul periods, refer to Hartzell Propeller (non-aviation) Service Letter HM-SL-001.

4. Post-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.

A. General

(1) Propellers used in a “pusher” configuration are affected by these post-operational check requirements.

(a) Propeller blades used in a “pusher” configuration are exposed to hot exhaust gasses which make them more susceptible to erosion and corrosion. Additional inspections and corrosion preventative measures are required to prevent corrosion pitting in highly stressed areas of propeller blade shanks.

B. Requirements

(1) Perform blade cleaning within three days after any operation.

NOTE: It is recommended to perform blade cleaning after the last operation of each day. This is a recommendation and is not mandatory.

(a) Blade Cleaning

1 Using cloth dampened with Stoddard solvent or jet fuel, wipe each propeller blade to remove engine exhaust residue.

2 If there is visual evidence of corrosion or bare metal exposed as a result of paint erosion, repair at the next scheduled inspection is recommended.

5. Inspection Procedures

A. Blade Damage (Rev. 1)

(1) Refer to the section, “Aluminum Blades” in the Maintenance Practices chapter of this manual for damage evaluation and repair information.

B. Grease/Oil Leakage (Rev. 1)

WARNING: UNUSUAL OR ABNORMAL GREASE LEAKAGE OR VIBRATION, WHERE THE CONDITION STARTED SUDDENLY, CAN BE AN INDICATION OF A FAILING PROPELLER BLADE OR BLADE RETENTION COMPONENT. A BLADE SEPARATION DURING OPERATION CAN RESULT IN DEATH, SERIOUS BODILY INJURY, AND/OR SUBSTANTIAL PROPERTY DAMAGE. UNUSUAL OR ABNORMAL GREASE LEAKAGE OR VIBRATION DEMANDS IMMEDIATE INSPECTION.

(1) Important Information

(a) 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. Leakage should cease within the first ten hours of operation.

(b) 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.

1 A determination should be made as to the source of the leak. If the source of the leak is the O-ring seal between the engine and the propeller flange or a lubrication fitting, field repair is permitted.

2 All other leakage repairs should be referred to a certified propeller repair station with the appropriate rating.

3 If abnormal leakage is detected, inspect the propeller assembly using the Inspection Procedure steps in this section.

(c) Grease Leakage - probable causes:

1 Loose/defective lubrication fitting

2 Faulty seal at the blade socket between the blade and the hub

a Refer to a certified propeller repair station with the appropriate rating for seal replacement.

3 Leakage from the hub and beta rod interface (if applicable)

a Over-greased hub

(1) Refer to a certified propeller repair station with the appropriate rating for grease removal.

b Faulty seal

(1) Refer to a certified propeller repair station with the appropriate rating for seal replacement.

4 Cracked hub

(d) Oil Leakage - probable causes:

1 Leaks between the hub and cylinder

a Faulty or missing seal between the hub and the cylinder

(1) Refer to a certified propeller repair station with the appropriate rating for seal replacement.

2 Leaks between the hub halves, beta rods and hub

a Faulty seal(s) between the hub and the pitch change rod

(1) Refer to a certified propeller repair station with the appropriate rating for seal replacement.

3 Leaks from the front of the cylinder or through the start lock units

a Faulty seal(s) between the piston and cylinder, or piston and pitch change rod

(1) Refer to a certified propeller repair station with the appropriate rating for seal replacement.

4 Leaks between the hub and the engine

a Faulty or missing seal between the propeller hub and the engine flange

(2) Inspection Procedure

(a) 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.

(b) Perform a visual inspection of the hub, blades, and blade retention areas to locate the source of the grease leak.

1 If the source of the grease leak is a lubrication fitting, blade O-ring, or the hub parting line, repairs can be accomplished during scheduled maintenance as long as operational safety is not compromised.

a To repair a grease leak from a lubrication fitting, blade O-ring, or hub parting line, the propeller must be disassembled and inspected at a certified propeller repair station with the appropriate rating.

2 If the source of the grease leak is a component or location other than a lubrication fitting, blade O-ring, or the hub parting line, the propeller must be disassembled and inspected at a certified propeller repair station with the appropriate rating before further operation.

(c) Perform a visual inspection for cracks in the hub.

1 Extra attention should be given to the blade retention area of the hub.

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

(d) If cracks are suspected, additional inspections to verify the condition must be performed before further operation.

1 Inspections typically include disassembly of the propeller followed by inspection of parts, using nondestructive methods in accordance with published procedures.

a These inspections must be performed by a certified propeller repair station with the appropriate rating.

(e) If cracks or failing components are found, these parts must be replaced before further operation.

1 Report such occurrences to the applicable authorities and to Hartzell Propeller Product Support.

C. Vibration (Rev. 1)

NOTE: Vibration may originate in the engine, propeller, or airframe. Troubleshooting procedures typically begin with an investigation of the engine. Craft components, such as engine mounts or loose landing gear doors, can also be the source of vibration. When investigating an abnormal vibration, the blades and the blade retention components should be considered as potential sources of the vibration.

(1) Important Information

(a) Instances of abnormal vibration should be investigated immediately. If the cause of the vibration is not readily apparent, examine the propeller in accordance with the instructions in this section.

(b) Perform troubleshooting and evaluation of possible sources of vibration in accordance with engine or craft manufacturer’s instructions.

(c) Refer to the section, “Vibration” in the Testing and Troubleshooting chapter of this manual.

1 Perform the checks to determine possible cause of the vibration.

a If no cause is found, the propeller could be the source of the vibration. Examine the propeller in accordance with the Inspection steps in this section.

(2) Inspection

(a) Remove the spinner dome.

(b) Visually examine the hub, blades, and blade clamps (if applicable) for cracks.

1 Pay particular attention to the blade retention areas of an aluminum hub, or the blade clamps on steel hub propellers.

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

(c) If cracks are suspected, additional inspections must be performed to evaluate the condition before further operation.

1 These inspections typically include disassembly of the propeller, followed by inspection of parts, using nondestructive methods in accordance with published procedures.

2 These inspections must be performed by a certified propeller repair station with the appropriate rating.

(d) Inspect the movement of the propeller blades in accordance with the section, “Loose Blades” in this chapter.

(e) Inspect blade track in accordance with the section, “Blade Track” in this chapter.

CAUTION: DO NOT USE BLADE PADDLES TO TURN BLADES.

1 Manually (by hand) attempt to turn the blades (change pitch).

2 Visually check for damaged blades.

(f) If abnormal blade conditions or damage are found, additional inspections must be performed to evaluate the condition before further operation.

1 These inspections must be performed at a certified propeller repair station with the appropriate rating.

(g) If cracks or failing components are found, these parts must be replaced before further operation.

1 Report such occurrences to the applicable authorities and Hartzell Propeller Product Support.

D. Blade Track

(1) If a blade track problem is suspected, examine the blade track as follows:

(2) Move the propeller to low pitch.

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

(b) Remove the spinner dome and set it aside.

(c) Remove forward bulkhead and spacers from the forward end of the cylinder.

(d) If applicable, remove the bolt, nut, and washer from the pitch change rod.

NOTE: Removal of the plug and O-ring is not required unless an early style propeller unfeathering tool that threads internally is used.

CAUTION 1: DO NOT ATTEMPT TO INSTALL AND USE THE PROPELLER UNFEATHERING TOOL WITHOUT REMOVING THE PITCH CHANGE ROD SAFETY BOLT. BOLT REMOVAL IS NECESSARY TO MAKE SURE OF ADEQUATE THREAD ENGAGEMENT OF THE TOOL.

CAUTION 2: DO NOT ATTEMPT TO MOVE THE PROPELLER BLADES BEYOND THE LOW PITCH MECHANICAL STOPS, IF APPLICABLE.

(e) Install propeller unfeathering tool part number 9943HART-001 or equivalent.

1 Screw the threaded rod of the tool onto the end of the pitch change rod as far as possible. Hand tighten.

2 Slide the cylindrical portion of the tool over the threaded rod and against the propeller cylinder.

3 Apply a small amount of lubricant or anti-seize compound to the threads of the 1-1/2 inch nut of the unfeathering tool.

4 Install the 1-1/2 inch nut onto the threaded rod of the unfeathering tool.

5 Turn the 1-1/2 inch nut down until it contacts the thrust bearing.

6 Continue turning the nut until the blades move to low pitch.

(3) Check blade track as follows:

WARNING: SAFELY SECURE THE CRAFT AND MAKE SURE OF THE SAFETY OF ANYONE NEAR THE CRAFT BEFORE PERFORMING A CHECK FOR BLADE TRACK.

(a) Secure the craft or tie the craft down to prevent movement.

(b) Refer to Figure 5-3. Place a fixed reference point beneath the propeller, within 0.250 inch (6.35 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 0.250 inch (6.35 mm) of the propeller arc.

(c) Rotate the propeller by hand in the direction of normal rotation until a blade points directly at the paper.

(d) Mark the position of the blade tip in relation to the paper.

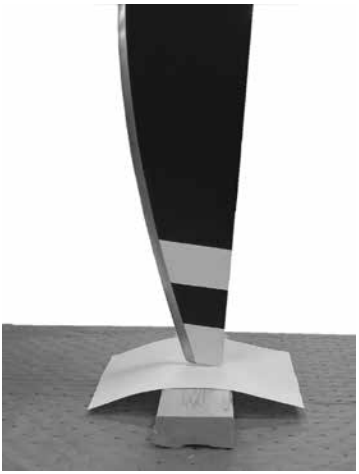
(e) Repeat this procedure with the remaining blades.

(f) Tracking tolerance is ± 0.125 inch (± 3.18 mm) or 0.250 inch (6.35 mm) total.

(4) Possible Correction

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

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



Checking Blade Track
Figure 5-3

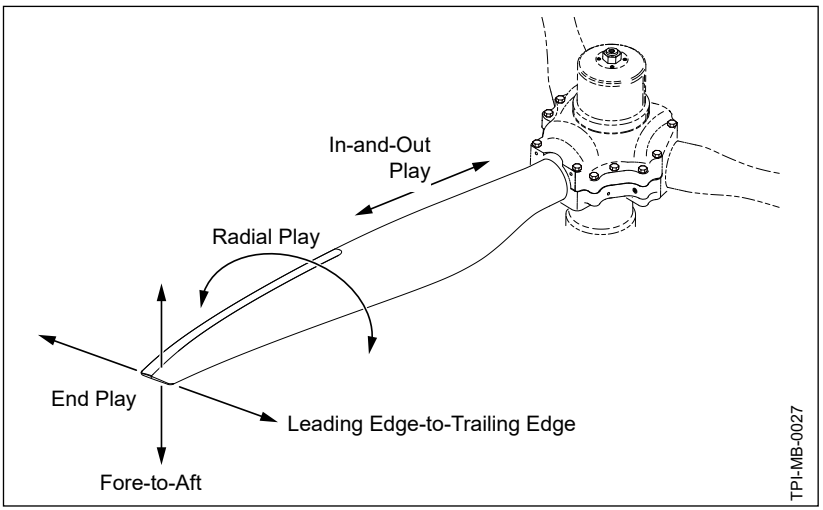
E. Blade Tolerances

(1) Limits for blade play are specified below. Refer to Figure 5-4.

(a)	End Play: Leading Edge-to-Trailing Edge	±0.0625 inch (1.58 mm) Total: 0.125 inch (3.17 mm)
	Fore-to-Aft (face to camber)	±0.0625 inch (1.58 mm) Total: 0.125 inch (3.17 mm)
(b)	In-and-Out Play	none permitted
(c)	Radial Play (pitch change)	±0.5 degree (1 degree total) measured at reference station

(2) Blades should be tight in the propeller; however, play that is within the allowable limits is acceptable if the blade returns to its original position when released.

(a) If blade play is greater than the allowable limits, or if the blade(s) do not return to their original position when released, there may be internal wear or damage that should be referred to a certified propeller repair station with the appropriate rating.



Blade Play
Figure 5-4

F. Corrosion (Rev. 1)

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

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

G. Spinner Damage (Rev. 2)

(1) Inspect the spinner for cracks, missing hardware, or other damage.

(a) Metal Spinners

1 For damage evaluation and repair information, refer to Hartzell Propeller Metal Spinner Maintenance Manual 127 (61-16-27) or a certified propeller repair station with the appropriate rating.

2 Contact the applicable authority for repair approval.

(b) Composite Spinners

1 For damage evaluation and repair information, refer to Hartzell Propeller Composite Spinner Maintenance Manual 148 (61-16-48) or a certified propeller repair station with the appropriate rating.

2 Contact the local airworthiness authority for repair approval.

6. Special Inspections (Rev. 1)

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.

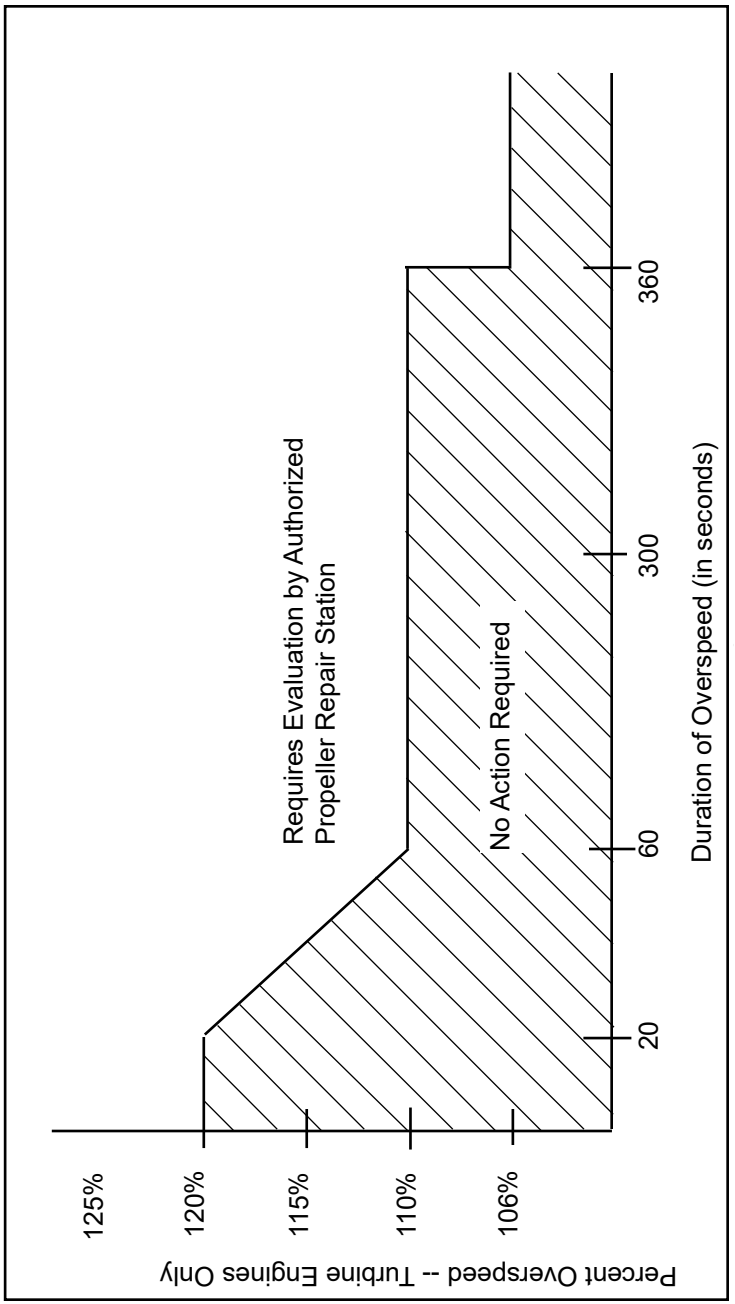
A. Overspeed/Overtorque

(1) An overspeed has occurred when the propeller RPM has exceeded the maximum RPM stated in the applicable Propeller Installation Data Sheet (IDS). 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 make sure no damage to the propeller has occurred.

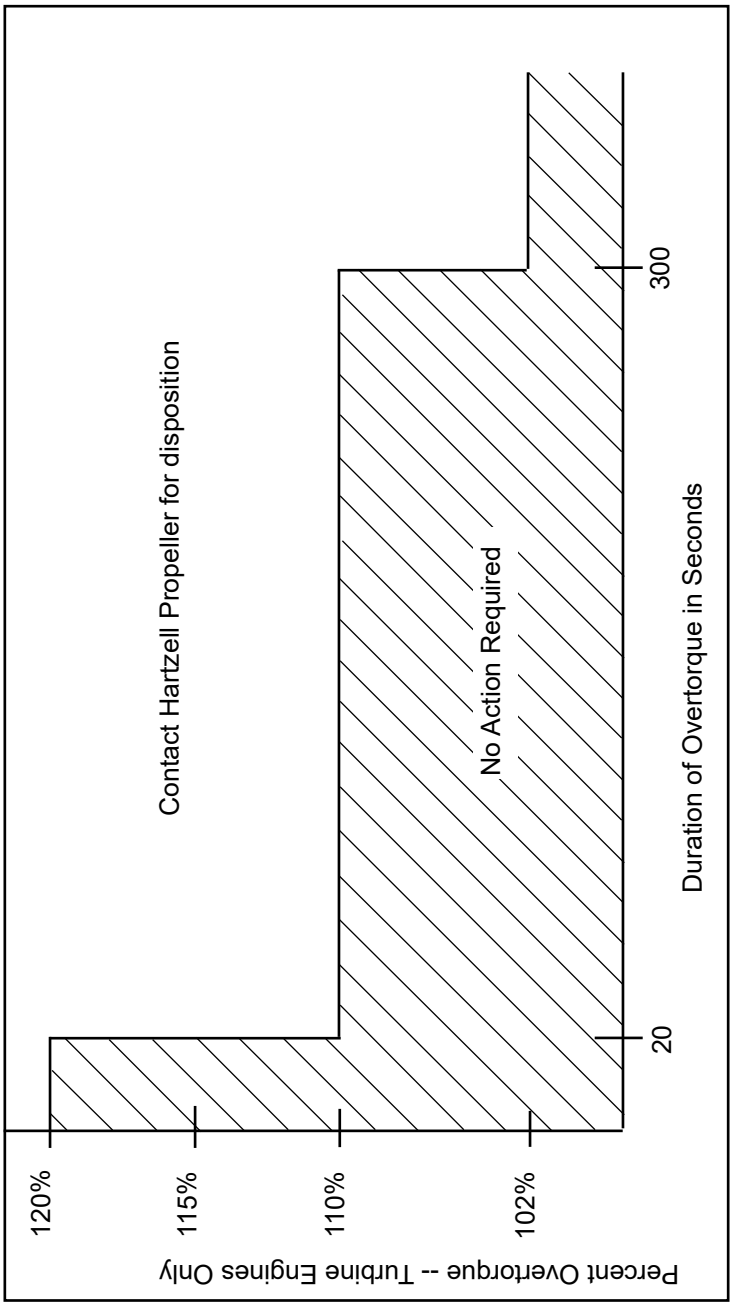
(2) The criteria for determining the required action after an overspeed are based on many factors. The additional centrifugal forces that occur during overspeed are not the only concern. Some applications have sharp increases in vibratory stresses at RPMs above the maximum rated for the craft/engine/propeller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

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

(b) When a propeller installed on a turbine engine has an overtorque event, refer to the Turbine Engine Overtorque Limits (Figure 5-6) to determine the corrective action to be taken.



Turbine Engine Overspeed Limits
Figure 5-5



Turbine Engine Overtorque Limits
Figure 5-6

(c) Make a record of the overspeed/overtorque event in the propeller logbook, indicating any corrective action(s) taken.

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 Product Support to confirm actual overtorque percentage.

B. Lightning Strike (Rev. 1)

CAUTION: REFER TO THE ENGINE AND CRAFT MANUFACTURER'S MANUALS FOR ADDITIONAL INSPECTIONS TO PERFORM AFTER A PROPELLER LIGHTNING STRIKE.

(1) General

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

(b) If the propeller meets the requirements of the "Temporary Operation Inspection" in this section, 10 hours of operation is permitted before propeller disassembly/inspection must be performed.

(2) Temporary Operation Inspection

(a) Remove the spinner dome and perform a visual inspection of the propeller, blades, spinner, and ice protection system for evidence of damage that would require repair before operation (such as broken wires or arcing damage to propeller hub).

CAUTION: IF THE PROPELLER EXPERIENCES A LIGHTNING STRIKE, REFER TO THE "ALUMINUM BLADES" SECTION IN THE MAINTENANCE PRACTICES CHAPTER OF THIS MANUAL TO EVALUATE THE DAMAGE BEFORE FURTHER OPERATION.

1 If the only evident damage is minor arcing burns to the blades, temporary operation for up to 10 flight hours is permitted before propeller disassembly and inspection.

2 If there is evidence of additional damage, beyond minor arcing burns to the blades, temporary operation is not permitted. The propeller must be removed from the aircraft, disassembled, evaluated, and/or repaired by a certified propeller repair station with the appropriate rating before further operation.

(b) Make a record of the lightning strike in the propeller logbook, indicating any corrective action(s) taken.

(3) For operation beyond the 10-hour temporary operation limit:

(a) The propeller must be removed from the craft, disassembled, evaluated, and/or repaired by a certified propeller repair station with the appropriate rating.

C. Foreign Object Strike/Ground Strike (Rev. 1)

(1) General

(a) A foreign object/ground strike can include a broad spectrum of damage, from a minor stone nick to severe ground/water impact damage.

1 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/ground 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.

a Examples of foreign object/ground strike include situations where an craft 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(s).

b These cases should be handled as foreign object/ground 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.

(c) In the event of a foreign object/ground strike, an inspection is required before further operation.

(2) Inspection Procedure

(a) Examine the propeller assembly for damage related to the foreign object/ground strike.

(b) If any of the following indications are found, the propeller must be removed from the craft, disassembled, and overhauled by a certified propeller repair station with the appropriate rating.

1 Blade(s) damaged, bent, or out of track/angle

2 Blade(s) loose in the hub (if applicable)

a Refer to the section, “Loose Blades” in this chapter for the permitted limits of blade movement.

3 Any noticeable or **suspected** damage to the pitch change mechanism

4 Any blade diameter reduction

5 Bent, cracked, or failed engine shaft

6 Vibration during operation (that was not present before the event)

(c) Aluminum Blades: Nicks, gouges, and scratches on blade surfaces or the leading and trailing edges must be removed before operation.

1 Refer to the section, “Aluminum Blades” in the Maintenance Practices chapter of this manual for damage evaluation and repair information.

(d) 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.

1 These components must be inspected and repaired in accordance with the applicable component maintenance manual.

(e) Make a record of the foreign object/ground strike event in the propeller logbook, indicating any corrective action(s) taken.

D. Fire/Heat Damage (Rev. 1)

WARNING: HIGH TEMPERATURES CAN CAUSE SERIOUS DAMAGE TO PROPELLER HUBS, CLAMPS, AND BLADES (ALUMINUM AND COMPOSITE). THIS DAMAGE CAN RESULT IN CATASTROPHIC FAILURE CAUSING DEATH, SERIOUS BODILY INJURY, AND/OR SUBSTANTIAL PROPERTY DAMAGE.

(1) A propeller that has been exposed to fire or high temperatures, such as an engine or hangar fire, must be inspected by a certified propeller repair station with the appropriate rating before further operation.

E. Sudden Stoppage (Rev. 1)

(1) When there is a propeller sudden stoppage because of catastrophic engine failure or seizure, the propeller and any engine driven/powered accessory must be inspected and repaired in accordance with the applicable component maintenance manual.

(2) If the sudden stoppage was caused by a foreign object/ground strike, refer to the section, “Foreign Object/Ground Strike” in this chapter.

F. Engine Oil Contamination (Rev. 1)

(1) Following an incident of oil contamination, the components of the propeller that were exposed to oil contamination must be removed, cleaned, and inspected.

(a) A propeller that was exposed to oil contamination must be removed and sent to a certified propeller repair station with the appropriate rating for disassembly, cleaning, and inspection.

(b) A governor that was exposed to oil contamination must be inspected and repaired in accordance with the applicable component maintenance manual.

7. Long Term Storage

A. Important Information

(1) Parts shipped from the Hartzell Propeller are not shipped or packaged in a container which is designed for long term storage.

(2) Long term storage procedures are detailed in Hartzell Propeller Standard Practices Manual 202A (61-01-02).

(3) Information regarding the return of a propeller assembly to service after long term storage is detailed in Hartzell Propeller Manual 202A (61-01-02).

MAINTENANCE PRACTICES - CONTENTS

MAINTENANCE PRACTICES - CONTENTS

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1. Cleaning (Rev. 2)

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: BEFORE CLEANING THE PROPELLER, BE SURE THE PROPELLER HAS BEEN INSPECTED IN ACCORDANCE WITH THE REQUIRED PERIODIC INSPECTIONS SPECIFIED IN THIS MANUAL. CLEANING THE PROPELLER PRIOR TO INSPECTION MAY REMOVE EVIDENCE OF A CONDITION THAT REQUIRES CORRECTIVE ACTION.

CAUTION 3: DO NOT USE PRESSURE WASHING EQUIPMENT TO CLEAN THE PROPELLER OR CONTROL COMPONENTS. PRESSURE WASHING CAN FORCE WATER AND/OR CLEANING SOLVENTS PAST SEALS, AND CAN LEAD TO INTERNAL CORROSION OF PROPELLER COMPONENTS.

A. General Cleaning

CAUTION 1: WHEN CLEANING THE PROPELLER, DO NOT ALLOW SOAP OR SOLVENT SOLUTIONS TO RUN OR SPLASH INTO THE HUB AREA.

CAUTION 2: DO NOT CLEAN PROPELLER WITH CAUSTIC OR ACIDIC SOAP SOLUTIONS. IRREPARABLE CORROSION OF PROPELLER COMPONENTS MAY OCCUR.

(1) Remove the spinner dome in accordance with the Installation and Removal chapter in this manual.

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

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

(2) Using a clean cloth dampened with Stoddard solvent CM23 or equivalent, wipe the inside of the spinner dome to remove grease, oil, and other residue.
   (a) Immediately dry the inside of the spinner dome using a clean dry cloth.

(3) Using a clean cloth dampened with Stoddard solvent CM23 or equivalent, wipe the accessible surfaces of the hub, counterweight clamps, slip ring, and bulkhead to remove grease, oil, and other residue.

(4) Fill a tank sprayer with a non-caustic/non-acidic soap solution.

IMPORTANT: WHEN PERFORMING STEPS 5 THRU 7, THE BLADE(S) TO BE CLEANED MUST POINT DOWNWARD. THIS WILL PREVENT THE SOAP SOLUTION AND/OR CONTAMINANTS FROM FLOWING INTO THE HUB/BLADE SEAL AREA.

CAUTION: DO NOT LET THE SOAP SOLUTION DRY ON THE SURFACES OF THE HUB, BULKHEAD, OR SLIP RING.

(5) Using the tank sprayer, apply a fine mist of the soap solution to the surfaces of the downward facing blades, and the hub, bulkhead, and slip ring around the downward facing blades.

(a) Use a cloth or soft nylon brush to loosen dirt and unwanted material on the surfaces where the soap solution was applied, particularly on the inboard surface of the counterweight clamp.

(6) Using clean potable water at low pressure, rinse the surfaces where the soap solution was applied to remove dirt, unwanted material, and soap residue.

(7) Use a clean dry cloth to dry the surfaces cleaned in the previous steps.

(8) Rotate the propeller so that the next blade(s) to be cleaned are pointing downward, then repeat steps 5 thru 7.

(a) Repeat steps 5 thru 8 until all blades have been cleaned and dried.

(9) Let the propeller dry.

(10) Install the spinner dome in accordance with the Installation and Removal chapter in this manual.

B. Spinner Cleaning and Polishing

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

(2) If an aluminum spinner dome is installed, polish the dome (if required) with an automotive-type aluminum polish.

2. Lubrication

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. Lubrication Intervals

(1) The propeller must be lubricated at intervals not to exceed 400 hours or 12 calendar months, whichever occurs first.

(a) Inspection and maintenance specified by the craft manufacturer’s maintenance program and approved by the applicable certification agency may not coincide with the lubrication interval specified.

1 In this situation, the craft manufacturer’s schedule may be applied as long as the calendar limit for the lubrication interval does not exceed twelve (12) months.

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

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

(2) Owners of high use crafts may wish to extend their lubrication intervals. The lubrication interval may be gradually extended after evaluating bearing wear and internal corrosion when the propeller is overhauled.

(3) Hartzell Propeller recommends that new or newly overhauled propellers be lubricated after approximately the first ten hours of operation because centrifugal loads will pack and redistribute grease which can result in a propeller imbalance. Redistribution of grease may also result in voids in the blade bearing area where moisture can collect.

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

B. Lubrication Procedure

WARNING 1: FOLLOW LUBRICATION PROCEDURES CORRECTLY TO MAINTAIN ACCURATE BALANCE OF THE PROPELLER ASSEMBLY.

WARNING 2: PITCH CONTROL DIFFICULTY COULD RESULT IF THE PROPELLER IS NOT CORRECTLY LUBRICATED.

(1) Remove the propeller spinner.

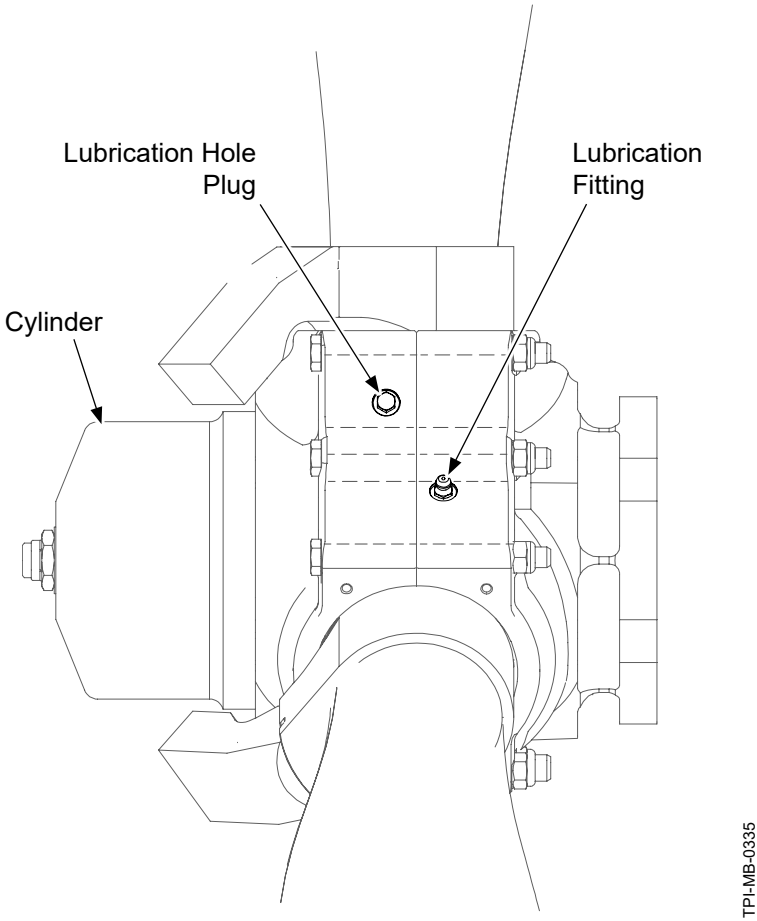
(2) Each blade socket has two lubrication fittings or one lubrication fitting and one lubrication hole plug. Refer to Figure 6-1.

(3) Remove the caps from the lubrication fittings.

(4) Remove the lubrication fittings or hole plugs as applicable.

(a) For all tractor or pusher propellers with clockwise (standard) rotation when viewed from BEHIND the aircraft, remove the lubrication fittings (p/n A-279 or C-6349) or lubrication hole plugs (p/n 106545) from the CYLINDER-SIDE hub half.

(b) For all tractor or pusher propellers with counter-clockwise (backward) rotation when viewed from BEHIND the aircraft, remove the lubrication fittings (p/n A-279 or C-6349) or lubrication hole plugs (p/n 106545) from the ENGINE-SIDE hub half.



NOTE: A tractor/pusher propeller with clockwise (standard) rotation is shown in this illustration.

Lubrication Fittings/Hole Plugs
Figure 6-1

CAUTION: USE CARE NOT TO DAMAGE THE THREADED HOLE WHEN REMOVING A BLOCKAGE.

(5) If there is a blockage in the threaded hole where the lubrication plug was removed (ex. hardened grease), bend a piece of safety wire and use the bent end to loosen the blockage.

CAUTION: USE ONLY HARTZELL PROPELLER APPROVED GREASE. DO NOT MIX DIFFERENT SPECIFICATIONS AND/OR BRANDS OF GREASE EXCEPT AS NOTED IN THIS SECTION.

(6) A label is normally applied to the propeller to indicate the type of grease previously used. Refer to Figure 6-2.

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

1 It is not possible to purge old grease through lubrication fittings.

2 To completely replace one grease with another, the propeller must be disassembled and cleaned in accordance with the applicable overhaul manual.

Lubrication Label
Figure 6-2

(7) If different grease types are accidentally mixed, the propeller must be disassembled and cleaned in accordance with the applicable overhaul/maintenance manual within three months or 30 flights whichever occurs first.

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

WARNING: WHEN MIXING AEROSHELL 5 AND AEROSHELL 6 GREASES, THE CRAFT MUST BE PLACARDED TO INDICATE THAT OPERATION IS PROHIBITED IF THE OUTSIDE AIR TEMPERATURE IS LESS THAN -40° F (-40° C). AEROSHELL 5 GREASE MUST BE INDICATED ON THE LABEL.

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

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

CAUTION 3: DO NOT ATTEMPT TO PUMP MORE THAN 1 FL. OZ. (30 ML) OF GREASE INTO THE LUBRICATION FITTING. USING MORE THAN 1 FL. OZ. (30 ML) OF GREASE COULD RESULT IN OVER SERVICING OF THE PROPELLER. VERIFY THE OUTPUT OF THE GREASE GUN BEFORE SERVICING THE PROPELLER.

CAUTION 4: OVER-LUBRICATING AN ALUMINUM HUB PROPELLER MAY CAUSE THE GREASE TO ENTER THE HUB CAVITY, LEADING TO EXCESSIVE VIBRATION AND/OR SLUGGISH OPERATION. THE PROPELLER MUST THEN BE DISASSEMBLED TO REMOVE THIS GREASE.

(8) Pump a maximum of 1 fl. oz. (30 ml) grease into the lubrication fitting, or until grease emerges from the hole where the lubrication fitting or hole plug was removed, whichever occurs first.

NOTE: It may be necessary to use a right angle coupler such as TE559 or equivalent, on the grease gun to access the lubrication fittings. Refer to Figure 6-3.

(a) For all tractor or pusher propellers with clockwise (standard) rotation when viewed from BEHIND the aircraft, the lubrication fitting is in the ENGINE-SIDE hub half.

(b) For all tractor or pusher propellers with counter-clockwise (backward) rotation when viewed from BEHIND the aircraft, the lubrication fitting is in the CYLINDER-SIDE hub half.

Right Angle Coupler for Grease Gun
Figure 6-3

(9) If a lubrication fitting (p/n A-279 or C-6349) was removed at the beginning of this procedure, it may be reinstalled or replaced with a lubrication hole plug (p/n 106545).

(a) Reinstall the lubrication fitting or hole plug that was removed at the beginning of this procedure.

(b) Tighten until finger-tight, then tighten one additional 360 degree turn.

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

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

C. Approved Lubricants

(1) For a list of lubricants approved for use in Hartzell propellers, refer to the Consumable Materials chapter of Hartzell Propeller Standard Practices Manual 202A (61-01-02).

3. Corrosion Inhibitor (Rev. 1)

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.

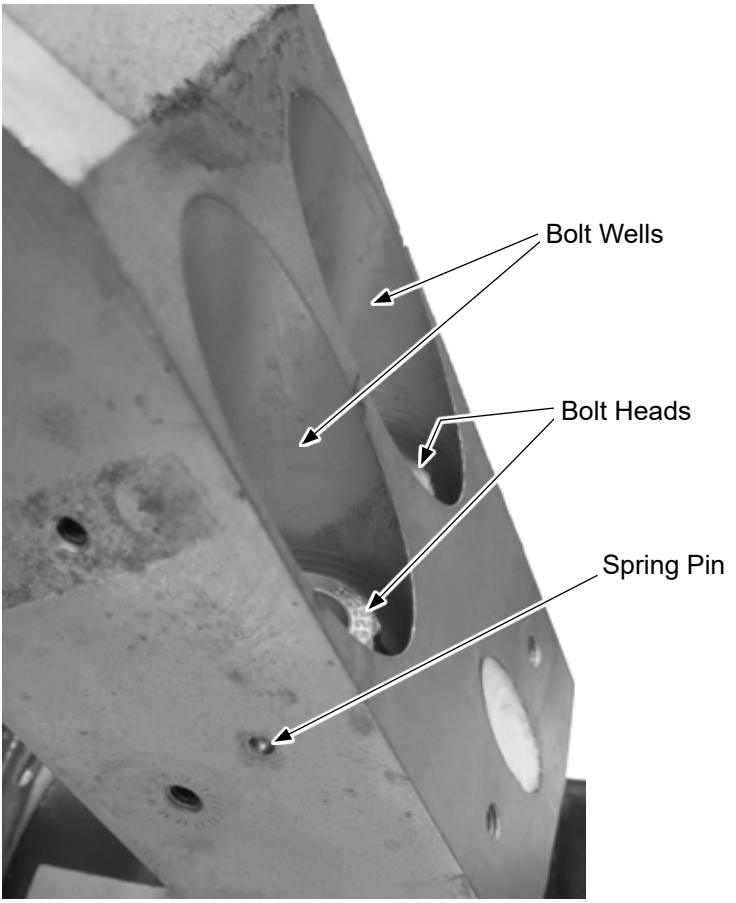
A. Application Intervals

(1) The bolt-on, steel counterweights on propellers manufactured after the release date of Service Letter HC-SL-61-364 dated April, 3, 2020 will be coated with corrosion inhibitor CM352 by Hartzell Propeller during the assembly process.

(a) Corrosion inhibitor CM352 is applied to prevent corrosion on the counterweight.

(b) Periodic re-application of the corrosion inhibitor CM352 will provide extended protection from corrosion.

1 Hartzell Propeller recommends re-application of the corrosion inhibitor CM352 at regularly scheduled intervals, similar to the lubrication interval specified in this propeller owner's manual.



Applying Corrosion Inhibitor
Figure 6-4

B. Application Procedure

(1) Remove the spinner dome in accordance with the Installation and Removal chapter of this manual.

CAUTION: DO NOT APPLY CORROSION INHIBITOR CM352 ONTO ICE PROTECTION SYSTEM COMPONENTS (TERMINAL STRIPS, BOOTS, HARNESSES, ETC.).

(2) Spray the corrosion inhibitor CM352 into a cup or container, then use a soft bristled brush to apply the corrosion inhibitor CM352 to the bolt heads, spring pins, and bolt wells of the counterweight. Refer to Figure 6-4.

(a) Use caution when applying the corrosion inhibitor CM352 around ice protection system components (terminal strips, boots, harnesses, etc.).

(b) Make sure the bolt heads, spring pins, and bolt wells are completely covered by the corrosion inhibitor CM352.

(c) Optionally, corrosion inhibitor CM352 can be applied to all exposed surfaces of the counterweight.

(3) Let the corrosion inhibitor CM352 cure for a minimum of three hours before flight.

4. Beta Feedback Block Assemblies (Rev. 1)

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. Inspection

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

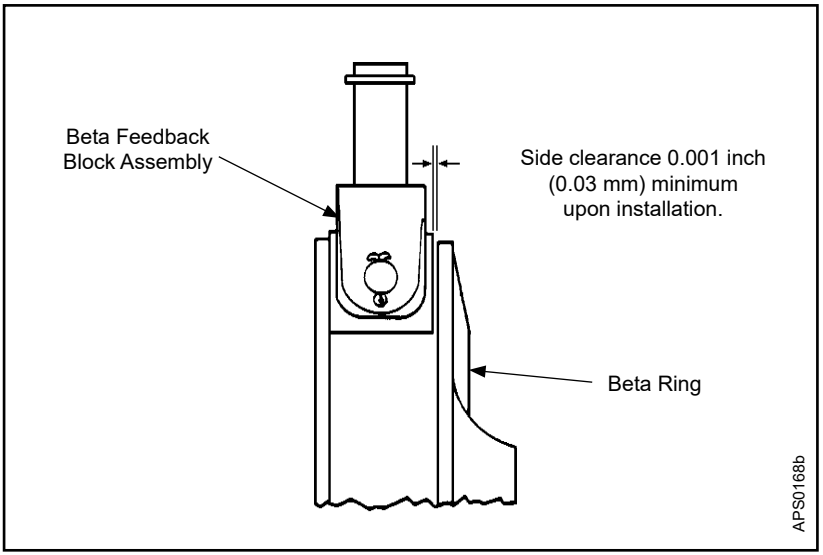
(2) Inspect the beta lever and beta feedback block assembly interface for free movement. If there is binding, do the following:

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

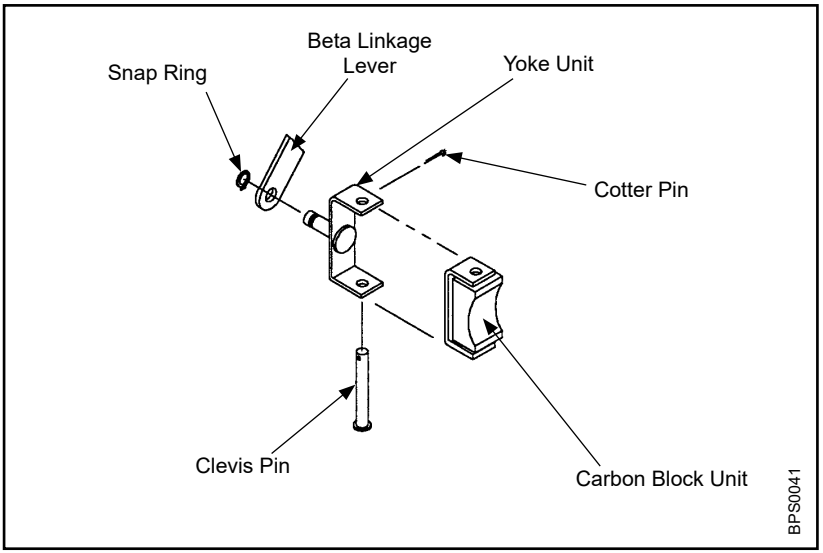
(b) Using an abrasive pad, lightly polish the yoke pin to provide adequate clearance and eliminate binding.

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

(d) Install, adjust, and safety the beta linkage in accordance with the craft manufacturer's instructions.



Beta Feedback Block Assembly and Beta Ring Clearance
Figure 6-5



Beta Feedback Block Assembly
Figure 6-6

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

(1) If the side clearance between the beta ring and the beta feedback block unit exceeds 0.010 inch (0.25 mm) - refer to Figure 6-5, replace the A-3026 carbon block unit in accordance with Figure 6-6 and the following steps:

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

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

(c) Inspect the yoke for wear or cracks.

1 Replace the yoke, if necessary.

(d) Install a new carbon block unit and slide a new clevis pin into position.

(e) Secure the clevis pin with a T-head cotter pin.

(f) Refit the carbon block in accordance with Figure 6-5.

1 Establish the required clearance by sanding the sides of the carbon block as needed.

C. Installation of the A-3044 Beta Feedback Block Assembly

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

5. Aluminum Blades

WARNING: 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 OPERATION FOR THE PRESENCE OF CRACKS OR OTHER ABNORMALITIES.

CAUTION 1: 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 PRODUCT SUPPORT DEPARTMENT FOR BLADE DIMENSIONAL LIMITS.

CAUTION 2: INSTRUCTIONS AND PROCEDURES IN THIS SECTION 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. Important Information

(1) LD99M01H( ) blades have a thin durable (HVOF) coating of metal alloy applied to the leading edge of the blade to protect against erosion.

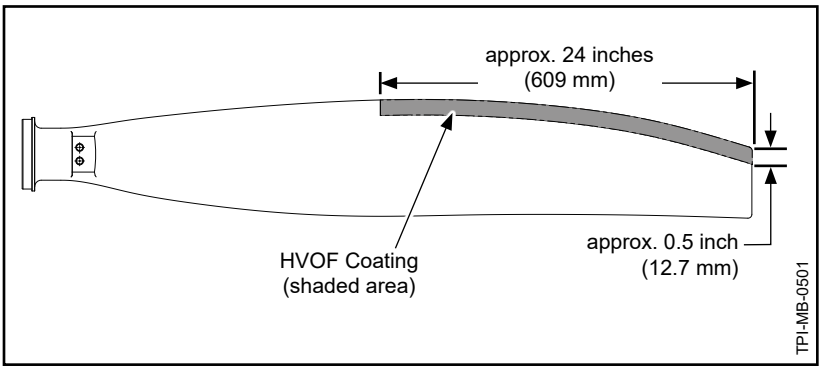
(a) Refer to Figure 6-7 for the location of the HVOF coating area.

CAUTION: FIELD REPAIRS ARE NOT PERMITTED IN THE HVOF COATING AREA. CONTACT HARTZELL PROPELLER IF THERE IS DAMAGE THAT PENETRATES THROUGH THE HVOF COATING.

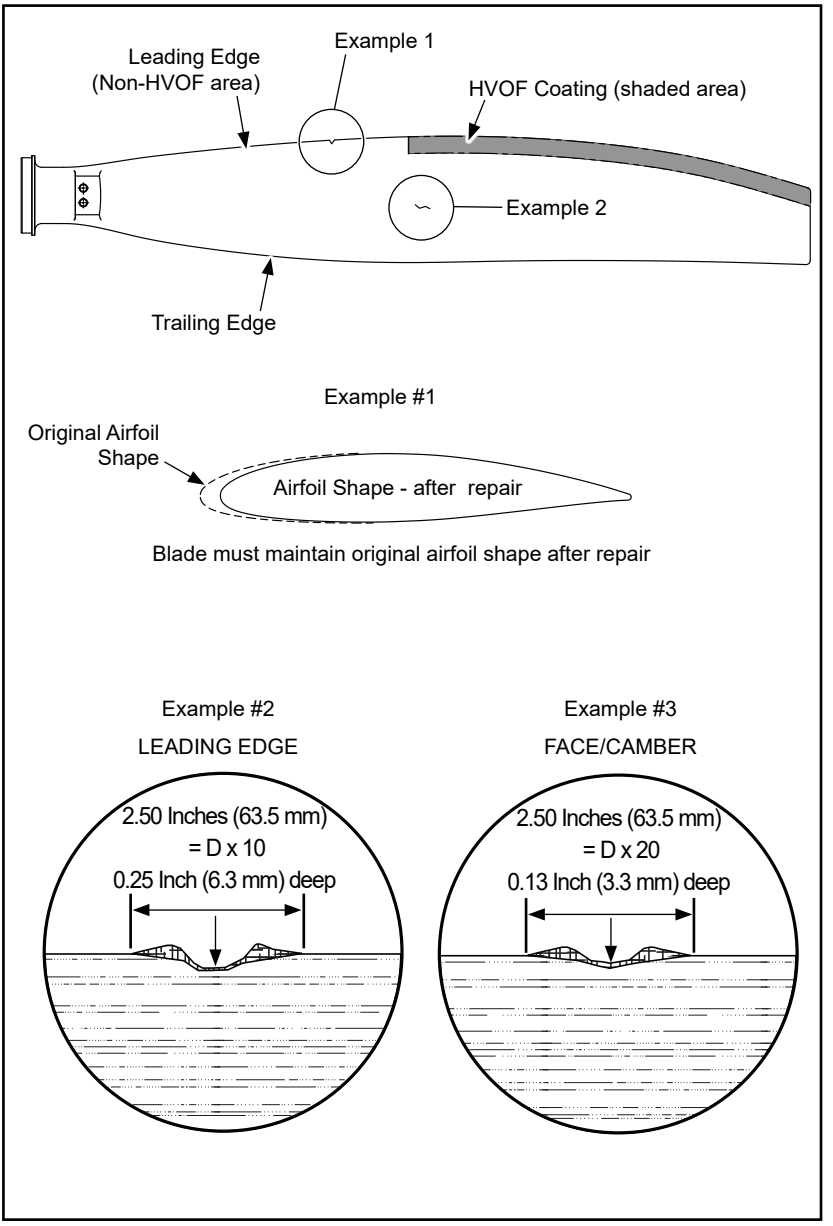
(2) Except in the HVOF coating area of the leading edge, field repair of small nicks and scratches may be performed by qualified personnel in accordance with FAA Advisory Circular 43.13-1B, and the procedures specified in this section.

(3) Nicks, gouges, and scratches on blade surfaces (except the HVOF coating area), that are greater than 0.031 inch (0.79 mm) wide or deep, must be removed before operation.

(4) Normal paint erosion (sand-blasted appearance) on the leading edge of the blade is acceptable, and does not require removal before further operation.



LD99M01H( ): HVOF Coating Area
Figure 6-7



Repair Limitations
Figure 6-8

B. Repair of Nicks and Gouges

CAUTION: REFERENCES TO THE "LEADING EDGE" IN THIS SECTION DO NOT APPLY TO THE HVOF COATING AREA ON LD99M01H( ) BLADES. REFER TO FIGURE 6-7. CONTACT HARTZELL PROPELLER IF THERE IS DAMAGE IN THE HVOF COATING AREA.

(1) Local repairs may be made using files, electrical or air powered equipment. Use emery cloth, scotch brite, and crocus cloth for final finishing.

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

CAUTION 2: SHOT PEENED BLADES ARE IDENTIFIED WITH AN “S” IMMEDIATELY FOLLOWING THE BLADE MODEL NUMBER, AS DESCRIBED IN THE DESCRIPTION AND OPERATION CHAPTER OF THIS MANUAL. BLADES THAT HAVE DAMAGE IN 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 OPERATION. SHOT PEENING OF AN ALUMINUM BLADE MUST BE ACCOMPLISHED BY A CERTIFIED PROPELLER REPAIR STATION WITH THE APPROPRIATE RATING IN ACCORDANCE WITH HARTZELL ALUMINUM BLADE OVERHAUL MANUAL 133C (61-13-33).

(2) Calculate the area of repair using Figure 6-8 and the following formulas:

(a) For leading and trailing edge damage:
Depth of the damage x 10.
Refer to Examples 1 and 2.

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

(b) For face and camber side damage:
Depth of damage x 20. Refer to Example 3.

(3) Repair damage to the leading or trailing edge of the blade by removing material from the bottom of the damaged area.

(a) Remove material from this point out to both sides of the damage to form a smooth, blended depression that maintains the original shape of the blade airfoil.

(4) Repair damage to the blade face or camber side by removing material from the bottom of the damaged area.

(a) Remove material from this point out to both sides of the damage to form a smooth, blended depression that maintains the original shape of the blade airfoil.

(b) Repairs that form a continuous line across the blade section (chordwise) are not permitted.

(5) After filing or sanding the damaged area, use emery cloth to polish the area, then remove any file marks using crocus cloth.

(6) Inspect the repaired area with a 10X magnifying glass.

(a) Be sure that no indication of the damage, file marks, or coarse surface finish remain.

(7) If inspections show any remaining blade damage, repeat steps (5) and (6) of this procedure until no damage remains.

(8) After repair, Hartzell Propeller recommends penetrant inspection of the blade in accordance with Hartzell Propeller Standard Practices Manual 202A (61-01-02).

(9) Treat the repaired area to prevent corrosion. Properly apply chemical conversion coating and approved paint to the repaired area before returning the blade to service.

(a) Refer to the section, “Blade Paint Touch-Up” in this chapter.

C. Repair of Bent Blades

CAUTION: DO NOT ATTEMPT TO “PRE-STRAIGHTEN” A BLADE BEFORE DELIVERY TO A CERTIFIED PROPELLER REPAIR STATION WITH THE APPROPRIATE RATING. THIS WILL CAUSE THE BLADE TO BE REPLACED BY THE REPAIR FACILITY.

(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.

6. Blade Paint Touch-Up (Rev. 2)

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. Important Information

(1) Blade paint touch-up on Hartzell propeller blades may be permitted when performed in accordance with the instructions in this section.

(a) Aluminum Blades Only:

1 Blade paint touch-up is permitted for any size area on an aluminum blade.

B. Paint

(1) The paints listed in Table 6-1 have been tested by Hartzell Propeller and are recommended for blade touch-up.

(a) Alternate paints may be used for blade touch-up, but Hartzell Propeller accepts no responsibility for wear or adhesion-related issues.

(2) Touch-up paint manufacturer's contact information:

(a) **Tempo Products Company**
A Plasti-kote Company
1000 Lake Road
Medina, OH 44256
Tel: 800.321.6300
Fax: 216.349.4241
Cage Code: 07708

(b) **Sherwin-Williams Company**
Refer to the Sherwin-Williams
Product Finishes Global Finishes Group website at:
http://oem.sherwin-williams.com

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	Gray Metallic	F75KXM9754-4311	A-6741-148-1
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	F63TXS30880-4311	A-6741-163-1
Sherwin-Williams	Silver	F75KXS13564-4311	A-6741-190-1
Sherwin-Williams	Bright Red	1326305 or F63TXR16285-4311	A-6741-200-5
Sherwin-Williams	Bright Yellow	1326313 or F63TXY16286-4311	A-6741-201-5
Sherwin-Williams	Bright Silver	1334259	A-6741-203-5
Sherwin-Williams	Prop Gold	F63TXS17221-4311	A-6741-204-5

Touch-up Paints
Table 6-1

C. Procedure

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

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

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

(2) Permit the solvent to evaporate.

CAUTION: BE SURE TO SAND/FEATHER THE EXISTING COATINGS TO PREVENT EXCESSIVE PAINT BUILDUP.

(3) 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.

(4) Using acetone, #700 lacquer thinner, or MEK, wipe the surface of the blade.

(5) Permit the solvent to evaporate.

(6) Aluminum Blades Only:

(a) Apply an approved corrosion preventative coating to the bare aluminum surface of the blade in accordance with the manufacturer's instructions.

1 Oakite 31, Chromicote L-25, or Alodine 1201 are approved chemical conversion coatings.

(7) Apply masking material to the erosion shield 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 A WELL VENTILATED AREA.

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

(8) Apply a sufficient amount of finish 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 hours, it must be lightly sanded before another coat is applied.

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

(10) Apply 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 hours, it must be lightly sanded before another coat is applied.

(11) Remove the masking material immediately from the erosion shield and tip stripes, if applicable.

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

7. Dynamic Balance

CAUTION 1: WHEN USING REFLECTIVE TAPE FOR DYNAMIC BALANCING, DO NOT APPLY THE TAPE ON EXPOSED BARE METAL OF A BLADE. THIS WILL CAUSE MOISTURE TO COLLECT UNDER THE TAPE AND CAUSE CORROSION THAT CAN PERMANENTLY DAMAGE THE BLADE.

CAUTION 2: 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.

A. Overview

(1) 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, and the craft.

(2) Static balancing is required when an overhaul or major repair is performed at a propeller overhaul 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.

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

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

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

NOTE: The Static and Dynamic Balance chapter of Hartzell Propeller Standard Practices Manual 202A (61-01-02) also contains information about weight placement and balancing.

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) Using a Stoddard solvent (or equivalent), completely remove any grease on the blades or inner surface of the spinner dome.

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

(c) Visually examine 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 before dynamic balancing.

(3) Before dynamic balance make a record of the number and location of all balance weights.

C. Modifying Spinner Bulkhead to Accommodate Dynamic Balance Weights

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

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

(2) The radial location must 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) Install nut plates (10-32 thread) of the type used to attach the spinner dome. This will permit 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.

(6) 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.

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

CAUTION: IF REFLECTIVE TAPE IS USED FOR DYNAMIC BALANCING, REMOVE THE TAPE IMMEDIATELY UPON COMPLETION. TAPE THAT REMAINS ON THE BLADE WILL CAUSE MOISTURE TO COLLECT UNDER THE TAPE AND CAUSE CORROSION THAT CAN PERMANENTLY DAMAGE THE BLADE.

(8) If reflective tape is used for dynamic balancing, remove the tape immediately after balancing is completed.

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

8. Hydraulic Low Pitch Stop Setting (Rev. 1)
   A. Hydraulic Low Pitch Stop Adjustment
      (1) The hydraulic low pitch stop is normally set by Hartzell Propeller in accordance with the aircraft manufacturer's requirements, and should not require any additional adjustment.
         (a) Adjustments may be required after maintenance or because of aircraft variances.
            1 Adjustments must be done in accordance with the specifications found in the airframe manufacturer's manual.

9. Feathering Pitch Stop Settings (Rev. 1)
   A. Feathering Pitch Stop Adjustment
      (1) The feathering pitch stop is set by Hartzell Propeller in accordance with the aircraft manufacturer's recommendations.
      (2) The feathering pitch stop can only be adjusted by Hartzell or by a certified propeller repair station with the appropriate rating.

10. Reverse Pitch Stop Settings (Rev. 1)
    A. Reverse Pitch Stop Adjustment
       (1) The reverse pitch stop is set by Hartzell Propeller in accordance with the aircraft manufacturer's recommendations.
       (2) The reverse pitch stop can only be adjusted by Hartzell or by a certified propeller repair station with the appropriate rating.

11. Start Lock Settings (Rev. 1)
    A. Start Lock Adjustment
       (1) The start locks are set by Hartzell Propeller in accordance with the aircraft manufacturer's recommendations.
       (2) The start locks can only be adjusted by Hartzell or by a certified propeller repair station with the appropriate rating.

12. Tachometer Calibration (Rev. 1)

WARNING: OPERATION WITH AN INACCURATE TACHOMETER CAN CAUSE RESTRICTED RPM OPERATION AND DAMAGING HIGH STRESSES. PROPELLER LIFE WILL BE SHORTENED AND COULD CAUSE CATASTROPHIC FAILURE.

A. Important Information

(1) All engine/propeller combinations have operating conditions at which the propeller blade stresses begin to reach design limits.

(a) In most cases, these conditions occur above the maximum rated RPM of the engine.

(b) Some engine/propeller combinations have certain ranges of RPM that are less than maximum engine speed, where stresses are at a level considered too high for continuous operation. This results in a restricted operating range where continuous operation is not permitted. A placard on the instrument panel or yellow arc on the tachometer will inform the pilot to avoid operation in this range.

(c) In other cases, the limiting condition occurs at an RPM only slightly above the maximum engine RPM.

(d) For these reasons, it is very important to accurately monitor engine speed.

(2) The accuracy of the tachometer is critical to the safe operation of the aircraft.

(a) Some tachometers have been found to be in error by as much as 200 RPM.

(b) Operating the aircraft with an inaccurate tachometer could cause continued operation at unacceptably high stresses, including repeatedly exceeding the maximum engine RPM.

(c) Continuous operation in a restricted RPM range subjects the propeller to stresses that are higher than the design limits.

(d) Stresses that are higher than the design limits will shorten the life of the propeller and could cause a catastrophic failure.

B. Tachometer Calibration

(1) Hartzell Propeller recommends that propeller owners/operators calibrate the engine tachometer in accordance with the National Institute of Standards and Technology (NIST) or similar national standard (traceable).

(2) Contact Hartzell Propeller if the propeller was operated in a restricted RPM range because of a tachometer error.

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RECORDS - CONTENTS

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1. Record Keeping (Rev. 1)
   A. General
      (1) Federal Aviation Regulations require that a record be kept of any repairs, adjustments, maintenance, or required inspections performed on a propeller or propeller system.
   B. Information to be Recorded
      (1) Refer to Part 43 of the U.S. Federal Aviation Regulations for a list of information that must be recorded.
      (2) The logbook may also be used to record:
         (a) Propeller position (on craft)
         (b) Propeller model
         (c) Propeller serial number
         (d) Blade design number
         (e) Blade serial numbers
         (f) Spinner assembly part number
         (g) Propeller pitch range
         (h) Craft information (craft type, model, serial number and registration number).

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