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Revision 8
September 2025

Propeller Owner's Manual
and Logbook

Steel Hub Reciprocating Propellers with Aluminum Blades

Two Blade

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

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Fellow aviation enthusiasts, I urge you to read this Manual thoroughly. It contains a wealth of information about your new propeller.

The propeller is among the most reliable components of your airplane. It is also among the most critical to flight safety. It therefore deserves the care and maintenance called for in this Manual. Please give it your attention, especially the section dealing with Inspections and Checks.

Thank you for choosing a Hartzell propeller. Properly maintained it will give you many years of reliable service.

JJ Frigge
President, Hartzell Propeller LLC

WARNING (Rev. 5)

People who fly 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 aircraft. A mechanical failure of the propeller could cause a forced landing or create vibrations sufficiently severe to damage the aircraft, 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 certified as being safe to operate on an airplane, 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 aircraft 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 aircraft control.

Hartzell Propeller LLC follows FAA regulations for propeller certification on certificated aircraft. Experimental aircraft 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.

Frequent inspections are strongly recommended if operating with a non-certificated installation; however, these inspections may not guarantee propeller reliability, as a failing device may be hidden from the view of the inspector. Propeller overhaul is strongly recommended to accomplish periodic internal inspection.

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

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REVISION 8 HIGHLIGHTS

Revision 8, dated September 2025, incorporates the following:

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

Minor language/format changes and renumbering, if applicable are marked with a revision bar, but are not listed below.

- INTRODUCTION
  - Revised the section, "Reference Publications"
  - Revised the section, "Personnel Requirements"
  - Revised the section, "Propeller Critical Parts"
- INSTALLATION AND REMOVAL
  - Revised the section, "Pre-Installation"
  - Added the section "Spinner Dome Installation
  - Added Table 3-3, "Spinner Dome and Spinner Cap Mounting Hardware"
- INSPECTION AND CHECK
  - Revised the section, "Blade Tolerances"
- RECORDS
  - Revised the section, "General"

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REVISION 8 HIGHLIGHTS

1. Introduction
   A. General
      (1) This is a list of current revisions that have been issued against this manual. Please compare it to the RECORD OF REVISIONS page to make sure 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	Feb/02	New Issue
Revision 1	Jun/10	Minor Revision
Revision 2	Jun/12	Minor Revision
Revision 3	Oct/15	Minor Revision
Revision 4	Jun/17	Minor Revision
Revision 5	Mar/21	Minor Revision
Revision 6	Jul/23	Major Revision
Revision 7	Apr/24	Minor Revision
Revision 8	Sep/25	Minor Revision

RECORD OF REVISIONS

This is a record of revisions inserted into this manual.
Revision 6 includes all prior revisions.

Revision Number	Issue Date	Date Inserted	Inserted By
6	Jul/23	Jul/23	HPI
7	Apr/24	Apr/24	Hartzell
8	Sep/25	Sep/25	Hartzell

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RECORD OF TEMPORARY REVISIONS

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

RECORD OF TEMPORARY REVISIONS

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

SERVICE DOCUMENTS LIST

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

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

Service Document Number	Incorporation Rev/Date
Service Letters:	
HC-SL-61-320	Rev. 2 Jun/12
HC-SL-61-324	Rev. 2 Jun/12
HC-SL-61-364	Rev. 5 Mar/21
HC-SL-61-185, Rev. 3	Rev. 4 Jun/17

SERVICE DOCUMENTS LIST

Service Document Number	Incorporation Rev/Date
Service Letters:	
SI136	Original Feb/02

AIRWORTHINESS LIMITATIONS

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

FAA APPROVED

by: _____ date: 6/30/10

Manager, Chicago ACO Branch
Compliance & Airworthiness Division, AIR-7CO
Federal Aviation Administration

Rev. No.	Description of Revision
5	Revised the wording of the initial paragraph. Added paragraph on page 2.

AIRWORTHINESS LIMITATIONS

1. The FAA establishes specific life limits for certain component parts, as well as the entire propeller. Such limits require replacement of the identified parts after a specified number of hours of use.
2. The following data summarizes all current information concerning Hartzell life limited parts as related to propeller models affected by this manual. These parts are not life limited on other installations; however, time accumulated toward life limit accrues when first operated on aircraft/engine/propeller combinations listed and continues regardless of subsequent installations (that may or may not be life limited).
   A. The propeller models affected by this manual currently do not have any life limited parts.
   B. There are no new (or additional) Airworthiness Limitations associated with this equipment and/or installation.

FAA APPROVED

by: _____ date 6/30/10

Manager, Chicago ACO Branch
Compliance & Airworthiness Division, AIR-7CO
Federal Aviation Administration

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1. General (Rev. 2)

A. Statement of Purpose

(1) This manual has been reviewed and accepted by the FAA. Additionally, the Airworthiness Limitations section of this manual has been approved by the FAA.

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

(2) 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.

(3) 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.

(4) 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 aircraft by pulling on the propeller.

(3) Avoid the use of blade paddles. If blade paddles must be used, use at least two paddles. Do not put the blade paddle in the area of the de-ice or anti-icing 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 or anti-icing boot. 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 a certified propeller repair station with the appropriate rating before return to service.

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

(a) Perform dynamic balancing in accordance with the Maintenance Practices chapter of this manual.

(b) Additional procedures may be found in the aircraft maintenance manual.

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

(9) As applicable, follow military standard NASM33540 for safety wire, 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) The airframe manufacturer’s manuals should be used in addition to the information in this manual due to possible special requirements for specific aircraft applications.

(12)If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller, applicable instructions and technical information for the components can be found in Hartzell Propeller Ice Protection System Manual 180 (30-61-80).

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

(14)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. Airframe or Engine Modifications (Rev. 2)

A. Propeller Stress Levels

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

B. Engine Modifications

(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 aircraft.

3. Restrictions and Placards (Rev. 1)

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 aircraft model.

(b) Review the propeller and aircraft type certificate data sheet (TCDS), Pilot Operating Handbook (POH), and any applicable Airworthiness Directives for specific information.

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) Some manuals are available on the Hartzell Propeller website at www.hartzellprop.com. The complete Hartzell Propeller Technical Library is available by subscription.

(3) 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.)	Hartzell Propeller Manual Title
n/a	Active Hartzell Propeller Service Bulletins, Service Letters, Service Instructions, and Service Advisories
Manual 127 (61-16-27)	Metal Spinner Maintenance Manual
Manual 130B (61-23-30)	Mechanically Actuated Governors and Accessories Overhaul Manual
Manual 133C (61-13-33)	Aluminum Blade Overhaul Manual
Manual 159 (61-02-59)	Application Guide
Manual 165A (61-00-65)	Illustrated Tool and Equipment Manual
Manual 171 (61-10-71)	-1, -4, -6 Series Steel “A” Hub Propeller Overhaul Manual

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

B. Vendor Publications

None.

5. Personnel Requirements (Rev. 3)

A. Service and Maintenance Procedures in this Manual

(1) Personnel performing the service and maintenance procedures in this manual are expected to have the required equipment/tooling, training, and certifications (when required by the applicable Aviation Authority) to accomplish the work in a safe and airworthy manner.

(2) Compliance to the applicable regulatory requirements established by the Federal Aviation Administration (FAA) or international equivalent 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 Federal Aviation Administration (FAA) or international equivalent.

(b) Refer to Title 14 Code of Federal Regulations (CFR) Part 43 for additional information about general aviation maintenance requirements.

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 HC-SL-61-61Y.

(3) Experience has shown that special care, such as keeping an aircraft 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 Airworthiness 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., flight time, or on calendar time.

(a) Overhaul intervals are specified in Hartzell Propeller Service Letter HC-SL-61-61Y.

(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. Airworthy/Unairworthy Damage

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

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

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

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

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

(b) Unairworthy 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 aircraft 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 Federal Aviation Administration (FAA) or international equivalent.

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 Propeller Product Support for evaluation **before proceeding with repair or inspection work**. Upon receipt of this form, the 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 service literature and revisions, contact:

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

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

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

Term	Definition
Blade Centerline	An imaginary reference line through the length of a blade around which the blade rotates
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

Term	Definition
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
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.

Term	Definition
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.
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

Term	Definition
Depression	Surface area where the material has been compressed but not removed
Distortion	Alteration of the original shape or size of a component
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
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

Term	Definition
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
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

Term	Definition
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
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

Term	Definition
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.
Reversing	The capability of rotating blades to a position to generate reverse thrust to slow the aircraft or back up

Term	Definition
Scratch	Same as “Nick”
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
MIL-X-XXX	Military Specification
MPI	Major Periodic Inspection (Overhaul)
MS	Military Standard
MSDS	Material Safety Data Sheet

Abbreviation	Term
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
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

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1. Description of Propellers and Systems

A. System Overview

(1) The Hartzell Propeller steel hub propeller covered in this manual is a constant speed assembly that uses a steel hub as a central component of the propeller.

(2) The propeller attaches to the engine through a splined shaft. A spline shaft attachment uses a Society of Automotive Engineers (SAE) Number 20 spline. Refer to Figure 2-1.

NOTE: The SAE Number 20 spline shaft propeller is identified simply as a "20 spline shaft" propeller throughout the text of this manual.

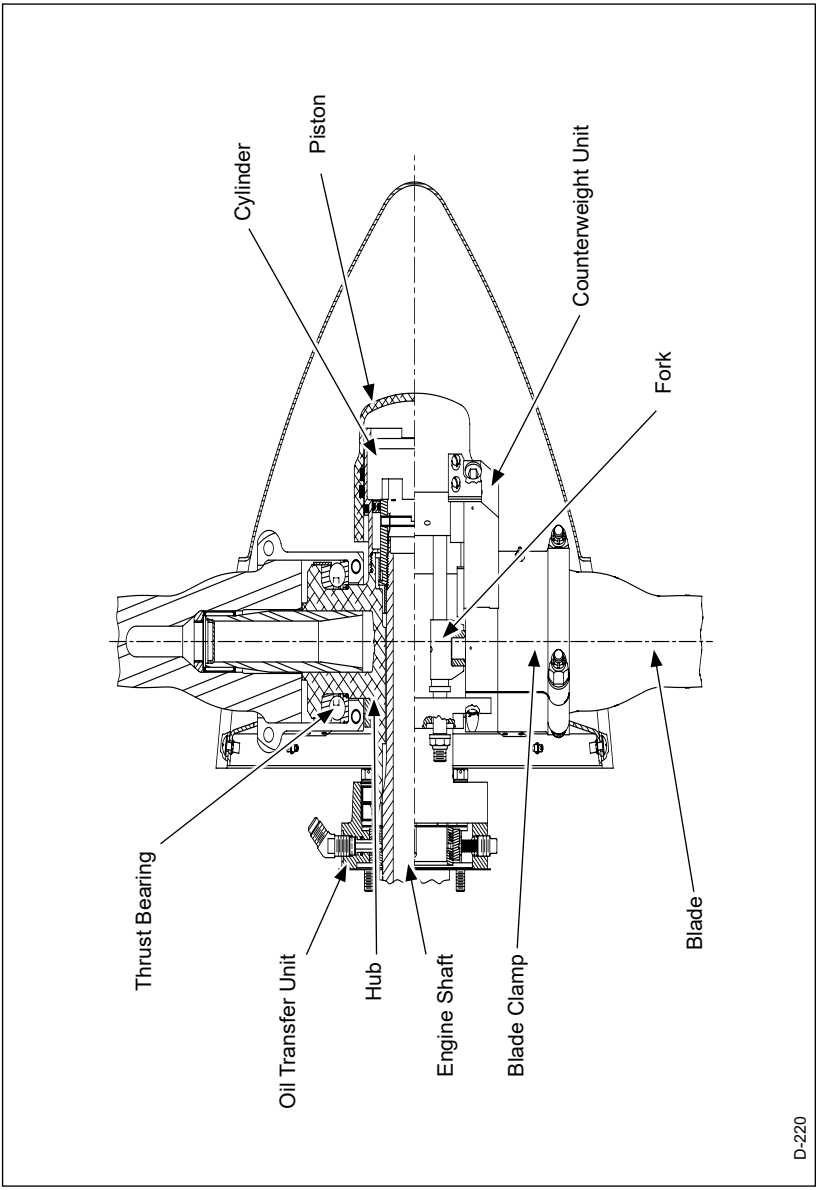
B. Propeller Models HC-A2(MV,V)20-4A1
Refer to Figure 2-1.

(1) This constant speed, counterweighted, nonfeathering propeller is typically used on single engine aircraft with a damped E-185, E-205, or E-225 Continental engine installed.

(2) This type of engine has no provisions to drive a governor, nor does the engine crankshaft have provisions to supply governor control oil to the propeller.

(3) The HC-A2(MV,V)20-4A1 propeller is designed to receive governor control oil for constant speed operation, external of the engine shaft, through an oil transfer unit that is supplied with the propeller.

(4) The governor is mounted on a Hartzell Propeller supplied "T" drive adaptor that is installed between the fuel pump and the engine accessory drive pad. This propeller and control system is typically installed on a Beech Bonanza under the authority of STC number SA1-570 or on a Navion under the authority of STC number SA1-635.



HC-A2(MV,V)20-4A1 Constant Speed, Counterweighted, Nonfeathering Propeller Assembly
Figure 2-1

(5) Propeller blade angle change is actuated by a hydraulic piston/cylinder combination mounted on the forward end of the propeller hub. The linear motion of the hydraulic piston is transmitted to each blade through a sliding rod and fork system, connected to a blade clamp that rotates with the blade. Each blade is retained on the propeller hub by a blade clamp and thrust bearing. The thrust bearing allows the blade to change angle with the blade under centrifugal load.

(6) Propeller forces consisting of blade counterweight centrifugal twisting moment and aerodynamic twisting moment of the blades in various combinations are constantly present while the propeller is operating. The summation of these forces causes the propeller to rotate to a higher blade angle. A variable hydraulic force (oil under pressure from the engine driven governor) toward a lower blade angle opposes the summation of these forces. Oil is metered by the governor to oppose these constant forces and maintain a constant engine RPM.

(7) A counterweight is a weight that is attached to each blade clamp to cause the blade to rotate to a higher blade pitch. Counterweighted propellers require governor supplied oil to decrease blade pitch. If the oil supply is lost, the counterweighted propeller will go to high pitch, or low RPM.

(8) The weight of each propeller blade when spinning, generates centrifugal force and a twisting force that attempts to rotate each blade to a lower blade angle.

(9) Air flow around the blade generates lift and an aerodynamic twisting moment that will attempt to increase or decrease blade angle, depending on flight condition and blade design. This force is generally very small in relation to the other forces.

(10) A governor is an engine speed-sensing device that maintains a constant engine/propeller RPM by changing blade angle, thereby varying the load on the engine.

(11) The governor uses an internal pump that is driven by an accessory drive from the engine. This pump uses an engine oil supply and increases the engine oil pressure for supply to the propeller. Engine speed sensing hardware within the governor controls the supply of oil to, or drain of oil from the propeller, resulting in a change of blade pitch to maintain constant engine speed.

(12) Oil pressure from the engine-driven governor is supplied to the propeller mounted hydraulic cylinder through the oil transfer unit and propeller hub. Increasing the oil volume within the hydraulic cylinder decreases blade angle to increase engine RPM. Decreasing the oil volume increases blade angle to decrease engine RPM. By changing the blade angle, the governor maintains constant engine RPM (within limits), independent of the throttle setting.

(13) If oil pressure is lost at any time, the summation of propeller forces that is in direct opposition to the lost variable hydraulic force will increase blade angle.

(14) The oil transfer unit attaches to the engine case and encircles the engine shaft and engine side portion of the propeller hub. Refer to Figure 2-1.

(15) The function of the oil transfer unit is to transfer governor control oil for constant speed operation from the non-rotating external hydraulic hose to the rotating propeller.

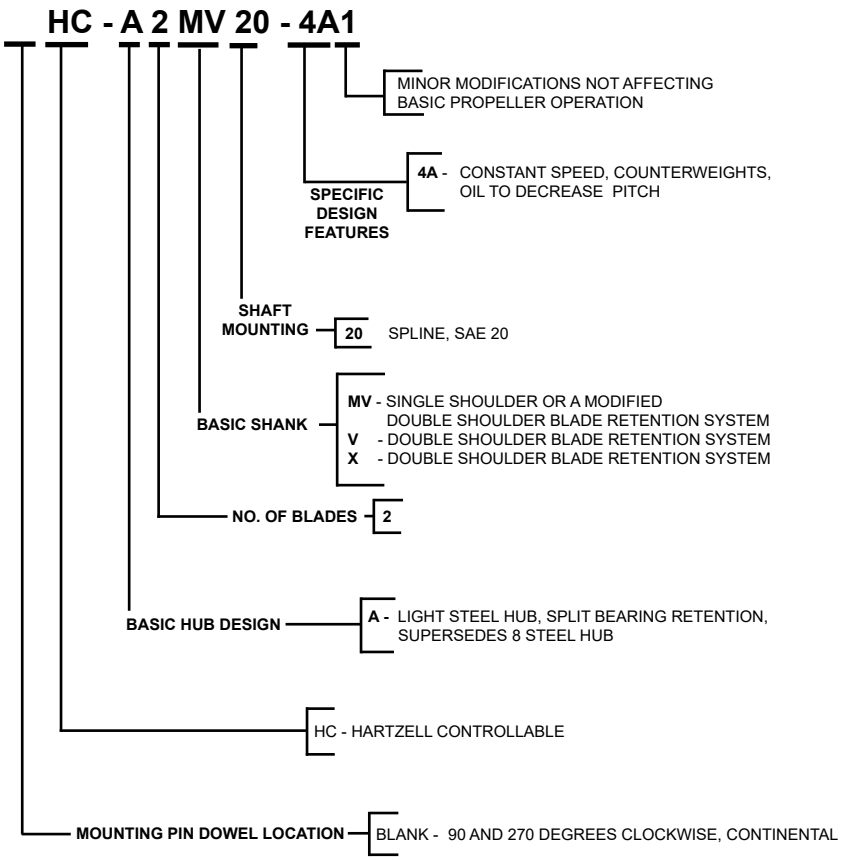
(16) Basic components of the unit consist of a housing, slip ring, piston rings, outer ring, rear cone and lip seal. The housing supports the internal parts and contains the oil. The slip ring, piston rings, rear cone, and outer ring transfer the oil from the non-rotating housing to the rotating propeller. The rear cone also supports and centers the engine side of the propeller hub. The lip seal prevents leakage oil from the high pressure oil supply system from escaping outside of the housing.

(17) Since the Continental E-185, E-205, and E-225 engines have no provision for a propeller governor, it is necessary to share an accessory drive on the engine with another accessory. Refer to Figure 3-12.

(18)Hartzell Propeller LLC supplies a "T" drive that installs between the engine and fuel pump and provides a second accessory drive for mounting the governor. The "T" drive allows an engine accessory drive pad to drive two accessories, instead of one.

(19)Additional accessories (Figure 3-11) consist primarily of a Vernier control cable, from the instrument panel to the governor, for RPM control and a hydraulic hose from the "T" drive to the oil transfer unit.

(20)For specific technical details and installation information, consult STC SA1-570 for Bonanza installations and SA1-635 for Navion installations.



Propeller Model Designations
Table 2-1

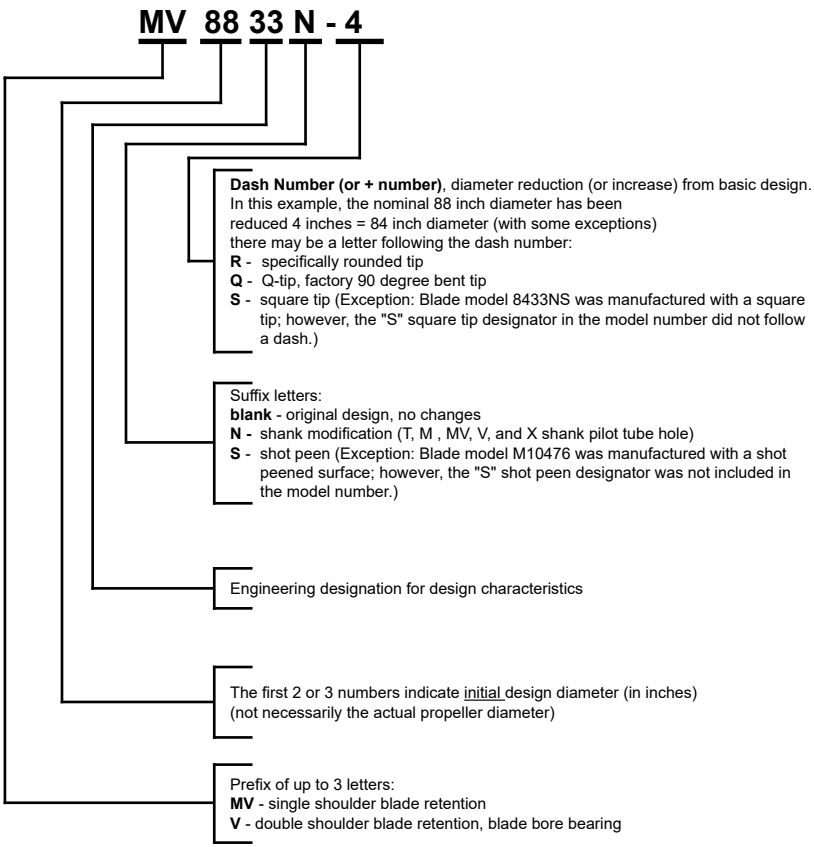
C. Propeller Model Designation

(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 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.



Aluminum Blade Model Designations
Table 2-2

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 charactieristics.

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

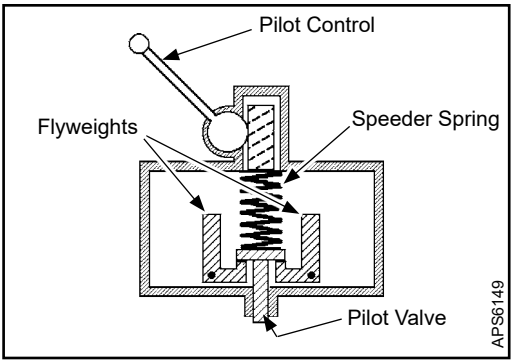
B. Blade Model Designation

(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 (/).

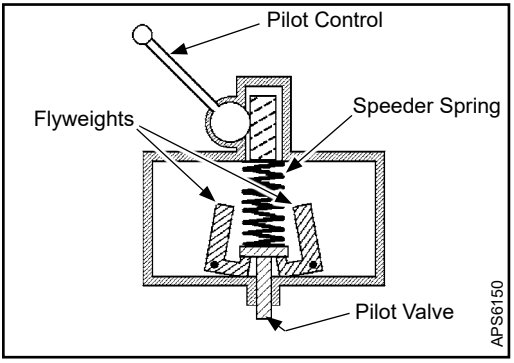
(a) Example: *propeller model number / blade model number*

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

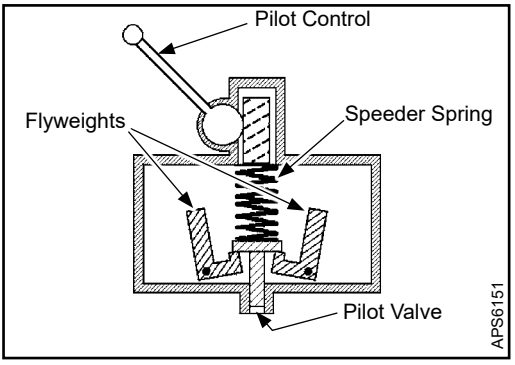
(3) Refer to Table 2-2 for a description of the characters used in the blade model number.



Governor in Onspeed Condition
Figure 2-2



Governor in Underspeed Condition
Figure 2-3



Governor in Overspeed Condition
Figure 2-4

3. Governors (Rev. 3)

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.

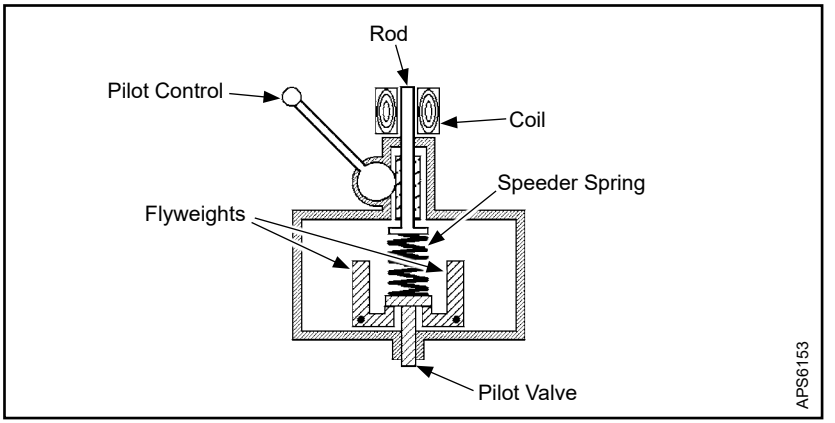
(2) When the engine is operating at the RPM set by the pilot using the cockpit control, the governor is operating **onspeed**. Refer to Figure 2-2. In an onspeed condition, the centrifugal force acting on the flyweights is balanced by the speeder spring, and the pilot valve is neither directing oil to 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 2-3. 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 2-4. 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) 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 the RPM of the engines consistent, but also keeps the propeller blades 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.



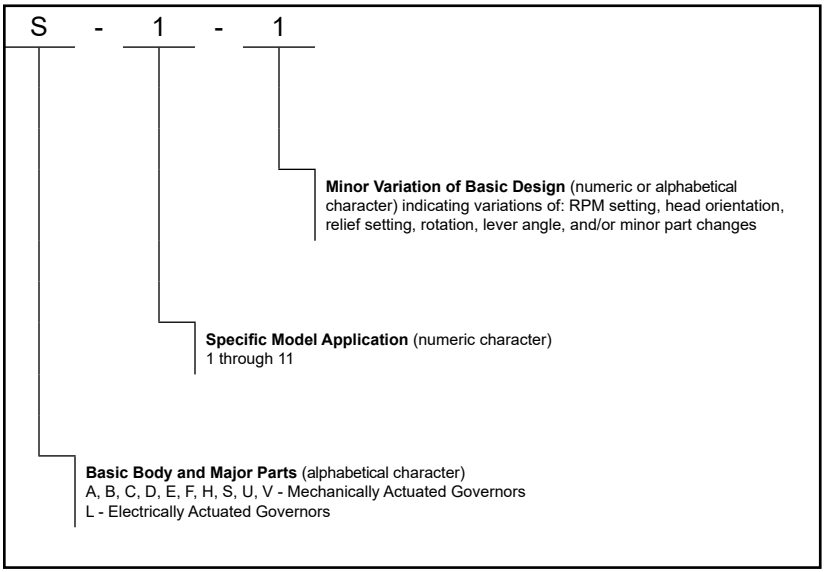
Synchronizer/Synchrophaser Governor
Figure 2-5

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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1. Tools, Consumables, and Expendables

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

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

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

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

2. Pre-Installation (Rev. 5)

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

            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 cardboard shipping container.

(3) Remove the cardboard from the hub and blades.

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

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

(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 “Knockdown” Propeller

(1) Propellers that were disassembled for shipment must be reassembled by trained personnel in accordance with the applicable propeller maintenance manual.

(2) For installation of ice protection systems manufactured by Hartzell, refer to Hartzell Propeller Ice Protection System Manual 180 (30-61-80).

(3) For installation of ice protection systems not manufactured by Hartzell, refer to the applicable TC or STC holder’s Instructions for Continued Airworthiness (ICA).

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.

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

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

CAUTION 1: FOR A PROPELLER THAT DOES NOT USE A LUBRICATED (WET) TORQUE, THE MOUNTING HARDWARE MUST BE CLEAN AND DRY TO PREVENT EXCESSIVE PRELOAD OF THE MOUNTING FLANGE.

CAUTION 2: TORQUE VALUES WITH "WET" NOTED AFTER THEM ARE BASED ON LUBRICATED THREADS WITH APPROVED ANTI-SEIZE COMPOUND MIL-PRF-83483( ).

CAUTION 3: REFER TO FIGURE 3-1 FOR TORQUE READING WHEN USING A TORQUE WRENCH ADAPTER.

Hardware	Torque
Shaft Nut A-2053	300 Ft-Lb (407 N•m)*
Oil Transfer Unit Mounting Bolt B-3805	18-22 Ft-Lb (24-30 N•m)**
Piston Rod Nut A-484-2	20-22 Ft-Lb (27-29 N•m)
Spinner Mounting Nut A-1373	30 Ft-Lb (41 N•m)**
Nut (Governor-to-"T" Drive) B-3808-5	18-20 Ft-Lb (24-26 N•m)**

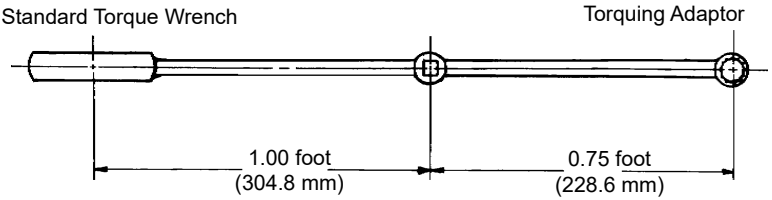
* Torque tolerance is ±10 Ft-Lb (±13.6 N•m)

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

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

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

Torque Values
Table 3-2



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

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.

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

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.

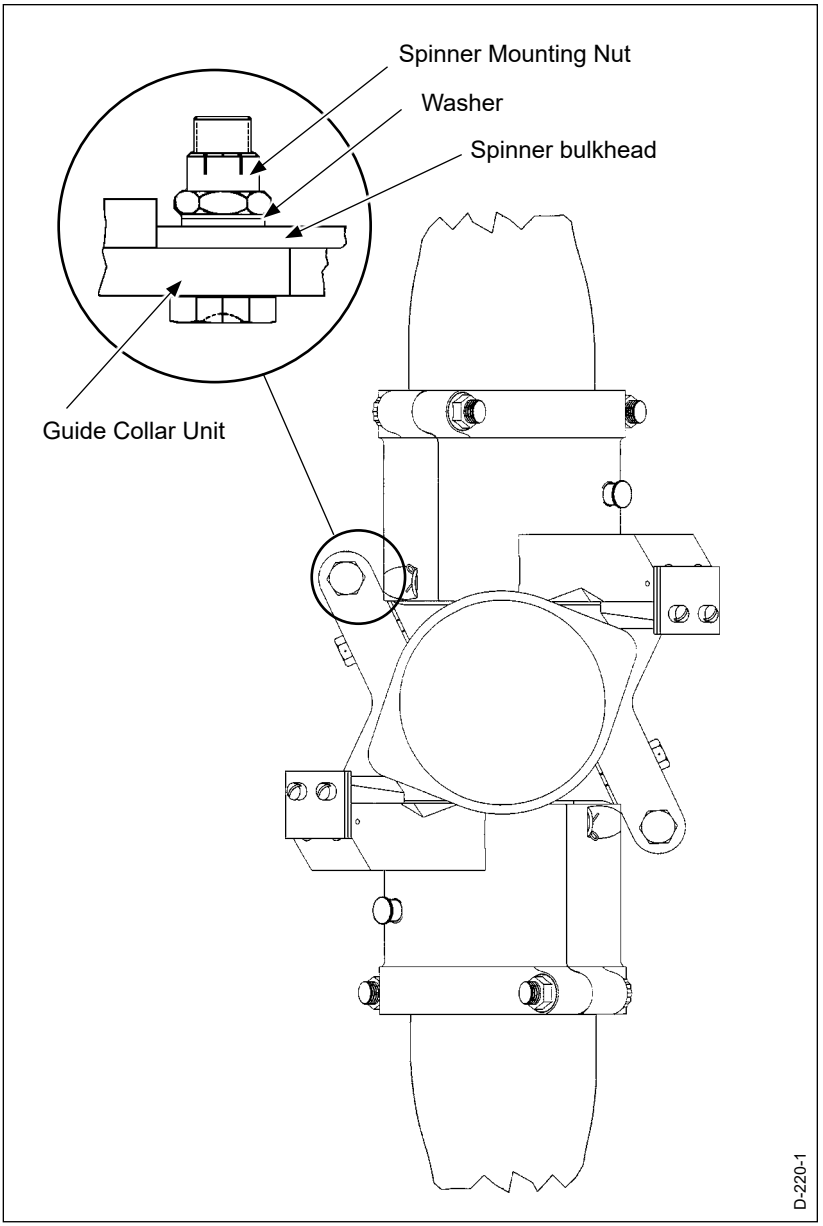
(b) Correct tension in a fastener depends on a variety of known load factors and can influence fastener service life.

(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.



Spinner Bulkhead Installation
Figure 3-2

4. Bulkhead Installation

CAUTION 1: THE PROPELLER IS STATICALLY BALANCED USING THE BULKHEAD AS A POINT FOR ATTACHING THE BALANCE WEIGHTS.

CAUTION 2: DO NOT INSTALL THE BALANCE WEIGHTS ON THE BLADE CLAMP.

A. Installation of Spinner Bulkhead

CAUTION: IF INSTALLING A NEW OR OVERHAULED REPLACEMENT SPINNER BULKHEAD, THE BALANCE WEIGHTS FROM THE PREVIOUS BULKHEAD MUST BE TRANSFERRED TO THE REPLACEMENT BULKHEAD.

(1) If installing a new or overhauled replacement spinner bulkhead, install the bulkhead in relation to the blade and balance weights from the previous spinner bulkhead.

(2) Align the index marks on the propeller guide collar with the marks on the bulkhead.

(3) Refer to Figure 3-2. Install the spinner bulkhead to the propeller guide collar at four locations.

(4) Torque the spinner mounting nuts in accordance with Torque Values Table 3-2.

5. Spinner Adapter Ring Installation (if applicable)

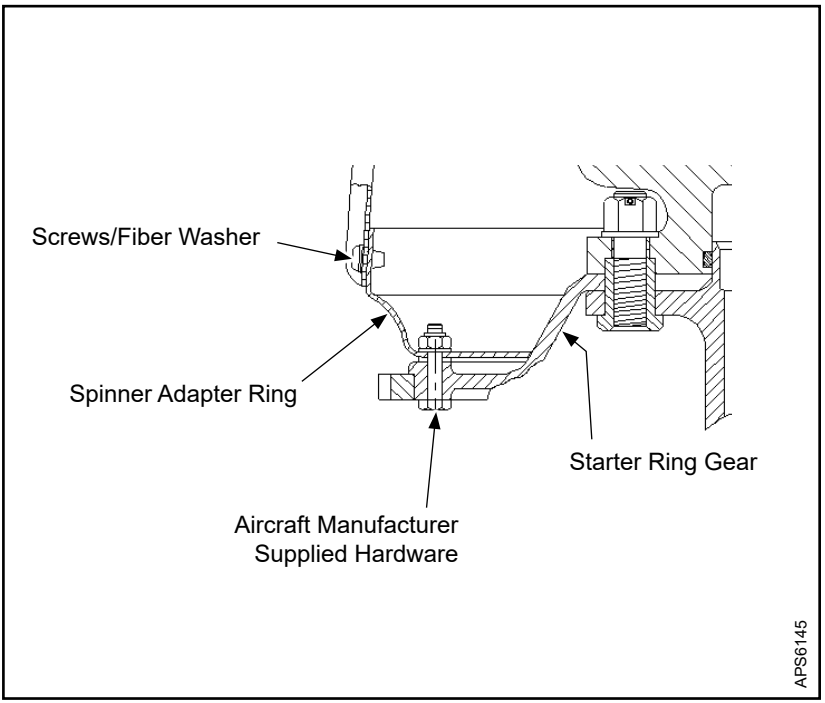
   A. Installation

      (1) Install the spinner adapter ring to the starter ring gear using hardware supplied by the airframe manufacturer. Refer to Figure 3-3.

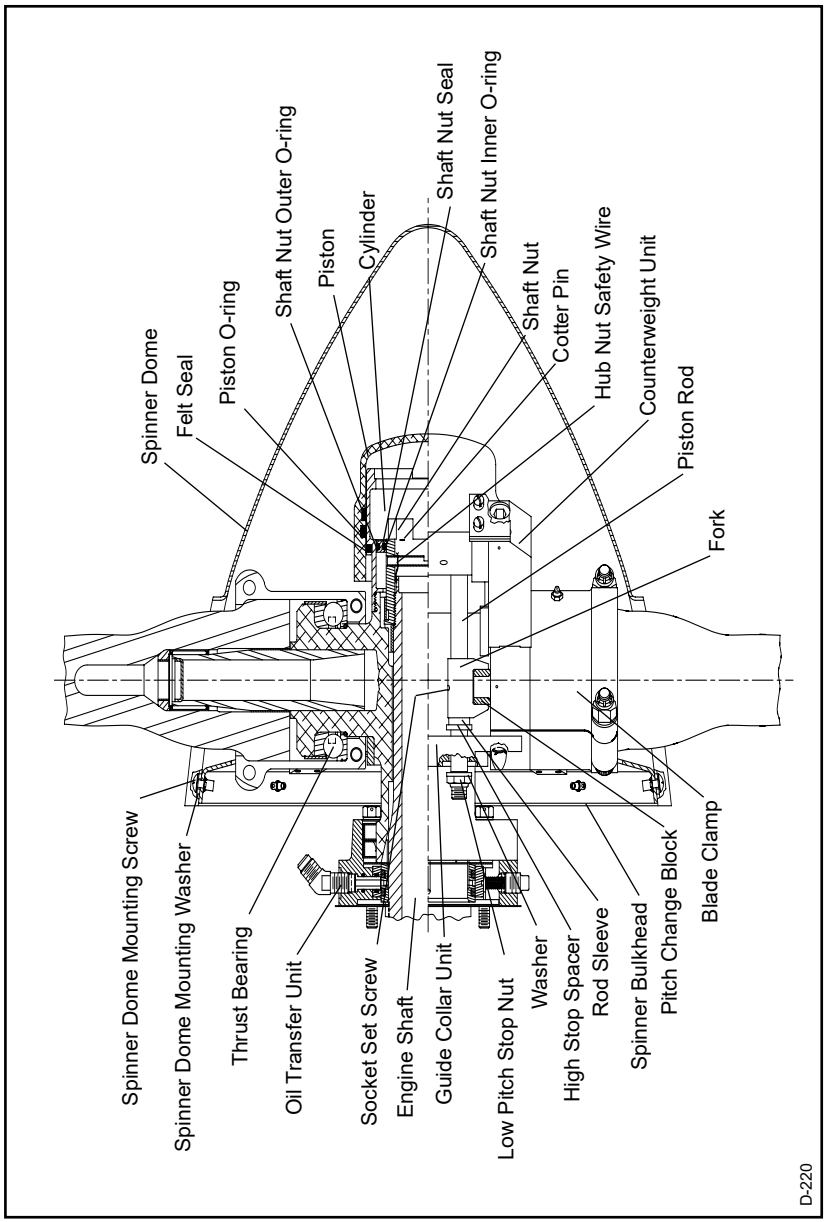
      CAUTION: BOLTS INSTALLED INCORRECTLY CAN DAMAGE ENGINE COMPONENTS.

         (a) Install spinner adapter bolts so that the bolt heads are at the rear of the starter ring gear. Refer to Figure 3-3.

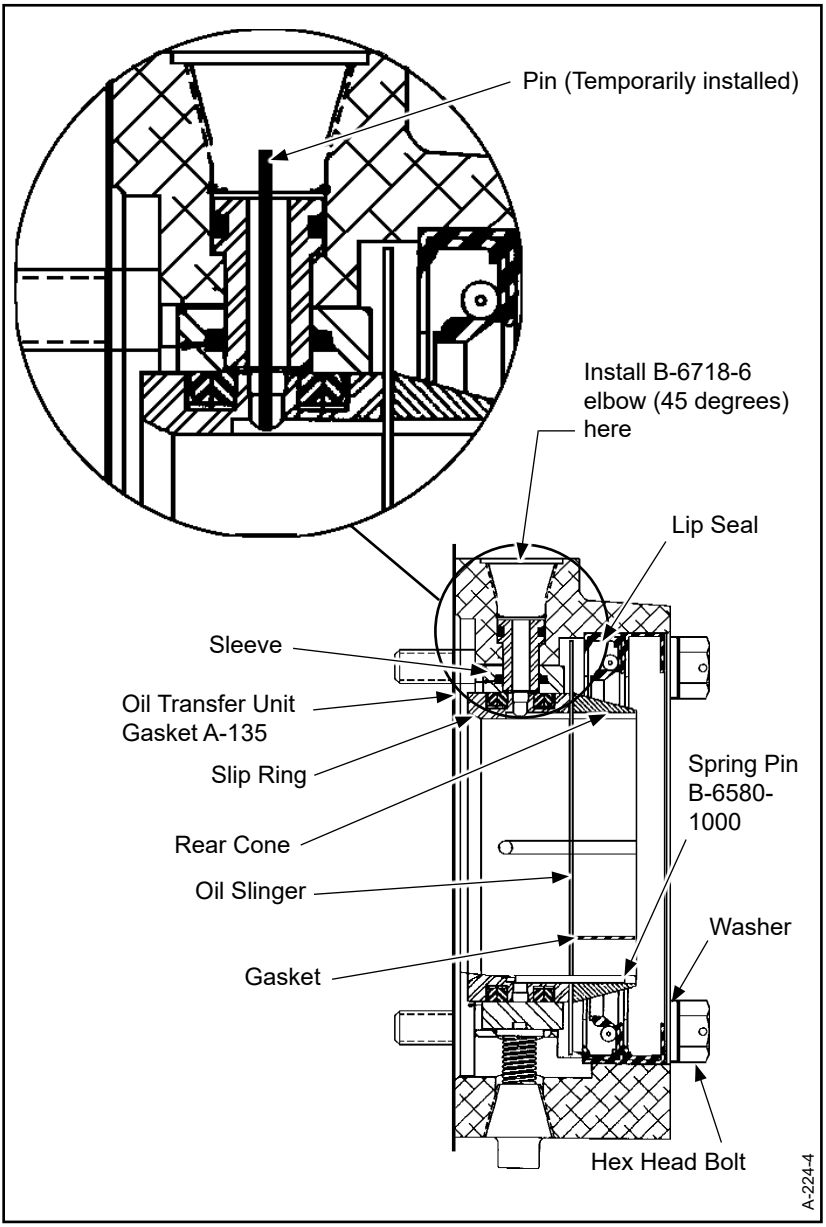
      (2) Torque the bolts as specified by the airframe manufacturer.



Spinner Adapter Ring
Figure 3-3



HC-A2(MV,V)20-4A1 Propeller Assembly
Figure 3-4



Oil Transfer Unit Installation
Figure 3-5

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.

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

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

6. Propeller Installation
Refer to Figure 3-4.

A. Precautions

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

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

(2) Follow the STC holder's instructions for propeller installation.

(a) Hartzell Propeller LLC STC SA1-570, for the Beech Bonanza, and Hartzell Propeller LLC STC SA1-635 for Navion aircraft

(b) An STC packet for these aircraft may be obtained at no charge. Contact Hartzell Propeller Product Support at (937) 778-4379 or by email at techsupport@hartzellprop.com.

B. A-224-( ) Oil Transfer Unit Installation
Refer to Figures 3-4 and 3-5.

(1) Verify that the crankshaft seal (Continental P/N 530589) is not installed. Remove the seal if it is installed.

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.

(2) Using Quick Dry Stoddard Solvent or MEK, clean the engine case encircling the engine shaft where the oil transfer unit will mount.

(3) Install the oil transfer unit mounting gasket around the engine shaft on the engine case. Refer to Figure 3-5 and Table 3-1.

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

(4) A new oil transfer unit is shipped from the factory with a temporary pin installed in the oil port to prevent the slip ring from moving and becoming misaligned. If not already installed, install a temporary pin, as shown in Figure 3-5, to prevent the slip ring from moving during installation of the oil transfer unit.

CAUTION 1: DO NOT REMOVE THE TEMPORARY PIN FROM THE OIL TRANSFER UNIT UNTIL THE OIL TRANSFER UNIT IS BOLTED TO THE ENGINE CASE.

CAUTION 2: DO NOT FORCE THE OIL TRANSFER UNIT ON THE ENGINE SHAFT. THIS WILL PUSH THE OIL RING OUT OF POSITION.

(5) Position the oil transfer unit around the engine shaft, against the gasket on the engine case and align the four through-holes in the oil transfer unit housing with the four gasket holes and engine case threaded holes.

NOTE: The lip seal must face toward the propeller.

(6) Install one washer on each of the four hex head oil transfer unit mounting bolts. Refer to Table 3-1.

(7) Move the hex head bolts (with installed washers) through each of the four transfer unit housing through-holes, and thread the bolts into the engine case.

(8) Using a staggered sequence, torque the four hex head bolts in accordance with Table 3-2, “Torque Values”.

(9) Remove the temporary pin that was previously installed to prevent the slip ring from moving during installation of the oil transfer unit. Refer to Figure 3-5.

(10) Install the spring pin into one of four oil passages between the oil slinger, slip ring and engine shaft.

NOTE: The oil passages are cut into the slip ring ID and are positioned parallel to the engine shaft centerline.

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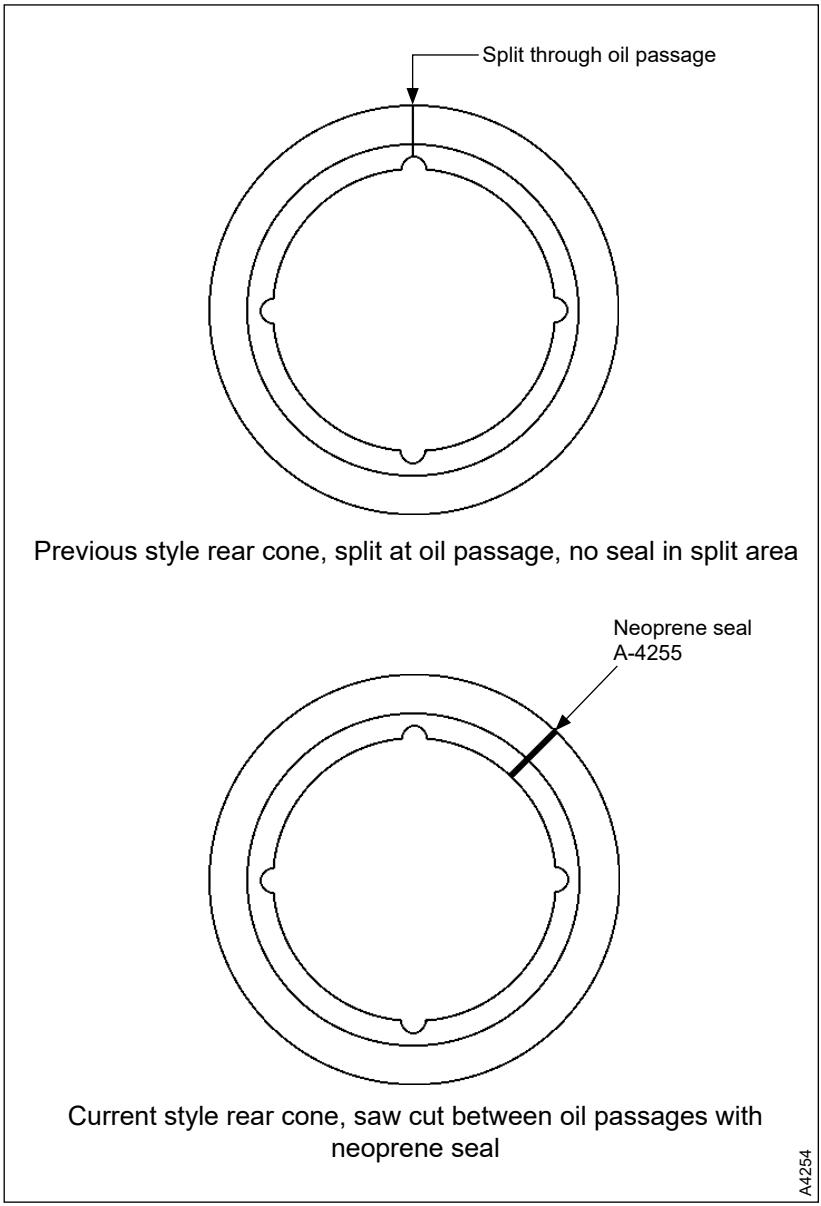


Rear Cone
Figure 3-6

CAUTION 1: THE TAPERED END OF THE REAR CONE MUST FACE TOWARD THE PROPELLER SO THE PROPELLER WILL INSTALL PROPERLY. REFER TO FIGURE 3-5.

CAUTION 2: A PREVIOUSLY MANUFACTURED REAR CONE WAS SPLIT THROUGH ONE OF THE OIL PASSAGES. NO GASKET WAS INSTALLED IN THIS SPLIT. A REAR CONE OF CURRENT DESIGN IS CUT BETWEEN THE OIL PASSAGES, AND A NEOPRENE GASKET IS INSTALLED. WHEN USING A REAR CONE OF CURRENT DESIGN, THE GASKET MUST BE INSTALLED. REFER TO FIGURE 3-6.

(11) If not already installed or if missing, install the A-4255 neoprene seal in the rear cone.

(a) Thoroughly clean the saw cut area of the rear cone to remove any oil or foreign material.

(b) Install the A-4255 neoprene seal, as shown in Figure 3-6, using Loctite 495 Super Bond.

NOTE: It is not necessary to trim the excess material from the neoprene seal.

(12) Slide the rear cone over the engine shaft and align one of the four ID oil passages with the spring pin.

(13) Slide the rear cone over the spring pin and against the slinger ring.

WARNING: MAKE SURE THE SLING IS SUITABLY RATED TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING INSTALLATION.

C. Propeller Installation

(1) With a suitable crane hoist and sling, carefully move the propeller assembly to the aircraft engine shaft in preparation for installation.

CAUTION: THE PISTON MUST BE REMOVED BEFORE INSTALLING THE PROPELLER ON THE AIRCRAFT. IF THE PISTON HAS ALREADY BEEN REMOVED, PROCEED TO STEP (3) IN THIS SECTION.

(2) Piston Removal

(a) Remove the self-locking nut and washer from the end of each guide rod.

(b) Loosen the set screw in each fork.

(c) Rotate the forks away from the clamp link screws.

(d) The piston ears, pitch change forks, pitch change blocks, guide collar, and counterweights should have corresponding index numbers (1 and 2) marked with a felt-tipped pen. If they are not marked, number them with a felt-tipped pen.

NOTE: This will ensure that the components are reassembled in their original locations.

(e) Slide the piston away from the hub and to the low pitch position, until the piston rods clear the guide collar, sleeve, and fork.

NOTE: Make sure that the sleeve, spacer, and fork remain with each piston rod. Use tape to hold them in place.

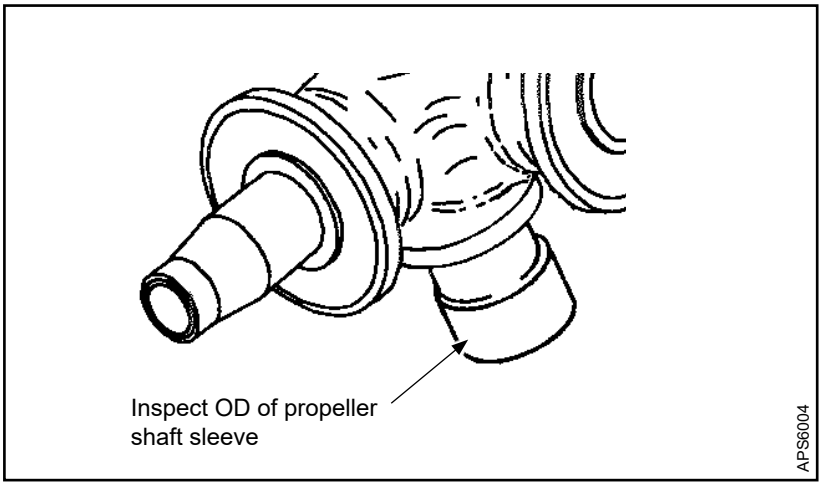
CAUTION: TO PREVENT OIL LEAKAGE, THE OUTSIDE SURFACE OF THE PROPELLER SHAFT SLEEVE FACING THE OIL TRANSFER UNIT MUST BE SMOOTH.

(3) Inspect the OD of the propeller shaft sleeve installed on the hub shaft end facing the oil transfer unit. The propeller shaft sleeve must be smooth and free of nicks or gouges. Refer to Figure 3-8.

(4) Replace the propeller shaft sleeve if nicks or gouges are present. Refer to the Maintenance Practices chapter of this manual for removal and installation procedures.

(5) Earlier manufacture propeller hubs were chromium plated in the seal area for the A-224-4 oil transfer unit. If any damage or grooves are present in this area of the hub, or if there is an existing propeller shaft sleeve installed that has damage, install a Hartzell Propeller A-249 propeller shaft sleeve as follows:

(a) Thoroughly clean the ID of the A-249 propeller shaft sleeve and the area where the hub seals in the oil transfer unit contact.



Inspection of Propeller Shaft Sleeve OD
Figure 3-8

(b) Apply a liberal coating of RTV-732 silicone on the hub.

(c) Using the installation tool supplied with the A-249 propeller shaft sleeve, press the sleeve over the hub so the rear surface of the sleeve is flush or no more than 1/8 inch (3.17 mm) past the rear most hub surface.

(d) Wipe off any excess silicone sealant.

(e) Allow the silicone to cure before reinstalling the propeller.

NOTE: Cure time may vary slightly. A 24-hour cure time is sufficient.

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.

(6) Clean the propeller hub spline and engine spline surfaces with Quick Dry Stoddard Solvent or MEK.

(7) Slide the propeller hub on the engine shaft and into the lip seal in the oil transfer unit.

(8) Turn the propeller shaft nut onto the engine shaft threads.

CAUTION: OVERTORQUE OF THE SHAFT NUT WILL CAUSE COLLAPSE OF THE OIL TRANSFER UNIT SLIP RING. EXCESSIVE WEAR, INTERNAL LEAKAGE, IMPROPER PERFORMANCE, AND PREMATURE REPLACEMENT OF THE OIL TRANSFER UNIT WILL RESULT.

(9) Using tool BST-2910, torque the shaft nut on the engine shaft. Refer to Table 3-2 and Figure 3-1 to determine the correct torque value to which the torque wrench must be set.

(10) Safety wire the shaft nut to the engine shaft with 0.032 inch (0.81 mm) minimum diameter stainless steel wire.

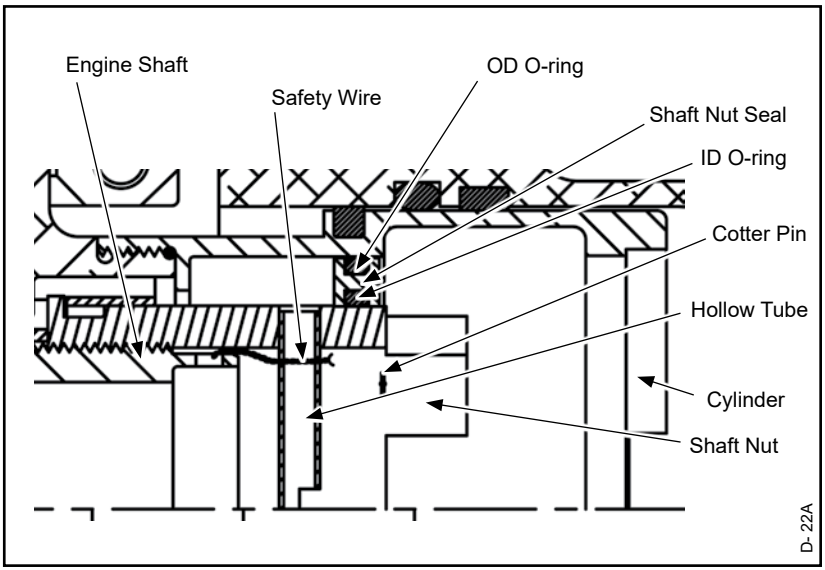
NOTE: The safety wire should be routed between a hole in the end of the engine shaft and the hollow tube attached to the shaft nut. Refer to Figure 3-9.

(11) Lubricate the inner and outer shaft seal O-rings (Table 3-1) with reciprocating engine oil and install them in the shaft nut seal. Refer to Figure 3-9.

(12) Slide the shaft nut seal over the shaft nut and inside the cylinder. Refer to Figure 3-9.

NOTE: The shaft nut seal will ensure that the piston cavity is purged of air to eliminate the possibility of surging.

(13) Install the four cotter pins (Table 3-1) into the shaft nut holes (from ID to OD), bending the ends of each cotter pin perpendicular to the engine shaft, to secure the shaft nut seal in place. Refer to Figure 3-9.



Safetying the Shaft Nut
Figure 3-9

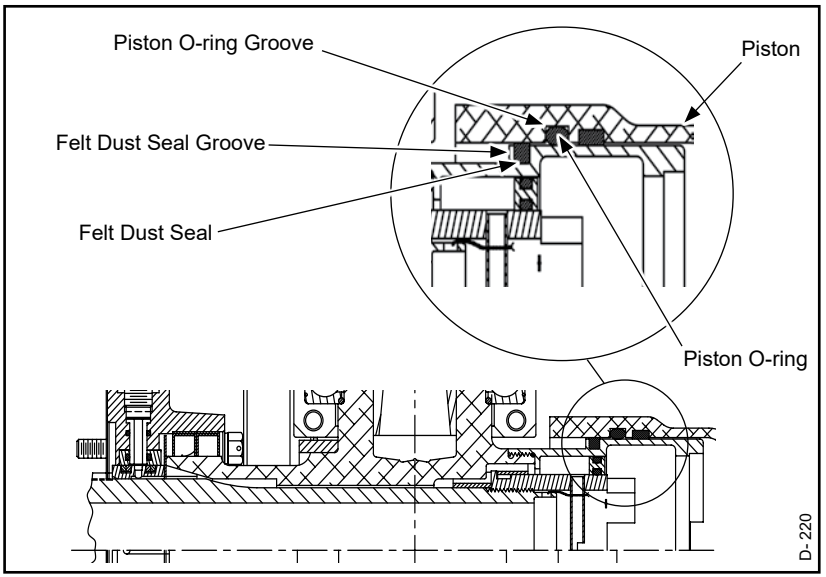
(14) If the piston O-ring (Table 3-1) and the felt dust seal are not already installed, perform the following steps. Refer to Figure 3-10:

(a) Lubricate the piston O-ring with aviation grade reciprocating engine oil and carefully install it in the groove provided for it in the piston.

(b) Cut the felt dust seal material to the necessary length.

NOTE: The felt seal material should be cut on a 30 degree diagonal so there will be an overlap with a smooth, fuzz-free surface.

(c) Install the felt dust seal material in the groove provided for it in the cylinder.



Installing Piston O-Ring and Felt Dust Seal
Figure 3-10

CAUTION: TO MAINTAIN PROPER BLADE ANGLES, IT IS IMPORTANT THAT THE PISTON, SLEEVE, AND FORK BE REINSTALLED IN THE SAME POSITION AS WHEN IT WAS ORIGINALLY ASSEMBLED. INDEX NUMBERS ON THE PISTON AND THE GUIDE COLLAR ARE PROVIDED TO ENSURE PROPER POSITIONING.

(15)Locate and match up the index numbers (1 and 2) on the forks and piston ears with the corresponding index numbers on the counterweights.

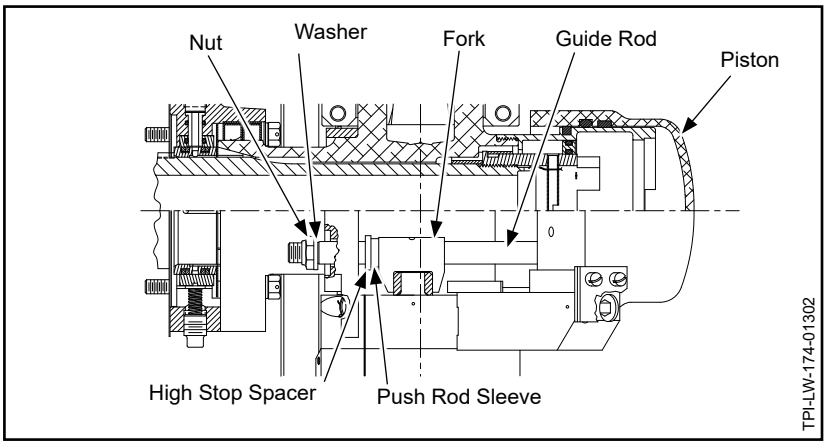
NOTE: The index marks will be either impression stamped or drawn with a felt-tipped pen.

(16) If applicable, remove the tape that was applied to each rod sleeve and high stop spacer to keep them with the piston.

(17)Remove the rod sleeve and high pitch stop spacer from each piston rod.

(19)Install the high pitch stop spacer (Table 3-1) on each rod sleeve.

(20)Install the rod sleeve, with high pitch stop spacer, in the guide collar, aligning it with the appropriate index numbers (1 and 2) on the pitch change block. Refer to Figure 3-11.



Guide Rod Attachment Details
Figure 3-11

(21) Lubricate the entire outside diameter surface of the cylinder with reciprocating engine oil.

(22) Locate and match the index numbers (1 and 2) on the pitch change blocks with the corresponding index numbers on the counterweights.

(23) Position the pitch change block on the clamp linkscrew, as shown in Figure 3-12.

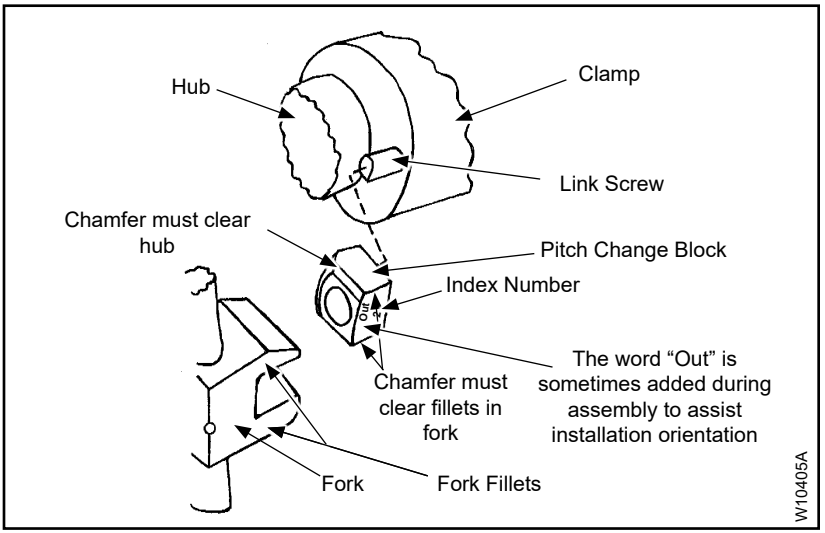
NOTE: Position the word “OUT” on the pitch change block if present. Refer to Figure 3-12.

(24) Remove the fork from each piston rod.

CAUTION: POSITION THE THICK SIDE OF THE FORK ON THE ENGINE SIDE OF THE PITCH CHANGE BLOCK.

(25) Install the fork on the pitch change block, matching the index numbers (1 and 2) on the counterweights.

(26) Slide the piston on the cylinder while sliding the piston rods through the bores in the fork, rod sleeve, high stop spacer, guide collar unit.



Positioning Pitch Change Block on Linkscrew
Figure 3-12

(27) Position the fork.

(28) Install the washer and self-locking nut (Table 3-1) on the end of each of the guide rods.

(29) Torque the self-locking nut against the sleeve on the piston guide rod. Refer to Table 3-2.

(30) Tighten the set screw in the fork until slightly snug.

(31) Peen the edge of the hole over the set screw to safety the set screw in the fork.

(32) Install the spinner dome as follows:

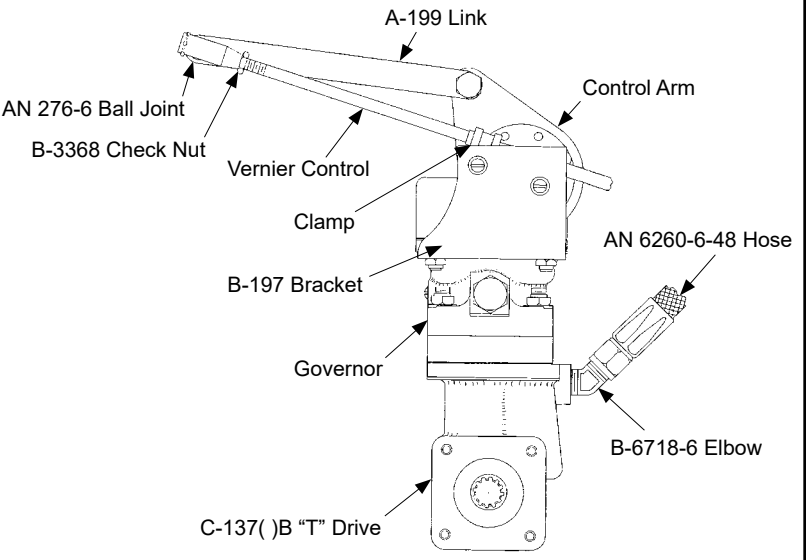
NOTE: The following instructions relate to Hartzell Propeller spinners only. If the airframe manufacturer produced the spinner assembly, refer to the airframe manufacturer's or STC holder's manual for spinner installation instructions.

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

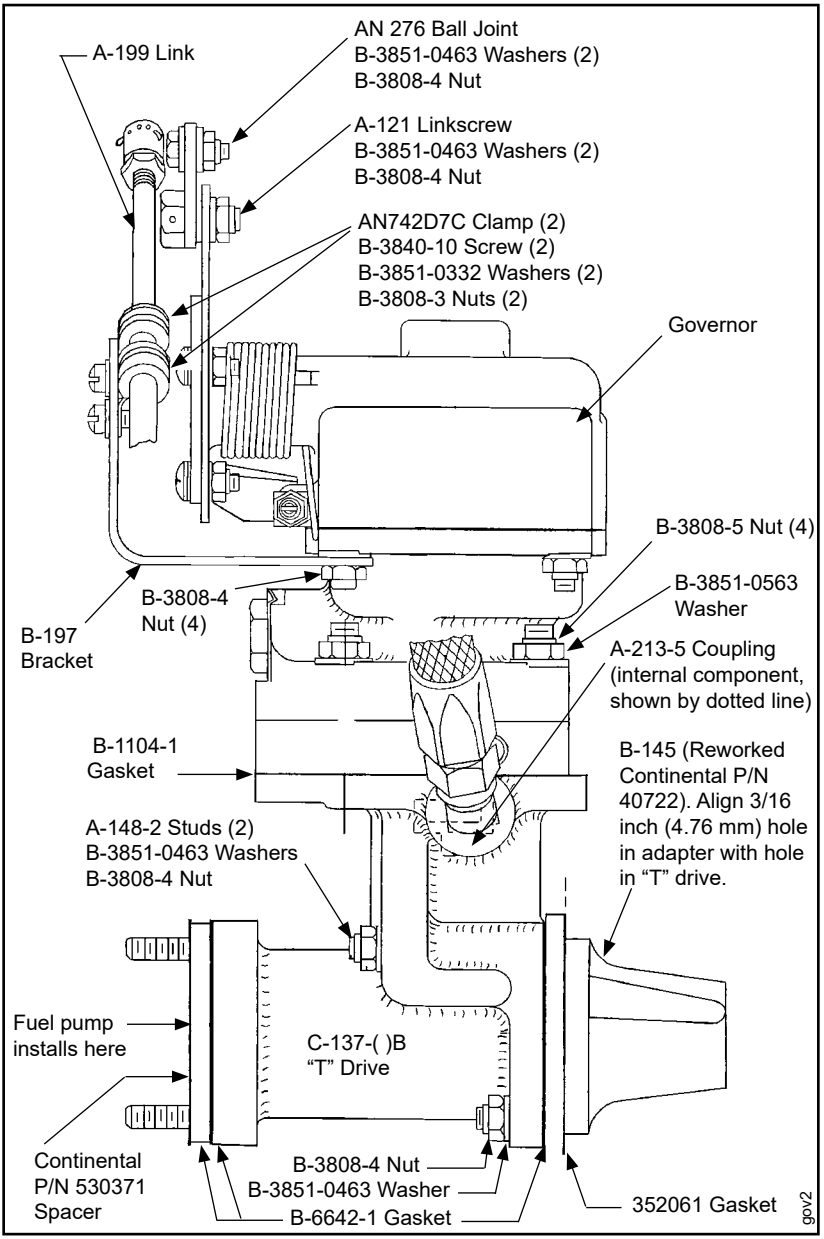
CAUTION 2: THE SPINNER DOME WILL WOBBLE IF NOT ALIGNED PROPERLY, AND MAY AFFECT THE BALANCE OF THE PROPELLER.

(a) Carefully slide the spinner dome over the reassembled propeller.

(b) Secure the spinner dome to the spinner bulkhead with the supplied screws and washers.



Installation of Governor and T-Drive
Figure 3-13



Installation of Governor and T-Drive
Figure 3-14

CAUTION: MAKE SURE THE A-213-5 COUPLING IS IN PLACE BEFORE INSTALLING THE GOVERNOR ON THE "T" DRIVE. REFER TO FIGURE 3-14.

D. Installation of Governor and "T" Drive

(1) Install the B-6718-6 elbow (45 degrees) on the C-137-1B "T" drive unit, as shown in Figure 3-13.

(2) Install the gasket on the governor pad, as shown in Figure 3-13.

(3) Install the B-197 bracket on the governor, as shown in Figure 3-14.

(a) Remove the two (2) B-3808-4 nuts and washers from the B-197 bracket.

(b) Install the B-197 bracket on the governor with the two (2) B-3808-4 nuts and washers, as shown in Figure 3-14.

(4) Install the governor on the governor pad C-137-1B "T" drive unit, with four (4) B-3808-5 nuts and B-3851-0563 washers.

(5) Torque the four (4) B-3808-5 nuts in accordance with Torque Values Table 3-2.

(6) Install the A-199 link on the governor, with the A-121 linkscrew, two (2) B-3851-0463 washers, and B-3808-4 nut, as shown in Figure 3-14.

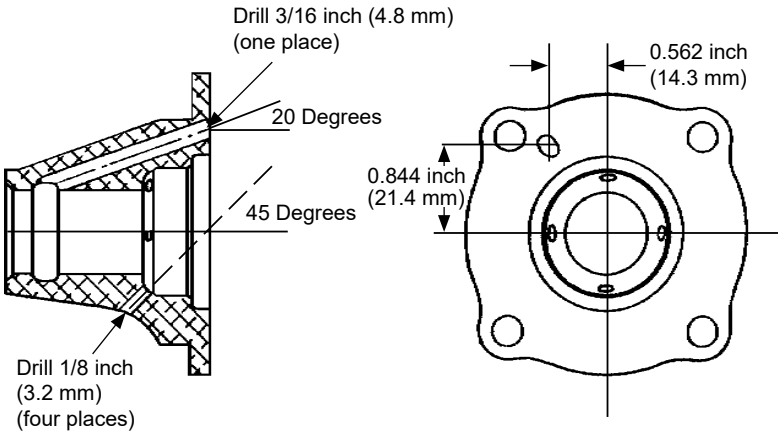
(7) Install the two (2) AN742D7C clamps on the B-197 bracket, as shown in Figure 3-14, but do not tighten the screws.

(8) Remove the fuel pump from the pad on the engine. Cover the opening of the fuel lines with tape.

NOTE: Do not stuff material in the lines.

(9) Remove the adapter (Continental P/N 40722) and gear shaft (Continental P/N 40724).

NOTE: On dry sump (Bonanza) engines, the shaft gear will remain in the engine due to the scavenge pump. The Woodruff drive key will not pass through the forward bearing. Remove only the 40722 adapter on these engines.



NOTE: Two holes are drilled by Continental.
Two additional holes are added.

Fig301

Modification of Shaft Gear Adapter (Continental P/N 40722)
Figure 3-15

(10) On Navion (wet sump) engines only, remove the gear shaft from the adapter.

CAUTION: THE SEAL (CONTINENTAL P/N 25102) IS NOT USED WHEN USING THE “T” DRIVE.

(11) Remove the seal (Continental P/N 25102) from the adapter.

(12) Modify the shaft gear adapter (Continental P/N 40722) by drilling two additional 1/8 inch (3.17 mm) holes through and one 3/16 inch (4.76 mm) hole, 1.750 inch (44.45 mm) deep as shown in Figure 3-15.

NOTE: Two holes are already drilled in the adapter by Continental.

(13) After the drilling operation, thoroughly clean the adapter to remove chips and dirt.

(14) For Bonanza installations only:

(a) Use an AN742D4C clamp to secure the cabin heater control line to the fire wall.

(b) Bend the hydraulic brake reservoir supply line to clear the governor “T” drive-fuel pump assembly.

(c) Alter the cowl flap mechanism for clearance.

1 While the cowl flap is closed, remove the bolt on the right side of the engine that holds the crescent-shaped control arm to the shaft.

2 Looking at the left side of the engine, turn the pear- shaped control arm clockwise 75 degrees.

3 Mark the position of the new bolt hole on the right side of the engine.

4 Remove the shaft and drill a new hole.

5 Reassemble the cowl flap mechanism.

(d) Relocate the fuel pump drain hole and bend the fuel pump air blast tube as necessary.

(15) Remove the fuel lines leading to the fire wall and carburetor.

(16) Replace the fuel line with AN6260-6-29 hose and reroute the hose under the engine cylinders with two AN742D12C clamps.

(17) On a Bonanza installation only, install the 6-C6BX-S bulkhead elbow on the fuel line fire wall fitting and install the original fuel line.

(18) Remove the two outboard studs on the engine pad and install the longer studs A-148-2, as shown in Figure 3-14.

(19) Install a new gasket 352061 on the pad of the engine, as shown in Figure 3-14.

(20) On a Navion installation only, replace the gear shaft in the adaptor.

(21) Replace this assembly in the engine, aligning the 3/16 inch (4.76 mm) hole with the hole in the “T” drive, as shown in Figure 3-14.

(22) Install the new AN4045-1 gasket on the adaptor B-145 (Reworked Continental Engines P/N 40722).

(23) Install the governor “T” drive assembly on the engine pad using four B-3808-4 nuts and four B-3851-0463 washers.

(24) Install a new B-6642-1 gasket on the fuel pump pad of C-137-1B “T” drive, and a new B-6642-1 gasket between the heat shield and the fuel pump. Refer to Figure 3-13.

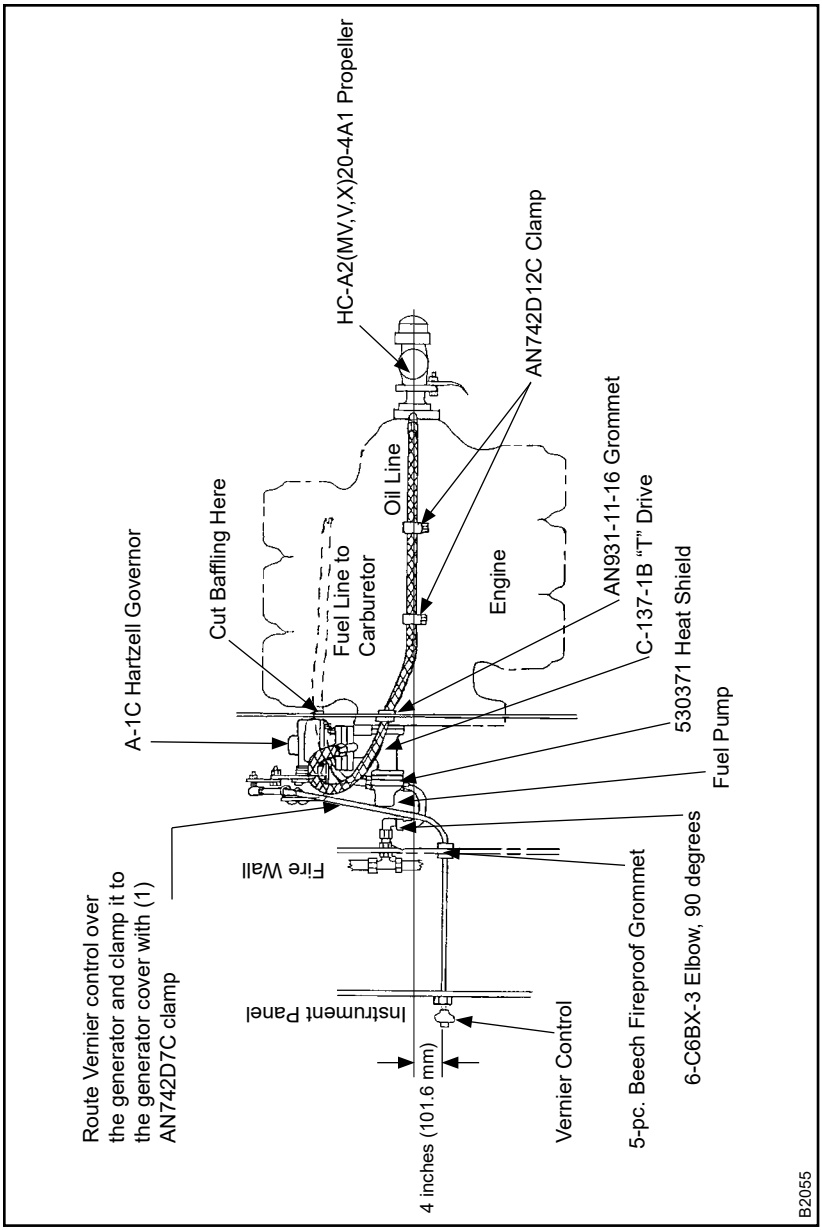
NOTE: An AN-4045-1 gasket may be used in place of the B-6642-1 gasket. A total of three would be required for the “T” drive and fuel pump installation.

(25) Install the fuel pump on the “T” drive with the #530371 heat shield between the fuel pump and the “T” drive.

(26) Remove the tape from the opening of the fuel lines.

CAUTION : MAKE SURE THAT THE FITTING INSTALLED IN THE OIL TRANSFER HOUSING DOES NOT BOTTOM AGAINST THE OIL TRANSFER PLUG.

(27) Connect the AN6260-6-48 hose to the fitting in the “T” drive and route it over the center of the engine, through the 1.00 inch (25.4 mm) diameter hole in the baffling, with grommet AN931-11-16.



Installation of Oil Line and Vernier Control
Figure 3-16

(28) Attach the hose to the engine with the AN 742C12C clamps, as shown in Figure 3-16.

NOTE: Measure the depth of the hole in the housing, and measure the same length on the fitting to ensure that no contact is made between the fitting and the oil transfer plug.

(29) Remove the plastic plug and alignment pin from the pressure port of the oil transfer unit.

(30) Install a B-6718-6 elbow (45 degrees) on the pressure side of the oil transfer unit, as shown in Figure 3-5.

(31) Attach the oil line from the “T” drive to the elbow.

(32) On engines that previously had an HC-12(X,V)20-7 propeller installed:

(a) Remove the old pressure and drain the lines.

(b) Install 1/8 inch (3.17 mm) pipe plugs in the engine where the lines were removed.

(33) Install the vernier control 4 inches (101.6 mm) to the right of the center of the cockpit, just below the dashboard.

(a) The vernier control is part number A-970BLO563 (Gerdes), 3A729-7 (Shakespeare) or A-970-10-0563 (ACS).

(b) The control should go straight forward, through the 3/4 inch (19.05 mm) hole in the fire wall and through the five-piece Beech fireproof grommet.

NOTE: The grommet consists of one 112436-6 retainer, two 112413-4 ball halves, and two 112412 split grommets.

(c) Route the control over the generator and use the AN742D7C clamp to secure the control to the generator cover.

(d) Route the control through the AN742D7C clamps on the B-197 Bracket. Refer to Figures 3-13 and 3-14.

(34) Install the B-3368 check nut and the AN276-6 ball joint on the vernier control. Refer to Figure 3-15.

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

(35) Push the vernier control handle in the cockpit to the forward or “in” position.

(36) Attach the ball joint to the A-199 link with two AN960-416 washers and one B-3308-4 nut, as shown in Figure 3-14.

(37) Tighten the clamps on the B-197 bracket and tighten the check nut against the ball joint.

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

7. Spinner Dome Installation (Rev. 4)

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

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

NOTE 1: The following instructions relate to Hartzell Propeller LLC spinners only. In some cases, the airframe manufacturer produced the spinner assembly. If so, refer to the airframe manufacturer's manual for spinner installation instructions.

NOTE 2: The B-3845-8 screws supplied for spinner domes with straight mounting holes are 0.500 inch (12.70 mm) long. If correct thread engagement cannot be achieved when installing the spinner dome, B-3845-9 screws may be used. The B-3845-9 screws are 0.562 inch (14.27 mm) long.

A. Installation Procedure

(1) Install the spinner dome.

(a) If anti-ice travel tubes are installed:

CAUTION: THE TRAVEL TUBES MUST NOT TOUCH THE SPINNER DOME BLADE CUTOUT.

1 Make sure there is clearance between the travel tubes and the spinner dome blade cutouts.

2 Make adjustments to the position of the travel tubes in accordance to Hartzell Propeller Ice Protection System Manual 180 (30-61-80).

CAUTION: MAKE SURE OF PROPER THREAD ENGAGEMENT FOR THE SCREWS IN THE NUT PLATES. APPROXIMATELY 1 TO 1 1/2 THREADS MUST EXTEND PAST THE BULKHEAD NUTPLATES. TO AVOID DAMAGING THE AIRCRAFT COWLING, THE SCREWS MUST NOT EXTEND MORE THAN THREE THREADS PAST THE BULKHEAD NUTPLATES.

(2) Attach the spinner dome to the spinner bulkhead with the supplied screws and washers. Refer to Table 3-5.

(a) Install a screw in the hole(s) centered between each two adjacent blade cutouts.

1 If the centerline between the adjacent blade cutouts does not align with a mounting hole, install screws in the two holes closest to the centerline.

CAUTION: BE SURE THE SCREWS DRAW THE SPINNER DOME TIGHT TO THE BULKHEAD.

(b) Tighten the screws until snug, then turn an additional 1/8 rotation.

CAUTION: IN THE FOLLOWING STEP, TIGHTEN EACH SCREW BEFORE INSTALLING THE NEXT SCREW.

(c) Working from the screw(s) previously installed at the centerline toward the blade cutouts, install the remaining screws one at a time.

1 Tighten each screw until snug, then turn an additional 1/8 rotation before installing the next screw.

Dome Mtg. Holes	Washer	Screw
Straight	A-1020 Washer, Fiber	B-3845-8 10-32, Truss Head
Countersunk	B-3860-10L Dimpled, 100°, Cres.	B-3867-272 10-32, 100° Head, Cres.

Spinner Dome Cap Mounting Hardware
Table 3-3

8. Post-Installation Checks

A. Important Information

(1) Refer to the airframe manufacturer's or STC instructions for post-installation checks.

(2) Perform a static RPM check as outlined in the Testing and Troubleshooting chapter of this manual.

9. Spinner Dome Removal

A. Procedure

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

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

(2) Remove the spinner dome.

(3) Remove layers of masking or duct tape from each blade shank, if applicable.

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

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

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.

10. Propeller Removal

A. Procedure

Refer to Figures 3-4 and 3-5.

CAUTION: OIL WILL FLOW OUT OF THE PROPELLER WHEN THE PISTON IS REMOVED. PLACE A DRIP PAN UNDER THE PROPELLER TO CATCH THE EXCESS OIL.

(1) Remove the self-locking nut from each piston rod.

(2) Remove the washer from each piston rod.

(3) Loosen the set screw in each fork.

(4) The piston ears, forks, pitch change blocks, counterweights, and guide collar should have corresponding index numbers (1 and 2) impression stamped or marked with a felt-tipped pen. If they are not marked, number them with a felt-tipped pen.

NOTE: Marking the components will ensure that the they are reassembled in their original location.

(5) Slide the piston away from the hub and to the low pitch position, until the piston rods clear the sleeve and fork.

(6) Slide the piston out of the forks, away from the clamp, link screws, and pitch change blocks.

(7) Slide the piston off the cylinder and remove it from the propeller.

(8) To prevent the loss of the sleeve, fork, and high pitch stop spacers, reinstall the washer and self-locking nut on each piston rod.

(9) The pitch change blocks should have index numbers (1 and 2) marked with a felt-tipped pen to correspond to the numbers on the piston ears, forks, counterweights, and guide collar. If they are not marked, number them with a felt-tipped pen.

NOTE: Marking the components will ensure that they are reassembled in their original location.

(10) Remove the pitch change block from each clamp linkscrew.

(11) Remove the safety wire from between the engine shaft and the hollow tube in the shaft nut. Refer to Figure 3-9.

(12) Completely loosen the shaft nut from the engine shaft threads.

NOTE: Because the shaft nut is pulling the propeller hub off the tapered rear cone, there will be significant initial resistance to the loosening of the shaft nut. If the shaft nut cannot be loosened, contact Hartzell Propeller Product Support.

WARNING: MAKE SURE THE SLING IS SUITABLY RATED TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING REMOVAL.

(13) Support the propeller assembly with a sling.

(14) Move the propeller from the engine splined shaft and lift the propeller from the engine.

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

(15) Remove the rear cone.

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

B. Removal of A-224-( )Transfer Unit

(1) Disconnect the oil supply line from the governor to the oil transfer unit.

(2) Insert a locally manufactured pin into the oil transfer plug and slip ring before removing the oil transfer unit. Refer to Figure 3-5.

(3) Remove the spring pin that protrudes from the oil slinger.

(4) Remove the four bolts and washers that attach the oil transfer unit to the engine.

CAUTION: HANDLE THE OIL TRANSFER UNIT CAREFULLY TO PREVENT THE SLIP RING AND ATTACHED SPRING STEEL OIL RINGS FROM SLIDING OUT OF THE OIL TRANSFER UNIT; OTHERWISE, RECOMPRESSION OF THE SPRING STEEL OIL RINGS WILL BE REQUIRED DURING REINSTALLATION ON THE ENGINE.

(5) Remove the oil transfer unit from the engine.

CAUTION: IT MAY BE NECESSARY TO SCRAPE THE GASKET FROM THE ENGINE OR OIL TRANSFER UNIT. USE CARE TO AVOID DAMAGING THE ENGINE AND OIL TRANSFER UNIT.

(6) Remove the gasket from the engine or oil transfer unit, or both.

C. Removal of the Governor from the “T” Drive Unit.

(1) Remove the governor from the oil transfer line. Refer to Figure 3-14.

(a) Remove the B-3808-4 nut and the A-121 link screw.

(b) Remove the B-3808-3 nuts and the B-3840-10 clamp screws.

(c) Remove the four B-3808-5 nuts and washers.

CAUTION: DO NOT LOOSEN THE A-213-5 DRIVE COUPLING.

(d) Remove the governor from the “T” drive.

(2) Remove the “T” Drive from the engine. Refer to Figure 3-14.

(a) Disconnect the oil line hose.

(b) Disconnect the fuel lines from the fuel pump.

(c) Remove the fuel pump from the “T” drive.

(d) Remove the four B-3803-4 nuts and B-3851-0463 washers from the A-148-2 studs.

(e) Remove the “T” drive from the engine.

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TESTING AND TROUBLESHOOTING - CONTENTS

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

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 will not turn over, following propeller installation

(1) The oil transfer unit is installed incorrectly.

(a) Remove the propeller and oil transfer unit.

(b) Inspect the oil transfer unit for damage.

C. Low Maximum RPM (on ground) following recent engine overhaul or repair:

(1) Shaft seal (Continental P/N 25102) is installed in shaft gear adapter.

(a) Remove the seal to correct.

(2) Shaft gear adapter is incorrectly installed on the engine accessory case, or the engine accessory case is missing the oil transfer annulus groove at the "T" drive mount. Refer to Figure 4-1.

(a) Remove the shaft gear adapter and verify proper alignment.

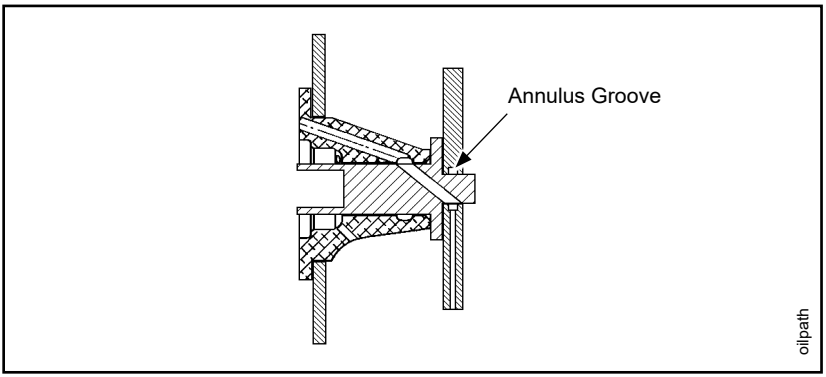
(b) Verify the presence of the annulus groove at the "T" drive mount. Refer to Figure 4-1.

D. Low Maximum RPM (on ground), following recent propeller and oil transfer unit removal:

(1) Misalignment of the oil transfer unit slip ring and oil slinger ring with the rear cone.

(a) Line the oil grooves in the slip ring, oil slinger ring and rear cone with the B-6580-1000 spring pin.

NOTE: Do not remove the spring pin after alignment.



Shaft Gear Adapter
Figure 4-1

E. Low Maximum RPM (on ground)

(1) Oil transfer unit is incorrectly installed.

(a) Line the oil grooves in the slip ring, oil slinger ring and rear cone with the B-6580-1000 spring pin.

NOTE: Do not remove the spring pin after alignment.

(2) Oil transfer unit is damaged.

(a) Oil seal rings (A-221 and A-221-1) have excessive wear or the end gap of the oil seal rings exceeds the allowable tolerance. Send the oil transfer unit to an authorized repair facility.

(3) Rear cone is missing the seal at the cut.

(a) Install the seal as described in Figure 3-5.

(4) Rear cone, oil slinger, and slip ring are not in alignment.

(a) Line the oil grooves in the slip ring, oil slinger ring and rear cone with the B-6580-1000 spring pin.

NOTE: Do not remove the spring pin after alignment.

(5) Malfunctioning governor, clogged governor mounting gasket screen, or incorrect gasket

(a) Remove the governor and inspect the gasket. Verify that the gasket is correct.

(b) Inspect the governor for proper operation.

(6) Incorrect governor maximum RPM stop setting

(a) Adjust the RPM setting to the specified static RPM requirements.

(7) Failure, collapse, or restriction of the oil line installed between the governor and the oil transfer unit

(a) Replace the oil line as required.

(8) Incorrect propeller blade angle

(a) With a blade angle protractor, check blade angles at the propeller 30 inch station, to confirm the correct blade angle settings. Refer to the STC blade angle requirements.

(b) If adjustment of the propeller low pitch blade angle is required, adjustment must be performed by a certified propeller repair station with the appropriate rating or by the Hartzell Propeller LLC factory.

(9) Follow aircraft POH and/or AMM recommended checks to determine if the engine power is low.

(a) If the engine power is low, refer to an appropriately licensed engine repair station or the engine manufacturer.

(b) If the engine power is within the permitted limits, examine the maximum RPM stop setting of the governor.

F. Maximum RPM is High

(1) Engine power is high.

(a) Follow the aircraft POH and/or AMM recommended engine checks to determine if the engine power is high.

(b) If the engine power is high, refer to an appropriately licensed engine repair station or to the engine manufacturer.

(2) If the engine power is within permitted limits, examine the maximum RPM stop setting of the governor.

G. Governor Maximum RPM Stop Setting

(1) Increase the maximum RPM stop screw of the governor by one turn.

(2) Advance the propeller RPM control to maximum RPM and reduce the control by 1 inch (25.4 mm).

(3) Set the brakes and chock the wheels of the aircraft, or tie the aircraft down.

(4) Start the engine.

(5) Slowly advance the throttle to maximum manifold pressure.

(6) Slowly advance the propeller control lever until the engine speed stabilizes.

(7) If the engine speed stabilizes at a higher RPM than it was previously running, then the governor maximum RPM stop setting is incorrectly set.

(a) Make additional fine adjustments to the governor maximum RPM stop setting until the rated maximum RPM is reached.

(8) If the engine speed does not increase from the RPM that it was previously running, then the propeller low pitch angle is probably incorrect.

(9) For low pitch setting verification, refer to the procedures in the Maintenance Practices chapter of this manual.

H. Engine Speed Varies with Airspeed

(1) Constant speed propeller models will experience some small variances in engine speed that are normal and are no cause for concern.

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

(a) Governor is not reducing oil volume in the propeller

1 Install an in-line high pressure oil gauge in the oil line, between the governor and the oil transfer unit, to check the governor pressure function.

(b) Excessive friction in the blade bearings or the pitch change mechanism

1 With the engine not running and the propeller control pulled to the full-out position, manually move the blades from low pitch to high pitch.

NOTE: The blades should move with little resistance, once the oil is forced from the propeller hub cavity.

(3) Decrease in engine speed while increasing airspeed:

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

1 Install an in-line high pressure oil gauge in the oil line, between the governor and the oil transfer unit, to check the governor pressure function.

(4) Increase in engine speed while decreasing airspeed:

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

1 Install an in-line high pressure oil gauge in the oil line, between the governor and the oil transfer unit, to check the governor pressure function.

(5) Decrease in engine speed while decreasing airspeed:

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

1 Install an in-line high pressure oil gauge in the oil line, between the governor and the oil transfer unit, to check the governor pressure function.

a Monitor the oil pressure gauge. The pressure should be 225 ±10 PSI at 1700 RPM.

b If the pressure cannot be maintained at 225 ±10 PSI, there is indication of internal leakage in the system.

c To establish that the correct pressure is being produced by the propeller governor, install a valve between the gauge and the oil transfer unit.

d With the engine running at a low RPM, momentarily close the valve and observe the pressure indicated on the gauge. The pressure must be 225 ±10 PSI.

(b) Excessive friction in the blade bearings or pitch change mechanism

1 With the engine not running and the propeller control pulled to the full-out position, manually move the blades from low pitch to high pitch.

NOTE: The blades should move with little resistance, once the oil is forced from the propeller hub cavity.

I. Loss of Propeller Control

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

(a) Loss of oil pressure - check:

1 Governor pressure relief valve for proper operation

a Refer to I.(1)(b) for corrective action.

2 Governor drive for damage

a Refer to I.(1)(b) for corrective action.

3 Adequate engine oil supply

a Refer to I.(1)(b) for corrective action.

4 Oil supply hose to oil transfer unit kinked or collapsed

a Refer to I.(1)(b) for corrective action.

5 Excessive wear in the oil transfer unit

a Oil transfer unit must be removed and inspected for excessive wear or incorrect end gap in the A-221 and A-221-1 oil seal rings.

(b) Corrective action for I.(1)(a)1 through I(1)(a)4:

1 Install an in-line high pressure gauge in the oil line, between the governor and oil transfer unit, to check the governor pressure function.

a Monitor the oil pressure gauge. The pressure should be 225 ±10 PSI at 1700 RPM.

b If the pressure cannot be maintained at 225 ±10 PSI, there is indication of internal leakage in the system.

c To establish that the correct pressure is being produced by the propeller governor, install a valve between the gauge and the oil transfer unit.

d With the engine running at a low RPM, momentarily close the valve and observe the pressure indicated on the gauge. The pressure must be 225 ±10 PSI.

(2) Engine RPM decreases during flight, or at high oil temperature (+180 degrees).

(a) Rear cone seal is missing. Refer to Figure 3-3.

(b) Oil transfer unit is not holding pressure.

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

(a) Governor pilot valve is sticking.

(b) Check the clamps at the governor bracket for slippage in the control shaft housing.

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

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

1 With the engine not running and the propeller control pulled to the full-out position, manually move the blades from low pitch to high pitch.

NOTE: The blades should move with little resistance, once the oil is forced from the propeller hub cavity.

(b) Governor is not reducing oil volume in the propeller.

1 Install an in-line high pressure oil gauge in the oil line, between the governor and the oil transfer unit, to check the governor pressure function.

2 Governor problem

3 Seal is installed in the shaft gear adapter.

J. Vibration

CAUTION 1: ANY VIBRATION THAT OCCURS SUDDENLY, OR IS ACCOMPANIED BY UNEXPLAINED GREASE 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 THAT IS POTENTIALLY HARMFUL TO THE PROPELLER. AVOID OPERATION UNTIL THE PROPELLER CAN BE CHECKED BY A CERTIFIED PROPELLER REPAIR STATION WITH THE APPROPRIATE RATING.

(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

(2) Dynamic Balance

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

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

K. Propeller Overspeed

(1) Check:

(a) Tachometer error

(b) Low pitch stop adjustment

(c) Governor maximum RPM set too high

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

L. Propeller Underspeed

(1) Check:

(a) Tachometer error

(b) Excessive oil transfer unit leakage

(c) Governor oil pressure low

(d) Governor oil passage clogged

(e) Governor pilot valve is jammed

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1. Pre-Flight Checks (Rev. 5)

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

A. Important Information

(1) Follow propeller preflight inspection procedures as specified in the Pilot Operating Handbook (P.O.H.) in addition to the inspections specified in this section.

(2) Defects or damage found during the pre-flight 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 erosion (sand-blasted appearance) on the leading edge of the blade is permitted and does not require removal before further flight.

(2) Visually examine 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, “Blade Tolerances” in this chapter for blade play limits.

(4) If an ice protection system is installed, visually examine the anti-icing or de-ice boot for damage.

(a) Refer to the Anti-ice and De-ice Systems chapter in this manual for operational checks and troubleshooting information for Hartzell Propeller ice protection systems.

C. Spinner Assembly and Blade Retention Components

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

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

D. Hardware

(1) Check for loose or missing hardware.

(a) Tighten or reinstall as necessary.

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

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 airframe manufacturer’s manual for additional pre-flight checks.

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

2. Operational Checks (Rev. 4)

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 flight, perform initial run-up as outlined in Operational Tests in the Testing and Troubleshooting chapter of this manual.

WARNING: REFER TO THE AIRCRAFT 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 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 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. AN IN-FLIGHT BLADE SEPARATION 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 flight.

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 airframe manufacturer’s manual for additional operational checks.

B. Static RPM Check

NOTE: This operational check should be performed after installation, maintenance, or propeller adjustment.

CAUTION: A CALIBRATED TACHOMETER MUST BE USED TO MAKE SURE OF THE ACCURACY OF THE RPM CHECK.

(1) Set the brakes and chock the aircraft or tie aircraft down.

(2) Back the Maximum RPM Stop on the governor out one turn.

(3) Start the engine.

(4) Advance the propeller control lever to MAX (max RPM), then retard the control lever 1.00 inch (25.4 mm).

(5) SLOWLY advance the throttle to the maximum manifold pressure.

(6) Slowly advance the propeller control lever until the engine speed stabilizes.

(a) If engine speed stabilizes at the maximum power static RPM specified by the TC or STC holder, then the low pitch stop is set correctly.

(b) If engine speed stabilizes above or below the rated RPM, the low pitch stop may require adjustment. Refer to the Maintenance Practices chapter of this manual.

(7) Stop the engine.

(8) Return the Maximum RPM Stop on the governor to the original position.

(9) Test fly the aircraft to confirm the maximum rated RPM specified in the aircraft TC or STC is achieved.

(a) Adjust the governor to the rated RPM with the Maximum RPM Stop screw.

1 If the governor is adjusted to the rated RPM with the maximum RPM stop screw, hold the maximum RPM stop screw in place and torque the maximum RPM stop locking nut in accordance with Table 3-1, Torque Table.

(10) Refer to the Aircraft Maintenance Manual for additional procedures that may be required after propeller installation.

C. Post-Run Check

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

D. Propeller Ice Protection System

(1) Refer to the Anti-ice and De-ice Systems chapter in this manual for operational checks and troubleshooting information for Hartzell Propeller ice protection systems.

3. Required Periodic Inspections and Maintenance (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. Periodic Inspection

(1) Perform detailed inspection procedures, as follows, at 100 hour intervals, not to exceed twelve (12) calendar months. Procedures involved in these inspections are detailed below.

(a) Inspection and maintenance specified by an airframe manufacturer's maintenance program and approved by the applicable airworthiness agency may not coincide with the inspection time interval specified.

1 In this situation, the airframe manufacturer's schedule may be applied as long as the calendar limit for the inspection interval does not exceed twelve (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 applicable section (Aluminum Blades or Composite Blades) in the Maintenance Practices chapter of this manual for damage evaluation and repair information.

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

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

(6) Check the blade track. Refer to Blade Track in the Inspection Procedures section of this chapter.

(7) Hartzell Propeller LLC 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). Refer to the section “Tachometer Calibration” in the Maintenance Practices chapter of this manual.

(8) Make an entry in the propeller logbook about completion of these 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. Airworthiness Limitations

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

(2) Life limited component times may exist for the propeller models covered in this manual. Refer to the Airworthiness Limitations chapter of this manual.

(3) Operators are urged to keep informed of airworthiness information via Hartzell Propeller 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) In flight, 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 Service Letter HC-SL-61-61Y.

4. Inspection Procedures

A. Blade Damage (Rev. 1)

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

B. Grease/Oil Leakage (Rev. 2)

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. AN INFLIGHT BLADE SEPARATION 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 Grease leaks between the blade clamp and the propeller hub

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

3 Grease leaks past the blade clamp seal gaskets

4 Grease leaks from between the blade clamp and the blade

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

5 Grease leaks from the clamp when the blade is pointed up and in a static position.

a Oil separating from the grease. Approved lubricants are listed in the Maintenance Practices chapter of this manual. These lubricants have varying separation rates.

1 If a clamp seal leaks after the first ten hours of operation, consult a certified propeller repair station with the appropriate rating.

(d) Oil Leakage - probable causes:

1 Faulty O-ring seal between the hub and the cylinder

2 Faulty O-ring seal between the piston and the cylinder

3 Displaced felt seal between the piston and the cylinder

4 Faulty O-ring(s) between the propeller hub and the engine flange

5 Faulty O-ring between the piston and the pitch change rod

(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, blade clamps, and blades to locate the source of the grease leak.

1 If the source of the grease leak is a non-critical part such as an O-ring, gasket, or sealant, repairs can be accomplished during scheduled maintenance as long as flight safety is not compromised.

2 If cracks are suspected, additional inspections to verify the condition must be performed before further flight.

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

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

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

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

C. Vibration (Rev. 3)

NOTE: Vibration may originate in the engine, propeller, or airframe. Troubleshooting procedures typically begin with an investigation of the engine. Airframe components, such as engine mounts or loose landing gear doors, can also be the source of vibration. When investigating an abnormal vibration, the 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 airframe 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 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 flight.

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 at a certified propeller repair station with the appropriate rating.

(d) Inspect the play of the propeller blades in accordance with the section, “Blade Tolerances” 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 flight.

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 flight.

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

D. Blade Track

(1) Check the blade track as follows:

(a) Chock the aircraft wheels securely.

(b) Refer to Figure 5-1. Place a fixed reference point beneath the propeller, within 0.25 inch (6.3 mm) of the lowest point of the propeller arc.

NOTE: This reference point may be a flat board with a sheet of paper attached to it. The board may then be blocked up to within 0.25 inch (6.3 mm) of the propeller arc.

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

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

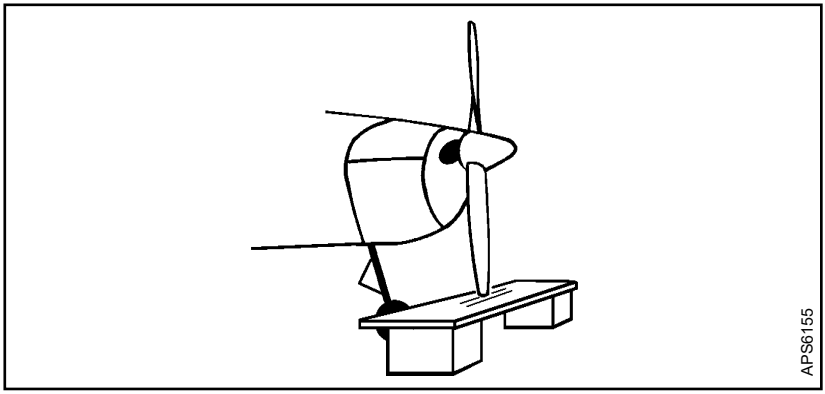
(d) Repeat this procedure with the remaining blade.

(e) Tracking tolerance is ±0.0625 inch (1.58 mm) or 0.125 inch (3.17 mm) total.

(2) Possible Correction

(a) Remove foreign matter from the propeller rear cone.

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



Checking Blade Track
Figure 5-1

E. Blade Tolerances (Rev. 4)

(1) Limits for blade play are specified below. Refer to Figure 5-2.

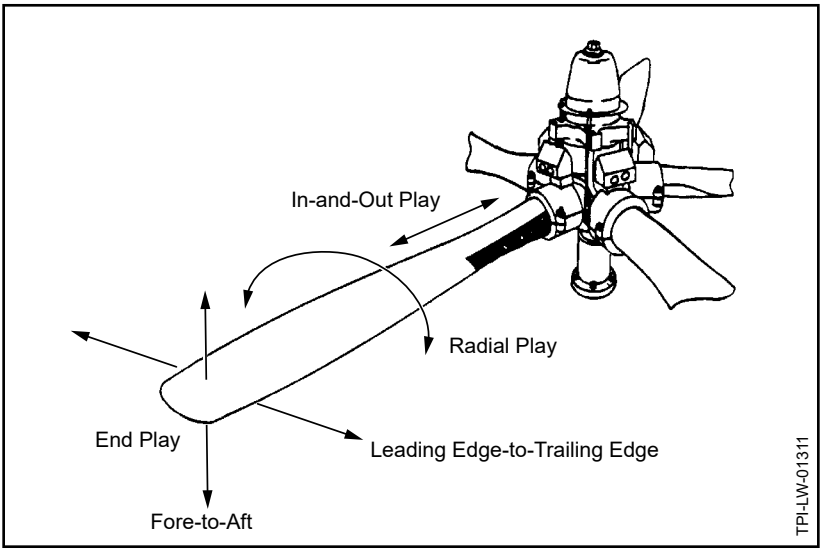
(a) End Play:

1	Leading Edge-to-Trailing Edge	±0.0625 inch (1.58 mm) Total: 0.125 inch (3.17 mm)
2	Fore-to-Aft (face to camber)	±0.0625 inch (1.58 mm) Total: 0.125 inch (3.17 mm))

(b) In-and-Out Play 0.032 inch (0.81 mm)

(c) Radial Play (pitch change) ±0.5 degree (Total: 1 degree) measured at reference station

(d) 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.



Blade Play
Figure 5-2

1 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.

(2) Limits for Blade Track are specified below:

(a) Aluminum Blades ±0.0625 inch (1.58 mm)
Total: 0.125 inch (3.17 mm)

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. 3)

(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 Manual 127 (61-16-27) or a certified propeller repair station with the appropriate rating.

2 Contact the local airworthiness 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.

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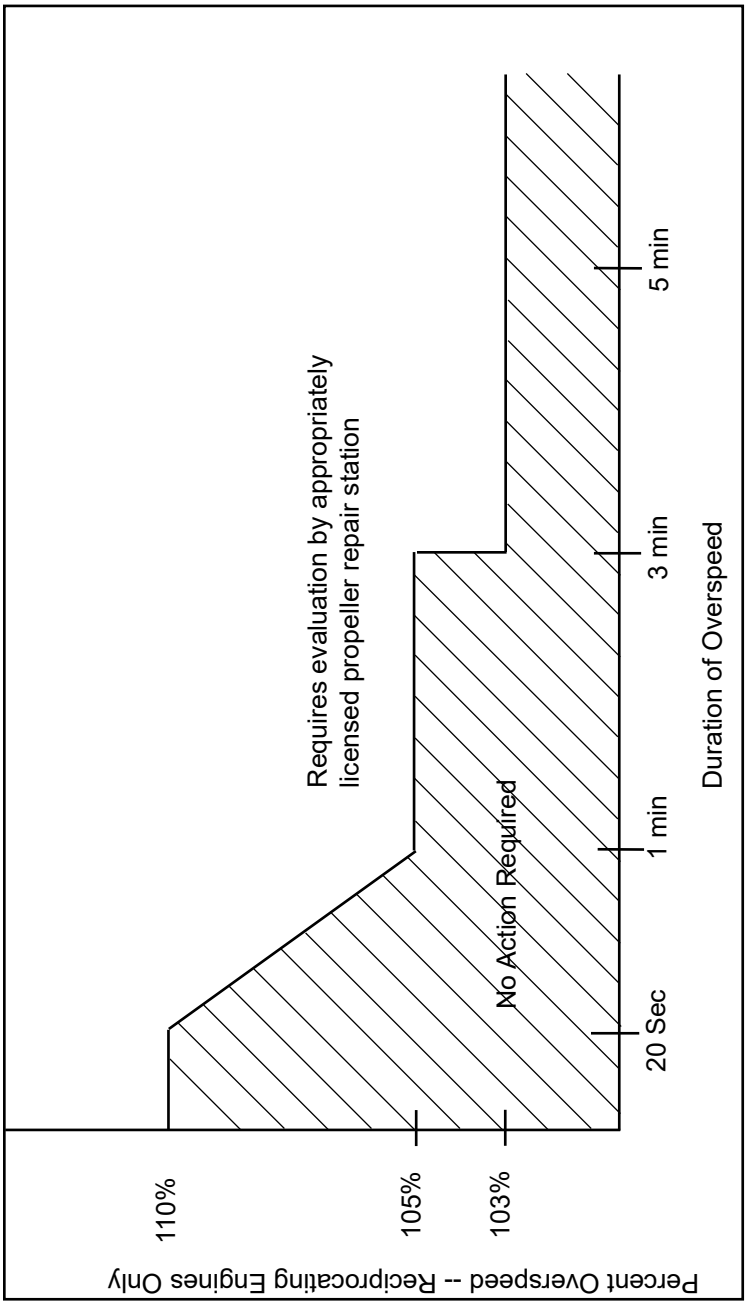

Reciprocating Engine Overspeed Limits
Figure 5-3

5. Special Inspections (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. Overspeed

(1) An overspeed occurs when the propeller RPM exceeds the maximum RPM stated in the applicable Aircraft Type Certificate Data Sheet. The duration of time and magnitude of overspeed for a single event determines the corrective action that must be taken to make sure no damage to the propeller has occurred.

(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 airframe/engine/propeller combination.

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

(b) If an overspeed requiring propeller evaluation occurs on an aircraft using a Hartzell Propeller governor, the governor must be evaluated by a certified propeller repair station with the appropriate rating.

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

B. Lightning Strike (Rev. 1)

CAUTION: REFER TO THE ENGINE AND AIRFRAME 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 flight.

(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 flight (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 FLIGHT.

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 flight.

(b) Perform an operational check of the propeller ice protection system (if installed) in accordance with the Anti-ice and De-ice Systems chapter of this manual.

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

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

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

C. Foreign Object Strike/Ground Strike (Rev. 3)

(1) General

(a) A foreign object/ground strike can include a broad spectrum of damage, from a minor stone nick to severe ground 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 aircraft is stationary and the landing gear collapses causing one or more blades to be significantly damaged, or where a hangar door (or other object) strikes the propeller blade(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 flight.

(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 aircraft, 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, “Blade Tolerances” in this chapter for the permitted limits of blade play.

3 Blade(s) rotated in the clamp (if applicable)

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

5 Any blade diameter reduction

6 Bent, cracked, or failed engine shaft

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

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

1 Refer to the section, “Aluminum Blades” in the Maintenance Practices chapter of this manual (if applicable) 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 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 flight.

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 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.

6. Long Term Storage (Rev. 1)

A. Important Information

(1) Parts shipped from Hartzell Propeller LLC are not shipped or packaged in a container that 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 Standard Practices Manual 202A (61-01-02).

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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 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 THE 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 (Rev. 6)

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 an airframe manufacturer's maintenance program and approved by the applicable airworthiness agency may not coincide with the lubrication interval specified.

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

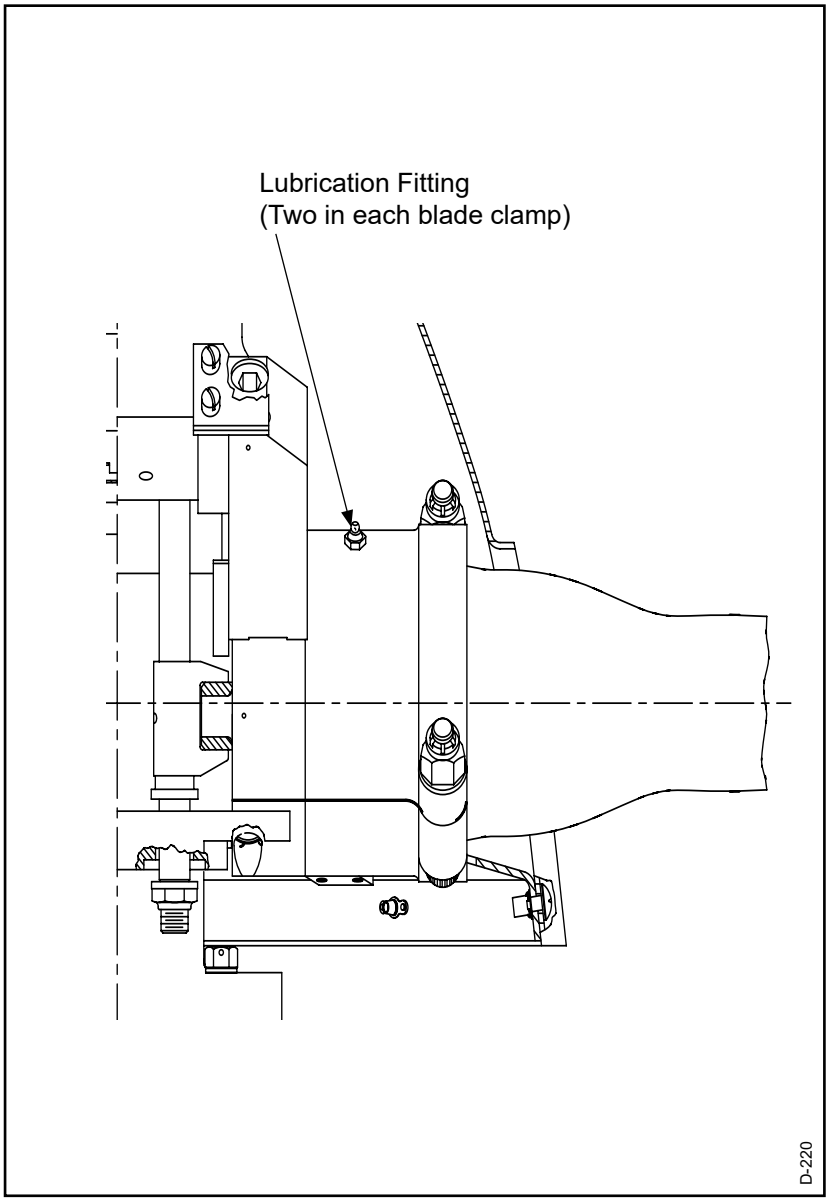
(b) If the aircraft is operated or stored under adverse atmospheric conditions, e.g. high humidity, salt air, calendar lubrication intervals should be reduced to six months.

(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 aircraft may wish to extend their lubrication interval. The lubrication interval may be gradually extended after evaluating bearing wear and internal corrosion when the propeller is overhauled.

(3) Hartzell Propeller LLC recommends that new or newly overhauled propellers be lubricated after approximately the first 10 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 aircraft should check the propeller logbook to verify whether the propeller was lubricated by the manufacturer during flight testing. If it was not lubricated, the propeller should be serviced at the earliest convenience.



Lubrication Fitting
Figure 6-1

B. Lubrication Procedure

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

(1) Remove the propeller spinner.

CAUTION: STEEL BLADE CLAMPS PRODUCED BEFORE 1967 MAY HAVE ONLY ONE LUBRICATION FITTING. DO NOT REMOVE THIS FITTING WHEN SERVICING.

(2) Remove the outboard lubrication fitting from the blade clamp, and the cap from the inboard lubrication fitting. Refer to Figure 6-1.

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

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

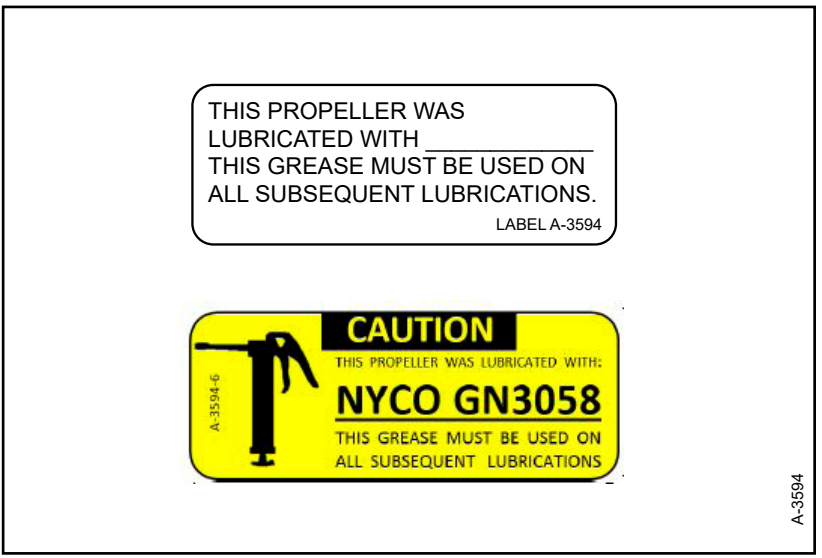
CAUTION: USE ONLY HARTZELL PROPELLER APPROVED GREASE. DO NOT MIX DIFFERENT SPECIFICATIONS AND/ OR BRANDS OF GREASE EXCEPT AS NOTED IN THIS SECTION.

(4) 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

(5) 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 AIRCRAFT MUST BE PLACARDED TO INDICATE THAT FLIGHT 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 A STEEL HUB PROPELLER MAY CAUSE THE GREASE TO DISLODGE THE CLAMP GASKET OR SEAL, LEADING TO A POTENTIAL GREASE LEAK. THE CLAMP MUST THEN BE DISASSEMBLED TO REMOVE THE SEAL OR CLAMP GASKET.

(6) Apply grease in accordance with the applicable step below.

(a) For blade clamps with two lubrication fittings:

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

a Repeat for each blade clamp assembly.

(b) For blade clamps with only one lubrication fitting:

1 Without using excessive pressure, slowly pump a maximum of 1 fl. oz. (30 ml) grease into the lubrication fitting.

a If there is too much pressure, loosen the lubrication fitting used to add the grease, then tighten the fitting until snug.

b Repeat for each blade clamp assembly.

(7) Reinstall the lubrication fittings on each clamp that were removed at the beginning of this procedure.

(8) Tighten the lubrication fittings until snug.

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

(9) 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. 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.

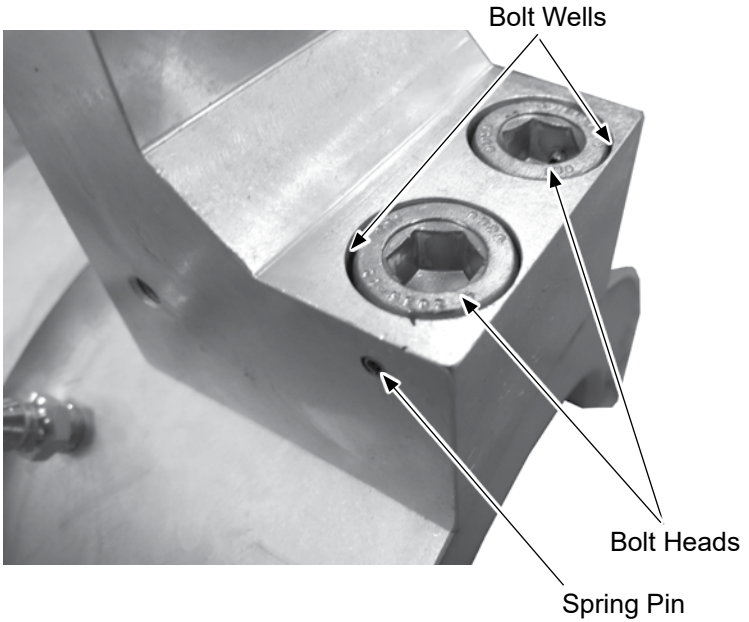
A. Application Intervals

(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 LLC recommends re-application of the corrosion inhibitor CM352 at regularly scheduled intervals, similar to the lubrication interval specified in this propeller owner’s manual.



NOTE: Non-painted clamp unit is shown.

TPI-LW-202A-VOL-5-00402

Applying Corrosion Inhibitor CM352
Figure 6-3

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 6-3.

(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. Aluminum Blades (Rev. 6)

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 FLIGHT 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 PRODUCT SUPPORT DEPARTMENT FOR BLADE DIMENSIONAL LIMITS.

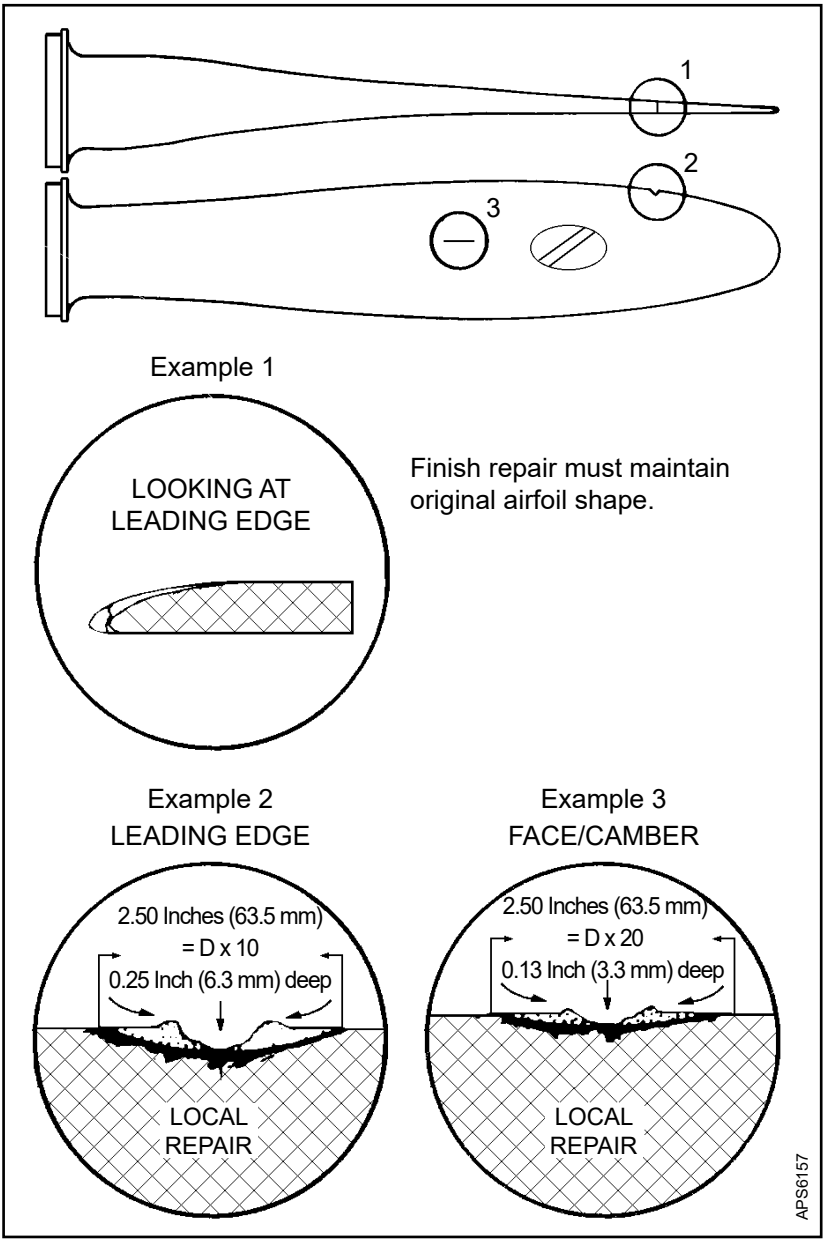
CAUTION 2: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

A. Important Information

(1) Nicks, gouges, and scratches on blade surfaces or on the leading or trailing edges of the blade, that are greater than 0.031 inch (0.79 mm) wide or deep, must be repaired before flight.

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



Repair Limitations
Figure 6-4

B. Repair of Nicks and Gouges

(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 REPAIRED AREA SHOT PEENED BEFORE FURTHER FLIGHT. SHOT PEENING OF AN ALUMINUM BLADE MUST BE ACCOMPLISHED BY A CERTIFIED PROPELLER REPAIR STATION WITH THE APPROPRIATE RATING IN ACCORDANCE WITH HARTZELL PROPELLER ALUMINUM BLADE OVERHAUL MANUAL 133C (61-13-33).

(2) Calculate the area of repair using Figure 6-4 and the following formulas:

(a) For leading and trailing edge damage:
Depth of the damage x 10. Refer to Example 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 of the damaged area, use emery cloth to polish the area, then remove any files 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.

Vendor	Color/Type	Vendor P/N	Hartzell Propeller LLC 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

5. Blade Paint Touch-Up (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. 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 LLC and are recommended for blade touch-up.

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

(2) Touch-up paint manufacturers 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

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 preventive 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, anti-icing or de-ice boot, and tip stripes, as needed.

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

CAUTION: APPLY FINISH COATING TO UNIFORMLY COVER THE REPAIR/EROSION. AVOID EXCESSIVE PAINT BUILD-UP 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 the 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 anti-icing or de-ice boot 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.

6. Dynamic Balance

WARNING: WHEN USING REFLECTIVE TAPE FOR DYNAMIC BALANCING, DO NOT APPLY THE TAPE ON EXPOSED BARE METAL OF THE BLADE. THIS WILL ALLOW MOISTURE TO COLLECT UNDER THE TAPE AND CAUSE CORROSION THAT CAN PERMANENTLY DAMAGE THE BLADE. REFLECTIVE TAPE MUST BE REMOVED AFTER DYNAMIC BALANCING IS COMPLETED.

A. Overview

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

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

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

(3) Follow the dynamic balance equipment manufacturer’s instructions for dynamic balance in addition to the specifications of this section.

NOTE: Some engine manufacturers' instructions also contain information on dynamic balance limits.

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

B. Inspection Procedures Before Balancing

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

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

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

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

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

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

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

(4) Static balance is accomplished at a propeller overhaul facility when an overhaul or major repair is performed.

NOTE: If static balancing is not accomplished before dynamic balancing, the propeller may be so severely unbalanced that dynamic balance may be unachievable due to measurement equipment limitations.

C. Placement of Balance Weights for Dynamic Balance

(1) Attach dynamic balance weight slugs only to the nut plates mounted on the spinner bulkhead. A maximum of four (4) A-48 weight slugs per location is allowed.

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

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

7. Propeller Low Pitch Stop Setting

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

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

A. Low Pitch Stop

(a) The propeller low pitch stop is set at the factory to the aircraft TC or STC Holder's requirements and should not require any additional adjustment.

(b) The aircraft TC or STC Holder provides the required low pitch stop blade angle and may also provide the acceptable RPM range for a maximum power static condition.

(c) Be aware that the aircraft TC or STC holder may specify the static RPM to be less than the RPM to which the engine is rated.

B. Propeller Low Pitch Measurement

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

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

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

2 With the blade in a horizontal position, measure the low pitch blade angle.

3 Check the measured blade angle against the required blade angle as specified in accordance with the aircraft TC or STC Holder's requirements.

4 If the blade angle requires adjustment, have the low pitch blade angle adjusted by a certified propeller repair station with the appropriate rating or by the Hartzell Propeller LLC factory.

8. Propeller High Pitch Setting (Rev. 2)

A. High Pitch (Minimum RPM) Stop Adjustment

(1) The high pitch stop is set by Hartzell Propeller LLC in accordance with the aircraft manufacturer's recommendations.

(2) The high pitch stop can only be adjusted by Hartzell or by a certified propeller repair station with the appropriate rating.

9. Tachometer Calibration (Rev. 2)

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 LLC 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 LLC if the propeller was operated in a restricted RPM range because of a tachometer error.

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ANTI-ICE AND DE-ICE SYSTEMS

NOTE: The propellers covered in this manual do not use anti-ice or de-ice systems

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1. Record Keeping (Rev. 2)

   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 Title 14 Code of Federal Regulations (CFR) Part 43 for a list of information that must be recorded.

      (2) The log book may also be used to record:

         (a) Propeller position (on aircraft)

         (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) Aircraft information (aircraft type, model, serial number and registration number)

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