

Manual No. 136

61-00-36

Revision 5

October 2025



Propeller Owner's Manual and Logbook

Reversible Propeller Model
HC-E3YR-7()

Pressure Control Unit
B-4270-()

Hartzell Propeller LLC

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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

I 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 5 HIGHLIGHTS

Revision 5, dated October 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"
- Revised Figure 3-1, "Calculating Torque When Using a Torque Wrench Adapter"
- Revised the section, "Spinner Adapter Ring Installation"
- Revised the section, "One-Piece Spinner Dome Installation"
- Revised Table 3-3, "Spinner Dome and Spinner Cap Mounting Hardware"
- Revised the section, "Two-Piece Spinner Dome Installation"

- INSPECTION AND CHECK

- Revised the section, "Blade Tolerances"

- RECORDS

- Revised the section, "Record Keeping"

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REVISION 5 HIGHLIGHTS1. 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.

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<u>Revision No.</u>	<u>Issue Date</u>	<u>Comments</u>
Orig	Jun/82	Initial Release
Rev. 1	Aug/13	Minor Revision
Rev. 2	Feb/17	Reissue
Rev. 3	Jul/23	Major Revision
Rev. 4	Apr/24	Minor Revision
Rev. 5	Oct/25	Minor Revision

RECORD OF REVISIONS

This is a record of revisions inserted into this manual.
Revision 3 includes all prior revisions.

Revision Number	Issue Date	Date Inserted	Inserted By
3	Jul/23	Jul/23	HPI
4	Apr/24	Apr/24	Hartzell
5	Oct/25	Oct/25	Hartzell

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SERVICE DOCUMENTS LIST

CAUTION 1: DO NOT USE OBSOLETE OR OUTDATED INFORMATION. PERFORM ALL INSPECTIONS OR WORK IN ACCORDANCE WITH THE MOST RECENT REVISION OF 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-61-185	Rev. 2, Feb/17
HC-SL-61-354	Rev. 2, Feb/17
HC-SL-61-364	Rev. 3, Jul/23

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SERVICE DOCUMENTS LIST

[illegible]

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: Mark Grace for T. Smith date: 28 Feb 2017

Manager, Chicago Aircraft Certification
Office,
ACE-115C
Federal Aviation Administration

[illegible]

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 relate 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. 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: Mark Brown for Thompson date: Feb 28 2017
Manager, Chicago Aircraft Certification
Office,
ACE-115C
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 WITH THE AIRCRAFT ON WHICH IT IS INSTALLED, AT ALL TIMES. THE LOGBOOK RECORD WITHIN THIS MANUAL MUST BE MAINTAINED, RETAINED CONCURRENTLY, AND BECOME A PART OF THE AIRCRAFT AND ENGINE SERVICE RECORDS.

- (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 prior to 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 152 (61-10-52)	Compact Constant Speed and Reversing Propeller Overhaul Manual
Manual 159 (61-02-59)	Application Guide

Manual No. (ATA No.)	Hartzell Propeller Manual Title
Manual 165A (61-00-65)	Illustrated Tool and Equipment Manual
Manual 170 (61-13-70)	Composite Propeller Blade Field Maintenance and Minor Repair Manual
Manual 180 (30-61-80)	Ice Protection System Manual
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. <u>Note:</u> Do not confuse <i>blade station</i> with <i>reference blade radius</i> ; 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. <u>Note:</u> Do not confuse <i>reference blade radius</i> with <i>blade station</i> ; 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 synchronization in which not only the RPM of the engines (propellers) are held constant, but also the position of the propellers in relation to each other
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

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

Abbreviation	Term
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

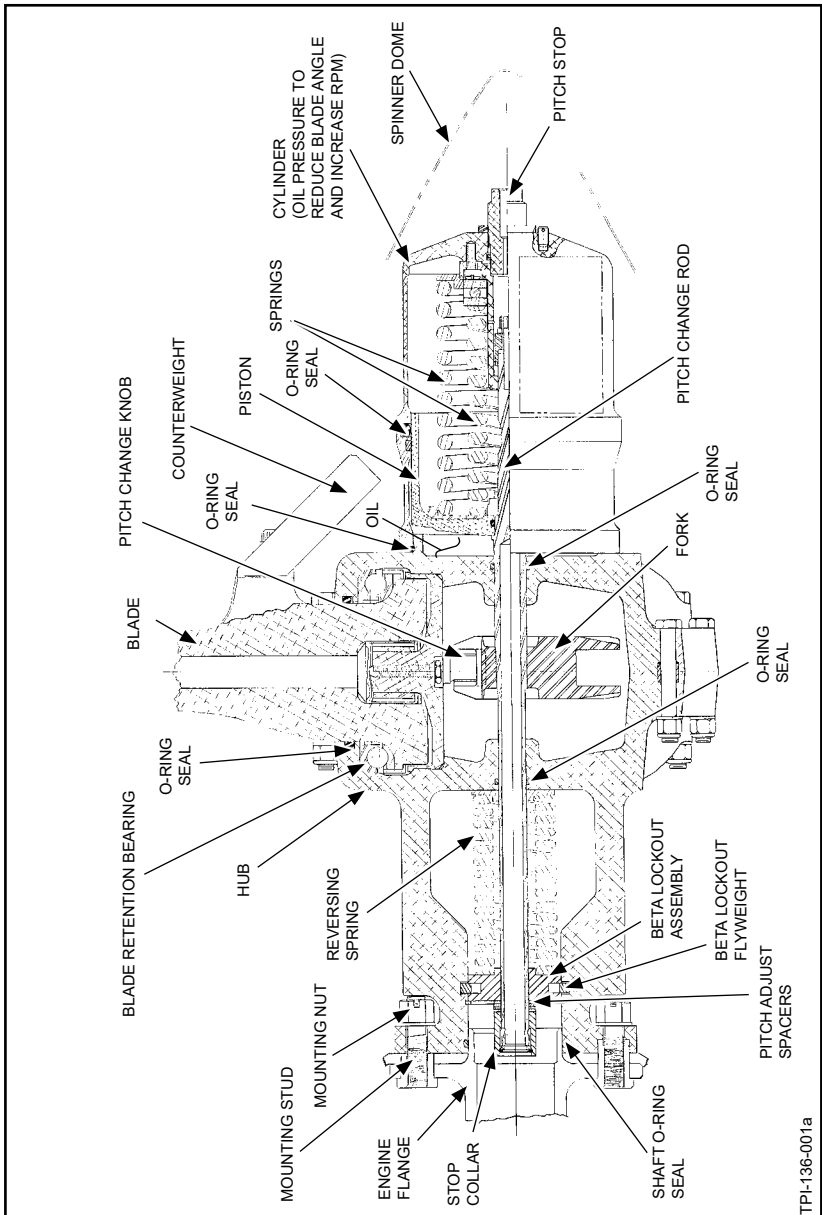
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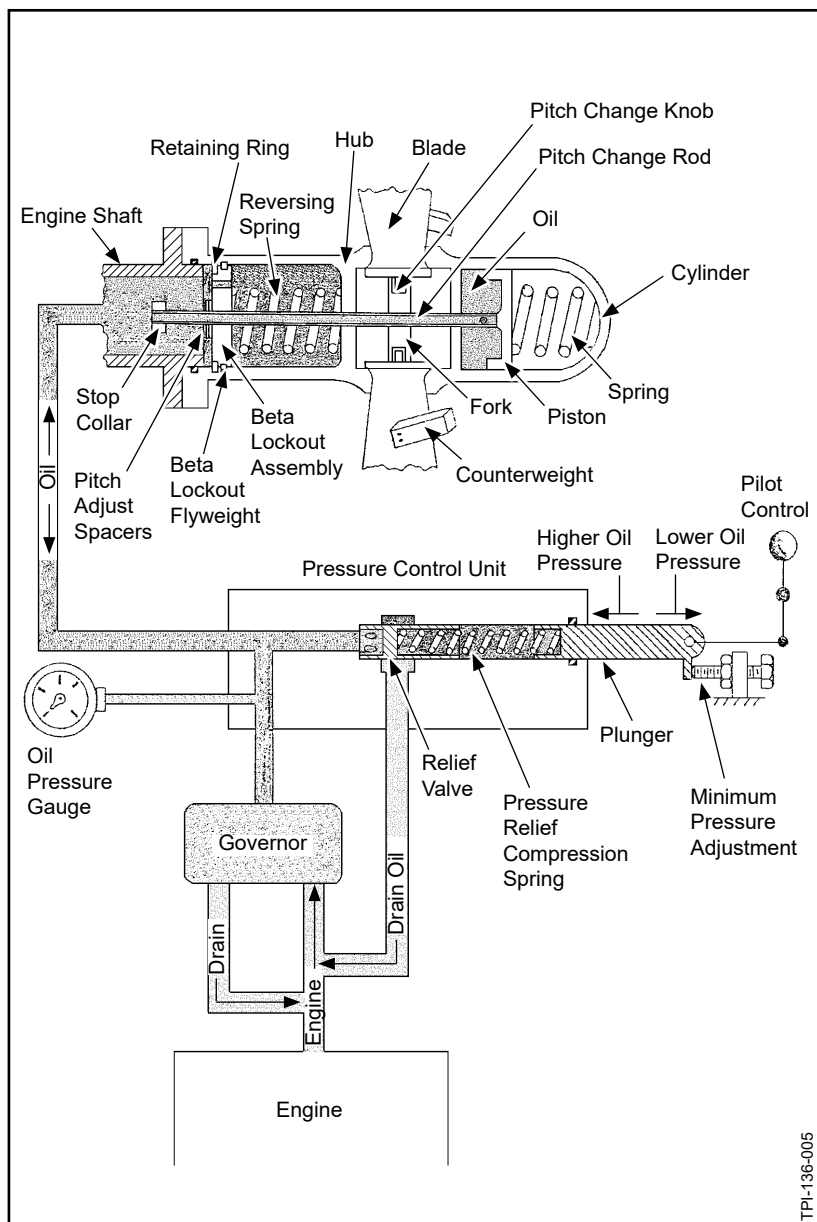
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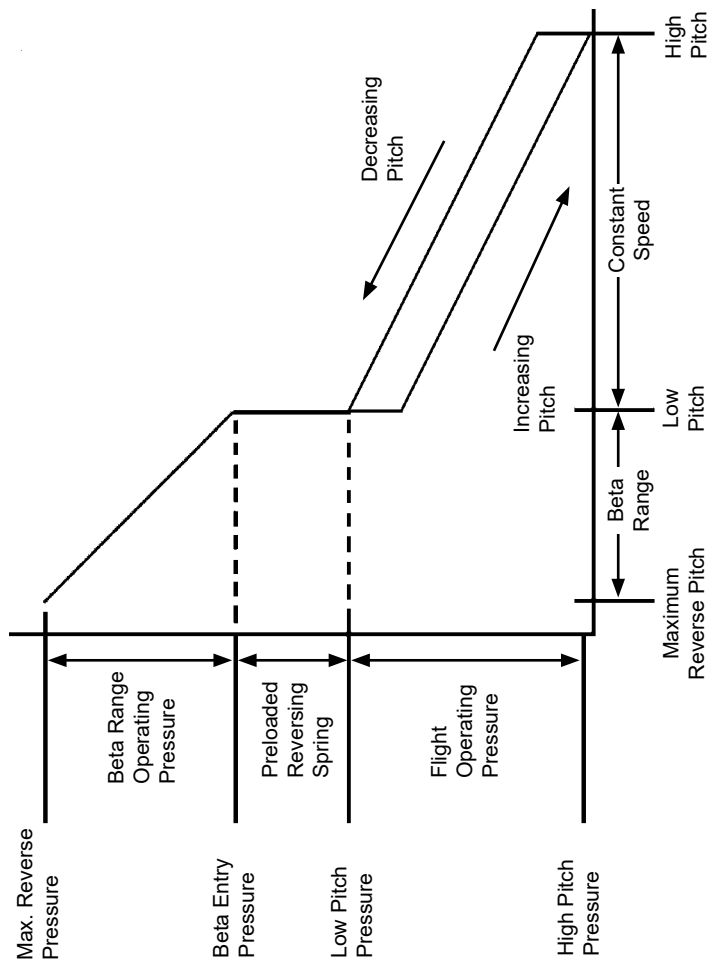
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-7 Series Constant Speed and Reversing Propeller HC-E3YR-7()
Figure 2-1



Pressure Control Reversing Propeller System
Figure 2-2



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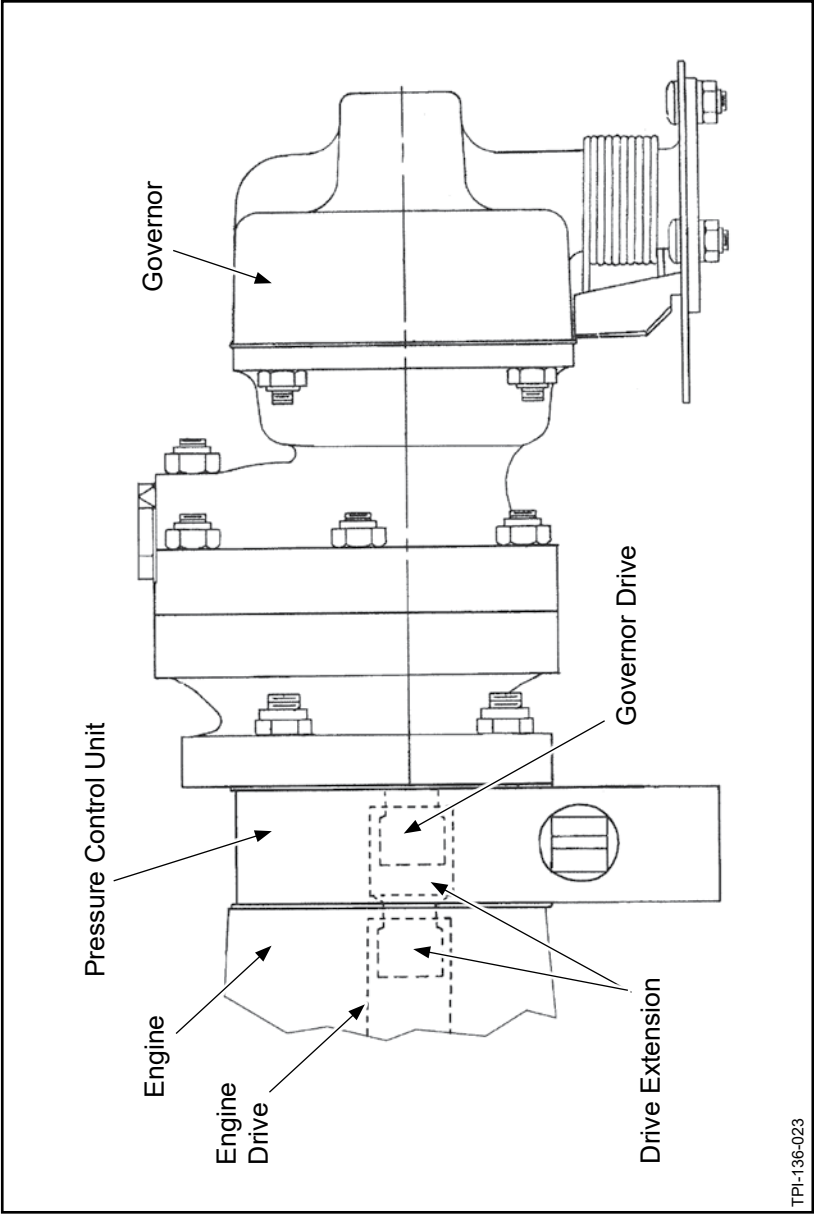
Oil Pressures - Pressure Control Reversing Propeller
Figure 2-3

1. Description of Propeller and Systems

A. General Operation and System Overview - Refer to Figure 2-2

- (1) The propeller and control system provides constant speed (RPM) control in flight and manually controlled positive and reverse thrust for (slow speed) maneuvering.
- (2) Major components consist of (1) a propeller, (2) a governor, (3) a pressure control unit and (4) an oil pressure gage. The (1) propeller attaches to the engine to produce thrust for flight under constant speed (RPM) control by a governor. The (2) governor installs on the engine and controls blade angle through the supply or drain of oil to the hydraulically controlled propeller for constant speed (RPM) operation. The (3) pressure control unit is used for propeller blade angle control in beta range (low pitch to maximum reverse pitch). It also establishes the maximum oil pressure available to the governor for constant speed (RPM) control of propeller blade angle. The (4) oil pressure gage monitors that the oil pressure available to the governor is what it should be and has not changed
- (3) The propeller is compatible with a reciprocating engine that will accommodate governor installation and operation. The target engine type is generally unable to accommodate the more common reversing propellers that use a blade angle feedback system to a valve for position control of blade angle in beta range (low pitch to maximum reverse pitch). This propeller uses oil pressure control to the propeller to manually control blade angle in beta range for thrust control. The control concept is described as pressure control reversing. This control concept does not use blade angle feedback to a valve to facilitate propeller blade angle control in beta range.
- (4) The propeller may be used on a single engine fixed wing amphibian aircraft for constant speed (RPM) control in flight and manually controlled blade angle for water maneuvering, docking, and undocking of the aircraft in a waterborne environment. This propeller will not accommodate reverse thrust use during landing to shorten the landing distance.

- (5) A second use for the propeller is on a lighter than air vehicle such as a blimp. Constant speed (RPM) control would be used during constant forward motion and manually controlled blade angle for maneuvering when close to the ground and during docking with a mooring mast.
 - (6) The propeller will reach a high blade angle although it will not feather (a higher blade angle) to accommodate the possibility of an in-flight shutdown to prevent propeller windmilling. This propeller is not intended for multiple engine fixed wing aircraft although it is available for use on lighter than air vehicles (blimps) with a single engine or multiple engines.
 - (a) Lighter than air vehicles float and do not depend on forward speed and airflow over a wing to produce lift. This results in an aircraft that does not require feathering even though it utilizes multiple engines.
- B. Propeller and Pressure Control Unit Features – Refer to Figure 2-1 and Figure 2-2.
- (1) Propeller
 - (a) The propeller uses a two piece aluminum hub that retains each propeller blade on a blade retention bearing which allows blade angle change during propeller rotation on the engine shaft.
 - (b) A cylinder is attached to the hub and contains a hydraulic piston and a spring set.
 - (c) The hydraulically actuated piston transmits linear motion through a pitch change rod to a fork that attaches to each blade through a pitch change knob that is attached to each blade.
 - (d) The propeller attaches to the engine flange on the end of the engine shaft
 - (e) The pressure control unit installs between the engine and governor on the governor accessory pad provided on the engine.
 - 1 A drive extension must be installed for the engine to drive the governor and permit installation of the pressure control unit.



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Pressure Control Unit
Figure 2-4

- (f) A cockpit mounted pressure gage is attached hydraulically to the pressure control unit.
- (g) During flight propeller blade angle is controlled by a governor to maintain a constant Propeller/Engine RPM.
- (h) During maneuvering (on land or water for fixed wing aircraft or close to the ground maneuvering of a craft that is lighter than air) reverse thrust as well as positive thrust is required and is available in beta range with manual blade angle control by the pilot.
- (i) Beta operation (in Beta Range) for maneuvering (positive and reverse thrust) is facilitated by the Beta Lockout Assembly and a Reversing Spring. Refer to Figure 2-1. The Beta Lockout Assembly prevents Beta Operation unless a very low RPM (less than 900 RPM) is selected to insure ground or water operation with fixed wing aircraft. The Reversing Spring increases the force (oil pressure) required to reverse blade angle.

(2) Pressure Control Unit

- (a) The pressure control unit installs between the engine and the governor on the governor accessory pad provided on the engine. Refer to Figure 2-4.
 - 1 A drive extension must be installed also for the engine to still drive the governor and permit the installation of the pressure control unit.
- (b) Through a pilot control connected to the plunger, the pressure control unit controls oil pressure from the governor that is supplied to the propeller to permit governed control and permit blade angle control in beta range (low positive blade angles and reverse blade angles).
- (c) A cockpit mounted pressure gauge is attached hydraulically to the pressure control unit to permit the pilot to monitor the oil pressure output to the propeller. Refer to Figure 2-2.

- (d) For pressure control, the pressure control unit uses a pressure limiting configuration consisting of a relief valve and a pressure relief compression spring. The addition of a plunger to permit pilot input of a different position and load on the pressure relief compression spring, permits different/variable oil pressure output selection during beta range operation.
- C. Propeller Governed Operation - Refer to Figure 2-2 and Figure 2-3
 - (1) In flight the propeller is controlled by an engine speed sensing device (governor) to maintain a constant engine/propeller RPM by changing blade angle through the supply or drain of oil through a hollow engine shaft to the hydraulic piston of the propeller. The linear motion of the hydraulic piston is transmitted to each blade through a pitch change rod and an attached fork that engages a pitch change knob on each blade. Each blade is supported and retained by the hub at its root by a blade retention bearing that permits the blade to rotate for pitch change during propeller rotation.
 - (2) The governor uses an internal pump that is driven by the engine through an accessory drive location. The governor pump increases engine oil pressure for supply to the propeller. Engine speed sensing hardware within the governor controls the supply of oil to or the drain of oil from the propeller as appropriate to change blade angle to maintain constant engine speed (RPM). Increasing the volume of oil within the hydraulic piston and cylinder will decrease blade angle and increase propeller RPM. Decreasing the volume of oil within the hydraulic piston and cylinder will increase blade angle and decrease propeller RPM. By changing the blade angle, the governor can vary the load on the engine and maintain constant engine/propeller RPM.

- (3) During propeller operation the following forces are constantly present, (1) spring force, (2) counterweight force, (3) centrifugal twisting moment of each blade and (4) blade aerodynamic twisting forces. Spring and counterweight forces attempt to rotate the blades to higher blade angles while the centrifugal twisting moment of each blade is generally toward lower blade angles. Blade aerodynamic twisting force is generally very small in relation to the other forces and can attempt to increase or decrease blade angle based on blade design. Summation of the propeller forces is toward higher pitch (low RPM) and is opposed by a variable force toward lower pitch (high RPM). The variable force is oil under pressure from a governor with an internal pump that is mounted on and driven by the engine. The supply of oil will move the propeller pitch to a lower blade pitch (higher RPM), the drain of oil will move the propeller pitch to a higher blade pitch (lower RPM) and no change of oil will maintain the current blade pitch (no change of RPM).
- (4) Figure 2-3 shows an example of the different oil pressures in the propeller piston at different blade pitches between low pitch and high pitch. The orientation of the oil pressures required for opposing the propeller internal force (spring) is a slope that has a higher value at low pitch and is lower at high pitch. Two slopes are shown (between low pitch and high pitch) and are parallel. The upper line represents the required oil pressure from the governor when blade pitch is decreasing and the lower line represents the required oil pressure from the governor when blade pitch is increasing. The separation between the two lines is because of friction involved in moving the propeller pitch change components. In the installation chapter it will be necessary to understand this relationship to properly set the pressure control unit to a pressure attenuation value that will permit the governor to reach an oil pressure slightly above the low pitch pressure and within the range labeled as preloaded reversing spring.

D. Propeller Beta (Reverse) Operation - Refer to Figure 2-2 and Figure 2-3

- (1) Propeller beta operation is in the range between low pitch and maximum reverse pitch. Blade pitch or blade angle is controlled manually by the pilot through a lever/cable connected to a plunger in the pressure control unit; thus, blade angle control in beta range is not controlled by the RPM sensing hardware of the governor and constant speed operation is not maintained in beta range. RPM will change as blade angle is changed. Blade angle control of the propeller by the governor is disabled and is manually controlled by the pilot.
- (2) Constant speed propellers that do not reverse will operate between a high pitch and a low pitch range under governor blade pitch control for constant speed operation. In these propellers low pitch is maintained with a fixed stop and will not permit blade angle movement below low pitch.
- (3) A propeller with reversing capability must be able to reach blade pitch below low pitch in the beta range (between low pitch and maximum reverse pitch). Maximum reverse pitch is maintained by a fixed stop.
- (4) The low pitch stop on a reversing propeller must function as a stop when in constant speed operation (governor control), but it must permit blade pitch movement below low pitch into the beta range when amphibian water maneuvering or lighter than air vehicle maneuvering is desired. Beta range permits manual selection of a low positive blade pitch for variable low positive thrust and selectable reverse blade pitch for variable reverse thrust. The solution to the requirement of a fixed low pitch stop for constant speed operation and releasable to permit movement into beta range operation is the beta lockout assembly shown in Figure 2-2. This unit is held in place between a preloaded reversing spring and a retaining ring that is anchored in the barrel of the hub, as shown in Figure 2-2.

Centrifugal locks built into the beta lockout assembly are RPM sensitive such that they will engage a groove in the hub barrel at RPMs above 900 RPM to prevent axial moment in the barrel of the hub. At an RPM below 900 RPM the centrifugal locks will retract into the body of the low pitch stop unit and permit axial movement in the barrel of the hub for beta range operation.

For fixed wing amphibian aircraft this requires that the aircraft is landed with minimum forward movement to permit the engine to be idled down to an RPM below 900 RPM to permit release of the centrifugal locks and allow linear movement of the beta lockout assembly below low pitch into beta range.

A lighter than air vehicle, such as a blimp, will also need to idle the engine below 900 RPM to facilitate movement of blade pitch from low pitch into beta range.

- (5) Before selecting beta range for maneuvering (low positive blade pitch and reverse blade pitch) the governor must be set by the pilot to a maximum RPM selection. It is important to understand that all operation in the beta range must be at an RPM less than the maximum governor RPM selection. In this manner the governor interprets all beta range operation as an underspeed and will continue to supply maximum oil pressure to the pressure control unit in an effort to decrease blade angle for RPM increase in a positive thrust constant speed situation.

If the RPM is allowed to exceed the governor maximum RPM selection then the governor will interpret this as an overspeed and will immediately drain oil to force a sudden and unexpected blade angle increase. This will cause a sudden and powerful positive thrust that could cause damage to the aircraft during manual pilot control during maneuvering.

The supply of maximum oil pressure (270 to 300 PSI) to the pressure control unit is required to maintain pilot control of propeller blade angle in beta range (between low pitch and maximum reverse blade angle) for maneuvering. A minimum pressure of 270 PSI from the governor is required to reach maximum reverse pitch. Refer to Figure 2-3.

- (6) Operation in beta range is at elevated pressures that are considerably above oil pressures required for constant speed operation as shown in Figure 2-3. The slope of the line representing oil pressures required for beta range operation is shown to be much steeper than for constant speed operation.

Operation in constant speed only compresses a spring set located in the propeller cylinder that pushes against the piston. Operation in beta range requires that two spring sets be compressed; one spring set is acting against the piston (as in constant speed operation) and the second spring set is in the barrel of the propeller hub (between the blades and the engine flange) and identified as a reversing spring in Figure 2-2. The reversing spring is compressed by the moving the beta lockout unit when blade angle movement below low pitch occurs.

Compression of one spring set (for constant speed operation) versus compression of two spring sets (during beta range operation) is why the slope of the operating oil pressure line in constant speed operation is less than the slope of the oil pressure line in beta range.

- (7) The function of the Pressure Control Unit is to reduce the governor supplied oil pressure of 270 to 300 PSI to a lower oil pressure. Refer to Figure 2-2. One mode of reduction is fixed and the second is variable. The two modes of reduction are discussed in paragraphs 1.D.(7)(a) and 1.D.(7)(b).
- (a) This adjustment supports governor control constant speed operation. Initial adjustment of the Pressure Control Unit requires that the plunger position (length of extension from the pressure control unit body) is limited by a restraining bolt or screw. This is to limit the minimum (lower) oil pressure that the Pressure Control Unit will reduce the governor supplied oil pressure of 270 to 300 PSI. This pressure must be high enough to make sure that the governor will be able to supply enough oil pressure to the propeller to reach low pitch during normal constant speed operation (governed control). Refer to Figure 2-3.
- 1 The minimum pressure adjustment is the lowest pressure that the pressure control unit will attenuate the governor supplied oil pressure of 270 to 300 PSI. This lowest pressure for the pressure control unit is conversely the maximum pressure permitted by the pressure control unit to reach the propeller during constant speed operation between low pitch and high pitch. Refer to Figure 2-3.

- (b) During maneuvering, the propeller operates in Beta Range (Low Pitch to Full Reverse Pitch) which is manually selectable. Manual selection of blade angle by the pilot is accomplished by moving the pilot control that pushes a Plunger into the Pressure Control Unit to increase the oil pressure allowed by the Pressure Control Unit to reach the propeller. Refer to Figure 2-2. Control of the higher pressure by the pilot is what allows selection of different blade angles in Beta Range. Refer to Figure 2-3. Oil pressures controlled by the pilot will vary between the minimum oil pressure, that is discussed in paragraph 1.D.(7)(a), through the maximum oil pressure of 270 to 300 PSI available from the governor. Moving toward minimum oil pressure will obtain positive thrust and moving toward maximum oil pressure will obtain negative thrust. Refer to Figure 2-2.
- (8) It is recommended that the cockpit mounted lever used by the pilot to control the pressure control unit be equipped with a catch or detent that must be consciously disabled to prevent an unintentional attempt to enter beta range.
- (9) Operation in beta range during flight with a fixed wing aircraft is not permitted. A lighter than air vehicle is permitted to operate in beta range with no restrictions since the air vehicle floats and does not fly on an airfoil and does not stall at a slower forward airspeed.

E. 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.

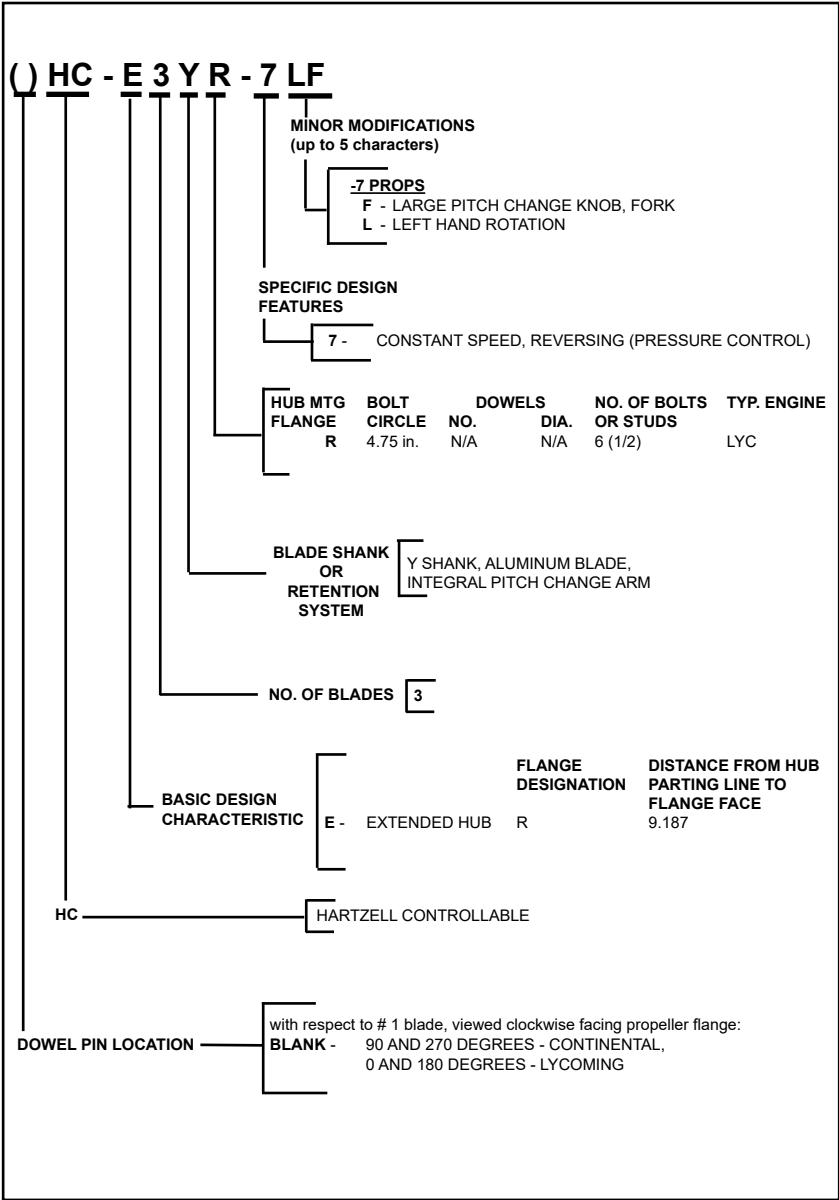
2. Propeller Blades

A. Description of Aluminum Blades

- (1) Aluminum propeller blades are manufactured from one solid piece of aluminum that has been forged and heat-treated prior to manufacture.
- (2) Aluminum blades are identified by shank design, propeller diameter, tip configurations, and other blade characteristics.
 - (a) Refer to the section, "Blade Model Designation" in this chapter.

B. Blade Model Designation

- (1) Hartzell Propeller LLC uses a model number designation system to identify specific propeller and blade assemblies. The propeller model number and blade model number are separated by a slash (/).
 - (a) Example: *propeller model number / blade model number*
- (2) The blade model number is impression stamped on the butt end of the blade, and also identified by a label on the cylinder.
- (3) Refer to the Table 2-2 for a description of the characters used in the blade model number:



Propeller Model Designations
Table 2-1

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

prop model/**FLC 8468 G-8Q**

Dash Number: change from basic propeller diameter. In this example, the nominal 84 inch diameter has been reduced 8 inches = 76 inch diameter (with some exceptions) there may be a letter following the dash number. (NOTE: This basic diameter may not reflect the actual prop diameter, depending on the hub model used.)

Q - Q-tip, factory 90 degree bent tip
S - Square tip

Suffix letters:

G - a negative pitch change knob angle
S - shot peening of blade surface

The first 2 or 3 numbers indicate basic design diameter (in inches), the last 2 numbers indicate a specific model

Prefix of up to 3 letters:

C - counterweighted Y shank
F - large pitch change knob Y shank
L - left hand rotation, pusher

Aluminum Blade Model Designations

Table 2-2

3. Pilot Operation of Propeller Blade Angle in Beta Range
(Low Pitch to Full Reverse Pitch) for Maneuvering

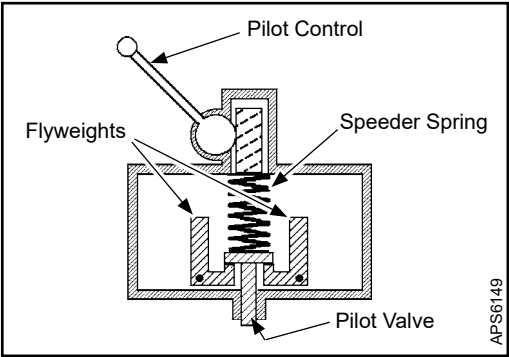
A. Operation Information

- (1) The blade angle selection is manually controlled by the pilot.
- (2) First, decrease throttle to idle to decrease RPM below 900 RPM to disengage the centrifugal locks in the low pitch stop unit.
- (3) Second, the pilot must select maximum RPM on the governor control.
- (4) Third, the pilot moves the pilot control cockpit lever past the catch or detent into beta range. The pilot control is connected to the plunger in the pressure control unit to compress the pressure control spring and increase the oil pressure supply to the propeller. Refer to Figure 2-2.
- (5) Fourth, decrease blade angle to approximately neutral thrust, i.e., no forward or reverse sensation in the aircraft.
- (6) Fifth, increase throttle (for power) to an RPM that is clearly under the maximum RPM selected for governor control. In this manner the pilot will be able to move only the pilot control cockpit lever freely to higher positive pitch (lower oil pressure) still less than low pitch or back through neutral pitch and into reverse pitch (higher oil pressure). This procedure will permit simple one lever control without fear of an overspeed.

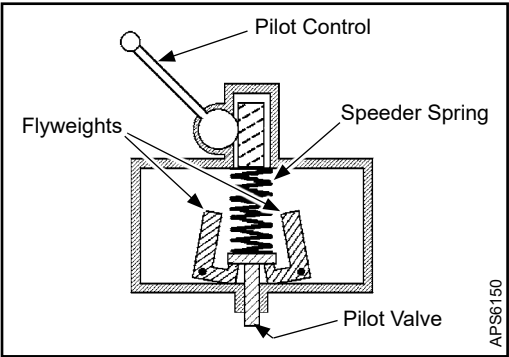
WARNING: PROPELLER OVERSPEED WHILE
IN BETA RANGE WILL CAUSE
SUDDEN AND UNWANTED BLADE
ANGLE MOVEMENT THAT IS
CONTROLLED BY THE GOVERNOR
AND NOT THE PILOT.

- (a) Too much power selected when moving through neutral pitch with the pilot control could cause an unwanted overspeed that will prompt the governor to suddenly drop oil pressure (drain oil) and move the propeller to a blade angle higher than low pitch.

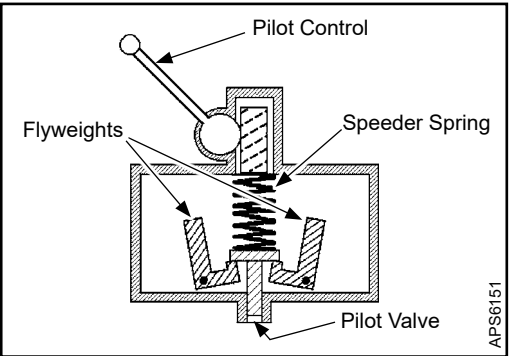
- (1) If this occurs the RPM will probably be higher than 900 RPM and the centrifugal locks will re-engage a groove in the barrel of the hub and prevent reversal even if the pilot control cockpit lever is quickly moved toward a reverse pitch (thrust) selection.
 - (2) This occurrence could be unsettling to the pilot and could cause unwanted and severe movement of the aircraft causing property damage.
 - (a) Use of one lever only during beta range operation is strongly recommended because using two levers (adding the throttle control lever) introduces the strong possibility that the pilot will inadvertently have the throttle at high power while moving the propeller blade angle through neutral pitch (blade angle) and cause overspeed and the unwanted consequences (damage) described in paragraph (6)(a) in this section.
- (7) Sixth, pilot selects blade angle as required to obtain the desired thrust direction for maneuvering.
 - (8) Seventh, return the Pilot Control to the original position past the catch or detent out of beta range after maneuvering is complete.



Governor in Onspeed Condition
Figure 2-5



Governor in Underspeed Condition
Figure 2-6



Governor in Overspeed Condition
Figure 2-7

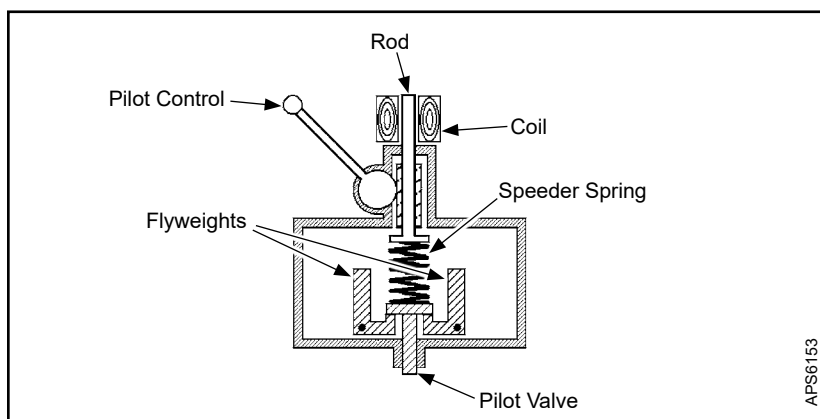
4. Governors (Rev. 3)

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 2-5. 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 2-6. 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 2-7. 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 2-8 illustrates a governor as a component of a synchronizing or synchrophasing system.

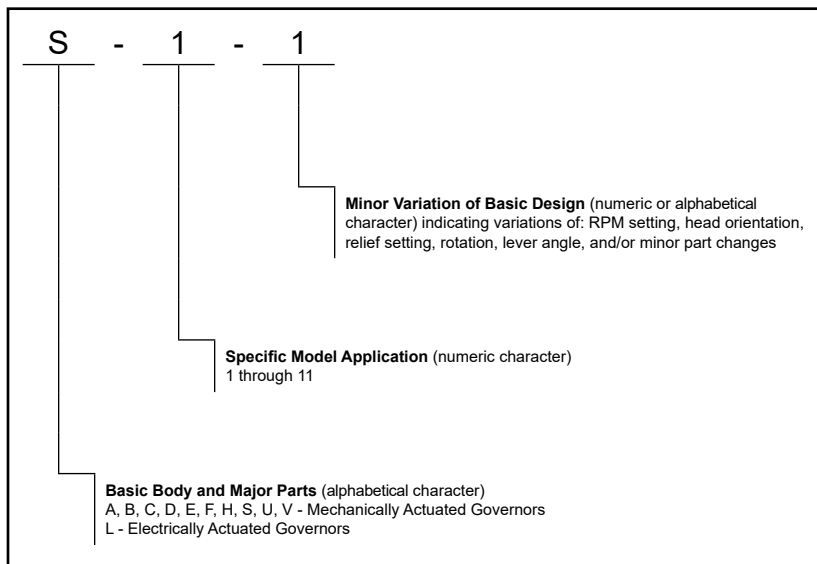
- (a) Hartzell Propeller synchronizing or synchrophasing systems use one engine (the master engine) as an RPM and phase reference and adjust the RPM of the remaining engine(s) [slave engine(s)] to match it. The RPM of the master engine is monitored electronically, and this information is used to adjust 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 2-8

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

5. Propeller Ice Protection Systems (Rev. 1)

A. System Description

- (1) For detailed descriptions of propeller ice protection systems, refer to the Anti-ice and De-ice Systems chapter in this manual.

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1. Tools, Consumables, and Expendables

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

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

NOTE: Pressure control reversing compact propellers are manufactured with one basic hub mounting flange design. The flange type is designated as "R". The flange type used on a particular propeller installation is indicated in the propeller model number stamped on the hub. For example, HC-E3Y**R**-7 indicates an "R" flange. Refer to Aluminum Hub Propeller Model Identification in the Description and Operation chapter of this manual for a description of this flange.

A. Tooling

CAUTION: USE CARE WHEN USING TOOLS. INCORRECT USE OF TOOLS COULD CAUSE DAMAGE TO THE HUB THAT CANNOT BE REPAIRED AND WOULD REQUIRE THAT THE HUB BE REPLACED.

(1) Tools for Bulkhead Mounting

CAUTION 1: DO NOT USE AN OPEN END WRENCH TO TORQUE THE HUB CLAMPING NUTS. THE POINTED ENDS CAN DAMAGE THE HUB.

CAUTION 2: WHEN USING THE TORQUE WRENCH ADAPTER TE457, MAKE SURE THAT IT IS CORRECTLY ENGAGED ON THE NUT BEFORE APPLYING TORQUE.

(a) Three-bladed propeller hubs:

- 1 Newer hubs have less clearance around the heads of the hub clamping bolts than the previous design of the compact hub.

- 2 Torque wrench adapter Hartzell Propeller Part Number 101939 (TE457) is required when torquing the hub clamping bolts for a three-bladed hub.

(2) Tools for Propeller Removal or Installation:

R Flange Propellers

- Safety wire pliers (Alternate: Safety cable tool)
- Torque wrench (1/2 inch drive)
- Torque wrench adapters:
 - Hartzell Propeller Part Number BST-2860 (TE150) or 3/4 inch crowfoot wrench

NOTE: Using a wrench other than Hartzell Propeller Part Number BST-2860 (TE150) increases the risk of the wrench causing damage to the hub in the areas around the mounting fasteners

- 3/4 inch open end wrench

B. Consumables

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

C. Expendables

- 0.032 inch stainless steel aircraft safety wire (Alternate: 0.032 inch [0.81 mm] aircraft safety cable, and associated hardware)
- O-ring - propeller to engine seal (Refer to Table 3-2)

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.

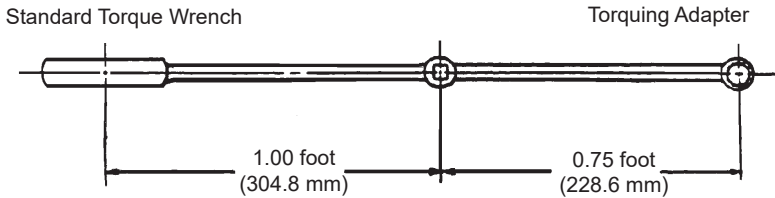
- (4) Put the propeller on a padded surface that supports the entire length of the propeller.
- (5) Remove the plastic dust cover cup from the propeller mounting flange, if installed.

C. Inspection after Shipment

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

D. Reassembly of a "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).



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

EXAMPLE:

$$\frac{100 \text{ Ft-Lb (136 N}\cdot\text{m)} \times 1 \text{ ft (304.8 mm)}}{1 \text{ ft (304.8 mm)} + 0.75 \text{ ft (228.6 mm)}} = 57.1 \text{ Ft-Lb (77.4 N}\cdot\text{m)} < \text{reading on torque wrench with 9-inch (228.6 mm) adapter for actual torque of 100 Ft-Lb (136 N}\cdot\text{m)}$$

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.

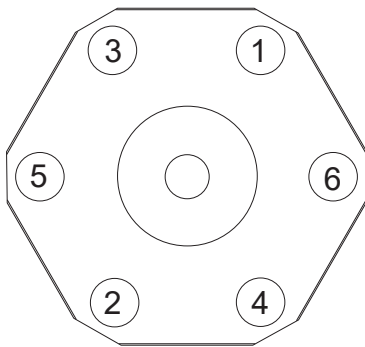
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**Calculating Torque When Using a
Torque Wrench Adapter
Figure 3-1**

- 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
Hub clamping bolts/spinner mtg. nuts	20-22 Ft-Lbs (28-29 N•m)
R flange propeller mtg. studs	60-70 Ft-Lbs (82-95 N•m)
Governor Max. RPM Stop locking nut	30-36 In-Lbs (3.4-4.0 N•m)
Governor Attachment Self-locking Nuts B-3808-5	18-20 Ft-Lbs (25-27 N•m)

Torque Table
Table 3-1



R Flange

Step 1 - Torque all mounting bolts/nuts to the initial torque value in accordance with Table 3-1 and Figure 3-1 in the sequence shown.

Step 2 - Torque all mounting bolts/nuts to the final torque value in accordance with Table 3-1 and Figure 3-1 in the sequence shown.

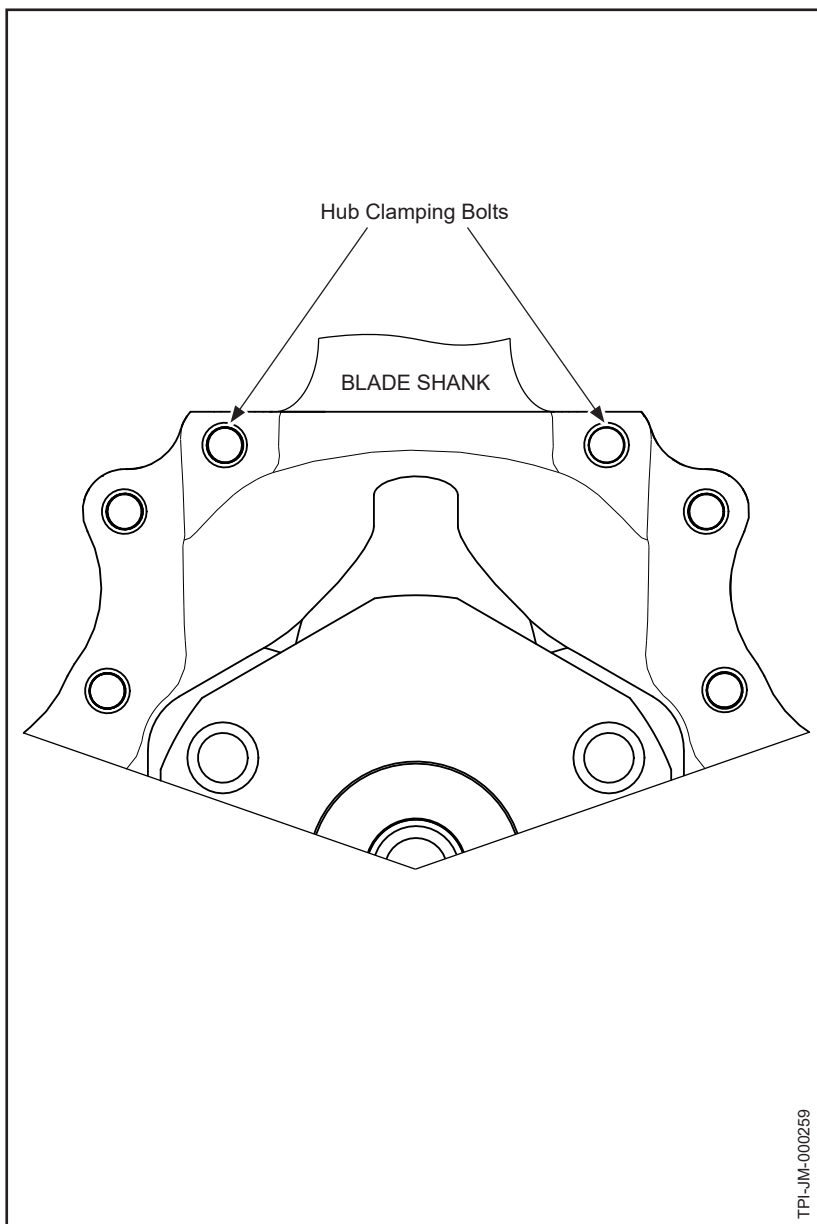
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Torquing Sequence for Propeller Mounting Bolts/Nuts
Figure 3-2

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

Flange	O-ring	Bolt/Stud	Washer	Nut	Spring Pin
R	C-3317-228	A-2067	A-1381	A-2069	B-3842-0750

Propeller Mounting Hardware
Table 3-2



Hub Clamping Bolt Location
Figure 3-3

4. Bulkhead Installation (Rev. 5)

A. General

- (1) The spinner support must be mounted to the hub before the propeller can be installed.
- (2) The spinner assembly may be supplied with spinner mounting hardware, including long hub clamping bolts, washers, and nuts.
 - (a) If the propeller is shipped with longer hub clamping bolts, spinner mounting hardware will not be supplied with the spinner assembly. Refer to Hartzell Propeller Application Guide Manual 159 (61-02-59) for the applicable installation.
 - (b) On some installations, it may be necessary to install spacers and/or washers under the head of the hub clamping bolt to avoid interference with the aircraft cowling.
 - 1 If the installation of the spinner mounting kit requires removal of hub clamping bolts, the propeller must be sent to certified propeller repair station with the appropriate rating.

B. Installation of a Metal Bulkhead

CAUTION: REMOVE THE NUTS AND WASHERS FROM THE HUB CLAMPING BOLTS ON THE LEFT/RIGHT SIDE OF THE BLADE SHANK ONLY. DO NOT REMOVE THE HUB CLAMPING BOLTS.

- (1) Remove the nuts and washers from the hub clamping bolts located on the left/right side of the blade shank. Refer to Figure 3-3.

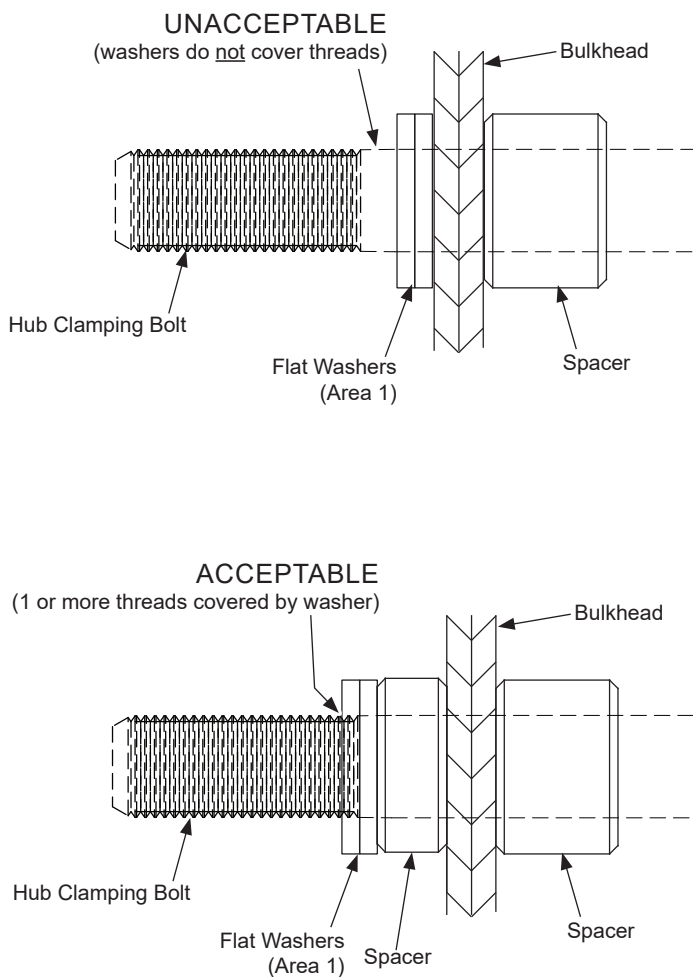
NOTE: Additional washers/spacers may have been used during assembly of the propeller for hub clamping purposes. These additional washers/spacers may not be components of the applicable spinner mounting kit.

CAUTION 1: USE ONLY WASHERS/SPACERS FROM THE APPLICABLE SPINNER MOUNTING KIT TO INSTALL THE SPINNER BULKHEAD.

CAUTION 2: THE STACK-UP SEQUENCE FOR EACH HUB CLAMPING BOLT MUST BE THE SAME. VARIANCES BETWEEN STACK-UPS CAN CAUSE CRACKING OF THE SPINNER BULKHEAD. EXCEPTIONS MAY BE REQUIRED IF PROPELLER APPLICATIONS HAVE DE-ICE OR ANTI-ICE APPLICATIONS. REFER TO HARTZELL PROPELLER ICE PROTECTION SYSTEM MANUAL 180 (30-61-80) FOR INSTALLATION INSTRUCTIONS.

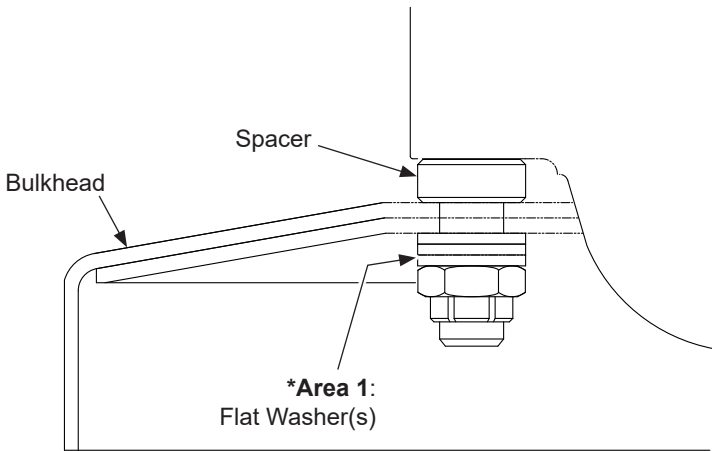
CAUTION 3: DO NOT LET THE SPINNER BULKHEAD TOUCH THE HUB. TO MAINTAIN BULKHEAD TO HUB CLEARANCE, ADDITIONAL FLAT WASHER(S) OR SPACER(S) MAY BE REQUIRED.

- (2) If applicable, install the spacer(s) onto the hub clamping bolts, then install the spinner bulkhead onto the hub clamping bolts.
 - (a) For applications that do not use spacers, install a minimum of two flat washers between the spinner bulkhead and the propeller hub.
 - (b) Refer to Hartzell Propeller Application Guide 159 (61-02-59) for the applicable spinner mounting kit and the spinner mounting kit parts list.



TPI-JM-000256

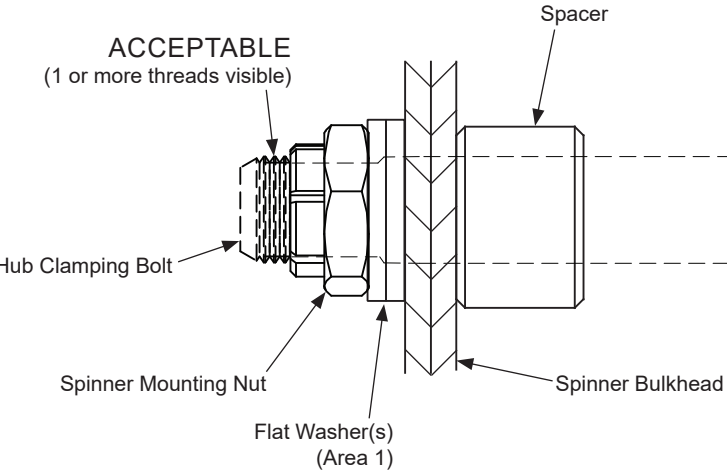
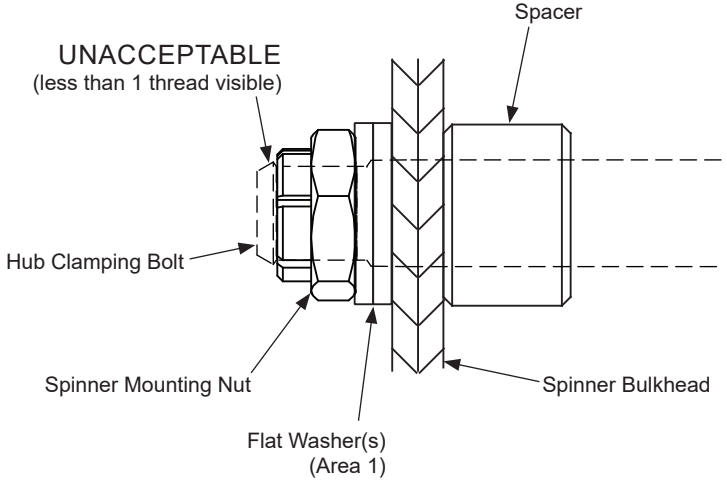
Thread Coverage: Metal Bulkhead
Figure 3-4



* Up to three flat washers can be installed in **Area 1** to get proper thread engagement.

TPH-MB-0459

**Metal Bulkhead Mounting
Figure 3-5**



TPI-JM-000258

Thread Exposure: Metal Bulkhead
Figure 3-6

CAUTION: A MINIMUM OF ONE THREAD MUST BE COVERED BY FLAT WASHER(S) TO MAKE SURE THE SPINNER MOUNTING NUT WILL NOT BOTTOM OUT ON THE NON-THREADED AREA OF THE HUB CLAMPING BOLT. REFER TO FIGURE 3-4 FOR ILLUSTRATIONS OF ACCEPTABLE/UNACCEPTABLE THREAD COVERAGE.

- (3) Install one flat washer and/or spacer (if applicable) onto the hub clamping bolts, then check the thread coverage on the hub clamping bolts in accordance with Figure 3-4.
 - (a) If the washer/spacer covers a minimum of one thread on the hub clamping bolt, go to step (4) of this procedure.
 - (b) If the washer/spacer does not cover at least one thread on the hub clamping bolt, install additional flat washer(s) from the spinner mounting kit in accordance with Figure 3-5.
 - 1 Up to three flat washers can be installed in Area 1 to get proper thread coverage. Refer to Figure 3-4 and Figure 3-5.

CAUTION: AT LEAST ONE THREAD OF THE HUB CLAMPING BOLT MUST BE VISIBLE BELOW THE SPINNER MOUNTING NUT. REFER TO FIGURE 3-6 FOR ILLUSTRATIONS OF ACCEPTABLE AND UNACCEPTABLE THREAD EXPOSURE.

- (4) Install a spinner mounting nut on each of the hub clamping bolts used to mount the spinner bulkhead.
 - (a) Torque each spinner mounting nut in accordance with the section, "Propeller Mounting Hardware and Torque Information" in this chapter.

- (b) If there is less than one hub clamping bolt thread visible below the spinner mounting nut, remove one of the additional washers added in Area 1, then reinstall/torque the spinner mounting nut and check the thread exposure.

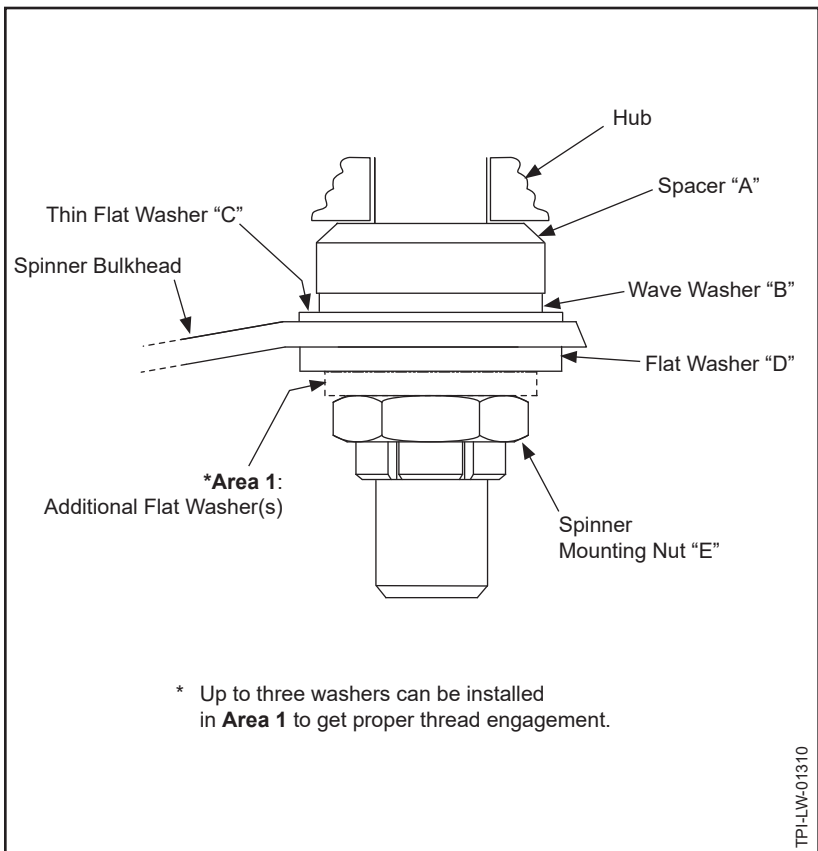
1 A minimum of one washer is required in Area 1.

- (5) Refer to the section, "Spinner Assembly Clearance Checks" in this chapter.
- (6) To adjust the position/spacing of the spinner bulkhead, refer to the section, "Metal Bulkhead Spacing Adjustments" in this chapter.

C. Installation of a Composite Bulkhead

CAUTION: REMOVE THE NUTS AND WASHERS FROM THE HUB CLAMPING BOLTS ON THE LEFT/RIGHT SIDE OF THE BLADE SHANK ONLY. DO NOT REMOVE THE HUB CLAMPING BOLTS.

- (1) Remove spinner mounting nuts "E" and flat washers "D" from the hub clamping bolts located on the left/right side of the blade shank. Refer to Figure 3-3 and Figure 3-7.



Composite Bulkhead Mounting
Figure 3-7

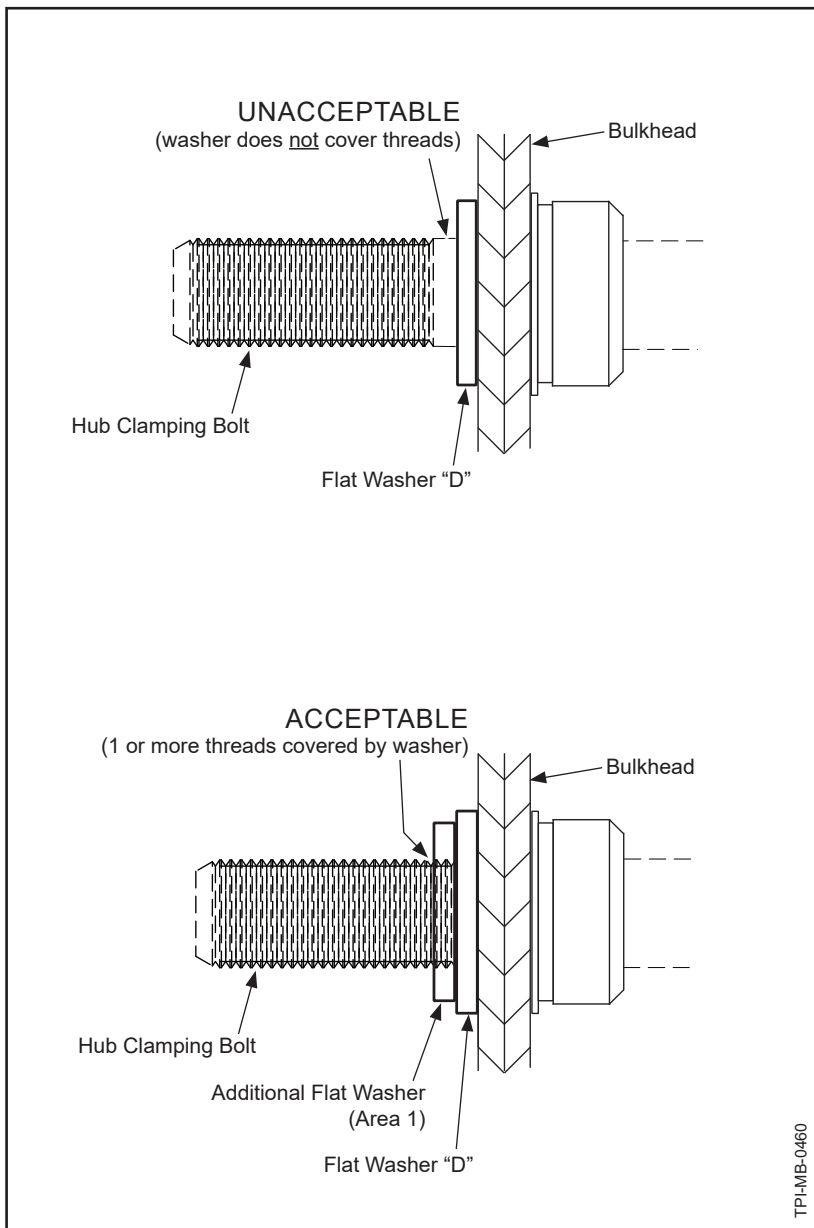
CAUTION 1: THE STACK-UP SEQUENCE FOR EACH HUB CLAMPING BOLT MUST BE THE SAME. VARIANCES BETWEEN STACK-UPS CAN CAUSE CRACKING OF THE SPINNER BULKHEAD. EXCEPTIONS MAY BE REQUIRED IF PROPELLER APPLICATIONS HAVE DE-ICE OR ANTI-ICE APPLICATIONS. REFER TO HARTZELL PROPELLER ICE PROTECTION SYSTEM MANUAL 180 (30-61-80) FOR INSTALLATION INSTRUCTIONS.

CAUTION 2: DO NOT LET THE SPINNER BULKHEAD TOUCH THE HUB. TO MAINTAIN BULKHEAD TO HUB CLEARANCE, ADDITIONAL FLAT WASHER(S) OR SPACER(S) MAY BE REQUIRED.

(2) Install spacer "A", wave washer "B", and thin flat washer "C" onto the hub clamping bolts in accordance with Figure 3-7, then install the spinner bulkhead onto the hub clamping bolts.

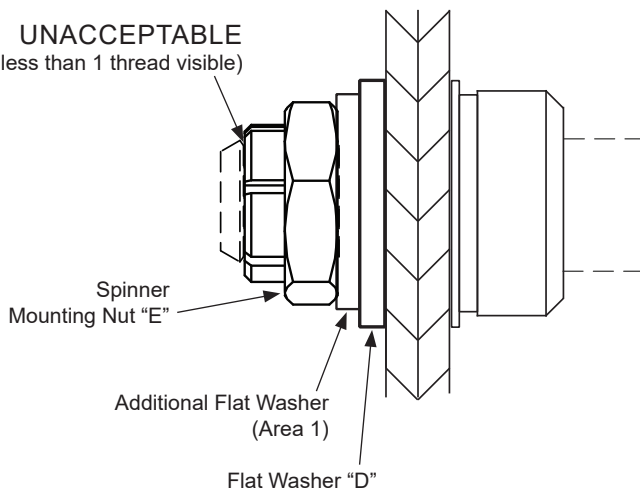
(a) Refer to Hartzell Propeller Application Guide 159 (61-02-59) for the applicable spinner mounting kit.

(b) Refer to Hartzell Propeller Composite Spinner Maintenance Manual 148 (61-16-48) for the parts list of the spinner mounting kit.

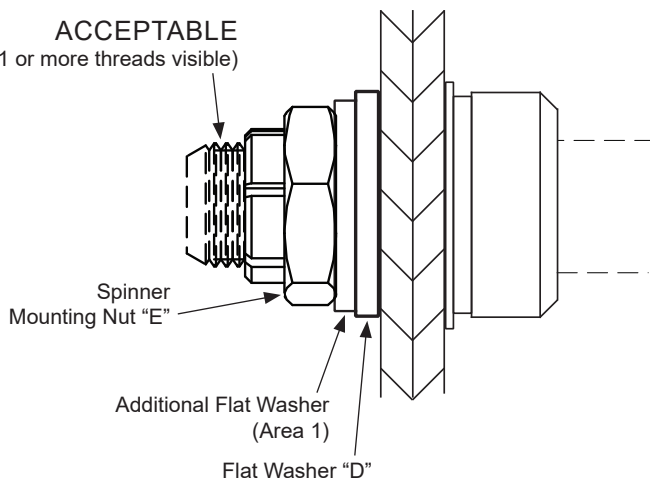


Thread Coverage: Composite Bulkhead
Figure 3-8

UNACCEPTABLE
(less than 1 thread visible)



ACCEPTABLE
(1 or more threads visible)



TPL-MB-0461

Thread Exposure: Composite Bulkhead
Figure 3-9

CAUTION: A MINIMUM OF ONE THREAD MUST BE COVERED BY FLAT WASHER “D” AND/OR ADDITIONAL FLAT WASHER(S) TO MAKE SURE THE SPINNER MOUNTING NUT “E” DOES NOT BOTTOM OUT ON THE NON-THREADED AREA OF THE HUB CLAMPING BOLT. REFER TO FIGURE 3-8 FOR ILLUSTRATIONS OF ACCEPTABLE/ UNACCEPTABLE THREAD COVERAGE.

- (3) Install one flat washer “D” onto the hub clamping bolts, then check the thread coverage on the hub clamping bolts in accordance with Figure 3-8.
 - (a) If washer “D” covers a minimum of one thread on the hub clamping bolt, go to step (4) of this procedure.
 - (b) If washer “D” does not cover at least one thread on the hub clamping bolt, install additional flat washer(s) in accordance with Figure 3-7.
 - 1 Up to three flat washers may be installed in Area 1 to get proper thread coverage
Refer to Figure 3-7 and Figure 3-8.

CAUTION: AT LEAST ONE THREAD OF THE HUB CLAMPING BOLT MUST BE VISIBLE BELOW THE SPINNER MOUNTING NUT. REFER TO FIGURE 3-9 FOR ILLUSTRATIONS OF ACCEPTABLE AND UNACCEPTABLE THREAD EXPOSURE.

- (4) Install a spinner mounting nut “E” on each of the hub clamping bolts used to mount the spinner bulkhead.
 - (a) Torque each spinner mounting nut in accordance with the section, “Propeller Mounting Hardware and Torque Information” in this chapter.
 - (b) If there is less than one hub clamping bolt thread visible below the spinner mounting nut “E”, remove one of the additional washers added in Area 1, then reinstall/torque the spinner mounting nut and check the thread exposure. Refer to Figure 3-9.
 - 1 Flat washer “D” is required in Area 1.

- (5) Refer to the section, “Spinner Assembly Clearance Checks” in this chapter.
- (6) To adjust the position/spacing of the spinner bulkhead, refer to the section, “Composite Bulkhead Spacing Adjustments” in this chapter.

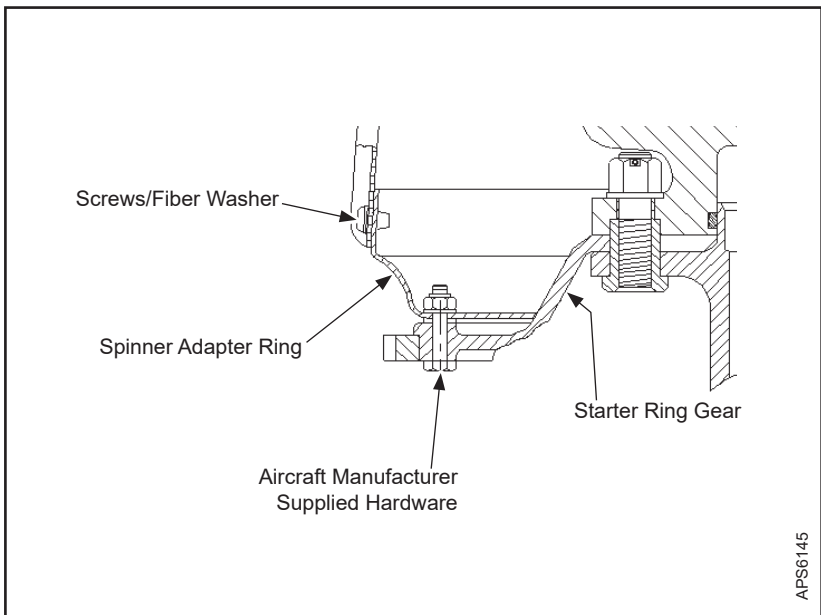
5. Spinner Adapter Ring Installation (if applicable)

A. Installation

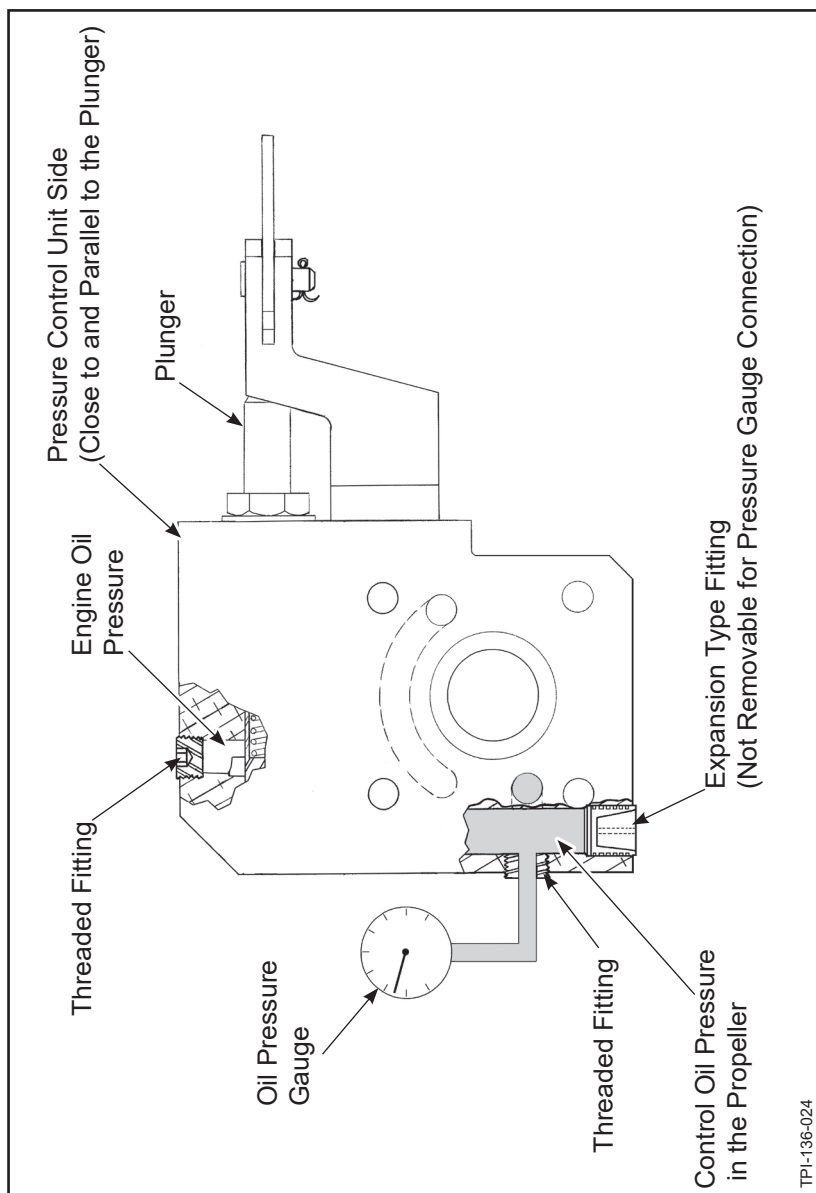
- (1) Install the spinner adapter ring to the starter ring gear using hardware supplied by the airframe manufacturer. Refer to Figure 3-10.

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 3-10.
- (2) Torque the bolts as specified by the airframe manufacturer.



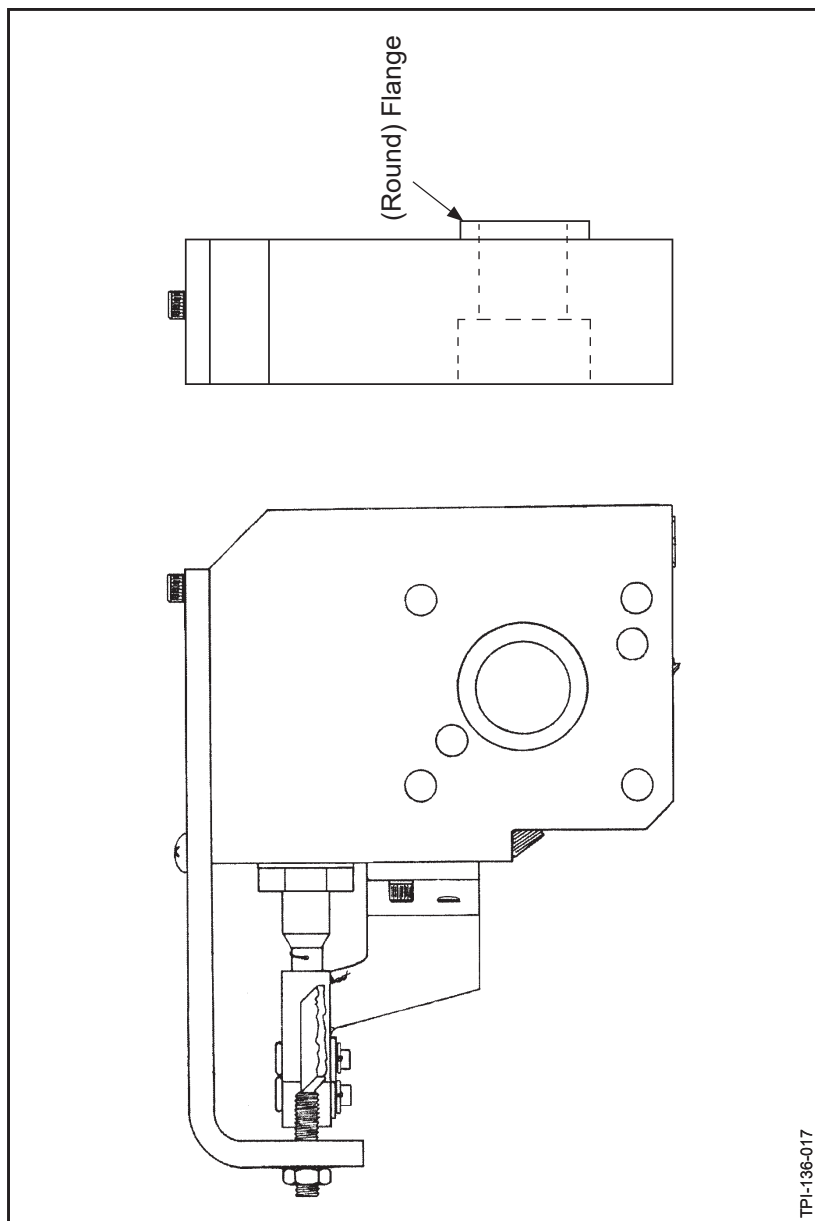
Spinner Adapter Ring
Figure 3-10



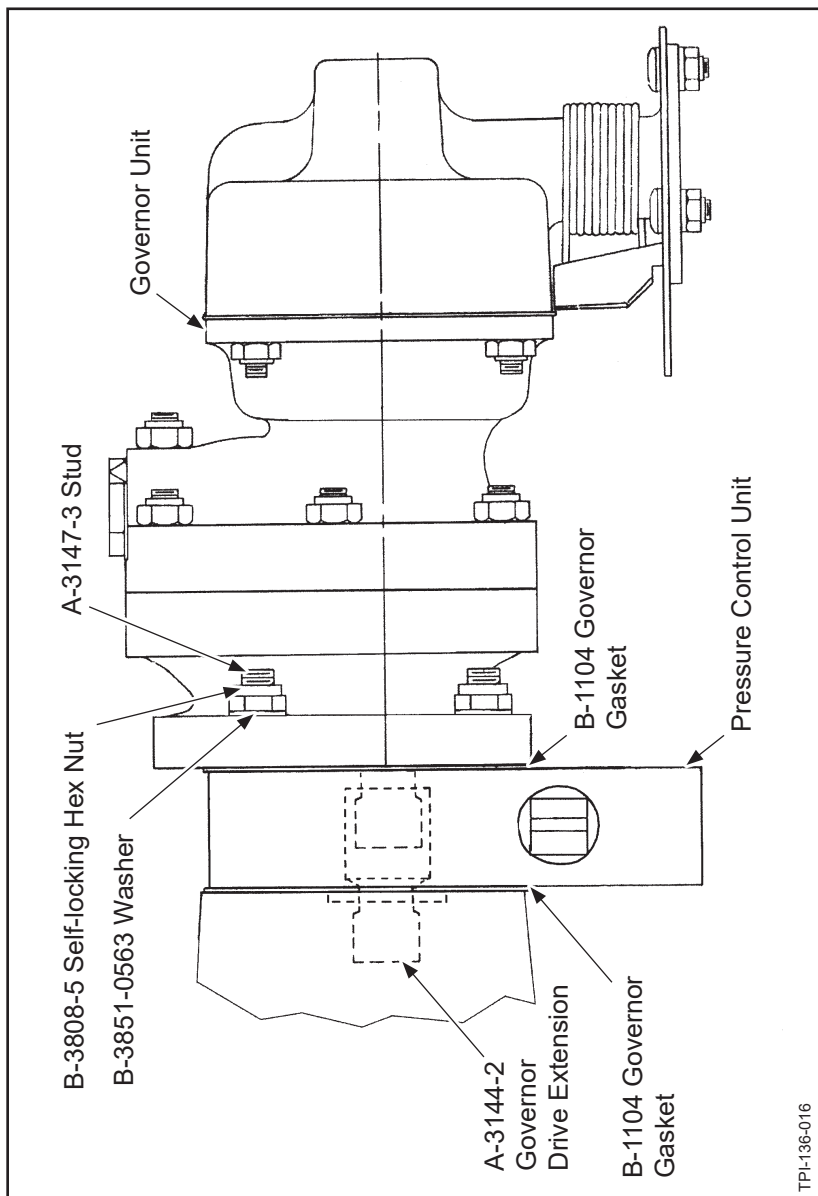
Sample of a Pressure Control Unit and
Pressure Gauge Attachment

Figure 3-11

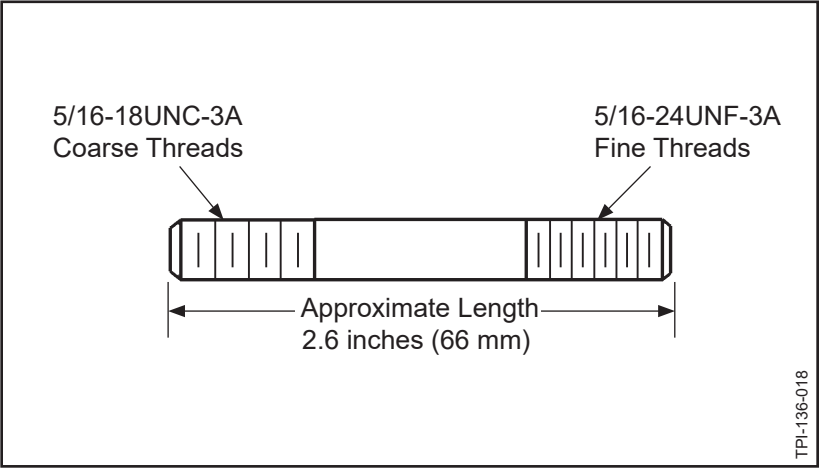
6. Pressure Gauge Attachment to the Pressure Control Unit
 - A. Hydraulic connection of the cockpit mounted pressure gauge is shown in Figure 3-11.
 - B. The pressure gauge is locally procured.
 - (1) The pressure range of the pressure gauge must be from a minimum of no more than 25 psi through a high pressure of no less than 300 psi.
 - (2) A liquid filled pressure gauge is recommended for damping of the needle movement.
 - C. There are many pressure control unit designs available because of the unique requirements of each installation/application.
 - (1) Figure 3-11 shows a sample pressure control unit, which can vary from the pressure control unit that is supplied.
 - D. The pressure control unit side that is close to and parallel to the plunger will have several threaded fittings to connect to engine oil pressure and internal porting. Refer to Figure 3-11.
 - (1) The oil pressure gauge is NOT to be connected to the pressure control unit at these threaded fittings.
 - (2) The oil pressures under these fittings are not representative of the control oil pressure in the propeller. Refer to Figure 3-11.
 - E. The oil pressure gauge is shown attached to the pressure control unit at a threaded fitting that accesses the control oil pressure in the propeller. Refer to Figure 3-11.
 - (1) The threaded fitting is easily removable and replaceable with another fitting and hydraulic tube for connection to the pressure gauge.
 - F. Some pressure control units have one of two fittings, that access the control oil pressure in the propeller, as an expansion type fitting that installs in a smooth bore and is not field removable for pressure gauge connection. Refer to Figure 3-11.



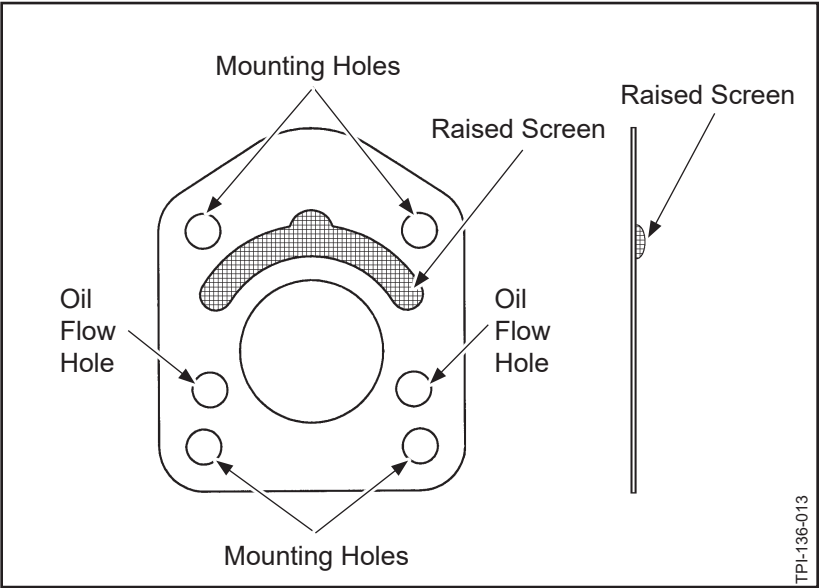
Sample Pressure Control Unit
Figure 3-12



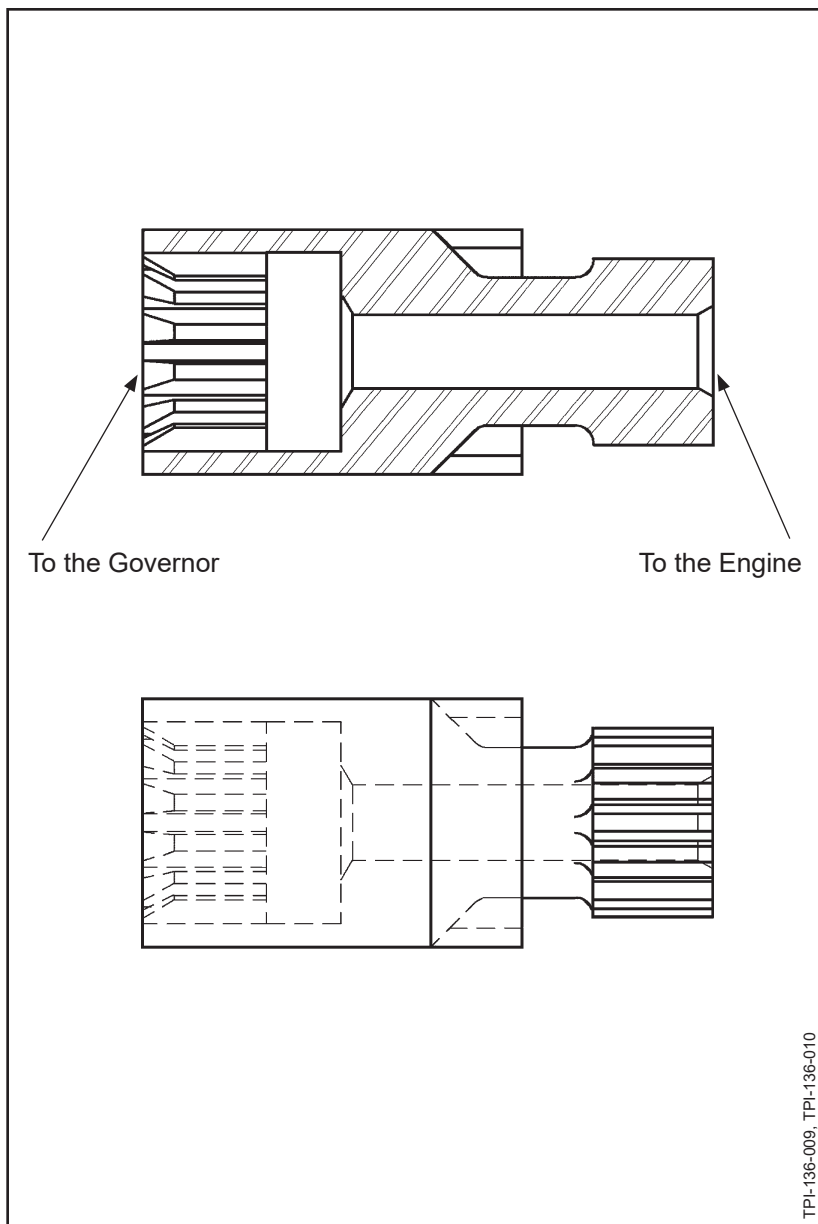
**Sample Governor Unit and Pressure Control Unit
Installed on the Engine
Figure 3-13**



A-3147-3 Stud
Figure 3-14



B-1104 Governor Gasket
Figure 3-15



A-3144-2 Governor Drive Extension
Figure 3-16

7. Pressure Control Unit and Governor Installation

A. Before Installation

(1) Before installation the following items must be available:

(a) One pressure control unit, available from Hartzell Propeller LLC.

1 For a sample pressure control unit, refer to Figure 3-12.

2 The specific pressure control unit supplied may vary from the sample shown in Figure 3-12.

(a) The part number for the pressure control unit is as required for the applicable installation.

(b) One governor unit, available from Hartzell Propeller LLC.

1 For a sample governor that is shown in the installed position, refer to Figure 3-13.

(a) The part number for the governor is as required for the applicable installation.

(c) Four A-3147-3 studs, available from Hartzell Propeller LLC. Refer to Figure 3-14.

(d) Two B-1104 governor gaskets, available from Hartzell Propeller LLC. Refer to Figure 3-15.

(e) One A-3144-2 governor drive extension, available from Hartzell Propeller LLC. Refer to Figure 3-16.

(f) Four B-3808-5 self-locking hex nuts. Refer to Figure 3-13.

(g) Four B-3851-0563 washers. Refer to Figure 3-13.

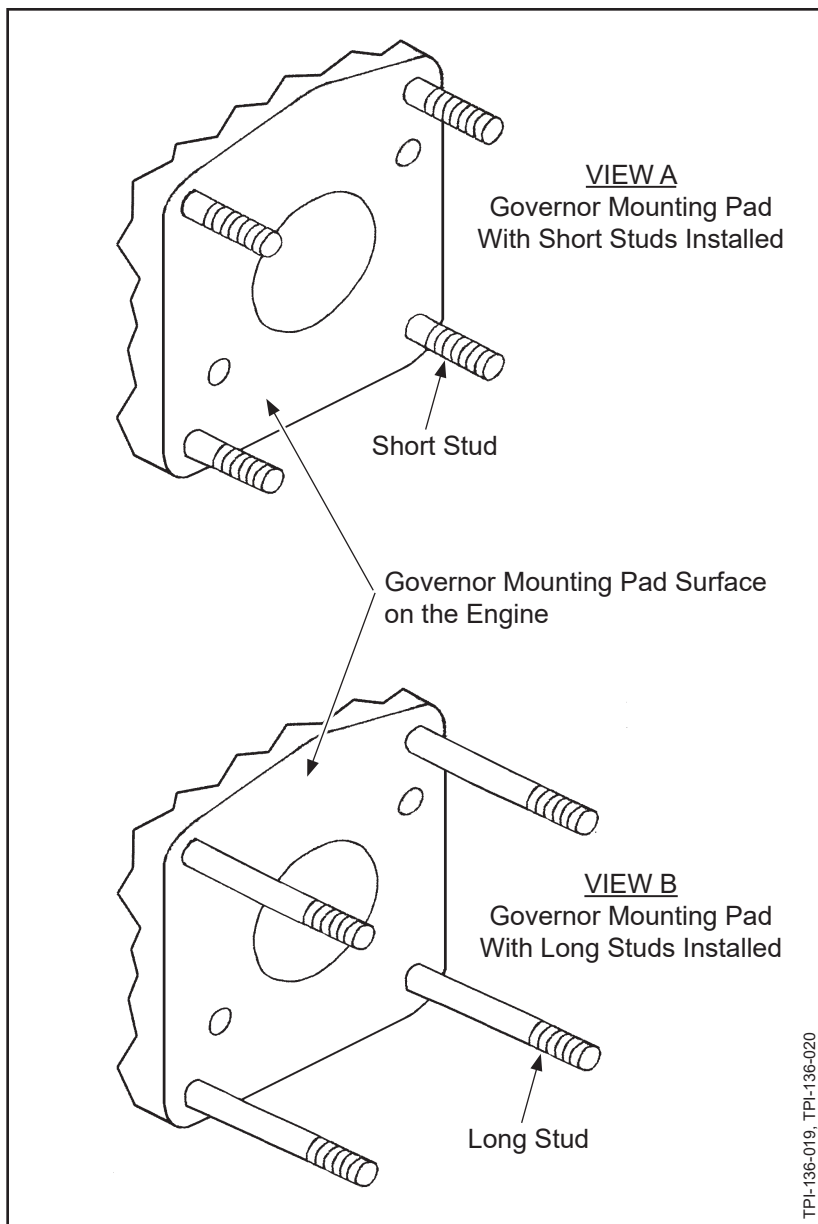
(h) Threadlocker CM152, available from Hartzell Propeller LLC or locally procured

(i) Primer T CM127, available from Hartzell Propeller LLC or locally procured

(j) A torque wrench and a torque wrench adapter to attach to B-3808-5 self-locking hex nuts (1/2 inch across the flats), locally procured

(k) Stud installer/remover to fit a 5/16-UNF24-3A thread, locally procured

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Governor Mounting Pad With Studs Installed

Figure 3-17

B. Preparing the Governor Mounting Pad on the Engine.**(1) General**

(a) If a governor only was previously installed on the engine, the four studs installed in the governor mounting pad will be too short for the required installation of the pressure control unit between the governor and the engine.

1 Figure 3-17, View A, shows the governor mounting pad on the engine with short studs installed.

2 Figure 3-17, View B, shows the governor mounting pad on the engine with long studs installed.

(b) The four long studs are Hartzell Propeller part number A-3147-3.

1 The A-3147-3 studs have a 5/16-24UNF-3A thread (fine thread) on one end and a 5/16-18UNC-3A thread (coarse thread) on the other end and are approximately 2.6 inches (66 mm) long.

(2) Using a locally procured stud installer/remover, remove the four short studs.

(3) Using a plastic tool, remove any remaining gasket material to make the governor mounting pad surface on the engine flat.

WARNING: ADHESIVES AND SOLVENTS ARE FLAMMABLE AND TOXIC TO THE SKIN, EYES, AND RESPIRATORY TRACT. SKIN AND EYE PROTECTION ARE REQUIRED. AVOID PROLONGED CONTACT AND BREATHING OF VAPORS. USE SOLVENT RESISTANT GLOVES TO MINIMIZE SKIN CONTACT AND WEAR SAFETY GLASSES FOR EYE PROTECTION. USE IN A WELL VENTILATED AREA AWAY FROM SPARKS AND FLAME. READ AND OBSERVE ALL WARNING LABELS.

- (4) Using solvent MEK CM106 or MPK CM219, clean the governor mounting pad surface on the engine.
- (5) Using solvent MEK CM106 or MPK CM219, clean each of the four 5/16-18 threaded holes in the governor mounting pad on the engine.
- (6) Using solvent MEK CM106 or MPK CM219, clean the 5/16-18UNC-3A threads (coarse threads) on each of the four A-3147-3 studs.
- (7) Apply Primer T CM127 to each of the four 5/16-18 threaded holes in the governor mounting pad on the engine and let air dry.
- (8) Apply Primer T CM127 to the 5/16-18UNC-3A threads (coarse threads) on each of the four studs and let air dry.

CAUTION: APPLY CM152 TO BOTH THE THREADS ON THE STUD AND THE THREADS IN THE GOVERNOR MOUNTING PAD.

- (9) Apply threadlocker CM152 to each of the 5/16-18 threaded holes in the governor mounting pad on the engine.

NOTE: Application of CM152 to both the threads on the stud and the threads in the governor mounting pad is required to prevent loss of CM152 during installation of the studs into a blind hole. Displaced air in the blind hole will try to push the CM152 off of the stud and out of the hole.

- (10) Apply threadlocker CM152 to the 5/16-18UNC-3A threads (coarse threads) on each stud.
- (11) Turn the 5/16-18UNC-3A threads (coarse threads) of a stud into each of the 5/16-18 threaded holes in the governor mounting pad on the engine.
- (12) Let the threadlocker CM152 cure for a minimum of 24 hours.

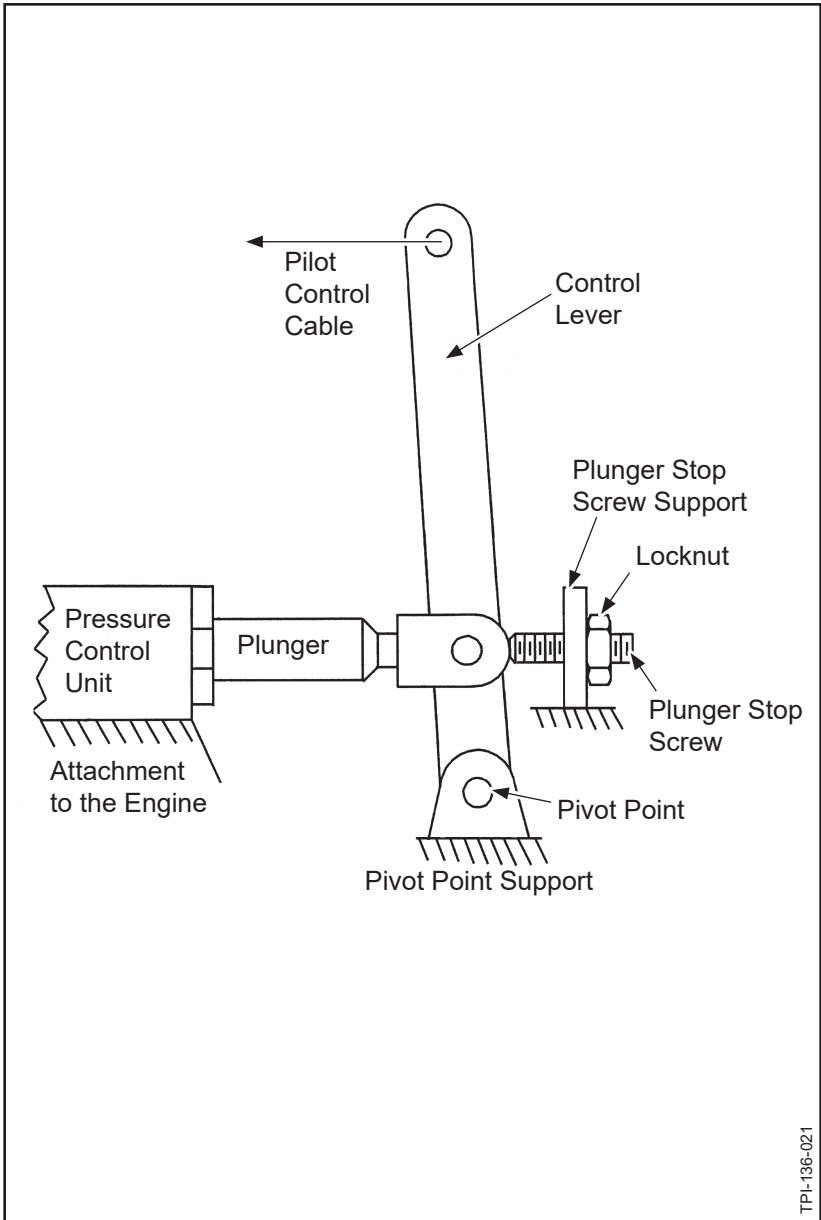
C. Installing the Pressure Control Unit and the Governor

- (1) With the raised screen pointing away from the engine mounting pad, install the B-1104 governor gasket over the four studs, making sure that the screened slot and oil flow holes in the governor gasket correctly align with the oil holes in the governor mounting pad of the engine. Refer to Figure 3-15.
 - (a) One oil flow hole in the governor gasket may not be needed.
- (2) With the (round) flange pointing toward the engine governor mounting pad, install the pressure control unit. Refer to Figure 3-12 and Figure 3-13.
 - (a) The pressure control unit will only install in one of four possible orientations.
 - (b) Make sure that the pressure control unit, control lever, and pressure gauge port align with the aircraft fittings.
- (3) With the raised screen pointing away from the pressure control unit, install a second B-1104 governor gasket over the four studs, making sure that the oil flow holes in the pressure control unit correctly align with the screened slot and oil flow holes in the B-1104 governor gasket.

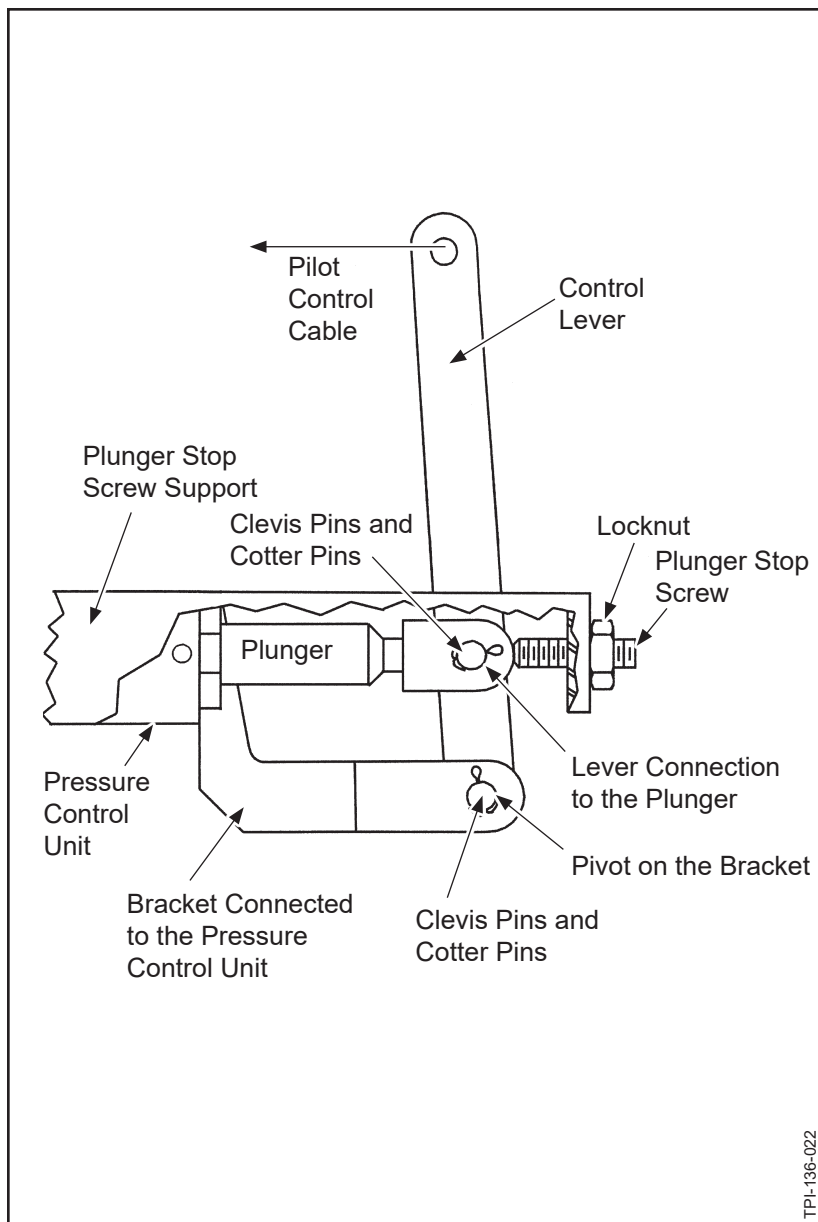
- (4) Install the governor over the four studs.
 - (a) Make sure that the semicircular screen in the B-1104 governor gasket aligns with the semicircular groove in the governor base and that the oil ports of the governor correctly align with the pressure control unit and governor gasket oil flow holes(s).
 - (b) Push the four studs through the four holes in the governor until the studs are through the governor flange surface and a washer and nut can be installed.
- (5) Install a B-3851-0563 washer on each of the four studs.
- (6) Turn a B-3808-5 self-locking hex nut on each stud.
- (7) Torque each B-3808-5 self-locking hex nut with a torque wrench and a torque adapter (that fits a hex nut that is 1/2 inch across the flats) in accordance with Table 3-1 and Figure 3-1.
- (8) Attach the RPM control cable to the control arm of the governor.
- (9) Attach the pilot control cable (manual reverse thrust operation and maneuvering) to the pressure control unit control lever.

D. Pressure Control Unit Adjustment

- (1) After installation of the propeller, pressure control unit, and governor, the pressure control unit will require adjustment for correct operation of the propeller.
 - (a) The adjustment instructions assume that the governor RPM control has been connected to the cockpit control and that any maximum RPM adjustments at the governor or cockpit control have been completed.
- (2) The distance that the plunger of the pressure control unit is permitted to extend out of the pressure control unit body must be adjusted and secured.
 - (a) The procedure used to determine this distance will be discussed in the section, "Plunger Stop Screw Adjustment" in this chapter.



Pressure Control Components - Field Supplied
Figure 3-18



TPI-136-022

Pressure Control Components - Hartzell Propeller LLC Supplied
Figure 3-19

- (b) This section discusses the additional parts outside the basic pressure control unit that are required and the geometries associated with these parts.
 - 1 The pressure control reversing propeller system in Figure 2-2, "Pressure Control Reversing Propeller System" in the Description and Operation chapter of this manual shows a bolt or set screw and a locking nut attached to a secure feature to restrain the amount of movement of the plunger away from the pressure control unit body.
 - a If the plunger extends farther out of the pressure control unit body, it will lower the oil pressure permitted to reach the propeller during normal governed flight.
 - (1) Reducing this distance will increase the oil pressure to the propeller during normal governed flight.
 - 2 Figure 2-2, "Pressure Control Reversing Propeller System" in the Description and Operation chapter of this manual is a simplified representation of the pressure control reversing propeller system and does not show some detail and components.
 - a A more accurate representation of the parts involved with the minimum oil pressure adjustment is shown in Figure 3-18 or Figure 3-19.
 - (1) If installing a pressure control unit that does not have a plunger stop, pivot point (bracket), or control lever, refer to Figure 3-18.
 - (a) These pressure control units still require these features and the customer or airframe manufacturer must provide these features or parts.

- (2) If installing a pressure control unit with the plunger stop, pivot point (bracket) and lever incorporated into the Hartzell Propeller supplied pressure control unit, refer to Figure 3-19.
- 3 A control lever has been introduced to permit the pilot to pull on a cable and push the plunger into the pressure control unit body.
- a The plunger compresses the pressure relief compression spring that resists the movement of the plunger into the pressure control unit body. Refer to Figure 2-2, "Pressure Control Reversing Propeller System" in the Description and Operation chapter of this manual.
- 4 The control lever is first attached to a pivot point that is secured.
- a The control lever rotates around the pivot point that is attached at one end of its length. Refer to Figure 3-18 or Figure 3-19.
- 5 The second control lever attachment is to the pressure control unit plunger. Refer to Figure 3-18 or Figure 3-19.
- 6 The third control lever attachment is to the pilot control through a cable. Refer to Figure 3-18 or Figure 3-19.
- 7 The pressure relief compression spring pushes on the plunger that pushes the control lever away from the pressure control unit until it is stopped by the plunger stop screw. Refer to Figure 2-2, "Pressure Control Reversing Propeller System" in the Description and Operation chapter of this manual and Figure 3-18 or Figure 3-19.
- 8 Moving the propeller blade angle from low pitch into beta range is done by pulling on the pilot control.



- a This will pull the lever and plunger away from the plunger stop screw and increase oil pressure supplied to the propeller.
 - 9 Determination of the adjustment location of the plunger stop screw is discussed in the section, "Plunger Stop Screw Adjustment" in this chapter.
- (3) Plunger Stop Screw Adjustment
 - (a) It is necessary to understand the operational features of the pressure control reversing propeller system to correctly locate the plunger stop screw location of the pressure control unit.
 - 1 In the Description and Operation chapter, the section 1.C.(4) discusses setting the Pressure Control Unit to a pressure attenuation value which will be performed by the plunger stop screw.
 - (b) Refer to the Description and Operation chapter of this manual for construction, hardware description, and operation.
 - 1 Careful reading and understanding of the section "Propeller Beta (Reverse) Operation" in the Description and Operation chapter of this manual is required.
 - 2 The section 1.D.(7)(a) addresses the feature of fixed oil pressure attenuation that is performed by correct location (adjustment) of the plunger stop screw.
 - (c) The propeller control oil pressures that are shown in Figure 2-3, "Oil Pressures - Pressure Control Reversing Propeller" in the Description and Operation chapter of this manual are reproduced with some additional information as Figure 3-20 in this section.
 - 1 The oil pressure chart in Figure 3-20 will be used to help understand how to determine where to locate the plunger stop screw to obtain the correct fixed oil pressure reduction for governed propeller operation.

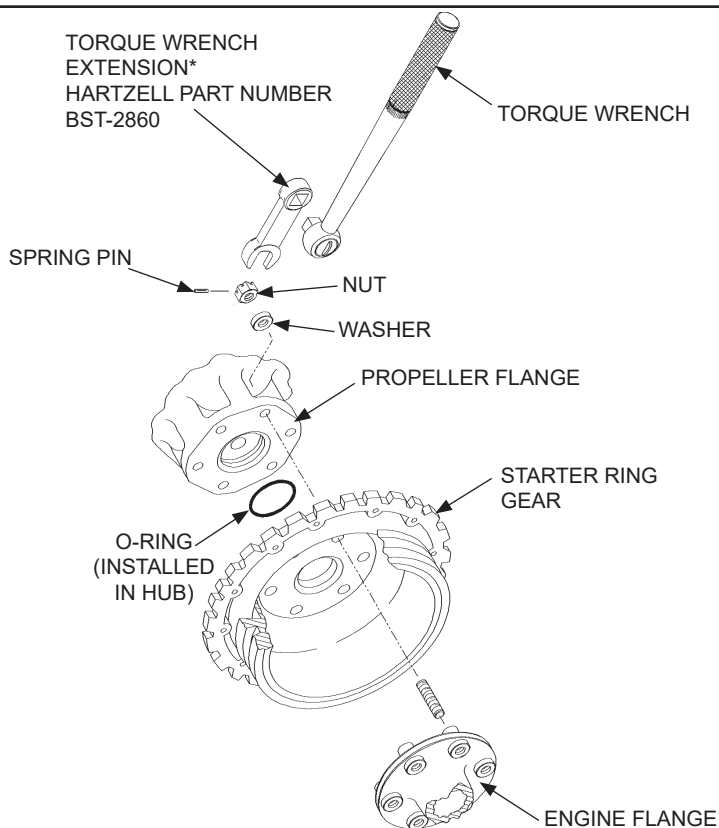
- (d) Figure 3-20 shows propeller control oil pressures that are required between the blade angle ranges of high pitch and maximum reverse pitch.
 - 1 The horizontal axis represents the blade angle of the propeller.
 - 2 The vertical axis represents the magnitude of oil pressure required for propeller control.
- (e) Between low pitch and high pitch there are two straight sloped lines that are parallel to each other. Refer to Figure 3-20.
 - 1 The lower line represents the oil pressure that is required for propeller control when the blade angle is increasing.
 - 2 The upper line represents the oil pressure that is required for propeller control when the blade angle is decreasing.
 - 3 The different oil pressures that are required for propeller control at the same blade angle when increasing or decreasing blade angle is caused by friction involved in moving the propeller pitch change components.
 - 4 The oil pressure between low pitch and high pitch, which changes, is caused by the springs in the cylinder of the propeller. Refer to Figure 2-2, "Pressure Control Reversing Propeller System" in the Description and Operation chapter of this manual.
- (f) The plunger stop screw must be adjusted get a pressure that is 10 to 20 psi above the low pitch oil pressure that was obtained during a decrease pitch movement of the propeller blades. Refer to Position 3 in Figure 3-20.

- (g) The preloaded spring in the hub that is between the propeller blades and the engine flange, must be overcome by the propeller oil pressure before the blades will move from low pitch to lower blade angles in the beta range. Refer to Figure 2-2, "Pressure Control Reversing Propeller System" in the Description and Operation chapter of this manual and Position 2 in Figure 3-20.
- (h) When at low pitch blade angle position it is possible to be at many oil pressures ranging from Position 1 (increasing pitch from low pitch) to Position 2 (decreasing blade pitch into beta range). Refer to Figure 3-20.
- (i) The plunger stop screw is to be adjusted to get an oil pressure at Position 3 that is 10 to 20 psi above the oil pressure that it takes to reach low pitch position during decreasing pitch, which is shown as Position 4. Refer to Figure 3-20.
- (j) The installed cockpit mounted oil pressure gauge is shown in Figure 2-2, "Pressure Control Reversing Propeller System" in the Description and Operation chapter of this manual and discussed in the Description and Operation chapter.
 - 1 The pressure range recommended is 0 to 300 psi.
 - 2 The purpose is to monitor that the oil pressure reduction value is still at Position 3 before each flight.
 - a This is to make sure that the governor has sufficient oil pressure available for blade angle control during governed flight and that the oil pressure is not so high, oil pressure above Position 2, that accidental entry into beta range might occur.

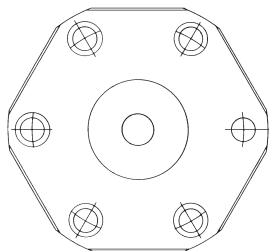
- (k) Position 4 at low pitch blade angle must be determined.
 - 1 The objective is to determine what oil pressure is required to just reach low pitch blade angle during decreasing blade pitch.
 - 2 The blade model, counterweights, cylinder mounted springs, and friction resisting blade movement will affect the oil pressure required to reach low pitch blade angle.
 - 3 The cockpit mounted oil pressure gauge will be monitored to identify the Position 4 oil pressure.
- (l) Determine the Position 4 oil pressure:
 - 1 Before starting the engine, adjust the plunger stop screw away from the plunger. Refer to Figure 3-18 or Figure 3-19.
 - a This will make sure that the oil pressure will be lower than required.
 - b With the aircraft static on the ground start the engine at idle power.
 - c Select maximum RPM with the governor RPM control.
 - d Increase engine power (throttle) slowly until reaching 1200 to 1400 RPM.
 - e Now move the pilot control in the cockpit to push the plunger into the pressure control unit and get an oil pressure of 100 PSI for the first effort to determine the Position 4 oil pressure value.
 - f Continue increasing engine power (throttle) slowly to maximum power.
- (m) If the engine RPM reaches maximum before reaching maximum power, then the governor was activated to increase blade angle to stop the RPM increase and will have dropped the oil pressure shown on the cockpit mounted oil pressure gauge to a Position 1 location or lower. Refer to Figure 3-20.

- 1 This is not a true indication of the oil pressure permitted by the pressure control unit.
 - 2 Repeat step 4.D.(3)(l) and move the pilot control in the cockpit to push the plunger into the pressure control unit and obtain an oil pressure that is increased 10 PSI from the previous effort.
- (n) If the engine RPM does not reach the maximum RPM permitted by the governor, then move the pilot control to push the plunger farther into the pressure control unit and slowly increase oil pressure above the previously selected oil pressure until the resultant increase of RPM just reaches maximum RPM.
- 1 This is the Position 4 oil pressure. Refer to Figure 3-20.
 - 2 Move the pilot control to obtain an additional 10 to 15 PSI increase.
 - 3 This is Position 3 oil pressure value. Refer to Figure 3-20.
 - a Record this pressure value in the propeller logbook.
 - 4 Lock the pilot control in place to permit later examination of the pressure control unit plunger location after the engine is shut down.
 - 5 Shut down the engine.
- (o) The pressure control unit plunger was repositioned into the pressure control unit by the pilot control and control lever. Refer to Figure 3-18 or Figure 3-19.
- 1 Release the locknut on the plunger stop screw and turn the plunger stop screw toward the new location of the pressure control unit plunger until it contacts the pressure control unit plunger.
 - 2 Apply threadlocker CM152 to the interface between the locknut and the plunger stop screw and mechanically jam the lock nut onto the plunger stop screw and against the plunger stop screw support.

- (p) Determine that the Position 3 oil pressure is still the same. Refer to Figure 3-20.
- 1 With the aircraft static on the ground, start the engine at idle power.
 - 2 Select maximum RPM with the governor RPM control.
 - 3 Increase engine power (throttle) slowly until reaching 1200 to 1400 RPM.
 - 4 The oil pressure value on the oil pressure gauge should be the same Position 3 oil pressure as previously obtained. Refer to Figure 2-2 and Figure 3-20.
 - 5 Minor plunger stop screw positional changes are permitted to obtain the previously determined Position 3, oil pressure value. Refer to Figure 3-20.



***NOTE:** When using the torque wrench extension, use the calculation in Figure 3-1 to determine correct torque wrench setting



APS6160D, APS6172

"R" Flange Propeller Mounting
Figure 3-21

WARNING: FAILURE TO FOLLOW THESE INSTALLATION INSTRUCTIONS MAY LEAD TO PROPELLER DAMAGE, ENGINE DAMAGE, OR PROPELLER FAILURE, WHICH MAY RESULT IN DEATH, SERIOUS BODILY INJURY, AND/OR SUBSTANTIAL PROPERTY DAMAGE. UNUSUAL OR ABNORMAL VIBRATION DEMANDS IMMEDIATE INSPECTION FOR IMPROPER PROPELLER INSTALLATION. PROPELLER SEPARATION MAY OR MAY NOT BE PROCEEDED BY VIBRATION.

8. Propeller Installation

A. Flange Description

- (1) Compact propellers are manufactured with six basic hub mounting flange designs. The flange type designators are D, F, K, L, N, or R.
- (2) The flange type used on a particular propeller installation is indicated in the propeller model stamped on the hub. For example, HC-E3YR-7 indicates an "R" flange.
- (3) Refer to Aluminum Hub Propeller Model Identification in the Description and Operation Chapter of this manual for description of each flange type. A sample "R" flange is also shown in Figure 3-21.

B. Installation of "R" Flange Propellers

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.

(1) General

- (a) An "R" flange is an SAE No. 2 flange that has six 1/2 inch studs configured in a 4.75 inch circle.

- (b) Five ("R" flange) drive bushings transfer torque and index the propeller with respect to the engine crankshaft. The bushings are located on the engine flange and fit into counterbored holes on the propeller flange. Refer to Figure 3-21.
 - (c) The bushing locations used on a particular propeller installation are indicated in the propeller model stamped on the hub. Refer to Aluminum Hub Propeller Model Identification in the Description and Operation chapter of this manual.
- (2) Perform the applicable steps under Spinner Pre-Installation within this chapter.

WARNING: ADHESIVES AND SOLVENTS ARE FLAMMABLE AND TOXIC TO THE SKIN, EYES, AND RESPIRATORY TRACT. SKIN AND EYE PROTECTION ARE REQUIRED. AVOID PROLONGED CONTACT AND BREATHING OF VAPORS. USE SOLVENT RESISTANT GLOVES TO MINIMIZE SKIN CONTACT AND WEAR SAFETY GLASSES FOR EYE PROTECTION. USE IN A WELL VENTILATED AREA AWAY FROM SPARKS AND FLAME. READ AND OBSERVE ALL WARNING LABELS.

- (3) Using Quick Dry Stoddard Solvent or MEK, clean the engine flange and propeller flange.
- (4) Install the O-ring in the O-ring groove in the rear of the hub. Refer to Figure 3-21. For the applicable O-ring and mounting hardware, refer to Table 3-2.

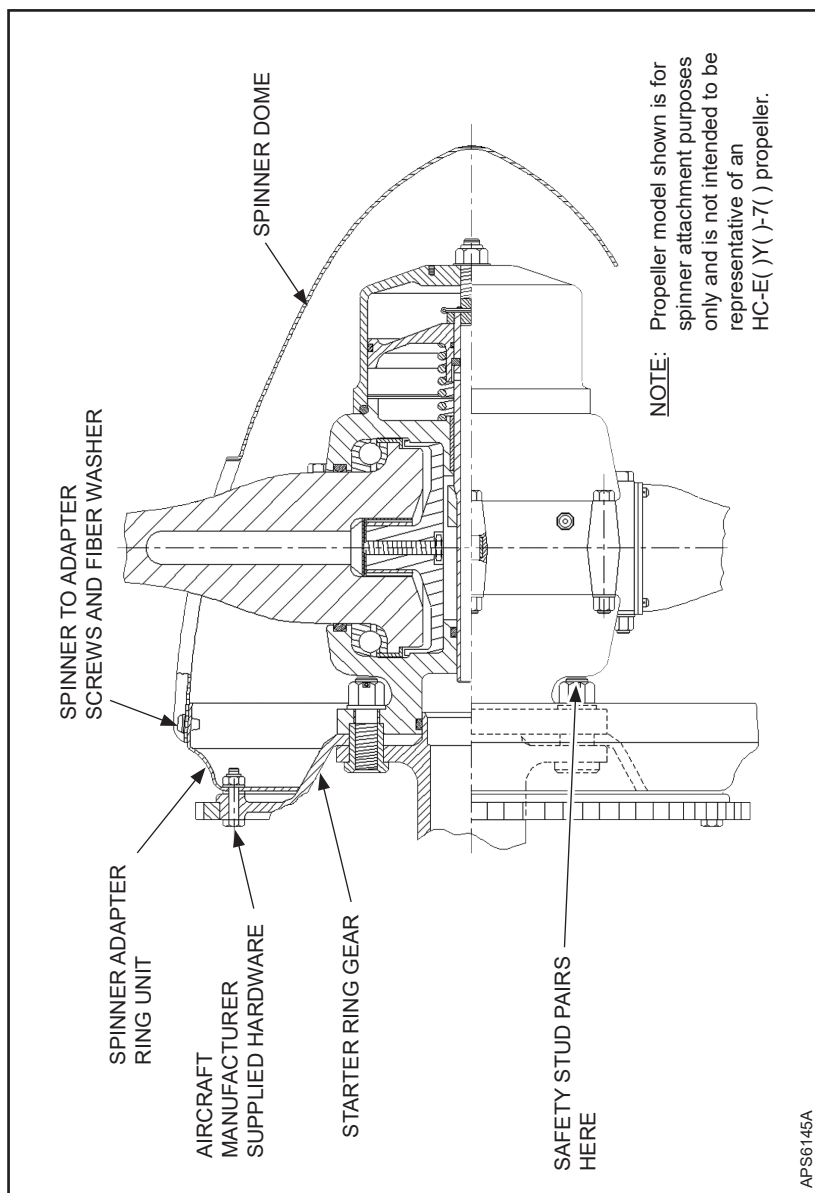
NOTE: When the propeller is received from the factory, the O-ring has been installed.

WARNING: MAKE SURE THAT ANY EQUIPMENT USED TO INSTALL THE PROPELLER IS RATED UP TO 800 LBS. (363 KG) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING INSTALLATION. ONE PERSON MUST NEVER ATTEMPT TO INSTALL AN UNSUPPORTED PROPELLER BY HIMSELF, REGARDLESS OF THE SIZE OR WEIGHT OF THE PROPELLER. MANUALLY LIFTING THE PROPELLER ONTO THE ENGINE CAN RESULT IN PERSONAL INJURY.

CAUTION 1: A PROPELLER MUST BE CORRECTLY SUPPORTED DURING INSTALLATION ON THE ENGINE. AVOID ANY ROCKING OR SHIFTING OF THE PROPELLER WHEN IT IS PARTIALLY ENGAGED WITH THE ENGINE. ROCKING OF THE PROPELLER DURING PROPELLER INSTALLATION CAN DAMAGE THE PROPELLER HUB MOUNTING FACE, CAUSING ACTUATION OIL LEAKAGE OR DAMAGE THAT MAY SCRAP THE HUB. HUB DAMAGE CAN ALSO INTRODUCE METAL INTO THE PROPELLER OIL ACTUATION SYSTEM, WHICH COULD POSSIBLY DAMAGE THE ENGINE.

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

- (5) With a suitable support, such as a crane hoist or similar equipment, carefully move the propeller assembly to the aircraft engine mounting flange in preparation for installation.
- (6) Install the propeller on the engine flange. Align the engine flange bushings with the corresponding holes in the propeller flange.



**Spinner Adapter and Spinner Mounting
(Starter Ring Gear Mount)**

Figure 3-22

CAUTION 1: MOUNTING HARDWARE MUST BE CLEAN AND DRY TO PREVENT EXCESSIVE PRELOAD OF THE MOUNTING FLANGE.

CAUTION 2: TIGHTEN NUTS EVENLY TO AVOID HUB DAMAGE.

- (7) Torque the 1/2 inch propeller mounting studs (dry) in accordance with Table 3-1, Figure 3-1, and Figure 3-2.
- (8) If required by the aircraft maintenance manual, safety all mounting studs with 0.032 inch (0.81 mm) minimum diameter stainless steel wire or equivalent aircraft safety cable and associated hardware (two studs for each safety). Refer to Figure 3-22.
 - (a) If the propeller is removed between overhaul intervals, mounting studs may be reused if they are not damaged or corroded.
- (9) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller LLC, applicable instructions and technical information for the components supplied by Hartzell Propeller LLC can be found in Hartzell Propeller Ice Protection System Manual 180 (30-61-80).
- (10) 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).
- (11) Install the propeller spinner dome in accordance with the applicable Spinner Dome Installation section in this chapter.

9. One-Piece Spinner Dome Installation (Rev. 5)

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 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: There are three types of one-piece spinner domes used on Hartzell Propeller LLC Compact-series propellers:

- Spinner Dome without a Forward Bulkhead
- Spinner Dome with a Bonded Forward Bulkhead
- Spinner Dome with a Removable Forward Bulkhead

NOTE 3: A forward bulkhead is an internal support that encircles the propeller cylinder.

NOTE 4: Refer to the applicable installation instructions for the type of dome/forward bulkhead being installed.

NOTE 5: 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 of a One-Piece Spinner Dome without a Forward Bulkhead

- (1) Examine the low pitch stop hardware configuration.
 - (a) If the visual examination shows that the hardware configuration is one hex nut safety wired to a set screw, no further action is required.
 - (b) If the visual examination shows that the hardware configuration is not one hex nut safety wired to a set screw, modify the propeller assembly to the hardware configuration of one hex nut safety wired to a set screw in accordance with the section "Modification of the Low Pitch Stop Hardware" in the Maintenance Practices chapter of this manual.
- (2) 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 NUTPLATES. 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.

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

Spinner Dome/Cap	Washer	Screw
Dome w/straight mounting holes	A-1020 Washer, Fiber	B-3845-8 10-32, Truss Head
Dome w/countersunk mounting holes	B-3860-10L Dimpled, 100°, Cres.	B-3867-272 10-32, 100° Head, Cres.
Metal Cap	n/a	B-3866-50 8-32, 100° Head, Cres.

Spinner Dome and Spinner Cap Mounting Hardware
Table 3-3

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.

B. Installation of a One-Piece Spinner Dome with a Bonded Forward Bulkhead

- (1) Examine the low pitch stop hardware configuration.

- (a) If the visual examination shows that the hardware configuration is one hex nut safety wired to a set screw, no further action is required.
- (b) If the visual examination shows that the hardware configuration is not one hex nut safety wired to a set screw, modify the propeller assembly to the hardware configuration of one hex nut safety wired to a set screw in accordance with the section "Modification of the Low Pitch Stop Hardware" in the Maintenance Practices chapter of this manual.

- (2) Install the spinner dome.

CAUTION: THE FORWARD BULKHEAD MUST
FIT SNUGLY ON THE CYLINDER. AN
IMPROPERLY SUPPORTED DOME
COULD CAUSE CYLINDER DAMAGE OR
A CRACK IN THE DOME OR BULKHEAD.

- (3) Using both hands, grasp the spinner dome in the approximate location of the forward bulkhead and apply lateral force (side-to-side).

- (a) If there is no lateral movement: Go to step (4) of this procedure.
- (b) If there is lateral movement: Apply UHMW tape CM137 in accordance with the following steps.

- 1 Option 1: Apply UHMW tape CM137 around the cylinder.

- a. Install 2.5 inch (63 mm) strips of UHMW tape CM137 in equally spaced locations around the ID of the forward bulkhead as shown in Figure 3-23.
- b. If necessary, install additional layers of UHMW tape CM137 until the forward bulkhead fits snugly on the cylinder.



UHMW Tape Location - For Bonded Forward Bulkhead

Figure 3-23

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

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

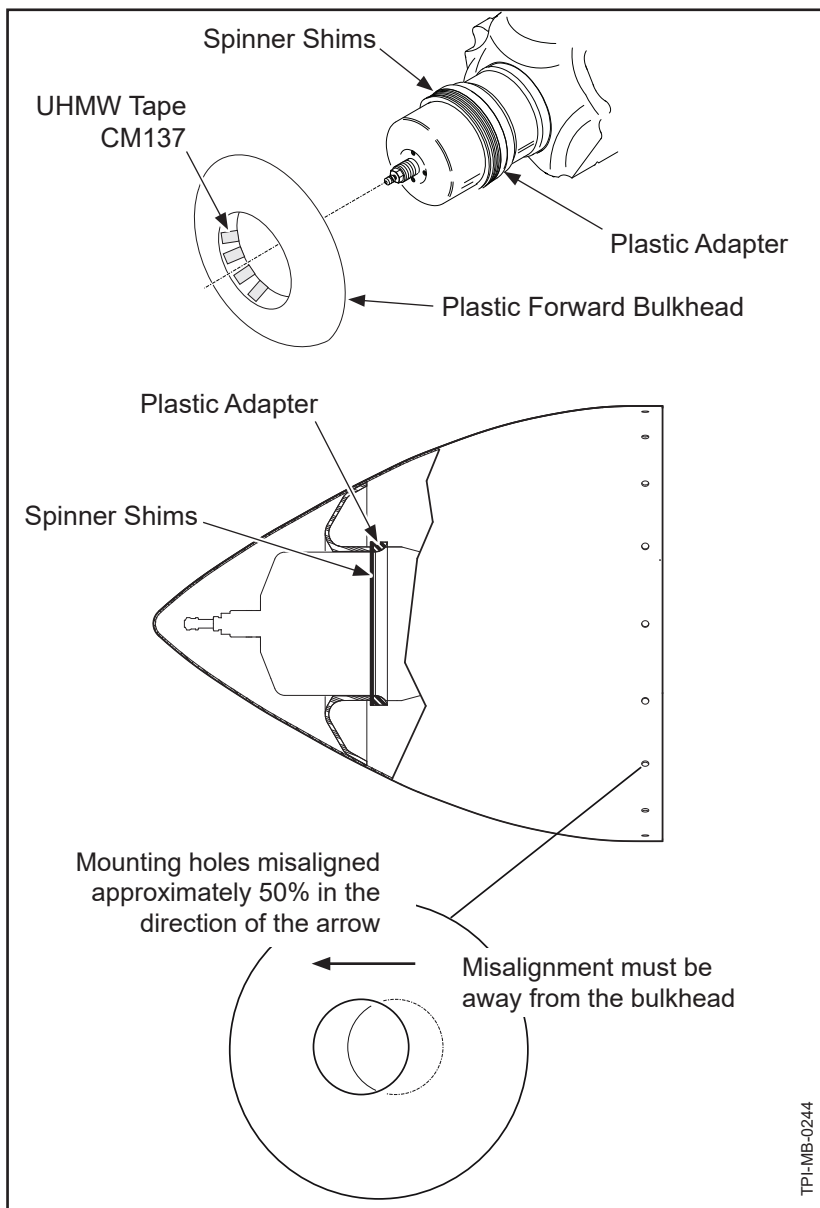
- 1 Make sure there is clearance between the travel tubes and the spinner dome blade cutouts.
- 2 Make adjustments to the position of the travel tubes in accordance to Hartzell Propeller Ice Protection System Manual 180 (30-61-80).

CAUTION: MAKE SURE OF PROPER THREAD ENGAGEMENT FOR THE SCREWS IN THE NUTPLATES. 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.

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



**One-Piece Spinner Dome Installation with
Removable Forward Bulkhead
Figure 3-24**

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.

(5) If the spinner loosens in service, add one or more layers of UHMW tape to the cylinder until the spinner fits snugly.

C. Installation of a One-Piece Spinner Dome with a Removable Plastic Forward Bulkhead

(1) Put the plastic adapter on the cylinder with the radiused side of the adapter against the raised surface on the cylinder as shown in Figure 3-24.

(2) Put ten spinner shims on top of the plastic adapter.

NOTE: The spinner shims are used to adjust the spinner dome preload. Shims can be added or removed after pre-fitting the spinner dome later in this procedure.

(3) Put the forward bulkhead over the cylinder on top of the spinner shims.

CAUTION: THE FORWARD BULKHEAD MUST
FIT SNUGLY ON THE CYLINDER. AN
IMPROPERLY SUPPORTED DOME
COULD CAUSE CYLINDER DAMAGE OR
A CRACK IN THE DOME OR BULKHEAD.

(4) Using both hands, grasp the forward bulkhead and apply lateral force (side-to-side).

(a) If there is no lateral movement: Go to step (5) of this procedure.

- (b) If there is lateral movement: Apply UHMW tape CM137 in accordance with the following steps.
- 1 Option 1: Apply UHMW tape CM137 around the ID of the forward bulkhead that fits over the cylinder.
 - a Install 2.5 inch (63 mm) strips of UHMW tape CM137 in equally spaced locations around the ID of the forward bulkhead as shown in Figure 3-24.
 - b If necessary, install additional layers of UHMW tape CM137 until the forward bulkhead fits snugly on the cylinder.
 - 2 Option 2: Apply UHMW tape CM137 around the cylinder.
 - a Wrap one or more layers of UHMW tape CM137 around the cylinder until the forward bulkhead fits snugly on the cylinder.
- (5) Install the spinner dome and gently push the dome as far as it will go onto the bulkhead.
- (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).
- (6) Examine the alignment of the mounting holes in the spinner dome and the bulkhead.
- (a) Approximately 50% of the diameter of each bulkhead mounting hole must be visible through the spinner dome mounting holes.
- NOTE:** The temporary misalignment of the mounting holes is necessary to get the proper preload of the spinner dome.
- (b) If the mounting hole position is correct, go to step (7) of this procedure.

- (c) If the mounting hole position is incorrect, add/remove spinner shims to get proper alignment.

CAUTION: MAKE SURE OF PROPER THREAD ENGAGEMENT FOR THE SCREWS IN THE NUTPLATES. 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.

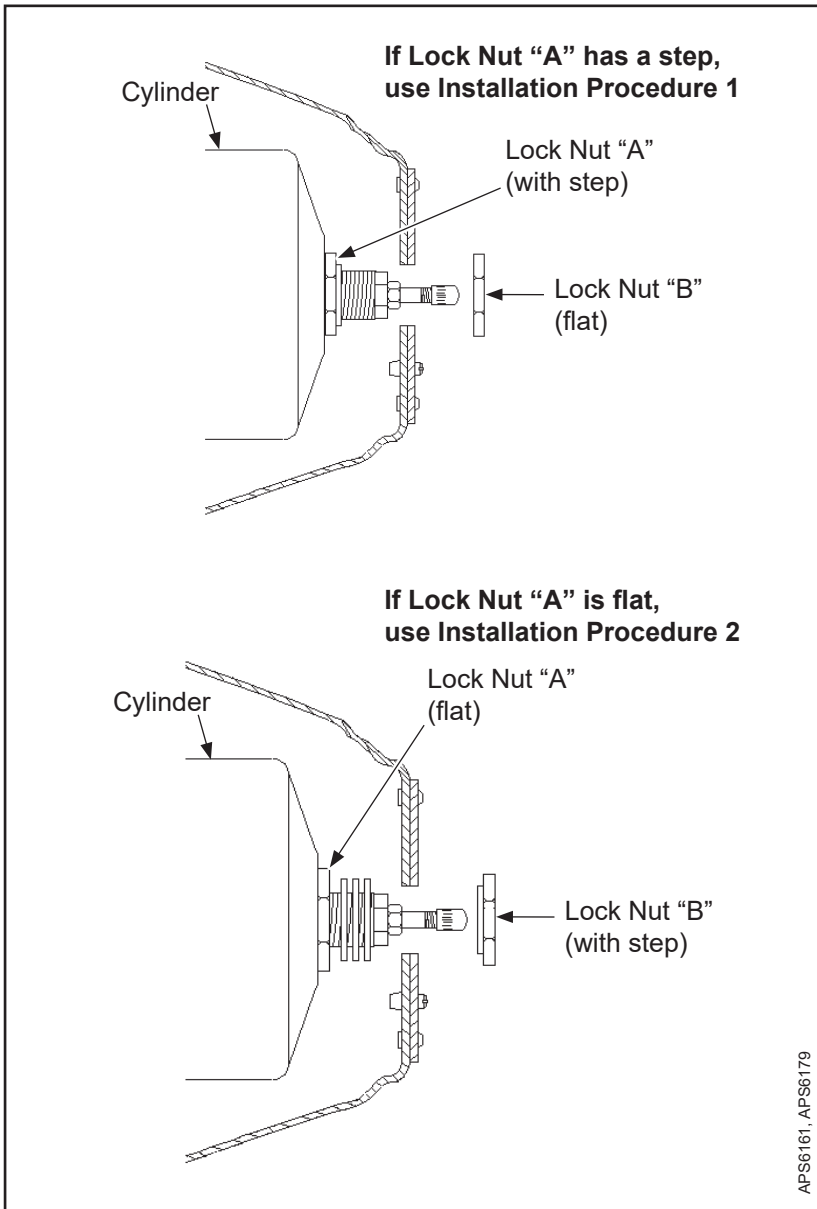
- (7) Attach the spinner dome to the spinner bulkhead with the supplied screws and washers. Refer to Table 3-3.
- (a) Install a screw in the hole(s) centered between each two adjacent blade cutouts.
- 1 If the centerline between the adjacent blade cutouts does not align with a mounting hole, install 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.
- (8) If the spinner loosens in service, add one or more layers of UHMW tape to the forward bulkhead or cylinder until the spinner fits snugly.



Lock Nut "A" Identification

Figure 3-25

10. Two-Piece Spinner Dome Installation

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

CAUTION 2: THE SPINNER DOME WILL WOBBLE IF NOT ALIGNED PROPERLY. 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: There are two different procedures for installing two-piece spinner domes. Examine the lock nut "A" at the top of the cylinder, then refer to Figure 3-25 to determine the applicable installation procedure for the two-piece spinner dome.

NOTE 3: 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

(1) General

(a) A spinner dome that is installed using Procedure 1 can be identified by the lock nut "A" at the top of the cylinder. The lock nut "A" will have a "step" facing away from the cylinder as shown in Figure 3-25.

- 1 Lock nut "A" may have drilled holes for safety wire, but safety wire is not required in this location.

- (2) Install the spinner dome.
- (a) Push the spinner dome toward the bulkhead to align the spinner mounting holes with those of the bulkhead.

- (b) 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 NUTPLATES. 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.

- (3) Attach the spinner dome to the spinner bulkhead with the supplied screws and washers. Refer to Table 3-3.
- (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 to achieve an approximate torque value of 20-30 In-Lbs. (2.3-3.3 N•m).

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

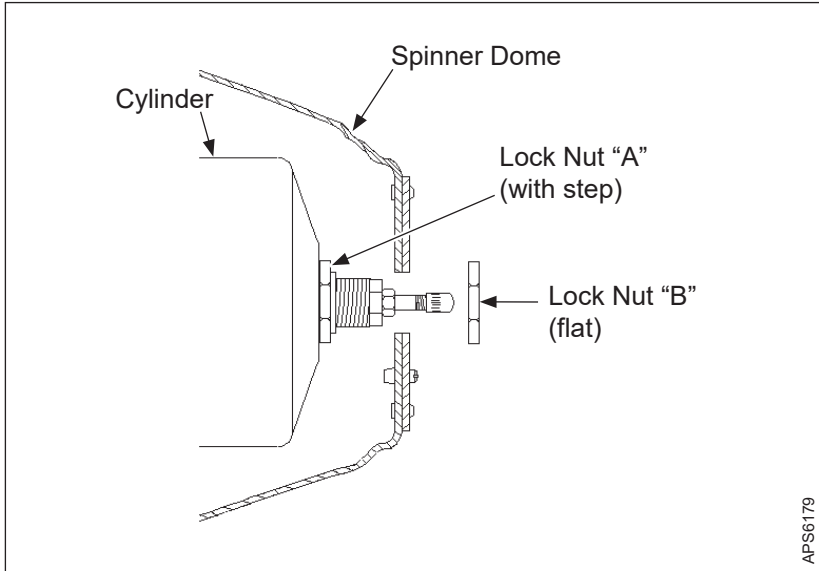
(c) Working from the screw(s) previously installed at the centerline toward the blade cutouts, install the remaining screws one at a time.

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

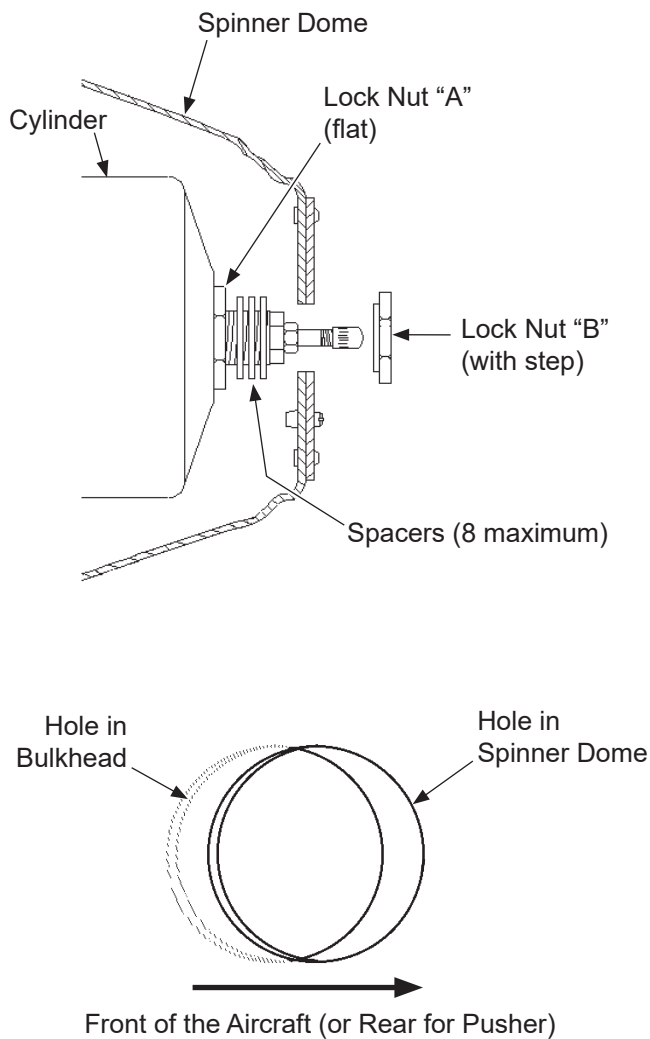
(4) Install the lock nut "B" on the low pitch stop in accordance with Figure 3-26.

(a) Torque lock nut "B" in accordance with Table 3-1 and Figure 3-1.

(5) Safety wire the lock nut "B" to each of the two screws on the flat face of the spinner dome surrounding the lock nut "B".



Two-Piece Spinner Dome Installation - Procedure 1
Figure 3-26



APS6161, APS6162

Two-Piece Spinner Dome Installation - Procedure 2**Figure 3-27**

CAUTION: MAKE SURE THAT THE SCREWS DO NOT EXTEND MORE THAN THREE THREADS PAST THE BULKHEAD NUTPLATES. IF THE SCREWS EXTEND MORE THAN THREE THREADS, THIS CAN CAUSE DAMAGE TO THE AIRCRAFT COWLING.

- (6) Using flat head screws, attach the spinner dome cap to the spinner dome. Refer to Table 3-3.

B. Installation Procedure 2

(1) General

- (a) A spinner dome that is installed using Procedure 2 can identified by the lock nut "A" at the top of the cylinder. The lock nut "A" will be flat as shown in Figure 3-27.

1 Lock nut "A" may have drilled holes for safety wire, but safety wire is not required in this location.

- (2) Put spacers on the low pitch stop lock nut "A" in accordance with Figure 3-27.

(a) Up to eight spacers may be used.

- (3) Install spacers, then examine the spinner fit. The spinner is correctly spaced when the holes in the spinner dome are misaligned 1/4 - 1/3 of their diameter toward the front of the aircraft, or rear in a pusher installation. Refer to Figure 3-27.

(a) Add or remove spacers to achieve this alignment.

- (4) Install spinner dome.

- (5) Push the spinner dome aft to align the spinner mounting holes with those of the bulkhead or adapter ring.

(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 NUTPLATES. 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.

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

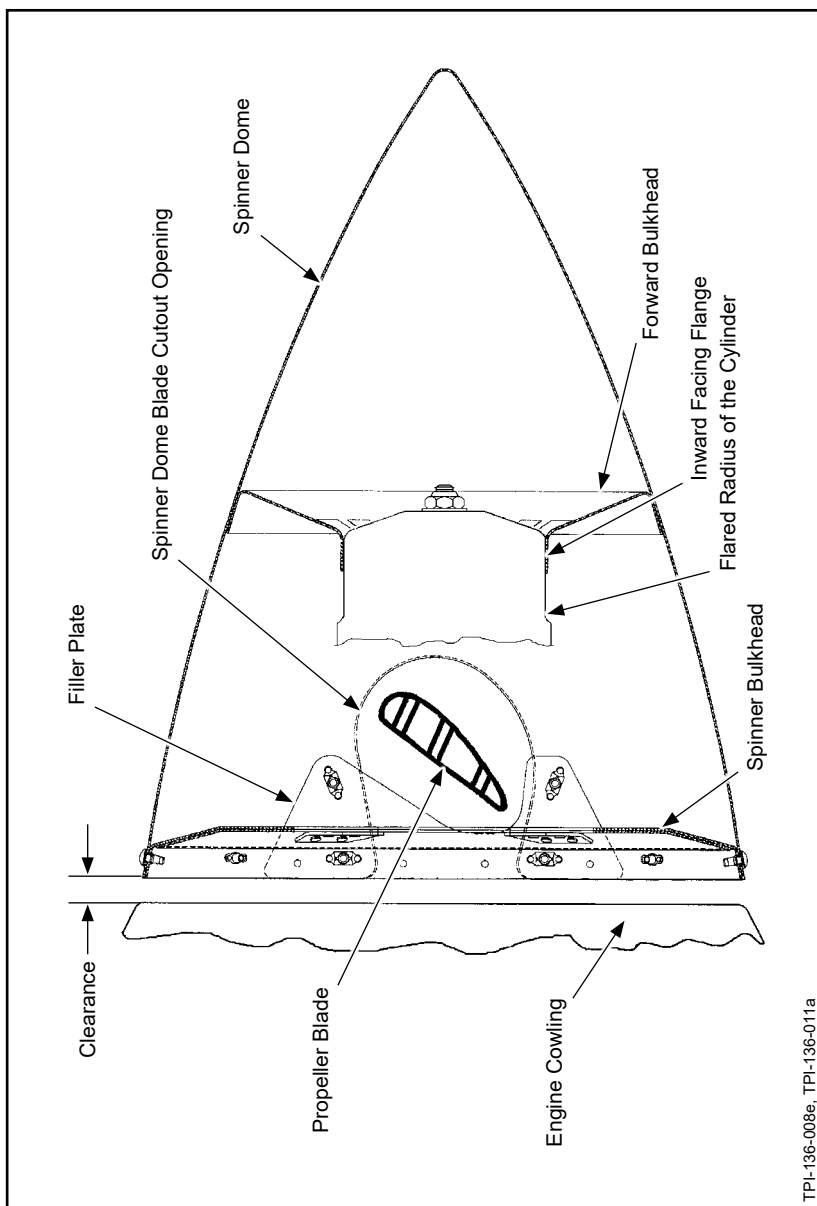
CAUTION: BE SURE THE SCREWS DRAW THE SPINNER DOME TIGHT TO THE BULKHEAD.

- (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.

- (7) Install the lock nut "B" on the low pitch stop with the step facing the cylinder as shown in Figure 3-27.
 - (a) Torque lock nut "B" in accordance with Table 3-1 and Figure 3-1.
- (8) Safety wire the lock nut to each of the two screws on the flat face of the spinner dome surrounding the lock nut "B".
- (9) Using flat head screws, attach the spinner dome cap to the spinner dome.



TPI-136-008e, TPI-136-011a

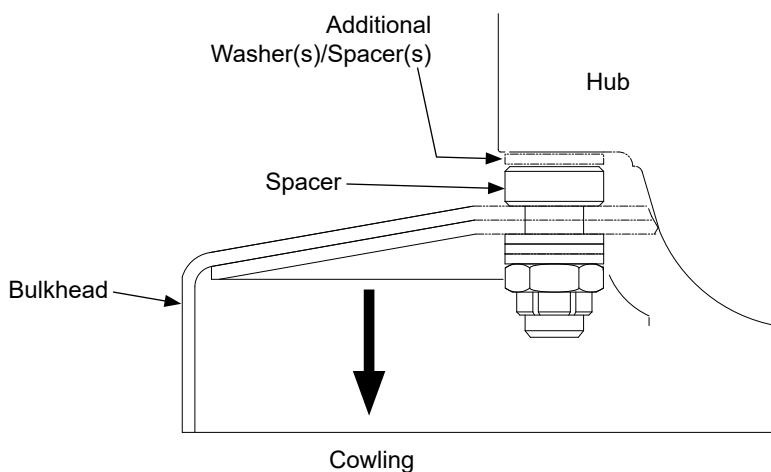
Spinner Assembly Clearance
Figure 3-28

11. Spinner Assembly Clearance Checks (Rev. 2)

CAUTION: CLEARANCE BETWEEN THE BULKHEAD AND THE ENGINE COWLING MAY CHANGE DURING AIRCRAFT OPERATION

A. Clearance Checks - Refer to Figure 3-28

- (1) The spinner bulkhead must be spaced between the propeller hub and the engine cowling to prevent contact between the spinner assembly and the propeller blades throughout the full range of blade travel.
- (2) The spinner assembly and the hub clamping bolts must not touch any of the following components/areas or cause interference during propeller/engine operation:
 - (a) Engine cowling
 - (b) Any non-rotating part of the aircraft
 - (c) Ice protection system components (wire harnesses, anti-ice tubes, etc.)
 - (d) Counterweights/mounting hardware
- (3) For spinner domes with a bonded forward bulkhead, make sure the flange on the forward bulkhead does not bottom out on the flared radius of the cylinder.
 - (a) Using both hands, grasp the spinner dome in the approximate location of the forward bulkhead and apply lateral force (side-to-side).
 - 1 If there is lateral movement: Refer to the applicable Spinner Dome Installation section in this chapter.
- (4) If there is any spinner assembly interference, refer to the applicable section, "Metal/Composite Bulkhead Spacing Adjustment" in this chapter.



TPL-MB-0455

Metal Bulkhead Toward the Cowling
Figure 3-29

12. Metal Bulkhead Spacing Adjustments (Rev. 2)**A. To Move the Bulkhead Toward the Cowling**

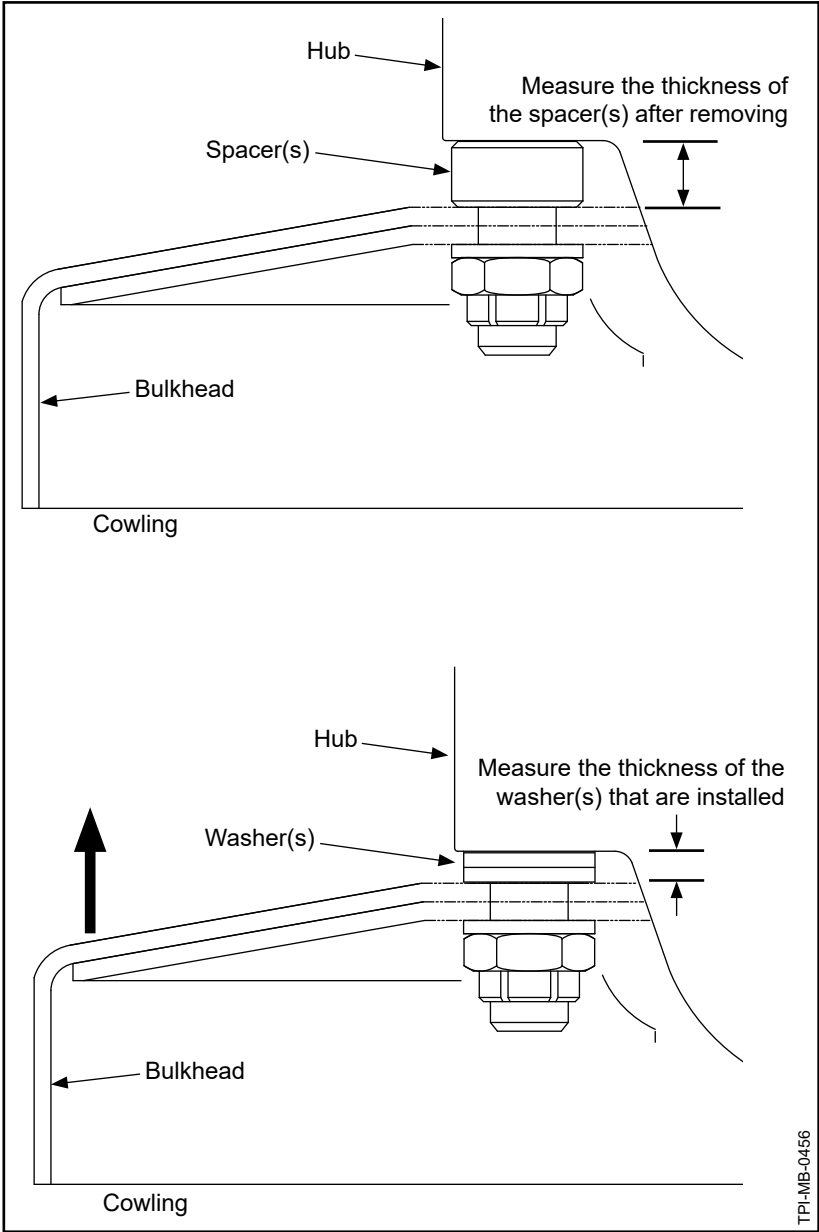
CAUTION 1: THE STACK-UP SEQUENCE FOR EACH HUB CLAMPING BOLT MUST BE THE SAME. VARIANCES BETWEEN STACK-UPS CAN CAUSE CRACKING OF THE SPINNER BULKHEAD. EXCEPTIONS MAY BE REQUIRED IF PROPELLER APPLICATIONS HAVE DE-ICE OR ANTI-ICE APPLICATIONS. REFER TO HARTZELL PROPELLER ICE PROTECTION SYSTEM MANUAL 180 (30-61-80) FOR INSTALLATION INSTRUCTIONS.

CAUTION 2: THE COMBINED THICKNESS OF ADDITIONAL WASHERS/SPACERS MUST BE LESS THAN OR EQUAL TO 0.125 INCH (3.17 MM). IF MORE ADJUSTMENT IS NEEDED, CONTACT THE HARTZELL PRODUCT SUPPORT DEPARTMENT.

- (1) Put additional washer(s)/spacer(s) between the spacer and the hub as shown in Figure 3-29 to get the desired bulkhead spacing.

CAUTION: THREAD COVERAGE/ENGAGEMENT REQUIREMENTS SPECIFIED IN THE "BULKHEAD INSTALLATION" SECTION MUST BE MET.

- (2) Complete the spinner bulkhead/dome installation in accordance with the applicable sections in this chapter.



Metal Bulkhead Away From the Cowling
Figure 3-30

B. To Move the Bulkhead Away From the Cowling

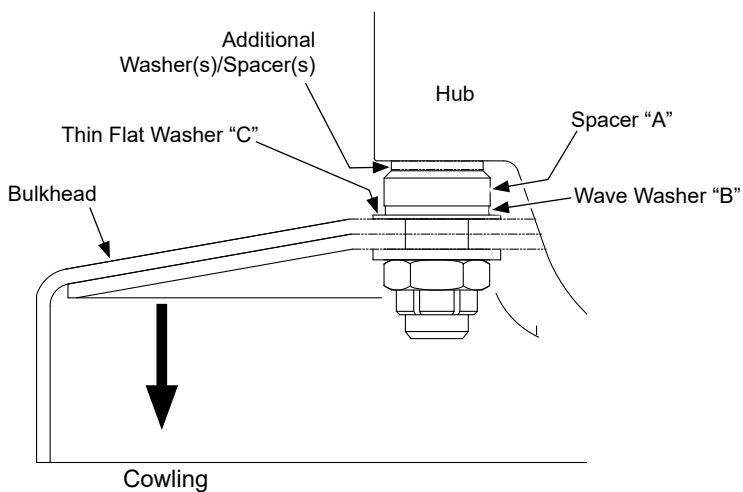
CAUTION 1: THE STACK-UP SEQUENCE FOR EACH HUB CLAMPING BOLT MUST BE THE SAME. VARIANCES BETWEEN STACK-UPS CAN CAUSE CRACKING OF THE SPINNER BULKHEAD. EXCEPTIONS MAY BE REQUIRED IF PROPELLER APPLICATIONS HAVE DE-ICE OR ANTI-ICE APPLICATIONS. REFER TO HARTZELL PROPELLER ICE PROTECTION SYSTEM MANUAL 180 (30-61-80) FOR INSTALLATION INSTRUCTIONS.

CAUTION 2: THE MAXIMUM PERMITTED BULKHEAD ADJUSTMENT AWAY FROM THE COWLING IS 0.125 INCH (3.17 MM). IF MORE ADJUSTMENT IS NEEDED, CONTACT THE HARTZELL PRODUCT SUPPORT DEPARTMENT.

- (1) Remove the spacer(s)/washer(s) between the bulkhead and the hub. Refer to Figure 3-30.
 - (a) Measure the combined thickness of the spacer(s)/washer(s) that were removed.
- (2) Install washer(s) and/or spacer(s) between the bulkhead and the hub to get the desired bulkhead spacing.
 - (a) Measure the combined thickness of the washer(s)/spacers that were installed.
 - (b) The difference between the thickness of the washer(s)/spacer(s) that were removed, and the thickness of the washer(s)/spacer(s) that were installed must be 0.125 inch (3.17 mm) or less.

CAUTION: THREAD COVERAGE/ENGAGEMENT REQUIREMENTS SPECIFIED IN THE "BULKHEAD INSTALLATION" SECTION MUST BE MET.

- (3) Complete the spinner bulkhead/dome installation in accordance with the applicable sections in this chapter.



TP1-MB-0458

Composite Bulkhead Toward the Cowling
Figure 3-31

13. Composite Bulkhead Spacing Adjustments (Rev. 2)**A. To Move the Bulkhead Toward the Cowling**

CAUTION 1: THE STACK-UP SEQUENCE FOR EACH HUB CLAMPING BOLT MUST BE THE SAME. VARIANCES BETWEEN STACK-UPS CAN CAUSE CRACKING OF THE SPINNER BULKHEAD. EXCEPTIONS MAY BE REQUIRED IF PROPELLER APPLICATIONS HAVE DE-ICE OR ANTI-ICE APPLICATIONS. REFER TO HARTZELL PROPELLER ICE PROTECTION SYSTEM MANUAL 180 (30-61-80) FOR INSTALLATION INSTRUCTIONS.

CAUTION 2: THE COMBINED THICKNESS OF ADDITIONAL WASHERS/SPACERS MUST BE LESS THAN OR EQUAL TO 0.125 INCH (3.17 MM). IF MORE ADJUSTMENT IS NEEDED, CONTACT THE HARTZELL PRODUCT SUPPORT DEPARTMENT.

- (1) Put additional washer(s)/spacer(s) between the spacer "A" and the hub as shown in Figure 3-31 to get the desired bulkhead spacing.

CAUTION: THREAD COVERAGE/ENGAGEMENT REQUIREMENTS SPECIFIED IN THE "BULKHEAD INSTALLATION" SECTION MUST BE MET.

- (2) Complete the spinner bulkhead/dome installation in accordance with the applicable sections in this chapter.

B. To Move the Bulkhead Away From the Cowling

- (1) If the bulkhead is too close to the cowling, contact Hartzell Propeller LLC.
 - (a) Refer to the section, "Hartzell Propeller Contact Information" in the Introduction chapter of this manual.

14. Post-Installation Checks

- A. Perform Static RPM Check as outlined in the Testing and Troubleshooting chapter in this manual.

15. Pressure Control Unit and Governor Removal

- A. Disconnect the pilot control cable from the control lever that is attached to the pressure control unit.
- B. Disconnect the governor RPM control cable from the governor control arm on the governor unit.

CAUTION: DISCARD THE FOUR SELF-LOCKING HEX NUTS B-3808-5 AND WASHERS B-3851-0563 IF THEY ARE DAMAGED OR CORRODED, OR WHEN REMOVAL IS FOR OVERHAUL.

- (1) If the governor unit and pressure control unit are removed between overhaul intervals, the mounting nuts and washers may be reused if they are not damaged or corroded.
- C. Loosen and remove the four B-3808-5 self-locking hex nuts that are holding the governor unit in position.
 - (1) Use an open end wrench to fit a nut that is 1/2 inch across the flats. Refer to Figure 3-13.
- D. Remove the four B-3851-0563 washers that are on the studs. Refer to Figure 3-13.
- E. Remove the governor unit from the four A-3147-3 studs. Refer to Figure 3-13.
- F. Remove the B-1104 governor gasket from the four A-3147-3 studs.
 - (1) Discard the B-1104 governor gasket if it is damaged or if removal is for overhaul. Refer to Figure 3-13.
- G. Remove the pressure control unit from the four A-3147-3 studs. Refer to Figure 3-13.
- H. Remove the A-3144-2 governor drive extension from the engine accessory drive. Refer to Figure 3-13.

- I. Remove the B-1104 governor gasket from the four A-3147-3 studs.
 - (1) Discard B-1104 governor gasket if it is damaged or if removal is for overhaul. Refer to Figure 3-13.
- J. Examine each of the four A-3147-3 studs for damage or corrosion.
 - (1) Remove and replace any stud that is damaged or corroded.
- K. Use a plastic tool to remove remaining gasket material that is on the governor unit base, either side of the pressure control unit, or the governor mounting pad surface on the engine.

16. Spinner Removal

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

- A. Removal of the Spinner
 - (1) Remove the screws and washers that attach the spinner dome to the spinner bulkhead or adapter ring.
 - (2) Remove the spinner dome.
- B. Hub Mounted Spinner Bulkhead Removal
 - (1) Remove propeller. Refer to Propeller Removal in this chapter.
 - (2) Remove the flat washers and self-locking nuts that attach the spinner bulkhead to the propeller hub. Remove the spinner bulkhead.
 - (3) Reinstall the flat washers and self-locking nuts that were removed during the spinner bulkhead removal.

17. Propeller Removal

A. Removal of "R" Flange Propellers

- (1) Remove the spinner dome in accordance with the Spinner Removal procedures in this chapter.
- (2) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller LLC, applicable instructions and technical information for the components supplied by Hartzell Propeller can be found in Hartzell Propeller Ice Protection System Manual 180 (30-61-80).
- (3) 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).
- (4) If installed, cut and remove the safety wire or safety cable on the propeller mounting stud nuts.

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

- (5) Support the propeller assembly with a sling.
- (6) If the propeller will be reinstalled and it has been dynamically balanced, make an identifying mark (with a felt-tipped pen only) on the propeller hub and a matching mark on the engine flange to make sure of correct positioning of the propeller during re-installation.

NOTE: This will prevent dynamic imbalance.

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

- (7) Remove the six 1/2 inch mounting studs from the engine bushings.
 - (a) If the propeller is removed between overhaul intervals, mounting studs, nuts and washers may be reused if they are not damaged or corroded.

CAUTION: REMOVE THE PROPELLER FROM THE
MOUNTING FLANGE WITH CARE TO
PREVENT DAMAGING THE PROPELLER
MOUNTING STUDS.

- (8) Using the support sling, remove the propeller from the mounting flange.
- (9) Put the propeller on a cart for transport.

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TESTING AND TROUBLESHOOTING - CONTENTS

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1. Operational Checks (Rev. 1)

A. Operational Checks

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

2. Propeller Ice Protection Systems (Rev. 2)

WARNING: CONSULT THE PILOT OPERATING HANDBOOK (INCLUDING ALL SUPPLEMENTS) REGARDING FLIGHT INTO CONDITIONS OF KNOWN ICING. THE AIRCRAFT MAY NOT BE CERTIFICATED FOR FLIGHT INTO KNOWN ICING CONDITIONS, EVEN THOUGH AN ICE PROTECTION SYSTEM IS INSTALLED.

A. Operational Checks and Troubleshooting

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

3. 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/Propeller Speed Varies with Airspeed
- (1) Small variances in engine speed are normal and are no cause for concern.
 - (2) Decrease in engine speed while decreasing airspeed:
 - (a) Governor is not increasing oil volume in the propeller to decrease blade pitch.
 - 1 Internal oil leakage to opposite side of the hydraulic piston and the propeller resists the governor attempt to move the piston for pitch change decrease.
 - 2 Inadequate engine oil supply to the governor.
 - 3 Governor oil pump pressure relief valve not maintaining sufficient oil pressure (275 psi minimum).
 - 4 Blockage of oil line from the governor to the propeller.
 - 5 Governor pilot valve is sticking to retard pumping of oil.
 - (b) Engine oil transfer system is leaking excessively.
 - 1 Normal governor oil pumping capacity is unable to overcome the excessive leakage to decrease blade pitch.
 - (c) Excessive friction in propeller blade bearings or pitch changing mechanism is not permitting a decrease of blade pitch.
 - (3) Increase in engine speed while increasing airspeed:
 - (a) Governor is not decreasing oil volume in the propeller to increase blade pitch.
 - 1 Blockage of the oil line from the governor to the propeller.
 - 2 Governor pilot valve is sticking to retard oil drain
 - (b) Excessive friction in propeller blade bearings or pitch changing mechanism is not permitting an increase of blade pitch.

- C. Engine/Propeller Speed Increases With Increasing Engine Power And Decreases With Decreasing Engine Power
 - (1) Excessive friction in propeller blade bearings or pitch changing mechanism of the propeller
 - (2) Governor is not pumping oil to the propeller or draining oil from the governor
 - (a) Blockage of the oil line from the governor to the propeller.
 - (b) Governor pilot valve is sticking.
- D. Governor RPM Control of Engine/Propeller Speed Has Little or No Effect
 - (1) Excessive friction in propeller blade bearings or pitch changing mechanism of the propeller
 - (2) Blockage of the oil line from the governor to the propeller.
 - (3) Engine oil transfer system is leaking excessively.
 - (4) Internal oil leakage to opposite side of hydraulic piston and the propeller resists the attempt by the governor to move the piston for pitch change.
- E. Propeller Underspeed
 - (1) Check for tachometer error.
 - (2) Check propeller low pitch adjustment if underspeed is during engine run-up with the aircraft static.
 - (3) Governor maximum RPM is set too low.
 - (4) Excessive friction in propeller blade bearings or pitch change mechanism is not permitting a decrease of blade pitch.
 - (5) Internal oil leakage to opposite side of the hydraulic piston and the propeller resists the governor attempt to move the piston for pitch change.

- (6) Governor is not increasing oil volume in the propeller to decrease blade pitch.
 - (a) Internal oil leakage to opposite side of the hydraulic piston and the propeller resists the governor attempt to move the piston for pitch change decrease.
 - (b) Inadequate engine oil supply to the governor.
 - (c) Governor oil pump pressure relief valve not maintaining sufficient oil pressure (275 psi minimum).
 - (d) Blockage of oil line from the governor to the propeller.
 - (e) Governor pilot valve is sticking to retard pumping of oil.
 - (f) Pressure relief system in the pressure control unit is not maintaining Position 3 oil pressure as shown in Figure 3-20. Output pressure to the propeller is lower than desired.
 - 1 Pressure relief compression spring may be damaged. Refer to Figure 2-2.
 - 2 Relief valve may be jammed or broken. Refer to Figure 2-2.
 - (g) Check the drive connection between the engine and the governor for damage that may affect governor rotation by the engine.
- (7) Engine oil transfer system is leaking excessively.
 - (a) Normal governor oil pumping capacity is unable to overcome the excessive leakage to decrease blade pitch.
- (8) Oil volume is not increasing in the propeller to decrease blade pitch because of the pressure control unit.
 - (a) The plunger stop screw (refer to Figure 2-2, Figure 3-18, or Figure 3-19) is incorrectly adjusted/positioned to obtain the correct Position 3 oil pressure (refer to Figure 3-20). Oil pressure will be lower than required.

F. Propeller Overspeed

- (1) Check for tachometer error.
- (2) Check propeller low pitch adjustment if the overspeed is during engine run-up with the aircraft static.
- (3) Governor maximum RPM set too high.
- (4) Excessive friction in propeller blade bearings or pitch change mechanism is not permitting a increase of blade pitch.
- (5) Governor is not decreasing oil volume in the propeller to increase blade pitch.
 - (a) Blockage of the oil line from the governor to the propeller.
 - (b) Governor pilot valve is sticking to retard oil drain.
- (6) A sudden increase of propeller/engine RPM with an increase of engine power followed by an equally sudden RPM stabilization at Max RPM. A forward surge may be felt also.
 - (a) The plunger stop screw (refer to Figure 2-2, Figure 3-18, or Figure 3-19) is incorrectly adjusted/positioned to obtain the correct Position 3 oil pressure (refer to Figure 3-20). Oil pressure will be higher than required. Blade pitch movement into beta range may be occurring during underspeed operation below 900 RPM.

G. Beta Range Operation

- (1) Propeller refuses to enter beta range from low pitch blade angle.
 - (a) Propeller RPM is not below 900 RPM.
 - 1 Beta lockout flyweights in the beta lockout assembly prevent movement into the beta range unless the engine/propeller speed is below 900 RPM.
 - 2 Beta lockout flyweights will not disengage from a groove in the barrel (inside diameter) because of damage. Propeller must be disassembled and repaired by qualified personnel at a certified propeller repair station with the appropriate rating.
 - (b) Low oil pressure. Oil pressure supplied to the propeller by the pressure control unit when commanded by the pilot control is less than that required to move blade angle from low pitch into beta range.
 - 1 Check the output oil pressure increase on the oil pressure gauge that is connected to the pressure control unit. Refer to Figure 2-2.
 - 2 Oil pressure increase from the Position 3 oil pressure valve at low pitch (refer to Figure 3-20) should be a minimum of 75 PSI to easily enter beta range.
 - 3 Pressure relief compression spring in the pressure control unit may be broken. Refer to Figure 2-2.
 - 4 Relief valve may be jammed or broken. Refer to Figure 2-2.
 - (c) Mechanical connection between the pilot control to the pressure control unit is either jammed or disconnected.

H. Vibration (Rev. 1)

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

CAUTION 2: VIBRATION PROBLEMS BECAUSE OF PROPELLER SYSTEM IMBALANCE ARE NORMALLY FELT THROUGHOUT THE RPM RANGE, WITH THE INTENSITY OF VIBRATION INCREASING WITH RPM. VIBRATION PROBLEMS THAT OCCUR IN A NARROW RPM RANGE ARE A SYMPTOM OF RESONANCE 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) Correct 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, incorrect installation, or “wobble” during operation
 - (i) Static balance
 - (j) Propeller installation
 - 1 Remove and reinstall the propeller 180 degrees from the original installation position.
 - a “R” flange propellers installed on an engine that has an “R” flange cannot be reinstalled 180 degrees from the original installation position.
 - (k) Hub damage or cracking
 - (l) Grease or oil leakage
 - (m) 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 correctly before operation.
 - 1 Refer to the engine or airframe manuals, and the Maintenance Practices chapter of this manual.

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1. Pre-Flight Checks (Rev. 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.

A. Important Information

- (1) Follow propeller pre-flight inspection procedures specified in the Pilot Operating Handbook (POH) in addition to the inspections specified in this section.
- (2) Defects or damage found during the pre-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 the 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) Retighten or reinstall as necessary.
- WARNING:** ABNORMAL GREASE/OIL 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 the Initial Run-Up procedure in accordance with the instructions in this section.

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 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 one 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 the following inspection procedures 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 intervals 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 section, "Aluminum Blades" in the Maintenance Practices chapter of this manual for damage evaluation and repair information.
 - (b) A cracked blade must be referred to a certified propeller repair station with the appropriate rating.

CAUTION: DO NOT ATTEMPT TO REPAIR A
CRACKED HUB.

- (4) Visually inspect the hub parts for cracks, or wear. Refer to Grease or Oil Leakage in the Inspection Procedures section of this chapter for procedure.
 - (a) A cracked hub must be referred to a certified propeller repair station with the appropriate rating.
- (5) Inspect all visible propeller parts for cracks, wear or unsafe conditions.
- (6) Check for oil and grease leaks. Refer to Grease or Oil Leakage in the Inspection Procedures section of this chapter for procedure.
- (7) If a blade track problem is suspected, check the blade track. Refer to "Blade Track" in the Inspection Procedures section of this chapter.
- (8) Check the accuracy of the tachometer. Refer to the section, "Tachometer Calibration" in the Maintenance Practices chapter of this manual.
- (9) Clean or replace the anti-ice system filter (if an anti-ice system is installed).
- (10) 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 included 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 Aluminum 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 Cause:
 - 1 Loose/defective lubrication fitting
 - 2 Damaged blade shank to hub O-ring seal
 - 3 Damaged hub seal (at hub parting line)
 - 4 Damaged hub/engine flange interface O-ring
 - 5 Cracked hub
- (2) Inspection Procedure
 - (a) Remove the spinner dome.

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

- (b) Perform a visual inspection of the hub, blades, and blade retention areas to locate the source of the grease leak.
 - 1 If the source of the grease leak is a lubrication fitting, blade O-ring, or the hub parting line, repairs can be accomplished during scheduled maintenance as long as flight safety is not compromised.
 - a To repair a grease leak from a lubrication fitting, blade O-ring, or hub parting line, the propeller must be disassembled and inspected at a certified propeller repair station with the appropriate rating.
 - 2 If the source of the grease leak is a component or location other than a lubrication fitting, blade O-ring, or the hub parting line, the propeller must be disassembled and inspected at a certified propeller repair station with the appropriate rating before further flight.

- (c) Perform a visual inspection for cracks in the hub.
 - 1 Extra attention should be given to the blade retention area of the hub.
 - 2 A crack may be visible or may be indicated by grease leaking from a seemingly solid surface.
- (d) If cracks are suspected, additional inspections to verify the condition must be performed before further flight.
 - 1 Inspections typically include disassembly of the propeller followed by inspection of parts, using nondestructive methods in accordance with published procedures.
 - a These inspections must be performed by a certified propeller repair station with the appropriate rating.
- (e) If cracks or failing components are found, these parts must be replaced before further 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.

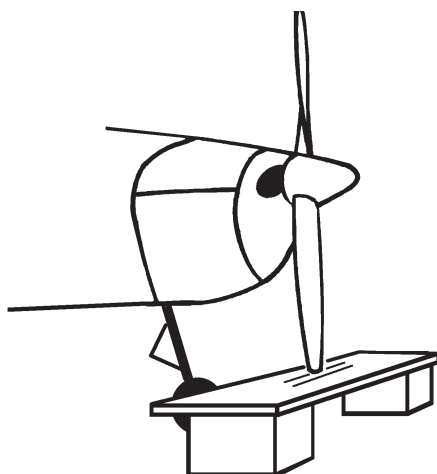
(2) Inspection

- (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 an aluminum hub, or the blade clamps on steel hub propellers.
 - 2** A crack may be readily visible, or may be indicated by grease leaking from a seemingly solid surface.

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



APS6155

Checking Blade Track
Figure 5-1

D. Blade Track

(1) Check blade track as follows:

- (a) Chock the aircraft wheels securely.
- (b) Refer to Figure 5-1. Put a fixed reference point under the propeller, within 0.25 inch (6.3 mm) of the lowest point of the propeller arc.
 - 1 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.
- (c) Put a narrow piece of tape on the same place on each blade to mark the tip of the blade.

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

- (d) Rotate the propeller by hand (opposite the direction of normal rotation) until a blade points directly at the reference surface (paper).
 - 1 The propeller does not have a start lock and blade track must be checked when the propeller is in high pitch position:
- (e) Mark the position of the narrow piece of tape that was put on the blade to mark the tip of the blade in relation to the reference surface (paper).
- (f) Repeat this procedure with the remaining blades.
- (g) 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 mounting flange.
- (b) If no foreign matter is present, refer to a certified propeller repair station with the appropriate rating.

E. Blade Tolerances (Rev. 5)

(1) Limits for blade play are specified below.

Refer to Figure 5-2.

(a) End Play:

Leading Edge-to-Trailing Edge Total: ± 0.0625 inch (1.58 mm)
Total: 0.125 inch (3.17 mm)

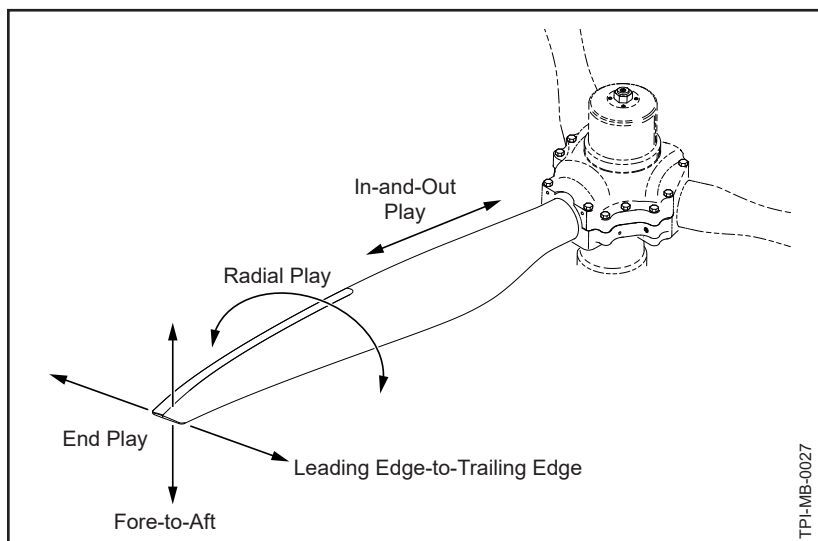
Fore-to-Aft (face to camber) Total: ± 0.0625 inch (1.58 mm)
Total: 0.125 inch (3.17 mm)

(b) In and Out Play none permitted

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

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

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



Blade Play
Figure 5-2

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

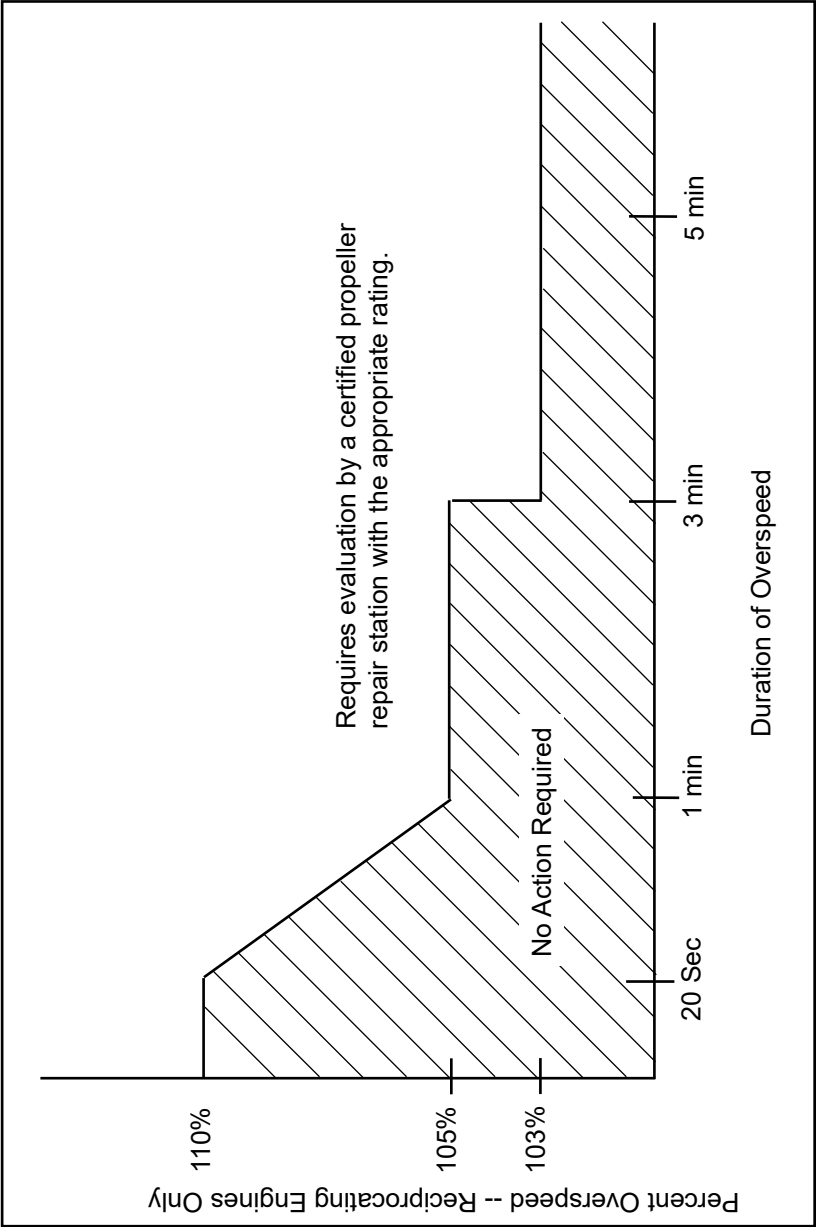
- 1 For damage evaluation and repair information, refer to Hartzell Propeller Manual 127 (61-16-27) or a certified propeller repair station with the appropriate rating.
 - 2 Contact the local airworthiness authority for repair approval.

- (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.

H. Propeller Ice Protection Systems (Rev. 1)

- (1) Refer to the Anti-ice and De-ice Systems chapter of this manual for operational checks and troubleshooting information.



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) Aluminum Blades: 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.

NOTE: It is not necessary to remove the de-ice/anti-icing boot for this inspection.

- (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.

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

D. Fire/Heat Damage (Rev. 1)

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

- (1) A propeller that has been exposed to fire or high temperatures, such as an engine or hangar fire, must be inspected by a certified propeller repair station with the appropriate rating before further 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 CAN LEAD TO INTERNAL CORROSION OF PROPELLER COMPONENTS.

A. General Cleaning

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

CAUTION 2: DO NOT CLEAN 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.

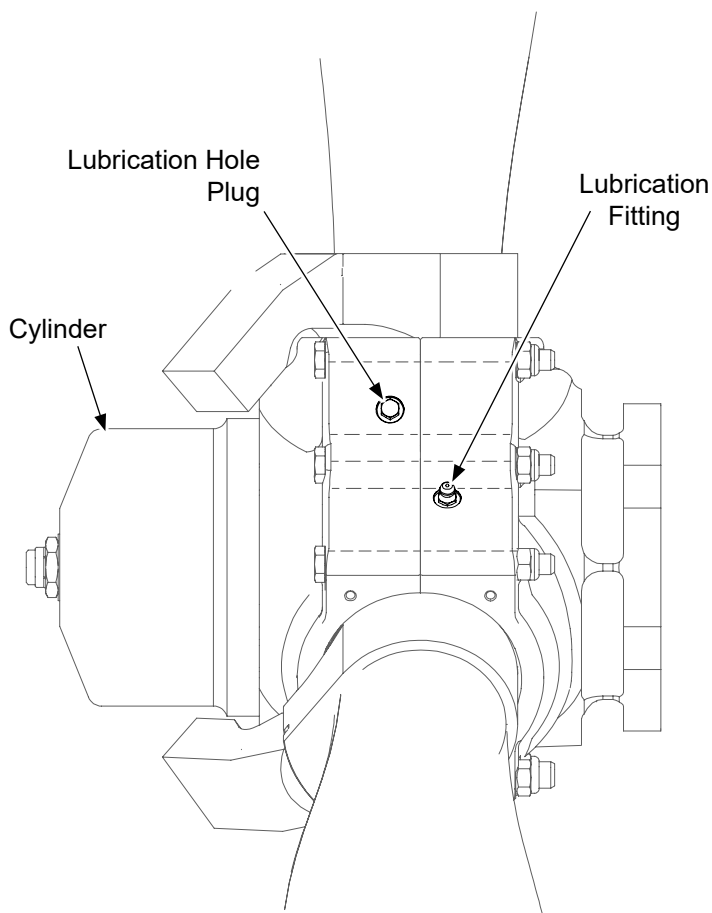
IMPORTANT: WHEN PERFORMING STEPS 5 THRU 7, THE BLADE(S) TO BE CLEANED MUST POINT DOWNWARD. THIS WILL PREVENT THE SOAP SOLUTION AND/OR CONTAMINANTS FROM FLOWING INTO THE HUB/BLADE SEAL AREA.

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.



TPI-MB-0335

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

Lubrication Fittings/Hole Plugs
Figure 6-1

2. Lubrication (Rev. 7)

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 ten hours of operation because centrifugal loads will pack and redistribute grease which can result in a propeller imbalance. Redistribution of grease may also result in voids in the blade bearing area where moisture can collect.
- (a) Purchasers of new 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.

B. Lubrication Procedure

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

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

- (1) Remove the propeller spinner.
- (2) Each blade socket has two lubrication fittings or one lubrication fitting and one lubrication hole plug. Refer to Figure 6-1.
- (3) Remove the caps from the lubrication fittings.
- (4) Remove the lubrication fittings or hole plugs as applicable.
 - (a) For all tractor or pusher propellers with clockwise (standard) rotation when viewed from BEHIND the aircraft, remove the lubrication fittings (p/n A-279 or C-6349) or lubrication hole plugs (p/n 106545) from the CYLINDER-SIDE hub half.

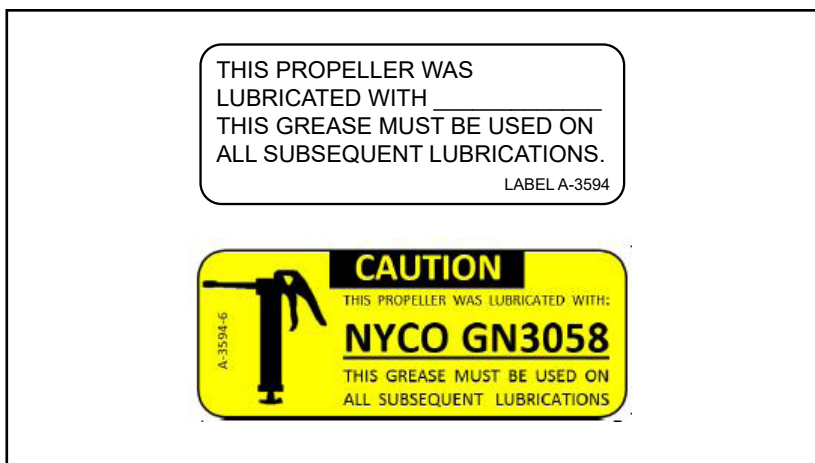
- (b) For all tractor or pusher propellers with counter-clockwise (backward) rotation when viewed from BEHIND the aircraft, remove the lubrication fittings (p/n A-279 or C-6349) or lubrication hole plugs (p/n 106545) from the ENGINE-SIDE hub half.

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

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

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

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



Lubrication Label
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.
- (7) If different grease types are accidentally mixed, the propeller must be disassembled and cleaned in accordance with the applicable overhaul/maintenance manual within three months or 30 flights whichever occurs first.
 - (a) EXCEPTION: Aeroshell 5 and Aeroshell 6 greases both have a mineral oil base and the same thickening agent; therefore, mixing of these two greases is permitted in Hartzell propellers.

WARNING: WHEN MIXING AEROSHELL 5 AND AEROSHELL 6 GREASES, THE 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 AN ALUMINUM HUB PROPELLER MAY CAUSE THE GREASE TO ENTER THE HUB CAVITY, LEADING TO EXCESSIVE VIBRATION AND/OR SLUGGISH OPERATION. THE PROPELLER MUST THEN BE DISASSEMBLED TO REMOVE THIS GREASE.

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

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



TPHMB-0358

Right Angle Coupler for Grease Gun
Figure 6-3

- (a) For all tractor or pusher propellers with clockwise (standard) rotation when viewed from BEHIND the aircraft, the lubrication fitting is in the ENGINE-SIDE hub half.
 - (b) For all tractor or pusher propellers with counter-clockwise (backward) rotation when viewed from BEHIND the aircraft, the lubrication fitting is in the CYLINDER-SIDE hub half.
- (9) If a lubrication fitting (p/n A-279 or C-6349) was removed at the beginning of this procedure, it may be reinstalled or replaced with a lubrication hole plug (p/n 106545).
- (a) Reinstall the lubrication fitting or hole plug that was removed at the beginning of this procedure.
 - (b) Tighten until finger-tight, then tighten one additional 360 degree turn.
- (10) Make sure that the ball of each lubrication fitting is correctly seated.
- (11) Reinstall a lubrication fitting cap on each lubrication fitting.
- C. Approved Lubricants
- (1) For a list of lubricants approved for use in Hartzell propellers, refer to the Consumable Materials chapter of Hartzell Propeller Standard Practices Manual 202A (61-01-02).

3. Corrosion Inhibitor (Rev. 2)

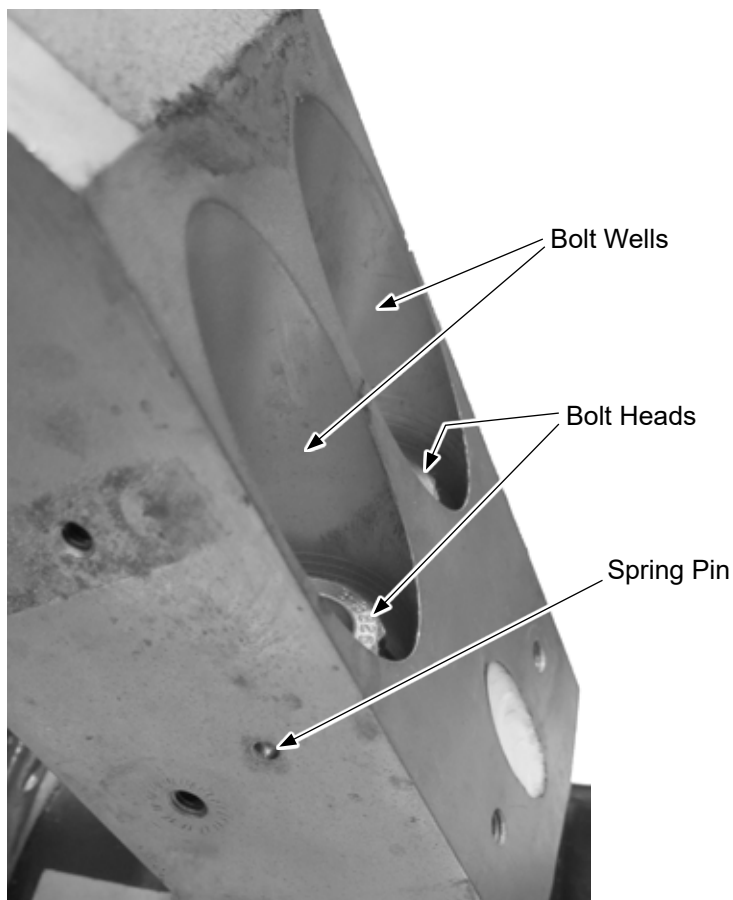
CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC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

B. Application Procedure

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



TPH-JM-000147

Applying Corrosion Inhibitor CM352
Figure 6-4

- CAUTION: DO NOT APPLY CORROSION INHIBITOR CM352 ONTO ICE PROTECTION SYSTEM COMPONENTS (TERMINAL STRIPS, BOOTS, HARNESSES, ETC.).
- (2) Spray the corrosion inhibitor CM352 into a cup or container, then use a soft bristled brush to apply the corrosion inhibitor CM352 to the bolt heads, spring pins, and bolt wells of the counterweight. Refer to Figure 6-4.
 - (a) Use caution when applying the corrosion inhibitor CM352 around ice protection system components (terminal strips, boots, harnesses, etc.).
 - (b) Make sure the bolt heads, spring pins, and bolt wells are completely covered by the corrosion inhibitor CM352.
 - (c) Optionally, corrosion inhibitor CM352 can be applied to all exposed surfaces of the counterweight.
 - (3) Let the corrosion inhibitor CM352 cure for a minimum of three hours before flight.

4. 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.

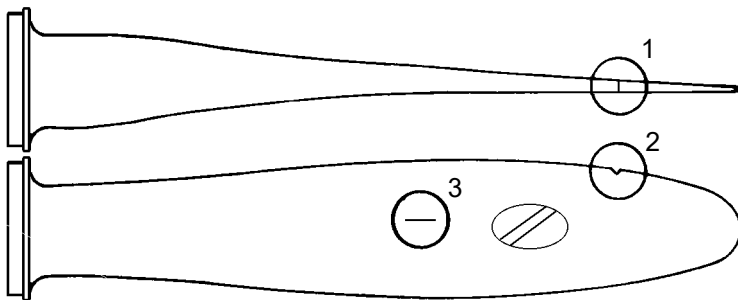
- (2) Field repair of small nicks and scratches may be performed by qualified personnel in accordance with FAA Advisory Circular 43.13-1B, and the procedures specified in this section.
- (3) Normal erosion (sand-blasted appearance) on the leading edge of the blade is acceptable, and does not require removal before further flight.

B. Repair of Nicks and Gouges

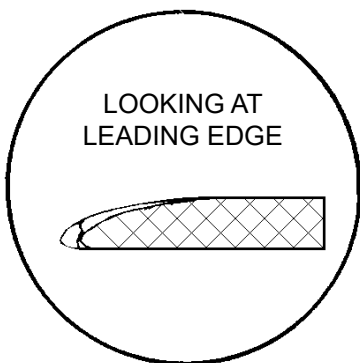
- (1) Local repairs may be made using files, electrical or air powered equipment. Use emery cloth, scotch brite, and crocus cloth for final finishing.

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 REWORKED 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).

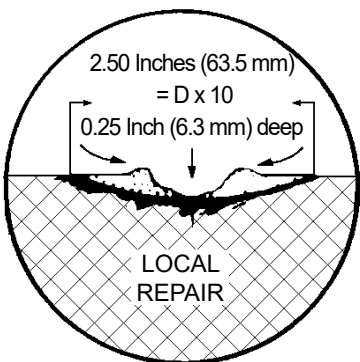


Example 1

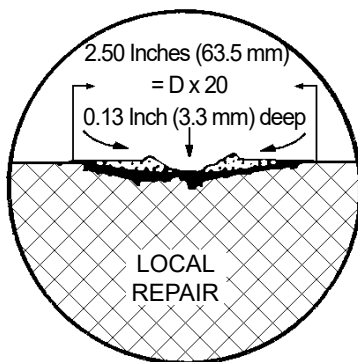


Finish repair must maintain original airfoil shape.

Example 2
LEADING EDGE



Example 3
FACE/CAMBER



AP56157

Repair Limitations
Figure 6-5

- (2) Calculate the area of repair using Figure 6-5 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 the damaged area, use emery cloth to polish the area, then remove any file marks using crocus cloth.
- (6) Inspect the repaired area with a 10X magnifying glass.
 - (a) Be sure that no indication of the damage, file marks, or coarse surface finish remain.
- (7) If inspections show any remaining blade damage, repeat steps (5) and (6) of this procedure until no damage remains.
- (8) After repair, Hartzell Propeller recommends penetrant inspection of the blade in accordance with Hartzell Propeller Standard Practices Manual 202A (61-01-02).

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

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

C. Repair of Bent Blades

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

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

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 manufacturer's contact information:

(a) **Tempo Products Company**

A Plasti-kote Company
1000 Lake Road
Medina, OH 44256
Tel: 800.321.6300
Fax: 216.349.4241
Cage Code: 07708

(b) **Sherwin-Williams Company**

Refer to the Sherwin-Williams
Product Finishes Global Finishes Group website at:
<http://oem.sherwin-williams.com>

Vendor	Color/Type	Vendor P/N	Hartzell Propeller 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

C. Procedure

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

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

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

(2) Permit the solvent to evaporate.

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

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

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

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

(5) Permit the solvent to evaporate.

(6) Aluminum Blades Only:

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

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

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

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

- (8) Apply a sufficient amount of finish coating to achieve 2 to 4 mils thickness when dry.

- (a) Re-coat before 30 minutes, or after 48 hours.
 - (b) If the paint is permitted to dry longer than four hours, it must be lightly sanded before another coat is applied.

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

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

- (a) Re-coat before 30 minutes, or after 48 hours.
 - (b) If the paint is permitted to dry longer than four hours, it must be lightly sanded before another coat is applied.

- (11) Remove the masking material immediately from the 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

A. Overview

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: IF REFLECTIVE TAPE IS USED FOR DYNAMIC BALANCING, DO NOT APPLY THE TAPE ON EXPOSED BARE METAL OF THE BLADE. THIS WILL PERMIT 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.

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

- (1) 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.

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 examine each propeller blade assembly for evidence of grease leakage.
 - (c) Visually examine the inner surface of the spinner dome for evidence of grease leakage.
- (2) If there is no evidence of grease leakage, lubricate the propeller in accordance with the Maintenance Practices chapter in this manual. If grease leakage is evident, determine the location of the leak and correct before re-lubricating the propeller and 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 not be possible because of measurement equipment limitations.

C. Modifying Spinner Bulkhead to Accommodate Dynamic Balance Weights

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

- (1) It is recommended that balance weights be placed in a radial location on aluminum spinner bulkheads that have not been previously drilled.
- (2) The radial location should be outboard of the de-ice slip ring or bulkhead doubler and inboard of the bend where the bulkhead creates the flange surface to attach the spinner dome.
- (3) Twelve equally spaced locations are recommended for weight attachment.
- (4) Installing nut plates (10-32 thread) of the type used to attach the spinner dome will permit convenient balance weight attachment on the engine side of the bulkhead.
- (5) Alternatively, drilling holes for use with the AN3-() type bolts with self-locking nuts is permitted.
- (6) Chadwick-Helmuth Manual AW-9511-2, "The Smooth Propeller", specifies several generic bulkhead rework procedures. These are permitted if they comply with the conditions specified herein.

D. Placement of Balance Weights for Dynamic Balance

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

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

- (2) If the location of static balance weights has not been altered, subsequent removal of the dynamic balance weights will return the propeller to its original static balance condition.
- (3) Use only stainless or plated steel washers as dynamic balance weights on the spinner bulkhead.
- (4) A maximum of six AN970 style washers weighing up to approximately 1.0 ounce (28.0 g) may be installed at any one location.

NOTE: The dimensions of an AN970 washer are:
ID 0.203 inch (5.16 mm), OD 0.875 inch
(22.23 mm), and thickness 0.063 inch (1.59 mm).

- (5) Install weights using aircraft quality #10-32 or AN-3() type screws or bolts.
- (6) Balance weight screws attached to the spinner bulkhead must protrude through the self-locking nuts or nut plates a minimum of one thread and a maximum of four threads.

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

- (7) 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.
- (8) If reflective tape is used for dynamic balancing, remove the tape immediately after balancing is completed.
- (9) 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 Setting

WARNING 1: RPM ADJUSTMENTS MUST BE MADE WITH REFERENCE TO A CALIBRATED TACHOMETER. AIRCRAFT MECHANICAL TACHOMETERS DEVELOP ERRORS OVER TIME, AND SHOULD BE PERIODICALLY RECALIBRATED TO MAKE SURE THE PROPER RPM IS DISPLAYED.

WARNING 2: LOW PITCH BLADE ANGLE ADJUSTMENTS MUST BE MADE IN CONSULTATION WITH THE APPLICABLE TYPE CERTIFICATE OR SUPPLEMENTAL TYPE CERTIFICATE HOLDERS 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

- (1) 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. The 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. 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.
- (2) An overspeed at the maximum power static condition may indicate that the propeller low-pitch blade angle is set too low or that the governor is improperly adjusted.
- (3) An underspeed during the maximum power static condition may be caused by any one or a combination of the following: The propeller low pitch blade angle is too high; the governor is improperly adjusted; the engine is not producing rated power.

8. Propeller High Pitch Settings (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. Reverse Pitch Stop Settings (Rev. 2)

A. Reverse Pitch Stop Adjustment

- (1) The reverse pitch stop is set by Hartzell Propeller LLC in accordance with the aircraft manufacturer's recommendations.
- (2) The reverse pitch stop can only be adjusted by Hartzell or by a certified propeller repair station with the appropriate rating.

10. Propeller Ice Protection Systems (Rev. 1)

A. Maintenance Information

- (1) Refer to the Anti-ice and De-ice Systems chapter of this manual for ice protection system maintenance information.

11. 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.

ANTI-ICE AND DE-ICE SYSTEM - CONTENTS

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1. Anti-ice System Description (Rev. 1)

WARNING: CONSULT THE PILOT OPERATING HANDBOOK (INCLUDING ALL SUPPLEMENTS) REGARDING FLIGHT INTO CONDITIONS OF KNOWN ICING. THE AIRCRAFT MAY NOT BE CERTIFICATED FOR FLIGHT INTO KNOWN ICING CONDITIONS, EVEN THOUGH AN ICE PROTECTION SYSTEM IS INSTALLED.

NOTE: There are many configurations of anti-ice systems. This section provides a general overview of system operation. Consult the airframe manufacturer's manual for a description of your specific anti-ice system and controls.

A. Overview of an Anti-ice System

- (1) A propeller anti-ice system prevents formation of ice on the propeller blades. The system dispenses a liquid (usually isopropyl alcohol) onto the propeller blades. This liquid mixes with moisture on the blades and lowers the freezing point of the water, allowing the water/alcohol mixture to flow off of the blades before ice forms.

- (a) Anti-ice systems must be in use before ice forms. This system is not effective for removing ice after it has formed.

B. Components of an Anti-ice System

- (1) A typical anti-ice system includes the following components:
 - (a) Fluid tank, pump, slinger ring, blade mounted anti-icing boots, and fluid dispensing tubes located at each blade mounted anti-icing boot

C. Anti-ice System Operation

- (1) The anti-ice system is typically controlled by the pilot using a cockpit mounted rheostat. The rheostat controls the pump and the flow of anti-ice fluid from the fluid tank.
- (2) The anti-ice fluid is pumped through airframe mounted distribution tubing and into a rotating slinger ring that is mounted on the rear of the propeller hub.

- (3) From the slinger ring, centrifugal force pushes the anti-icing fluid through the fluid dispensing tubes onto the blade mounted anti-icing boots.
- (4) The anti-icing boots evenly distribute the fluid along the leading edge of the propeller blade to prevent ice from forming.

2. De-ice System Description (Rev. 1)

WARNING: CONSULT THE PILOT OPERATING HANDBOOK (INCLUDING ALL SUPPLEMENTS) REGARDING FLIGHT INTO CONDITIONS OF KNOWN ICING. THE AIRCRAFT MAY NOT BE CERTIFICATED FOR FLIGHT INTO KNOWN ICING CONDITIONS, EVEN THOUGH AN ICE PROTECTION SYSTEM IS INSTALLED.

NOTE: There are many configurations of de-ice systems. This section provides a general overview of system operation. Consult the airframe manufacturer's manual for a description of your specific de-ice system and controls.

A. Overview of a De-ice System

- (1) A propeller de-ice system removes ice after it forms on the propeller blades. The system uses electrical heating elements to melt the ice layer next to the blade permitting the ice to be thrown from the blade by centrifugal force.

B. Components of a De-ice System

- (1) A typical de-ice system includes the following components:
 - (a) ON/OFF switch(es), ammeter, timer or cycling unit, slip ring, brush blocks, and blade mounted de-ice boots.

C. De-ice System Operation

- (1) The de-ice system is controlled by the pilot using a cockpit control switch. When this switch is ON, electrical power is supplied to the de-ice system.
 - (a) Some systems may have additional controls to adjust for different icing conditions.
 - 1 A mode selector switch lets the pilot set the cycling speed for heavy or light icing conditions.
 - 2 For twin engine aircraft, a full de-ice mode switch lets the pilot de-ice both propellers simultaneously. This switch is used when ice builds up on the propeller before the system is turned on and may only be used for short periods.
- (2) The ammeter indicates current draw by the system. It is typically located near the de-ice system switches. The ammeter may indicate total system load, or in twin engine aircraft, a separate ammeter may be supplied for each propeller.
- (3) The timer or cycling unit is controlled by the pilot using a cockpit control switch. When the timer/cycling unit is ON, power is applied to each de-ice boot (or boot segment) in a sequential order for a preset amount of time. This heating interval evenly de-ices the propeller.
- (4) The brush block supplies electrical current to the de-ice boot on each propeller blade via a slip ring. The brush block is typically mounted on the engine just aft of the propeller. The slip ring rotates with the propeller and is typically mounted on the spinner bulkhead.
- (5) The de-ice boots contain internal heating elements that melt the ice layer from the blades when electrical current is applied. De-ice boots are attached to the leading edge of each blade using adhesive.

3. Operational Checks (Rev. 2)**A. De-ice and Anti-ice Systems**

- (1) Perform the applicable Operational Check procedure(s) in accordance with the Check chapter in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) and/or the Aircraft Maintenance Manual.

4. Troubleshooting (Rev. 2)**A. De-ice and Anti-ice Systems**

- (1) Refer to the applicable chapter(s) in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) to troubleshoot malfunctions in Hartzell de-ice and anti-ice systems.
 - (a) Part numbers for components used in Hartzell de-ice and anti-ice systems are found in Hartzell Propeller Ice Protection System Manual 180 (30-61-80).

5. Periodic Inspections (Rev. 2)**A. De-ice and Anti-ice Systems**

- (1) Refer to the Check chapter in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) for detailed information about inspection intervals and procedures.

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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 logbook 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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