

FAA Approved  
Manual No. 169  
61-00-69  
Revision 2  
May 2009

# Propeller Owner's Manual and Logbook

## Steel Hub Reciprocating Propellers with Aluminum Blades

Two Blade	Three Blade
(B)HC-92( )F-1( )	HC-93Z20-1( )
HC-92( )K-1( )	HC-93ZF-2( )
(B)HC-92( )F-2( )	HC-93Z20-2( )
HC-92( )K-2( )	HC-93Z30-2( )
(B)HC-92( )F-3( )	
HC-92WF-5A	
HC-92( )F-8( )	
HC-92( )K-8( )	

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**COVER 61-00-69**

Inside Cover  
Rev. 2 May/09

As a fellow pilot, 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.

A handwritten signature in black ink that reads "Jim Brown". The signature is fluid and cursive, with a long horizontal stroke extending to the right.

Jim Brown  
Chairman, Hartzell Propeller Inc.

# WARNING

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, 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 a propeller or propeller blades and cause loss of propeller control and/or loss of aircraft control.

Hartzell Propeller Inc. 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.

Visually inspect metal blades for cracks. Inspect hubs, with particular emphasis on each blade arm for cracks. Eddy current equipment is recommended for hub inspection, since cracks are usually not apparent.

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REVISION HIGHLIGHTS

Revision 2, dated May 2009, incorporates the following:

- Revised Cover, Revision Highlights, List of Effective Pages, and Table of Contents to reflect changes.
- [Added Airworthiness Limitations section.](#)
- Introduction Chapter
  - [Updated Reference Publications section.](#)
  - [Added information about Hartzell Recommended Facilities.](#)
- Installation and Removal Chapter
  - [Relocated Low Pitch Adjustment information to the Maintenance Practices Chapter.](#)
  - [Revised side clearance limits for installation of the carbon block into the beta linkage lever.](#)
- Testing and Troubleshooting Chapter
  - [Added Static RPM Check to the Operational Tests section.](#)
  - [Relocated previous Propeller Equipment and Settings information to the Maintenance Practices Chapter.](#)
  - [Relocated Maximum RPM information from the Maintenance Practices Chapter to the Testing and Troubleshooting chapter.](#)
- Inspection and Check Chapter
  - [Revised the Operational Checks section.](#)
  - [Revised the blade radial play tolerance.](#)
  - [Revised the definition of foreign object strike.](#)
  - [Updated Long Term Storage Information.](#)
- Maintenance Practices Chapter
  - [Addressed the mixing of Aeroshell greases 5 and 6.](#)
  - [Updated Approved Touch-up Paints Table 6-1.](#)
  - [Updated dynamic balance information.](#)
  - [Relocated Propeller Low Pitch Stop information from the Testing and Troubleshooting chapter to the Maintenance Practices chapter.](#)
  - [Relocated Propeller High Pitch Settings, Feathering Pitch Stop Settings, and Start Lock Settings information from the Testing and Troubleshooting chapter to the Maintenance Practices chapter.](#)
- Anti-ice and De-ice System Chapter
  - [Updated reference information.](#)

REVISION HIGHLIGHTS1. Introduction

## A. General

This is a list of current revisions that have been issued against this manual. Please compare it to the RECORD OF REVISIONS page to ensure that all revisions have been added to the manual.

## B. Components

- (1) Revision No. indicates the revisions incorporated in this manual.
- (2) Issue Date is the date of the revision.
- (3) Comments indicates the level of the revision.
  - (a) New Issue is a new manual distribution. The manual is distributed in its entirety. All the page revision dates are the same and no change bars are used.
  - (b) Reissue is a revision to an existing manual that includes major content and/or major format changes. The manual is distributed in its entirety. All the page revision dates are the same and no change bars are used.
  - (c) Major Revision is a revision to an existing manual that includes major content or minor content changes over a large portion of the manual. The manual is distributed in its entirety. All the page revision dates are the same, but change bars are used to indicate the changes incorporated in the latest revision of the manual.
  - (d) Minor Revision is a revision to an existing manual that includes minor content changes to the manual. Only the revised pages of the manual are distributed. Each page retains the date and the change bars associated with the last revision to that page.



<u>Revision No.</u>	<u>Issue Date</u>	<u>Comments</u>
Original	July/00	New Issue
Revision 1	Aug/05	Minor Revision
Revision 2	May/09	Minor Revision

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RECORD OF REVISIONS

<b>Rev. No.</b>	<b>Issue Date</b>	<b>Date Inserted</b>	<b>Inserted By</b>
1	Aug/05	Aug/05	HPI
2	May/09	May/09	HPI

RECORD OF REVISIONS

Rev. No.      Issue Date      Date Inserted      Inserted By

Rev. No.	Issue Date	Date Inserted	Inserted By

### RECORD OF TEMPORARY REVISIONS

<b>TR No.</b>	<b>Issue Date</b>	<b>Date Inserted</b>	<b>Inserted By</b>	<b>Date Removed</b>	<b>Removed By</b>
TR-001	Nov/03	Nov/03	HPI	Aug/05	HPI
TR-002	May/04	May/04	HPI	Aug/05	HPI





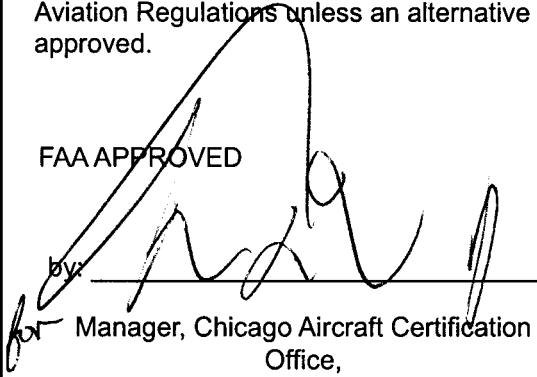




### AIRWORTHINESS LIMITATIONS

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

FAA APPROVED



by: \_\_\_\_\_

**MAY 06 2009**

date: \_\_\_\_\_

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

Rev. No.	Description of Revision	Rev. No.	Description of Revision

## AIRWORTHINESS LIMITATIONS

1. The FAA establishes specific life limits for certain component parts as well as the entire propeller. Such limits require replacement of the identified parts after a specified number of hours of use.
2. The following data summarizes all current information concerning Hartzell life limited parts as related to propeller models affected by this manual. These parts are not life limited on other installations: however, time accumulated toward life limit accrues when first operated on aircraft/engine/propeller combinations listed and continues regardless of subsequent installations (that may or may not be life limited).
  - A. Propeller models affected by this manual currently do not have any life limited parts.

FAA APPROVED

by: 

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

date: \_\_\_\_\_

**MAY 8 6 2009**

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**1. Purpose**

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

This manual supports the following two and three-bladed, "9" type steel hub reciprocating propellers: constant speed, nonfeathering; constant speed, feathering; and constant speed, feathering, and reversing.

The purpose of this manual is to enable qualified personnel to install, operate, and maintain a Hartzell propeller. Separate manuals are available concerning overhaul procedures and specifications for the propeller.

This manual covers different design types. Sample hub and blade model numbers within each design are covered in the Description and Operation chapter of this manual.

**NOTE:** All propeller models covered by this manual use aluminum propeller blades.

**2. Airworthiness Limits**

Refer to the Airworthiness Limitations section of this manual for Airworthiness Limits information.

**3. Airframe or Engine Modifications**

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

- B. Engine modifications can also 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 increase the maximum power output, while others improve the power available during hot and high operation (flat rating) or at off-peak conditions. Examples of such engine modifications include, but are not limited to: changes to the compressor, power turbine, or hot section of a turboprop engine; and on piston engines, the addition or alteration of a turbocharger or turbonormalizer, increased compression ratio, increased RPM, altered ignition timing, electronic ignition, full authority digital electronic controls (FADEC), or tuned induction or exhaust.
- C. All such modifications must be reviewed and approved by the propeller manufacturer before obtaining approval on the aircraft.

#### 4. Restrictions and Placards

The propellers covered by this manual may have a restricted operating range that requires a cockpit placard. The restrictions, if present, will vary depending on the propeller, blade, engine, and/or aircraft model. Review the propeller and aircraft type certificate data sheet (TCDS), Pilot Operating Handbook (POH), and any applicable Airworthiness Directives for specific information.

#### 5. General

##### A. Personnel Requirements

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

##### B. Maintenance Practices

- (1) The propeller and its components are highly vulnerable to damage while they are removed from the engine. Properly protect all components until they are reinstalled on the engine.
- (2) Never attempt to move the aircraft by pulling on the propeller.

- (3) Avoid the use of blade paddles, if possible. Do not place the blade paddle in the area of the de-ice boot when applying torque to a blade assembly. Place the blade paddle in the thickest area of the blade, just outside of the de-ice boot. Use one blade paddle per blade.
- (4) Use only the approved consumables, e.g. cleaning agents, lubricants, etc.
- (5) Observe applicable torque values during maintenance.
- (6) Before installing the propeller on the engine, the propeller must be statically balanced. New propellers are statically balanced at Hartzell. Overhauled propellers must be statically balanced by the overhaul facility before return to service.

NOTE: Dynamic balance is recommended, but may be accomplished at the discretion of the operator, unless specifically required by the airframe or engine manufacturer. Dynamic balancing is to be accomplished in accordance with the procedures and limitations in Maintenance Practices chapter of this manual. Additional procedures may be found in the aircraft maintenance manual.

- (7) As necessary, use a soft, non-graphite pencil or crayon to make identifying marks on components.
- (8) As applicable, follow military standard NASM33540 for safety wire and cotter pin general practices. Use 0.032 inch (0.81 mm) diameter stainless steel safety wire, unless otherwise indicated.
- (9) 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.
- (10) If the propeller is equipped with an anti-ice system, applicable instructions and technical information can be obtained by contacting Hartzell Product Support at (937) 778-4379 (business hours are 8:00 a.m. through 5:00 p.m., United States Eastern Time).

(11) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller Inc., applicable instructions and technical information for the components supplied by Hartzell can be found in the following publications, available on the Hartzell website at [www.hartzellprop.com](http://www.hartzellprop.com).

- (a) Hartzell Manual No. 180 (30-61-80) - Propeller Ice Protection System Manual
- (b) Hartzell Manual No. 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual
- (c) Hartzell Manual No. 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual
- (d) Hartzell Manual No. 183 (61-12-83) - Propeller Anti-icing Boot Removal and Installation Manual

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

(13) Approved corrosion protection followed by approved paint must be applied to all aluminum blades. For information concerning 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, e.g., "polished blades" is not permitted.

C. Continued Airworthiness

Operators are urged to keep informed of Airworthiness information via Hartzell Service Bulletins and Service Letters which are available from Hartzell distributors, or from the Hartzell factory by subscription. Selected information is also available on Hartzell Propeller's website at [www.hartzellprop.com](http://www.hartzellprop.com).



**6. Reference Publications**

The following publications contain information vital to the airworthiness of the propeller models covered in this manual:

Hartzell Manual No. 105A - Overhaul Manual

Hartzell Manual No. 110 - Overhaul Manual

Hartzell Manual No. 114B - Overhaul Manual

Hartzell Manual No. 126 (61-00-26) - Active Service Bulletins, Letters, Instructions, and Advisories

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

Hartzell Manual No. 133C (61-13-33) - Aluminum Propeller Blade Maintenance Manual

Hartzell Manual No. 159 (61-02-59) - Application Guide - Also available on the Hartzell Propeller Inc. website at [www.hartzellprop.com](http://www.hartzellprop.com)

Hartzell Manual No. 165A (61-00-65) - Illustrated Tool and Equipment Manual.

Hartzell Manual No. 180 (30-61-80) - Propeller Ice Protection System Manual (Available on the Hartzell website at [www.hartzellprop.com](http://www.hartzellprop.com).)

Hartzell Manual No. 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual (Available on the Hartzell website at [www.hartzellprop.com](http://www.hartzellprop.com).)

Hartzell Manual No. 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual (Available on the Hartzell website at [www.hartzellprop.com](http://www.hartzellprop.com).)

Hartzell Manual No. 183 (61-12-83) - Propeller Anti-icing Boot Removal and Installation Manual (Available on the Hartzell website at [www.hartzellprop.com](http://www.hartzellprop.com).)

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

Hartzell Service Letter HC-SL-61-61Y - Overhaul Periods and Service Life Limits for Hartzell Propellers, Governors, and Propeller Damper Assemblies - Also available on the Hartzell Propeller Inc. website at [www.hartzellprop.com](http://www.hartzellprop.com)

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**7. Definitions**

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

<u>Term</u>	<u>Definition</u>
Annealed .....	softening of material due to overexposure to heat.
Blade Angle .....	measurement of blade airfoil location described as the angle between the blade airfoil and the surface described by propeller rotation.
Brinelling .....	a depression caused by failure of the material in compression.
Chord .....	a straight line distance between the leading and trailing edges of an airfoil.
Cold Rolling .....	compressive rolling process that provides improved strength and resistance to fatigue.
Constant Force .....	a force that is always present in some degree when the propeller is operating.
Constant Speed .....	a propeller system which employs a governing device to maintain a selected engine RPM.
Corrosion .....	gradual material removal or deterioration due to chemical action.
Crack .....	irregularly shaped separation within a material, sometimes visible as a narrow opening at the surface.
Depression .....	surface area where the material has been compressed but not removed.
Distortion .....	alteration of the original shape or size of a component

<u>Term</u>	<u>Definition</u>
Erosion .....	gradual wearing away or deterioration due to action of the elements.
Exposure .....	leaving material open to action of the elements.
Feathering .....	a propeller with blades that may be rotated to a position parallel to the relative wind, thus reducing aerodynamic drag.
Gouge.....	surface area where material has been removed
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.
Nick .....	removal of paint and possibly a small amount of material.
Onspeed .....	condition in which the RPM selected by the pilot through the propeller control lever and the actual engine (propeller) RPM are equal.
Overhaul.....	the periodic disassembly, inspection, repair, refinish, and reassembly of a propeller assembly to maintain airworthiness.
Overspeed .....	condition in which the RPM of the propeller or engine exceeds predetermined maximum limits; the condition in which the engine (propeller) RPM is higher than the RPM selected by the pilot through the propeller control lever.

<u>Term</u>	<u>Definition</u>
Overspeed Damage .....	damage that occurs when the propeller hub assembly rotates at a speed greater than the maximum limit for which it is designed.
Pitch.....	same as "Blade Angle"
Pitting.....	formation of a number of small, irregularly shaped cavities in surface material caused by corrosion or wear.
Scratch .....	same as "Nick".
Single Acting.....	hydraulically actuated propeller which utilizes a single oil supply for pitch control.
Synchronizing .....	adjusting the RPM of all the propellers of a multi-engine aircraft to the same RPM.
Synchrophasing.....	a form of propeller sychronization in which not only the RPM of the engines (propellers) are held constant, but also the position of the propellers in relation to each other.
Underspeed .....	the condition in which the actual engine (propeller) RPM is lower than the RPM selected by the pilot through the propeller control lever.
Vertical Balance.....	balance between the leading and trailing edges of a two-blade propeller, with the blades positioned vertically.
Variable Force .....	a force which may be applied or removed during propeller operation.
Windmilling .....	the rotation of an aircraft propeller caused by air flowing through it while the engine is not producing power.

**8. Abbreviations**

<u>Abbreviation</u>	<u>Term</u>
AMM .....	Aircraft Maintenance Manual
AN.....	Air Force-Navy (or Army-Navy)
AOG.....	Aircraft on Ground
FAA.....	Federal Aviation Administration
Ft-Lb .....	Foot-Pound
ID .....	Inside Diameter
In-Lb .....	Inch-Pound
IPS.....	Inches Per Second
Lbs.....	Pounds
MIL-X-XX .....	Military Specification
MPI .....	Major Periodic Inspection
MS .....	Military Standard
NAS .....	National Aerospace Standards
N•m.....	Newton-Meters
OD .....	Outside Diameter
POH.....	Pilot Operating Handbook
PSI.....	Pounds per Square Inch
RPM.....	Revolutions per Minute
TBO .....	Time Between Overhaul
TSN .....	Time Since New
TSO .....	Time Since Overhaul

9. Hartzell Product Support

Hartzell Propeller is ready to assist you with questions concerning your propeller system. Hartzell Product Support may be reached during business hours (8:00 a.m. through 5:00 p.m., United States Eastern Time) at (937) 778-4379.

After business hours, you may leave a message on our 24 hour product support line at (937) 778-4376. AOG support is also available 24 hours per day, seven days per week via this message service.

Additional information is available on our website at [www.hartzellprop.com](http://www.hartzellprop.com)

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

10. Warranty Service

If you believe you have a warranty claim, it is necessary to contact Hartzell's Warranty Administrator. Hartzell's Warranty Administrator will provide you with a *Warranty Application* form. It is necessary to complete this form and return it to the Warranty Administrator for evaluation **before proceeding with repair or inspection work**. Upon receipt of this form, the Warranty Administrator will provide instructions on how to proceed. Hartzell Warranty may be reached during business hours (8:00 a.m. through 5:00 p.m.), United States Eastern Time) at (937)-778-4379 or toll free from the United States and Canada at (800) 942-7767. Hartzell Warranty Administration can also be reached by fax at (937) 778-4391, or by e-mail at [warranty@hartzellprop.com](mailto:warranty@hartzellprop.com).

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

11. Hartzell Recommended Facilities

- A. Hartzell Propeller Inc. recommends using Hartzell approved distributors and repair facilities for the purchase, repair and overhaul of Hartzell propeller assemblies or components.
- B. Information about the Hartzell worldwide network of aftermarket distributors and approved repair facilities is available on the Hartzell web site at [www.hartzellprop.com](http://www.hartzellprop.com).

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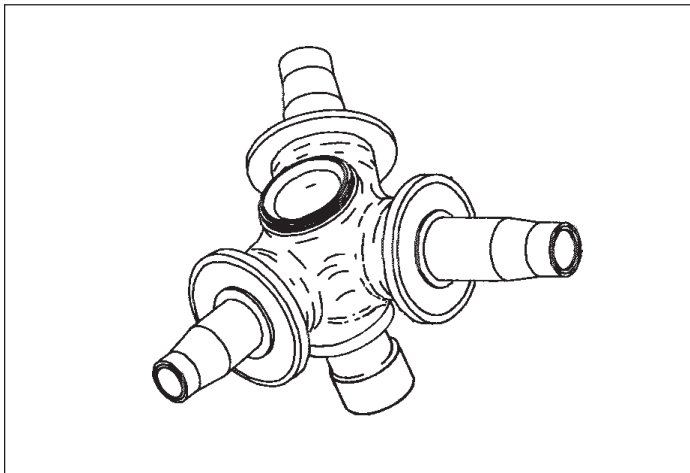
**1. Description of Propeller and Systems**

Hartzell steel hub propellers covered in this manual are constant speed assemblies that use a steel hub as a central component (Figure 2-1).

The propeller is attached to the engine through either a splined shaft or one of several flanged designs. A spline shaft attachment uses either a Society of Automotive Engineers (SAE) Number 20 or Number 30 spline (Figure 2-2).

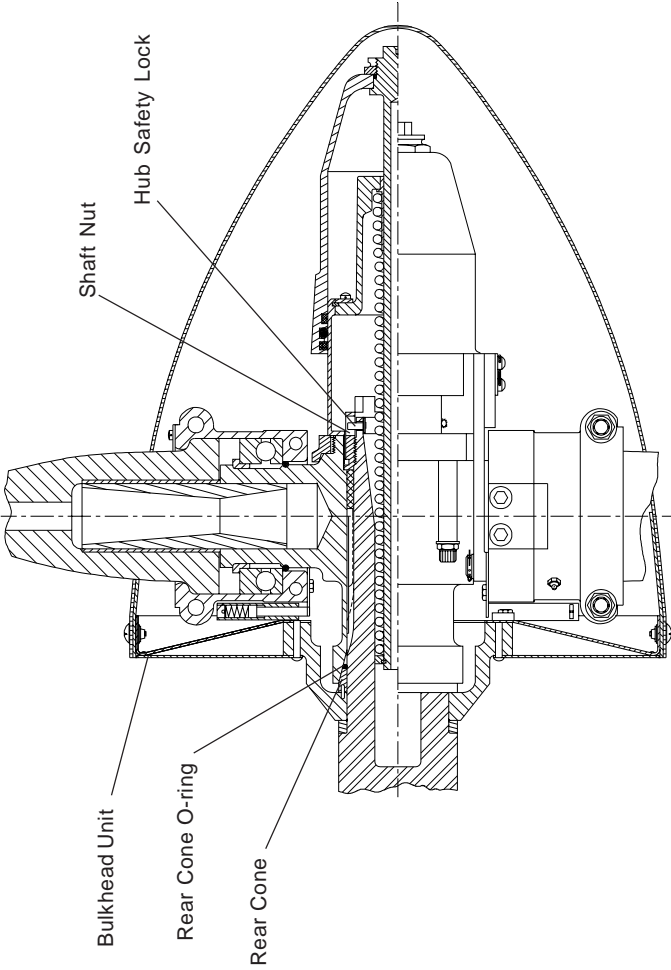
**NOTE:** SAE Number 20 and SAE Number 30 spline shaft propellers are identified simply as "20 spline shaft" and "30 spline shaft" propellers throughout the text of this manual.

A flanged shaft attachment uses one of two six-bolt patterns and two dowel pin interface, or an eight-bolt and two dowel pin interface between the engine and the propeller flange. (Figure 2-3).

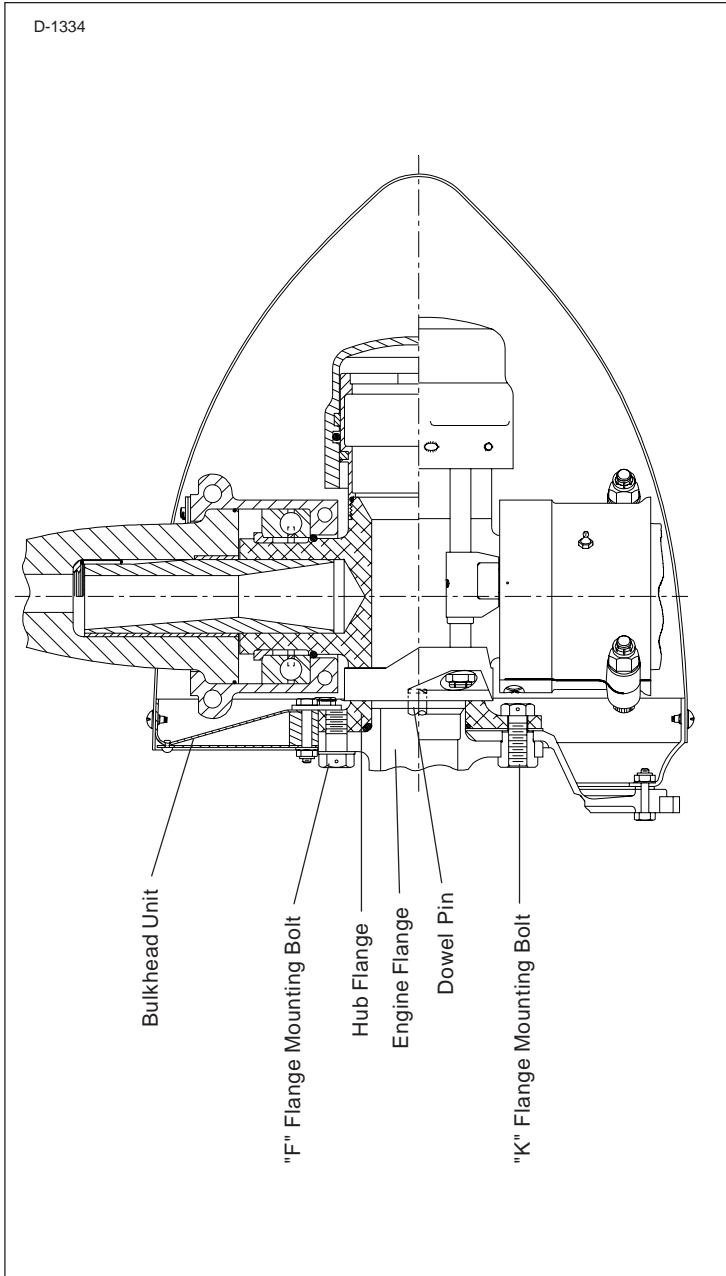


**Steel Hub Unit (For Splined Shaft Mounting)  
Figure 2-1**

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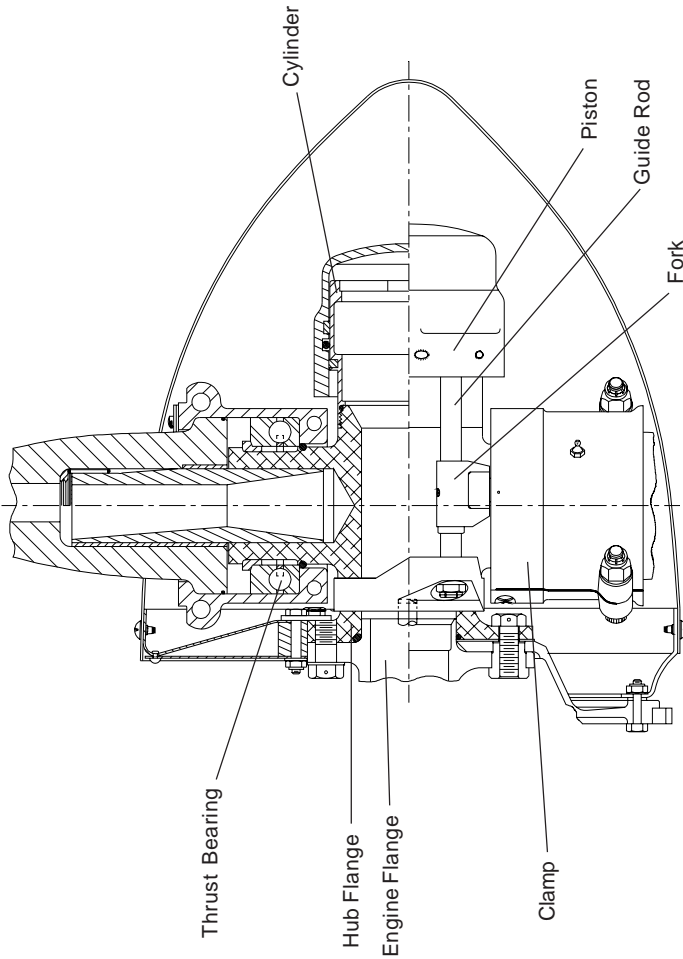


**Spline Shaft Attachment  
Figure 2-2**



Flanged Attachment  
Figure 2-3

D-1334



**Constant Speed, Non-feathering, Non-counterweighted Propeller Assembly**  
**Figure 2-4**

A. Constant Speed, Non-counterweighted, Non-feathering Propellers

Propeller models HC-92( )F-8( ), and HC-92( )K-8( )  
Refer to Figure 2-4.

Constant speed non-counterweighted, non-feathering propellers are typically used on single engine aircraft.

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

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

A non-counterweighted propeller requires governor supplied oil to increase blade angle. If the oil supply is lost, the non-counterweighted propeller will go to low pitch, or high RPM.

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

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

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

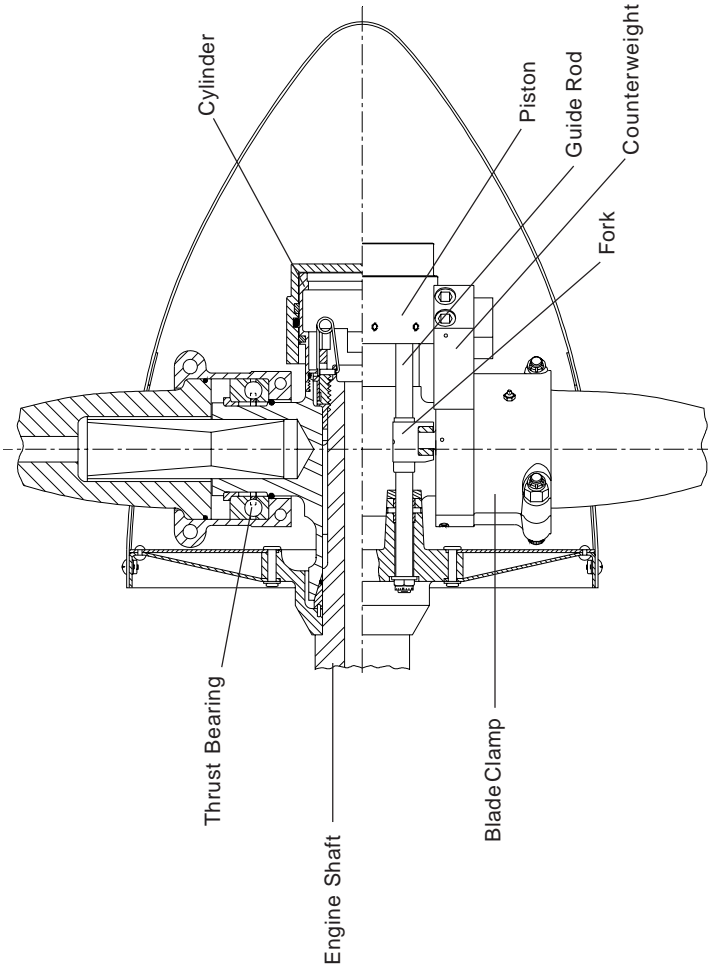
The governor uses an internal pump that is driven by an accessory drive from the engine. This pump uses an engine oil supply and increases the engine oil pressure for supply to the propeller. Engine speed sensing hardware within the governor controls the supply of oil to, or drains oil from the propeller,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

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



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Constant Speed, Nonfeathering, Counterweighted Propeller Assembly  
Figure 2-5

- B. Constant Speed, Counterweighted, Non-feathering Propellers  
Propeller models (B)HC-92( )F-1( ), HC-92( )K-1, and  
HC-93Z20-1  
Refer to Figure 2-5.

Constant Speed, counterweighted, non-feathering propellers are typically used on single engine aircraft.

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

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

A counterweight is a weight that is attached to each blade clamp to cause the blade to rotate to a higher blade pitch in the absence of additional controlling forces. Counterweighted propellers require governor supplied oil to decrease blade pitch, while non-counterweighted propellers require governor supplied oil to increase blade pitch.

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

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

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

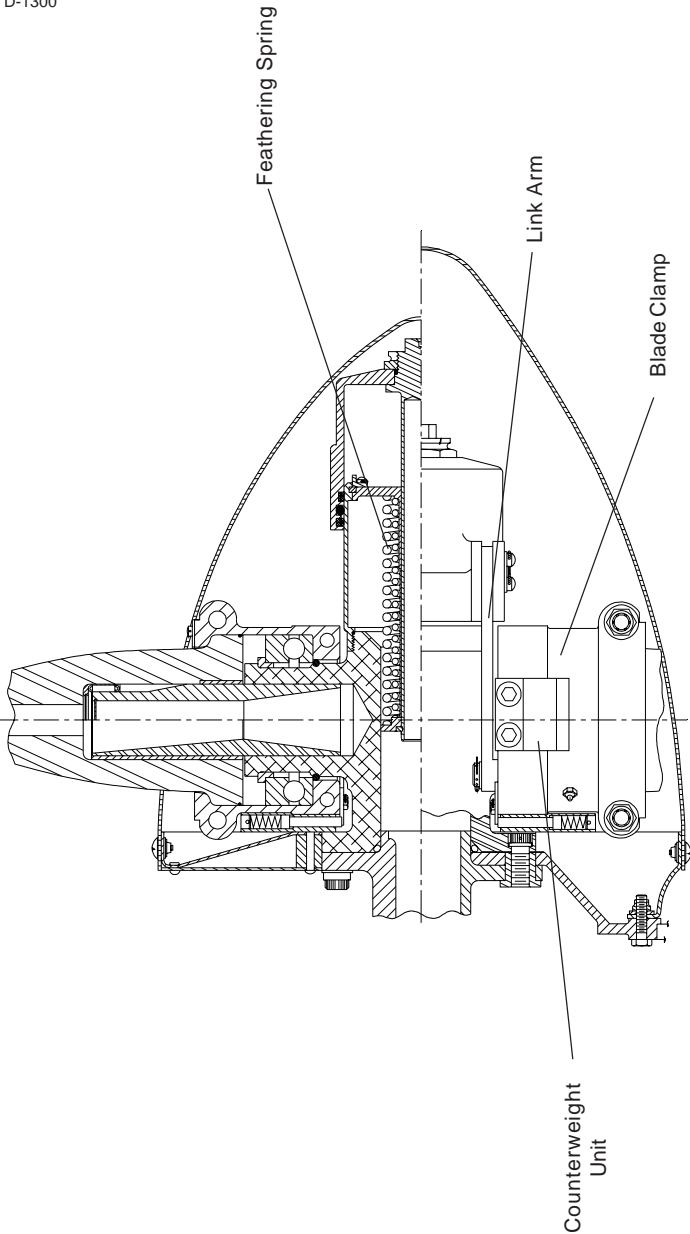
The governor uses an internal pump that is driven by an accessory drive from the engine. This pump uses an engine oil supply and increases the engine oil pressure for supply to the propeller. Engine speed sensing hardware within the governor controls the supply of oil to, or drain of oil from the propeller,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

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

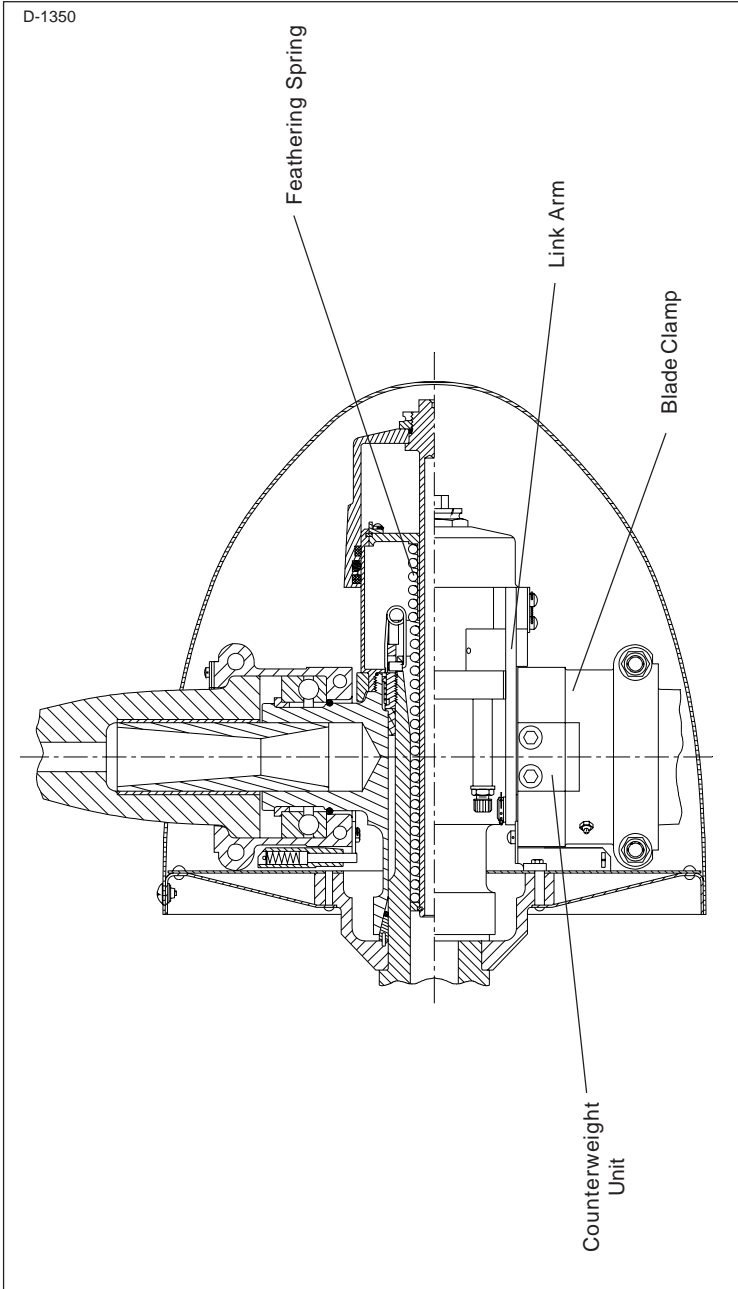
If oil pressure is lost at any time, the summation of propeller forces that is in direct opposition to the lost variable hydraulic force will increase blade angle.

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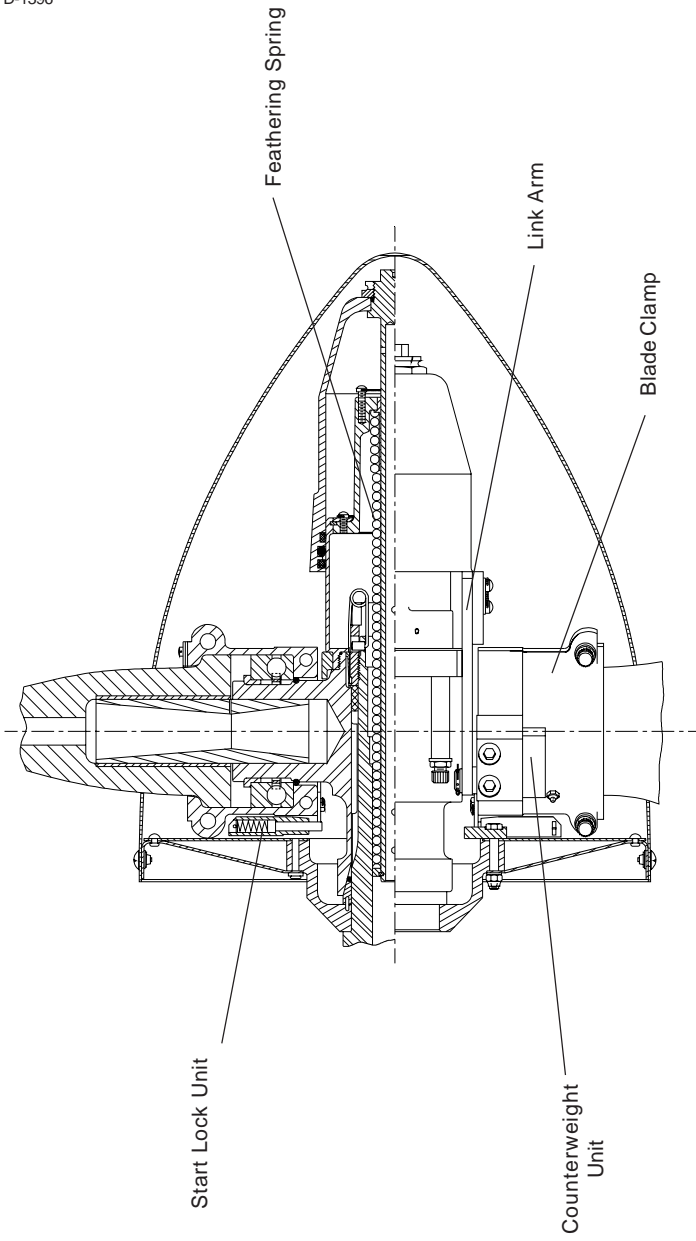


**Constant Speed, Feathering Propeller Assembly (Flanged Attachment, Short Piston)**  
Figure 2-6



Constant Speed, Feathering Propeller Assembly (Splined Attachment, Short Piston)  
Figure 2-7

D-1396



**Constant Speed, Feathering Propeller Assembly (Splined Attachment, Long Piston)**  
Figure 2-8



**C. Constant Speed, Feathering Propellers**

Propeller models HC-92 ZF-2( ), HC-92( )K-2( ), HC-93ZF-2( ), HC-93Z20-2( ), and HC-93Z30-2( ) Refer to Figures 2-6 through 2-8.

A constant speed and feathering propeller is typically used on a twin engine aircraft.

Propeller blade angle change is actuated by a hydraulic piston/cylinder combination mounted on the forward end of the propeller hub. The linear motion of the hydraulic piston is transmitted to each blade through a link arm system connected to a blade clamp that rotates with the blade. Each blade is retained on the propeller hub by a blade clamp and thrust bearing. The thrust bearing permits the blade to change angle.

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

The forces of the installed spring and counterweight attempt to rotate the blades to a higher blade angle.

The counterweight is a weight that is attached to each blade clamp to cause the blade to rotate to a higher blade angle. Counterweighted propellers require governor supplied oil to decrease blade pitch.

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

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

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

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

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

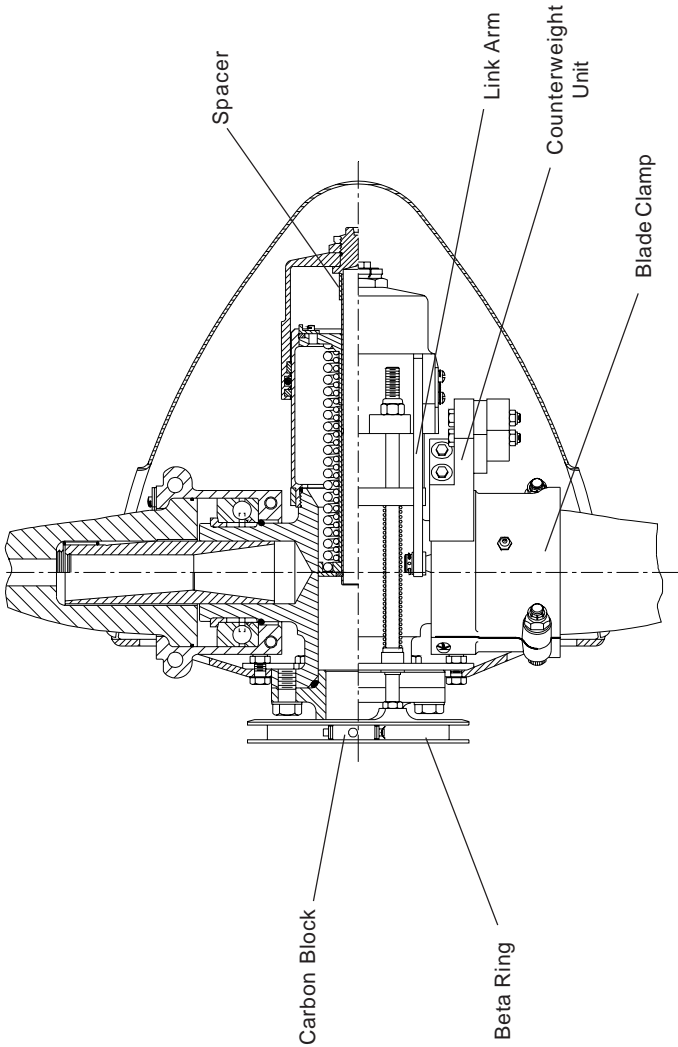
If oil supply is lost during flight, the propeller will feather. Feathering occurs because the spring and blade clamp mounted counterweight forces are no longer opposed by hydraulic oil pressure and are free to increase blade pitch to the feathering (high pitch) stop.

Normal in-flight feathering of these propellers is accomplished when the pilot retards the propeller pitch control past the feather detent. This permits oil to drain from the propeller and return to the engine sump. Engine shutdown is normally accomplished during the feathering process.

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

It is undesirable to feather the propeller when the engine is stopped after landing. To prevent feathering during normal engine shut down, the propeller incorporates spring energized latches (start locks). If the propeller rotation is approximately 800 RPM or above, the latches are disengaged by centrifugal force acting on the latch weights to compress the springs. When the propeller drops below 800 RPM, the springs overcome the centrifugal force acting on the latch weights and move the latches to engage the start locks, preventing blade angle movement to feather.

D-2975



**Constant Speed, Feathering, and Reversing Propeller Assembly**  
**Figure 2-9**

D. Constant Speed, Feathering and Reversing Propellers  
(External Beta System)

Propeller models (B)HC-92(W,Z)F-3( )

Refer to Figure 2-9

A constant speed, feathering and reversing propeller is typically used on a twin engine aircraft. It is counterweighted and has an external feedback system.

Propeller blade angle change is actuated by a hydraulic piston/cylinder combination mounted on the forward end of the propeller hub. The linear motion of the hydraulic piston is transmitted to each blade through a link arm system connected to a blade clamp that rotates with the blade. Each blade is retained on the propeller hub by a blade clamp and thrust bearing. The thrust bearing permits the blade to change angle.

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

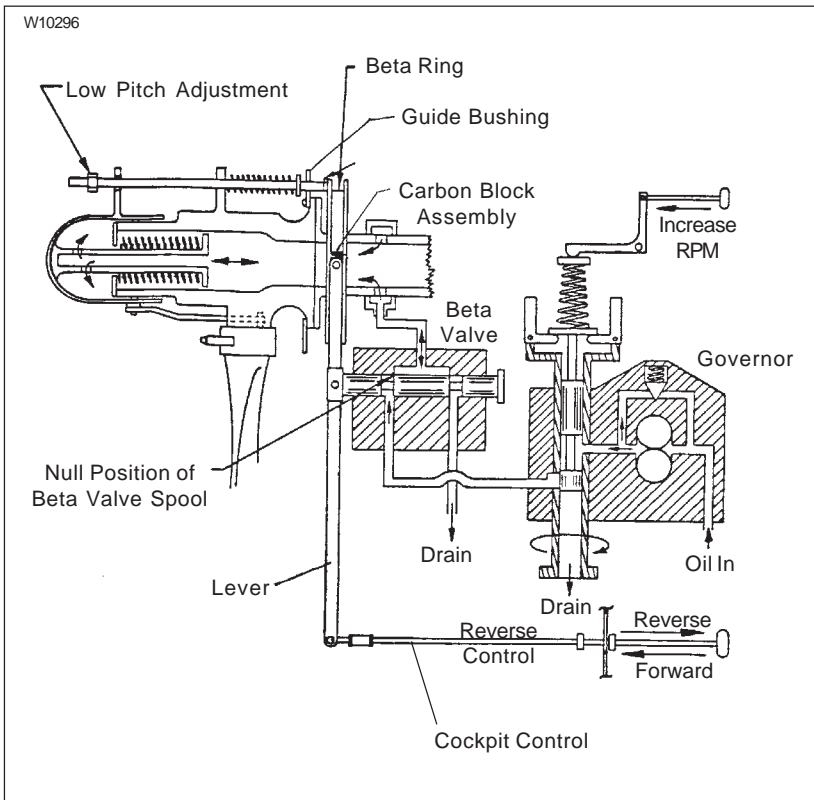
The forces of the installed spring and counterweight attempt to rotate the blades to a higher blade angle.

The counterweight is a weight that is attached to each blade clamp to cause the blade to rotate to a higher blade angle.

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

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

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



**Fundamental Elements of a Reversing System**  
**Figure 2-10**

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

The lowest blade angle attainable by the governor is low pitch. A beta valve hydraulically controls the low pitch stop and the blade angles between low pitch and reverse. Beta refers to the blade angle range between low pitch and full reverse blade angles.

NOTE: The beta valve is normally installed between the base of the governor and the engine.

In reverse mode of operation, the governor operates in an underspeed condition to act strictly as a source of pressurized oil, without attempting to control RPM. In this mode, the pilot input to the propeller (through cockpit controls) controls the blade angle, rather than RPM.

Fundamental elements of a reversing system include a beta valve, cockpit control cable, propeller mounted blade angle feedback mechanism (beta ring), carbon block, and a lever that interfaces between those four elements and the governor operating in underspeed (as an oil pressure source). Refer to Figure 2-10.

Propeller blade angle is moved into the beta range by manually repositioning the cockpit control to move the lever and move the beta valve spool to supply oil from the governor pump to the propeller. Propeller blade angle change or piston movement is communicated back to the beta valve through the propeller mounted beta ring, carbon block assembly, and lever. The repositioned beta valve spool will prevent oil from reaching the propeller when the desired blade angle is obtained in the beta range. Any additional unwanted movement of the propeller toward reverse will cause the beta valve to drain oil from the propeller to slightly increase pitch. Any unwanted movement toward higher pitch will cause the beta valve to pump oil to the propeller to slightly decrease pitch. Thus, movement of the cockpit control in one direction will move blade angles below low pitch and toward reverse pitch, and movement in the opposite direction will move blade angles back toward the low pitch blade angle.

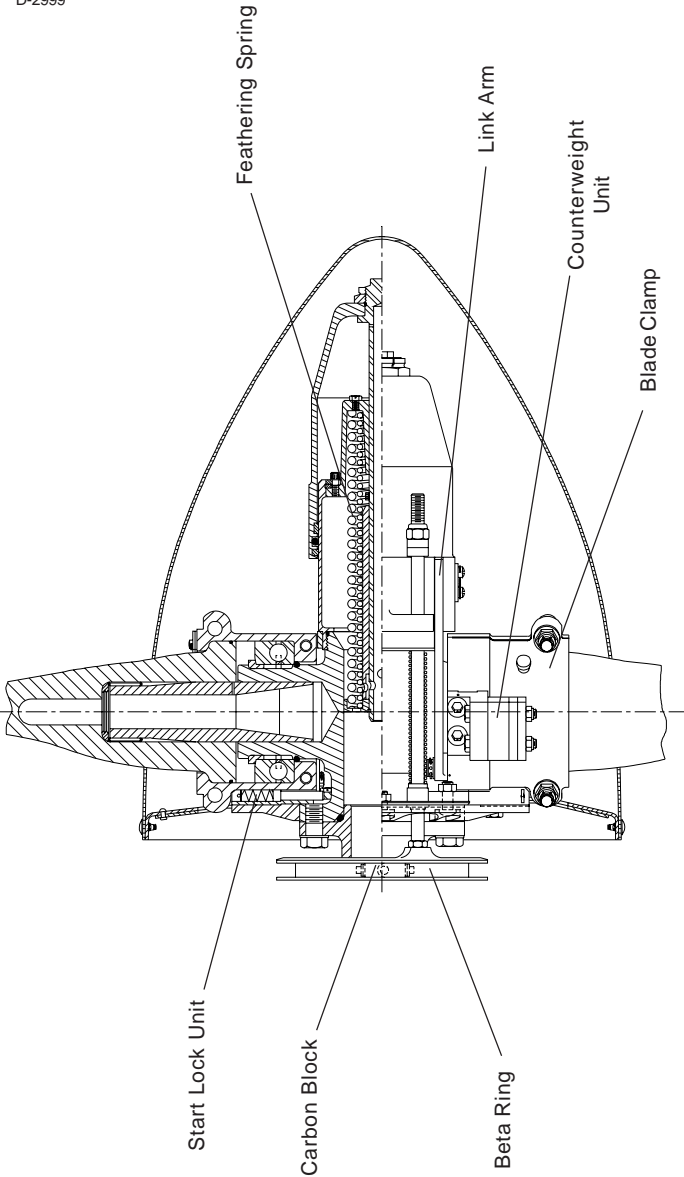
**NOTE:** Blade angle may be moved into beta only when the governor is in underspeed condition, supplying oil to the propeller.

The blade angle selection by the cockpit control must be moved to the low pitch position before the engine is shut off; otherwise, the reversing mechanism as shown in Figure 2-10 may be damaged when the internal propeller forces move the blades to a high blade angle above low pitch, even though the reversing linkage is still set for operation in the beta blade angle range.



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D-2999



**Constant Speed, Feathering, and Reversing Propeller Assembly (External Beta System)  
Figure 2-11**

**E. Constant Speed, Feathering and Reversing Propellers**

Propeller model HC-92WF-5A

Refer to Figure 2-11

A constant speed, feathering and reversing propeller is typically used on a twin engine aircraft. It is counterweighted and has an external feedback system.

Propeller blade angle change is actuated by a hydraulic piston/cylinder combination mounted on the forward end of the propeller hub. The linear motion of the hydraulic piston is transmitted to each blade through a link arm system connected to a blade clamp that rotates with the blade. Each blade is retained on the propeller hub by a blade clamp and thrust bearing. The thrust bearing permits the blade to change angle.

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

The forces of the installed spring and counterweight attempt to rotate the blades to a higher blade angle.

The counterweight is a weight that is attached to each blade clamp to cause the blade to rotate to a higher blade angle.

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

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

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

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

If governor supplied oil is lost during flight, the propeller will increase pitch and will feather. Feathering occurs because the spring and blade clamp mounted counterweighted forces are no longer opposed by hydraulic oil pressure and are free to increase blade pitch to the feathering (high pitch) stop.

Normal in-flight feathering of these propellers is accomplished when the pilot retards the propeller pitch control past the feather detent. This permits oil to drain from the propeller and return to the engine sump. Engine shutdown is normally accomplished during the feathering process.

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

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

**NOTE:** The beta valve is normally installed between the base of the governor and the engine.

Fundamental elements of a reversing system include a beta valve, cockpit control cable, propeller mounted blade angle feedback mechanism (beta ring), carbon block, and a lever that interfaces between those four elements and the governor operating in underspeed (as an oil pressure source). Refer to Figure 2-10.

The propeller is reversed by manually repositioning the cockpit-control to cause the beta valve to supply oil from the governor pump to the propeller. An external propeller feedback mechanism, which includes a beta ring and carbon block assembly, communicates propeller blade angle position to the beta valve.

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

Movement of the cockpit-control in the opposite direction will move the propeller from reverse to higher blade angle.

It is undesirable to feather the propeller when the engine is stopped after landing. To prevent feathering during normal engine shutdown, the propeller incorporates spring energized latch pins called start locks (Figure 2-11). These units are installed on the spinner bulkhead, which is bolted to the propeller hub flange. If propeller rotation is approximately 800 RPM or above, the start locks are disengaged from the blade clamp mounted plates by centrifugal force acting on the start locks pins to compress the springs (within the units). When the RPM drops below 800, the springs overcome the centrifugal force and move the latch pins to engage the clamp-mounted plate, preventing blade angle movement to feather.

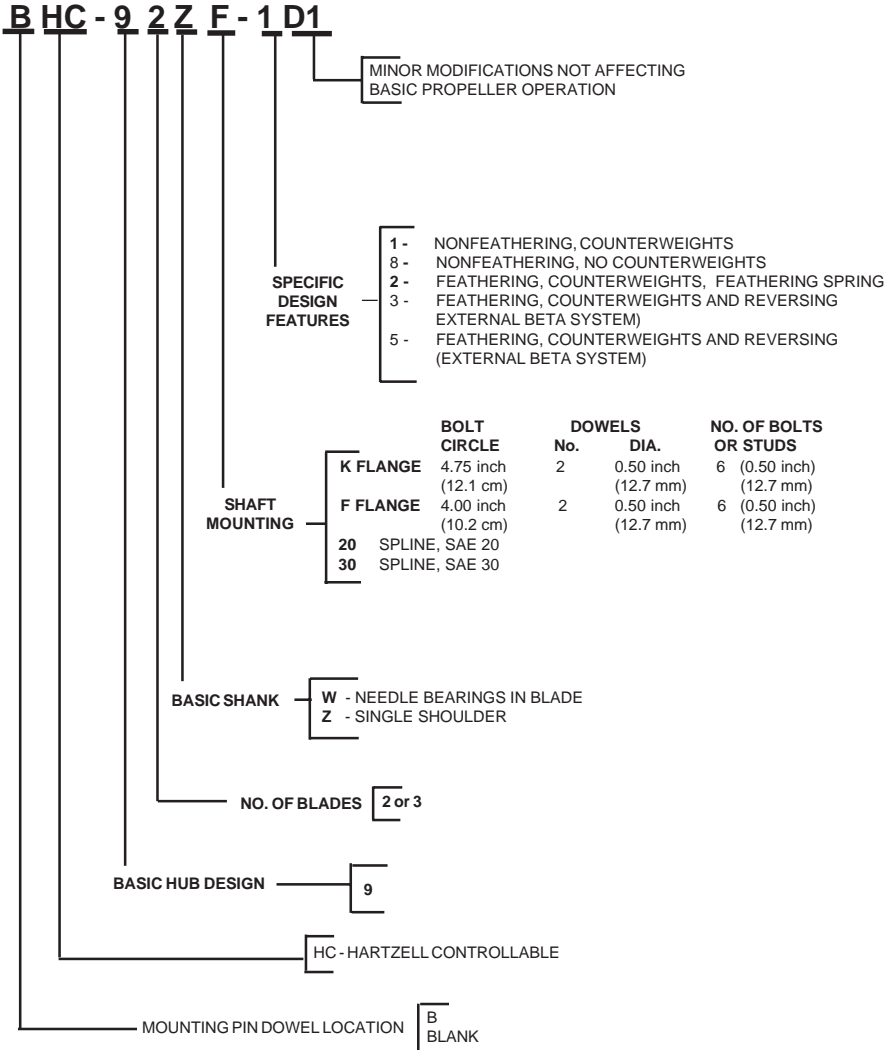
Shortly after engine start-up, with the propeller RPM above 800, the latch pins in the start locks will still retain the blade angle. To release the start locks pins, it is necessary to manually actuate the propeller slightly toward reverse. This will move the clamp-mounted plate, permitting the start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

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### 2. Model Designation

The following pages illustrate sample model designations for constant speed Hartzell steel hub reciprocating propeller hub assemblies and blades.

#### A. Steel Hub Propeller Model Identification

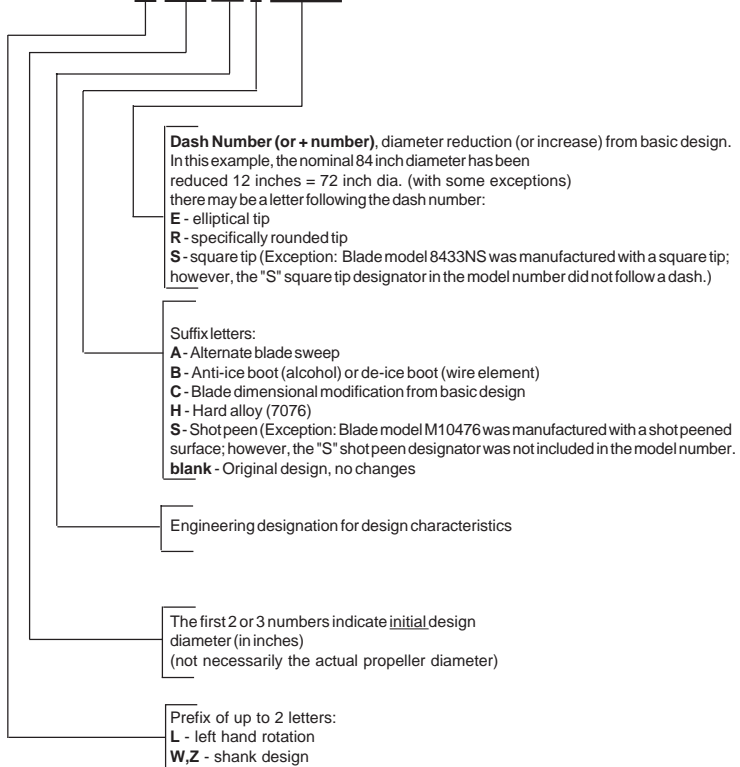


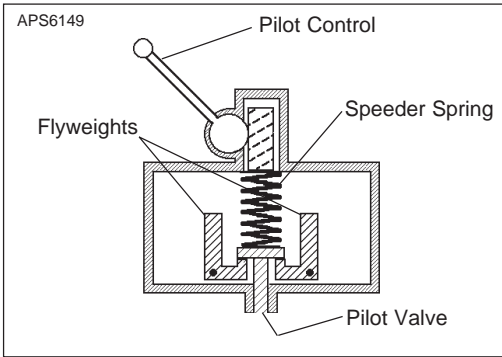


### B. Aluminum Blade Model Identification

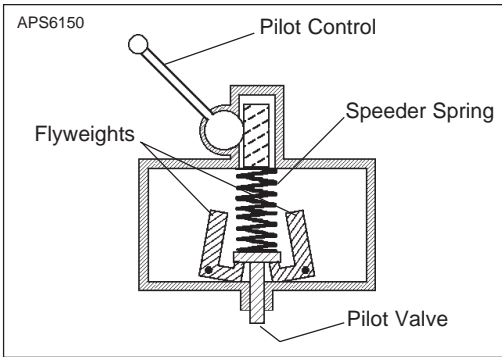
Hartzell uses a model designation to identify specific blade assemblies. Example: HC-92WK-2/**W8447-12R**. A slash mark separates the propeller and blade designations. The blade designation is impression stamped on the blade butt end (internal) and is either on a decal or ink stamped on the blade camber side (external).

### prop model/**W84 47 -12R**

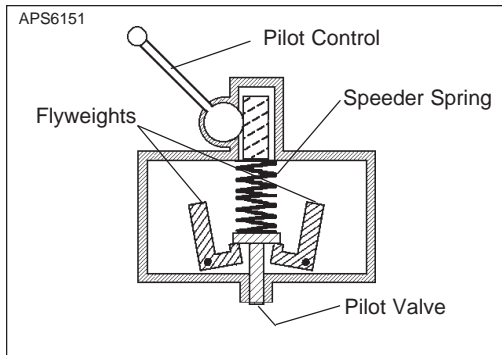




**Governor in Onspeed Condition  
Figure 2-12**



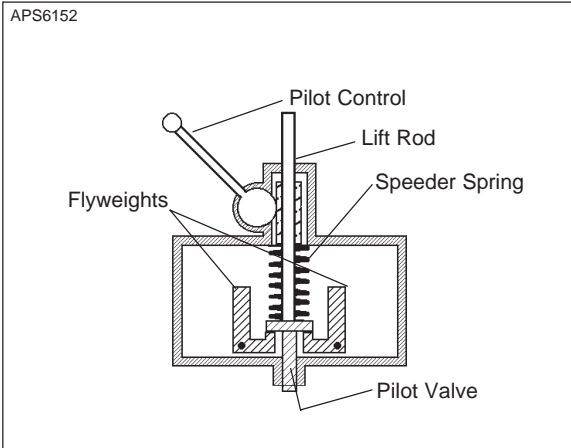
**Governor in Underspeed Condition  
Figure 2-13**



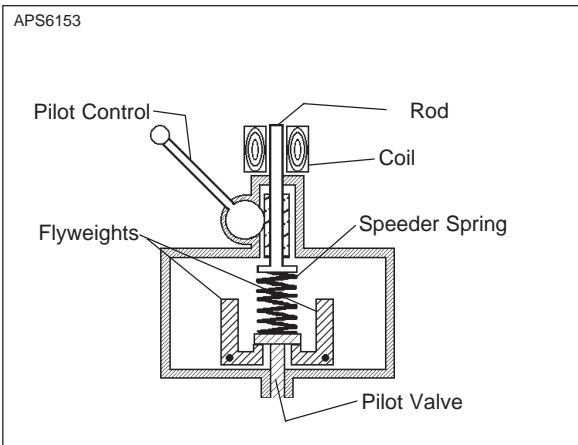
**Governor in Overspeed Condition  
Figure 2-14**

**3. Governors****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 2-12. 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 2-13. 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 2-14. 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.



**Feathering Governor**  
**Figure 2-15**



**Synchronizer/Synchrophaser Governor**  
**Figure 2-16**

- (5) Refer to Figure 2-15. This figure illustrates a feathering propeller governor. This governor is similar to the constant speed governors illustrated in Figures 2-12 through 2-14 with the addition of the lift rod. When it is desired to feather the propeller, the lift rod may be moved by the cockpit control to mechanically engage the pilot valve to lift the valve. This essentially puts the pilot valve in an overspeed condition. The lifted pilot valve dumps oil to increase propeller pitch until the propeller feathers.
- (6) Refer to Figure 2-16. This figure illustrates a governor as a component of a synchronizing or synchrophasing system. A synchronizing system is employed in a multi-engine aircraft to keep the engines operating at the same RPM. A synchrophasing system not only keeps RPM of the engines consistent, but also keeps the propeller blades operating in phase with each other. Both synchronizing and synchrophasing systems serve to reduce noise and vibration.
- (7) A Hartzell synchronizing or synchrophasing system uses one engine (the master engine) as an RPM and phase reference and adjusts 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 on the speeder spring. In this manner, engine RPM and phase of the propellers is synchronized or synchrophased.

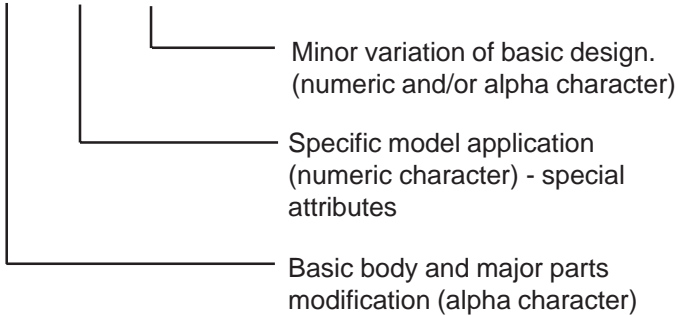
B. Governor Types

The governors commonly used in Hartzell Constant Speed propeller systems are supplied either by Hartzell or other manufacturers. These governor types function in a similar manner.

C. Identification of Hartzell Governors

Hartzell governor may be identified by model number as follows: Example F-6-4

**(X) - (X) - (X)**



NOTE: Refer to Hartzell Manual 130B (61-23-30) for maintenance and overhaul instructions for Hartzell governors.

#### 4. Propeller Anti-Ice and De-Ice Systems

Some Hartzell propellers may be equipped with an anti-ice or de-ice system. A short description of each of these systems follows:

##### A. Propeller Anti-Ice System

A propeller anti-ice system is a system that prevents ice from forming on propeller surfaces. The system dispenses a liquid (usually isopropyl alcohol), which mixes with moisture on the propeller blades, reducing the freezing point of the water. This water/alcohol mixture flows off the blades before ice forms.

**NOTE:** This system must be in use before ice forms. It is ineffective in removing ice that has already formed.

##### (1) System Overview

A typical anti-ice system consists of a fluid tank, pump, and distribution tubing. The rate at which the anti-icing fluid is dispensed is controlled by a pump speed rheostat in the cockpit. The anti-icing fluid is dispensed through airframe mounted distribution tubing and into a rotating slinger ring mounted on the rear of the propeller hub. The anti-icing fluid is then directed through blade feed tubes from the slinger ring onto the blades via centrifugal force. The anti-icing fluid is directed onto feed shoes that are attached to the leading edge of the blade. These feed shoes evenly distribute and direct the fluid along the blade leading edge.

**B. Propeller De-Ice System**

A propeller de-ice system is a system that permits ice to form, and then removes it by electrically heating the de-ice boots. The ice partially melts and is thrown from the blade by centrifugal force.

**(1) System Overview**

- (a) A de-ice system consists of one or more on/off switches, a timer or cycling unit, a slip ring, brush blocks, and de-ice boots. The pilot controls the operation of the de-ice system by turning on one or more switches. All de-ice systems have a master switch, and may have another toggle switch for each propeller. Some systems also have a selector switch to adjust for light or heavy icing conditions.
- (b) The timer or cycling unit determines the sequence of which blades (or portion thereof) are currently being de-iced, and for what length of time. The cycling unit applies power to each de-ice boot or boot segment in a sequential order.
- (c) A brush block, which is normally mounted on the engine just behind the propeller, is used to transfer electricity to the slip ring. The slip ring rotates with the propeller and provides a current path to the blade de-ice boots.
- (d) De-ice boots contain internal heating elements. These boots are securely attached to the leading edge of each blade with adhesive.



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## 1. Tools, Consumables, and Expendables

The steel hub reciprocating propellers covered in this manual are manufactured with either a flange mounting or a spline mounting. The flange type or spline type used on a particular propeller installation is indicated in the propeller model identification number stamped on the hub. For example, HC-92W**K**-2B indicates a "K" flange. HC-93Z**20**-2A indicates a "20" spline. Refer to the Steel Hub Model Identification in the Description and Operation chapter of this manual for a description of each flange type.

The flange mounted propeller is shipped completely assembled. The spline mounted propeller is shipped with the piston removed.

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

### A. Tooling

#### **F Flange**

- Safety wire pliers
- Torque wrench
- Torque wrench adapter (Hartzell P/N AST-2814)

#### **K Flange**

- Safety wire pliers
- Torque wrench
- Torque wrench adapter (Hartzell P/N AST-2805)

#### **20 Spline**

- Safety wire pliers
- Shaft nut wrench (Hartzell P/N BST-2910)

#### **30 Spline**

- Safety wire pliers
- Spanner wrench (Hartzell P/N BT461) or Strap Wrench (P/N 100923)
- Shaft nut wrench (Hartzell P/N BST-2910)

### B. Consumables

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

### C. Expendables

- 0.032 inch (0.81 mm) Stainless steel Aircraft Safety wire
- O-ring Propeller to engine seal (see Table 3-1)

### 2. O-ring and Propeller Mounting Hardware Identification

Part	Propeller Model	Part No.
Bolt/Stud, Mounting	HC-92WK-2( )	A-1328-2 (4) or A-1333 (2)
	HC-92ZF-2( )	A-1333-4
	HC-92ZK-2(A)( )	A-1328 (4) or A-1315 (2)
	HC-92ZK-2B	A-1328 (4) or A-1333 (2)
	HC-93ZF-2( )	B-6739H7A
	HC-92( )K-1D	* NOTE
	BHC-92( )F-1D1	A-1328-2
	HC-92WF-8( )	A-1333-4
	HC-92( )K-8( )	* NOTE
	HC-92ZF-8D	A-1333-4
	(B)HC-92( )F-3	A-1328-1
	BHC-92( )F-3(L)G	A-2986
	BHC-92WF-5A	A-1328-1
	Dowel Pins	HC-92ZF-2( )
HC-93ZF-2( )		B-6138-8-8
HC-92( )F-8( )		B-6138-8-8
(B)HC-92( )F-1D1		B-1344 or B-6138-8-8
(B)HC-92( )F-3		B-6138-8-8
BHC-92WF-3(L)G		B-6138-8-9 or B-6138-8-10
HC-92WF-5A		B-6138-8-8
Felt Dust Seal	(B)HC-92( )F-1D1	B-1843
	HC-93Z20-1( )( )	B-1843
	HC-93Z20-2( )( )	B-1843
	HC-93Z30-2E	B-1843
	HC-93Z30-2B	A-810
Nut, Fork Rod	HC-92( )F,K-8( )	A-848 or A-848-2
	HC-92( )K-1D	A-848 or A-848-2
	(B)HC-92WF-1D1	A-848-2
	HC-93Z20-1(A,B,C)(1)	A-848-2
Nut, Piston Rod	HC-93Z20-2( )(1)	B-3368
	HC-93Z30-2( )	B-3368
	HC-93ZF-2( )	B-3368
* NOTE: (2) A-1333 + (2) A-1333-3 or A-1333 (under lugs of collar) + (2) A-1333-6 or A-1333-2 (under rods of piston)		

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

Part	Propeller Model	Part No.
Nut, Pitch change rod	HC-92Z( )-2( )(L)	A-880-2
	HC-93Z20-2( )(1)	A-880-1
	HC-93Z30-2( )	A-880-1
	HC-93ZF-2A	A-880-2
	HC-93ZF-2B	A-880-1
	(B)HC-92( )F-3	A-880-2
	BHC-92WF-3(L)G	A-880-2
	HC-92WF-5A	A-880-2
Nut, Shaft/Hub	HC-93Z20-2( )(1)	A-63-B
	HC-93Z20-1( )(1)	A-63-B
	HC-93Z30-2( )	B-1814
Nut, Castle (Mounting Stud)	HC-92WF-3	A-2069-2
Nut Lock, Shaft	HC-93Z30-2(B,C)	A-1839
	HC-93Z30-2E	A-1839-1
O-ring, Bushing	HC-B3Z30-2E	C-3317-210-1
O-ring, Piston	(BHC)-92( )F-1D1	C-3317-343-1
	HC-93Z20-2( )(1)	C-3317-343-1
	HC-93Z20-1( )(1)	C-3317-343-1
	HC-93Z30-2B	C-3317-343-1
	HC-93Z30-2E	C-3317-347-1
O-ring, Pitch change rod	HC-92( )(F,K)-2( )(L)	C-3317-024
	HC-93Z20-2(A,B,D)(1)	C-3317-116
	HC-93Z20-2C1	C-3317-020
	HC-93Z30-2( )	C-3317-020
	HC-93ZF-2(A,B)	C-3317-343-1
	(B)HC-92( )F-3	C-3317-024
	BHC-92( )F-3(L)G	C-3317-024
	HC-92WF-5A	C-3317-230
O-ring, Rear Cone	HC-93Z20-2( )(1)	C-3317-229
	HC-93Z20-1( )(1)	C-3317-229
	HC-93Z30-2( )	C-3317-111

**O-ring and Propeller Mounting Hardware Identification  
Table 3-1, Continued**

Part	Propeller Model	Part No.
O-ring, Shaft	HC-92( )K-2( )(L)	C-3317-329
	HC-92ZF-2(A,B)	C-3317-228
	HC-92WF-8( )	C-3317-228
	HC-92WK-8( )	C-3317-329
	HC-92( )K-1D	C-3317-329
	HC-92ZF-8D	C-3317-228
	HC-92ZK-8( )	C-3317-329
	(B)HC-92( )F-1D1	C-3317-228
	HC-93ZF-2(A,B)	C-3317-228
	(B)HC-92( )F-3	C-3317-228
	BHC-92( )F-3(L)G	C-3317-228
	HC-92WF-5A	C-3317-228
	Safety Pin	HC-93Z20-2( )(1)
HC-93Z20-1( )(1)		A-847
Screw, Piston Rod	HC-93Z20-2( )(1)	A-2037
	HC-93Z30-2( )	A-2037
Shim	HC-92( )K-2( )(L)	B-1322
	HC-92( )K-1D	B-1322
	HC-92( )K-8( )	B-1322
Spacer	HC-93Z30-2( )	A-1819
	(B)HC-92( )F-3G(L)	C-2987
Spinner Mounting Plate	(B)HC-92WF-1D1	B-1344
Washer, Fork Rod	HC-92( )(F,K)-8( )	A-965
	HC-92( )K-1D	A-965
	(B)HC-92WF-1D1	A-965
	HC-93Z20-1( )(1)	A-965
Washer, Mounting	HC-92ZF-2( )	B-3851-0863
	HC-92WF-8( )	B-3851-0863 or A-1381
	HC-92ZF-8D	B-3851-0863 or A-1381
	(B)HC-92( )F-3	A-1381
	BHC-92( )F-3(L)G	A-1381
	BHC-92WF-5A	A-1381
	HC-92(W,Z)K-2 (located at counter-bore under blade)	A-946
Washer, Piston Rod	HC-93Z20-2( )(1)	A-1444
	HC-93Z30-2( )	A-1444

**O-ring and Propeller Mounting Hardware Identification  
Table 3-1, Continued**



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

Examine the exterior of the shipping container for signs of shipping damage, especially the box ends around each blade. A hole, tear, or crushed appearance at the end of the box (blade tips) may indicate that the propeller was dropped during shipment, possibly damaging the blades.

**B. Uncrating**

(1) Put the propeller on a firm support.

(2) Remove the banding and any external wood bracing from the shipping container.

(3) Remove the cardboard from the hub and blades. Put the propeller on a padded surface that supports the propeller over a large area. Never stand the propeller on a blade tip.

(4) On flange mounted models, remove the plastic dust cover cup from the propeller mounting flange (if installed).

**C. Inspection after Shipment**

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

**D. Reassembly of a Propeller Disassembled for Shipment**

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

**4. Propeller Assembly Installation****A. Precautions**

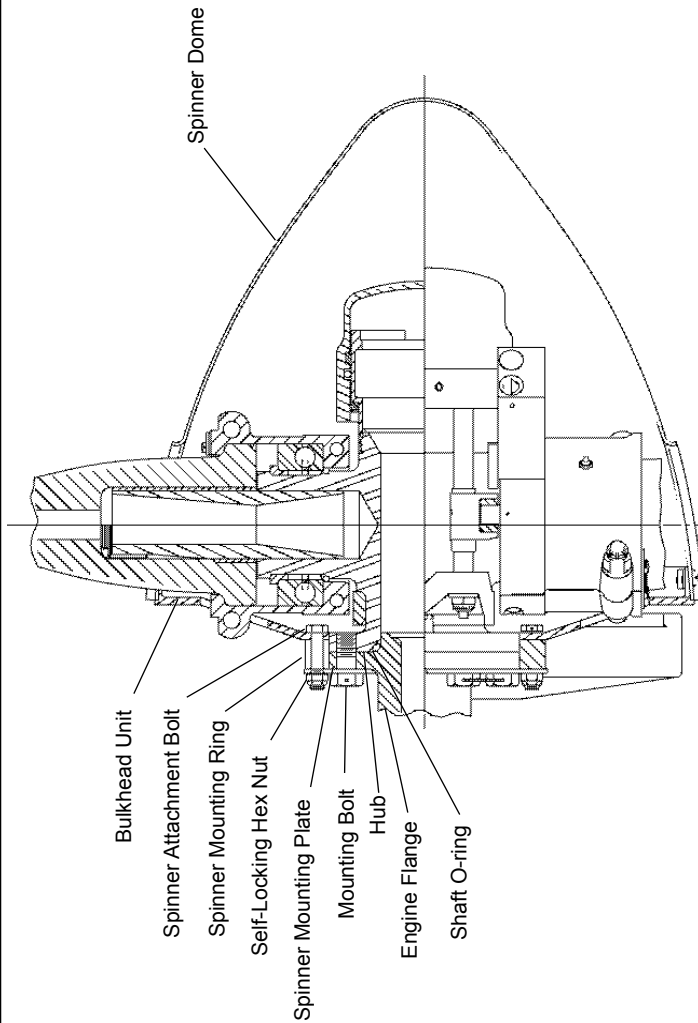
**WARNING 1:** DURING ENGINE INSTALLATION OR REMOVAL, USING THE PROPELLER TO SUPPORT THE WEIGHT OF THE ENGINE IS NOT AUTHORIZED. UNAPPROVED INSTALLATION AND REMOVAL TECHNIQUES MAY CAUSE DAMAGE TO THE PROPELLER THAT MAY LEAD TO FAILURE RESULTING IN AN AIRCRAFT ACCIDENT.

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

- (1) Be sure the propeller is removed before the engine is removed or installed in the airframe.
  - (2) Follow the airframe manufacturer's instructions for installing the propeller. If such instructions are not in the airframe manufacturer's manual, then follow the instructions in this manual; however, mechanics must consider that this owner's manual does not describe important procedures that are outside its scope. In addition to propeller installation procedures, items such as rigging and preflight testing, installation and adjustment of de-ice equipment, and propeller synchronization devices are normally found in the airframe manufacturer's manuals.
- B. O-ring and Propeller Mounting Hardware Identification**  
Refer to Table 3-1 for specific part numbers of O-rings and propeller mounting hardware, and propeller model effectivity.

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**BHC-92( )F-1D1 Propeller Assembly**  
**Figure 3-1**

- C. Installing the F Flange Propeller Models BHC-92( )F-1D1  
Refer to Figure 3-1.

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

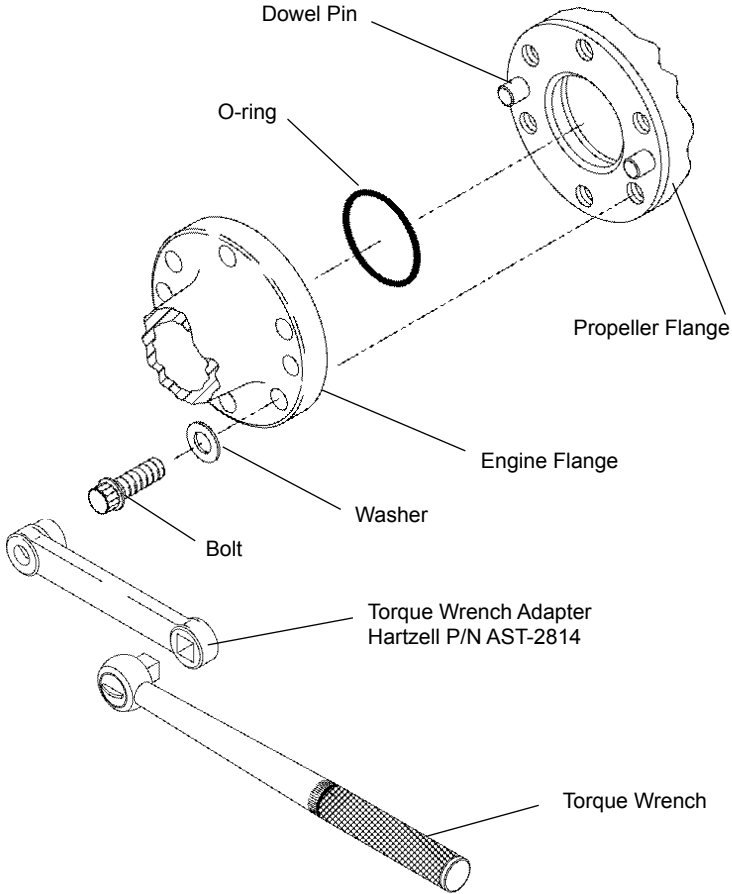
**CAUTION:** WHEN INSTALLING THE PROPELLER ON THE AIRCRAFT, DO NOT DAMAGE THE ICE PROTECTION SYSTEM COMPONENTS, IF APPLICABLE.

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

**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.

- (2) Clean the engine flange and propeller flange with Quick Dry Stoddard Solvent or MEK.
- (3) Press fit two dowel pins (Table 3-1) through the holes in the propeller flange to be flush with the propeller side of the hub flange.
- (4) Install the specified shaft O-ring (Table 3-1) on the engine shaft.
- (5) Slide the spinner mounting ring onto the engine flange OD.

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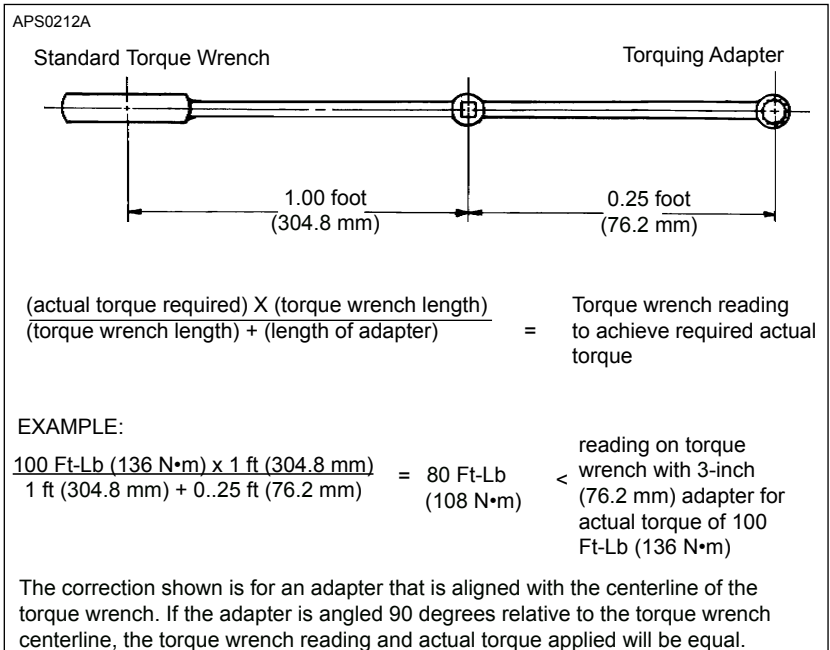


**NOTE:** If torque wrench adapter is used, use the calculation in Table 3-1 to determine correct torque wrench setting.

**Installing F Flange Propeller on the Engine Flange  
Figure 3-2**

**CAUTION:** USE CARE TO AVOID SCRAPING ALUMINUM FROM THE BORE OF THE RING. SCRAPINGS COULD BECOME WEDGED BETWEEN THE FLANGE SURFACES.

- (6) Align the spinner bulkhead mounting holes with the ring (on the propeller side of the ring).
- (7) Align the spinner mounting plate with the ring (on the engine side of the ring).
- (8) Install the spinner attachment bolts and self-locking hex head nuts to hold the spinner bulkhead, spinner mounting ring, and spinner mounting plate together.
- (9) Torque the spinner attachment bolts and self-locking hex head nuts to 8 to 12 Ft-Lb (10-16 N•m).
- (10) Align the mounting holes and dowel pins in the propeller hub flange with the mounting holes and the dowel pin holes in the engine flange.



### Determining Torque Value When Using Torquing Adapter

Figure 3-3

<u>Propeller Model</u>	<u>Mounting Bolt</u>	<u>Torque</u>
HC-92WK-1D **	A-1333	70-80 Ft-Lb (81-95 N•m)*
HC-92ZK-1D	A-1333	70-80 Ft-Lb (81-95 N•m)*
BHC-92WF-1D1	A-1328-2	70-80 Ft-Lb (81-95 N•m)*
BHC-92ZF-1D1	A-1328-2	70-80 Ft-Lb (81-95 N•m)*
HC-92ZF-1D1	A-1328-2	70-80 Ft-Lb (81-95 N•m)*
HC-92WK-2, -2B	A-1328 and A-1333	70-80 Ft-Lb (81-95 N•m)*
HC-92ZK-2, -2A, -2AL, -2B	A-1328 and A-1333	70-80 Ft-Lb (81-95 N•m)*
HC-92ZF-2A, -2B	A-1333-4	70-80 Ft-Lb (81-95 N•m)*
BHC-92WF-3	A-1328-1 or A-1333-4	70-80 Ft-Lb (81-95 N•m)*
BHC-92ZF-3	A-1328-1 or A-1333-4	70-80 Ft-Lb (81-95 N•m)*
HC-92WF-3	A-1328-1 or A-1333-4	70-80 Ft-Lb (81-95 N•m)*
HC-92ZF-3	A-1328-1 or A-1333-4	70-80 Ft-Lb (81-95 N•m)*
BHC-92WF-3G, -3LG	A-2069-2 Stud Nut	90 Ft-Lb (122 N•m)*
BHC-92ZF-3LG	A-2069-2 Stud Nut	90 Ft-Lb (122 N•m)*
HC-92WF-5A	A-1328-1 or A-1333-4	70-80 Ft-Lb (81-95 N•m)*
HC-92WF-8D, -8E	A-1333-4	70-80 Ft-Lb (81-95 N•m)*
HC-92ZF-8D	A-1333-4	70-80 Ft-Lb (81-95 N•m)*
HC-92WK-8D	A-1333	70-80 Ft-Lb (81-95 N•m)*
HC-92ZK-8D	A-1333	70-80 Ft-Lb (81-95 N•m)*
HC-92WK-8L	A-1333	70-80 Ft-Lb (81-95 N•m)*
HC-92ZK-8L	A-1333	70-80 Ft-Lb (81-95 N•m)*
HC-93ZF-2A, -2B	A-1328	70-80 Ft-Lb (81-95 N•m)*

**Torque Values Table  
Table 3-2**



<b>Propeller Model</b>	<b>Mounting Bolt</b>	<b>Torque</b>
HC-93Z20-2A, -2A1	A-63B Hub Nut	450 Ft-Lb (610 N•m)*
HC-93Z20-2C	A-63B Hub Nut	450 Ft-Lb (610 N•m)*
HC-93Z20-2D1	A-63B or B-2063 Nut	450 Ft-Lb (610 N•m)*
HC-93Z20-1A	A-63B or B-2063 Nut	450 Ft-Lb (610 N•m)*
HC-93Z20-1A1	A-63B or B-2063 Nut	450 Ft-Lb (610 N•m)*
HC-93Z20-1B1	A-63B or B-2063 Nut	450 Ft-Lb (610 N•m)*
HC-93Z20-2C1	A-63B Shaft Nut	450 Ft-Lb (610 N•m)*
HC-93Z30-2B, -2E	B-1814 Nut	600 Ft-Lb (813 N•m)*
<b>Spinner mounting bolts</b>		
		30-40 Ft-Lb (41-54 N•m)*
<b>Piston Nut</b>		
	A-880-1	120 Ft-Lb (163 N•m)*
<b>Low-pitch stop nut</b>		
	A-848	20-22 Ft-Lb (27-30 N•m)*
	A-848-2	
* Torque tolerance is $\pm 10$ percent unless otherwise noted.		
** Exceptions to torque values listed in above chart: HC-92WK-1D when installed on a Found Bros. Centennial 100 or Technoimport - Torque = 80-90 Ft-Lb (108-122 N•m)*		
<u>NOTE 1:</u> Torque values are based on non-lubricated threads.		
<u>NOTE 2:</u> <b>Specified torques take into account the run on torque of the fasteners. No adjustment of the specified torque is required to allow for run on torque.</b>		

**Torque Values Table  
Table 3-2, Continued**

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

- (11) Slide the propeller flange onto the engine flange.
- (12) Align the spinner mounting plate clearance holes with the engine flange clearance holes.

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

- (13) Install the mounting bolts (Table 3-1) with washers (if applicable) through the spinner mounting plate and the engine flange from the rear and into the tapped holes in the propeller flange. Refer to Figure 3-1.

**NOTE:** For propeller removals between overhaul intervals, mounting bolts and washers may be reused if they are not damaged or corroded.

- (14) Use a torque wrench with a torque wrench adapter Hartzell P/N AST-2814 (Figure 3-2) to torque all mounting bolts in sequence. Refer to Table 3-2 and Figure 3-3 to determine the proper torque value to which the torque wrench must be set.
  - (a) Torque the mounting bolts to half of the final torque, beginning with any mounting bolt, and moving clockwise or counterclockwise until all the bolts are torqued.
  - (b) Final torque the bolts in sequence, beginning with any mounting bolt, and moving clockwise or counterclockwise until all the bolts are torqued.
- (15) Safety all mounting bolts with 0.032 inch (0.81 mm) minimum diameter stainless steel wire (two bolts per safety).

(16) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller Inc., applicable instructions and technical information for the components supplied by Hartzell can be found in the following publications available on the Hartzell web site at [www.hartzellprop.com](http://www.hartzellprop.com).

- (a) Manual 180 (30-61-80) - Propeller Ice Protection System Manual
- (b) Manual 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual
- (c) Manual 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual
- (d) Manual 183 (61-12-83) - Propeller Anti-icing Boot Removal and Installation Manual

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

(18) Install the spinner dome as follows:

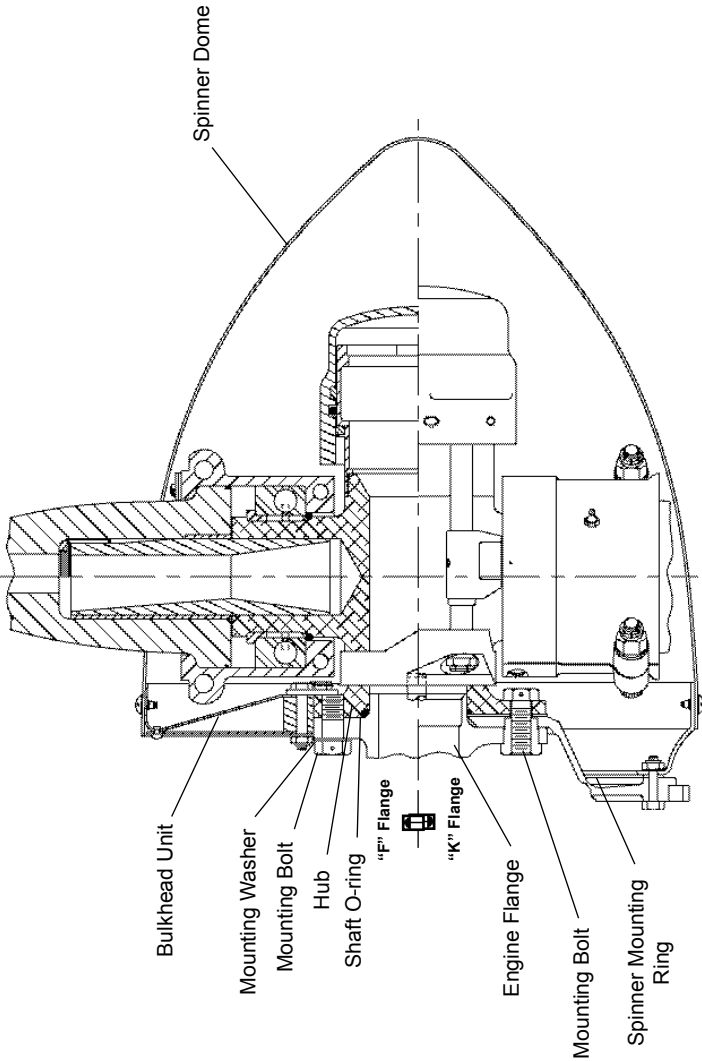
**NOTE:** The following instructions relate to Hartzell spinners only. In some cases, the airframe manufacturer produced the spinner assembly. In those cases, refer to the airframe manufacturer's manual for spinner installation instructions.

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

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

- (a) Carefully slide the spinner dome over the reassembled propeller.
- (b) Attach the spinner dome to the spinner bulkhead with the supplied screws and washers.

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HC-92( )-1D,-8( ) Propeller Assembly  
Figure 3-4

- D. Installing the F Flange Propeller Models HC-92( )F-8( )  
Refer to Figure 3-4.

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

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

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

**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.

- (2) Clean the engine flange and propeller flange with Quick Dry Stoddard Solvent or MEK.
- (3) Press fit two dowel pins (Table 3-1) through the holes in the propeller flange to be flush with the propeller side of the hub flange.
- (4) Install the specified shaft O-ring (Table 3-1) on the engine shaft.
- (5) Align the mounting holes and dowel pins in the propeller hub flange with the mounting holes and the dowel pin holes in the engine flange.

**NOTE:** The spinner bulkhead is already attached to the propeller side of the propeller mounting flange.

**CAUTION 1:** USE CARE TO AVOID SCRAPING ALUMINUM FROM THE BORE OF THE RING. SCRAPINGS COULD BECOME WEDGED BETWEEN THE FLANGE SURFACES.

**CAUTION 2:** MAKE SURE THAT COMPLETE AND TRUE SURFACE CONTACT IS ESTABLISHED BETWEEN THE PROPELLER HUB FLANGE AND THE ENGINE FLANGE.

(6) Slide the propeller flange and spinner bulkhead onto the engine flange.

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

(7) Install the mounting bolts (Table 3-1) with mounting washers through the engine flange from the rear and into the tapped holes in the propeller flange. Refer to Figure 3-4.

**NOTE:** For propeller removals between overhaul intervals, mounting bolts and washers may be reused if they are not damaged or corroded.

(8) Use a torque wrench with a torque wrench adapter Hartzell P/N AST-2814 (Figure 3-2) to torque all mounting bolts in sequence. Refer to Table 3-2 and Figure 3-3 to determine the proper torque value to which the torque wrench must be set.

(a) Torque the mounting bolts to half of the final torque, beginning with any mounting bolt, and moving clockwise or counterclockwise until all the bolts are torqued.

(b) Final torque the bolts in sequence, beginning with any mounting bolt, and moving clockwise or counterclockwise until all the bolts are torqued.

(9) Safety all mounting bolts with 0.032 inch (0.81 mm) minimum diameter stainless steel wire (two bolts per safety).

- (10) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller Inc., applicable instructions and technical information for the components supplied by Hartzell can be found in the following publications available on the Hartzell web site at [www.hartzellprop.com](http://www.hartzellprop.com).
- (a) Manual 180 (30-61-80) - Propeller Ice Protection System Manual
  - (b) Manual 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual
  - (c) Manual 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual
  - (d) Manual 183 (61-12-83) - Propeller Anti-icing Boot Removal and Installation Manual
- (11) Propeller ice protection system components not supplied by Hartzell Propeller Inc. are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).
- (12) Install the spinner dome as follows:

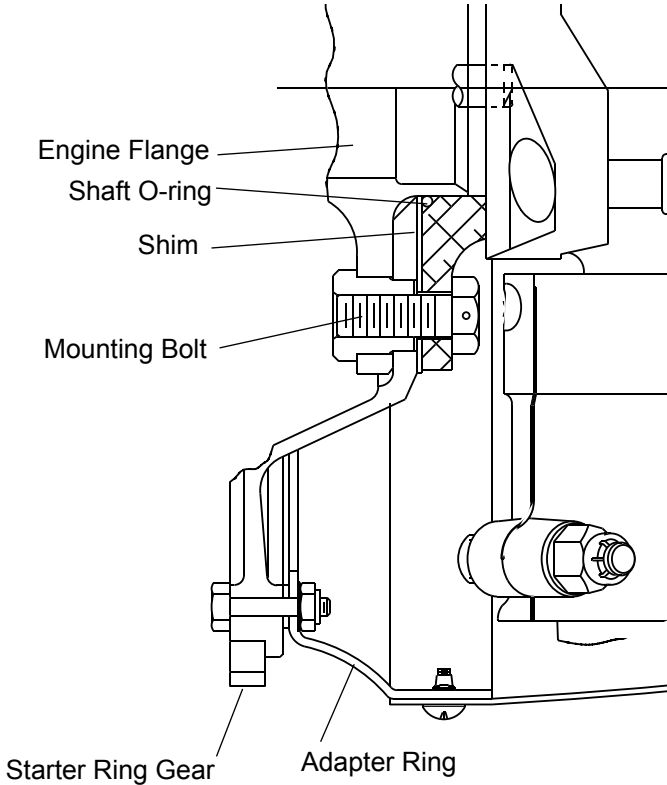
**CAUTION 1:** TO PREVENT DAMAGE TO THE BLADE AND BLADE PAINT, WRAP THE BLADE SHANKS IN SEVERAL LAYERS OF MASKING OR DUCT TAPE BEFORE INSTALLING THE SPINNER DOME. REMOVE THE TAPE AFTER THE SPINNER IS INSTALLED.

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

**NOTE:** The following instructions relate to Hartzell spinners only. In some cases, the airframe manufacturer produced the spinner assembly. In those cases, refer to the airframe manufacturer's manual for spinner installation instructions.

- (a) Carefully slide the spinner dome over the reassembled propeller.
- (b) Secure the spinner dome to the spinner bulkhead with the supplied screws and washers.

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**K Flange Installation on -1 Propeller Models**  
**Figure 3-5**



- E. Installing the K Flange Propeller Models HC-92( )K-1D and HC-92( )K-8( )

Refer to Figure 3-4.

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

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

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

**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.

- (2) Clean the engine flange and propeller flange with Quick Dry Stoddard Solvent or MEK.
- (3) Install the spinner adapter ring on the engine starter gear. Refer to Figure 3-5.

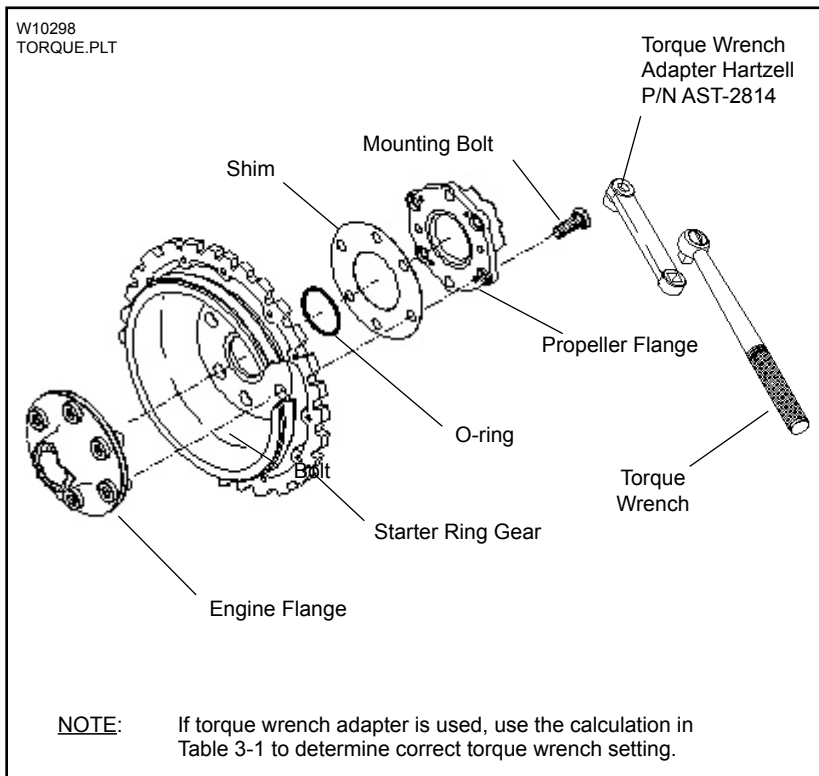
**CAUTION:** FAILURE TO INSTALL THE SHIM BETWEEN THE PROPELLER FLANGE AND THE STARTER RING GEAR CAN RESULT IN MOUNTING BOLT FAILURE.

- (4) Install the shim on the engine shaft, between the starter ring gear and the propeller flange. Refer to Figure 3-5.
- (5) Install the specified shaft O-ring (Table 3-1) on the engine shaft.

- (6) Align the six mounting bolts in the propeller hub flange with the bushings in the engine flange.

**NOTE 1:** The propeller mounting bolts will already be installed in the propeller flange. Interference with other propeller parts requires that the bolts be installed during propeller assembly.

**NOTE 2:** For propeller removals between overhaul intervals, mounting bolts and washers may be reused if they are not damaged or corroded.



**Installing K Flange Propeller on the Engine Flange  
Figure 3-6**

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

(7) Slide the propeller flange onto the engine flange, against the starter ring gear.

**NOTE:** The engine bushings will insert into the counterbores in the propeller flange that encircles the propeller mounting bolts.

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

(8) Use a torque wrench with a torque wrench adapter Hartzell P/N AST-2814 (Figure 3-6) to torque all mounting bolts in sequence. Refer to Table 3-2 and Figure 3-3 to determine the proper torque value to which the torque wrench must be set.

(a) Torque the mounting bolts to half of the final torque, beginning with any mounting bolt, and moving clockwise or counterclockwise until all the bolts are torqued.

(b) Final torque the bolts in sequence, beginning with any mounting bolt, and moving clockwise or counterclockwise until all the bolts are torqued.

(9) Safety all mounting bolts with 0.032 inch (0.81 mm) minimum diameter stainless steel wire (two bolts per safety).

(10) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller Inc., applicable instructions and technical information for the components supplied by Hartzell can be found in the following publications available on the Hartzell web site at [www.hartzellprop.com](http://www.hartzellprop.com).

(a) Manual 180 (30-61-80) - Propeller Ice Protection System Manual

(b) Manual 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual

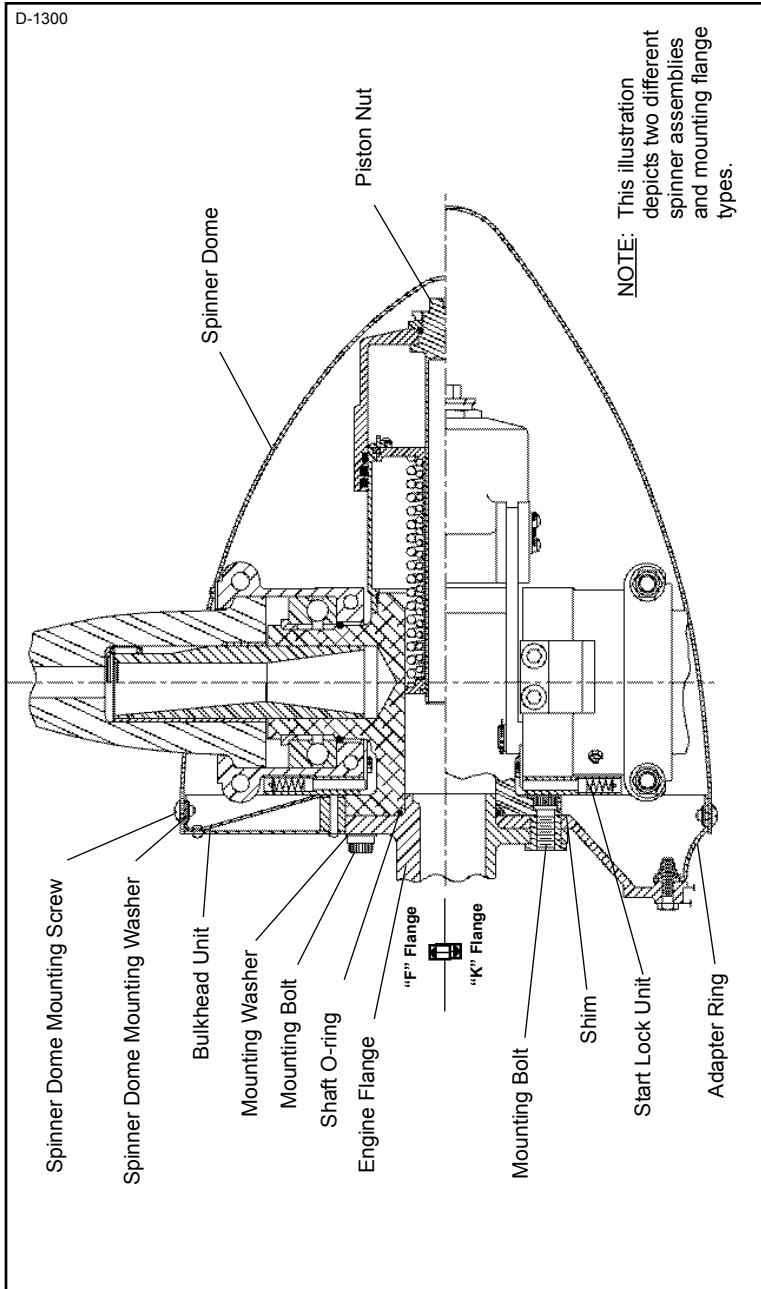
- (c) Manual 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual
  - (d) Manual 183 (61-12-83) - Propeller Anti-icing Boot Removal and Installation Manual
- (11) Propeller ice protection system components not supplied by Hartzell Propeller Inc. are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).
- (12) Install the spinner dome as follows:

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

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

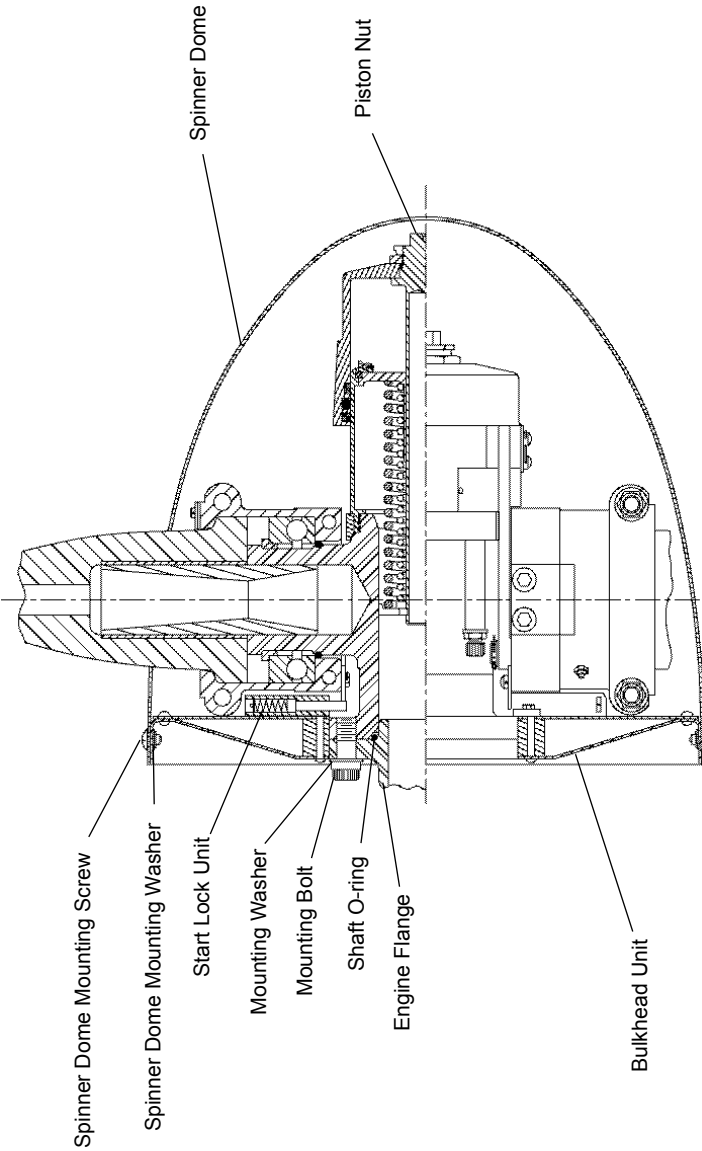
CAUTION 2: THE SPINNER DOME WILL WOBBLE IF NOT ALIGNED PROPERLY, AND MAY AFFECT THE BALANCE OF THE PROPELLER.

- (a) Carefully slide the spinner dome over the reassembled propeller.
- (b) Secure the spinner dome to the spinner bulkhead with the supplied screws and washers.



HC-92ZF-2(), HC-92() (K-2()) Propeller Assembly  
Figure 3-7

D-1950



HC-93ZF-2() Propeller Assembly  
Figure 3-8

- F. Installing the F Flange Propeller Models HC-92ZF-2( ) and HC-93ZF-2( )

Refer to Figures 3-7 and 3-8.

- (1) Press two dowel pins (Table 3-1) through the holes in the propeller flange to be flush with the propeller side of the hub flange.

**WARNING 1:** TO FACILITATE BOXING AND SHIPPING OF THE PROPELLER, THE PISTON NUT SHOULD HAVE BEEN REMOVED IN ORDER TO PERMIT ROTATING OF THE BLADES BEFORE PACKAGING.

FOR SAFETY REASONS, IF THE PISTON NUT WAS NOT REMOVED, THE PROPELLER MUST BE PUT IN FEATHER POSITION BEFORE IT IS INSTALLED ON THE AIRCRAFT.

**WARNING 2:** MAKE SURE THE SLING IS RATED UP TO 800 LBS. (363 KG) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING INSTALLATION.

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

- (2) With a suitable crane hoist and sling, carefully move the propeller assembly to the aircraft engine mounting flange in preparation for installation.

**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.

- (3) Clean the engine flange and propeller flange with Quick Dry Stoddard Solvent or MEK.

- (4) If the spinner bulkhead is to be installed and is not already in place, perform the following steps:
  - (a) Install the spinner bulkhead facing toward the propeller.
  - (b) From the engine side of the bulkhead, insert the attaching bolts through the bulkhead and into the start locks.
  - (c) Install the washers and locking nuts on the propeller side of the start locks to secure the attaching bolts and the bulkhead.
- (5) Install the shaft O-ring (Table 3-1) on the engine shaft.

**CAUTION:** USE CARE TO AVOID SCRAPING ALUMINUM FROM THE BORE OF THE SPINNER BULKHEAD. SCRAPINGS COULD BECOME WEDGED BETWEEN THE FLANGES.

- (6) Align the threaded holes of the propeller flange with the bolt holes in the engine flange, and align the dowel pins in the propeller flange with the dowel pin holes in the engine flange.

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

- (7) Slide the propeller onto the engine shaft.

**NOTE:** Propeller model HC-93ZF-2B only: When sliding the propeller onto the engine shaft, the bottom of the spring assembly protrudes from the propeller assembly and fits into the engine flange.



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

- (8) Install mounting bolts (Table 3-1) with mounting washers through the engine flange from the rear and into the tapped holes in the propeller flange.

**NOTE:** For propeller removals between overhaul intervals, mounting bolts and washers may be reused if they are not damaged or corroded.

- (9) Use a torque wrench with a torque wrench adapter Hartzell P/N AST-2814 (Figure 3-2) to torque all mounting bolts in sequence. Refer to Table 3-2 and Figure 3-3 to determine the proper torque value to which the torque wrench must be set.
- (a) Torque the mounting bolts to half of the final torque, beginning with any mounting bolt, and moving clockwise or counterclockwise until all the bolts are torqued.
- (b) Final torque the bolts in sequence, beginning with any mounting bolt, and moving clockwise or counterclockwise until all the bolts are torqued.
- (10) Safety all mounting bolts with 0.032 inch (0.810 mm) minimum diameter stainless steel wire (two bolts per safety).

- (11) Procedure for reinstallation of the piston nut, if applicable.
- (a) Following the installation of the propeller, retract the start lock pins and hold them in place with a heavy wire inserted through the hole of each start lock housing.
  - (b) Carefully push the piston toward the engine, rotating the blades to feather position, and attach the piston nut to the pitch change rod.
  - (c) Use a breaker bar and a 5/8 inch deep well socket to hold the pitch change rod.
  - (d) Using a 1-7/16 inch crowfoot wrench and torque wrench, torque the piston nut. Refer to Table 3-2 and Figure 3-3 for the proper torque value.
- NOTE:** The removal and subsequent reinstallation of the piston nut does not require that the propeller blade angles be rechecked.
- (12) Remove the wires from the start lock brackets.
- (13) Position the propeller on the start locks.

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

- (a) Using the blade paddles, slowly rotate the blades simultaneously toward low pitch until the start lock pins engage the stop plate.
- (14) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller Inc., applicable instructions and technical information for the components supplied by Hartzell can be found in the following publications available on the Hartzell web site at [www.hartzellprop.com](http://www.hartzellprop.com).
- (a) Manual 180 (30-61-80) - Propeller Ice Protection System Manual
  - (b) Manual 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual

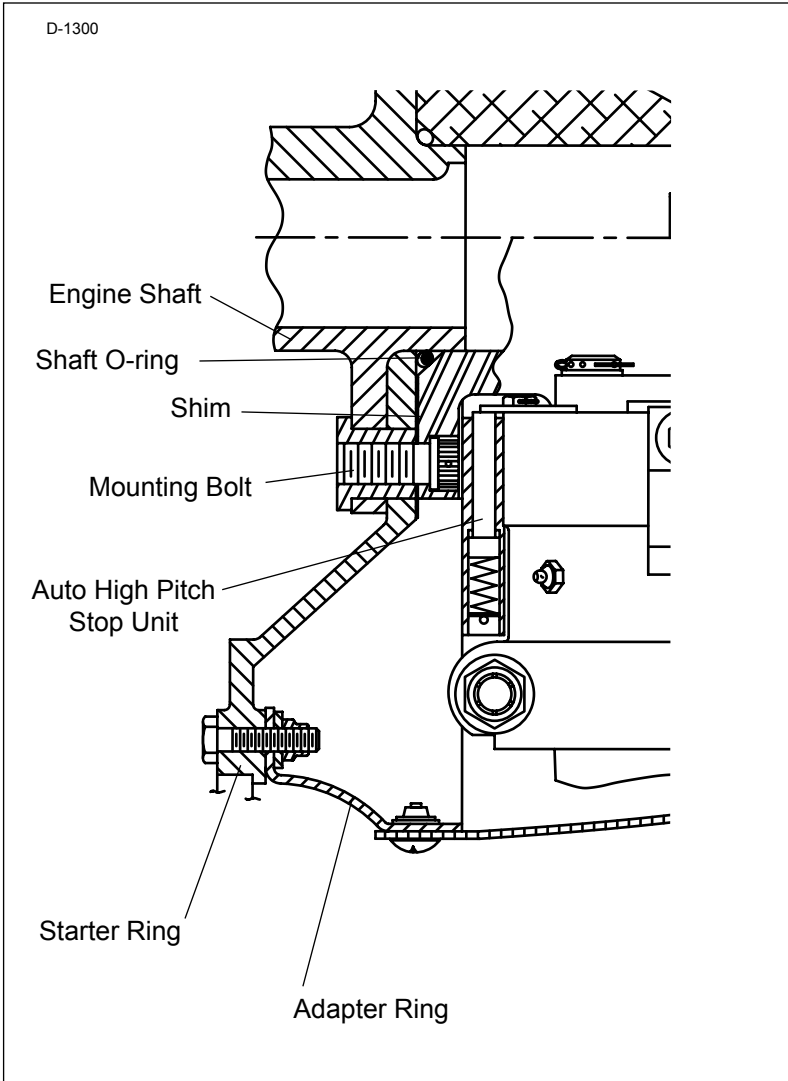
- (c) Manual 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual
- (d) Manual 183 (61-12-83) - Propeller Anti-icing Boot Removal and Installation Manual
- (15) Propeller ice protection system components not supplied by Hartzell Propeller Inc. are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).
- (16) Install the spinner dome as follows:

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

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

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

- (a) Carefully slide the spinner dome over the reassembled propeller.
- (b) Secure the spinner dome to the spinner bulkhead with the supplied screws and washers.



**K Flange Installation on -2 Propeller Models**  
**Figure 3-9**

- G. Installing the K Flange Propeller Models HC-92( )K-2( )  
Refer to Figure 3-7.

**WARNING 1:** TO FACILITATE BOXING AND SHIPPING OF THE PROPELLER, THE PISTON NUT SHOULD HAVE BEEN REMOVED IN ORDER TO PERMIT ROTATING OF THE BLADES BEFORE PACKAGING.

FOR SAFETY REASONS, IF THE PISTON NUT WAS NOT REMOVED, THE PROPELLER MUST BE PUT IN FEATHER POSITION BEFORE IT IS INSTALLED ON THE AIRCRAFT.

**WARNING 2:** MAKE SURE THE SLING IS RATED UP TO 800 LBS. (363 KG) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING INSTALLATION.

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

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

**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.

- (2) Clean the engine flange and propeller flange with Quick Dry Stoddard Solvent or MEK.
- (3) Install the spinner adapter ring on the engine starter gear. Refer to Figure 3-9.

**CAUTION:** FAILURE TO INSTALL THE PLASTIC SHIM BETWEEN THE PROPELLER FLANGE AND THE STARTER RING GEAR CAN RESULT IN MOUNTING BOLT FAILURE.

- (4) Install the plastic shim on the engine shaft between the starter ring gear and the propeller flange. Refer to Figure 3-9.
- (5) Install the specified shaft O-ring (Table 3-1) on the engine shaft.

**WARNING:** THE PROPELLER MUST BE IN FEATHER POSITION BEFORE REMOVING THE START LOCKS.

- (6) Remove the start locks to gain access to the propeller mounting bolts.
- (7) Align the six mounting bolts in the propeller hub flange with the bushings in the engine flange.

**NOTE 1:** The propeller mounting bolts are already installed in the propeller flange. Interference with other propeller parts requires that the bolts be installed during propeller assembly.

**NOTE 2:** For propeller removals between overhaul intervals, mounting bolts and washers may be reused if they are not damaged or corroded.

**CAUTION:** MAKE SURE THAT COMPLETE AND TRUE SURFACE CONTACT IS ESTABLISHED BETWEEN THE PROPELLER HUB FLANGE AND THE STARTER RING GEAR.

- (8) Slide the propeller flange onto the engine flange against the starter ring gear.

**NOTE 1:** The engine bushings will insert into the counterbores in the propeller flange that encircles the propeller mounting bolts.

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

- (9) Use a torque wrench with a torque wrench adapter Hartzell P/N AST-2805 (Figure 3-6) to torque all mounting bolts in sequence. Refer to Table 3-2 and Figure 3-3 to determine the proper torque value to which the torque wrench must be set.
- (a) Torque the mounting bolts to half of the final torque, beginning with any mounting bolt, and moving clockwise or counterclockwise until all the bolts are torqued.
  - (b) Final torque the bolts in sequence, beginning with any mounting bolt, and moving clockwise or counterclockwise until all the bolts are torqued.
- (10) Install the start locks.
- (11) Safety all mounting bolts with 0.032 inch (0.810 mm) minimum diameter stainless steel wire (two bolts per safety).

**NOTE:** The mounting bolts that are adjacent to the start locks must be safety-wired to the start lock brackets.

(12) Procedure for reinstallation of the piston nut, if applicable.

- (a) Following the installation of the propeller, retract the start lock pins and hold them in place with a heavy wire inserted through the hole of each start lock housing.
- (b) Carefully push the piston toward the engine, rotating the blades to feather position, and attach the piston nut to the pitch change rod.
- (c) Use a breaker bar and a 5/8 inch deep well socket to hold the pitch change rod.
- (d) Using a 1-7/16 inch crowfoot wrench and torque wrench, torque the piston nut. Refer to Table 3-2 and Figure 3-3 for the proper torque value.

**NOTE:** The removal and subsequent reinstallation of the piston nut does not require that the propeller blade angles be rechecked.

(13) Remove the wires from the start lock brackets.

(14) Position the propeller on the start locks.

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

- (a) Using the blade paddles, slowly rotate the blades simultaneously toward low pitch until the start lock pins engage the stop plate.

(15) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller Inc., applicable instructions and technical information for the components supplied by Hartzell can be found in the following publications available on the Hartzell web site at [www.hartzellprop.com](http://www.hartzellprop.com).

- (a) Manual 180 (30-61-80) - Propeller Ice Protection System Manual
- (b) Manual 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual



- (c) Manual 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual
- (d) Manual 183 (61-12-83) - Propeller Anti-icing Boot Removal and Installation Manual
- (16) Propeller ice protection system components not supplied by Hartzell Propeller Inc. are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).
- (17) Install the spinner dome as follows:

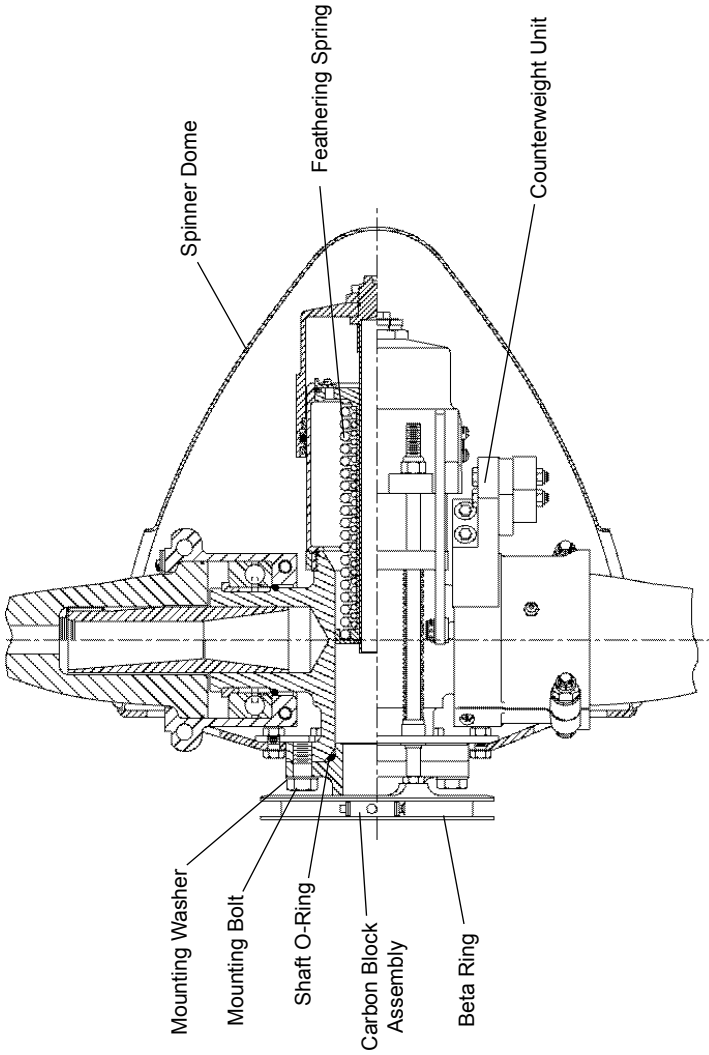
NOTE: The following instructions relate to Hartzell spinners only. In some cases, the airframe manufacturer produced the spinner assembly. In those cases, refer to the airframe manufacturer's manual for spinner installation instructions.

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

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

- (a) Carefully slide the spinner dome over the reassembled propeller.
- (b) Secure the spinner dome to the spinner bulkhead with the supplied screws and washers.

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(B)HC-92( ) F-3 Propeller Assembly  
Figure 3-10

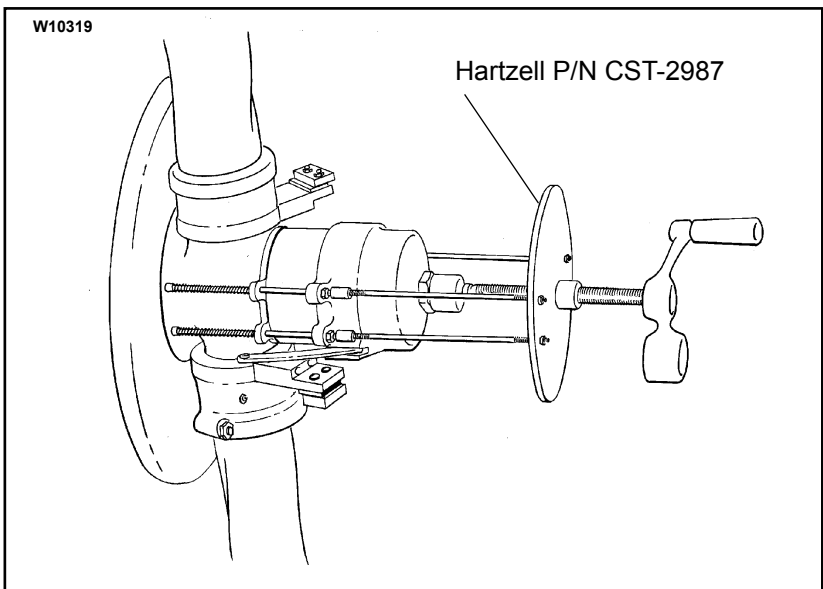
H. Installing the F Flange Propeller Models (B)HC-92( )F-3  
Refer to Figure 3-10.

- (1) Use a beta system puller CST-2987 (Figure 3-11) to compress the beta system and pull the beta ring forward to permit installation of the propeller mounting bolts.

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

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

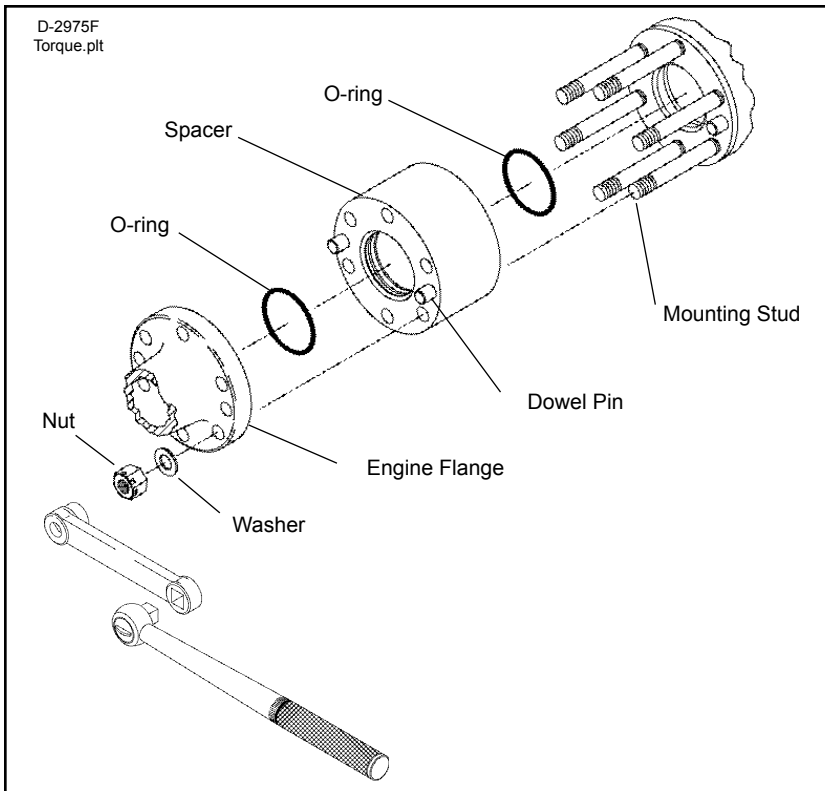
- (2) With a suitable crane hoist and sling, carefully move the propeller assembly to the aircraft engine mounting flange in preparation for installation.



**Tool for Decompressing External Beta System  
Figure 3-11**

**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.

- (3) Clean the engine flange and propeller flange with Quick Dry Stoddard Solvent or MEK.
- (4) Press fit two dowel pins (Table 3-1) through the holes in the propeller flange to be flush with the propeller side of the hub flange.



**HC-92WF-3 Installation on TSIO-520-C Engine  
Figure 3-12**

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

**NOTE:** For propeller model HC-92WF-3 when installed on a TSIO-520-C engine only, proceed to step (6). For all other installations, proceed to step (7).

- (6) For propeller model HC-92WF-3 when installed on a TSIO-520-C engine only (Figure 3-12):
  - (a) Install the specified O-ring (Table 3-1) on the spacer, facing the propeller flange.
  - (b) Install the spacer and O-ring (Table 3-1) against the propeller flange, matching the dowel pins in the propeller flange to the holes in the spacer.
  - (c) Press fit two dowel pins (Table 3-1) through the holes in the spacer, approximately 1/2 inch (12.7 mm) deep.
- (7) Align the mounting and dowel pin holes in the engine flange with the mounting holes (or studs) and dowel pins in the propeller flange or spacer as applicable.
- (8) Slide the propeller flange (or spacer) onto the engine flange.

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

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

- (9) Install mounting bolts with washers (Table 3-1), if applicable, through the engine flange and into the propeller hub flange. Refer to Figure 3-10.

NOTE 1: On propeller model HC-92WF-3 when installed on a TSIO-520-C engine, install mounting nuts (Table 3-1) with washers onto the mounting studs that protrude through the engine side of the engine flange (Figure 3-12).

NOTE 2: For propeller removals between overhaul intervals, mounting bolts and washers or studs and washers may be reused if they are not damaged or corroded.

- (10) Use a torque wrench with a torque wrench adapter Hartzell P/N AST-2814 (Figure 3-2) to torque all mounting bolts (Figure 3-2) or nuts (Figure 3-12) in sequence. Refer to Table 3-2 and Figure 3-3 to determine the proper torque value to which the torque wrench must be set.

(a) Torque the mounting bolts or nuts to half the final torque, beginning with any mounting bolt, and moving clockwise or counterclockwise until all the bolts are torqued.

(b) Final torque the bolts or nuts in sequence, beginning with any mounting bolt, and moving clockwise or counterclockwise until all the bolts are torqued.

- (11) Safety all mounting bolts or mounting studs with 0.032 inch (0.81 mm) minimum diameter stainless steel wire (two bolts or studs per safety).

(12) Decompress and remove the beta system puller.

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

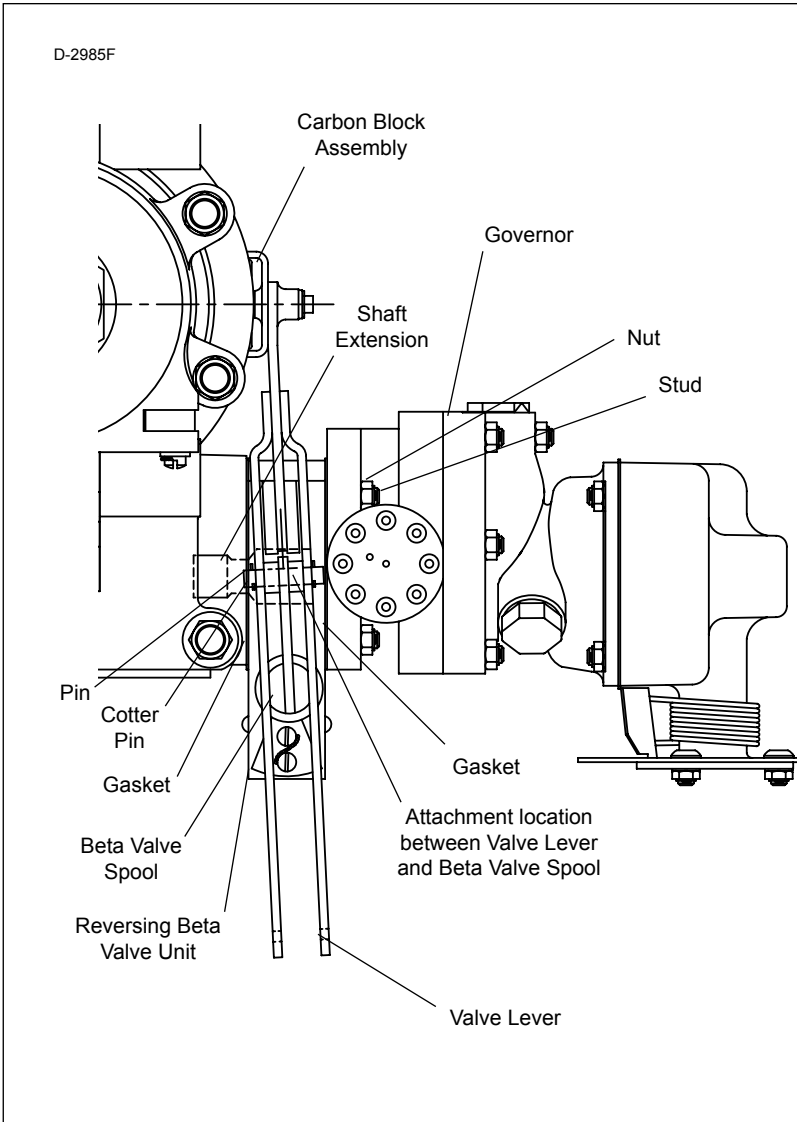
- (14) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller Inc., applicable instructions and technical information for the components supplied by Hartzell can be found in the following publications available on the Hartzell web site at [www.hartzellprop.com](http://www.hartzellprop.com).
- (a) Manual 180 (30-61-80) - Propeller Ice Protection System Manual
  - (b) Manual 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual
  - (c) Manual 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual
  - (d) Manual 183 (61-12-83) - Propeller Anti-icing Boot Removal and Installation Manual
- (15) Propeller ice protection system components not supplied by Hartzell Propeller Inc. are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).
- (16) Install the spinner dome as follows:

**NOTE:** The following instructions relate to Hartzell spinners only. In some cases, the airframe manufacturer produced the spinner assembly. In those cases, refer to the airframe manufacturer's manual for spinner installation instructions.

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

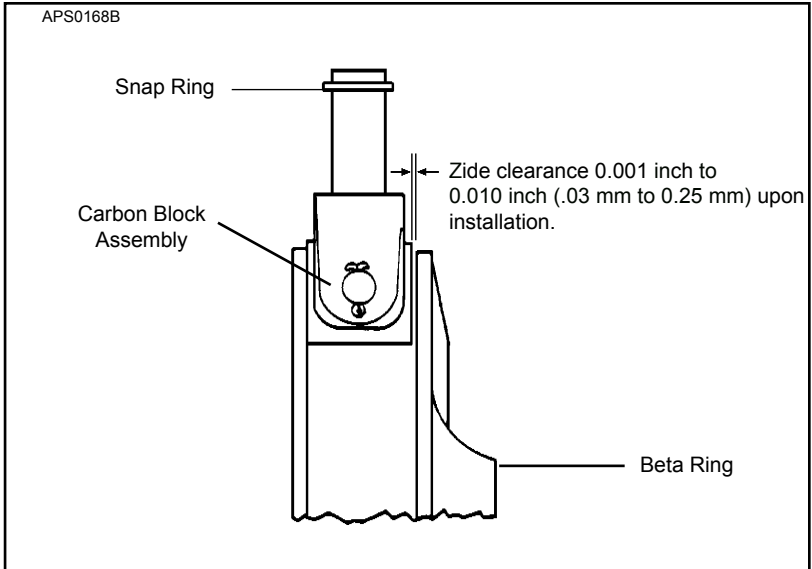
**CAUTION 2:** THE SPINNER DOME WILL WOBBLE IF NOT ALIGNED PROPERLY, AND MAY AFFECT BALANCE OF THE PROPELLER.

- (a) Carefully slide the spinner dome over the reassembled propeller.
- (b) Secure the spinner dome to the spinner bulkhead with the supplied screws and washers.

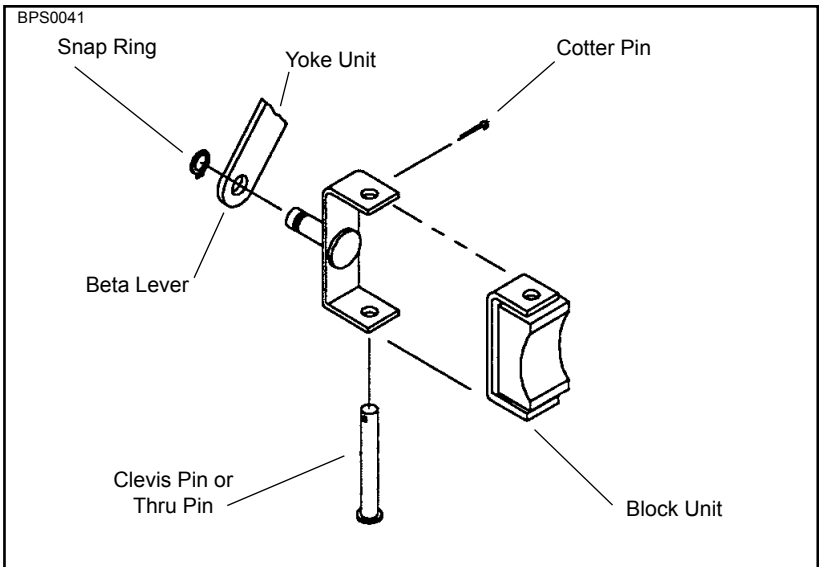


**Installation of Beta Valve, Governor, and Linkage**  
**Figure 3-13**





**Carbon Block and Beta Ring Clearance**  
**Figure 3-14**



**Carbon Block Assembly**  
**Figure 3-15**

(17) Installation of the beta valve, governor, and linkage. Refer to Figure 3-13.

- (a) Remove the four studs from the engine governor pad and install four new studs (Table 3-1).
- (b) Install the governor gasket (Table 3-1) against the face of the engine pad.
- (c) Install the beta valve unit as shown in Figure 3-13.
- (d) Install a governor gasket (Table 3-1) against the valve face (contacting the governor).
- (e) Install the shaft extension (Table 3-1) into the female splines of the engine governor drive shaft.
- (f) Install the governor and attach it with nuts.

**NOTE:** Follow the applicable airframe manufacturer's instructions for the rigging of the governor control cable.

- (g) Torque the nuts to 10-15 Ft-Lb (14-20 N•m).
- (h) Install the carbon block into the beta linkage lever, per the airframe manufacturer's instructions.

**CAUTION 1:** FIT THE BLOCK IN THE BETA RING WITH A MINIMUM SIDE CLEARANCE OF 0.001 INCH (0.03 mm). REFER TO FIGURE 3-14.

**CAUTION 2:** MAXIMUM SIDE CLEARANCE PERMITTED IS 0.010 INCH (0.25 mm) IN ACCORDANCE WITH THE CARBON BLOCK ASSEMBLIES SECTION IN THE MAINTENANCE PRACTICES CHAPTER OF THIS MANUAL.

- (i) Install the carbon block assembly (Figure 3-15) into the beta ring.
- (j) Attach the valve lever to the beta valve spool (Figure 3-13).
- (k) Install, adjust, and safety the beta linkage per the airframe manufacturer's instructions.

**NOTE:** If airframe manufacturer's instructions are unavailable, then follow step 4.H.(18).

- (l) Connect the outer end of the lever with the control push-pull fitting provided.
- (m) Secure the housing of the push-pull control to a bracket.

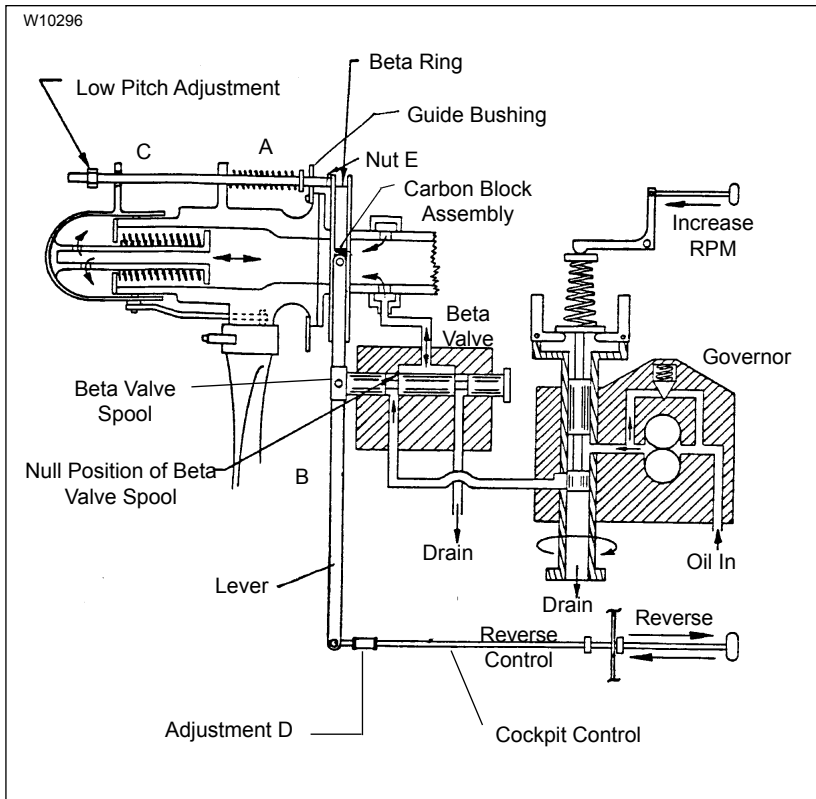
### (18) Adjusting the Propeller Reverse Control System

**NOTE:** Follow the instructions in this step only if the manufacturer's instructions for this procedure are unavailable.

Refer to Figure 3-16.

- (a) Set the reverse control in forward position.
- (b) Adjust "D", at the end of the reverse control rod, so that "B" is approximately 1/16 inch (1.6 mm) as measured from the spool flange to the valve body (or within 1/16 inch (1.6 mm) of the end of its travel).

**NOTE:** "A" is zero.



**Adjusting Propeller Reverse Control System  
Figure 3-16**

- (c) The low pitch adjustment "C" has been made at the factory according to published information. The readjustment of low pitch should not be required. Refer to the Propeller Low Pitch Setting section in the Maintenance Practices Chapter of this manual for adjustment information.

**CAUTION:** TO PREVENT ENGINE OVERSPEED, DO NOT PERMIT THE RPM TO REACH THE RPM SET BY THE GOVERNOR. THIS WILL PERMIT THE GOVERNOR TO OVERRIDE THE REVERSE PITCH CONTROL AND CAUSE THE PITCH TO COME OUT OF REVERSE.

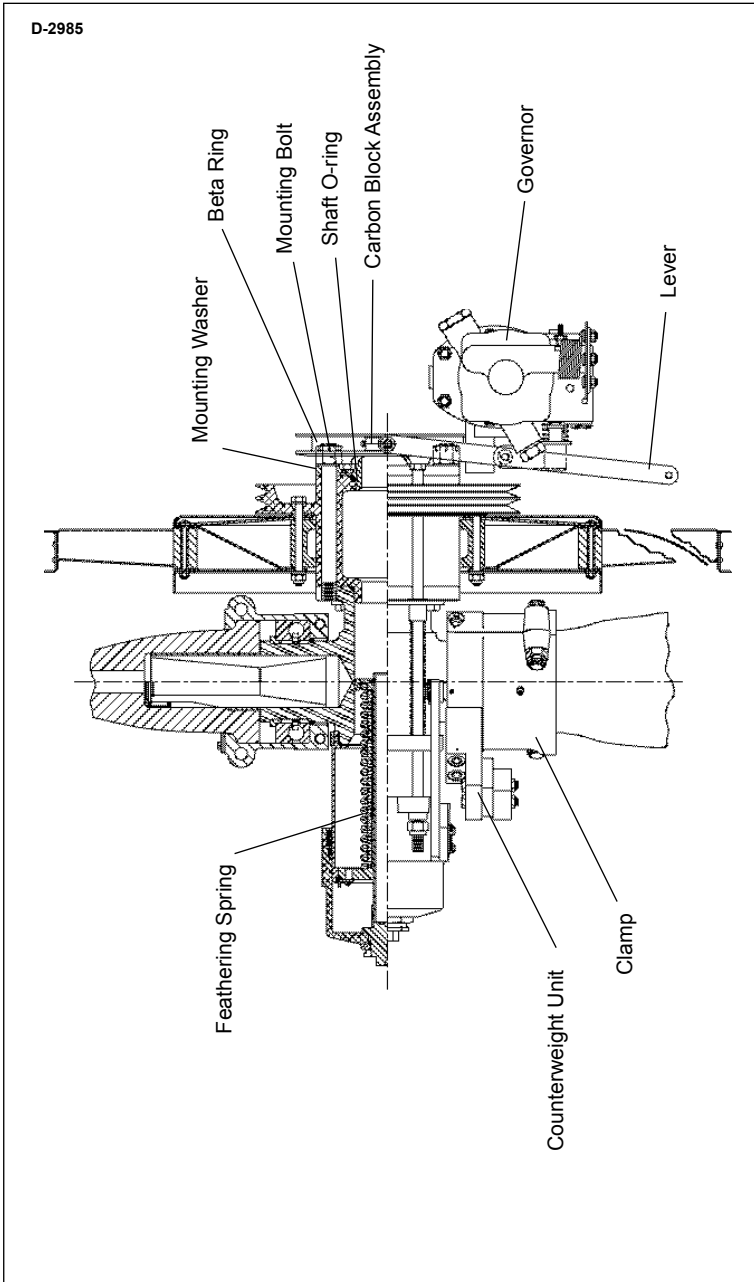
- (d) Check the RPM during reverse pitch operation.
- 1 Set the propeller governor control for maximum RPM.
  - 2 While the engine is idling, set the pitch control for maximum reverse pitch.
  - 3 Gradually open the throttle until the RPM reaches the maximum value, or until the RPM reaches approximately 80 percent to 90 percent of the engine rating.

**NOTE:** It is desirable to have the reverse pitch set to provide 80 percent to 90 percent of the engine rated RPM. This provides a margin of safety for reverse pitch operation.

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

- (e) If the RPM exceeds the desired value for reverse pitch, check to be sure the reverse push-pull control (Figure 3-16) has enough travel to move the piston up against its internal stop. To accomplish this:
- 1 Using blade paddles (one per blade), rotate the blade angle into full reverse pitch, and determine if the beta valve is calling for oil pressure. This condition is met if "B" (Figure 3-16) is  $\frac{3}{16}$  inch (4.8 mm) or less.
  - 2 While in full reverse, check for clearance between nut "E" (Figure 3-16) and the guide bushing. There should be a positive clearance.

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**BHC-92(W,Z)F-3(L)G Propeller Assembly**  
**Figure 3-17**



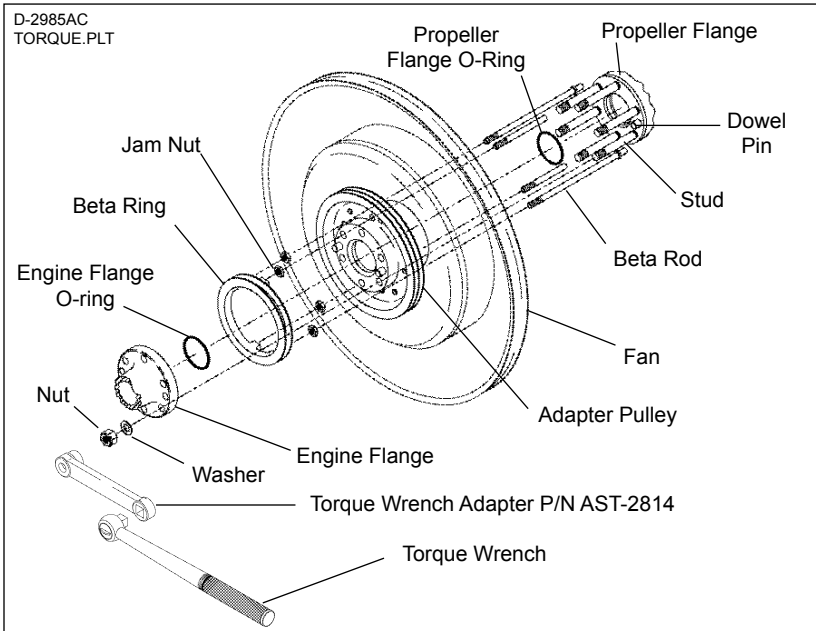
- I. Installing the F Flange Propeller Models BHC-92(W,Z)F-3(L)G  
Refer to Figure 3-17.

- (1) Use a beta system puller CST-2987 (Figure 3-11) to compress the beta system and pull the beta ring forward to permit installation of the mounting nuts.

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

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

- (2) With a suitable crane hoist and sling, carefully move the propeller assembly to the aircraft engine mounting flange in preparation for installation.



**BHC-92(W,Z)F-3(L)G Installation**  
**Figure 3-18**

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.

- (3) Clean the engine flange and propeller flange with Quick Dry Stoddard Solvent or MEK.
- (4) Press fit two dowel pins (Table 3-1) through the holes in the propeller flange to be flush with the propeller side of the hub flange. Refer to Figure 3-18.
- (5) Install the specified O-ring (Table 3-1) on the engine flange.
- (6) Install the specified O-ring (Table 3-1) on the adapter pulley (Figure 3-18), facing the propeller flange.
- (7) Install the spacer and O-Ring (Figure 3-18) against the propeller flange, matching the dowel pins in the propeller flange to the holes in the spacer.
- (8) Press fit two dowel pins (Table 3-1) through the holes in the adapter pulley, to a depth of approximately 0.50 inch (12.7 mm). Refer to Figure 3-18.
- (9) Align the mounting and dowel pin holes in the engine flange with the mounting studs and dowel pins in the adapter pulley.
- (10) Slide the propeller and adapter pulley onto the engine flange.

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

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

(11) Install mounting nuts with washers (Table 3-1) through the engine flange and into the propeller hub flange. Refer to Figure 3-18.

NOTE: For propeller removals between overhaul intervals, mounting studs and washers may be reused if they are not damaged or corroded.

(12) Use a torque wrench with a torque wrench adapter Hartzell P/N AST-2814 (Figure 3-2) to torque all mounting nuts in sequence. Refer to Table 3-2 and Figure 3-3 to determine the proper torque value to which the torque wrench must be set.

(a) Torque the mounting nuts to half of the final torque, beginning with any mounting nut, and moving clockwise or counterclockwise until all the bolts are torqued.

(b) Final torque the nuts in sequence, beginning with any nut, and moving clockwise or counterclockwise until all the bolts are torqued.

(13) Safety all mounting studs with 0.032 inch (0.81 mm) minimum diameter stainless steel wire (two studs per safety).

(14) Decompress and remove the beta system puller.

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

- (16) Installation of the beta valve, governor, and linkage. Refer to Figure 3-13.
- (a) Remove the four studs from the engine governor pad and install four new studs (Table 3-1).
  - (b) Install the governor gasket (Table 3-1) against the face of the engine pad.
  - (c) Install the beta valve unit as shown in Figure 3-13.
  - (d) Install a governor gasket (Table 3-1) against the valve face (contacting the governor).
  - (e) Install the shaft extension (Table 3-1) into the female splines of the engine governor drive shaft.
  - (f) Install the governor and attach it with nuts.  
**NOTE:** Follow the applicable airframe manufacturer's instructions for the rigging of the governor control cable.
  - (g) Torque the nuts to 10-15 Ft-Lb (14-20 N•m).
  - (h) Install the carbon block into the beta linkage lever, per the airframe manufacturer's instructions.

**CAUTION 1:** FIT THE BLOCK IN THE BETA RING WITH A MINIMUM SIDE CLEARANCE OF 0.001 INCH (0.03 mm). REFER TO FIGURE 3-14.

**CAUTION 2:** MAXIMUM SIDE CLEARANCE PERMITTED IS 0.010 INCH (0.25 mm) IN ACCORDANCE WITH THE CARBON BLOCK ASSEMBLIES SECTION IN THE MAINTENANCE PRACTICES CHAPTER OF THIS MANUAL.

- (i) Install the carbon block assembly (Figure 3-15) into the beta ring.
- (j) Attach the valve lever to the beta valve spool (Figure 3-13).
- (k) Install, adjust, and safety the beta linkage per the airframe manufacturer's instructions.

**NOTE:** If airframe manufacturer's instructions are unavailable, then follow step 4.I.(17).

- (l) Connect the outer end of the lever with the control push-pull fitting provided.

- (m) Attach the housing of the push-pull control to a bracket.

(17) Adjusting the Propeller Reverse Control System

**NOTE:** Follow the instructions in this step only if the manufacturer's instructions for this procedure are unavailable.

Refer to Figure 3-16.

- (a) Set the reverse control in forward position.
- (b) Adjust "D", at the end of the reverse control rod, so that "B" is approximately 1/16 inch (1.6 mm) as measured from the spool flange to the valve body (or within 1/16 inch (1.6 mm) of the end of its travel).  
**NOTE:** "A" is zero.
- (c) The low pitch adjustment "C" has been made at the factory according to published information. The readjustment of low pitch should not be required. Refer to the Propeller Low Pitch Setting section in the Maintenance Practices Chapter of this manual for adjustment information.
- (d) Check the runout of the beta ring by installing a dial indicator on the nose of the engine, so that it touches the rear face of the beta ring. If necessary, loosen nut "E" and rotate the rods to bring the runout to within 0.010 total indicator reading.
- (e) Torque nut "E" to 10-15 Ft-Lb (14-20 N•m).
- (f) Make sure the four low pitch adjusting nuts contact the piston bosses at the same time the piston is moved toward reverse pitch. To accomplish this:
  - 1 Equalize "C" (Figure 3-16) for all four rods by means of accurate measurements.
  - 2 Adjust the nuts if necessary. This will make sure that the slip ring runs true during pitch reversal.

CAUTION: TO PREVENT ENGINE OVERSPEED, DO NOT PERMIT THE RPM TO REACH THE RPM SET BY THE GOVERNOR. THIS WILL PERMIT THE GOVERNOR TO OVERRIDE THE REVERSE PITCH CONTROL AND CAUSE THE PITCH TO COME OUT OF REVERSE.

- (g) Check the RPM during reverse pitch operation.
- 1 Set the propeller governor control for maximum RPM.
  - 2 While the engine is idling, set the pitch control for maximum reverse pitch.
  - 3 Gradually open the throttle until the RPM reaches the maximum value, or until the RPM reaches approximately 80 percent to 90 percent of the engine rating.

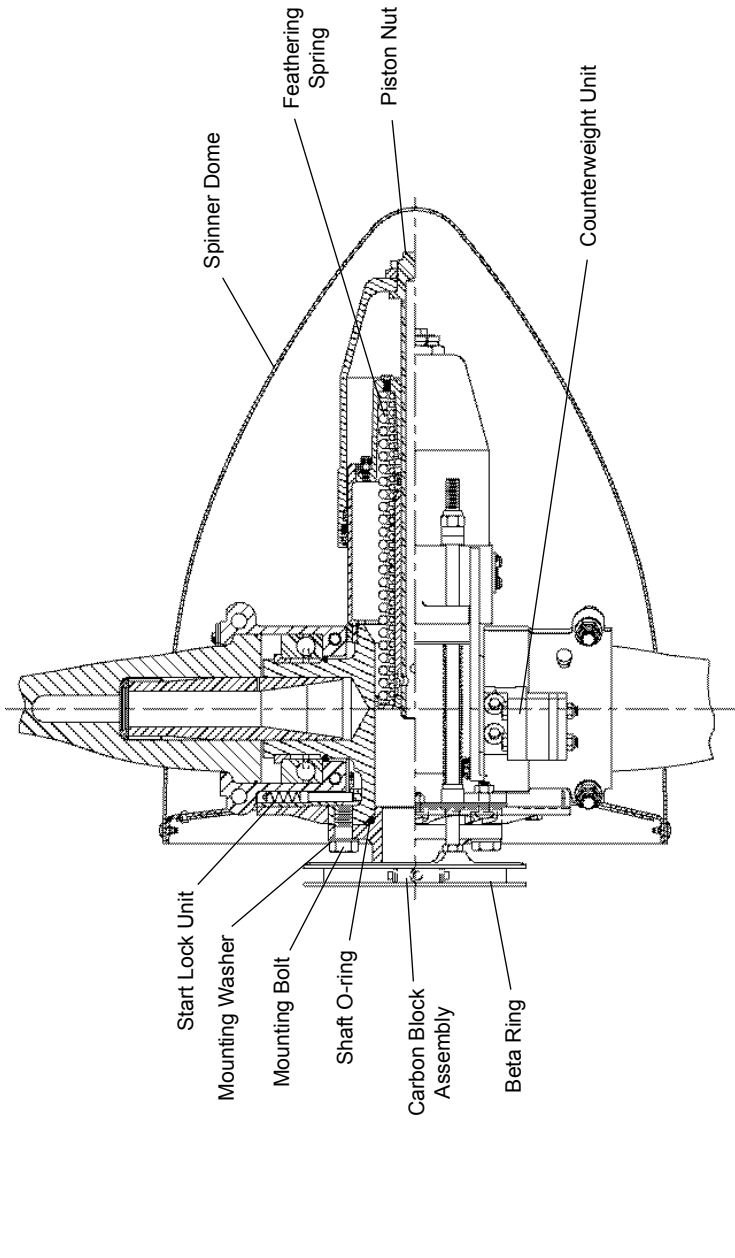
NOTE: It is desirable to have the reverse pitch set to provide 80 percent to 90 percent of the engine rated RPM. This provides a margin of safety for reverse pitch operation.

**CAUTION:**

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

- (h) If the RPM exceeds the desired value for reverse pitch, check to be sure the reverse push-pull control (Figure 3-16) has enough travel to move the piston up against its internal stop. To accomplish this:
- 1 Using blade paddles (one per blade), rotate the blade angle into full reverse pitch, and determine if the beta valve is calling for oil pressure. This condition is met if "B" (Figure 3-16) is 3/16 inch (4.8 mm) or less.
  - 2 While in full reverse, check for clearance between nut "E" (Figure 3-16) and the guide bushing. There should be a positive clearance.

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HC-92WF-5A Propeller Assembly  
Figure 3-19



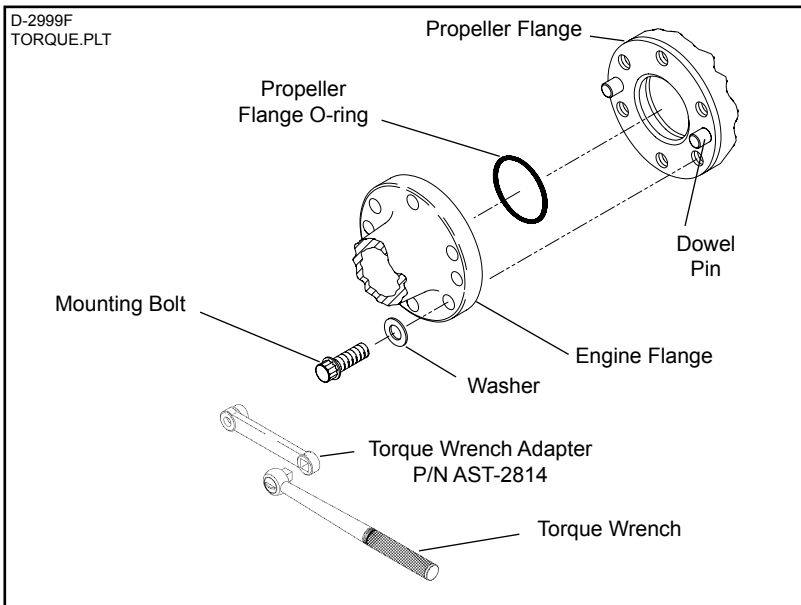
- J. Installing the F Flange Propeller Model HC-92WF-5A  
Refer to Figure 3-19.

- (1) Use a beta system puller CST-2987 (Figure 3-11) to compress the beta system and pull the beta ring forward to permit installation of the double hex head propeller mounting fasteners.

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

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

- (2) With a suitable crane hoist and sling, carefully move the propeller assembly to the aircraft engine mounting flange in preparation for installation.



**HC-92WF-5A Installation  
Figure 3-20**

**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.

- (3) Clean the engine flange and propeller flange with Quick Dry Stoddard Solvent or MEK.
- (4) Press fit two dowel pins (Table 3-1) through the holes in the propeller flange to be flush with the propeller side of the hub flange. Refer to Figure 3-20.
- (5) Install the specified O-ring (Table 3-1) on the engine flange.
- (6) Align the mounting and dowel pin holes in the engine flange with the mounting holes and dowel pins in the propeller flange. Refer to Figure 3-20.
- (7) Slide the propeller flange onto the engine flange.

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

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

- (8) Install mounting bolts with washers (Table 3-1) through the engine flange and into the propeller hub flange. Refer to Figure 3-19.

**NOTE:** For propeller removals between overhaul intervals, mounting bolts and washers may be reused if they are not damaged or corroded.

- (9) Use a torque wrench with a torque wrench adapter Hartzell P/N AST-2814 (Figure 3-2) to torque all mounting bolts in sequence. Refer to Table 3-2 and Figure 3-3 to determine the proper torque value to which the torque wrench must be set.
  - (a) Torque the mounting bolts to half of the final torque, beginning with any mounting bolt, and moving clockwise or counterclockwise until all the bolts are torqued.
  - (b) Final torque the bolts in sequence, beginning with any mounting bolt, and moving clockwise or counterclockwise until all the bolts are torqued.
- (10) Safety all mounting studs with 0.032 inch (0.81 mm) minimum diameter stainless steel wire (two studs per safety).
- (11) Decompress and remove the beta system puller.
- (12) Install, adjust, and safety the beta linkage per the airframe manufacturer's instructions.
- (13) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller Inc., applicable instructions and technical information for the components supplied by Hartzell can be found in the following publications available on the Hartzell web site at [www.hartzellprop.com](http://www.hartzellprop.com).
  - (a) Manual 180 (30-61-80) - Propeller Ice Protection System Manual
  - (b) Manual 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual
  - (c) Manual 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual
  - (d) Manual 183 (61-12-83) - Propeller Anti-icing Boot Removal and Installation Manual
- (14) Propeller ice protection system components not supplied by Hartzell Propeller Inc. are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).

(15) Install the spinner dome as follows:

**NOTE:** The following instructions relate to Hartzell spinners only. In some cases, the airframe manufacturer produced the spinner assembly. In those cases, refer to the airframe manufacturer's manual for spinner installation instructions.

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

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

- (a) Carefully slide the spinner dome over the reassembled propeller.
- (b) Secure the spinner dome to the spinner bulkhead with the supplied screws and washers.

(16) Installation of the beta valve, governor, and linkage. Refer to Figure 3-13.

- (a) Remove the four studs from the engine governor pad and install four new studs (Table 3-1).
- (b) Install the governor gasket (Table 3-1) against the face of the engine pad.
- (c) Install the beta valve unit as shown in Figure 3-13.
- (d) Install a governor gasket (Table 3-1) against the valve face (contacting the governor).
- (e) Install the shaft extension (Table 3-1) into the female splines of the engine governor drive shaft.
- (f) Install the governor and secure it with nuts.

**NOTE:** Follow the applicable airframe manufacturer's instructions for the rigging of the governor control cable.

- (g) Torque the nuts to 10-15 Ft-Lb (14-20 N•m).

- (h) Install the carbon block into the beta linkage lever, per the airframe manufacturer's instructions.

**CAUTION 1:** FIT THE BLOCK IN THE BETA RING WITH A MINIMUM SIDE CLEARANCE OF 0.001 INCH (0.03 mm). REFER TO FIGURE 3-14.

**CAUTION 2:** MAXIMUM SIDE CLEARANCE PERMITTED IS 0.010 INCH (0.25 mm) IN ACCORDANCE WITH THE CARBON BLOCK ASSEMBLIES SECTION IN THE MAINTENANCE PRACTICES CHAPTER OF THIS MANUAL.

- (i) Install the carbon block assembly (Figure 3-15) into the beta ring.
- (j) Attach the valve lever to the beta valve spool (Figure 3-13).
- (k) Install, adjust, and safety the beta linkage per the airframe manufacturer's instructions.

**NOTE:** If airframe manufacturer's instructions are unavailable, then follow step 4.J.(17).

- (l) Connect the outer end of the lever with the control push-pull fitting provided.
- (m) Attach the housing of the push-pull control to a bracket.

#### (17) Adjusting the Propeller Reverse Control System

Refer to Figure 3-16.

- (a) Set the reverse control in forward position.
- (b) Adjust "D", at the end of the reverse control rod, so that "B" is approximately 1/16 inch (1.6 mm) as measured from the spool flange to the bottom of the counterbore (or within 1/16 inch (1.6 mm) of the end of its travel).

**NOTE:** "A" is zero.

- (c) The low pitch adjustment "C" has been made at the factory according to published information. The readjustment of low pitch should not be required. Refer to the Propeller Low Pitch Setting section in the Maintenance Practices Chapter of this manual for adjustment information.
- (d) Check the runout of the beta ring by installing a dial indicator on the nose of the engine, so that it touches the rear face of the beta ring. If necessary, loosen nut "E" and rotate the rods to bring the runout to within 0.010 total indicator reading.
- (e) Torque nut "E" to 10-15 Ft-Lb (14-20 N•m).
- (f) Make sure the four low pitch adjusting nuts contact the piston bosses at the same time the piston is moved toward reverse pitch. To accomplish this:
  - 1 Equalize "C" (Figure 3-16) for all four rods by means of accurate measurements.
  - 2 Adjust the nuts if necessary. This will make sure that the slip ring runs true during pitch reversal.

**CAUTION:** TO PREVENT ENGINE OVERSPEED, DO NOT PERMIT THE RPM TO REACH THE RPM SET BY THE GOVERNOR. THIS WILL PERMIT THE GOVERNOR TO OVERRIDE THE REVERSE PITCH CONTROL AND CAUSE THE PITCH TO COME OUT OF REVERSE.

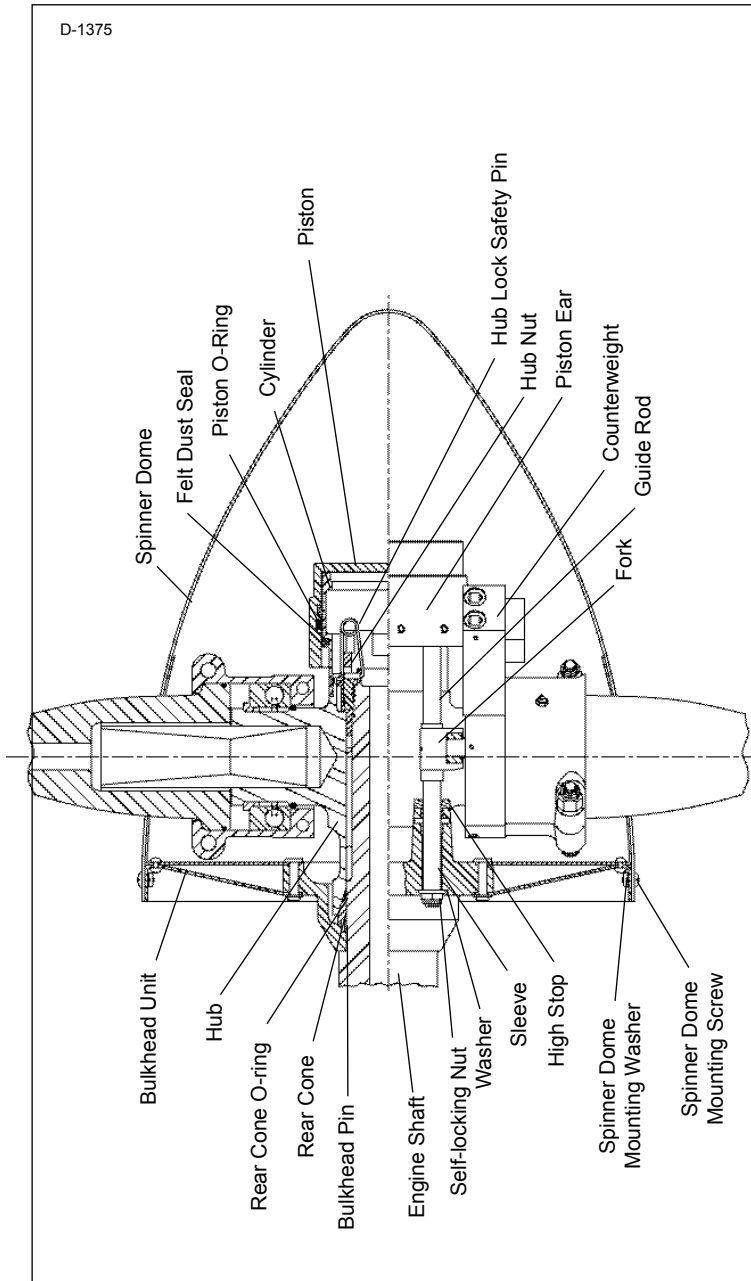
- (g) Check the RPM during reverse pitch operation.
  - 1 Set the propeller governor control for maximum RPM.
  - 2 While the engine is idling, set the pitch control for maximum reverse pitch.
  - 3 Gradually open the throttle until the RPM reaches the maximum value, or until the RPM reaches approximately 80 percent to 90 percent of the engine rating.

**NOTE:** It is desirable to have the reverse pitch set to provide 80 percent to 90 percent of the engine rated RPM. This provides a margin of safety for reverse pitch operation.

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

- (h) If the RPM exceeds the desired value for reverse pitch, check to be sure the reverse push-pull control (Figure 3-16) has enough travel to move the piston up against its internal stop. To accomplish this:
- 1 Using blade paddles (one per blade), rotate the blade angle into full reverse pitch, and determine if the beta valve is calling for oil pressure. This condition is met if "B" (Figure 3-16) is 3/16 inch (4.8 mm) or less.
  - 2 While in full reverse, check for clearance between nut "E" (Figure 3-16) and the guide bushing. There should be a positive clearance.

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HC-93Z20-1() Propeller Assembly  
Figure 3-21



- K. Installing the 20 Spline HC-93Z20-1 ( ) Propeller Models  
Refer to Figure 3-21.

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

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

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

**NOTE:** In most cases, the piston is not installed on the cylinder when the propeller is not installed on the engine.

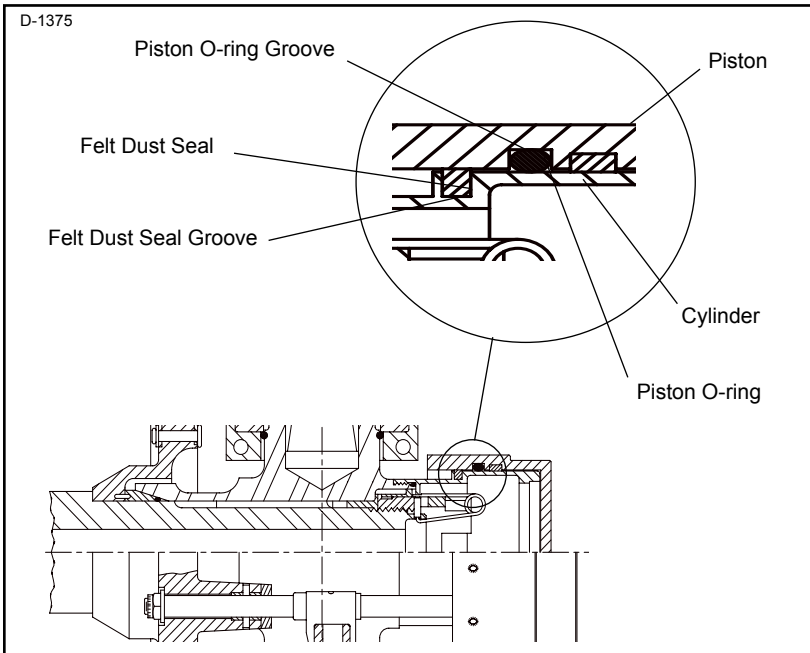
- (2) If the piston is installed on the cylinder, perform the following steps:

- (a) Move the piston to low pitch and rotate the forks away from the clamp linkscrews.
- (b) Remove the self-locking nut from the end of each guide rod.
- (c) Remove the washer from each guide rod.
- (d) Loosen the set screw in each fork.
- (e) Lift the piston from the cylinder.
- (f) Remove the sleeve from each bulkhead boss.
- (g) Remove the high stop spacer from each sleeve.
- (h) The piston ears, forks, and counterweights should have corresponding index numbers (1,2, and 3) impression-stamped or marked with a felt-tipped pen. If they are not marked, number them with a felt-tipped pen.

**NOTE:** This will make sure that the components are reassembled in their original location.

**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.

- (3) Clean the propeller hub spline and engine spline surfaces with Quick Dry Stoddard Solvent or MEK.
- (4) Slide rear spinner bulkhead onto the engine shaft.
- (5) Install the rear cone onto the bulkhead, matching the holes in the cone with the pins in the bulkhead. Push the cone against the bulkhead.



**Installing Piston O-ring and Felt Dust Seal**  
**Figure 3-22**

- (6) Install the rear cone O-ring (Table 3-1) over the shaft and against the cone.
- (7) Slide the propeller hub onto the engine shaft and tighten the hub nut until the rear bulkhead is snug, but do not torque the nut.

**CAUTION:** 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.

- (8) Carefully slide the spinner dome over the installed propeller.
- (9) To properly position the rear bulkhead, temporarily install the spinner dome using at least three screws.
- (10) Adjust the spinner to equalize the clearance between the blades and the blade cutouts in the dome.
- (11) Remove the spinner dome.
- (12) Using Tool BST-2910, torque the propeller shaft nut. Refer to Table 3-2 and Figure 3-3 to determine the proper torque value to which the torque wrench must be set.
- (13) Safety the hub nut using the hub lock safety pin (Table 3-1). Refer to Figure 3-21.
- (14) If the piston O-ring (Table 3-1) and the felt dust seal are not already installed in the piston, perform the following steps: Refer to Figure 3-22.
  - (a) Lubricate the piston O-ring and carefully install it in the groove provided for it in the piston.
  - (b) Cut the oiled felt dust seal material to the necessary length.

**NOTE:** The felt seal material should be cut on a 30 degree diagonal so there will be an overlap with a smooth, fuzz-free surface.
  - (c) Install the felt dust seal material in the groove provided for it in the piston.

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

(15)Locate and match up the index numbers (1, 2 and 3) on the forks and piston ears with the corresponding index numbers on the counterweights.

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

(16)Install the high stop spacers (Table 3-1) on each rod sleeve.

(17)Slide the rod sleeves with high stop spacers into each spinner bulkhead boss.

(18)Oil the entire surface of the cylinder.

(19)Install the pitch change block on each clamp linkscrew.

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

(20)Slide a fork onto each pitch change block.

(21)Slide the guide rods through the forks and rod sleeves until the piston rods protrude through the spinner bulkhead.

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

**NOTE:** Align the forks with the pitch change blocks.

(23)Torque the self-locking nut against the guide rod. Refer to Table 3-2.

(24)Torque the set screw in each fork.

(25)Safety the set screws.

(26) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller Inc., applicable instructions and technical information for the components supplied by Hartzell can be found in the following publications available on the Hartzell web site at [www.hartzellprop.com](http://www.hartzellprop.com).

- (a) Manual 180 (30-61-80) - Propeller Ice Protection System Manual
- (b) Manual 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual
- (c) Manual 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual
- (d) Manual 183 (61-12-83) - Propeller Anti-icing Boot Removal and Installation Manual

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

(28) Install the spinner dome as follows:

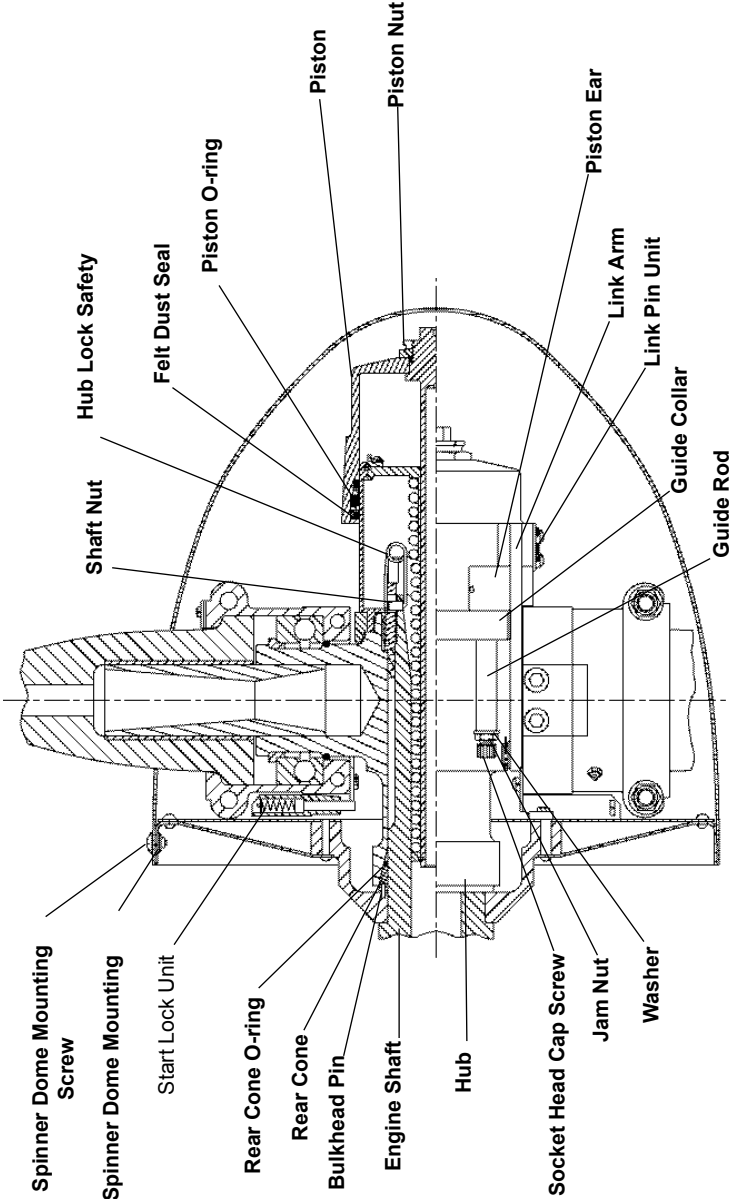
**NOTE:** The following instructions relate to Hartzell spinners only. In some cases, the airframe manufacturer produced the spinner assembly. In those cases, refer to the airframe manufacturer's manual for spinner installation instructions.

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

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

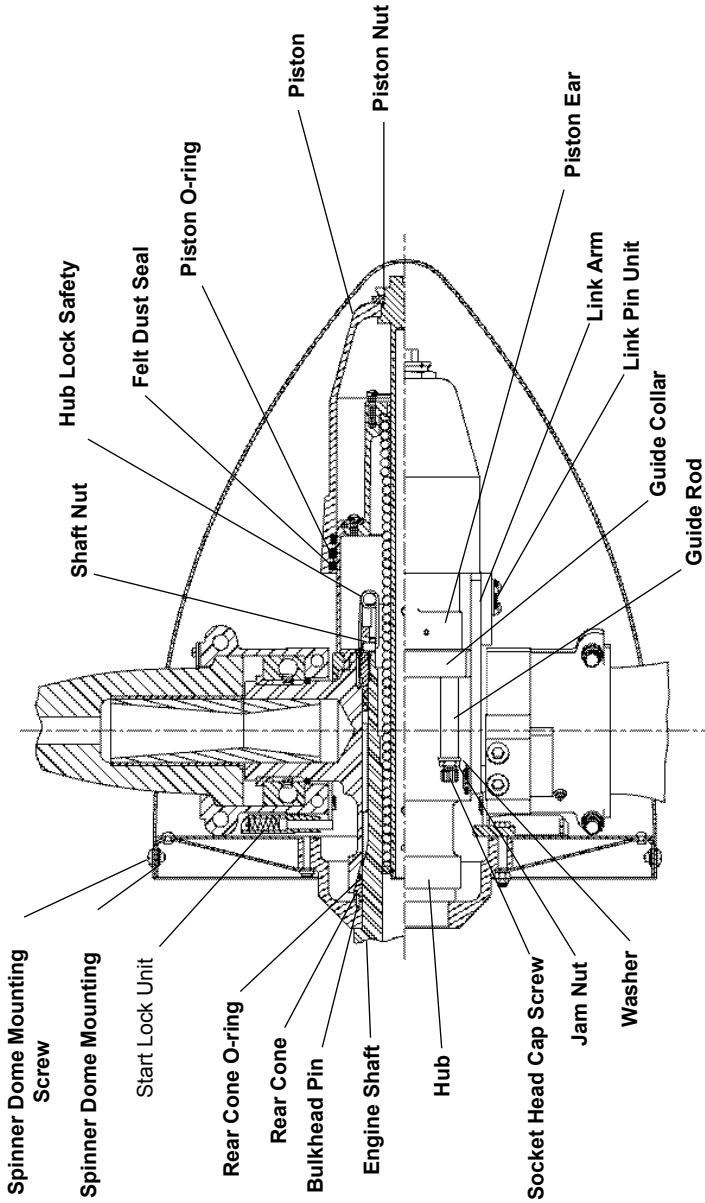
- (a) Carefully slide the spinner dome over the installed propeller.
- (b) Secure the spinner dome to the spinner bulkhead with the supplied screws and washers.

D-1350



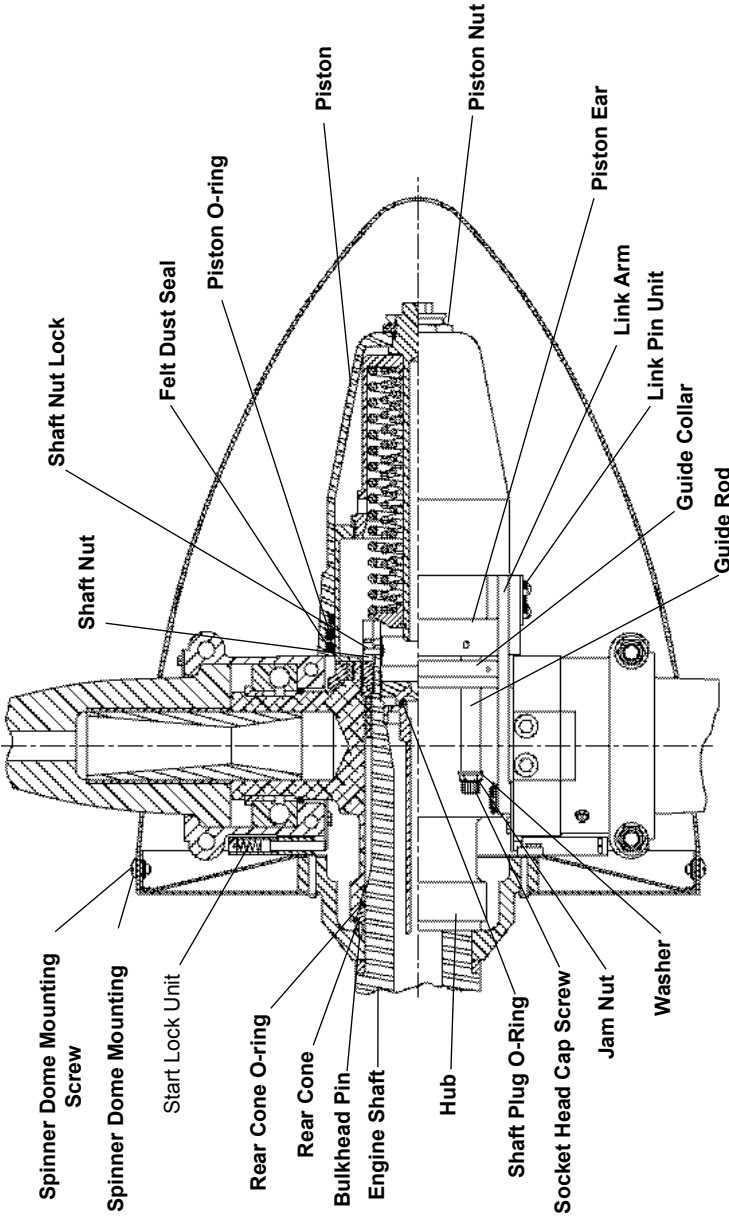
HC-93Z20-2A(1), -2B, -2C, -2D1 Propeller Assembly  
Figure 3-23

D-1396



HC-93Z20-2C1 Propeller Assembly  
Figure 3-24

D-1850



HC-93Z30-2E Propeller Assembly  
Figure 3-25



- L. Installing the 20 Spline HC-93Z20-2( ) and the 30 Spline HC-93Z30-2( ) Propeller Models

Refer to Figures 3-23 through 3-25.

**WARNING 1:** TO FACILITATE BOXING AND SHIPPING OF THE PROPELLER, THE PISTON NUT SHOULD HAVE BEEN REMOVED IN ORDER TO PERMIT ROTATING OF THE BLADES BEFORE PACKAGING.

FOR SAFETY REASONS, IF THE PISTON NUT WAS NOT REMOVED (HC-B3[ ]30-2E [ ] MODELS ONLY), THE PROPELLER MUST BE PUT IN FEATHER POSITION BEFORE IT IS INSTALLED ON THE AIRCRAFT.

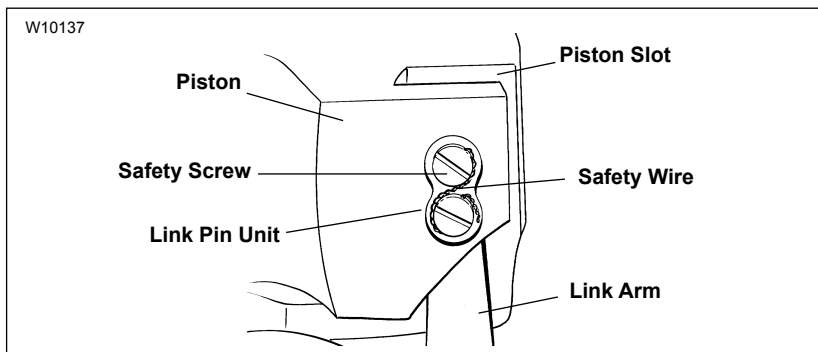
**WARNING 2:** MAKE SURE THE SLING IS RATED UP TO 800 LBS. (363 KG) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING INSTALLATION.

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

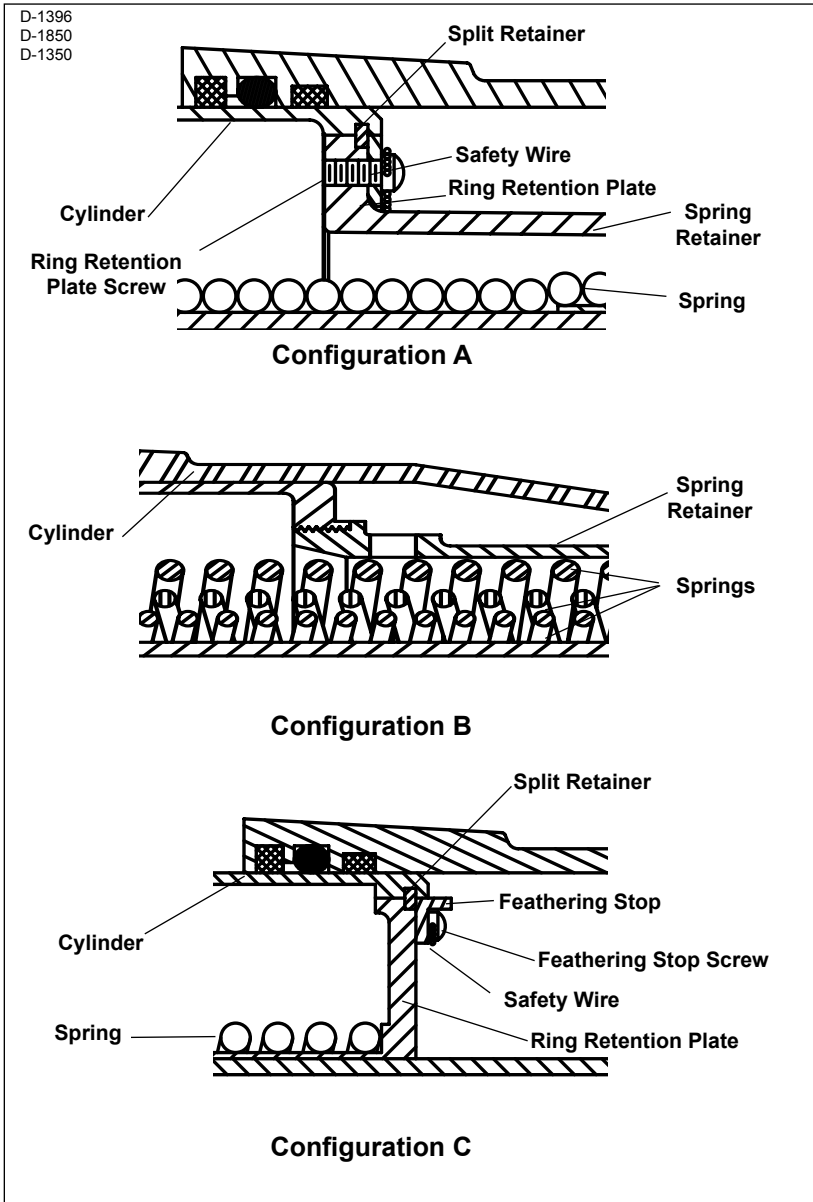
- (1) With a suitable crane hoist and sling, carefully move the propeller assembly to the aircraft engine shaft.

**CAUTION:** THE PISTON MUST BE REMOVED BEFORE INSTALLING THE PROPELLER ON THE AIRCRAFT. IF THE PISTON HAS ALREADY BEEN REMOVED, PROCEED TO STEP 4.K.(4).

- (2) Piston Removal (Refer to Figures 3-23 through 3-25).
- (a) Remove the piston nut (Table 3-1), if it was not previously removed to facilitate boxing and shipping of the propeller.
  - (b) Remove the safety wire (if installed) from the link pin units.
  - (c) Remove the safety screw from each link pin unit.
  - (d) Remove each link pin unit.
  - (e) The piston ears and guide collar should have corresponding index numbers (1, 2, and 3) impression stamped or marked with a felt-tipped pen. If they are not marked, number them with a felt-tipped pen.
- NOTE:** This will insure that the components are reassembled in their original location.
- (f) Slide the link arms out of the piston slots.
  - (g) Remove the socket head cap screw (Table 3-1), jam nut, and washer from each piston guide rod.
  - (h) Slide the piston off the cylinder.



**Piston-to-Link Arm Attachment Details**  
**Figure 3-26**



**Spring Assembly-to-Cylinder Attachment Details**  
**Figure 3-27**

APS0190  
APS0211

Spanner Wrench  
BT-461

NOTE: May use  
Strap Wrench  
100923 as alternate

Spring Retainer

Cylinder

Number  
51 Drill bit  
(0.067 inch  
[1.70 mm]  
diameter)

Safety-Wire

**Feathering Spring Assembly**  
**Figure 3-28**

**CAUTION:** THE SPRING ASSEMBLY MUST BE REMOVED BEFORE INSTALLING THE PROPELLER ON THE AIRCRAFT. IF THE SPRING ASSEMBLY HAS ALREADY BEEN REMOVED, PROCEED TO STEP 4.L.(5).

(3) Spring assembly removal

(a) Configuration A - Propeller model HC-93Z20-2C1

- 1 Remove the ring retention plate screw safety wire (if installed).
- 2 Remove the ring retention plate screws.
- 3 Remove the retention plate.
- 4 Remove the split retainer.
- 5 Remove the spring assembly from the cylinder.

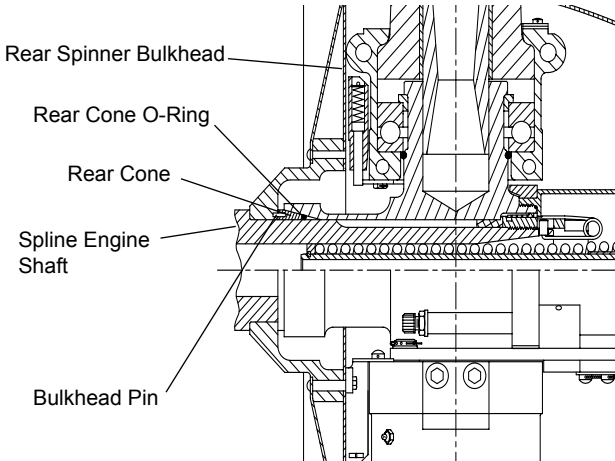
(b) Configuration B - Propeller model HC-93Z30-2E

- 1 Remove the safety wire (if installed).
- 2 Using a spanner wrench BT-461 or strap wrench 100923, unthread the spring retainer from the cylinder. Refer to Figure 3-28.
- 3 Remove the spring retainer and the attached spring assembly from the cylinder.

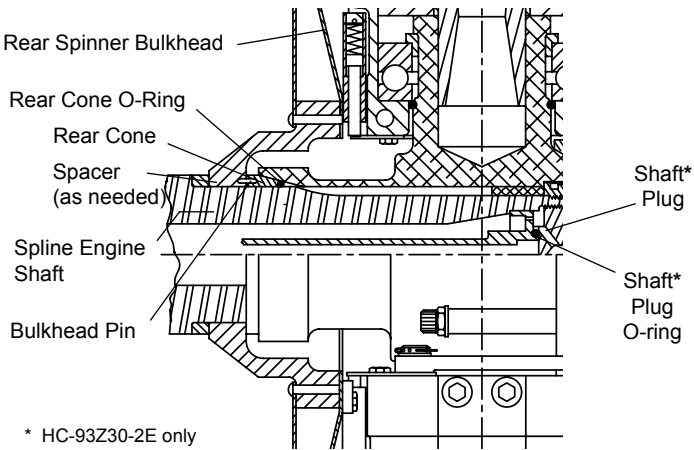
(c) Configuration C - Propeller models HC-93Z20-2A(1),-2B,-2C,-2D1, and HC-93Z30-2B

- 1 Remove the safety wire (if installed).
- 2 Remove two screws from each of two feather stops on the front spring retainer.
- 3 Remove the feather stops.
- 4 Remove the split retainer.
- 5 Remove the spring assembly from the cylinder.

D-1350  
D-1820



### 20 Spline Shaft Propellers



### 30 Spline Shaft Propellers

**Rear Hub Mounting Parts on 30-Spline Shaft Propeller  
Figure 3-29**

**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.

- (4) Clean the propeller hub spline and engine spline surfaces with Quick Dry Stoddard Solvent or MEK.
- (5) On 30 spline shaft models only, slide the spacers (as required) (Table 3-1) onto the shaft ( Figure 3-29).
- (6) Slide the spinner bulkhead onto the shaft.
- (7) Install the rear cone onto the bulkhead (Figure 3-29), matching the holes in the cone with the pins in the bulkhead.
- (8) Install the rear cone O-ring (Table 3-1) over the shaft and against the cone (Figure 3-23).
- (9) On HC-93Z30-2E propeller model only, install the plug O-ring (Table 3-1) in the groove of the shaft plug, and install the shaft plug and O-ring in the engine shaft. Refer to Figure 3-29.
- (10) Slide the propeller hub onto the shaft and tighten the shaft nut until the rear bulkhead is snug, but do not torque the nut.

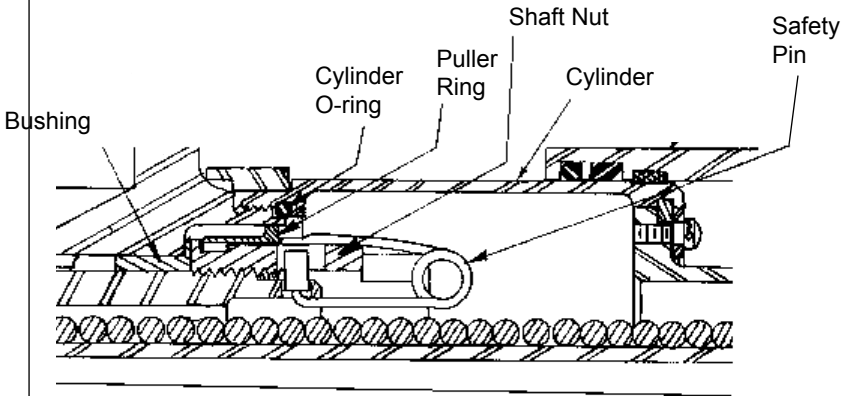
**CAUTION:**      TO PREVENT DAMAGE TO THE BLADE AND BLADE PAINT, WRAP THE BLADE SHANKS IN SEVERAL LAYERS OF MASKING OR DUCT TAPE BEFORE POSITIONING THE SPINNER BULKHEAD OR INSTALLING THE SPINNER DOME. REMOVE THE TAPE AFTER THE SPINNER IS INSTALLED.

- (11) Carefully slide the spinner dome over the installed propeller.
- (12) To properly position the rear bulkhead, temporarily install the spinner dome with at least three screws.

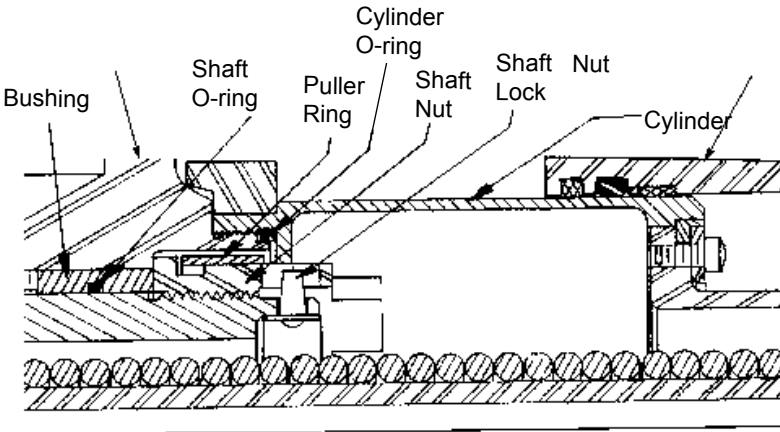
**NOTE:**      Make sure the start lock pins are parallel with the blade axis, but offset to one side.

- (13) Adjust the spinner to equalize the clearance between the blades and the blade cutouts in the dome.

W10135  
W10140



**Safety Pin on 20 Spline Shaft Models**



**Shaft Nut Lock on 30 Spline Shaft Models**

**Safelying the Shaft Nut on a Splined Shaft Propeller  
Figure 3-30**



- (14) Remove the spinner dome.
- (15) Using tool BST-2910, torque the propeller shaft nut (Table 3-1). Refer to Table 3-2 and Figure 3-5 to determine the proper torque value to which the torque wrench must be set.
- (16) Safety the shaft nut to the engine shaft using a hub lock safety pin (Table 3-1) for 20 spline models, or a shaft nut lock (Table 3-1) for 30 spline models. Refer to Figure 3-30.

NOTE: The hub lock safety pin or the shaft nut lock are normally supplied in a separate package when the propeller is shipped new from the factory.

- (17) Install the spring assembly (Refer to Figure 3-27).

(a) Configuration A - Propeller model HC-93Z20-2C1

- 1 Put the feathering spring assembly into the engine shaft, with the front spring retainer inside the cylinder.
- 2 Install the split retainer between the cylinder and the front spring retainer, sliding the split retainer into the recess in the cylinder.
- 3 Pull the spring retainer tight against the split retainer.
- 4 Install the ring retainer plate that secures the split retainer, into place.
- 5 Install the ring retention screws and tighten them until they are snug.
- 6 Safety the stop plate screws with 0.032 inch (0.81 mm) minimum diameter stainless steel wire (two per safety).

- (b) Configuration B - Propeller model HC-93Z30-2E
- 1 Insert the feathering spring assembly into the cylinder.
  - 2 Using a spanner wrench BT-461 (Figure 3-28) or strap wrench 100923, thread the feathering spring into place in the cylinder.
  - 3 Torque the feathering spring assembly. Refer to Table 3-2 and Figure 3-5 to determine the proper torque value to which the torque wrench must be set.
  - 4 Using a number 51 drill (0.067 inch [1.70 mm] diameter), drill a hole through the lip on the spring cup to line up with the slot in the cylinder (Figure 3-28).
  - 5 Insert 0.032 inch (0.81 mm) minimum diameter stainless steel wire through the hole in the spring cup, matching it with the slots in the cylinder (Figure 3-28).
- (c) Configuration C - Propeller models HC-93Z20-2A(1), -2B, -2C, -2D1, and HC-93Z30-2B
- 1 Put the feathering spring assembly into the engine shaft, with the front spring retainer inside the cylinder.
  - 2 Install the split retainer between the cylinder and the front spring retainer, sliding the split retainer into the recess in the cylinder.
  - 3 Locate the two feathering stops, on the front spring retainer, that secure the split retainer into place.
  - 4 Install the feathering stop retention screws and tighten them until they are snug.
  - 5 Safety the stop plate screws with 0.032 inch (0.81 mm) minimum diameter stainless steel wire (two per safety).

(18) If the piston O-ring (Table 3-1) and the felt dust seal are not already installed in the piston, perform the following steps. Refer to Figure 3-22.

- (a) Lubricate the piston O-ring and carefully install it in the groove provided for it in the piston.
- (b) Cut the oiled felt dust seal material to the necessary length.

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

- (c) Install the felt dust seal material in the groove provided for it in the piston.
- (d) Install the rod O-ring (Table 3-1) in the groove at the end of the threaded portion of the pitch change rod.

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

(19) Locate and match up the index numbers (1, 2 and 3) on the piston ears with the corresponding index numbers on the guide collar.

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

- (20) Oil the surface of the cylinder and install the piston.
- (21) Slide the piston onto the cylinder and pass the guide rods through the collar bushing.
- (22) Install the washer, socket head cap screw, and jam nut (Table 3-1), at the end of each guide rod (Figures 3-23 through 3-25).
- (23) Connect the link arms to the piston (Figure 3-26).
- (24) Install the link pin units (Figure 3-26).
- (25) Install the link pin safety screws (Figure 3-26).

- (26) Safety the two screws together with 0.032 inch (0.81 mm) minimum diameter stainless steel wire (Figure 3-26).
- (27) Carefully rotate the blades into feather position and fasten the piston to the pitch change rod with the piston nut (Table 3-1).
- (28) Torque the piston nut per Table 3-2.
- (29) Torque the jam nut against the guide rod. Refer to Table 3-2.
- (30) Remove the wires from the start lock brackets.
- (31) Position the propeller on the start locks.

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

- (32) Using the paddles, simultaneously rotate the blades toward low pitch until the start lock pins engage the stop plate.

(33) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller Inc., applicable instructions and technical information for the components supplied by Hartzell can be found in the following publications available on the Hartzell web site at [www.hartzellprop.com](http://www.hartzellprop.com).

- (a) Manual 180 (30-61-80) - Propeller Ice Protection System Manual
- (b) Manual 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual
- (c) Manual 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual
- (d) Manual 183 (61-12-83) - Propeller Anti-icing Boot Removal and Installation Manual

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

(35) Install the spinner dome as follows:

**NOTE:** The following instructions relate to Hartzell spinners only. In some cases, the airframe manufacturer produced the spinner assembly. In those cases, refer to the airframe manufacturer's manual for spinner installation instructions.

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

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

- (a) Carefully slide the spinner dome over the reassembled propeller.
- (b) Secure the spinner dome to the spinner bulkhead with the supplied screws and washers.

5. Post-Installation Checks
  - A. Refer to the airframe manufacturer's instructions for post-installation checks.
  - B. Perform a static RPM check as outlined in the Maintenance Practices chapter of this manual.

**6. Propeller Assembly Removal****A. Removing the F Flange Propeller Models****BHC-92( )F-1D1**

Refer to Figure 3-1.

**NOTE:** If the propeller is equipped with an anti-ice or a de-ice system, follow the manufacturer's instructions for removing the components necessary for propeller removal.

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

**(1) Spinner dome removal**

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

(b) Remove the spinner dome.

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

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

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

- (2) Support the propeller assembly with a sling.
- (3) Cut and remove the safety wire on the propeller mounting bolts.

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

- (4) Remove the propeller mounting bolts and washers.

**NOTE:** For propeller removals between overhaul intervals, mounting bolts and washers may be reused if they are not damaged or corroded.

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

- (5) Using the support sling, lift the propeller from the mounting flange.
- (6) Remove the spinner attaching nuts and bolts that hold the spinner bulkhead, spinner mounting ring, and spinner mounting plate together.
- (7) Remove the spinner bulkhead, spinner mounting ring, and spinner mounting plate.
- (8) Remove and discard the engine shaft O-ring.
- (9) Put the propeller and associated parts on a suitable cart for transportation.



- B. Removing the F Flange Propeller Models HC-92( )F-8( )  
Refer to Figure 3-4.

**NOTE:** If the propeller is equipped with an anti-ice or a de-ice system, follow the manufacturer's instructions for removing the components necessary for propeller removal.

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

- (1) Spinner dome removal

- (a) Remove the screws and washers that secure the spinner dome to the spinner bulkhead.  
(b) Remove the spinner dome.

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

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

- (2) Cut and remove the safety wire on the propeller mounting bolts.

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

(3) Support the propeller assembly with a sling.

**NOTE 1:** Supporting the propeller with the sling may be delayed until all but two mounting bolts and washers have been removed to permit propeller rotation for ease of nut removal.

**NOTE 2:** If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark on the propeller hub and a matching mark on the engine flange to make sure of proper orientation during re-installation to prevent dynamic imbalance.

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

(4) Remove the propeller mounting bolts and washers.

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

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

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

(6) Remove and discard the engine shaft O-ring.

(7) Put the propeller and associated parts on a suitable cart for transportation.

- C. Removing the K Flange Propeller Models HC-92( )K-1D and HC-92( )K-8( )  
Refer to Figure 3-4.

**NOTE:** If the propeller is equipped with an anti-ice or a de-ice system, follow the manufacturer's instructions for removing the components necessary for propeller removal.

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

(1) Spinner dome removal

- (a) Remove the screws and washers that secure the spinner dome to the spinner bulkhead.
- (b) Remove the spinner dome.

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

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

- (2) Cut and remove the safety wire on the propeller mounting bolts.

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

- (3) Support the propeller assembly with a sling.

**NOTE 1:** Supporting the propeller with the sling may be delayed until all but two mounting bolts and washers have been removed to permit propeller rotation for ease of nut removal.

**NOTE 2:** If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark on the propeller hub and a matching mark on the engine flange to make sure of proper orientation during re-installation to prevent dynamic imbalance.

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

- (4) Remove the propeller mounting bolts and washers.

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

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

- (5) Using the support sling, lift the propeller from the mounting flange.
- (6) Remove and discard the engine shaft O-ring.
- (7) Remove the shim.
- (8) Remove the fasteners that attach the spinner adaptor ring to the engine starter gear.

(9) Remove the spinner adapter ring from the engine starter gear.

(10) Put the propeller and associated parts on a suitable cart for transportation.

**D. Removing the F Flange Propeller Models HC-92ZF-2( ) and HC-93ZF-2( )**

Refer to Figures 3-7 and 3-8.

**NOTE:** If the propeller is equipped with an anti-ice or a de-ice system, follow the manufacturer's instructions for removing the components necessary for propeller removal.

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

(1) Spinner dome removal

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

(b) Remove the spinner dome.

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

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

**WARNING 3:** FOR SAFETY REASONS, THE PROPELLER MUST BE PUT IN THE FEATHER POSITION BEFORE IT IS REMOVED FROM THE AIRCRAFT.

- (2) Routine propeller engine shutdown will engage the start locks, preventing the propeller from feathering. For purposes of propeller removal, the propeller should be put in feather position during engine shutdown. If this was not accomplished, then the propeller may be feathered as follows:

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

- (a) Rotate the blades simultaneously to a slightly lower pitch to disengage the stop plates from the start locks.
- (b) Retract the start lock pins and hold them in place with a heavy wire inserted through the hole of each start lock housing.
- (c) Slowly and carefully permit the blades to rotate to high/feather pitch.
- (3) Cut and remove the safety wire on the propeller mounting bolts.

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

- (4) Support the propeller assembly with a sling.

NOTE 1: Supporting the propeller with the sling may be delayed until all but two mounting bolts and washers have been removed to permit propeller rotation for ease of nut removal.

NOTE 2: If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark on the propeller hub and a matching mark on the engine flange to make sure of proper orientation during re-installation to prevent dynamic imbalance.

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

- (5) Remove the propeller mounting bolts and washers.

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

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

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

- (7) Remove and discard the engine shaft O-ring.

- (8) Remove the spinner bulkhead, with the start locks attached.

- (9) Put the propeller and associated parts on a suitable cart for transportation.

- E. Removing the K Flange Propeller Models HC-92( )K-2( )  
Refer to Figure 3-7.

**NOTE:** If the propeller is equipped with an anti-ice or a de-ice system, follow the manufacturer's instructions for removing the components necessary for propeller removal.

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

(1) Spinner dome removal

- (a) Remove the screws and washers that secure the spinner dome to the spinner bulkhead.
- (b) Remove the spinner dome.

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

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

**WARNING 3:** FOR SAFETY REASONS, THE PROPELLER MUST BE PUT IN THE FEATHER POSITION BEFORE IT IS REMOVED FROM THE AIRCRAFT.



- (2) Routine propeller engine shutdown will engage the start locks, preventing the propeller from feathering. For purposes of propeller removal, the propeller should be put in feather position during engine shutdown. If this was not accomplished, then the propeller may be feathered as follows:

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

- (a) Rotate the blades simultaneously to a slightly lower pitch to disengage the stop plates from the start locks.
- (b) Retract the start lock pins and hold them in place with a heavy wire inserted through the hole of each start lock housing.
- (c) Slowly and carefully permit the blades to rotate to high/feather pitch.
- (3) Cut and remove the safety wire on the propeller mounting bolts.

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

- (4) Support the propeller assembly with a sling.

**NOTE 1:** Supporting the propeller with the sling may be delayed until all but two mounting bolts and washers have been removed to permit propeller rotation for ease of nut removal.

**NOTE 2:** If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark on the propeller hub and a matching mark on the engine flange to make sure of proper orientation during re-installation to prevent dynamic imbalance.

- (5) Remove the start lock brackets to access the mounting bolts.

**NOTE:** It is not necessary to remove the wire that is holding the start lock pin in place.

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

- (6) Remove the propeller mounting bolts and washers.

**NOTE:** For propeller removals between overhaul intervals, mounting bolts and washers may be reused if they are not damaged or corroded.

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

- (7) Using the support sling, lift the propeller from the mounting flange.
- (8) Remove and discard the shaft O-ring.
- (9) Remove the shim.
- (10) Remove the fasteners that attach the spinner adapter ring to the engine starter gear.
- (11) Remove the spinner adapter ring from the engine starter gear.
- (12) Remove the spinner bulkhead.
- (13) Put the propeller and associated parts on a suitable cart for transportation.

- F. Removing the F Flange Propeller Models (B)HC-92( )F-3  
Refer to Figure 3-10.

**NOTE:** If the propeller is equipped with an anti-ice or a de-ice system, follow the manufacturer's instructions for removing the components necessary for propeller removal.

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

- (1) Spinner dome removal
  - (a) Remove the screws and washers that secure the spinner dome to the spinner bulkhead.
  - (b) Remove the spinner dome.
- (2) Disconnect the propeller beta ring from the carbon block assembly and lever. Refer to Figure 3-16.
  - (a) Disconnect the outer end of the lever from the control push-pull fitting.
  - (b) Disconnect the lever from the beta valve spool.
  - (c) Remove the carbon block assembly and lever from the beta ring.

**NOTE:** Replace the carbon block unit at overhaul, or if the side clearance between the beta ring and carbon block exceeds 0.010 inch (0.25 mm).

- (d) If the propeller is equipped with an anti-ice or a de-ice system, follow the manufacturer's instructions for removing the components necessary for propeller removal.

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

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

(3) Cut and remove the safety wire on the propeller mounting bolts.

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

(4) (3) Support the propeller assembly with a sling.

NOTE 1: Supporting the propeller with the sling may be delayed until all but two mounting bolts and washers have been removed to permit propeller rotation for ease of nut removal.

NOTE 2: If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark on the propeller hub and a matching mark on the engine flange to make sure of proper orientation during re-installation to prevent dynamic imbalance.

(5) Cut and remove the safety wire on the propeller mounting bolts or mounting nuts.

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

(6) Remove the propeller mounting bolts and washers.

NOTE 1: On propeller model HC-92WF-3 when installed on a TSIO-520-C engine, remove the mounting nuts and washers from the mounting studs.

NOTE 2: When the propeller is removed between overhaul intervals, mounting bolts and washers may be reused if they are not damaged or corroded.

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

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

(8) Remove and discard the engine flange O-ring.

(9) On propeller model HC-92WF-3 when installed on a TSIO-520-C engine only, remove the spacer from the engine flange.

(10) Remove and discard the propeller flange O-ring.

(11) Decompress and remove the beta system puller.

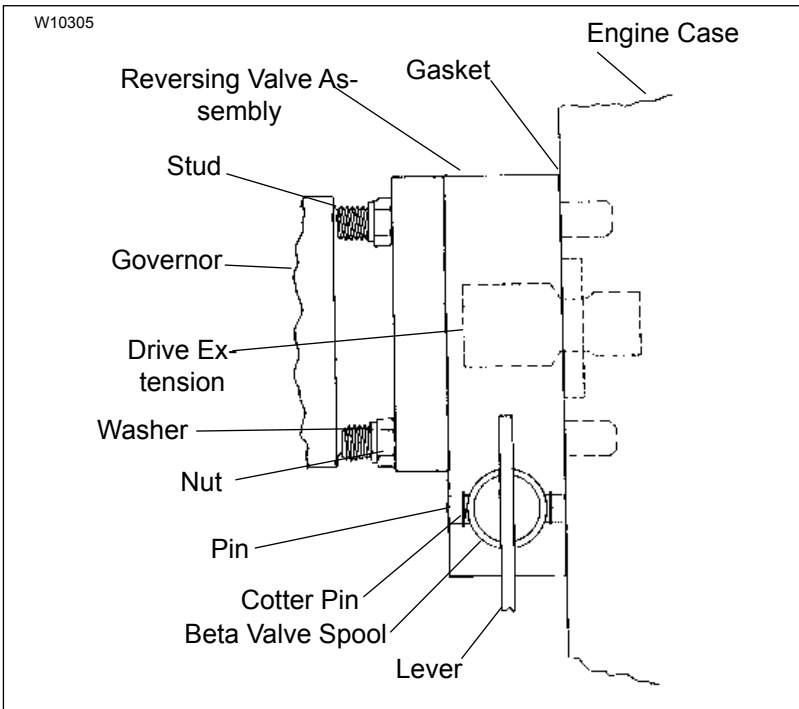
(12) Put the propeller and associated parts on a suitable cart for transportation.

### (13) Reversing (beta) system and governing hardware removal

**NOTE:** The lever was previously disconnected from the cockpit control and beta valve spool. The lever and carbon block assembly were previously removed from the beta ring to permit propeller removal.

Refer to Figure 3-31

- (a) Disconnect the governor RPM control cable from the cockpit.
- (b) Remove the nuts that secure the governor and beta valve to the engine.



**Reversing (Beta) System and Governing Hardware  
Figure 3-31**

- (c) Remove the drive extension between the engine drive and the governor.
- (d) Remove the governor gasket from between the valve face and the governor.
- (e) Remove the beta valve unit.
- (f) Remove the governor gasket from between the engine pad and governor.
- (g) Remove the snap ring that retains the carbon block assembly to the lever (Figure 3-15).

- G. Removing the F Flange Propeller Models  
BHC-92(W,Z)F-3(L)G  
Refer to Figure 3-17.

**NOTE:** If the propeller is equipped with an anti-ice or a de-ice system, follow the manufacturer's instructions for removing the components necessary for propeller removal.

- (1) Disconnect the propeller beta ring from the carbon block assembly and lever.
- (a) Disconnect the outer end of the lever from the control push-pull fitting.
  - (b) Disconnect the lever from the beta valve spool.
  - (c) Remove the carbon block assembly and lever from the beta ring.

**NOTE:** Replace the carbon block unit at overhaul, or if the side clearance between the beta ring and carbon block exceeds 0.010 inch (0.25 mm).

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

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



- (2) Cut and remove the safety wire on the propeller mounting bolts.
- (3) Use a beta system puller CST-2987 to compress the beta system spring and pull the beta ring forward to expose the propeller mounting nuts.

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

- (4) Support the propeller assembly with a sling.

**NOTE 1:** Supporting the propeller with the sling may be delayed until all but two mounting bolts and washers have been removed to allow rotating the propeller for ease of nut removal.

**NOTE 2:** If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark on the propeller hub and a matching mark on the engine flange to ensure proper orientation during re-installation to prevent dynamic imbalance.

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

- (5) Remove the propeller mounting nuts and washers.

**NOTE:** For propeller removals between overhaul intervals, mounting studs and washers may be reused if they are not damaged or corroded.

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

- (6) Using the support sling, lift the propeller from the mounting flange.
- (7) Remove and discard the engine flange O-ring.
- (8) Remove the adapter pulley with attached fan assembly from the propeller mounting studs.

- (9) Remove and discard the propeller flange O-ring.
- (10) Decompress and remove the beta system puller.
- (11) Put the propeller and associated parts on a suitable cart for transportation.
- (12) Reversing (beta) system and governing hardware removal

NOTE: The lever was previously disconnected from the cockpit control and beta valve spool. The lever and carbon block assembly were previously removed from the beta ring to permit propeller removal.

Refer to Figure 3-31

- (a) Disconnect the governor RPM control cable from the cockpit.
- (b) Remove the nuts that secure the governor and beta valve to the engine.
- (c) Remove the drive extension between the engine drive and the governor.
- (d) Remove the governor gasket from between the valve face and the governor.
- (e) Remove the beta valve unit.
- (f) Remove the governor gasket from between the engine pad and governor.
- (g) Remove the snap ring that retains the carbon block assembly to the lever (Figure 3-15).

- H. Removing the F Flange Propeller Model HC-92WF-5A  
Refer to Figure 3-19.

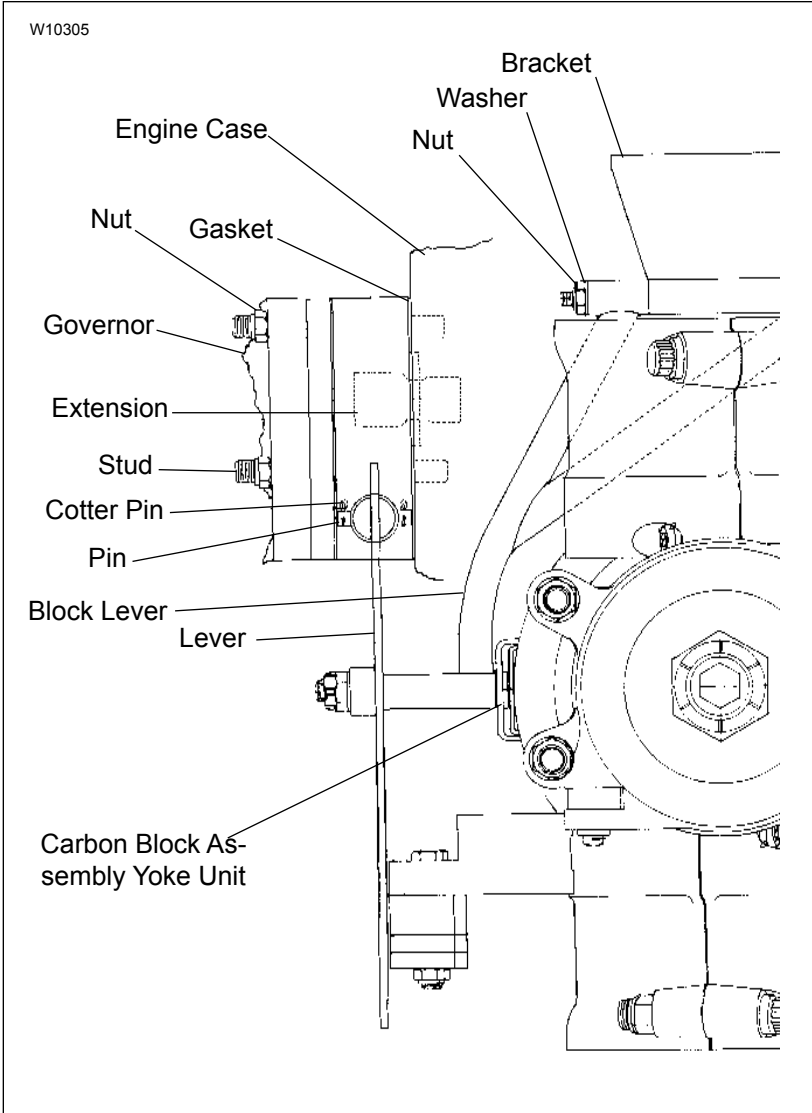
**WARNING:** FOR SAFETY REASONS, THE PROPELLER MUST BE PUT IN THE FEATHER POSITION BEFORE IT IS REMOVED FROM THE AIRCRAFT.

- (1) Routine propeller engine shutdown will engage the start locks, preventing the propeller from feathering. For purposes of propeller removal, the propeller should be put in feather position during engine shutdown. If this was not accomplished, then the propeller may be feathered as follows:

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

- (a) Rotate the blades simultaneously to a slightly lower pitch to disengage the stop plates from the start locks.
- (b) Retract the start lock pins and hold them in place with a heavy wire inserted through the hole of each start lock housing.
- (c) Slowly and carefully permit the blades to rotate to high/feather pitch.

**NOTE:** If the propeller is equipped with an anti-ice or a de-ice system, follow the manufacturer's instructions for removing the components necessary for propeller removal.



**Disconnecting the Beta Ring  
Figure 3-32**

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

- (2) Spinner dome removal
  - (a) Remove the screws and washers that secure the spinner to the spinner bulkhead.
  - (b) Remove the spinner dome.
- (3) Disconnect the propeller beta ring from the carbon block assembly and lever. Refer to Figure 3-32.
  - (a) Disconnect the outer end of the lever from the control push-pull fitting.
  - (b) Disconnect the lever from the beta valve spool and block assembly.
  - (c) Remove the lever.
  - (d) Remove the bolt, nut, and washer that connect the block lever to the bracket that is attached to the engine.
  - (e) Remove the block lever and carbon block assembly from the beta ring.
  - (f) Slide the carbon block assembly out of the block lever.
- (4) Remove the safety wire from the beta linkage.
- (5) Remove the beta linkage.
- (6) Remove the carbon block assembly from the beta ring.

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

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

- (7) Cut and remove the safety wire on the propeller mounting bolts.
- (8) Use a beta system puller CST-2987 to compress the beta system spring and pull the beta ring forward to expose the propeller mounting bolts and washers.

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

- (9) Support the propeller assembly with a sling.

NOTE 1: Supporting the propeller with the sling may be delayed until all but two mounting bolts and washers have been removed to permit propeller rotation for ease of nut removal.

NOTE 2: If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark on the propeller hub and a matching mark on the engine flange to make sure of proper orientation during re-installation to prevent dynamic imbalance.

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

(10) Remove the propeller mounting bolts and washers.

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

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

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

(12) Remove and discard the engine flange O-ring.

(13) Decompress and remove the beta system puller.

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

(15) Reversing (beta) system and governing hardware removal

**NOTE:** The lever was previously disconnected from the cockpit control and beta valve spool. The lever and carbon block assembly were previously removed from the beta ring to permit propeller removal.

Refer to Figure 3-32

- (a) Disconnect the governor RPM control cable from the cockpit.
- (b) Remove the nuts that secure the governor and beta valve to the engine.
- (c) Remove the drive extension between the engine drive and the governor.
- (d) Remove the governor gasket from between the valve face and the governor.
- (e) Remove the beta valve unit.
- (f) Remove the governor gasket from between the engine pad and governor.
- (g) Remove the snap ring that retains the carbon block assembly to the lever (Figure 3-15).

- I. Removing the 20 Spline Propeller Models HC-93Z20-1( )  
Refer to Figure 3-21.

**NOTE:** If the propeller is equipped with an anti-ice or a de-ice system, follow the manufacturer's instructions for removing the components necessary for propeller removal.

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

- (1) Spinner dome removal

- (a) Remove the screws and washers that secure the spinner dome to the spinner bulkhead.
- (b) Remove the spinner dome.

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

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



**CAUTION 1:** OIL WILL FLOW OUT OF THE PROPELLER WHEN THE PISTON IS REMOVED. PUT A DRIP PAN UNDER THE PROPELLER TO CATCH THE EXCESS OIL.

**CAUTION 2:** USING A FELT-TIPPED PEN, IDENTIFY EACH PISTON ROD AND ITS COMPONENTS WITH A CORRESPONDING LETTER. THIS WILL INSURE THAT THE COMPONENTS ARE REASSEMBLED ON THE PISTON ROD FROM WHICH THEY WERE REMOVED.

- (2) Piston Removal (Refer to Figure 3-21.)
  - (a) Remove the self-locking nut from each piston rod.
  - (b) Loosen the set screw in each fork.
  - (c) Remove the washer from each piston rod.
  - (d) Slide the piston away from the hub and to the low pitch position, until the piston rods clear the bulkhead and forks.
  - (e) Remove the pitch change block from each clamp linkscrew.
  - (f) The piston ears and guide collar should have corresponding index numbers (1, 2, and 3) impression stamped or marked with a felt-tipped pen. If they are not marked, number them with a felt-tipped pen.

**NOTE:** This will insure that the components are reassembled in their original location.
  - (g) Slide the piston off the cylinder.
  - (h) To prevent the loss of the sleeve, fork, and high pitch stop spacers, reinstall the self-locking nut on each piston rod.
- (3) Remove the hub lock safety pin. Refer to Figure 3-30.

- (4) Completely loosen the hub nut from the engine shaft threads.

**NOTE 1:** If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark on the propeller hub and a matching mark on the engine flange to make sure of proper orientation during re-installation to prevent dynamic imbalance.

**NOTE 2:** Because the shaft nut is pulling the propeller hub off the tapered rear cone, there will be significant resistance to the loosening of the shaft nut.

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

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

- (5) Using the support sling, slide the propeller from the engine splined shaft and lift the propeller from the engine.
- (6) Remove and discard the rear cone O-ring.
- (7) Put the propeller and associated parts on a suitable cart for transportation.

- J. Removing the 20 Spline HC-93Z20-2( ) and the 30 Spline HC-93Z30-2( ) Propeller Models  
Refer to Figures 3-23 through 3-25.

**NOTE:** If the propeller is equipped with an anti-ice or a de-ice system, follow the manufacturer's instructions for removing the components necessary for propeller removal.

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

(1) Spinner dome removal

- (a) Remove the screws and washers that secure the spinner dome to the spinner bulkhead.
- (b) Remove the spinner dome.

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

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

**WARNING 3:** FOR SAFETY REASONS, THE PROPELLER MUST BE PUT IN THE FEATHER POSITION BEFORE IT IS REMOVED FROM THE AIRCRAFT.

- (2) Routine propeller engine shutdown will engage the start locks, preventing the propeller from feathering. For purposes of propeller removal, the propeller should be put in feather position during engine shutdown. If this was not accomplished, then the propeller may be feathered as follows:

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

- (a) Rotate the blades simultaneously to a slightly lower pitch to disengage the stop plates from the start locks.
- (b) Retract the start lock pins and hold them in put with a heavy wire inserted through the hole of each start lock housing.
- (c) Slowly and carefully permit the blades to rotate to high/feather pitch.
- (3) Piston removal (Refer to figures 3-23 through 3-25)
- (a) Remove the piston nut.
- (b) Remove the safety wire from the link pin units.
- (c) Remove the safety screws from each link pin unit.
- (d) Remove each link pin unit.
- (e) The piston ears and guide collar should have corresponding index numbers (1, 2, and 3) impression stamped or marked with a felt-tipped pen. If they are not marked, number them with a felt-tipped pen.

**NOTE:** This will make sure that the components are reassembled in their original location.

- (f) Remove the socket head cap screw, jam nut, and washer from each piston guide rod.
- (g) Slide the piston off the cylinder.
- (4) Spring assembly removal (Refer to Figure 3-28)
  - (a) Configuration A - Propeller model HC-93Z20-2C1
    - 1 Remove the safety wire from the ring retention plate screws.
    - 2 Remove the ring retention plate screws.
    - 3 Remove the ring retention plate.
    - 4 Remove the spring retainer.
    - 5 Remove the split retainer from the recess in the cylinder.
    - 6 Remove the spring assembly from the cylinder.
  - (b) Configuration B - Propeller model HC-93Z30-2E
    - 1 Remove the safety wire from the spring cup and cylinder (Figure 3-28).
    - 2 Using a spanner wrench BT-461 (Figure 3-28) or strap wrench 100923 unthread the spring retainer and feathering spring assembly from the cylinder.
    - 3 Remove the feathering spring assembly from the cylinder.
  - (c) Configuration C - Propeller models HC-93Z20-2A(1),-2B,-2C,-2D1, and HC-93Z30-2B
    - 1 Remove the safety wire from the stop plate screws.
    - 2 Remove the feathering stop retention screws.
    - 3 Remove the feathering stops.
    - 4 Remove the split retainer from the recess in the cylinder.
    - 5 Remove the spring assembly from the cylinder.
- (5) Remove the hub lock safety pin (20 spline models) or the shaft nut lock (30 spline models). Refer to Figure 3-30.
- (6) Support the propeller assembly with a sling.

- (7) Using tool BST-2910, completely loosen the shaft nut from the engine shaft threads.

**NOTE 1:** If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark on the propeller hub and a matching mark on the engine flange to make sure of proper orientation during re-installation to prevent dynamic imbalance.

**NOTE 2:** Because the shaft nut is pulling the propeller hub off the tapered rear cone, there will be significant resistance to the loosening of the shaft nut.

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

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

- (8) On HC-93Z30-2E only, remove the shaft plug and shaft plug O-ring from the engine shaft.
- (9) Using the support sling, slide the propeller from the engine splined shaft and lift the propeller from the engine.
- (10) Remove and discard the rear cone O-ring on the engine splined shaft.
- (11) Remove the rear cone.
- (12) Remove the spinner bulkhead.
- (13) Put the propeller and associated parts on a suitable cart for transportation.

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**1. Operational Tests**

Following propeller installation, and before flight, the propeller hydraulic system must be purged of air and proper operation verified.

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

**A. Initial Run-Up**

- (1) Perform engine start and warm-up per the Pilot's Operating Handbook (POH).
- (2) Cycle the propeller control throughout its operating pitch range from low to high (or as directed by the POH).
- (3) Repeat this procedure at least three times to purge air from the propeller hydraulic system and to introduce warmed oil to the cylinder.

**NOTE:** Pitch change response on the first operation from low to high blade angle may be slow, but should speed up on the second and third cycles.

- (4) Verify proper operation from low pitch to high pitch and throughout operating range.
- (5) Shut down the engine in accordance with the POH.

**NOTE:** Air trapped in the propeller hydraulic system will cause the pitch control to be imprecise and may result in propeller surging.

**B. 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 governor Maximum RPM Stop 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 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 Testing and Troubleshooting chapter and perform the adjustments under Max. RPM (Static) Low Pitch Stop Adjustment.
- (7) Stop the engine.
- (8) Return the governor Maximum RPM Stop to the original position, or adjust the governor to the rated RPM with the Maximum RPM Stop screw.

C. Post-Run Check

After engine shutdown, check the propeller for signs of engine oil leakage.

2. Propeller Ice Protection Systems

A. Electric De-ice System

- (1) Consult the Pilot Operating Handbook (including all supplements) regarding flight into conditions of known icing. The aircraft may not be certified for flight in known icing conditions, even though propeller de-ice equipment is installed.
- (2) Refer to the Anti-ice and De-ice Systems chapter of this manual for functional tests of the de-ice system.

B. Anti-ice System

- (1) Consult the Pilot Operating Handbook (including all supplements) regarding flight into conditions of known icing. The aircraft may not be certified for flight in known icing conditions, even though propeller anti-ice equipment is installed.
- (2) Refer to the Anti-ice and De-ice Systems chapter of this manual for functional tests of the anti-ice system.

**3. Troubleshooting****A. Incorrect Maximum RPM (on Ground)**

- (1) Incorrect maximum RPM on the ground may be caused by low engine power, and incorrect governor maximum RPM stop setting, or an incorrect propeller low pitch stop.

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

- (2) Perform a check as described in the Maximum RPM Check (On Ground) procedure in the Maintenance Practices chapter of this manual.

(3) Maximum RPM is Low

(a) Engine power is low

- 1 Follow aircraft POH and/or AMM recommended checks to determine if the engine power is low.
- 2 If the engine power is low, refer to a certificated engine repair station or the engine manufacturer.

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

(4) Maximum RPM is High

(a) Engine power is high

- 1 Follow the aircraft POH and/or AMM recommended engine checks to determine if the engine power is high.
- 2 If the engine power is high, refer to an appropriately licensed engine repair station or to the engine manufacturer.

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

- (5) Governor maximum RPM stop setting
  - (a) When RPM is high, both the governor maximum RPM stop and the propeller low pitch blade angle are improperly adjusted.
  - (b) Adjust the governor maximum RPM stop to obtain the rated maximum RPM.
  - (c) For low pitch setting verification refer to the procedures in the Maintenance Practices chapter of this manual.

## B. Hunting and Surging

Hunting is characterized by a cyclic variation in engine speed above and below desired speed. Surging is characterized by a large increase/decrease in engine speed, followed by a return to set speed after one or two occurrences.

- (1) If propeller is hunting, a repair facility should check:
  - (a) Governor
  - (b) Fuel control
  - (c) Synchrophaser, or synchronizer.
- (2) If propeller is surging:
  - (a) Perform the steps 1.A.(1)-(5) under Operational Tests section in this chapter to release trapped air from the propeller. If surging reoccurs it is most likely due to a faulty governor.
  - (b) Hunting and/or surging may also be caused by friction or binding within the governor control, or internal propeller corrosion, which causes the propeller to react slower to governor commands.

**NOTE:** The governor must be tested on a test bench at an appropriately licensed propeller repair facility to isolate these faults.
  - (c) Hunting and/or surging on reversing propellers (propeller models [B]HC-92[ ]F-3[ ] and HC-92WF-5A) when operating at or near low pitch may be caused by excessive side clearance between the beta ring and the carbon block assembly. For side clearance limits, refer to Carbon Block Assemblies in the Maintenance Practices chapter of this manual.

- C. Engine Speed Varies with Airspeed
- (1) A constant speed propeller will experience some small variances in engine speed that are normal and are no cause for concern.
  - (2) Increase in engine speed while descending or increasing airspeed:
    - (a) HC-92( )(-)8( ) propeller models:
      - 1 Governor is not increasing oil volume in the propeller.
      - 2 Engine oil transfer bearing is leaking excessively.
      - 3 Excessive friction in the blade bearings, in the pitch change mechanism, or in the misalignment between the guide collar and the piston rods.
    - (b) (B)HC-92( )F-1( ), HC-92( )K-1( ), HC-93Z20-1( ), HC-92( )(-)2( ), HC-93( )(-)2( ), (B)HC-92( )F-3( ), and HC-92WF-5A propeller models:
      - 1 Governor is not reducing oil volume in the propeller.
      - 2 Excessive friction in the blade bearings or the pitch change mechanism.
      - 3 Excessive friction in the misalignment between the guide collar and the piston rods.
  - (3) Decrease in engine speed while increasing airspeed:
    - (a) HC-92( )(-)8( ) propeller models:
      - 1 Governor pilot valve is stuck and is excessively increasing oil volume.
    - (b) (B)HC-92( )F-1( ), HC-92( )K-1( ), HC-93Z20-1( ), HC-92( )(-)2( ), HC-93( )(-)2( ), (B)HC-92( )F-3( ), and HC-92WF-5A propeller models:
      - 1 Governor pilot valve is stuck and is excessively decreasing oil volume.
      - 2 Feathering command is engaged on the propeller pitch control - HC-92( )(-)2( ), HC-93( )(-)2( ), (B)HC-92( )F-3( ), and HC-92WF-5A propeller models only.

- (4) Increase in engine speed while decreasing airspeed:
  - (a) HC-92( )(-)8( ) propeller models:
    - 1 Governor pilot valve is stuck and is excessively decreasing oil volume in the propeller.
  - (b) (B)HC-92( )F-1( ), HC-92( )K-1( ), HC-93Z20-1( ), HC-92( )(-)2( ), HC-93( )(-)2( ), (B)HC-92( )F-3( ), and HC-92WF-5A propeller models:
    - 1 Governor pilot valve is stuck and is excessively increasing oil volume.
- (5) Decrease in engine speed while decreasing airspeed:
  - (a) HC-92( )(-)8( ) propeller models:
    - 1 Governor is not reducing oil volume in the propeller.
    - 2 Excessive friction in the blade bearings or pitch change mechanism.
  - (b) (B)HC-92( )F-1( ), HC-92( )K-1( ), HC-93Z20-1( ), HC-92( )(-)2( ), HC-93( )(-)2( ), (B)HC-92( )F-3( ), and HC-92WF-5A propeller models:
    - 1 Governor is not increasing oil volume in the propeller.
    - 2 Engine oil transfer bearing is leaking excessively.
    - 3 Excessive friction in the blade bearings or the pitch change mechanism.
- D. Loss of Propeller Control - HC-92( )(-)8( ) Propeller Models:
  - (1) Propeller goes to uncommanded low pitch (high RPM)
    - (a) Loss of propeller oil pressure - check:
      - 1 Governor pressure relief valve for proper operation.
      - 2 Governor pilot valve sticking.
      - 3 Governor drive for damage.
      - 4 Adequate engine oil supply.
      - 5 Engine oil transfer bearing for excessive leakage.
  - (2) Propeller goes to uncommanded high pitch (low RPM)
    - (a) Governor pilot valve sticking.

- (3) RPM increases with power and airspeed, propeller RPM control has little or no effect.
  - (a) Excessive friction in blade bearings or pitch change mechanism.
  - (b) Misalignment between the guide collar and piston rods.
- E. Loss of Propeller Control - (B)HC-92( )F-1( ), HC-92( )K-1( ), HC-93Z20-1( ), HC-92( )(-)2( ), HC-93( )(-)2( ), (B)HC-92( )F-3( ), and HC-92WF-5A Propeller Models:
  - (1) Propeller goes to uncommanded high pitch (or feather)
    - (a) Loss of propeller oil pressure - check:
      - 1 Governor pressure relief valve for proper operation.
      - 2 Governor drive for damage.
      - 3 Adequate engine oil supply.
      - 4 Engine oil transfer bearing for excessive leakage.
    - (b) Start locks not engaging -HC-9( )(-)2( ) and HC-92WF-5A propeller models only.
  - (2) Propeller goes to uncommanded low pitch (high RPM)
    - (a) Governor pilot valve sticking.
  - (3) RPM increases with power and airspeed, propeller RPM control has little or no effect.
    - (a) Excessive friction in blade bearings or pitch change mechanism.
    - (b) Excessive friction in misalignment between the guide collar and the piston rods.
    - (c) Broken spring.
      - NOTE 1:** Propeller models (B)HC-92( )F-1( ), HC-92( )K-1( ) and HC-93Z20-1( ) do not have a spring.
      - NOTE 2:** Refer to the propeller assembly figures in the Description and Operation chapter of this manual to determine if a spring is installed.

- F. Failure to Feather or Feathers Slowly - HC-92( )(-)2( ), HC-93( )(-)2( ), and HC-92WF-5A Propeller Models:
- (1) Broken feathering spring.
  - (2) Check for proper function and rigging of propeller/governor control linkage.
  - (3) Check governor drain function.
  - (4) Propeller must be checked for misadjustment or internal corrosion (usually in blade bearings or pitch changing mechanism) that results in excessive friction. This must be accomplished at an appropriately licensed propeller repair facility.
- G. Failure to Unfeather - HC-92( )(-)2( ), HC-93( )(-)2( ), and HC-92WF-5A propeller models.
- (1) Check for proper function and rigging of the propeller control linkage to the governor.
  - (2) Check governor function.
  - (3) Check for excessive oil leakage at engine oil transfer bearing.
  - (4) Propeller must be checked for misadjustment or internal corrosion (usually in blade bearings or pitch change mechanism) that results in excessive friction. This must be accomplished at an appropriately licensed propeller repair facility.



- H. Start Locks (Anti-Feather Latches) Fail to Engage on Shutdown - HC-9( ) ( )-2( ) ( ) and HC-92WF-5A Propellers:  
Refer to the propeller assembly figures in the Description and Operation chapter of this manual to determine if start locks are installed.

- (1) Propeller was feathered before shutdown.

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

- (a) Using the blade paddles, simultaneously rotate the blades toward low pitch until the start lock pins engage a clamp mounted stop plate.

- (2) Shutdown occurred at high RPM with the propeller control set for coarse blade angle or low RPM.

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

Using the blade paddles, simultaneously rotate the blades toward low pitch until the start lock pins engage a clamp mounted stop plate.

- (3) Excessive engine oil transfer bearing leakage.  
Refer to an appropriately licensed propeller repair facility.
- (4) Excessive governor pump leakage.  
Refer to an appropriately licensed propeller repair facility.
- (5) Broken start locks.  
Refer to an appropriately licensed propeller repair facility.

**I. Vibration**

**CAUTION:** ANY VIBRATION THAT CAN BE DESCRIBED AS APPEARING SUDDENLY, OR IS ACCOMPANIED BY UNEXPLAINED GREASE LEAKAGE, SHOULD BE INVESTIGATED IMMEDIATELY, BEFORE FURTHER FLIGHT.

**NOTE:** Vibration problems due to propeller system imbalance are normally felt throughout the RPM range, with the intensity of vibration increasing with RPM. Vibration problems that occur in a narrow RPM range are a symptom of resonance, which is potentially harmful to the propeller. Avoid operation until the propeller can be checked by an appropriately licensed propeller repair facility.

**(1) Check:**

- (a) Control surfaces, cowl flaps, exhaust system, landing gear doors, etc. for excessive play, which may be causing vibration unrelated to the propeller.
- (b) Secure attachment of engine mounted hardware.
- (c) Engine mount wear.
- (d) Uneven lubrication of propeller.
- (e) Proper engine/propeller flange mating.
- (f) Blade track. (For procedure, refer to the Inspection and Check chapter of this manual.)
- (g) Blade angles: Blade angle must be within 0.2 degree from blade to blade.
- (h) Spinner for cracks, improper installation, or "wobble" during operation.
- (i) Static balance.
- (j) Airfoil profile identical between blades (after overhaul or rework for nicks - verify at propeller repair station).
- (k) Hub, blade or blade clamp for damage or cracking.
- (l) Grease or oil leakage from a seemingly solid surface of the hub, blade clamp or blade.

(m) Blade deformation.

**NOTE:** Dynamic balancing is recommended after installing or performing maintenance on a propeller. While normally an optional task, it may be required by the engine or airframe manufacturer to make certain the propeller/engine combination is balanced within close tolerances before operation. Refer to the engine or airframe manuals, and the Maintenance Practices chapter of this manual.

**J. Propeller Overspeed**

(1) Check:

- (a) Tachometer error.
- (b) Low pitch stop adjustment.
- (c) Governor Maximum RPM set too high.
- (d) Loss of oil pressure - HC-92( )(-8)( ) propeller models.
  - 1 Governor failure
  - 2 Excessive leakage in the governor oil supply to the propeller
- (e) Broken spring causes momentary overspeed - HC-9( )(-2( ), (B)HC-92( )F-3( ) and HC-92WF-5A propeller models:
- (f) Governor pilot valve jammed, supplying high pressure only HC-9( )(-2( ), (B)HC-92( )F-3( ) and HC-92WF-5A propeller models.

**K. Propeller Underspeed**

(1) Check:

- (a) Tachometer error.
- (b) Excessive transfer bearing leakage - HC-9( )(-2( ), (B)HC-92( )F-3( ) and HC-92WF-5A propeller models.
- (c) Governor oil pressure low - HC-9( )(-2( ), (B)HC-92( )F-3( ) and HC-92WF-5A propeller models.
- (d) Governor oil passage clogged - HC-92( )(-2( ), (B)HC-92( )F-3( ) and HC-92WF-5A propeller models.
- (e) Governor pilot valve jammed, supplying high pressure only - HC-92( )(-8( ) propeller models.

**L. Oil or Grease Leakage**

**CAUTION:** GREASE LEAKAGE THAT CAN BE DESCRIBED AS EXCESSIVE AND APPEARING SUDDENLY, ESPECIALLY WHEN ACCOMPANIED BY VIBRATION, SHOULD BE INVESTIGATED IMMEDIATELY BEFORE FURTHER FLIGHT.

**(1) Grease Leakage - Probable Cause:**

**NOTE:** The blade clamp is the only source of grease leakage.

- (a) Improperly torqued or loose lubrication fitting. (Tighten the fitting).
- (b) Defective lubrication fitting. (Replace the fitting).
- (c) Incorrect O-ring between the blade clamp and the propeller hub. (Refer to an appropriately licensed propeller repair facility for replacement of the O-ring).
- (d) Grease leaks past the blade clamp seal gaskets. (Replace gaskets).
- (e) Grease leaks from between the blade clamp and the blade. (Refer to an appropriately licensed propeller repair facility for replacement of sealant).

**(2) Oil Leakage - Probable Cause**

- (a) Faulty O-ring seal between the hub and the cylinder.
- (b) Faulty O-ring seal between the piston and the cylinder.
- (c) Displaced felt seal between the piston and the cylinder
- (d) Faulty O-ring between the propeller hub and the engine flange.
- (e) Faulty O-ring between the piston and the pitch change rod.

- (3) Beta System Oil Leakage - Probable Cause
  - (a) Governor leaks oil. Refer to an appropriately licensed propeller repair facility for reseal.
  - (b) Faulty gasket between the governor and beta valve, or the beta valve and engine. Replace the gasket.
  - (c) Faulty O-rings between the beta valve body and beta valve spool. (Refer to an appropriately licensed propeller repair facility for replacement.)

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**1. Pre-Flight Checks**

Follow propeller preflight inspection procedures as specified in the aircraft maintenance manual or this manual. In addition, perform the following inspections:

**A. Blades**

- (1) Visually inspect the entire blade for nicks, gouges, erosion and cracks. Repair before further flight. Refer to the Maintenance Practices chapter of this manual for blade repair information.
- (2) Visually inspect the blades for lightning strike. Refer to the Lightning Strike Damage section in this chapter for a description of damage.

B. Inspect the spinner and visible blade retention components for damage or cracks. Repair or replace components as required before further flight.

C. Check for loose/missing hardware. Retighten or reinstall as necessary.

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

D. Inspect for grease and oil leakage and determine its source.

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

E. Check the blades for radial play or movement of the blade tip (in and out or back and forth). Refer to Loose Blades, in the Periodic Inspections section of this chapter, for blade play limits.

F. Inspect de-ice boots (if installed) for damage. Refer to De-ice Systems in the Anti-ice and De-ice Systems chapter of this manual, for inspection information.

- G. Refer to the Periodic Inspections section in this chapter for additional inspection information and possible corrections to any discrepancies discovered as a result of preflight checks.

**2. Operational Checks**

- A. Following propeller installation and before flight, perform initial run-up as outlined in Operational Tests in the Testing and Troubleshooting chapter of this manual.
- B. Check the propeller speed control and operation from reverse or low pitch to high pitch, using the procedure specified in the Pilot Operating Handbook (POH) for the aircraft.
  - (1) Perform all ground functional, feathering, and cycling checks with a minimum propeller RPM drop required to demonstrate function.
  - (2) A typical RPM drop is 300-500 RPM for feathering propellers and 100 to 300 RPM for non-feathering propellers.

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

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

### 3. Required Periodic Inspections and Maintenance

#### A. Periodic Inspection

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

NOTE 1: Inspection and maintenance specified by an airframe manufacturer's maintenance program and approved by the applicable airworthiness agency may not coincide with the inspection time interval specified. In this situation the airframe manufacturer's schedule may be applied with the exception that the calendar limit for the inspection interval may not exceed (12) calendar months.

NOTE 2: Refer to Inspection Procedures in this chapter for additional inspection information and possible corrections to any discrepancies discovered as a result of the Periodic Inspection.

- (1) Remove the spinner.
- (2) Visually inspect the blades for nicks, gouges, and cracks. If any damage is discovered, refer to the Blade Repairs section in the Maintenance Practices chapter of this manual for additional information. A cracked blade must be referred to an appropriately licensed propeller repair facility.
- (3) Inspect all visible propeller parts for cracks, wear or unsafe conditions.
- (4) Check for oil and grease leaks. Refer to Oil and Grease Leakage in the Inspection Procedures section of this chapter.
- (5) Check the blade track. Refer to Blade Track in the Inspection Procedures section of this chapter.
- (6) Check the accuracy of the tachometer. Refer to Tachometer Inspection in the Inspection Procedures section of this chapter.
- (7) Clean or replace the anti-ice system filter (if anti-ice system is installed).
- (8) Make an entry in this log book verifying this inspection.

**B. Periodic Maintenance**

- (1) Lubricate the propeller assembly. Refer to the Lubrication section in the Maintenance Practices chapter of this manual for intervals and procedures.

**C. Airworthiness Limitations**

- (1) Certain components, as well as the entire propeller may have specific life limits established as part of the certification by the FAA. Such limits call for mandatory replacement of specified parts after a defined number of hours and/or cycles of use.
- (2) Life limited component times may exist for the propeller models covered in this manual. Refer to the Airworthiness Limitations section of this manual.
- (3) Refer to the latest revision of Hartzell Service Letter HC-SL-61-61Y for life limit data that has not yet been incorporated into the applicable overhaul manual. The service letter is available on the hartzell Propeller Inc. website at [www.hartzellprop.com](http://www.hartzellprop.com).

**D. Overhaul Periods**

In flight, the propeller is constantly subjected to vibration from the engine and the airstream, as well as high centrifugal forces. The propeller is also subject to corrosion, wear, and general deterioration due to aging. Under these conditions, metal fatigue or mechanical failures can occur. To protect your safety and your investment, and to maximize the safe operating lifetime of your propeller, it is essential that a propeller be properly maintained and overhauled according to the recommended service procedures.

**CAUTION 1:** OVERHAUL PERIODS LISTED BELOW, ALTHOUGH CURRENT AT THE TIME OF PUBLICATION, ARE FOR REFERENCE PURPOSES ONLY. OVERHAUL PERIODS MAY BE INCREASED OR DECREASED AS A RESULT OF ENGINEERING EVALUATION.

**CAUTION 2:** CHECK THE LATEST REVISION OF HARTZELL SERVICE LETTER 61( ) FOR THE MOST CURRENT INFORMATION.

(1) Hartzell "reciprocating" propellers installed on piston engine aircraft are to be overhauled at intervals as follows:

(a) Agricultural Aircraft - 2000 hours or 36 calendar months (whichever occurs first).

**NOTE 1:** Agricultural aircraft are defined as aircraft used as aerial applicators, which expose the propeller to a relatively severe chemical/corrosive environment.

**NOTE 2:** Once the propeller is used on agricultural aircraft, the 36 month overhaul limit is to be maintained even if propeller is later installed on other category airplanes.

- (b) Aerobatic Aircraft - 1000 hours or 60 calendar months (whichever occurs first).

NOTE: Aerobatic aircraft are defined as certificated acrobatic category aircraft or other aircraft routinely exposed to aerobatic use.

- (c) Jacobs R-755 engine applications - 1000 hours or 60 calendar months (whichever occurs first).
- (d) All others - 2000 hours or 60 calendar months, whichever occurs first.

#### 4. Inspection Procedures

The following inspections are made on a regular basis, either before flight, during the periodic inspection, or if a problem is noted. Possible corrections to problems discovered during inspections, additional inspections, and limits are detailed in the following inspection procedures.

##### A. Blade Damage

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

##### B. Grease or Oil Leakage

**NOTE:** A new or newly overhauled propeller may leak slightly during the first several hours of operation. This leakage may be caused by the seating of seals and O-rings, and the slinging of lubricants used during assembly. Such leakage should cease within the first ten hours of operation.

Leakage that persists beyond the first ten hours of operation on a new or newly overhauled propeller, or occurs on a propeller that has been in service for some time will require repair. A determination should be made as to the source of the leak. The only leakage that is field repairable is the removal and replacement of the O-ring seal between the engine and propeller flange. All other leakage repairs should be referred to an appropriately licensed propeller repair facility. An instance of abnormal grease leakage should be inspected using the following procedure:



- (1) Remove the spinner dome.

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

- (2) Perform a visual inspection of the hub, blade clamps and blades to locate the origin of leakage. If the origin of the grease leakage is determined to be a noncritical part, such as an O-ring, gasket or sealant, repairs can be accomplished during scheduled maintenance as long as flight safety is not compromised.
- (3) If cracks are suspected, additional inspections must be performed by qualified personnel at an appropriately licensed propeller repair facility to verify the condition before further flight. Such inspections typically include disassembly of the propeller followed by inspection of parts, using nondestructive methods in accordance with published procedures.
- (4) If cracks or failing components are found, these parts must be replaced before further flight. Report such occurrences to airworthiness authorities and to Hartzell Propeller Inc. Product Support.

**C. Vibration**

Instances of abnormal vibration should be investigated immediately. If the cause of the vibration is not readily apparent, the propeller may be inspected following the procedure below:

**NOTE:** It may sometimes be difficult to readily identify the cause of abnormal vibration. Vibration may originate in the engine, propeller, or airframe. Troubleshooting procedures typically begin with an investigation of the engine. Airframe components, such as engine mounts or loose landing gear doors, can also be the source of vibration. When investigating an abnormal vibration, the possibility of a failing blade or blade retention component should be considered as a potential source of the problem.

- (1) Perform troubleshooting and evaluation of possible sources of vibration in accordance with engine or airframe manufacturer's instructions.
- (2) Refer to Vibration section in the Testing and Troubleshooting chapter of this manual. Perform the checks to determine possible cause of the vibration. If no cause is found, then consider that the origin of the problem could be the propeller and proceed with steps 4.C.(3) through 4.C.(8) in this chapter.
- (3) Remove the spinner dome.
- (4) Perform a visual inspection for cracks in the hub, blade clamps and blades.

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

- (5) If cracks are suspected, additional inspections must be performed before further flight. These inspections must be performed by qualified personnel at an appropriately licensed propeller repair facility to verify the condition. Such inspections typically include disassembly of the propeller followed by inspection of parts, using nondestructive methods in accordance with published procedures.

- (6) Check the blades and compare blade-to-blade differences:
  - (a) Inspect the propeller blades for unusual looseness or movement. Refer to Loose Blades section of this chapter.
  - (b) Check blade track. Refer to Blade Track section of this chapter.

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

- (c) Manually (by hand) attempt to turn the blades (change pitch). Do not use a blade paddles.
  - (d) Visually check for damaged blades.
- (7) If abnormal blade conditions or damage are found, perform additional inspections (by qualified personnel at an appropriately licensed propeller repair facility) to evaluate the condition. Refer to Blade Repairs section in Maintenance Practices chapter of this manual.
- (8) If cracks or failing components are found, these parts must be replaced before further flight. Report such occurrences to airworthiness authorities and Hartzell Propeller Inc. Product Support.

#### D. Tachometer Inspection

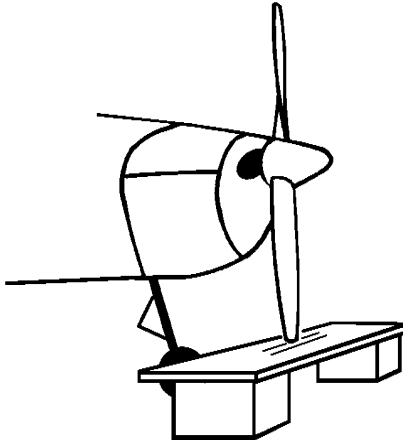
**WARNING:** OPERATION WITH AN INACCURATE TACHOMETER MAY RESULT IN OPERATION AT A RESTRICTED RPM AND DAMAGING HIGH STRESSES. BLADE LIFE WILL BE SHORTENED AND COULD RESULT IN CATASTROPHIC FAILURE.

- (1) Use a hand held tachometer to verify the accuracy of the engine tachometer at 100 hour intervals or at annual inspection, whichever occurs first.

**NOTE:** An appropriately licensed propeller repair facility may also be able to perform an engine tachometer inspection.

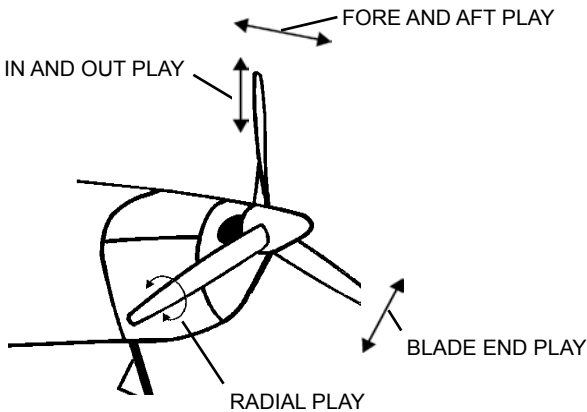
- (2) Hartzell Propeller Inc recommends using a tachometer that is accurate within +/- 10 RPM, has NIST calibration (traceable), and has an appropriate calibration schedule.

APS6155



**Checking Blade Track**  
**Figure 5-1**

APS6163



**Blade Play**  
**Figure 5-2**

**E. Blade Track**

(1) Check the blade track as follows:

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

**NOTE:** This reference point may be a flat board with a sheet of paper attached to it. The board may then be blocked up to within 0.25 inch (6.0 mm) of the propeller arc.

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

- (c) Rotate the propeller by hand (the opposite direction of normal rotation) until a blade points directly at the paper. Mark the position of the blade tip in relation to the paper.
- (d) Repeat this procedure with the remaining blades.
- (e) Tracking tolerance is  $\pm 0.06$  inch (1.5 mm) or 0.12 inch (3.0 mm) total.

(2) Possible Correction

- (a) Remove foreign matter from the propeller mounting flange.
- (b) If no foreign matter is present, refer to an appropriately licensed propeller repair facility.

**F. Loose Blades**

Refer to Figure 5-2. Limits for blade looseness are as follows:

End Play	$\pm 0.06$ inch (1.5 mm)
Fore & Aft Movement	$\pm 0.06$ inch (1.5 mm)
In and Out	0.032 inch (0.813 mm)
Radial Play (pitch change)	$\pm 0.5$ degree (1 degree total)

Blade movement beyond these limits should be referred to an appropriately licensed propeller repair facility.

**G. Corrosion**

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

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

Heavy corrosion that results in severe pitting must be referred to an appropriately licensed propeller repair facility.

**H. Spinner Damage**

Inspect the spinner for cracks, missing hardware, or other damage. Refer to an appropriately licensed propeller repair facility for spinner damage acceptance and repair information. There are no Hartzell approved field repairs to metal spinners. Contact the local airworthiness authority for repair approval.

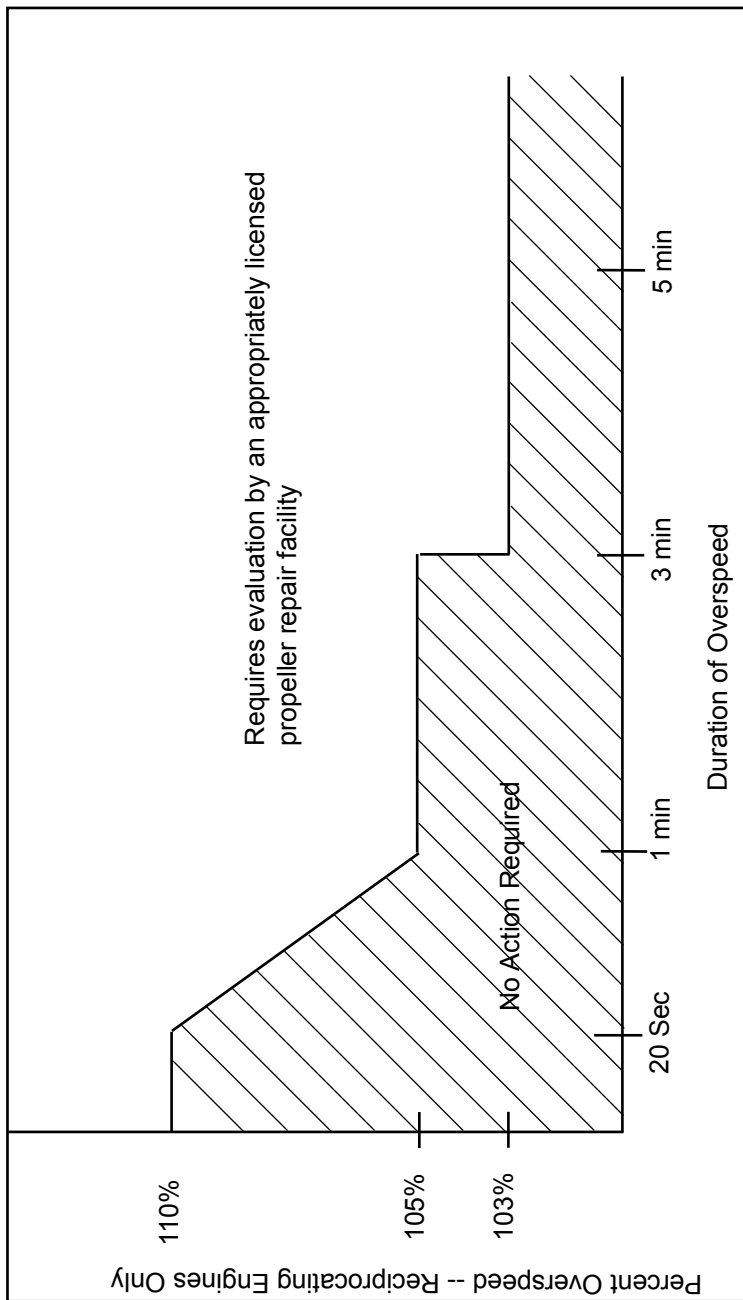
**I. Electric De-ice System**

Refer to the Anti-Ice and De-ice Systems chapter of this manual for inspection procedures.

**J. Anti-ice System**

Refer to the Anti-Ice and De-ice Systems chapter of this manual for inspection procedures.

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**Reciprocating Engine Overspeed Limits**  
Figure 5-3



**5. Special Inspections****A. Overspeed**

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

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

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

**B. Lightning Strike**

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

**(1) General**

In the event of a propeller lightning strike, an inspection is required before further flight. It may be permissible to operate a propeller for an additional ten (10) hours of operation if the propeller is not severely damaged and meets the requirements in paragraph 5.B.(2). Regardless of the outcome of the initial inspection, the propeller must eventually be removed from the aircraft, disassembled, evaluated, and/or repaired by an appropriately licensed propeller repair facility.

**(2) Procedure for Temporary Operation**

If temporary additional operation is desired before propeller removal and disassembly:

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

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

- (b) If the only evident damage is minor arcing burns to the blades, then operation for ten (10) hours is acceptable before disassembly and inspection.
- (c) Perform a functional check of the propeller de-ice system (if installed) in accordance with aircraft maintenance manual procedures.

- (d) Regardless of the degree of damage, make a log book entry to document the lightning strike.
- (e) The propeller must be removed from the aircraft, disassembled, evaluated, and/or repaired by an appropriately licensed propeller repair facility for flight beyond the temporary operation limits granted above.

**C. Foreign Object Strike/Ground Strike****(1) General**

- (a) A foreign object strike can include a broad spectrum of damage, from a minor stone nick to severe ground impact damage. A conservative approach in evaluating the damage is required because there may be hidden damage that is not readily apparent during an on-wing, visual inspection.
- (b) A foreign object strike is defined as:
  - 1** Any incident, whether or not the engine is operating, that requires repair to the propeller other than minor dressing of the blades. Examples of foreign object strike include situations where an aircraft is stationary and the landing gear collapses causing one or more blades to be significantly damaged, or where a hangar door (or other object) strikes the propeller blade. These cases should be handled as foreign object strikes because of potentially severe side loading on the propeller hub, blades and retention bearings.
  - 2** Any incident during engine operation in which the propeller impacts a solid object that causes a drop in revolutions per minute (RPM) and also requires structural repair of the propeller (incidents requiring only paint touch-up are not included). This is not restricted to propeller strikes against the ground.
  - 3** A sudden RPM drop while impacting water, tall grass, or similar yielding medium, where propeller blade damage is not normally incurred.

**(2) Procedure**

- (a) In the event of a foreign object strike, an inspection is required before further flight. If the inspection reveals one or more of the following indications, the propeller must be removed from the aircraft, disassembled and overhauled in accordance with the applicable propeller and blade maintenance manuals.
  - 1 A blade rotated in the clamp.
  - 2 Any noticeable or **suspected** damage to the pitch change mechanism.
  - 3 A bent blade (out of track or angle).
  - 4 Any diameter reduction.
  - 5 Blade Damage.
  - 6 A bent, cracked, or failed engine shaft.
  - 7 Vibration during operation that was not present before the event.
- (b) Nicks, gouges, and scratches on blade surfaces or the leading and trailing edges must be removed before flight. Refer to the Blade Repairs section in the Maintenance Practices chapter of this manual.
- (c) Engine mounted components - such as governors, pumps, etc. may be damaged by a foreign object strike, especially if the strike resulted in a sudden stoppage of the engine. These components should be inspected, repaired, or overhauled as recommended by the applicable component maintenance manual.
- (d) Make an entry in the propeller log book to document the foreign object strike/ground strike incident and any corrective action(s) taken.

**D. Fire Damage or Heat Damage**

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

On rare occasions propellers may be exposed to fire or heat damage, such as an engine or hangar fire. In the event of such an incident, an inspection by an appropriately licensed propeller repair facility is required before further flight.

**6. Long Term Storage**

- A.** Parts shipped from the Hartzell factory are not shipped or packaged in a container that is designed for long term storage.
- B.** Long term storage procedures may be obtained by contacting a Hartzell distributor, or the Hartzell factory via the product support number listed in the Introduction chapter of this manual. Storage information is also detailed in Hartzell Standard Practices Manual 202A (61-01-02).
- C.** Information regarding the return of a propeller assembly to service after long term storage may be obtained by contacting a Hartzell distributor, or the Hartzell factory via the product support number listed in the Introduction chapter of this manual. This information is also detailed in Hartzell Standard Practices Manual 202A (61-01-02).

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**1. Cleaning**

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

**A. General Cleaning**

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

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

(1) Wash propeller with a noncorrosive soap solution.

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

(2) To remove grease or oil from propeller surfaces, apply Stoddard Solvent or equivalent to a clean cloth and wipe the part clean.

(3) Thoroughly rinse with water and permit to dry.

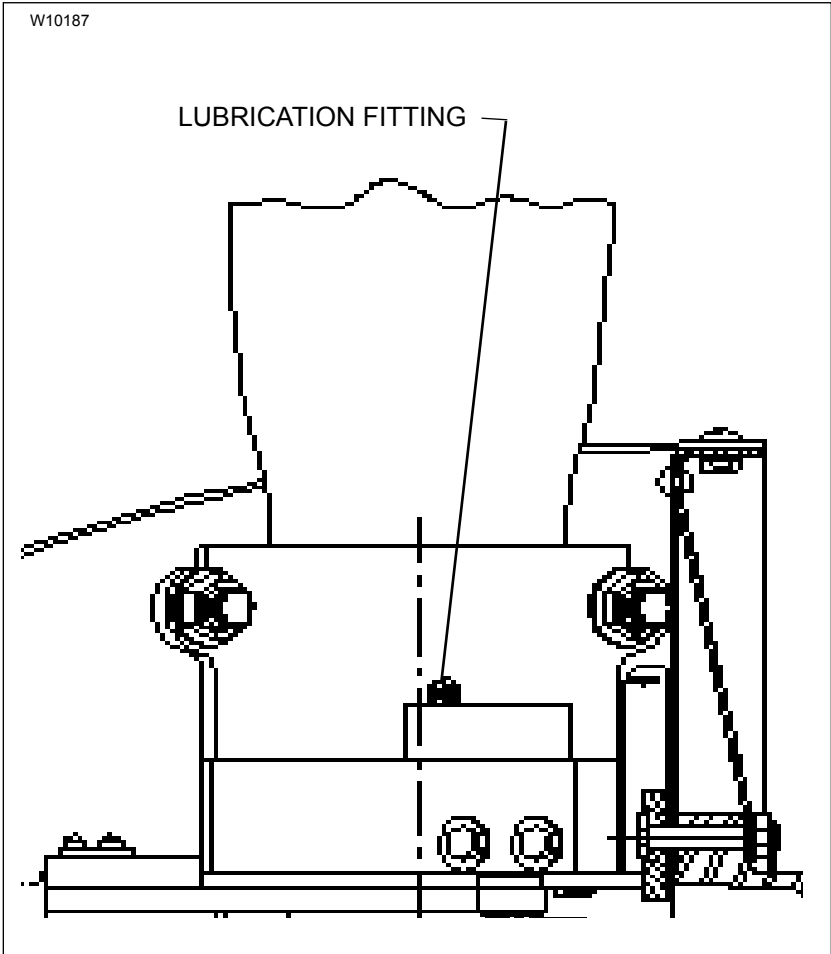
**B. Spinner Cleaning and Polishing**

(1) Clean the spinner using the General Cleaning procedures above.

(2) Polish the dome (if required) with an automotive-type aluminum polish.

W10187

LUBRICATION FITTING



Lubrication Fitting  
Figure 6-1

**2. Lubrication****A. Lubrication Intervals**

- (1) The propeller is to be lubricated at intervals not to exceed 100 hours or at 12 calendar months, whichever occurs first.

NOTE 1: If annual operation is significantly less than 100 hours, calendar lubrication intervals should be reduced to six months.

NOTE 2: 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.

- (2) Owners of high use aircraft may wish to extend their lubrication intervals. Lubrication interval may be gradually extended after evaluation of previous propeller overhauls, with regard to bearing wear and internal corrosion.
- (3) New or newly overhauled propellers should be lubricated after the first one or two hours of operation, because centrifugal loads will pack and redistribute lubricant.

NOTE: Purchasers of new aircraft should check the propeller logbook to verify whether the propeller was lubricated by the manufacturer during flight testing. If not, the propeller should be serviced at earliest convenience.

**B. Lubrication Procedure**

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

- (1) Remove the propeller spinner.
- (2) Refer to Figure 6-1. Each blade clamp has two lubrication fittings. Remove both lubrication fitting caps and one of the lubrication fittings from each blade clamp.

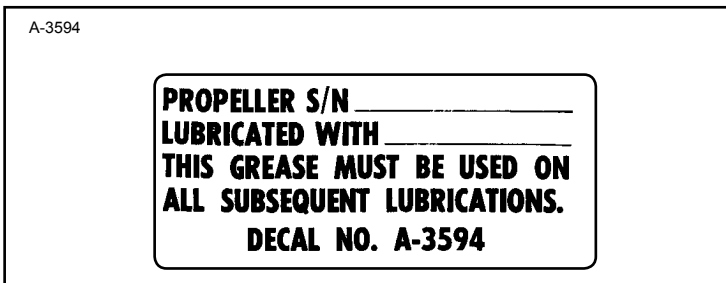
NOTE: Certain steel blade clamps produced before 1967 may have only one fitting, which must be carefully relubricated without excessive pressure.

- (3) Use a piece of safety wire to loosen any blockage or hardened lubricant at the threaded holes where the lubrication fitting was removed.

**WARNING:** WHEN MIXING AEROSHELL GREASES 5 AND 6, AEROSHELL GREASE 5 MUST BE INDICATED ON THE LABEL (HARTZELL P/N A-3594) AND THE AIRCRAFT MUST BE PLACARDED TO INDICATE THAT FLIGHT IS PROHIBITED IF THE OUTSIDE AIR TEMPERATURE IS LESS THAN -40°F (-40°C).

**CAUTION:** USE HARTZELL PROPELLER APPROVED GREASE ONLY. EXCEPT IN THE CASE OF AEROSHELL GREASES 5 AND 6, DO NOT MIX DIFFERENT SPECIFICATIONS AND/OR BRANDS OF LUBRICANT.

- (4) Aeroshell greases 5 and 6 both have a mineral oil base and have the same thickening agent; therefore, mixing of these two greases is acceptable in Hartzell propellers.
- (5) A label (Hartzell P/N A-3494) is normally applied to the propeller to indicate the type of grease previously used (Figure 6-2).
  - (a) This grease type should be used during re-lubrication unless the propeller has been disassembled and the old grease removed.



Lubrication Label  
Figure 6-2

- (b) Purging of old grease through lubrication fittings is only about 30 percent effective.
- (c) To completely replace one grease with another, the propeller must be disassembled in accordance with the applicable overhaul manual.

**CAUTION:** DO NOT USE AN AIR ASSISTED GREASE GUN TO LUBRICATE THE PROPELLER.

(6) Apply Lubricant

- (a) Blade clamps with two lubrication fittings:  
Pump lubricant into each blade clamp lubricant fitting until lubrication emerges from the hole of the removed lubrication fitting.

**NOTE:** Lubrication is complete when grease emerges in a steady flow with no air pockets or moisture, and has the color and texture of the new grease.

- (b) Blade clamps that have only one lubrication fitting:  
Without using excessive pressure, add a small amount (1 to 2 fluid ounces) of lubricant equally to the lubrication fitting in each blade clamp.

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

(8) Tighten the lubrication fittings until snug.

**NOTE:** Make sure the ball of each lubrication fitting is properly seated.

(9) Install a new lubrication fitting cap on each lubrication fitting.

**C. Approved Lubricants**

- (1) The following lubricants are approved for use in Hartzell propellers:

Aeroshell 6 -	Recommended "all purpose" grease. Used in most new production propellers since 1989. Higher leakage/oil separation than Aeroshell 5 at higher temperatures (approximately 100°F [38°C]).
Aeroshell 5 -	Good high temperature qualities, very little oil separation or leakage. Cannot be used in temperatures colder than -40°F (-40°C). Aircraft serviced with this grease must be placarded to indicate that flight is prohibited if the outside air temperature is less than -40°F (-40°C).
Aeroshell 7 -	Good low temperature grease, but high leakage/oil separation at higher temperatures. This grease has been associated with sporadic problems involving seal swelling.
Aeroshell 22 -	Qualities similar to Aeroshell 7.
Royco 22CF -	Not widely used. Qualities similar to Aeroshell 22.

- (2) A label (Figure 6-2) indicating the type of grease used for previous lubrication (if used) is installed on the propeller piston or on the blade clamp. If the propeller is to be lubricated with a different type of grease, the propeller must be disassembled and cleaned of old grease before relubricating.

**3. Carbon Block Assemblies****A. Inspection**

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

- (1) Inspect the beta lever and carbon block interface for free movement. If there is binding, do the following:
  - (a) Disconnect the beta linkage and remove the carbon block assemblies from the beta ring.
  - (b) Polish the yoke pin to provide adequate clearance and eliminate binding.
  - (c) Reinstall the carbon block assembly into the beta ring.

**NOTE:** Use a dry lubricant between the yoke pin and beta lever.

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

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

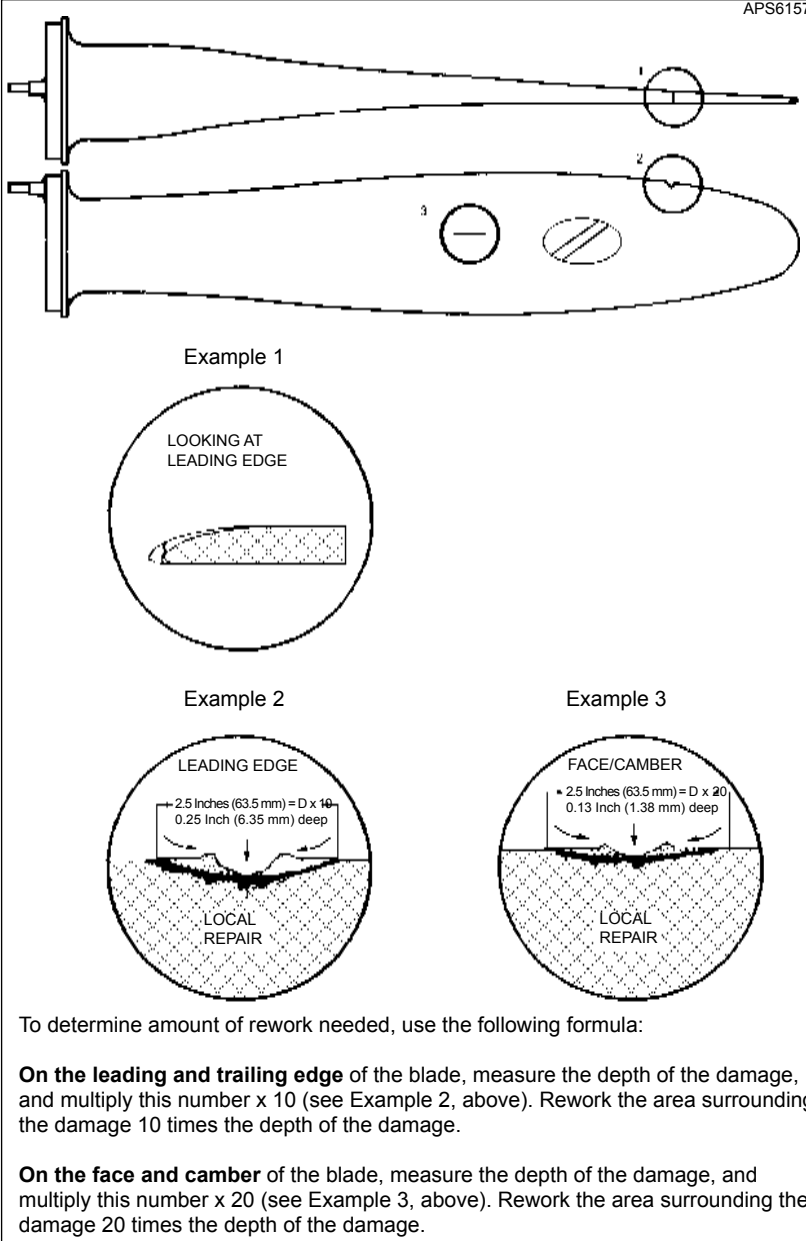
Replace an A-3026 carbon block unit if the side clearance between the beta ring and carbon block exceeds 0.010 inch (0.25 mm).

- (1) Remove the cotter pin from the end of the clevis pin.
- (2) Slide the pin from the assembly and remove and discard the carbon block unit.
- (3) Inspect the yoke for wear or cracks. Replace the yoke, if necessary.
- (4) Install a new carbon block unit and slide a new clevis pin into place.
- (5) Secure the clevis pin with a T-head cotter pin (Figure 3-15).
- (6) Refit the carbon block (Figure 3-14).
  - (a) Establish the required clearance by sanding the sides of the carbon block as needed.

- C. Installation of the A-3044 Carbon Block Assembly  
Refer to Installation and Removal chapter of this manual for installation instructions.



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## Repair Limitations

Figure 6-3

**4. Blade Repairs**

Nicks, gouges, and scratches on blade surfaces or on the leading or trailing edges of the blade must be removed before flight. Field repair of small nicks and scratches may be performed by qualified personnel in accordance with FAA Advisory Circular 43.13-1B, as well as the procedures specified below.

**A. Repair of Nicks or Gouges**

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

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

**CAUTION 2:** BLADES THAT HAVE BEEN SHOT PEENED (AS INDICATED BY A "PEBBLE GRAIN" SURFACE) THAT HAVE DAMAGE IN THE SHOT PEENED AREAS IN EXCESS OF 0.015 INCH (0.38 MM) DEEP ON THE FACE OR CAMBER OR 0.250 INCH (6.35 MM) ON THE LEADING OR TRAILING EDGES MUST BE REMOVED FROM SERVICE, AND THE REWORKED AREA SHOT PEENED BEFORE FURTHER FLIGHT. SHOT PEENING OF AN ALUMINUM BLADE MUST BE ACCOMPLISHED BY AND FAA APPROVED REPAIR FACILITY IN ACCORDANCE WITH HARTZELL ALUMINUM BLADE MANUAL 133C (61-13-33).

- (1) Repairs to the leading or trailing edge are to be accomplished by removing material from the bottom of the damaged area. Remove material from this point out to both sides of the damage, providing a smooth, blended depression which maintains the original airfoil general shape.

- (2) Repairs to the blade face or camber should be made in the same manner as above. Repairs that form a continuous line across the blade section (chordwise) are unacceptable.
  - (3) The area of repair should be determined as follows:  
Leading and trailing edge damage: Depth of nick x 10.  
Face and camber: Depth of nick x 20. Refer to Figure 6-3.  
**NOTE:** Leading edge includes the first 10 percent of chord from the leading edge. The trailing edge consists of the last 20 percent of chord adjacent to the trailing edge.
  - (4) Make sure that no indication of the damage remains. After filing or sanding the damaged area, the area must then be polished with emery cloth, and finally with crocus cloth to remove any traces of filing or sanding marks.
- B. Fluorescent Penetrant Inspection Procedures
- (1) Overview
    - (a) This fluorescent penetrant inspection process is intended for the detection of discontinuities open to the surface on a propeller blade.
    - (b) The surface of the blade to be inspected must be smooth, clean, dry, free of oil, scale, machining marks, or other contaminants or conditions that may interfere with the efficiency of the inspection.
    - (c) Surface preparation by machining may be necessary when surface irregularities could mask the indications of unacceptable discontinuities.
    - (d) Penetrant, developer, solvent materials, and the propeller blade must not be at a temperature below 40° F (4° C) or above 125° F (52° C).
    - (e) Blades that have undergone rework, grinding or polishing must be etched before fluorescent penetrant inspection.
    - (f) Fluorescent penetrant must be Type 1, Sensitivity Level 3, and conform to the requirements of MIL-I-25135 or AMS-2644. Developer and Solvent Cleaner must be compatible with the fluorescent penetrant in accordance with manufacturer's specifications.

- (2) Personnel Requirements
  - (a) Personnel performing dye penetrant inspections must be qualified and certified based on the requirements of the American Society for Nondestructive Testing Inc, Recommended Practice No. SNT-TC-1A, National Aerospace Standard NAS 410 (replaces MIL-STD- 410E), Air Transport Association ATA 105, or equivalent international standard such as ISO 9712.
- (3) Safety
  - (a) Many developers are nonflammable chlorinated hydrocarbons. The materials are non-toxic, but volatile in nature. Precautions must be maintained to have adequate ventilation and to limit breathing fumes and direct contact with skin.
  - (b) Dryness and skin irritation may result from continual contact with fluorescent penetrant materials. Wash affected skin areas frequently to help prevent rash problems.
  - (c) Do not smoke or eat while using fluorescent penetrant materials. Wash hands thoroughly after use. Protective hand wear is recommended to prevent drying of skin.
- (4) Fluorescent Penetrant Equipment and Materials
  - (a) Typical systems are composed of the following equipment as a minimum:
    - 1 Portable black light
    - 2 Cloth/cover for darkened area
    - 3 Light meter
- (5) Materials
  - (a) Before testing the blade, make sure the fluorescent penetrant is Type 1, Sensitivity Level 3, and conforms to the requirements of MIL-I-25135 or AMS-2644. Developer and Solvent Cleaner must be compatible with the fluorescent penetrant in accordance with manufacturer's specifications. To eliminate the need for in-process checks, it is recommended that all penetrant materials be used in aerosol can form.

**(6) Pre-Penetrant Surface Preparation**

**CAUTION:** ALL SURFACE COATINGS IN THE REPAIR AREA MUST BE REMOVED BEFORE ETCHING AND PENETRANT INSPECTION.

**(a) Removal of Surface Coatings/Contaminants**

- 1** Use a solvent that is approved by the fluorescent penetrant manufacturer to remove surface contaminants, such as dirt and grease, from the surface of the part.
- 2** Remove surface coatings such as paint, adhesives, anodize, and chemical conversion coatings, from the damaged area before performing etch and fluorescent penetrant inspection.

**(b) Etch Process**

**WARNING:** THE ETCHING PROCESS REMOVES MATERIAL FROM THE PART. WHERE TOLERANCES ARE CLOSE, MASK PROPELLER COMPONENTS AS REQUIRED.

- 1** Apply the caustic solution with a swab or brush.
- 2** Keep the test area wet for approximately 5 minutes.

**NOTE:** The blade may appear black in color due to residue formation on the surface.

**WARNING:** TILT THE BLADE SO NO SOLUTION CONTACTS THE HUB OR O-RINGS.

- 3** Rinse the part thoroughly with cold water.
- 4** Apply acid solution as necessary, to remove residue.
- 5** Rinse the blade thoroughly with cold water.
- 6** Dry the blade using a heat gun (pointed directly at the repair area) at  $150^{\circ}\text{F} \pm 10^{\circ}\text{F}$  ( $65^{\circ}\text{C} \pm 5^{\circ}\text{C}$ ) for 30 minutes (monitor the blade temperature with a thermometer or thermocouple to make sure the temperature is controlled), or by air drying at ambient temperature for 24 hours.

- 7 Inspect the part for obvious flaws (dark lines or stains) revealed by the etch process.
  - 8 Remove the flaws and locally re-etch.
- (7) Solvent-removable Method
- (a) Application of Fluorescent Penetrant
- 1 Use a solvent-removable penetrant to completely coat the repair area.
  - 2 Rotate the propeller as needed to prevent pooling of the fluorescent penetrant.
  - 3 Permit the penetrant to dwell on the surface of the part for a minimum of 30 minutes. If the dwell time exceeds 2 hours, clean and reprocess.
- (b) Removal of Excess Fluorescent Penetrant
- 1 Using a dry, clean, lint-free cloth, remove the excess penetrant from the surface of the part.
- CAUTION 1: MAKE SURE THE SOLVENT IS COMPATIBLE WITH THE TYPE OF FLUORESCENT PENETRANT BEING USED.
- CAUTION 2: DO NOT FLUSH THE SURFACE OF THE PART WITH SOLVENT REMOVER.
- 2 Moisten a dry, clean, lint-free cloth with solvent and remove any remaining traces of fluorescent penetrant from the surface of the part.
- (c) Application of Developer
- CAUTION 1: MAKE SURE THE DEVELOPER IS COMPATIBLE WITH THE TYPE OF PENETRANT BEING USED.
- CAUTION 2: MAKE SURE THERE IS COMPLETE COVERAGE OF THE REPAIR AREA(S).
- 1 Apply a non-aqueous developer to the area as recommended by the manufacturer.
  - 2 The minimum dwell time is 10 minutes.

**(d) Inspection**

- 1** Inspection must be performed in a darkened area. A maximum of 2 foot-candles (20 lx/m<sup>2</sup>) ambient light is permitted.
- 2** The inspector must be in the darkened area at least one minute before inspection, to permit vision to adapt to the dark.
- 3** All areas of fluorescence must be interpreted.
  - a** A blade with no indications or only nonrelevant indications may be accepted.
  - b** A blade with a relevant indication must be evaluated further.
- 4** A blade with excessive background fluorescence must be cleaned and reprocessed.

**(e) Post-Cleaning**

**CAUTION: MAKE SURE THE PENETRANT AND DEVELOPER ARE COMPLETELY REMOVED.**

- 1** Use a solvent that is approved by the fluorescent penetrant manufacturer to clean the area.
- 2** To prevent corrosion, properly treat the repaired area. Apply chemical conversion coating and approved paint to the repaired area before returning the blade to service. Refer to the Painting After Repair section of this chapter.

**C. Repair of Bent Blades**

**CAUTION: DO NOT ATTEMPT TO "PRE-STRAIGHTEN" A BLADE BEFORE DELIVERY TO AN APPROPRIATELY LICENSED PROPELLER REPAIR FACILITY. THIS WILL CAUSE THE BLADE TO BE SCRAPPED BY THE REPAIR STATION.**

Repair of a bent blade or blades is considered a major repair. This type of repair must be accomplished by an appropriately licensed propeller repair facility, and only within approved guidelines.



**5. Painting After Repair**

Propeller blades are painted with a durable specialized coating that is resistant to abrasion. If this coating becomes eroded, it is necessary to repaint the blades to provide proper corrosion and erosion protection. Painting should be performed by an appropriately licensed propeller repair facility in accordance with Hartzell Standard Practices Manual 202A (61-01-02).

It is permissible to perform a blade touch-up with aerosol paint in accordance with the procedures in Painting of Aluminum Blades, below.

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

<b>Vendor</b>	<b>Color/Type</b>	<b>Vendor P/N</b>	<b>Hartzell P/N</b>
Tempo	Epoxy Black	A-150	n/a
Tempo	Epoxy Gray	A-151	n/a
Tempo	Epoxy White (tip stripe)	A-152	n/a
Tempo	Epoxy Red (tip stripe)	A-153	n/a
Tempo	Epoxy Yellow (tip stripe)	A-154	n/a
Sherwin-Williams	Black	F75KXB9958-4311	A-6741-145-1
Sherwin-Williams	Gray	F75KXA10445-4311	A-6741-146-1
Sherwin-Williams	White (tip stripe)	F75KXW10309-4311	A-6741-147-1
Sherwin-Williams	Red (tip stripe)	F75KXR12320-4311	A-6741-149-1
Sherwin-Williams	Yellow (tip stripe)	F75KXY11841-4311	A-6741-150-1
Sherwin-Williams	Silver	F75KXS13564-4311	A-6741-190-1

**Approved Touch-up Paints  
Table 6-1**

The paint manufacturers may be contacted via the information below:

**Tempo Products Co.**

A plasti-kote Company  
1000 Lake Road  
Medina, OH 44256  
Tel: 800.321.6300  
Fax: 440.248.1348  
Cage Code: 07708

**Sherwin Williams Co.**

2390 Arbor Boulevard  
Dayton, Ohio  
Tel: 937.298.8691  
Fax: 937.298.3820  
Cage Code: 0W199

**A. Painting of Aluminum Blades**

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

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

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

**NOTE:** Paint erosion is typically very similar on all blades in a propeller assembly. If one blade has more extensive damage, e.g. in the tip area, all the blades should be sanded in the tip area to replicate the repair of the most severely damaged blade tip. This practice is essential in maintaining balance after refinishing.

- (3) Use acetone, #700 lacquer thinner, or MEK to wipe the surface of the blade. Permit solvent to evaporate.

- (4) Before refinishing the blades, apply a corrosion preventive coating to the bare aluminum surface. Oakite 31, Chromicote L-25, or Alodine 1201 are approved chemical conversion coatings. Apply these coatings in accordance with the directions provided by the product manufacturer.
- (5) Mask off de-ice boot and tip stripes, as needed.

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

**CAUTION:** APPLY FINISH COATING ONLY TO THE DEGREE REQUIRED TO UNIFORMLY COVER THE REPAIR/EROSION. AVOID EXCESSIVE PAINT BUILDUP ALONG THE TRAILING EDGE TO AVOID CHANGING BLADE PROFILE.

- (6) Apply sufficient finish coating to achieve 2 to 4 mils thickness when dry. Re-coat before 30 minutes, or after 48 hours. If the paint is permitted to dry longer than four (4) hours, it must be lightly sanded before another coat is applied.
- (7) Remove the masking from the tip stripes and re-mask to allow for the tip stripe refinishing, if required.
- (8) Apply sufficient tip stripe coating to achieve 2 to 4 mils thickness when dry. Re-coat before 30 minutes, or after 48 hours. If the paint is permitted to dry longer than four (4) hours, it must be lightly sanded before another coat is applied.
- (9) Remove the masking immediately from the de-ice boot and tip stripes, if required.
- (10) Optionally, perform dynamic balancing in accordance with the procedures and limitations specified in Dynamic Balance section of this chapter.

**6. Dynamic Balance****A. Overview**

**WARNING:** WHEN USING REFLECTIVE TAPE FOR DYNAMIC BALANCING, DO NOT APPLY THE TAPE ON EXPOSED BARE METAL OF A 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 which may be caused by a rotating system (propeller and engine) imbalance. Dynamic balancing can help prolong the life of the propeller, engine, airframe, and avionics.

- (1) Dynamic balance is accomplished by using an accurate means of measuring the amount and location of the dynamic imbalance.
- (2) The number of balance weights installed must not exceed the limits specified in this chapter.
- (3) Follow the dynamic balance equipment manufacturer's instructions for dynamic balance in addition to the specifications of this section.

**NOTE:** Some engine manufacturer's instructions also contains information on dynamic balance limits.

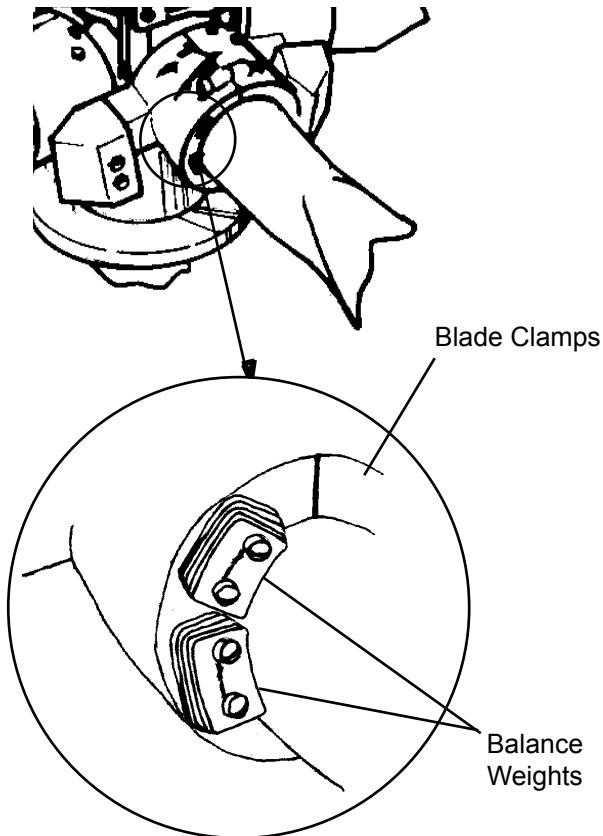
- (4) Unless otherwise specified by the engine or airframe manufacturer, Hartzell recommends that the propeller be dynamically balanced to a reading of 0.2 IPS or less.

**B. Inspection Procedures Before Balancing**

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

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

- (a) Using Stoddard solvent or equivalent, completely remove any grease on the blades or inner surface of the spinner dome.
- (b) Visually check each propeller blade assembly for evidence of grease leakage.
- (c) Visually inspect the inner surface of the spinner dome for evidence of grease leakage.

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**Location of Balance Weights**  
**Figure 6-4**

- (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 static balance weights.
- (4) Static balance is required when an overhaul or major repair is performed at a propeller overhaul facility.

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

C. Placement of Balance Weights for Dynamic Balance

The preferred method of attachment of dynamic balance weights is to add the weights to the spinner bulkhead; however, the configuration of the spinner bulkhead on propeller models covered in this manual may make it impractical to mount dynamic balance weights in this manner. Dynamic balance must then be accomplished through the removal or addition and/or the relocation of the static balance weights located on the blade clamps.

- (1) Each blade clamp has four balance weight locations on the outboard circular surface of the clamp (Figure 6-4).
- (2) The maximum number of balance weights per location is four (4).

**NOTE:** For propellers with a de-ice system using a blade clamp-mounted terminal block, a maximum of three weights may be attached to the de-ice terminal block mounted on the blade clamp.

- CAUTION 1: BEFORE DYNAMIC BALANCE, RECORD THE NUMBER AND LOCATION OF ALL STATIC BALANCE WEIGHTS.
- CAUTION 2: USE ONLY STEEL BALANCE WEIGHTS A-1305.
- CAUTION 3: DO NOT EXCEED THE MAXIMUM NUMBER OF BALANCE WEIGHTS PER LOCATION.
- (3) Alter the number and/or location of static balance weights as necessary to achieve dynamic balance.
- (4) If reflective tape is used for dynamic balancing, remove the tape immediately upon completion of dynamic balancing.
- (5) Make a record of the number and location of static balance weights, if they have been reconfigured, in the propeller logbook.

**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 APPROVED MAINTENANCE DATA.

**A. Low Pitch Stop - All Propeller Models**

- (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.
- (2) 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.
- (3) Be aware that the aircraft TC or STC holder may specify the static RPM to be less than the RPM to which the engine is rated.

**B. Low pitch measurement on propeller models**

HC-9( ) ( )-2( ) ( ):

**CAUTION:** PUT A PAN UNDER THE PROPELLER PISTON BEFORE REMOVING THE NUT AND MOVING THE PISTON, AS ENGINE OIL MAY COME OUT OF THE OPENING IN THE PISTON.

- (1) Untorque and remove the piston nut from the pitch change rod.
- (2) Rotate the blades by hand to move the blades and piston to low pitch.

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



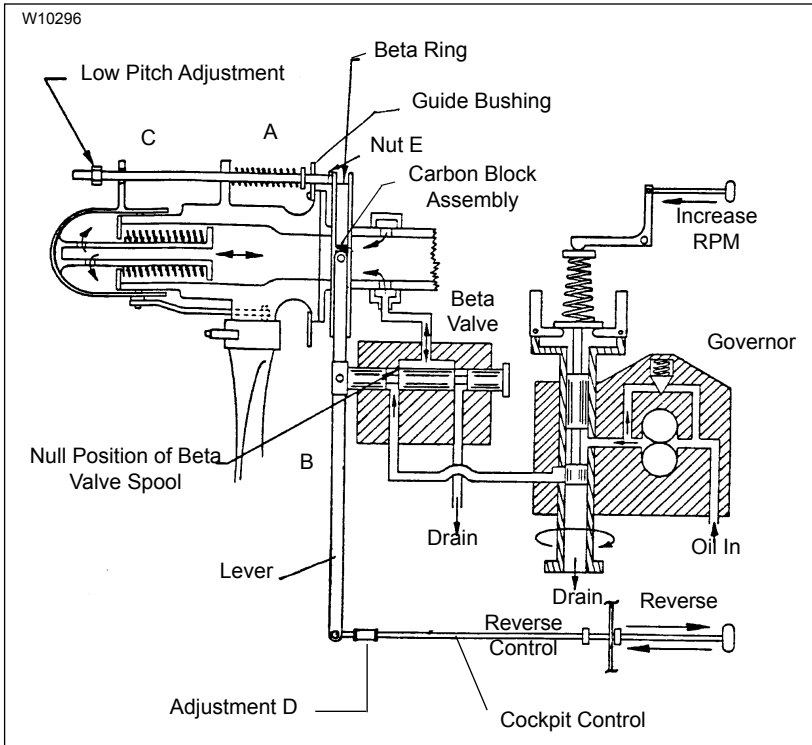
- (3) With the blade in a horizontal position, measure low pitch blade angle.
  - (4) If the blade angle requires adjustment, have the low pitch stop adjusted by an appropriately licensed propeller repair facility or by the Hartzell factory.
- C. Low pitch measurement on propeller models (B)HC-9( ) ( )-1( ) ( ) and HC-92( ) ( )-8( ):
- (1) Rotate the blades by hand to move the blades and piston to low pitch.  
NOTE: Low pitch is reached when a washer on the end of each piston guide rod stops against the guide collar.
  - (2) With the blade in a horizontal position, measure the low pitch blade angle.
  - (3) If the blade angle requires adjustment, have the low pitch stop adjusted by an appropriately licensed propeller repair facility.

- D. Low pitch measurement on propeller models HC-92( )(-3( ) and HC-92WF-5A.

**CAUTION:** PUT A PAN UNDER THE PROPELLER PISTON BEFORE REMOVING THE NUT AND MOVING THE PISTON, AS ENGINE OIL MAY COME OUT OF THE OPENING IN THE PISTON.

- (1) Remove the piston nut from the pitch change rod.
- (2) Rotate the blades by hand to move the blades and piston to low pitch. Refer to Figure 6-5.

**NOTE:** Low pitch is reached when the piston ears contact the self-locking nut on each rod, and when distance "C" is zero.



**Adjusting Low Pitch Angle**  
**Figure 6-5**

- (3) With the blade in a horizontal position, measure low pitch blade angle.
  - (4) If the blade angle requires adjustment, refer to Adjusting Low Pitch Angle - Propeller Models BHC-92( )f-3( ) ( ) and HC-92WF-5A in this chapter.
- E. Adjusting Low Pitch Angle - Propeller Models BHC-92( )f-3( ) ( ) and HC-92WF-5A

**WARNING 1:** LOW PITCH BLADE ANGLE ADJUSTMENTS MUST BE MADE IN CONSULTATION WITH THE APPLICABLE TYPE CERTIFICATE OR SUPPLEMENTAL TYPE CERTIFICATE HOLDER'S MAINTENANCE DATA.

**WARNING 2:** ADJUSTMENT OF THE LOW PITCH STOP TO ACHIEVE THE SPECIFIED STATIC RPM MAY MASK AN ENGINE POWER PROBLEM.

- (1) Refer to the following procedure for accomplishing an adjustment to the low pitch angle. Refer to Figure 6-5.
  - (a) The low pitch adjustment "C" has been made at the factory according to published information. The readjustment of low pitch should not be required, although it is accomplished by adjusting the four nuts at the outer ends of the rods as shown in Figure 6-5, if the maximum engine/propeller RPM is incorrect.
  - (b) To check the maximum engine/propeller RPM, start the engine and check the RPM for full throttle operation. The RPM should correspond to rated engine RPM. The governor must be set for maximum RPM for this test.
    - 1 If the RPM is too low, back the four low pitch adjustment nuts **out** approximately 3/4 of a turn (3/4 of a turn equals approximately 100 RPM increase). If this process does not increase the RPM, this means that the governor is limiting the RPM by calling for increased pitch. In this case, the governor must be adjusted to provide for higher RPM (increased compression on the speeder spring).

CAUTION: TO PREVENT THE RPM FROM EXCEEDING THE ENGINE RATING, TURN THE LOW PITCH ADJUSTMENT NUTS **IN** APPROXIMATELY 3/4 OF A TURN TO OBTAIN A 100 RPM REDUCTION.

2 An alternative method for determining whether the low pitch adjustment is limiting the RPM is to observe the movement of the beta valve spool during maximum power. "B" will increase from 1/16 inch (1.6 mm) to 3/16 inch (4.8 mm) during run-up of the engine for proper adjustment of the governor.

(c) Check the runout of the beta ring by installing a dial indicator on the nose of the engine, so that it touches the rear face of the beta ring. If necessary, loosen nut "E" and rotate the rods to bring the runout to within 0.010 total indicator reading.

(d) Torque nut "E" to 10-15 Ft-Lb (14-20 N•m).

(e) Make sure the four low pitch adjusting nuts contact the piston bosses at the same time the piston is moved toward reverse pitch. To accomplish this:

1 Equalize "C" for all four rods by means of accurate measurements.

2 Adjust the nuts if necessary. This will make sure that the slip ring runs true during pitch reversal.

8. High Pitch (Minimum RPM) Stop - Propeller models

HC-9( ) ( ) -1( ) ( ) ( ), HC-92( ) ( ) -3( ) ( ) ( ), and HC-92( ) ( ) -8( ) ( ) ( ) ( )

A. The high pitch stop is set at the factory per the aircraft manufacturer's recommendations. These stops are adjustable only by an appropriately licensed propeller repair facility or the Hartzell factory.

9. Feathering Pitch Stop Adjustment - Propeller Models  
HC-9( )(-)2( )(-) and HC-92WF-5A
  - A. The feathering pitch stop is set at the factory in accordance with the aircraft manufacturer's recommendations. This stop is adjustable only by an appropriately licensed propeller repair facility, aircraft manufacturer, or the Hartzell factory.
10. Start Lock Adjustment - Propeller models  
HC-9( )(-)2( )(-) and HC-92WF-5A
  - A. The start locks are set at the factory per the aircraft manufacturer's recommendations. Start locks are adjustable only by an appropriately licensed propeller repair facility, aircraft manufacturer, or the Hartzell factory.
11. Propeller Ice Protection Systems
  - A. Refer to the Anti-ice and De-ice Systems chapter of this manual for de-ice system maintenance information.

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**1. Introduction****A. Propeller De-ice System**

A propeller de-ice system is a system that removes ice after it forms on the propeller blades. A de-ice system uses electrical heating elements to melt the ice layer next to the blades, permitting the ice to be thrown from the blade by centrifugal force. Blades are alternately heated and permitted to cool as the current is applied and removed automatically by the de-ice system timer. De-ice systems used on Hartzell compact propellers are typically manufactured by the Goodrich Corporation.

System components include a timer or cycling unit, electrical slip ring(s), brush block assembly, and blade mounted de-ice boots.

**B. Propeller Anti-ice System**

A propeller anti-ice system is a system that prevents formation of ice on propeller surfaces. An anti-ice system dispenses a fluid that mixes with, and reduces the freezing point of, moisture on the propeller blades. The mixture may then flow off the blades before it forms ice.

System components include a fluid tank, pump, slinger ring, and blade mounted fluid feed shoes.

## 2. System Description

### A. De-ice System

**NOTE:** Because of the wide variances of various de-ice systems, the following description is general in nature. Consult the airframe manufacturer's manual for a description of your specific de-ice system and controls.

The de-ice system is controlled by the pilot via a cockpit control switch. This switch applies electrical power to the de-ice system, which will operate as long as the switch is in the ON position. Depending upon the system, another set of cockpit controls may be available. One of these controls is a mode selector that permits the pilot to select two cycling speeds for heavy or light icing conditions. Some systems on twin engine aircraft have a switch that provides a full de-ice mode that permits the pilot to de-ice both propellers simultaneously. This switch may only be used for short periods and is used when ice builds up on the propeller before the system is turned on.

An ammeter, which indicates current drawn by the system, is normally located near the de-ice system switches. This meter may indicate total system load, or a separate meter may be supplied for each propeller.

A timer, which is turned off and on by the cockpit control, is used to sequence the de-ice system. This timer turns the de-ice system on and off in proper sequence, controlling the heating interval for each propeller and ensuring even de-icing.

A brush block, which is mounted on the engine immediately behind the propeller, supplies electrical current to the de-ice boot on each propeller blade via a slip ring. The slip ring is normally mounted on the spinner bulkhead.

When the pilot places the de-ice system cockpit control switch in the ON position, system timer begins to operate. As the timer sequences, power is delivered to a power relay. The power relay delivers high current to the brush block and slip ring. Each propeller is de-iced in turn by the timer.

**B. Anti-ice System**

The anti-ice system is controlled by the pilot via a cockpit mounted rheostat. This rheostat operates a pump that pumps anti-ice fluid from the tank at a controlled rate.

The anti-ice fluid is delivered through a filter, a check valve, and then through tubing to a slinger ring located at the rear of the spinner bulkhead. The anti-ice fluid is dispensed into the rotating slinger ring that holds the fluid in a curved channel by centrifugal force. The fluid then flows out of the slinger ring through feed tubes that are welded to the slinger ring, and then out onto the blade feed shoes.

The blade feed shoes are ridged rubber sheets that are glued to the leading edge of the blades. The ridges in the shoes direct the fluid out onto the blades and permits an even distribution of the anti-ice fluid across the blades.

**3. De-ice System Functional Tests**

A. Functional tests of the de-ice system should be performed in accordance with the following Hartzell Manuals, which are available on the Hartzell Propeller website at [www.hartzellprop.com](http://www.hartzellprop.com):

- (1) Hartzell Manual No. 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual
- (2) Hartzell Manual No. 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual

**4. Anti-ice System Functional Tests**

A. Operational Checks of the anti-ice system should be performed in accordance with the following Hartzell Manuals, which are available on the Hartzell Propeller website at [www.hartzellprop.com](http://www.hartzellprop.com):

- (1) Hartzell Manual No. 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual
- (2) Hartzell Manual No. 183 (61-12-83) - Propeller Anti-ice Boot Removal and Installation Manual

**5. De-ice and Anti-ice System Inspections**

The inspections detailed below are made on a regular basis, either before flight, during the periodic inspection, or if a problem is noted. Possible corrections to problems discovered during inspections, additional inspections, and limits are detailed in the following Hartzell manuals.

**A. De-ice System Inspections**

- (1) Perform inspections in accordance with the following Hartzell Manuals, which are available on the Hartzell Propeller website at [www.hartzellprop.com](http://www.hartzellprop.com):
  - (a) Hartzell Manual No. 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual
  - (b) Hartzell Manual No. 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual

**B. Anti-ice System Inspections**

- (1) Perform inspections in accordance with the following Hartzell Manuals, which are available on the Hartzell Propeller website at [www.hartzellprop.com](http://www.hartzellprop.com):
  - (a) Hartzell Manual No. 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual
  - (b) Hartzell Manual No. 183 (61-12-83) - Propeller Anti-ice Boot Removal and Installation Manual

**6. De-ice and Anti-ice System Troubleshooting****A. De-ice System Troubleshooting**

- (1) Perform troubleshooting in accordance with the following Hartzell Manuals, which are available on the Hartzell Propeller website at [www.hartzellprop.com](http://www.hartzellprop.com):
  - (a) Hartzell Manual No. 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual
  - (b) Hartzell Manual No. 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual

**B. Anti-ice System Troubleshooting**

- (1) Perform troubleshooting in accordance with the following Hartzell Manuals, which are available on the Hartzell Propeller website at [www.hartzellprop.com](http://www.hartzellprop.com):
  - (a) Hartzell Manual No. 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual
  - (b) Hartzell Manual No. 183 (61-12-83) - Propeller Anti-ice Boot Removal and Installation Manual

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**1. Introduction**

Federal Aviation Regulations require that a record be kept of any repairs, adjustments, maintenance, or required inspections performed on a propeller or propeller system.

This chapter provides a method for maintaining these records. It also provides a location for recording information that can aid the service technician in maintaining the propeller system.

**2. Record Keeping****A. Information to be Recorded**

- (1) Information that is required to be recorded is listed in Part 43 of the U.S. Federal Aviation Regulations.
- (2) The log book may also be used to record:
  - (a) Propeller position (on aircraft)
  - (b) Propeller model
  - (c) Propeller serial number
  - (d) Blade design number
  - (e) Blade serial numbers
  - (f) Spinner assembly part number
  - (g) Propeller pitch range
  - (h) Aircraft information (aircraft type, model, serial number and registration number)

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